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From the Director's Desk

Dear Friends,

Greeting from Don Bosco Centre for Learning - Mumbai.

We at Don Bosco Centre for Learning, constantly strive to better ourselves at what we do. One such effort is the Don Bosco Journal of Science and Engineering (DBJSE), which has brought all research work under one banner.

The word 'Research' of two terms 'Re' and 'Search', where 'Re' stands for repeating and redoing; and 'Search' stands for looking for something new. Undergraduate research at Don Bosco Institute of Technology (DBIT) Mumbai has always been a series of repeating and redoing until something new is achieved. The prime focus being an endeavour to improve and innovate. The goal of our research is to address certain issues of society and arrive at significant and beneficial solutions. It is this commitment to research that keeps us moving on in this fast-paced world.

At Don Bosco Centre for Learning, we pay close attention to the relationship between cultures, science, technology, education, professionalism and integrity of life and religion. Special consideration is given to build a moral conscience based on values with special emphasis on a culture of solidarity through a model of sustainable human development, of equality and reciprocity in relationships, and of human life in its highest dignity.

Guided by the Salesian Educative System, DBIT is engaged in a scientific reflection and has interfaced with the world of science and culture as an attempt to make a specifically Salesian contribution in the field of education. Initiating and carrying out research on a variety of issues, translating them into publications have been a part of the activities of DBIT through DBJSE.Edison's adage, "Genius is 99% perspiration and 1% inspiration" emphasizes that solid work and dedication gets you surprisingly far. It is the inspiration of authors and dedication of authors and reviewers with the editorial team that has made this Journal a realisation.

I wish you all a fruitful reading experience.

God bless.

Fr. Colbert da Silva, sdb

From the Principal's Desk

DBIT has always nurtured creativity and a spirit of inquiry on campus. There is a constant endeavor to engage faculty and students in understanding real world challenges and designing sustainable solutions. To be able to do this both faculty and students have to step out into the real world, closely observe the environment around them and identify unique problems that affect us on a daily basis. Many of these problems go unnoticed or remain unaddressed for two reasons, (1) people have become immune to the problem and accept it as a way of life, like the traffic problem, pollution problem, flooding in rains, etc. or (2) the problems mainly affect that strata of society that doesn't have a voice, eg. child abuse, hygiene in slums, high school drop out rates in tribal villages, etc. It is heartening to see several groups of students and faculty of DBIT taking up these causes and using technology as a tool to address the problem. Addressing these problems is very challenging in terms of understanding its multiple dimensions and identifying and designing appropriate solutions.

As the readers browse through this issue of DBIT Journal of Science and Engineering (DBJSE), they cannot but be overwhelmed by the richness of the content in terms of diversity of the topics as well as the quality of research. Each paper included here is an original contribution which has undergone stringent quality checks by a team of experts who have made immense contribution to their field.

The contents of this journal reaffirm the fact that technology is not only about complex solutions but also about simple innovations that can go a long way to mitigate the problems created by mindless exploitation of our resources. There are a million problems to be solved but a beginning has been made and with each year we hope to influence hundreds of bright minds to join our campaign for a sustainable world.

Dr. Prasanna Nambiar, PhD

Investigation of Hypermode Characteristics of A Microstrip Patch Antenna

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Abstract: **A systematic detailed inquiry of the relevant aspects of hypermodes in a microstrip patch antenna and their characteristics is conferred in this communication. Field configurations and hypermodes in a frequency window of 0.9GHz to 6GHz are analyzed for return loss, surface current distribution and radiation pattern at the dominant and hypermode frequencies. The investigation is based on the theoretical, experimental, and simulation results.**

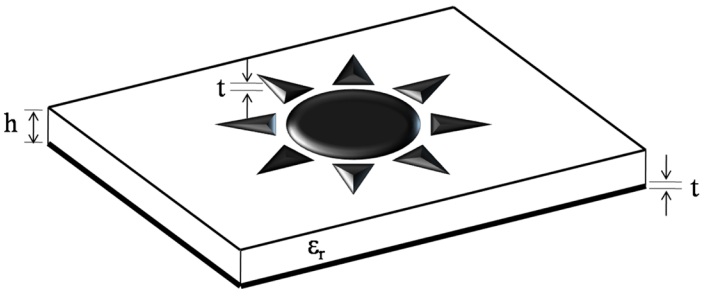
Keywords: Hypermodes, Microstrip patch antenna, Surface currents.

I. INTRODUCTION

Microstrip antennas (MiSA) since their conception [6] have proved to be a versatile technique of realizing antennas. Their low dimensional profile, conformability, robustness, ease in integration with other subsystems and acquiescent mass productivity provide an edge over other antenna techniques. These inherent characteristics of MiSA make them suitable for various applications, from basic wireless and satellite communication systems to bioengineering system solutions inspite of a few associated shortcomings. The study and analysis of these antennas has continued to be a matter of great interest to researchers.

The physical assembly of a MiSA is very simple and flat, with the upper surface of the dielectric substrate supporting the printed conducting strip or the radiating element which is suitably contoured while the lower surface is backed by the conducting ground plane as shown in Figure.1. The printed radiating element of thickness(*t*) and dimensions comparable to half-wavelength is electrically driven with respect to the ground plane. MiSA can be realized in a variety of shapes from simple rectangular, square or circular [7] to vibrant designs such as fractals [8], [13], [15]. The thickness of dielectric substrate *h* lies in the range of $0.003\lambda o \leq h \leq 0.05\lambda_o$ with respect to free space wavelength λ_o. The operating frequency of a MiSA is very sensitive to change in ϵ_r which is normally chosen in the range of 1 to 12.

In case of an excited microstrip antenna, along with the radiation waves, surface waves are generated. Surface waves [2], [3], [5] are waves that are trapped in the substrate medium between the radiating element and the ground plane. As they propagate within the substrate, they encounter reflections at the substrate-metal and substrate-air interfaces and continue to be confined in the substrate, unless at boundaries where they are reflected back and also diffracted. While the surface waves travel within the dielectric substrate, they also couple



with conducting strips or radiating elements. The surface modes exist in two modes; the Transverse Electric *TE* mode and the Transverse Magnetic *TM* mode. These modes exist in dominant and hyper *TE* and *TM* modes with cut off frequencies given by [7],

$$f_c = \frac{nc}{4h\sqrt{\epsilon_r - 1}} \tag{1}$$

Eqn. (1) shows the dependency of surface waves on substrate dielectric constant ϵ_r and also the height of the substrate *h*. Here, *c* is freespace light velocity and n = 1, 3, 5, 7 and so on for mode TE_n and n = 0, 2, 4, 6 and so on for mode TM_n.

The surface waves carry power and hence in context of antennas they are considered to be responsible for reduced radiated powers and in-turn reducing radiation efficiency. In [7] it is shown that the surface wave power increases as the height of substrate increases. Several researchers and designers have proposed microstrip antenna designs with suppressed surface waves for improved radiation efficiency [9]–[11], [17]. Surface waves have utmost effect in case of array configurations [4], [16] and hence design techniques for minimal surface wave effect is often considered [14]. The surface waves responsible for generation of infinite number of transverse *TE* and *TM* modes in the dielectric substrate have certain interesting radiation characteristics. This aspect of microstrip antennas at hypermodes demands a detailed investigation of the microstrip antennas, which is presented in this communication.

In this presentation, a detailed study of the transverse modes or the hypermodes in comparison with the dominant mode of a RMiSA, considering cavity model approach is documented. The patch cavity is studied for the transverse modes that exist within it for a frequency window of 0.9GHz to 6GHz. The resonant frequency at each mode, return loss, surface current distribution, gain and the radiation pattern at each higher mode is analyzed. The study is based on the theoretical, experimental and simulation results obtained and a comparison is made.

II. ANALYSIS

The analysis of RMiSA is based on three aspects; theoretical, simulation and experimental. A comparative analysis of the three aid better justified conclusions.

II-A. THEORETICAL ANALYSIS

The objective of this paper is to analyze a MiSA with respect to their radiation characteristics. A primary discussion on the electrical model and surface currents on the radiating elements aid a better insight.

In accordance with cavity model analysis [3], the internal region of RMiSA with a patch of length $l\wp$ and width $w\wp$, is treated as a dielectric loaded cavity bounded by electric conductors at the upper and lower sides and by magnetic walls along the perimeter. The four sidewalls along the perimeter represent four narrow radiating slots. As discussed earlier, due to surface waves within the interior region, there exist standing waves and thus the interior region is expressed in terms of a series of cavity resonant modes. The lowest resonant mode frequency in the cavity is termed as the dominant mode and others as higher order modes or the hypermodes. These mode frequencies for a RMiSA are expressed as,

$$f_(\varrho, mn) = \frac{1}{2\pi\sqrt{\mu\epsilon}}\sqrt{\left(\frac{m\pi}{\ell_\wp}\right)^2 + \left(\frac{n\pi}{w_\wp}\right)} \tag{2}$$

where, m and n are mode numbers. The radiation characteristics of the RMiSA at each of the resonant modes is unique and is based on the surface current density on the patch. This necessitates formulation of the complex surface current density on the radiating patch. Applying Galerkin's method of moments and disintegration of the surface current into basis functions, it is expressed as,

$$J_\wp = \sum_{p=1}^{Q} I_p J_ \tag{3}$$

Here the decomposition of Q number of surface current basis functions with coefficients Ip result in Fourier series terms aligned along x and y directions expressed as in (4a) and (4b),

$$J_{mnx} = \left[\frac{1}{w_\wp}\sin\left(\frac{m\pi}{\ell_\wp}\left(x-\frac{\ell_\wp}{2}\right)\right)\right]\left[\frac{1}{\ell_\wp}\sin\left(\frac{n\pi}{w_\wp}\left(y-\frac{w_\wp}{2}\right)\right)\right] \tag{4a}$$

$$J_{mny} = \left[\frac{1}{w_\wp}\sin\left(\frac{n\pi}{\ell_\wp}\left(x-\frac{\ell_\wp}{2}\right)\right)\right]\left[\frac{1}{\ell_\wp}\sin\left(\frac{m\pi}{w_\wp}\left(y-\frac{w_\wp}{2}\right)\right)\right] \tag{4b}$$

Using Maxwell's equations and known current density, the electric field for a RMiSA is formulated as,

$$\vec{E}_\wp(\varrho) = j\omega\mu\vec{A}_\wp(\varrho) + \frac{\nabla\left(\nabla.\vec{A}_\wp(\varrho)\right)}{j\omega\epsilon} \tag{5}$$

where, magnetic vector potential is given by,

$$\vec{A}_\wp(\varrho) = \int_S G(\varrho-\varrho^{'})J_s(\varrho^{'})dS(\varrho^{'}) \tag{6}$$

ϱ and $\varrho^{'}$ and I are the distances to the point of observation and the location of source respectively. G ($\varrho-\varrho^{'}$) is the Green's Dyadic function of Helmholtz operator given by,

$$G(\varrho-\varrho_{'}) = \frac{e^{jk|\varrho-\varrho_{'}|}}{4\pi\mid\varrho-\varrho_{'}\mid} \tag{7}$$

From (4a)(4b) and(6)(7)in (5) the electric fields in the far-field for varying modes is expressed as [12],

$$\vec{E}_{mn\phi} = 2E_f k sin\theta\cos\theta\frac{e^{-jk\varrho}}{2\lambda_{fo}\varrho}\left[1-\cos(m\pi)\,e^{kw_\wp\cos\phi\sin\theta}\right]\left[1-\cos(n\pi)\,e^{k\ell_\wp\sin\phi sin\theta}\right]\left[\frac{\sin^2\phi}{k^2\sin^2\phi\sin^2\theta-\frac{n^2\pi^2}{\ell_\wp^2}}-\frac{\cos^2\phi}{k^2\cos^2\phi\sin^2\theta-\frac{m^2\pi}{w_\wp^2}}\right]$$

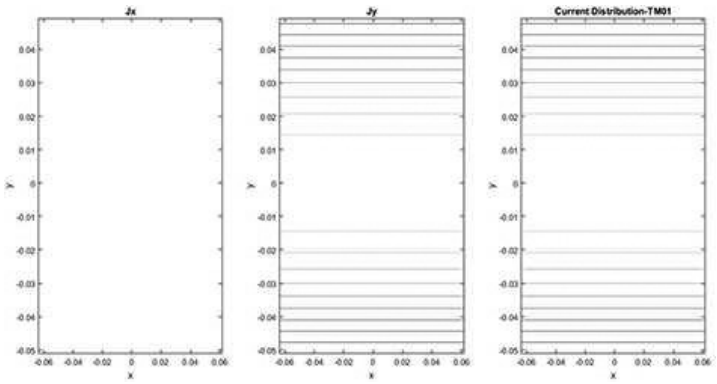
$$\vec{E}_{mn\theta} = -2E_f k sin\theta\cos\phi\sin\phi\frac{e^{-jk\varrho}}{2\lambda_{fo}\varrho}\left[1-\cos(m\pi)\,e^{kw_\wp\cos\phi\sin\theta}\right]\left[1-\cos(n\pi)\,e^{k\ell_\wp\sin\phi sin\theta}\right]\left[\frac{\sin^2\phi}{k^2\cos^2\phi\sin^2\theta-\frac{m^2\pi^2}{w_\wp^2}}-\frac{\cos^2\phi}{k^2\sin^2\phi\sin^2\theta-\frac{n^2\pi^2}{\ell_\wp^2}}\right]$$

Further, this theoretical analysis is applied to RMiSA design at 0.915GHz discussed in section II-B. For specific design dimension, the resonant frequencies are computed

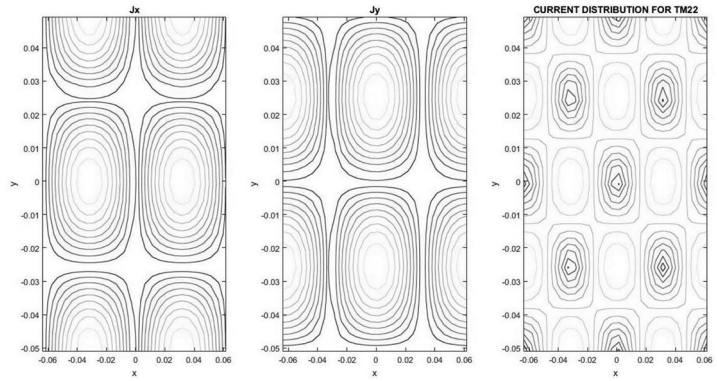
using (2) for an observation window of 0.9GHz to 6GHz. These frequencies and their respective modes are listed in Table.I. The surface current density distributions discussed with eqns. (4a) and (4b) is computed using Matlab at each mode within the observation window and a few are illustrated in Figure.2 and further, these current distributions are compared with those generated using the simulation tool in section II-C.

II-B DESIGN FOR IMPLEMENTATION

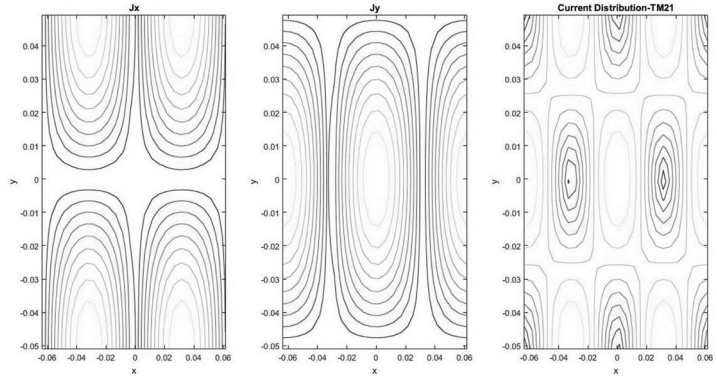
In this communication, microstrip patch analysis is done on a rectangular microstrip patch antenna (RMiSA) with an inset feed designed for an operating frequency of 0.915GHz impedance matched to 50Ω as shown in Figure.3. The RMiSA is designed on 2.33 Rogers substrate of 62mil thickness. The dimensions of the rectangular patch are computed using the empirical equations of (10) and (11) as in [1].



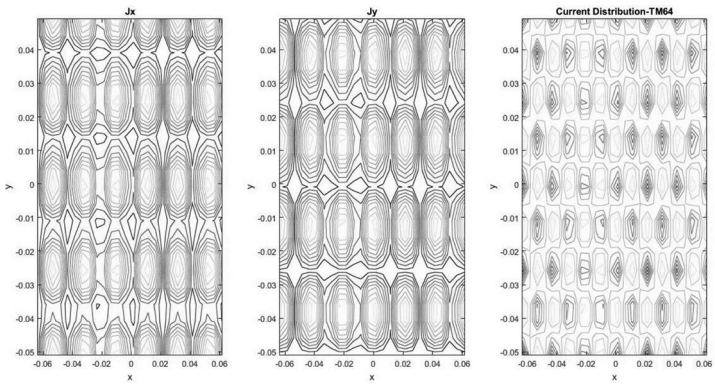
(a) For $m = 0$, $n = 1$.



(b) For $m = 2$, $n = 1$.



(c) For $m = 2$, $n = 2$.



(d) For $m = 6$, $n = 4$.

Fig. 2. Surface current distribution on a RMiSA. (a) At dominant mode. (b) - (d) At hypermodes.

$$w_{\wp} = \frac{1}{f_r\sqrt{\mu_o\epsilon_r}}\sqrt{\frac{2}{\epsilon_r+1}}$$

$$\ell_{\wp} = \frac{1}{2f_r\sqrt{\mu_o\epsilon_r}\sqrt{\epsilon_{r.eff}}} - 2\delta\ell_{corr}$$

where,

$$\delta\ell_{corr} = 0.412h\frac{\epsilon_r+0.3}{\epsilon_r-0.258}\frac{\left(\frac{w_{\wp}}{h}+0.264\right)}{\left(\frac{w_{\wp}}{h}+0.813\right)}$$

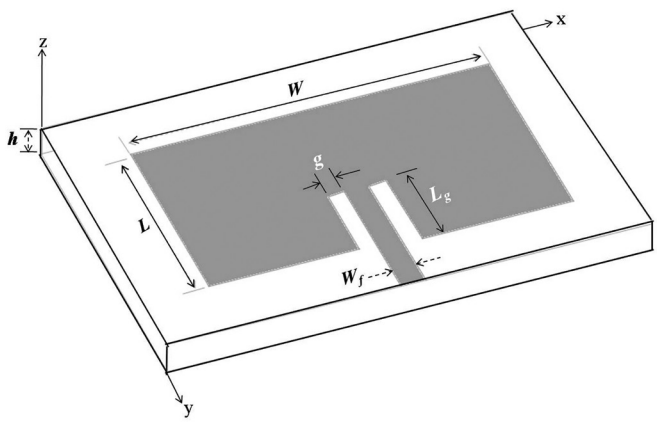


Fig. 3. Rectangular Microstrip Antenna.

The optimized patch dimensions of the RMiSA are patch length, $\ell_{\wp}$ = 106.79mm, patch width, $w_{\wp}$ = 127.05mm, excited by a 50Ω transmission line feeder of width, w_{feed} = 4.678mm at an inset gap, g_{in} = 2.339mm and inset length, $\ell_{\text{in.g}}$ = 33mm.

II-C. SIMULATION AND EXPERIMENTAL ANALYSIS

The performance of the RiMSA designed above is evaluated using a finite element method based software which involves computation of electric fields at the nodes of polygon meshes by interpolation of the field at individual nodes to the overall mesh nodes. Following the interpolation, adaptive solutions for a set level of convergence condition is computed. These analysed results are further compared with the experimentally measured outcomes for validation. The comparison is based on return loss (S11), gain, bandwidth, radiation efficiency and current distributions on the radiating patch at all mode resonances within the observation window and radiation pattern.

For experimental verification, the physically implemented RMiSA of dimensions 170mm × 180mm × 3.2mm is tested using a 8GHz vector network analyzer. The theoretically computed mode frequencies of RMiSA are compared with simulated and experimentally measured mode resonant frequencies as compiled in TableI. A comparative plot of the simulated and experimentally measured S11 values is also shown in Fig.4 which reflects congruence in the results.

It is seen that the gain is higher at all hypermode frequencies except at 2.4GHz in comparison to the dominant mode. It can also be observed that the radiation efficiency of the antenna at all mode operations is more or less constant to an average value of 0.92 and the least being at 2.4GHz.

TABLE I. Comparison of resonant mode frequencies and their respective gain, return loss, Half Power Beam Width [HPBW] in major lobe and radiation efficiency.

Resonant Modes TM_{mn}	**Theoretical** (*GHz*)	**Simulated** (*GHz*)	**Experimental** (*GHz*)	**Return Loss** (*dB*)	**Bandwidth (%)**	**Gain** (*dBi*)	**Radiation Efficiency**
*TM*01	0.9202	0.915	0.917	−32.5	1.27	4.97	0.92
*TM*20	1.5463	1.542	1.526	−14.0	1.16	6.04	0.92
*TM*21	1.7999	1.771	1.801	−20.95	1.26	7.74	0.91
*TM*22	2.4042	2.3926	2.400	−14.3	0.57	4.44	0.87
*TM*03	2.7606	2.7036	2.612	−15.7	1.44	11.1	0.97
*TM*41	3.2278	3.2682	3.227	−27.00	0.66	8.38	0.93
*TM*42	3.5999	3.6282	3.564	−19.27	0.90	12.34	0.94
*TM*24	3.9927	3.9728	4.127	−25.5	0.58	10.29	0.92
*TM*25	4.8541	4.7595	— — —	−27.80	0.45	10.61	0.93
*TM*26	5.7338	5.6725	— — —	−28.00	1.25	10.61	0.95
*TM*64	5.9233	5.97	5.883	−13.00	0.33	8.47	0.89

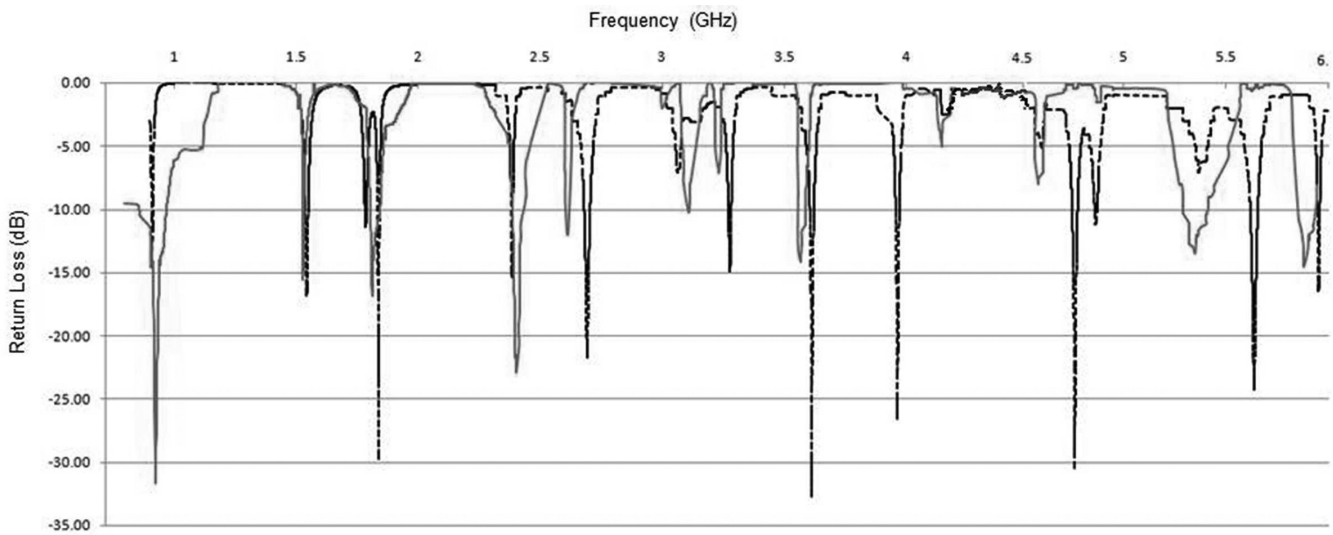


Fig. 4. Comparison of simulated and experimentally verified results for Return loss at dominant and hypermode frequencies.

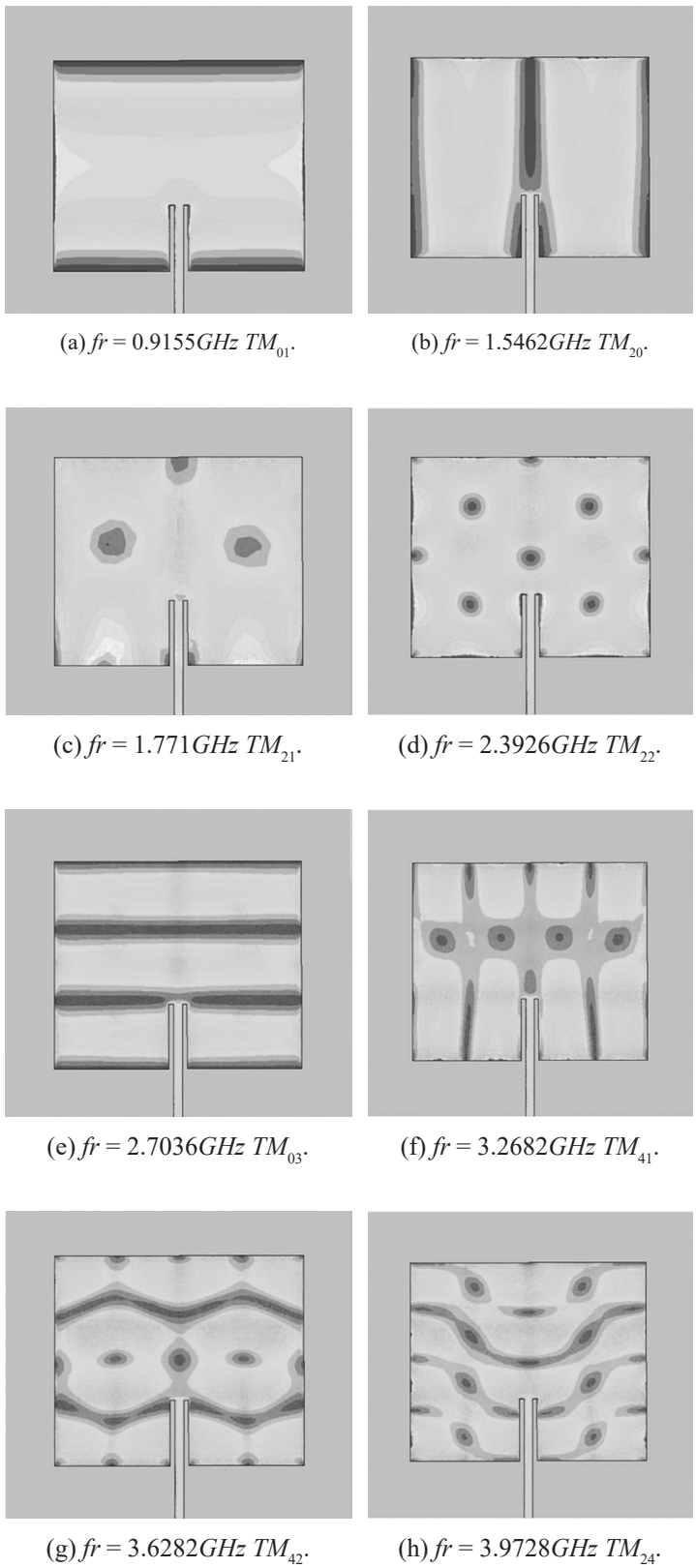
The surface current distribution for the resonant modes within the observation band is shown in Figure 5. Here the highest and lowest conduction current densities are indicated by red and deep blue respectively. An observation of 5a. demonstrates variation of current distribution along the length of the patch while it is constant along the width; implying radiation at the design frequency or the dominant mode is along only two edges of the patch in accordance to the conventional cavity mode theory. In case of higher order modes, the standing waves arrive in the x and y direction, hence the current density periodically varies along both the length and width of RMiSA, except in the TM20 and TM03 modes. Further, an observation of the radiation patterns at dominant and hypermodes is also made. The few E-plane radiation patterns are illustrated in Figure.6. The pattern measurement is done in a lab environment and not in an anechoic chamber and hence certain discrepancies are noted. It can be observed that the radiation pattern at dominant mode of the resonating patch is single lobed in contrary to the radiaton pattern at hypermodes.

III. CONCLUSION

An extensive study of the behavioural characteristics of an elementary patch configuration at its higher order modes is conducted both theoretically and experimentally with the aid of simulation tool.

A comparison drawn between the radiation patterns obtained by simulation and experimentally measured patterns, reveal that at the dominant mode radiation is a single directional broadside lobe, whereas at the hypermodes it is multilobed. The measured radiation patterns are in close agreement with the simulated results. Also an observation of the 3 dimensional radiation pattern at the hypermode frequencies, reveals presence of growing number of lobes as the order of modes increase. This characteristic feature of RMiSA can prove to be an advantage.

Also, the periodic nature of current distribution at hypermodes is an interesting and significant observation. Thus the surface current distribution in case of hypermodes can be used as an important tool in the study of patch antennas so as to either suppress or enhance them depending on specific antenna applications. The paper is an attempt to bring together all relevant aspects of a microstrip patch antenna so as to provide more insight with respect to existence of hypermodes and their characteristics. As highlighted, the gain at hypermode frequencies are higher than the dominant mode with no compromise on the radiation efficiency. Hence, unlike the common argument that surface waves are excited along the antenna substrate which results in radiation in undesirable directions, the authors believe that this characteristic of surface waves can be used to an advantage. Since radiation at hyper-modes are multilobed, this characteristic can be used in applications of multi-path propagation systems.



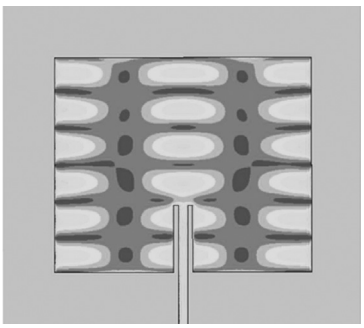
(a) $fr = 0.9155 GHz\ TM_{01}$. (b) $fr = 1.5462 GHz\ TM_{20}$.

(c) $fr = 1.771 GHz\ TM_{21}$. (d) $fr = 2.3926 GHz\ TM_{22}$.

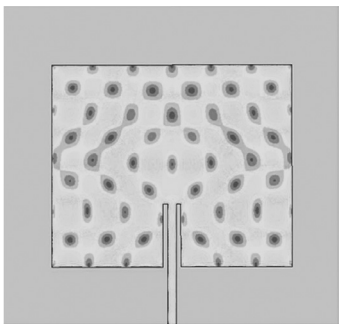
(e) $fr = 2.7036 GHz\ TM_{03}$. (f) $fr = 3.2682 GHz\ TM_{41}$.

(g) $fr = 3.6282 GHz\ TM_{42}$. (h) $fr = 3.9728 GHz\ TM_{24}$.

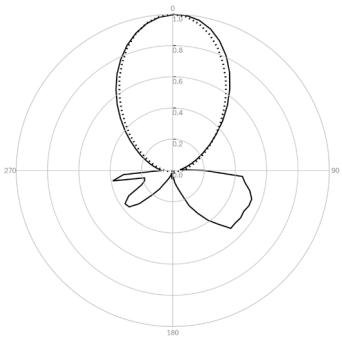
Fig. 6. E-Plane radiation pattern - comparison between experimentally measured and simulated patterns at different modes for = 0. (a) At dominant mode. (b)-(e) At hypermode.



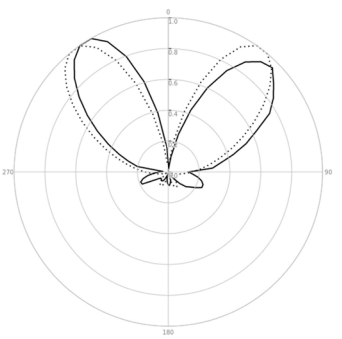
(i) $fr = 5.6725GHz\ TM_{26}$.



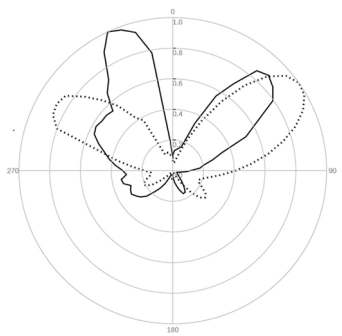
(j) $fr = 5.9233GHz\ TM_{64}$.



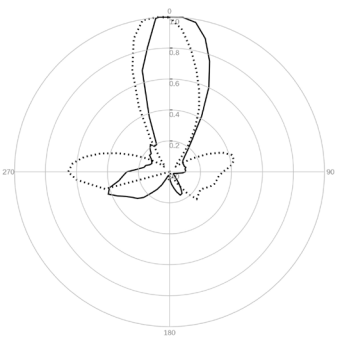
(a) TM_{01}.



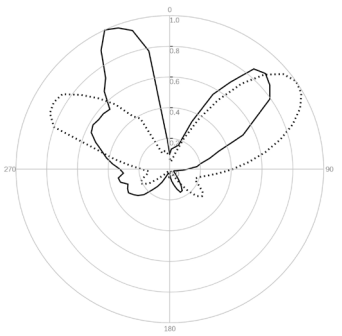
(b) TM_{20}.



(c) TM_{21}.



(d) TM_{22}.



(e) TM_{64}.

Fig. 6. E-Plane radiation pattern - comparison between experimentally measured and simulated patterns at different modes for = 0. (a) At dominant mode. (b)-(e) At hypermode.

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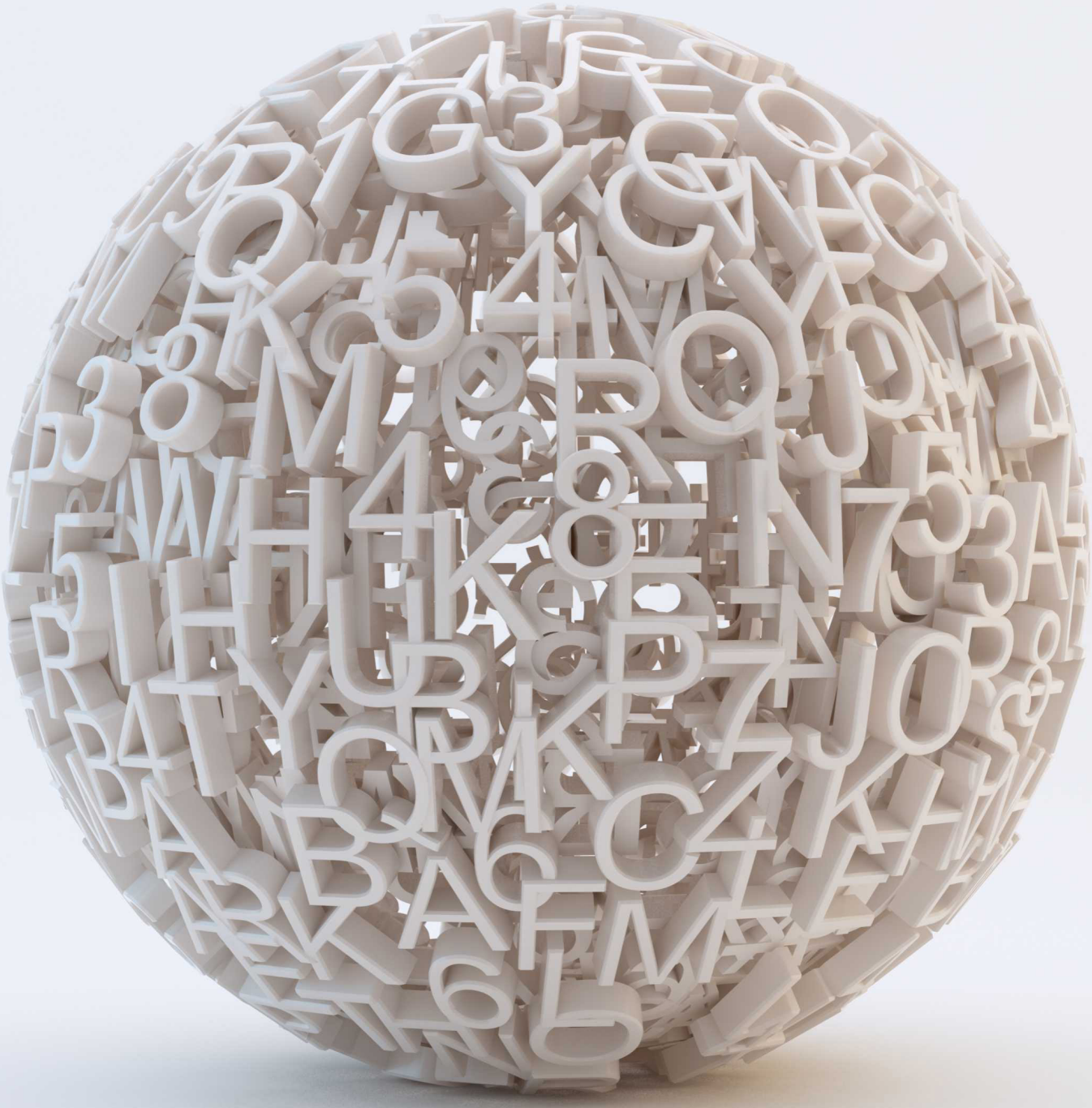

Testing and Calibration of a Delta Model 3D-Printer

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Abstract: **This paper presents testing and calibration process of Delta Model 3D-Printer. The process of calibration includes calibrating the belt tension, adjusting the number of steps taken by the stepper per millimetre, feed rate and flow rate. Various tests were conducted to test the accuracy and resolution of the prints. Based on the results the above mentioned parameters were modified. The accuracy obtained after the process is +/- 10 microns with a vertical resolution of 150 microns.**

I. INTRODUCTION

The process of 3D-Printing is basically manufacturing a 3 dimensional object layer by layer [1] from nothing. This process is carried out by depositing thermoplastic material on to a print surface. In order to obtain high accuracy and precision, excellent motion control and temperature control is required, thus making testing and calibration extremely important. In this paper, we will be discussing the process of testing and calibration of Delta Model 3D-Printer. In the next section, the Delta Machine will be explained and how it's various parameters will a effect the accuracy and resolution. Then various tests conducted, analysis made and the calibration done is explained.

A. Delta Machine

A Delta machine [2] is a type of parallel robot, which consists of closed kinematic chains. The part of the printer which deposits the material while printing; the effector is attached to several independent serial kinematic chains. The advantages of the Delta machine are speed, accuracy and repeatability of the motion.

In Fig. 1, aluminium extrusions have been used to construct the frame of the machine. The extrusions are joined together using plastic 3D printed objects. The surface on which the material is deposited while printing is called the print bed.

The machine consists of three stepper motors which control the belt and pulley mechanism. The belt is attached to a slider which moves the arms attached to the end effector. Thus the motors, belt and pulley system and the slider mechanism are all responsible for the motion of the end effector.

B. The Process of 3D-Printing

The process of any kind of manufacturing method starts with design. Computer aided design(CAD) model of the object is input to software(Fig.2). The software converts the 3D model into 2D layers to facilitate the process of layer by layer manufacturing of the object. This process of 3D model to 2D layer conversion is known as Slicing. Once the slices have been generated; the software generates geometric codes (G-Codes) and machine codes(M-Codes) which control motion of the end effector. The process of slicing is also responsible for accuracy and resolution of the printed object. These codes are then fed into the micro-controller which will move motors in order to get the end effector to the desired location.

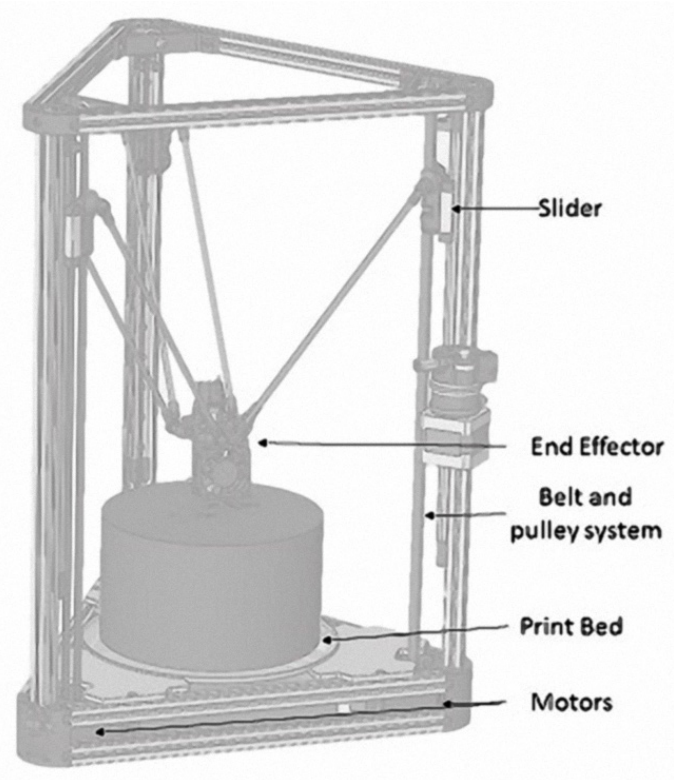

Fig. 1. Delta Model 3D-Printer

II. TESTING AND CALIBRATION

A. Mechanical Frame

It is very important for the frame to be symmetrical. The symmetry of the printer should be accounted for right from the design and build stage of the printer. The motion of all the arms attached to the end effector has to be symmetrical; for this symmetry of the structure is necessary.

B. Motors

The first test is to check the motors and endstops. The motors should move in the desired direction freely and with very little disturbance. If the motors move in a direction exactly opposite to that of the desired direction then check the wiring. If the motors emit a high pitch noise then the potentiometers of the drivers are turned on high. This will give the motors too much power which will lead to overheating and the motors working noisier than usual. Adjust the potentiometer so that the motors do not emit any foreign noise and the motors get enough current to move without skipping any steps.

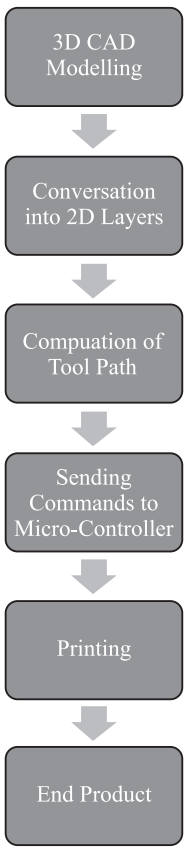

Fig. 2. The Process of 3D-Printing

C. Endstops

The endstops are the only feedback the software gets from the printer. Calibrating the endstops gives the software an optimum printable height.

The other thing is to check if they are wired properly as the RAMPS shield gives support for six endstops. Three are for minimum and three are for maximum position.

In order to check if the endstops are working correctly, the m-code M115 is used. It gives the status of the endstops in terms of high or low. High means the endstop switch is closed and it has reached the maximum height.

D. Bed Levelling

Before starting the first print it is essential to level the glass platform. If the bed is not leveled properly then it can be leveled using two methods. One method is to mechanically level the print bed and the other method is to configure the endstops. Mechanical leveling of the bed is done with the help of spirit level. Configuring the endstop is known as Z Probing. Z probing is done by manually moving the extruder to various test points and then measuring the height of the nozzle from the bed at each point. Delta printer needs more calibration than a normal Cartesian printer. Therefore a delta printer needs the endstop to be calibrated too. This is done by changing the value of endstop offset in the EEPROM configuration.

E. Belt Tension

It is necessary that all the three belts are under equal tension for a proper symmetric print in all the three directions.

One way to check if all the belts are under same tension is to print a circle; If the circle is proper that means all the belts are under approximately equal tension else it will be an elliptical print.

F. Extruder

The extruder needs to be calibrated to get better quality prints. If the extruder is not calibrated properly then it would give errors like stringing and blobs while printing along with noisier printing. To calibrate the extruder mark the expected length on the polymer. Extrude out this length and see if the actual extruded length is the same as the extruded length. If it is not the same then derive the new steps per mm. It can be calculated by using the expression:

$$Expectedlength * steps = actuallength * newsteps$$

This new steps per mm is the changed in the EEPROM configuration.

G. Feed-rate and Flow-rate

The amount of plastic flowing from the extruder is an important aspect. While the tool paths are being laid, the slicer software spaces the lines based on the width of the filament. The width to be extruded is determined by the combination of the layer height feed rate(travelling speed) and the flow rate(amount of plastic ejected by the nozzle).

As closer is the nozzle from the bed, more the plastic gets squished and wider is the melted filament. And as the feed rate increases, lesser the plastic coming out making the deposition thinner and wider thread is achieved by decreasing the feed rate. Feed rate and flow rate is set according to the requirement of the model to be printed. Generally, the feed rate is kept to be lesser at the perimeters which will call for higher flow rate, and the infill is set to print faster.

III. TROUBLESHOOTING

In order to arrive at best quality print the printer needs to be tweaked to the minute details. In this process it is common to face a lot of bad prints. This section covers all the problems faced and its solution.

A. Unable to extrude at the start

Most new 3D Printers face this problem and it is very easily resolved. There are four possible causes that could lead to the extruder not extruding plastic at the start of the print.

1. Priming: Most extruders start leaking plastic when they are sitting idle at a high temperature. This creates a void inside the nozzle where the plastic has drained out. To solve this issue, the extruder must be primed right before beginning a print so that the nozzle is full of plastic and ready to extrude. A common way to do this is by printing a base-perimeter shaped outline known as skirt which is nearly 5-6 mm away from actual perimeter, it will prime the extruder with plastic.

2. Clogged extruder: This could happen due to the foreign debris being trapped inside the nozzle, when hot plastic sits inside the extruder for too long, or if the thermal cooling for the extruder is not sufficient and the filament begins to soften outside of the desired melt zone. Fixing a clogged extruder may require disassembling and cleaning the extruder.

3. Nozzle close to the bed: If the nozzle is too close to the bed then there will not be enough room for plastic to come out of the extruder. The nozzle gets blocked. One way to recognize this issue is if the print does not extrude plastic for the first layer or two and begins to extrude normally around the third or fourth layers as the nozzle moves up along the Z-axis. This problem can be solved by using a Z offset. The Z offset will lift the nozzle from the bed surface by the amount specified.

4. Stripped filament: 3D printers use a small gear to push the filament into and pull it out of the tubing. The teeth on this gear bite into the filament and allow it to accurately control the position of the filament. However sometimes the drive gear strips off too much plastic and then it does not have much left to grab onto when it tries to move the filament back and forth.

B. Print Adhesion

The first layer forms the foundation of the print. If the foundation does not adhere properly to the bed surface then the entire print is build on shaky ground and creates problem later on. There are several ways to cope up with the first layer adhesion problem.

1. Bed not levelled: If the bed surface is not levelled then one side of the bed will be too close to the nozzle and the other side far away from it. This will lead to the layer not adhering properly to the bed surface. Therefore first make sure that the bed levelling is properly done using z probing.

2. Nozzle away from the bed: The goal is to locate the perfect distance of the nozzle away from the build plate not too far and not too close. For good adhesion the filament needs to be slightly squished to the bed pate. The nozzle position can be adjusted by changing the height of the height parameter in the firmware or by changing the offset setting in slicer.

3. Speed: If the first layer is printed too fast then the plastic may not get enough time to bond to the surface. For this reason, it is typically very useful to print the first layer at a slower speed so that the plastic has time to bind to the bed.

4. Temperature Setting: Plastic tends to shrink as it cools from a warm temperature to a cool temperature. If the first layer seems to stick initially, but later separates from the print bed as it cools then it is possible that the temperature and cooling settings are wrong. It is a common practice to keep the first layer temperature higher than for the rest of the print. Also the cooling fan can be disabled for the first few layers so that it gets enough time to the bed surface.

5. Bed surface: Different plastics tend to adhere better to different materials. For this reason, many printers include a special build platform material that is optimized for their materials. Make sure that the surface is free from dust, grease or oil before printing. Instead of printing directly onto the bed surface it is better to apply tape to the surface. For example, PLA tends to stick well to blue painters tape or masking tape. Hair spray, glue sticks, and other sticky substances tend to work very well if everything else has failed.

6. Brims and Rafts: Printing very small parts that does not have enough surface area to stick to the build platform surface leads to poor adhesion. Most slicers have several options that can help increase this surface area to provide a larger surface to stick to the print bed. One of these options is called a brim. The brim adds extra rings around the exterior of your part. Another option is to add a raft under the part, which can also be used to provide a larger surface for bed adhesion.

C. Holes and gaps

To save plastic, most 3D printed parts are created to have a solid shell that surrounds a porous, partially hollow interior. The exterior should be completely solid. To do this the slicer setting allows one to set the number of solid layers on top and bottom. This technique can save a tremendous amount of plastic and time, while still creating very strong parts. However there may be certain gaps to make up for the solid layers. This problem can be solved by changing several settings.

1. Top solid layers: The first setting to adjust is the number of top solid layers that are used. While printing a 100% solid layer on top of your partially hollow infill, the solid layer has to span across the hollow air pockets of the infill. As a good rule of thumb, the solid section at the top of the print should be at least 0.5mm thick. If there are still gaps between the extrusions in the top surface, the first thing is to increase the number of top solid layers.

2. Infill: The infill on the inside of the print will act as the foundation for the layers above it. If infill percentage is very low then there will be large air gaps in the infill. If even after increasing the number of top solid layers gaps in the top of your print persists then increase the infill percentage to see if the gaps go away.

3. Under-extrusion: If even after increasing the infill the print is face the problem of gaps and holes then it is an under-extrusion issue. This means that the printer is not extruding as much plastic as the software expects.

D. Stringing or oozing

Stringing occurs when small strings of plastic are left behind on a 3D printed model. This is typically due to plastic oozing out of the nozzle while the extruder is moving to a new location. The most common setting that is used to combat excessive stringing is something that is known as retraction.

If retraction is enabled, when the extruder is done printing one section of your model, the filament will be pulled backwards into the nozzle to act as a countermeasure against oozing. When it is time to begin printing again, the filament will be pushed back into the nozzle so that plastic once again begins extruding from the tip.

1. Retraction distance: This determines how much plastic is pulled out of the nozzle. In general, the more plastic that is retracted from the nozzle, the less likely the nozzle is to ooze while moving. Most direct-drive extruders only require a re- traction distance of 0.5-2.0mm, while some Bowden extruders may require a retraction distance as high as 15mm due to the longer distance between the extruder drive gear and the heated nozzle.

2. Retraction speed: determines how fast the filament is retracted from the nozzle. If retraction is done too slowly, the plastic will slowly ooze down through the nozzle and may start leaking before the extruder is done moving to its new destination. The ideal value of retraction speed ranges between 20-60 mm/s.

E. Stops extruding in between prints

If the extruder is working normally at the start and then suddenly stops extruding, then there are a few things that can cause this problem.

1. Stripped filament: During a print, the extruder motor is constantly spinning trying to push the filament into the nozzle so that the printer can keep extruding plastic. If the drive gear ends up grinding away the filament until there is nothing left to grab onto. If the extruder motor is spinning, but the filament is not moving, then this is likely the cause.

2. Clogged extruder: The extruder can stop extruding in between a print if the extruder is clogged. If this happens then check the extruder and make sure there is no dust or damaged filament.

3. Retraction speed: If the retraction speed is too high then while printing complex objects the print may stop in between. This is because the high speed retraction causes the filament inside the extruder to be damaged causing the extruder to be clogged.

4. Overheated extruder motor or motor driver: The extruder motor has to work incredibly hard during a print. It is constantly spinning back and forth, pushing and pulling plastic back and forth. This quick motion requires quite a bit of current, and if the printers electronics do not have sufficient cooling, it can cause the motor driver electronics to overheat. These motor drivers typically have a thermal cutoff that will cause the driver to stop working if the temperature gets too high. If this happens, the travel motors will be spinning and moving the extruder toolhead, but the extruder motor will not be moving at all. The only way to resolve this issue is to turn off the printer and allow the electronics to cool down.

F. Weak infill

The infill plays a very important role in the overall strength of the object. The infill is responsible for connecting the outer shells of the 3D print, and must also support and upper surfaces that will be printed on top of the infill.

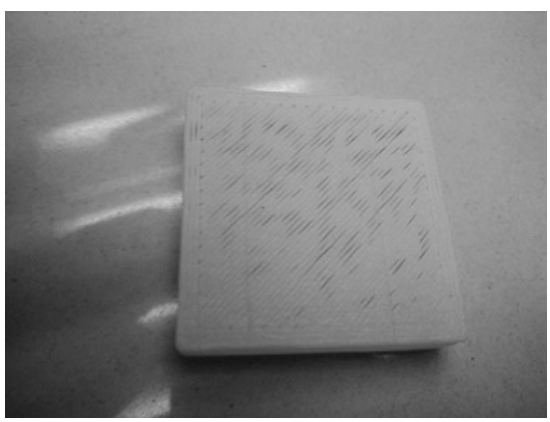

Fig. 3. Holes in print due to weak infill

1. Alternate infill pattern: The Internal Fill Pattern determines what pattern is used for the interior of the part. Some patterns tend to be more solid than others. For example, Grid, Triangular, and Solid Honeycomb are all strong infill patterns. Other patterns like Rectilinear and Fast Honeycomb may sacrifice some strength for faster printing speeds. If the printer is not producing reliable prints then try different patterns.

2. Extrusion width: Some slicers have the ability to modify the extrusion width that is used for the infill. For example, at a value of 200%, the infill extrusions will be twice as thick as the outline perimeters. One thing to keep in mind when adjusting this setting is that the software must also maintain the infill percentage. To maintain the same infill percentage, the infill lines must be spaced further apart. For this reason, many users tend to increase their infill percentage after increasing the infill extrusion width.

3. Curling Corners: If the tops layers of the print start curling then it is typically due to overheating issues. The plastic is extruded at a very hot temperature, and if it does not cool quickly, it may change shape over time. Curling can be prevented by rapidly cooling each layer so that it does not have time to deform before it has solidified.

Fig. 4. Curling around the surface

G. Dragging

In 3D Printing the entire object is made by printing one layer at a time. This means that the extruder can move to any point during the print. While this facilitates for faster printing, sometimes the nozzle leaves a mark when it travels on top of a previously printed layer. This is typically most visible on the top solid layers. These scars and marks occur when the nozzle tries to move to a new location, but ends up dragging across previously printed plastic.

1. Extruding too much plastic: This is one of the first things to look at. When the printer is extruding too much plastic, the layer height becomes more than intended. This is because the flowrate and printer speed is not calibrated properly. At lower speeds the nozzle will stay at one point for longer time and thus depositing more plastic. When the nozzle moves from one point to the next across each layer, it may drag through some of the excess plastic.

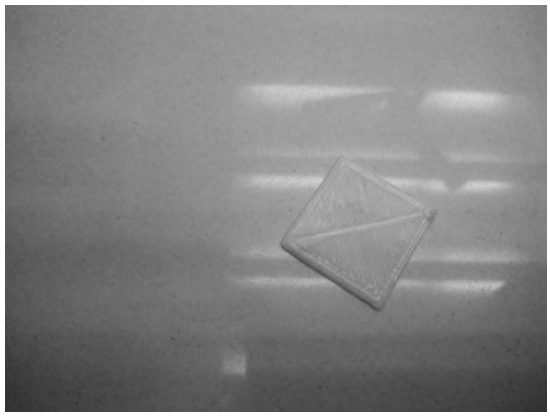

Fig. 5. Drag caused by low speed and high extrusion

2. Vertical lift (Z-Hop): If the printer is extruding the correct amount of plastic, yet the nozzle is dragging across the layers then lift the nozzle by some amount while travelling across the layers. This causes the nozzle to lift up a set distance above the previously printed layer before moving to a new location. When it arrives at its final location, the nozzle will lower back down to prepare for printing. By moving at an elevated height, this can avoid the nozzle scratch on the top surface of your print. This lift will only occur while the printer is performing a retraction.

H. Bad Surface Finish

A 3D Printer has hundreds of individual layers. If things are working properly, these layers will appear to be a single, smooth surface. However, if something goes wrong with just one of these layers, it is usually clearly visible from the outside of the print. These improper layers may appear to look like lines or ridges on the sides of your part(Fig. 6).

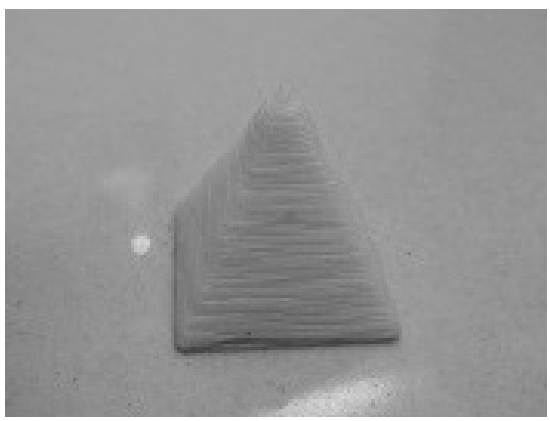

Fig. 6. Poor surface finish due to lines

1. Layer height: The smoothness of a print depends upon the layer height. The smaller the layer height, more smooth and precise a print is. Calibration of layer height also depends upon the speed. If the layer height is small and the speed is high then the print object wont stick to the print bed.

IV. RESULTS

The testing and calibration is an important part of designing and integration of a 3D-Printer. The result of these calibrations and tweaks was a print accuracy of +/- 10 microns and a vertical resolution of 150 microns with excellent surface finish (Fig. 7).

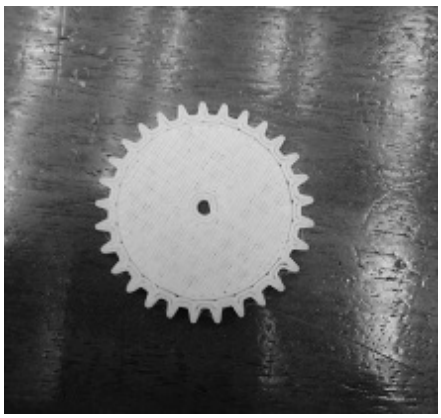

Fig. 7. 3-D Printed Gear

V. CONCLUSION

The computational processes of slicing and g-code generation also play an important role in deciding the print quality. An adaptive temperature control could be incorporated into the the g-codes could help obtain better prints while printing small objects. The algorithm should be designed in such a way; when the dimension of the object is less than the certain threshold, the temperature for that layer and further on should be less than the previous layers.

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Calibration of biogas plant at DBIT

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Abstract: **This article describes the sustainability and calibration of the kitchen waste type biogas plant installed at Don Bosco Institute of technology (DBIT), Mumbai, India. It gives a method of determining quantitative savings in conventional fuels when replaced with biogas. It describes procedure of finding amount of carbon dioxide emission that will get reduced by not using conventional fuels but equivalent quantity of biogas. It also guides in determining the methane content of the biogas by using a crude method. The conventional fuels that are presented for comparison are kerosene and wood, usually used in rural areas. The above methods are applied to the family size biogas plant at DBIT and the tabulated results support the sustainability of biogas. The length scale calibration of plant's gas generation/consumption in terms of volume is carried out in the article. Generation rate is again calibrated in terms of amount of CO2 emission reduced and savings on conventional fuels.**

Keywords: biogas volume scale, carbon dioxide scale, sustainability data, kerosene savings scale, wood savings scale.

I. INTRODUCTION

Sustainability means meeting the needs of present without compromising the ability of future generations to meet their own needs [1]. Energy is one of the primary needs of human society today and most of it is being obtained by burning the fuels, so it is necessary to bring sustainability in meeting the energy need. One of the ways of doing this is switching from conventional fuels to non- conventional fuels like biogas.

There are two major worldwide issues with reference to sustainability in energy. First one is, depletion of non-renewable conventional fossil fuels. Second, almost all of them are non eco-friendly. The other problems are energy security of the nation (dependency on other countries for the basic need, energy) and without fossil fuels, applications other than energy production will not be available, such as preparing some important medicines. So the data on amount of particular conventional fuel saved and carbon dioxide emission reduced due to the saving is very important and helpful in solving the above issues. This can even be used to compare between, and comment on sustainability level of, any two or more non-conventional fuels.

Objective of this article is to describe a methodology that gives the information on determining annual reduction in use of quantity of kerosene, quantity of wood etc. and hence reduction in quantity of carbon dioxide emission due to the use of biogas, which can promote sustainable development. The expected outcome is to create awareness in the society and motivate the people to shift to biogas by providing them the evidence of comparison with conventional fuels.

The article is divided into three major parts: First, marking the length scale as volume scale. Second, setting up graduations for an (volume flow) indicator showing quantity of conventional fuel saved and money saved due to use of biogas instead of a conventional fuel. Third, devising a scale for a (volume flow) meter showing reduction in CO2 due to the substitution of biogas for a particular conventional fuel.

II. GENERAL DESCRIPTION OF PLANT INSTALLED AT DBIT

The biogas plant installed in DBIT is ARTI floating drum type kitchen waste plant as shown in fig. 2.1. Plant parameters are as described in table 2.1.

TABLE 2.1

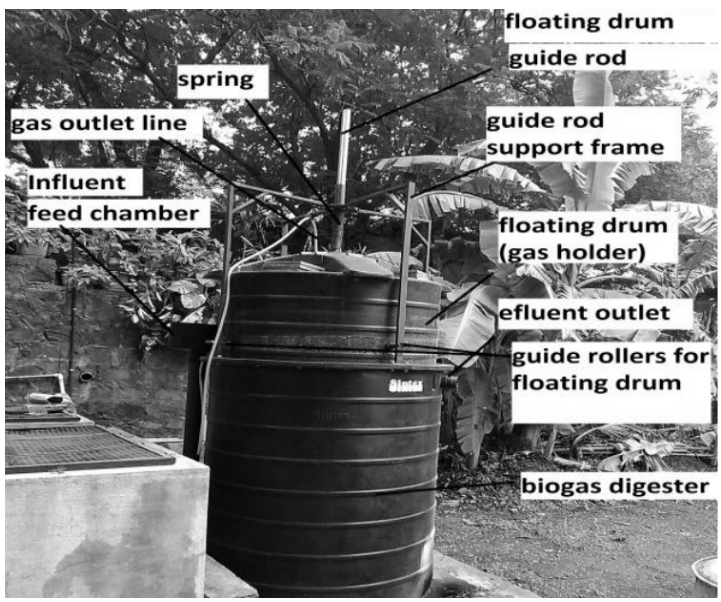

Fig. 2.1 Construction of biogas plant at DBIT

TABLE 2.1
Plant parameters

Sr. No.	Particulars / parameters	Dimensions / qty
1	Inner radius of floating drum	67 cm
2	Outer radius of floating drum	68 cm
3	Annular spacing between fermenter and floating drum	1760 cm^2
4	Maximum level of drum allowable to raise above digester drum opening	71 cm
5	Maximum gas pressure allowable	13 cm of water gauge
6	Maximum gas holding capacity	1 m3
7	Fermenter/digester drum inner radius	72 cm
8	Slurry level to be maintained from bottom surface of fermenter (effluent outlet level)	160 cm
9	Gas generation in 24 hr-	0.5 m3 to 0.7 m3
10	Influent added per day	7 kg kitchen waste+7 to 10 times water (fill, up to level of effluent outlet)
11	Retention time (time for complete digestion of influent for 5 kg kitchen waste with total gas production 1 cubic meter)-	2 days
12	Calorific value of biogas (avg)	12.55 MJ/m3
13	Methane content u(avg)	40%

Feeding the biogas plant starts with removal of hard material, metal pieces or plastic from the food waste and churning recommended quantity into the crushing unit. While crushing water along with food is poured slowly into the basin of crusher with the help of a small mug without over feeding the crusher. Crushed material is continuously collected in the bucket during this. Crusher is switched off and cleaned with water. Collected crushed waste is poured into the inlet pipe. Digester is not fed if floating drum is reached its maximum level. Extra amount of water is fed through the inlet pipe if required, to maintain the water level up to outlet in the biogas system. The daily feedstock quantity is reduced to half the recommended quantity during the cold season when the bacterial activity is low. Biogas is burnt by connecting the gas pipe with stove and igniting the gas using a lighter. During this slacking of pipe is avoided to stop water accumulation and pressure drop. Always maintain a positive pressure in the system so check if manometer is working daily. Precautions taken during the process are: No smoke or open flames are allowed near biogas digester. Crusher is switched off if blades get blocked and do not rotate. Crusher lid is kept closed when crusher is switched on. A positive pressure is always maintained in the system

III. CALIBRATING VOLUME SCALE OF BIOGAS PLANT

Biogas generated daily could be measured by using flow meters by emptying floating drum completely. In this article, the measurement is done by reading raised floating drum level and diameter of floating drum. The length measuring scale is calibrated in terms of volume as shown in table 3.1. In this it is assumed that there is negligible effect on volume due to increase in negligible pressure (maximum 13cm of water) The level difference in the volume is measured directly by looking at the volume scale before adding feedstock and after 24 hr. Reading is taken for several days and it is noted that volume generation per day (24hr) varies from 0.5 cubic meter to 0.7 cubic meter. (5 days reading is given in the table 3.2).

TABLE 3.1
Volume Scale

Length L (cm)	Volume (Litre) $(\pi/4)d^2L$
1	14
2	28
3	42
4	56
5	71
.....	.....
70	990

TABLE 3.2
Volume Of Gas Generated By The Plant For Five Days

Day	Level of floating drum		Volume generated (lit)	Food waste added (kg)	Water added (Lit)
	Previous day (after consumption/burning)	After approx 24 hrs (Before consumption/burning)			
1	14	54	570	5	35
2	14	50	500	5	40
3	14	68	770	7	65
4	14	54	570	5	40
5	14	68	770	7	60

IV. METHANE CONTENT IN BIOGAS

Determining percentage of methane in biogas is essential before doing analysis, because it is the key element which actually burns and produces energy. To determine methane content by volume of the biogas, first the calorific value of biogas is determined as follows:

A known mass of water is taken in a vessel and kept on a stove. It is heated from 25oC to 100oC until boiling is noticed. The amount of thermal energy required is calculated and divided by heating efficiency to get the calorific value, using the equation below.

Calorific value of biogas based on volume
= [Mass of water
x Isobaric specific heat of water
x temperature rise of water in a vessel kept on cooking stove]
/ [Overall efficiency of heating the water
x Volume of biogas consumed]

Where,
1. The volume of biogas consumed is measured by using a diaphragm type cumulative gas flow meter,

2. Mass of water is taken as 0.5 kg,

3. Iisobaric specific heat is assumed invariable with temperature,

4. Temperature of water raised by 75°C,

5. Overall efficiency of heating the water, due to losses to surroundings, is assumed as 16% [2]

The above data is recorded and calculated for five days by feeding almost same quantity and constituents of influent to the digester. It is tabulated as follows and an average calorific value is determined of daily generated biogas as 16020 kJ/ cubic meter.

TABLE 4.1
Observation Table To Calculate Average Calorific Value Of Biogas

Day No.	Volume of biogas Used (Cubic meter)	Calorific value (kJ/cubic meter)
1	0.060	16328
2	0.061	16060
3	0.059	16604
4	0.062	15801
5	0.064	15307

Average methane content of the biogas generated by the digester is calculated by following equation
Volume of methane in biogas
= Average calorific value of biogas
/ Calorific value of methane
This comes out to be 49% for the plant installed at DBIT.

V. SAVINGS IN KEROSENE AND WOOD

Kerosene is the fuel obtained from crude oil distillation and most of the crude oil is imported in many countries, so there is a problem of energy security with its use, so savings on this can reduce the problem to some extent.

Wood as a fuel is obtained from the trees, cutting the trees harms the environment. Also it has been observed that people in rural areas spend a large amount time in collection of firewood from the locations away from the residence. Women spend 374 hours each year collecting firewood in India [4]. This also causes health hazard, like spondylitis. This time, if reduced, can let them use for better livelihood. So savings of wood can lessen these problems.

The savings resulting from the use of biogas can be determined by following equations, with the knowledge of average volume of biogas generated daily, equal to 0.7 cubic meter for the plant in DBIT.

A. For kerosene:
Quantity of kerosene saved annually

= [(Average quantity of biogas generated daily x no. of days biogas generated in an year)
x (average calorific value of biogas)
/calorific value of kerosene)]

B. For wood:
Quantity of wood saved annually
= [(Average quantity of biogas generated daily x no. of days biogas generated in an year)
x (average calorific value of biogas)
/calorific value of wood)]

For the kitchen waste type of biogas plant installed at DBIT the above information can be tabulated as follows.

TABLE 4.2
Savings Data Due To The Use Of Biogas Instead Of Conventional Fuels

Sr. No.	Fuel	Annual Savings
1	Kerosene	144.4 litre
2	Wood	254.1 kg

Speaking in terms of cost, actual price of kerosene is 30 INR/ litre and subsidized is 15 INR/litre., so 4320 or 2160 INR can be saved annually. A simple payback period of the plant costing INR. 30000 will be 7 or14 years.

VI. REDUCTION OF CARBON DIOXIDE EMISSION

To estimate carbon dioxide generated due to burning of a conventional fuel, following procedure is used. In this it is assumed that combustion is complete and only CO_2 and H_2O are final products after combustion reaction. The amount of carbon dioxide produced by combusting hydrocarbon fuel equivalent to biogas can be considered as reduction in carbon dioxide, because biogas is carbon neutral. The reason is, even though biogas contains CO_2 (almost 30% to 50%) and generates CO_2 after burning, the amount of carbon that plants absorbed out of atmosphere is only emitted back when the influent is fermented and biogas is combusted [3]. So no carbon dioxide actually gets generated.

A. For kerosene:
Annually, the quantity of CO_2 produced by burning kerosene equivalent to biogas
= quantity of kerosene saved
x mass of CO_2 produced per unit mass of kerosene burnt

{Where mass of CO_2 produced per unit mass of kerosene burnt can be calculated by using combustion reaction by taking average chemical formula for kerosene as $C_{12}H_{23.5}$

$$C_xH_y + (x+y/4)O_2 \rightarrow xCO_2+(y/2)H_2O$$

For wood
Annually, the quantity of CO_2 produced in kg by burning wood equivalent to biogas (assuming wood as $C_6H_{12}O_6$)
= quantity of wood saved
x mass of CO_2 produced per unit mass of wood burnt

{Where kg of CO_2 produced per kg of wood burnt can be calculated by using combustion reaction of $C_6H_{12}O_6$

$$C_6H_{12}O_6+6O_2 \rightarrow 6CO_2+6H_2O$$

For the kitchen waste type of biogas plant installed at DBIT the above information can be tabulated as follows

TABLE 6.1
Reduction In Co2 Data Due To The Use Of Biogas Instead Of Conventional Fuels

Sr. No.	Fuel replaced by biogas	Annual reduction in CO_2 quantity
1	Kerosene	313.85 kg
2	Wood	371 kg

It is to be noted that, the kerosene is a petroleum product and some energy has to be spent in obtaining and processing of it. The amount of CO2 produced during this (mining & distillation) is not accounted in the above calculations and hence CO2 production in reality will be more.

Also burning of wood (6 carbon atoms in a molecule) and kerosene (on an average 12 carbon atoms in a molecule) compared to biogas (1 carbon atom in a molecule) can lead to incomplete combustion and emission of carbon monoxide, soot etc. because combustion tends to be less complete as the number of carbon atoms in the molecules rises. This can adversely affect the health of the person using wood or kerosene daily for cooking purpose.

VII. CALIBRATION OF PLANT IN TERMS OF SAVINGS IN REPLACED FUEL

Volume of biogas consumed/generated can be said as equivalent kerosene or wood saved due to replacing them for fullfilling energy needs. For calculating this, instantaneous methane content in biogas is required to be known. It could be assumed that the biogas contains annual average % of methane (50% approx) and hence a simple volume scale can be calibrated in terms of savings in fuel as given in table 7.1. In this way cumulative flow meter used to measure consumption of biogas, can be calibrated as cumulative savings meter with reference to a replaced conventional fuel.

Table 7.1
Calibrating Volume Scale Of Biogas In Terms Of Savings In Conventional Fuels And Hence Money

Biogas consumed/ generated (Lit)	Quantity of Kerosene saved (gm)	Quantity of wood saved (gm)
14	7.9	13.9
28	15.8	27.8
42	23.7	41.7
56	31.6	55.7
71	40.1	70.6
.....	....	.....
990	559.4	984.6

VIII. CALIBRATION OF PLANT IN TERMS OF REDUCTION IN EMISSION OF CO_2

For a definite amount of biogas burnt, there is an associated definite carbon dioxide emission reduction due to not burning of particular conventional fuel. Once the biogas volume generated (that will be burnt and consumed) and savings in replaced conventional fuel is known, instantaneously the reduction in carbon dioxide can be determined. Volume scale can be calibrated in terms of CO2 reduced as given in table 8.1.

Table 8.1
Calibrating Volume Scale Of Biogas In Terms Of Reduction In Co_2

Biogas consumed /generated (Lit)	Reduction in CO_2 (gm) due to not consuming equivalent of Kerosene	Reduction in CO_2 (gm) due to not consuming equivalent of wood
14	24.8	20.3
28	49.8	40.6
42	74.6	61
56	99.5	81.3
71	126.3	103.1
.....	....	.....
990	1760	1437.5

IX. CONCLUSION

The things that can be concluded from above discussion are:
1. One of the direct outcomes of using biogas is, it saves money and money spent on its installation can be recovered back in the duration much lesser than its lifespan.

2. Its use may result in reducing overall oil consumption and imports, also it saves environment being carbon neutral, hence supports sustainability.

3. Its indirect outcome is, especially in rural areas, it can bring better health and save time of the people which could be spent by them for doing the other work.

4. Biogas has significant potential in bringing sustainability in energy needs. The tabulated values are only for single family, cooking requirements, with the increase in number of families the values will be enormous.

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Energy Efficient Wood-Stove

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Abstract: **This paper has attempted to propose an improvement in the design of non-conventional woodstove. The paper highlights the current problems faced by the rural population in India that uses the traditional stoves/chulha to cook food. This paper is the modest attempt towards experimental study in lab backed with field work for energy efficient cooking devices based on wood as main fuel. The study is designed in such a way so as to compare these energy efficient cook stoves as opposed to traditional cook stoves in terms of their thermal efficiency, time of cooking, fuel consumption; finally being helpful in assessing the sustainability of such new technology interventions particularly in rural areas.**

Keywords: Non-conventional wood stove, combustion chamber.

I. INTRODUCTION

Four out of every five rural and one out of every five urban households primarily depend on direct burning of solid biomass fuel like wood, crop residue and cattle dung in traditional mud stove or three stone fire for cooking. To meet their cooking energy needs, large numbers of households in the country's poorer rural areas use traditional chulha/ stoves, which consume firewood and other biomass as fuel. Such traditional cooking practice is characterized by incomplete combustion of biomass fuels resulting in emission of toxic smoke.

A novel fuel-efficient stove was developed that requires no external power, costs $5, and vents nearly all of the smoke that is produced in the process of cooking. Current stoves have not been disseminated widely in India because they are costly, non-portable, and/or not suited to existing cooking methods.

In designing a smokeless stove to reduce IAP, smoke needs to be evacuated without decreasing thermal efficiency and without employing external power. The materials that are required to implement this solution would have to be low-cost and locally available.

A design of profiled conical funnel with a truncated tip was sought after that evacuates smoke through a connected "ventilation pipe" and breathes oxygen from an angled "air inlet" in its lower base, while heating a vessel that sits atop the structure. Since the fire is completely contained within this structure, the device harnesses the convective energies of the smoke toward the productive goal of ventilation. Smoke is driven down its energy gradient (up the ventilation duct and out of the house) by natural convection. By elevating the upper duct, small transient wind currents that create a small pressure gradient help force smoke out of the duct naturally.

II. DESIGN CALCULATIONS AND COMPONENT MODEL

The wood stove is circular in section and consists of a cylindrical clay pot as combustion chamber, a top section and a base. The hearth of the combustion chamber is made of clay, the outside of which is lined with fiberglass and encased in a mild steel casing. The grate or fuel bed is at the base of the combustion chamber. There is a gap between the bottom of combustion chamber and base of the steel casing. At the base of steel casing a simple AC Fan of 10 CFM is attached. The combustion chamber rests on the plate that has eight holes around its annulus.

Based on the choice of a domestic-size stove, the following parameters are selected for the design:

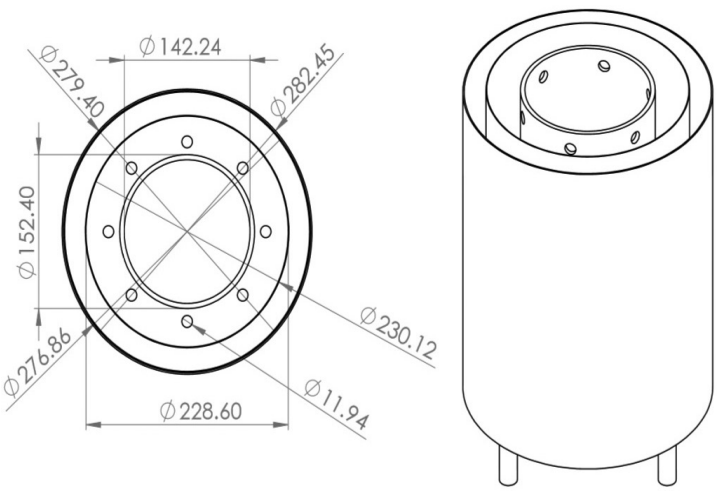

Fig. 1. Description of components

TABLE 1: Material properties of components

Sr. No.	Component Name	Material Name	Tensile Strength N/m^2	Thermal expansion coefficient / K	Thermal Conductivity W / (mk)	Mass Density Kg / m^3
1	Outer Chamber with base	Stainless steel[3]	5.8×10^8	1.6×10^{-5}	16.3	8000
2	Inner chamber	Stainless steel	5.8×10^8	1.6×10^{-5}	16.3	8000
3	Inside Annulus	Ceramic Wool[4]	–	–	0.05	5
4	Lead with vessel support	Plane carbon steel[3]	3.998×10^8	1.3×10^{-5}	43	7800
5	Combustion chamber	Clay[5]	4.87×10^7	5.9×10^{-6}	1.55	1600

Calculations:
Thermal efficiency of the stove shall be calculated as follows:
In S.I. units,

If w = mass of water in vessel= 0.5 kg;

W = mass of vessel complete with lid and stirrer= 0.4 kg;

X = mass of fuel consumed= 0.11kg;

c_1 = calorific value of wood= 1642.0 kcal/kg;

x = volume of kerosene consumed= 8 ml;

c_2 = calorific value of kerosene= 2460.113kcal/kg;

d = density of kerosene=.810 g/cc;

f_1 = initial temperature of water in degree Celsius= 24C;

f_2 = final temperature of water, in degree Celsius;

f_3 = final temperature of water in last vessel at the completion of test= 100C;

n = total number of vessels used=1.

(Specific heat of aluminium = 0.896 kJ/kg degree Celsius).
(1 kcal = 4.186 8 kJ)

Heat utilized = (n - 1) (W x 0.896 + w x 4.186 8) (f_2 - f_1) + (Wx0.896 + w x 4.186 8) (f_3 - f_1) kJ

Heat utilized = (0.4x0.896+0.5x4.1868)(100-24)
= 186.33kJ

Heat produced = $4.1868 [(X \times c_1) + (\frac{xd}{1000} \times c_2)]$ kJ

Heat produced = $4.1868[(0.11x\ 1642) + (\frac{8x0.810}{1000}x2460.113)]$

= 822.99kJ

Thermal efficiency = $\frac{Heatutilized}{Heatproduced}$ x 100 percent

$$= \frac{(n-1)(Wx0.896+wx4.1868)(f2-f1)+(Wx0.896+wx4.1868)(f3-f1)}{4.1868\left[(X*c1)+\left(\frac{xd}{1000}xc2\right)\right]}$$

$$= \frac{186.33}{822.99}$$

= 22.64%

Power Output Rating
The power output rating of a stove is a measure of total useful energy produced during one hour burning of fuel wood. It shall be calculated as follows:

Power output rating = $\frac{(FxCV)}{(860x100)} * \eta thermal$ KW

$$= \frac{\left(0.11x\frac{60}{7}x1642.0\right)}{(860)} \text{ x } 0.2264$$

= 407.57W

Where,
F = quantity of fuel wood burnt, kg/h;

CV = calorific value of fuel wood, kcal/kg; and = thermal efficiency of the stove, as calculated above.

III. ANALYSIS AND RESULTS

Experimental analysis: The stove and vessel are thoroughly cleaned and dried. The test is conducted in an enclosed kitchen environment. A measured amount of fuel wood was weighed out for each test. The same type of wood is used for the series of tests; it is therefore ensured that there was sufficient fuel wood available for the tests, stored in the same place so as to have uniform moisture content. The vessel, lid, and thermocouple are weighed, and then a measured amount of water by volume (about two-thirds the pot capacity) is added to the vessel and weighed again to determine the weight of the water. This was repeated for each test

The already weighed fuel wood is introduced into the combustion chamber and about 15ml of kerosene is sprinkled on it to initiate burning. The vessel is placed on the stove the day, the environmental conditions (ambient temperature) and the initial temperature of the water are recorded. Thereafter the commencement of the test the temperature of the water was recorded at intervals of five minutes until the moment the water came to a vigorous boil. The vessel is then removed from the stove and the fire immediately put out with the help of dry sand. The final weight of the remaining water, charcoal and the final temperature of water were then measured and recorded.

Fig. 2. Stove with thermocouples attached

Steady state Thermal analysis on Ansys workbench conducted on wood stove:

Expected outcome of analysis is to validate the temperature contour produced in the experimentation results with that is produced in the anys steady state thermal analysis.

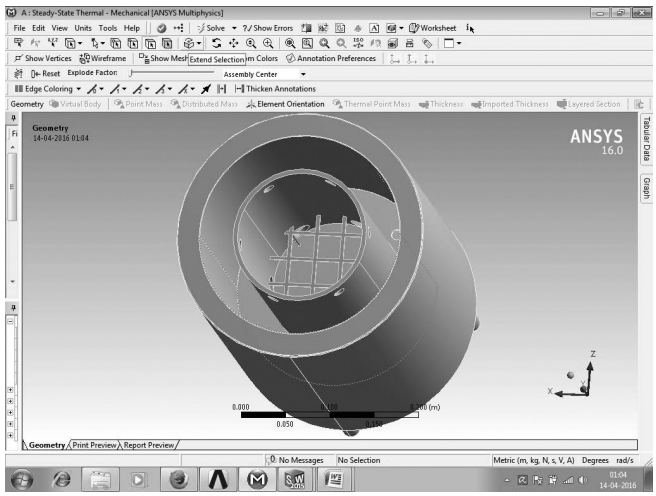

Fig. 3. Anys model of the stove

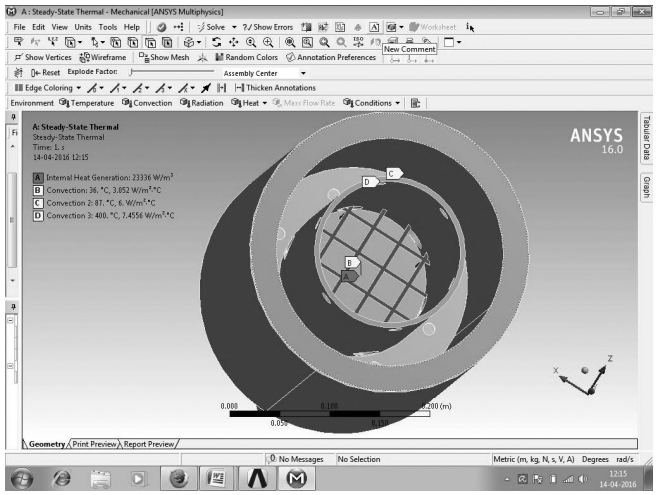

Fig. 4. Boundary conditions (for readings taken at 10 minutes)

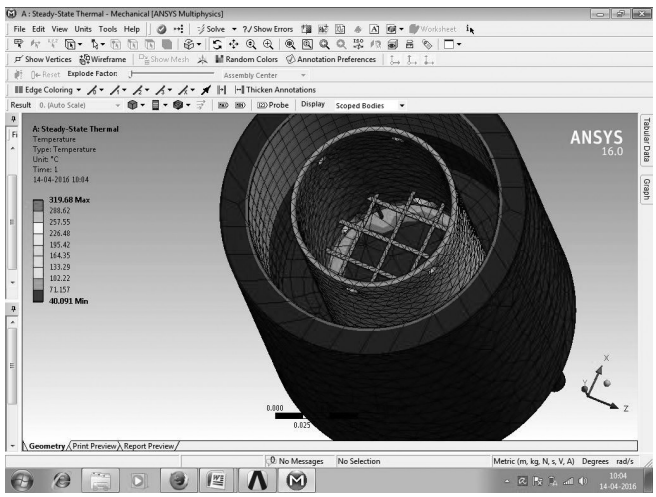

Fig. 5. Boundary conditions (for readings taken at 10 minutes)

Results obtained from simulation:
Comparison of The Results obtain from ansys and experimentally (for Conditions After 10 Minutes):

The power output rating of a stove is a measure of total useful energy produced during one hour burning of fuel wood. It shall be calculated as follows:

TABLE 2

Sr. No.	Position	Experimental Reading (in ^{O}C)	Software Reading (in ^{O}C)
1	Inside wall of combustion chamber	322	319
2	Outside wall of combustion chamber	130	220
3	Space between outside wall of combustion chamber and annulus	87	87
4	Outer wall of annulus(where ceramic wool is inserted)	101	110
5	Outermost Wall	42	40.091

IV. INFERENCE

The Ansys results of the temperatures at different positions are generally greater than the Experimental results. The average % error in the readings have a decreasing trend as the time elapses. That is, at higher temperatures the errors are found to be lower. In every reading, it is seen that the temperatures at positions beyond the combustion chamber reduces drastically. This may be due to the effect of radiation and flow of hot gases directly into the space between combustion chamber and annulus from the primary and secondary holes. These effects and flows are not compatible with ansys steady state thermal analysis

V. CONCLUSION

It would be seen that the modifications made in providing insulation around the combustion chamber and sizable air inlet to admit adequate quantity of air for combustion, incorporating smoke rings to seal the annulus between the pot and the pothole, and redesigning the configuration of the pot seat and the position of the flue gas exit port, have served to increase the thermal efficiency and therefore the percentage heat utilization of the stove. There has also been a drastic reduction in the smokiness of the stove, making it to be more user-friendly in health, comfort and convenience.

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Portable Trolley Jack

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Abstract: **The purpose of this paper is to design a portable lifting and shifting jack to shift furniture for domestic use which is easy for operating, safe which would be able to lift and lower the furniture without spending much effort and time. Available devices typically used in industries are expensive. There are not proper jacks or mechanisms available that can be used in houses or offices in much smaller efforts.**

There is manual load sustaining device but it becomes difficult when heavy furniture is to be shifted by women or elderly persons as they can't sustain heavy load. Manual shifting can cause back problem or injury, So there is a need to design such a portable jack which can be used by everybody easily and safely. When the furniture needs to be lifted, just rotate the handle one to two times and release the handle at the desired height level and shift wherever you want but on same ground level.

Selection of mechanism plays an important role in lifting and balancing. So mechanical toggle jack is selected.

I. INTRODUCTION

A. INTRODUCTION

Research survey has revealed that in several furniture lifting devices mostly some difficult methods are adopted in lifting and shifting furniture load on flat ground level. Proposed model has mainly concentrated on this difficulty and hence suitable device is to be designed such that the object can be lifted and shifted with application of much smaller force.

Portable trolley jack can be operated with minimum human efforts and less time. The operation is made so simple that even an unskilled person can handle with ease, by just demonstrating the working of portable trolley jack.

B. MOTIVATION

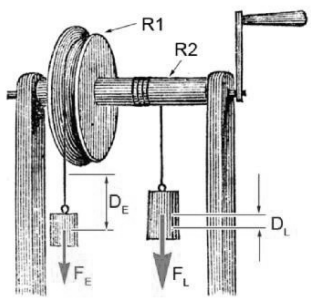
There are different lifting and shifting devices used in the industry which requires more space and are expensive too. For domestic use there is no such device available which can be operated by an individual with ease, with less human effort in reduced time. As women have to handle most of the things at home, so in manual operations women can face back problems while shifting is carried out in bent and squat position.

So the motivation comes from these difficulties to develop a trolley jack that can be operated by an individual(women), that should be compact, economical and helpful in carrying out shifting of cupboards and lockers with ease.

II. LITERATURE REVIEW

A. Various development in lifting devices:

1. Levers
2. Screw threads
3. Gears
4. Wheels and axles
5. hydraulics



- Lever operates on principle of momentum i.e. Torque.
- Screw thread is a simple mechanism which converts rotational motion into linear motion and torque into force.
- Gears operated devices are generally motorized.

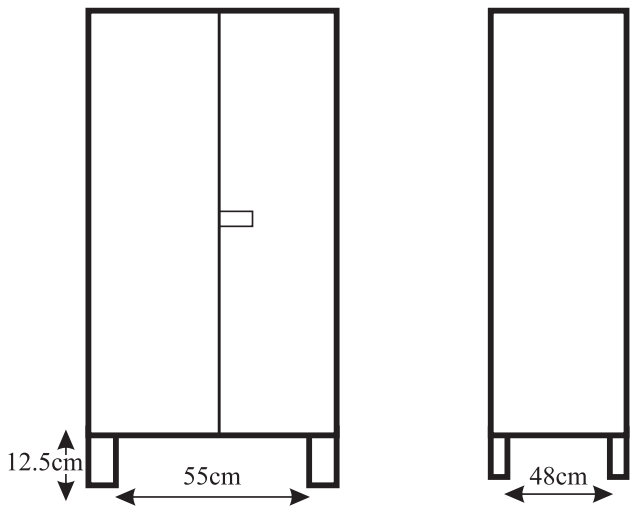
B. Types of lifting jack

1. Mechanical
2. Hydraulic
3. Pneumatic

A mechanical jack is a device which helps in lifting heavy equipments. The most common form is a car jack, floor jack or garage jack which helps in lifting vehicle to perform maintenance. car jacks usually use mechanical advantage to allow a person to lift vehicles easily. More powerful jack uses hydraulic power for more lift over greater distance. Mechanical jacks are usually rated for maximum lifting capacity (1.5 tons to 3 tons).

III. TROLLEY JACK DESIGN AND STUDY

A. Measurement of Cupboard



Cupboard Geometry

- Length of cupboard is 55cm, width is 48cm and ground clearance is 12.5cm.
- So in order to fulfil the requirements trolley jack must have dimensions lower than that of above.
- Unloaded weight of cupboard is 86kg and assume loaded weight as 100kg
- As trolley acts like simply supported beam the cupboard load will act at center as CG of rectangular section lies at center.

B. Design of trolley Jack

➤ Mechanism (scissor jack)

- Components to be designed:
  1. Screw
  2. Nut
  3. Frame
- Selection of material
  1. Screw – selecting C-40 (carbon steel)
  2. Nut - selecting bronze
  3. Frame – carbon steel

➤ Trolley:

- Trolley dimensions must be such that it will easily go under the cupboard.
- i.e. trolley dimensions should be less than cupboard ground clearance, length and width

➤ selection of wheels for shifting trolley:

Specifications:

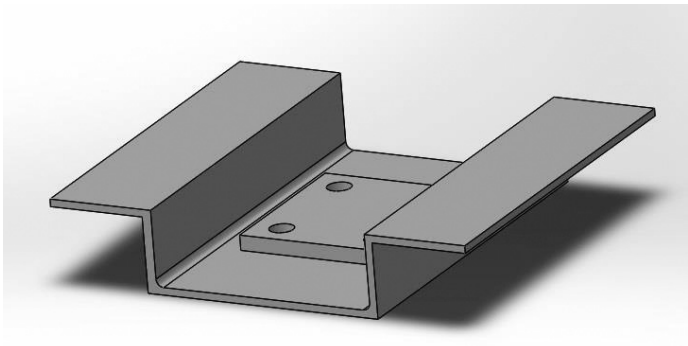
Material: polyurethane

- 5cm Dia. Polyurethane Wheel
- Wheel Width 2cm
- Overall Height 7cm
- Each Wheel 100kg capacity Overall 400kg
- Plate Size 5X5cm

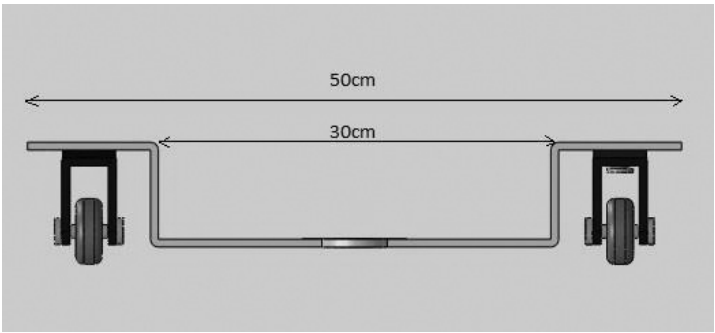
The lock secures the wheels from both rotating and from swiveling.

C. Modeling:-

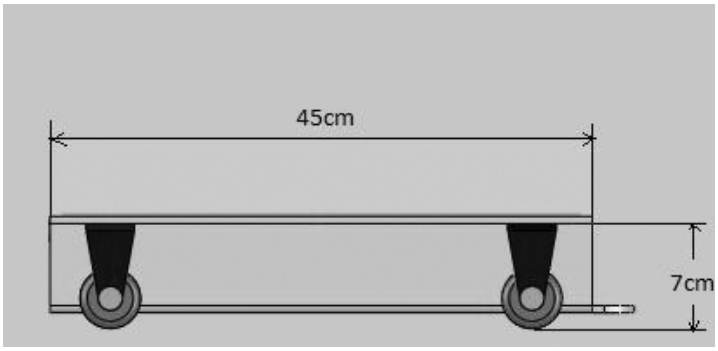
Actual dimensions of cupboard and toggle jack are used to generate a 3D model of trolley and mechanism resp. using solidworks software.



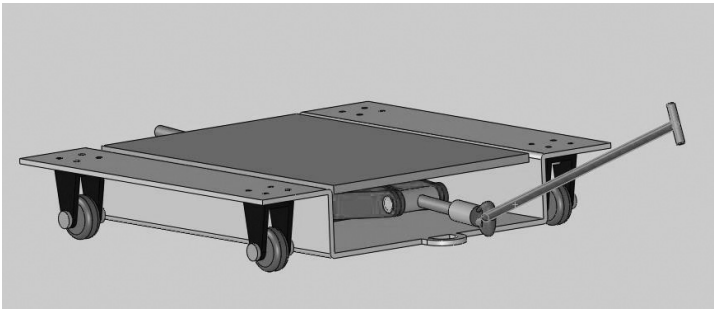
Trolley model



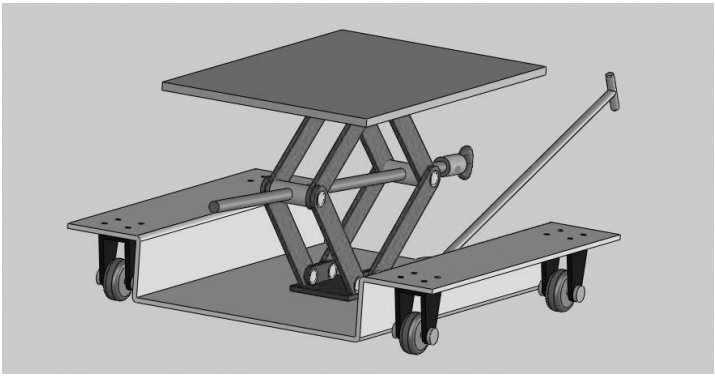
Front view of trolley



Side view of trolley



Compressed height of trolley jack



Extended height of trolley jack

IV. CONCLUSION

Screw Jacks are the ideal product to push, pull, lift, lower and position loads of anything from a couple of kg to hundreds of tones. The need have existed for a long time for lifting as well as shifting furniture for domestic use. It is highly desirable that a jack become available that can be operated by an individual, light in weight, compact enough so that it can be stored in homes or offices, and yet be capable of lifting a load of 100-150 kg off the ground. Further, it should balance the load and easily shift from one position to other in much smaller human effort in less time. Thus, the product has been developed considering all the above requirements. This particular design of the portable trolley jack will prove to be beneficial in lifting and shifting of loads.

V. FUTURE WORK

Its design can be improved to suit various application by adjusting its size.
It can be launched as commercial product.

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Intrusion Detection Using Keystroke Dynamics On Virtual Keyboard For Web Applications

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Abstract: **Password act as a crucial parameter for the sake of user authentication and security purpose. However nowadays protecting the password used by the user for authentification and security purpose has become a necessity as passwords are shared by people for various purposes knowingly as well as unknowingly, also they can be predicted easily by using sophisticated methods by the attackers for the sake of intrusion. With the help of this application one will be able to track the pattern through which user enters the password by recording the time for which key was pressed and the intermediate time between key press and release, forming a signature. As an end result even if the intruder obtains the password of the valid user, the intruder cannot log in to the account of valid user as the signature obtained from the intruder will be compared to the one stored in the database meant for the valid user. Thus, only the valid user can log into the account.**

Keywords: biometrics, secure authentication, keystroke dynamics feature selection, user-independent threshold

I. INTRODUCTION

Computers has become an integral part of our lives and the society has become heavily dependent on it in every aspect of our lives such as communication, aviation, medical and finance, the society heavily depends on computers. To perform any type of operation we provide the computer with vital information. The dependence on computers to store and process information makes the task of securing access to computer systems of great importance [1].

One of the primary means of authenticating users and providing security to computers are textual passwords. Passwords are convenient and require no specialized hardware. However, passwords are vichy on a users frequently shares the password with others and select poor passwords that may easily be cracked. Compromised passwords and shared accounts are frequently exploited by both external attackers and insiders.

One idea to overcome this is to use behavioral biometrics in intrusion detection applications. Keystroke dynamics is one such technique. It is a novel approach in improving the security of passwords in which a legitimate users typing patterns such as duration of keystrokes, latencies between keystrokes etc. are combined with the user's password to generate a hardened password that is convincingly more secure than the conventional passwords. This paper presents our approach for an authentication system based on the use of keystroke dynamics. We present our data selection and extraction methods as well as our classification and verification strategies. Our observations and findings are discussed and compared with prior work in this area.

A. Feature Sets to Use

The following features were identified and implemented:
Enter key: Used when the user finishes typing the username and password.

Shift Key: Used when the user uses any capital letters.

Backspace key: Alternative way to delete in the backward direction.

Mouse click: Alternative to the enter key for submission of username and password.

Keyup-Keydown: Time between the key releases of consecutive keys.

Keydown-Keyup: Time for which the key remained pressed before release.

Total time: Time taken to type complete password.

B. Decision to use Fuzzy Logic

1. *Why Fuzzy Logic?*
   Fuzzy logic being a form of many-valued logic, it deals with reasoning that is approximate rather than fixed and exact; fuzzy logic variables may have a truth value that ranges in degree between 0 and 1.

2. *Selection of Membership Functions* [3] [4]

Degree of membership is calculated by a Membership function. Out of the many membership functions that exist for fuzzy logic, the following six were implemented in the survey done for the same [2].

- Triangular Membership Function
- Trapezoidal Membership Function
- Gaussian Membership Function
- Bell Membership Function
- Sigmoid (S-shaped) Membership Function
- LR (Left-Right) Membership Function

TABLE I
Comparison of Various Algorithms in Terms of FAR and FRR

No.	Membership Functions	Results	
		FAR	FRR
1.	Triangular	0.00	0.93
2.	Trapezoidal	0.13	0.07
3.	Gaussian	0.02	0.01
4.	Bell	0.00	0.02
5.	Sigmoid	0.53	0.33
6.	Left-Right	1.00	0.00
7.	Pi	0.05	0.00

We selected and implemented the PI membership function for obvious reasons of low False Acceptance Ratio (FAR), allowing an intruder to login and False Rejection Ratio (FRR), not allowing the authenticate user to login, [2] as well as considering its edge over the Bell function, as in, a change

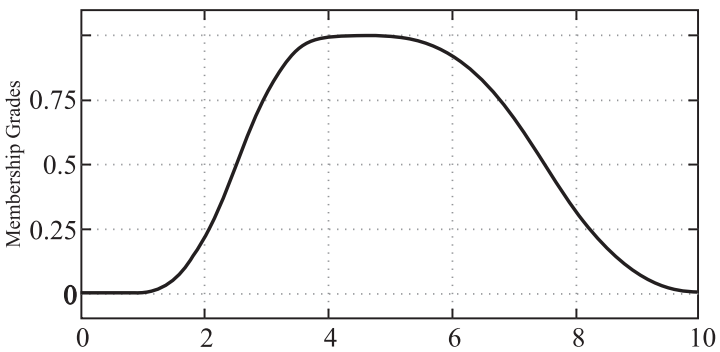

Fig. 1. PI Membership Function

in hardware does not cause much change in pattern detection. This membership function is implemented by using the below given mathematical equation.

$$f(x, a, b, c, d) = \begin{cases} 0, & x \le a \\ 2\left(\frac{x-a}{b-a}\right)^2, & a \le x \le \frac{a+b}{2} \\ 1-2\left(\frac{x-b}{b-a}\right)^2, & \frac{a+b}{2} \le x \le b \\ 1, & b \le x \le c \\ 1-2\left(\frac{x-c}{d-c}\right)^2, & c \le x \le \frac{c+d}{2} \\ 2\left(\frac{x-d}{d-c}\right)^2, & \frac{c+d}{2} \le x \le d \\ 0, & x \ge d \end{cases}$$

Fig. 2. Mathematical equation for PI Membership Function

Where, x = Current time
a = Average time - (2*Standard Deviation)
b = Average time - Standard Deviation
c = Average time + Standard Deviation
d = Average time + (2*Standard Deviation)

II. PROBLEM STATEMENT

To develop a web application that forms a signature of an authentic user's password using virtual keyboard and reduce the sample size if possible.

III. NEED FOR PROPOSED STATEMENT

There are many banking sites which urge the users to use the virtual keyboard as an alternative to physical keyboards. There is currently no such security in place for the virtual keyboards as opposed to the physical ones. The earlier project does not work on virtual keyboard. Also the total number of sample collection was 200 so we tried to find a way to reduce the number of samples required by using simulation.

TABLE II
Physical and Virtual Keyboard Results

	FAR	FRR
PHYSICAL	0.04	0.02
VIRTUAL	0	0.56

IV. ANALYSIS AND DESIGN

A. The expected outcomes of the project are to:

1. Minimum values FAR (False Acceptance Rate) and FRR (False Rejection Rate).
2. Successfully differentiate valid and non valid user.
3. Reduce the number of sample size. If Possible.

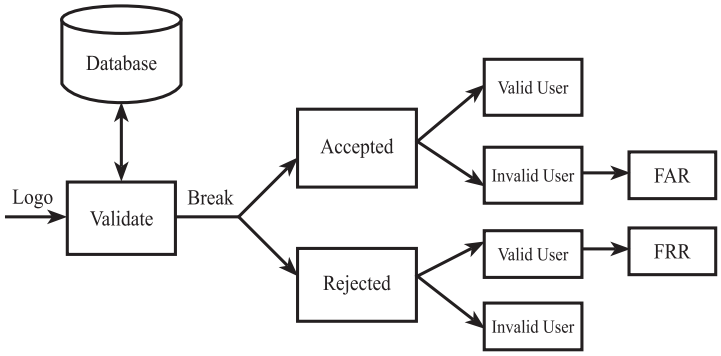

Fig. 3. Block Diagram of the System

B. Process Model Applied- The Incremental Model

The incremental model combines elements of the waterfall model applied in an iterative way. The model applies linear sequences in a staggered fashion as calendar time progresses. Each linear sequence produces deliverable "increments" of the software.

When an increment model is used, the 1st increment is often a core product. The core product is used by the customer. As a result of use and / or evaluation, a plan is developed for the next increment. The plan addresses the modification of the core product to meet the needs of the customer and the delivery of additional features and functionalities in a better way.

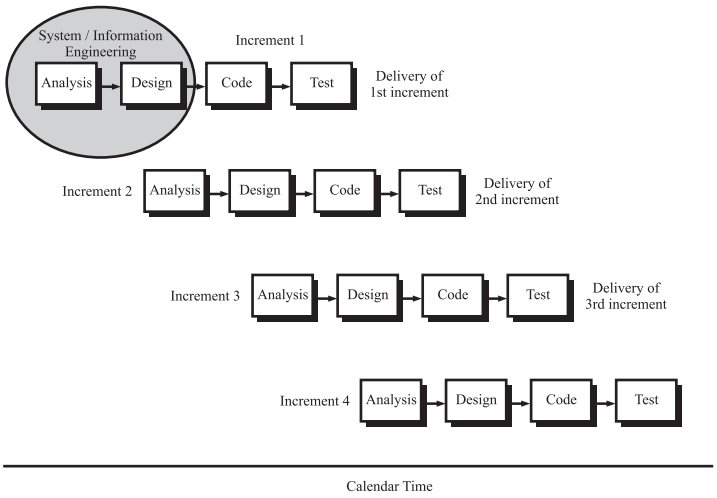

Fig. 4. Incremental Model

The process is repeated following the delivery of each increment, until the complete product is produced. If the customer demands delivery by a date that is impossible to meet, suggest delivering one or more increments by that date and the rest of the Software later.

V. IMPLEMENTATION

Implementation of the project involves:-

- Sample collection
- Signature formation.
- Validation
- Reduce the sample size
- Integration of virtual keyboard with system.
- Reducing the real samples to smaller value
- Monitoring progress of each member working under the project by maintaining a log that will contain:
  - the work done by individual member/group of members
  - the time taken for the same
  - reason for the incompletion of any planned work
  - remedial action identified to make up for the lost time in order to meet deadlines

As shown in Fig. 3, the sequence of implementation steps for the intrusion detection system is as follows:

A. Increment 1#: Sample collection (Password Sample Collection)

A login module was created for the user to type in 200 samples of their username and password at different points in time in different numbers. A database was created to store the 200 samples collected as shown in Fig. 5.

B. Increment 2#: Signature formation (Using PI membership function)

A module was created to form signatures using the PI membership function on the 200 samples [2] stored in the samples database file during the enrolment process. The resultant signatures were stored in the signature database file as shown in Fig. 6.

C. Increment 3#: Validation

Another module was developed to verify the efficiency of design of the system. A user for whom the password signature was formed, was asked to login at least 50 times at different time intervals and the resultant results recorded in terms of access granted or denied. Similarly, the results were noted down for different intruders who were given the login details and asked to try and login into the user account.

D. Increment 4#: Reduce the sample

The total number of sample collection was 200 so we tried to reduce the number of samples required by using simulation for which we collected ta user signature he sample from the database and applied the chi-square goodness-of-fit test for identifying the distribution followed by the sample data which resulted in the rejection of the hypothesis. This resulted in the conclusion that for our project 200 keystroke samples were needed for high accuracy rates, lower FAR and FRR to be precise.

record_number	username	password	enter	mouseclick	shift	capslock	backspace	tab	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	1
1	n@n.com	123456	2	0	0	0	0	0	64	95	98	87	6864	95	98	87	68	0	0	0	0	0	0	0	0	0	
2	n@n.com	123456	3	0	0	0	0	0	64	95	98	87	6864	95	98	87	6864	95	98	87	68	0	0	0	0	0	
3	n@n.com	123456	1	0	0	0	0	0	144	144	136	136	128	96	0	0	0	0	0	0	0	0	0	0	0	0	

ab	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	avgTimeBetween	totalTimePassword	EnterTime	MouseClickTime
0	64	95	98	87	6864	95	98	87	68	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	334.83333333333	824	78	NULL
0	64	95	98	87	6864	95	98	87	6864	95	98	87	68	0	0	0	0	0	0	0	0	0	0	0	0	439.33333333333	1236	191	NULL
0	144	144	136	136	128	96	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	428	784	408	NULL

Fig. 5. User Signature Samples

username	password	avgTime1	avgTime2	avgTime3	avgTime4	avgTime5	avgTime6	avgTime7	avgTime8	avgTime9	avgTime10	avgTime11	avgTime12	avg1
a@a.com	D0nB0sc0	145.105	98.365	121.075	117.8	208.505	134.025	131.34	125.6	0	0	0	0	
n@n.com	123456	90.666666666667	111.33333333333	110.66666666667	103.33333333333	4618.6666666667	95.333333333333	98	87	3466	47.5	49	43.5	
b@b.in	123456	153.88235294118	152.70588235294	164.47058823529	161.29411764706	148.58823529412	165.47058823529	NULL	NULL	NULL	NULL	NULL	NULL	

sdTime1	sdTime2	sdTime3	sdTime4	sdTime5	sdTime6	sdTime7	sdTime8
17.43357034574387	12.960168787481129	14.289912525974401	18.02746169043218	20.201878625514013	11.78528637751328	17.040528160828828	20.999151768583427
15.840163351430443	14.55173872772599	13.696268652446909	10.998035051771746	17.591983969979093	13.484100822820933	16.39331494847823	25.362077497713003

Fig. 6. User Database

VI. TESTING

The results of the 50 attempts during the validation phase by authentic users and intruders were recorded to test the ability of the system on the size of 25, 50,100,200 in discriminating between authentic users and intruders using the form of Fig.7. The FAR and FRR were calculated to evaluate the degree of efficiency as shown in Fig. 8 and Fig. 9.

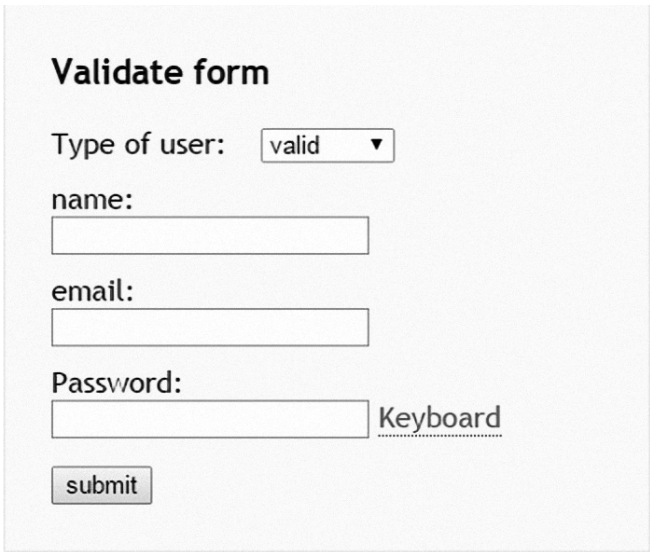

Fig. 7. Validation Form

num	name	email	password	FAR
1	neeraj25	x@x.com	Narendra@12@	1
2	neeraj50	x@x.com	Narendra@12@	0.64
3	neeraj100	x@x.com	Narendra@12@	0.48
4	neeraj200	x@x.com	Narendra@12@	0.12

Fig. 8. FAR

4	Naren25	x@x.com	Narendra@12@	0
4	Naren25	x@x.com	Narendra@12@	0.08
4	Naren50	x@x.com	Narendra@12@	0
5	Naren50	x@x.com	Narendra@12@	0
5	Naren100	x@x.com	Narendra@12@	0.04
6	Naren200	x@x.com	Narendra@12@	0.08

Fig. 9. FRR

VII. RESULTS AND DISCUSSION

A few observations were made regarding two things: - firstly, about the system being able to detect intruders and secondly, reducing the size of the sample.

1. Intrusion Detection

It was observed that the signature formed was not validated, i.e., if it did not match the signature present in the database the user was denied access. The output for the given scenario is as shown in Fig. 10.

Fig. 10. Intruder Snapshot

On the other hand, if the signature formed was validated i.e. if it matched the signature present in the database, the user was allowed access. The output for the scenario is as shown in Fig. 11.

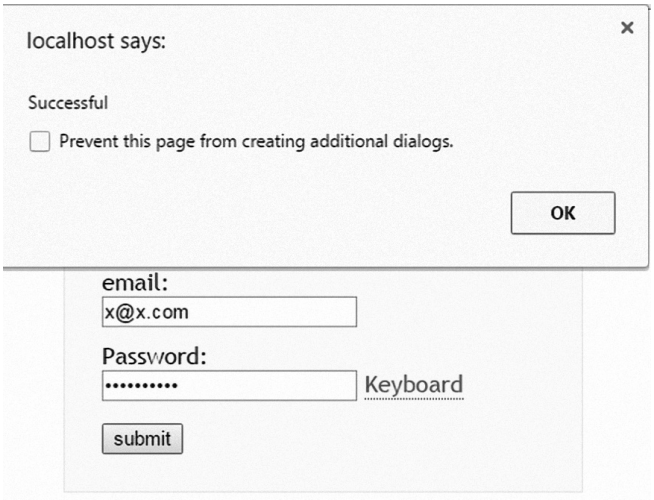

Fig. 11. Authentic User Snapshot

The data collected during the validation process was used to calculate the FAR and FRR using the formula and the results are shown in Table 3 and Table 4.

2. Sample Size

The total number of samples collected per user signature formed was 200, which we tried to reduce, by applying chi-square goodness-of-fit test to lesser number of samples. But as the test faced rejection to a large variance in sample timings, we decided to stay with the 200 samples for high accuracy.

VIII. CONCLUSION

In this paper, we have used PI membership function of fuzzy logic for validating a user based on behavioural biometrics, more specifically, keystroke dynamics that is through their typing characteristics and using the virtual keyboard.

IX. FURTHER WORK

Since the proposed system is applicable for web applications on desktops, it can also be used for recording the biometrics on touch-screen laptops and hand held devices. This would involve the recording of the average time between the touches used on the device screen.

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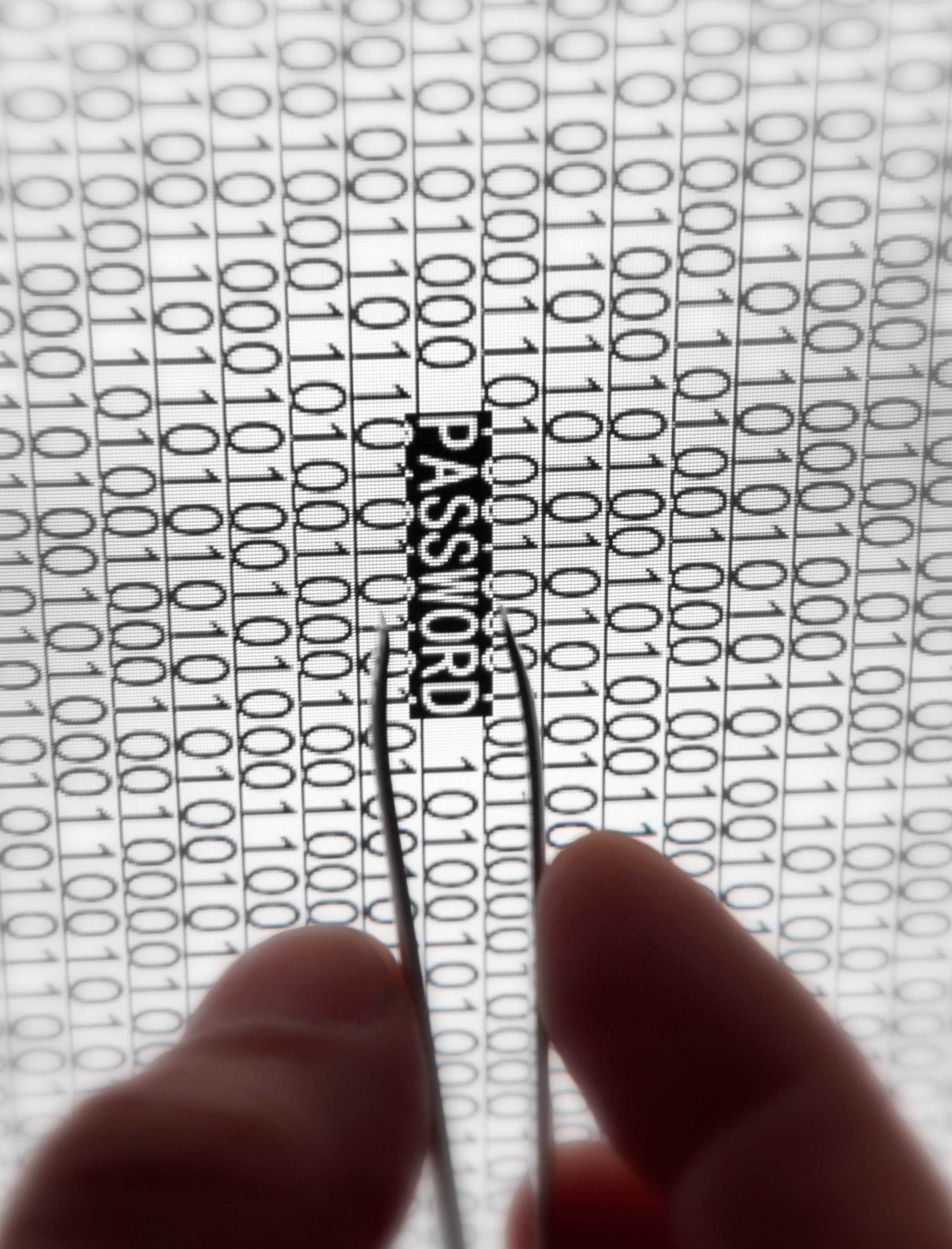
PASSWORD

Visual Cryptography Using Half-toned Images

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Abstract: **With an exponentially increasing pile of information dumped across the World Wide Web, securing private and public information has never been more imperative. Over the years, encryption techniques have evolved to include many steps with multiple calculations (performed iteratively) to help avoid revealing the concealed message within. These come with their inverse counterparts which unscramble the code to reveal the message, and includes (almost or maybe even more) steps with corresponding inverse calculations (again performed iteratively). Thus, it is only fair to say that both, encryption and decryption, when coupled together; are not only time-consuming but resource-consuming too. When included in an application, it would add to the net time taken and create a strain on the resources. Visual Cryptography provides an effective solution to solve this with fewer steps and lesser complexity. Its major computations are focused on encrypting the image while a simple operation deciphers it. The key process involves application of the twisted secret sharing to the image.**

Keywords: encryption, twisted secret sharing scheme.

I. INTRODUCTION

Visual Cryptography (VC), as the name suggests, adds a visual dimension to the whole security workspace. It encrypts visual information. It thus works on informative images, encrypts it, to what appears as a series of randomized pixels and decrypts it using a simple XOR operation. This greatly reduces the total time and cost spent in developing and maintaining information security.

In order to hide a message, VC never includes substitution of any character with an encrypted character. Though in terms of defining it, we said, it encrypts only visual information; this can be extended to suit all types. That is, any information whether a set of bits, characters, numeric or a combination of these, could be first visually produced as an image before being subjected to VC. This image is then encrypted by the action of the algorithms to deceive the perpetrator and secure the message.

An important application of VC is its use in digital watermarking to authenticate the originality of a document. This includes embedding of the private secret document with a copyright share, which won't be visible to the naked eye. But, overlapping it with its corresponding share reveals the copyright information, and thus, the authenticity of the document.

VC can be used to protect biometric templates in which the decryption doesn't require any complex computations [1]. Other applications include Remote Electronic Voting, Anti-Spam Bot Safeguard, Banking Customer Identification, Message Concealment and Key Management.

II. LITERATURE SURVEY

A. Halftone Visual Cryptography

In Visual cryptography, a secret binary image is encoded into shares of random binary patterns. If the shares are printed onto transparent or translucent sheets, then the encrypted image can be reproduced and can be seen by physically combining or overlapping proper shares. Half-toning is a method of converting high bit pixels to into printable lower bit format. The half-toned image is generated by the method of blue noise half-toning, or pixel reversal. The technique underlying the two-out-of-two halftone visual threshold scheme is extended to cryptography, where a secret binary image (secret image) is hidden into halftone shares. [2]

B. Secret Sharing Schemes for Protection of Digital Images

This paper focuses on the major algorithms of secret image sharing schemes. It first describes a secret sharing scheme based on polynomial interpolation. This technique creates a (k-1) degree polynomial function to compute shares using the secret image, where k is the minimum number of shares required to obtain the secret image. It also describes a (r, n) scheme where, the original image can be obtained if at least r or more of n *shares* are obtained; however $r - 1$ shares cannot be used to obtain the original image. It uses the polynomial function and all k coefficients of the polynomial to share the secret pixels so that the size of the image shares is reduced to $1/k^{th}$ of the secret image [3]. It then requires k or more image shares to reconstruct the secret image. The drawback of this scheme is that the original image cannot be recovered completely. Another secret sharing technique was proposed where a secret image with a pixel value greater than 250 is divided into two but though this technique completely recovers the image it

produces expandable shares. Visual Secret Sharing (VSS) is another scheme based on the *(k, n)* threshold concept but it suffers from two drawbacks: Pixel expansion and Low image quality.

C. An Extended Visual Cryptography Scheme without Pixel Expansion for Half-toned Images

In the basic (2, 2) scheme for visual cryptography, the resulting shares and the recovered image contains four times more pixels than the actual image. This is resolved by using a block-wise approach to dividing the pixels. There are two algorithms suggested for this purpose: The Simple Block Replacement (SBR) Algorithm and the Balanced Block Replacement (BBR) Algorithm [4]. Results of both reveal that the SBR produces darker images compared to BBR, which produces images that bear more resemblance to the actual image.

D. A Comparatively Study on Visual Cryptography

VC has been implemented with many variations based on number of secret images, pixel expansion, mode of deciphering [5]. This is summarized in TABLE I.

III. ALGORITHMS IMPLEMENTED

A number of algorithms with different techniques were searched and reviewed before finally implementing the optimum ones for encryption. Some of them were modified indefinitely to suit our purpose. They are as follows:

A. Simple Block Replacement Technique

Simple Block Replacement (SBR) follows a block-wise concept. It first divides the image as shown in *Fig. 1.,* into 2x2 blocks each containing 4 pixels. Working one block at a time, SBR pre-processes the image, before the main process of producing image shares is initiated.

The algorithm is as follows:

1. Divide the image into a set of 2x2 blocks
2. BLOCK COUNT
   Count the number of black pixels in the 2x2 block
3. IF Count >= 2
   Convert all pixels in the block to BLACK
   ELSE
   Convert all pixels in the block to WHITE
4. Perform steps 2. & 3. iteratively for all blocks within the image.

B. Balanced Block Replacement Technique

Balanced Block Replacement (BBR), unlike SBR, follows a cluster-wise concept. It first divides the image as shown in *Fig. 2.,* into 4x4 clusters each containing 16 pixels. Each cluster is then sub-divided into four 2x2 blocks each containing 4 pixels. BBR then works, one cluster at a time, pre-processing the image, before the image shares could be produced.

In comparison to SBR, there's just one operation BBR performs differently. That is, if the black pixel count for a block has been found equal to 2, then it performs a check to see that if on converting the block completely to black/white, how it would vary with respect to the black pixel count of the cluster.

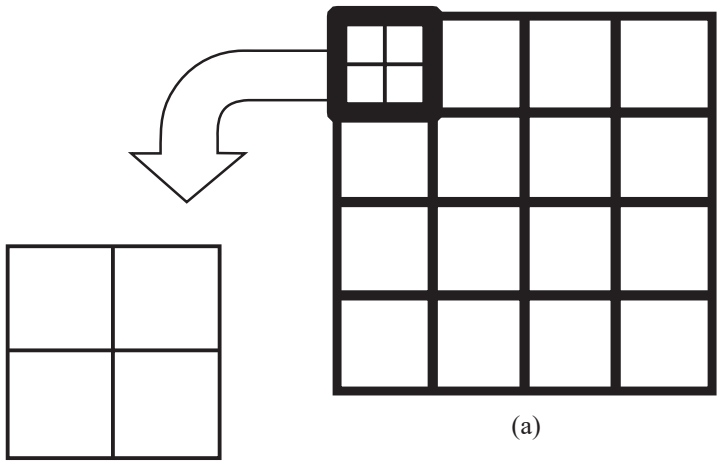


Fig. 1. Block Position with respect to the Image
(a) Image divided into set of 2x2 blocks
(b) 2x2 Block showing group of 4 pixels

The algorithm is as follows:

1. Divide the image into a set of 4x4 clusters

Fig. 1. Block Position with respect to the Image
(a) Image divided into set of 2x2 blocks
(b) 2x2 Block showing group of 4 pixels

2. PRE-CONVERSION COUNT
   Count the number of black pixels in the 4x4 cluster and save it as 'old'.
3.
3.1. Divide the cluster into a set of 4 2x2 blocks numbering each from 0-3
3.2. BLOCK COUNT
   Count the number of black pixels in the 2x2 block
3.3. IF count > 2
   Convert all pixels in the block to BLACK
   ELSE IF count < 2
   Convert all pixels in the block to WHITE
   ELSE
   Flag [*block_number*] = true
   where block_number = 0, 1, 2, 3
3.4. Perform steps 3.2. and 3.3. iteratively for all blocks within the cluster.
4. POST-CONVERSION COUNT
   Count the number of black pixels in the 4x4 cluster and save it as 'new'.
5. Perform 5.1. iterating i from 0-3

5.1. IF Flag[i] = true
THEN perform 5.1.1.
5.1.1. IF **(** [difference between(old, new+2)] < [difference between(old, new-2)] **)**
Convert all pixels in the flagged block to BLACK
ELSE
Convert all pixels in the flagged block to WHITE

6. Perform Steps 2-5 for all clusters within the image

TABLE. I: Comparisons of Different VC Techniques

Technique	Number of Secret Images	Pixel Expansion	Merit	Demerits
Traditional VC	1	1:2	Provides security for binary images	Does not generate meaningful image shares
Extended VC	1	1:2	Generates meaningful share	Contrast loss occurs
Random Grid VC	1	1:1	No pixel expansion	Lower visual quality
Multiple Secret Sharing VC (Version 1)	2	1:4	Image encrypts two secret images between two shares. Rotating angle is 90 degrees.	Size of the shares is 4 times the size of the main secret image.
Progressive VC	1	1:1	No pixel expansion.	No absolute guarantee on the correct reconstruction of the original pixel.
Multiple Secret Sharing VC (Version 2)	2	1:4	Rotating angle varies.	Pixel expansion is more.
Halftone VC	1	1:4	Provides meaningful share images.	Trade-off between pixel expansion and contrast of original image.

G. Secret Sharing Concept

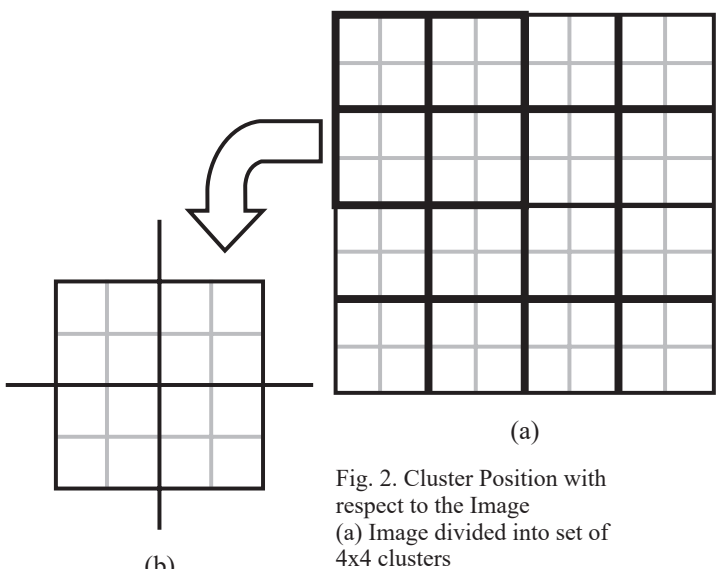
The secret sharing concept determines how many parts (shares) the secret image would be split into and how many of them would be required to reveal the secret image. Depending on the type of scheme implemented, the block representation pattern in the shares would change accordingly.

1) The (2, 2) Scheme

The (2, 2) scheme splits the secret image into 2 shares with both of them being required to reveal the same.
After an image has been pre-processed with SBR/BBR, the image contains only 2x2 blocks of white and black pixels. It is now ready to be split across the two shares. Based on the color of the pixels in the block, the pixels in the two secret shares are determined randomly as shown in *Fig. 3.*

2) The (2, 3) Scheme

The (2, 3) scheme splits the secret image into 3 shares and any two of them are superimposed to reveal the same. The



(a)

(b)

Fig. 2. Cluster Position with respect to the Image
(a) Image divided into set of 4x4 clusters
(b) 4x4 Cluster split into four 2x2 blocks

output slightly differs from that of (2, 2) scheme. The white block pixels, like the above, retain 50% of its white colour. But, the black block pixels aren't always 100% black. There is a 1/6 chance that it will be completely black. In the rest of the cases, it's always 75% black I.e. out of the four black pixels in the black block; after superimposing the two shares only 3 pixels would be black and the remaining one would be white. Thus, this scheme won't be as efficient as (2, 2).

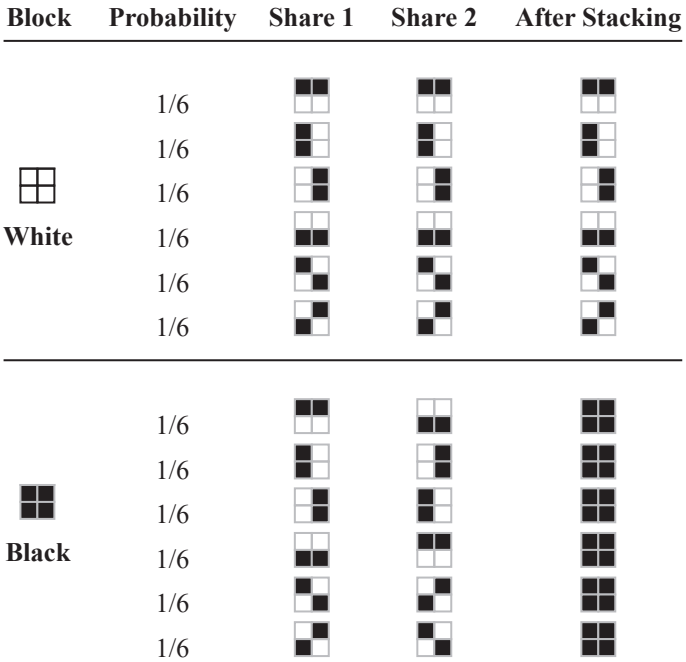


Fig. 3. Pattern showing Block representation used in the two shares of the (2, 2) scheme

D. Modification to the algorithm

1) BBR with Overlapping Clusters

Though BBR was proposed as an improvement to SBR and while it does improve the picture clarity, BBR was modified to suit overlapping clusters such that when clusters are iterated, two blocks from the previous cluster are retained with their modified pixel values.

An example is shown in *Fig. 4.* The step-by-step processing of this is shown in *Fig. 5.* This renewed technique has been experimented to give clearer images with even smoother edges.

2) Use of Block over Pixel in Sharing Schemes

The secret sharing methods supposedly worked on secret images directly. Due to this, the image shares suffered a pixel expansion of about 1:4. This increased the size of the shares four-fold. That is, a 1024x1024 secret image would produce shares with dimensions 4092x4092. This was a major drawback.

Therefore, instead of processing the image pixel-wise, we first divide the image into blocks and traverse the image based on a block-wise approach.

Pre-processing the image with SBR/BBR very conveniently eliminates pixel expansion. Having processed the image with one of the two, the output image would throughout contain only 2x2 blocks of pixels which are either completely black or white. Producing shares from this image doesn't require unnecessary redundancy of pixels introduced by earlier techniques.

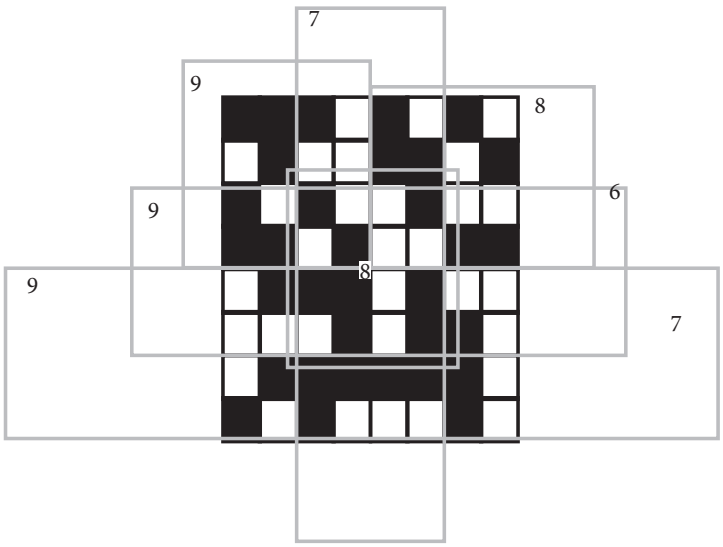
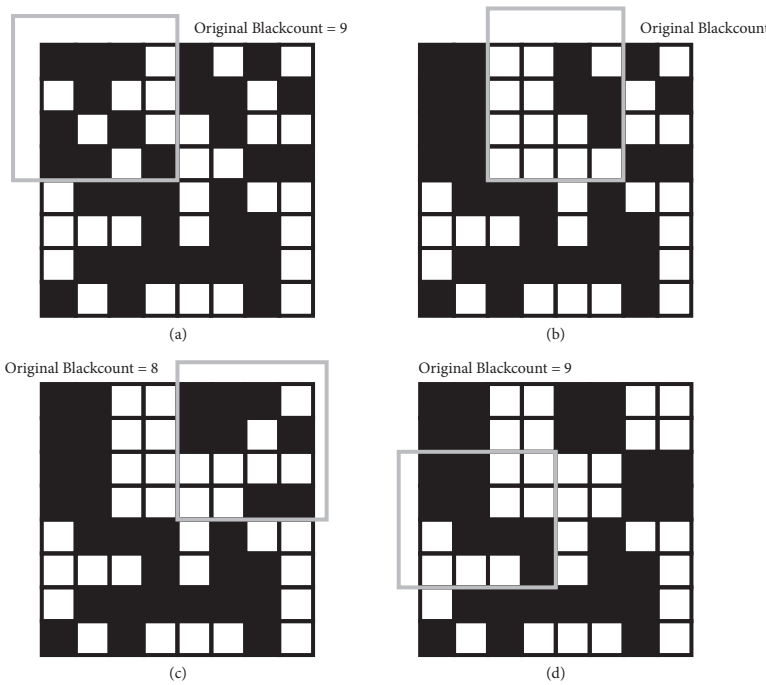


Fig. 4. A representation image showcasing the Overlapping Clusters with Initial Number of Black Pixels in each cluster



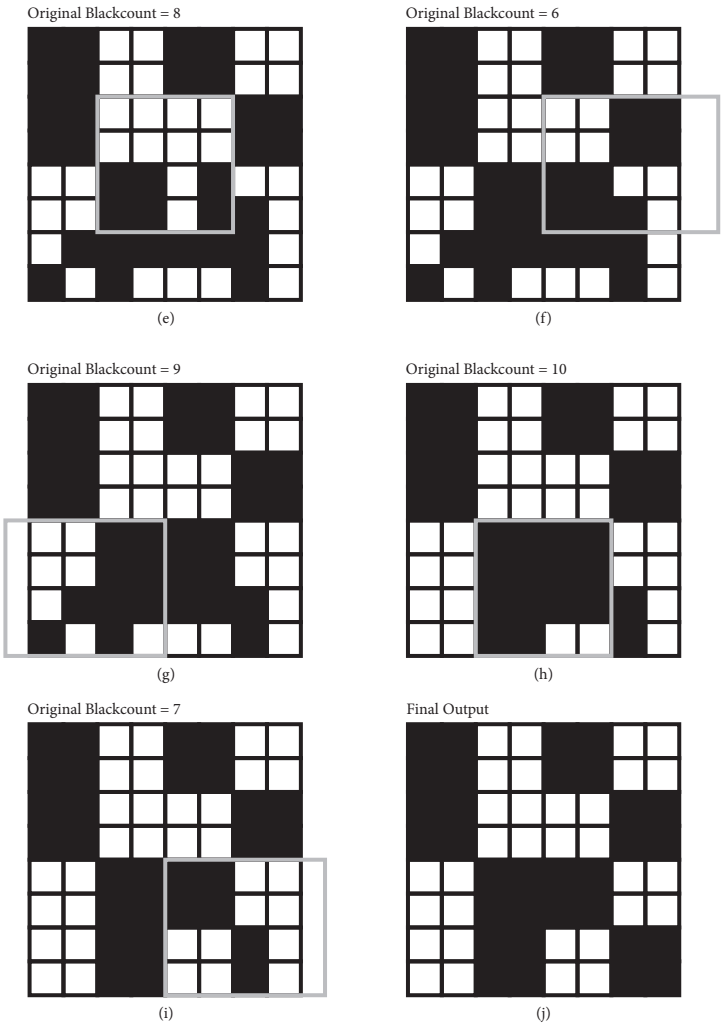


Fig. 5. A representation image showcasing the Overlapping Clusters with Initial Number of Black Pixels in each cluster

IV. RESULTS

In all, 6 codes were developed to achieve the desired security in Visual Cryptography. Three of their outputs are shown in *Fig. 6.* All *(b), (c)* and *(d)* are outputs obtained from the Original Image.

Due to the inability to develop a half-toning algorithm, these codes were experimented on readily available half-toned images and other binary images. Half-toning was used to convert grey-scaled images into a series of black dots of varying shapes and sizes. This made the image binary in black and white, but still giving the effect of different shades of grey.

Also, these images were taken in their bitmap format and a standard dimension of 256x256.

The first output obtained on implementing the (2, 2) scheme wasn't satisfactory. As it can be seen in *Fig. 7.*, the boundary of the image can be easily made out in the second share and nullifies the whole idea of keeping the image secure. Later, the reason for this was found out to be the usage of only one standard pattern out of the six available for black and white blocks. (*Refer Fig. 3.*). Also, for all images that were experimented upon, all produced the same standard first share. Thus, the first share of any image could be used with the second of another to reveal the secret image. This greatly contradicts the entire purpose of Visual Cryptography.

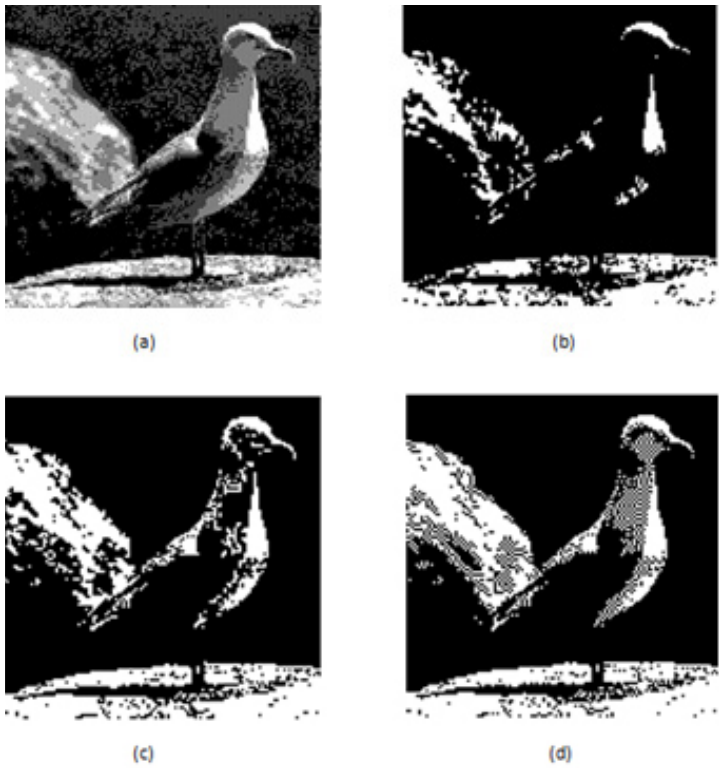


Fig.6. Processed Image Outputs
(a) Original Image
(b) SBR Output
(c) BBR Output
(d) BBR Overlap Output

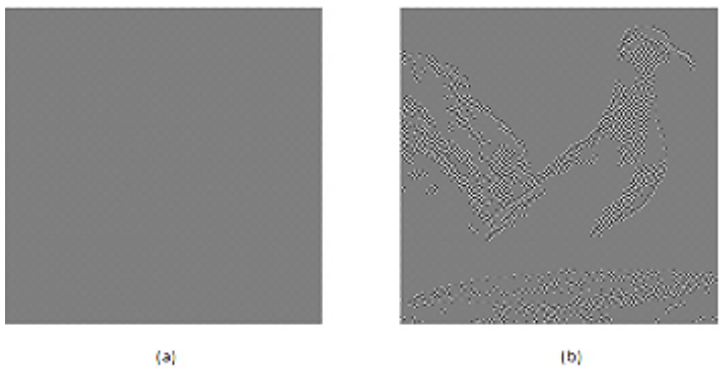


Fig. 7. Faulty (2, 2) Image Shares
(a) Standard 1st Share
(b) 2nd Share with visible boundaries

The code was later modified to include random selection from all 6 patterns for both white and black blocks. *(*Again *refer Fig. 3.).* Both (2, 2) and (2, 3) schemes were developed keeping this technique in mind and their outputs can be seen in Fig. 8. and Fig. 9.

The shares thus obtained contained random noise-like pixels which individually aren't able to reveal the image. These when stacked or overlapped produces the secret image.

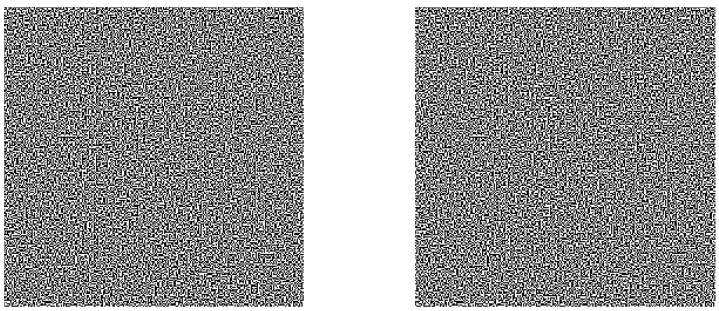


Fig. 8. Indistinguishable (2, 2) Image Shares
(a) 1st Share
(b) 2nd Share

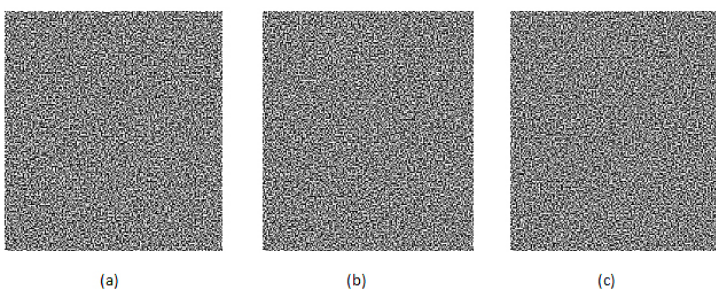


Fig. 9. Indistinguishable (2, 3) Image Shares
(a) 1st Share
(b) 2nd Share
(c) 3rd Share

V. CONCLUSION

Visual Cryptography can thus secure any type of data - numbers, strings, images and bit alike; by producing them on an image and splitting it into shares. Compared to other techniques used, we could resolve the dispute involved with Pixel Expansion but the issue of Picture Contrast still remains for highly-detailed images being not all that clear. Also, for splitting the images into more than 3 shares, it includes the use of a 3rd or a higher degree polynomial which on researching continues to mention Pixel Expansion as a disadvantage. Using block replacement in these cases isn't feasible, as we would have to increase the block size from 2x2 to 3x3 and higher. Since, blocks behaves as the basic unit of the image, increasing the block size will only make the image more distorted with sharper edges and pixelated effects. Thus, to avoid pixel expansion and still get a well contrasted image from overlapping shares; (2, 2) Visual Cryptography Secret Sharing scheme is advisable.

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Toddler
A child care support application

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Abstract: **According to Scientific American, approximately 150 babies are born around the world every single minute. Out of these babies 29 are born in India. Being a new parent is such an exciting time, but also an extremely busy one. If you need advice or organizational tools, smart phone applications can save you time, provide solutions and let you focus on what is really important - your baby. Existing smart phone applications provide incomplete solutions to this problem. Most of them offer mutually exclusive features which forces the parents to install multiple applications for different purposes. Some are region and platform oriented while some are expensive, whereas the free ones offer very limited features. In terms of android application the genre of child care is very less capitalized upon. There are multiple apps of the same genre with a very high caliber for other fields but this is absent in the field of child care. With Toddler we are trying to bring that level of excellence into the field of child care without charging an exorbitant rate while providing that level service. Toddler is a child care support system that provides an all in one postnatal platform for the new parents. Also loaded with some new features, it focuses on reducing the load on parents by assisting them and notifying them with the important activities necessary during the growth of the child.**

Keywords: Toddler, child care, new parents, Android Smartphone, postnatal.

I. INTRODUCTION

In the past few decades female participation as a working force in office is greatly increased in our society. Subsequently infant care has become a challenge to many families in their daily life. When both the parents have to work as well as to look after their infant, more workload and stress is there on such families especially their female counterpart. Parenting is not an easy task. Good parenting requires the parent to quickly respond to the needs of their child. Constant monitoring of the child also becomes a necessity, especially up to an age of 18 months. If a system is developed which can give solution to the queries of new parents during illness of their infants or during normal routine, it would be a great help to parents especially to a mother who is always worried about well being of her baby.

TODDLER is a child care application that aids parents with baby care. It acts like a support for new parents. Toddler makes it fast and easy to log required daily reports and to share updates with parents, in real time. Keeping in mind India's vivid culture and traditions, Toddler is designed specifically for Indian families. It is a user friendly application where new mothers can interact with each other using forums, where they will be able to share solutions to common problems. This application is designed for parents having children of the age group 0-5yrs.

II. RELATED WORK

A few existing baby care applications were studied for understanding the features covered by them and comparative study is carried out.

There are many child care applications available however these are location oriented and none of them are specifically designed for India. These applications cover prenatal or postnatal or both these requirements of new parents. Some of the different applications commonly used are Total Baby, My kids Health Application, WebMD Application, Baby Connect, Daily Connect, Best Baby Monitor.

Total Baby [3] Application gives features like scheduler, WiFi sync, food chart, sleep chart. However it does not provide reports of vaccinations done. My kids Health [4] Application provides features like vaccination log, allergies chart, height-weight chart, appointments, and lullabies. WebMD [5] is a descriptive kind of application that provides information on how parenting is important and what are various stages in prenatal period but it does not provide appointment schedule with doctors and also other reports that are available in other applications.

Baby Connect [6] application provides features like prescription log, gallery, and lullabies. It is more oriented for comforting baby with various lullabies. Daily Connect [7] application provides the following features bottle feed tracker, nursing tracker, sleep tracker, medicine tracker, emails and exports. Best Baby Monitor [8] application provides features like WiFi / Bluetooth sync, lullabies, and video monitor.

Since most of the features provided by these applications are mutually exclusive, multiple applications have to be installed for different purposes. Toddler brings all the necessary features like lullabies, prescription log, vaccination alert, manual scheduler, pattern log, etc along with some new features like emergency support systems and forums to a single platform.

III. METHODOLOGY

The proposed application "Toddler'' provides whole range of functionalities that are required as child care support and those not available in any existing single application. India has a unique cultural background and therefore Toddler is designed keeping the postnatal requirements of new parents of Indian babies in mind.

The complete set of features were identified first and then were arranged according to priority. The chassis for the project is designed, keeping in mind, all the options to come under one roof. The features of the application "Toddler" include vaccination scheduler, vaccination alerts, food and sleep time scheduler and pattern displayer, lullabies, prescription log and home remedies and forum for sharing expertise gained by parents from their experience of handling a particular health related problem of their babies.

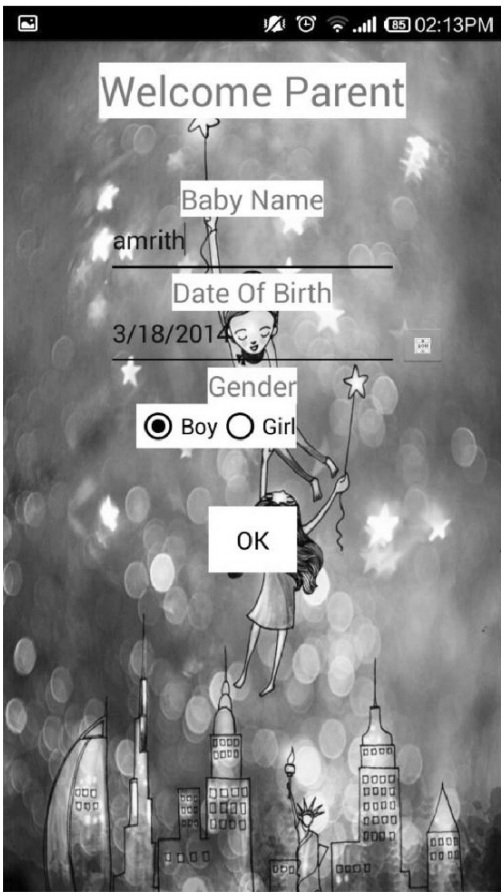

Fig. 1. Login Page

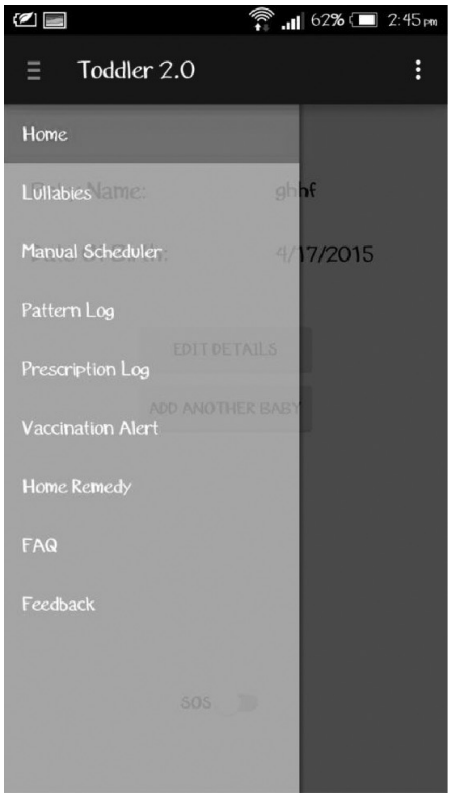

Fig. 2. Slide Menu

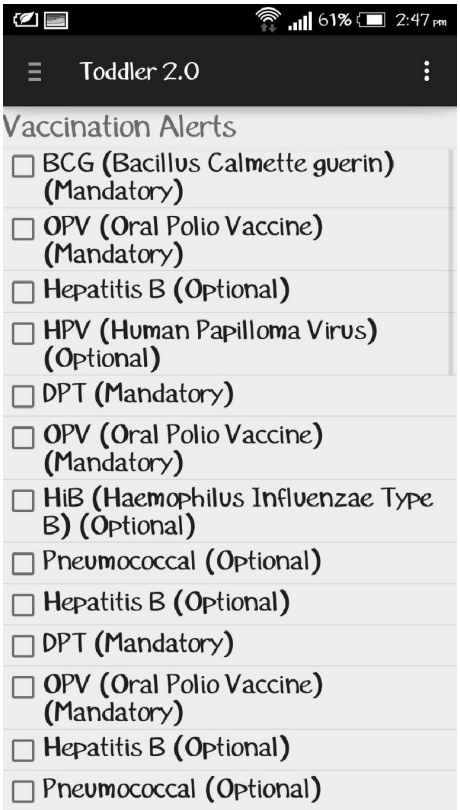

Fig. 3. Vaccination Alert

IV. RESULTS AND DISCUSSIONS

The application is useful for new parents in many ways. The screenshots of various features are shown with description above and a few more are shown below.

1. Vaccination Alert

   Parents want to do everything possible to make sure their children are healthy and protected from preventable diseases. Ever-changing vaccine schedules can be confusing for patients, providers and parents. Compounding this problem is the fact that immunization records are often scattered. Most children are not appropriately immunized are only missing one or two doses. When records are fragmented between providers, parents, and hospitals, it is difficult to assess whether all the necessary vaccinations are up to date or not. Vaccination alert is the best way to do that. This feature provides all the mandatory and optional lists of vaccinations that need to be given to the child from 0-5 years. It records details of baby's vaccines, and have those details at hand. It also allows you to set reminder alerts, so your device will remind you when vaccines need to be updated. If parent misses the deadline then he/she is alerted daily at a specific time till the vaccination is given. Once the vaccination is given the parent can then stop the alert and the date when the vaccination is given is stored in the log.

2. Prescription log

   The doctor or nurse may ask parents to keep a log of any medications that are prescribed on an "as needed" basis. They expect that parent to write down the date, time, dose, and reason you gave the medication. This helps them to determine what symptoms are causing the patient trouble and what medications are effective in treating them. A log can also come in handy if there is more than one caregiver or someone coming in to help temporarily. The prescription log lets parent store prescriptions in the form of an image file, along with doctor's name, clinic name and date. This helps to keep a record of all the medicines and use them in case of future emergencies.

3. Manual Daily Scheduler

   This option allows the parents to manually schedule certain activities like changing the diapers, or giving medicines, etc. So as per the given schedule there would be an alarm which would remind you about the task that needs to be performed.

4. Forum for new Mothers

   A forum is provided for new mothers where they can communicate with each other and share knowledge about common problems and also suggest remedies based on their experience of handling those problems. Knowledge shared is knowledge gained and we have incorporated this feature to make all parents interact and share experiences from each other and build the future of tomorrow in a harmonious and conducive way.

5. Emergency Support System

   In metropolitan cities most of the young parents do not have personal means of transport and could lose crucial time searching for transport while their baby may be suffering.

   In case of emergency the parent can use this feature where they can book a cab and the device will set the current location of the device as the source address and the nearby pediatrician's clinic will be set as the destination address and a cab provided as soon as possible.

6. Home remedies for common symptoms

   Certain common illnesses like cold, cough, improper food intake, etc are few issues which can be solved using home remedies itself. These homes remedies are provided as a ready recknor. Parents are by default a very paranoid species and often get very scared even if their child gets an untimely cough. This option helps with the small ailments and basic pediatric care that they can take as immediate action till the doctors can be contacted.

Fig. 4. Home Remedies

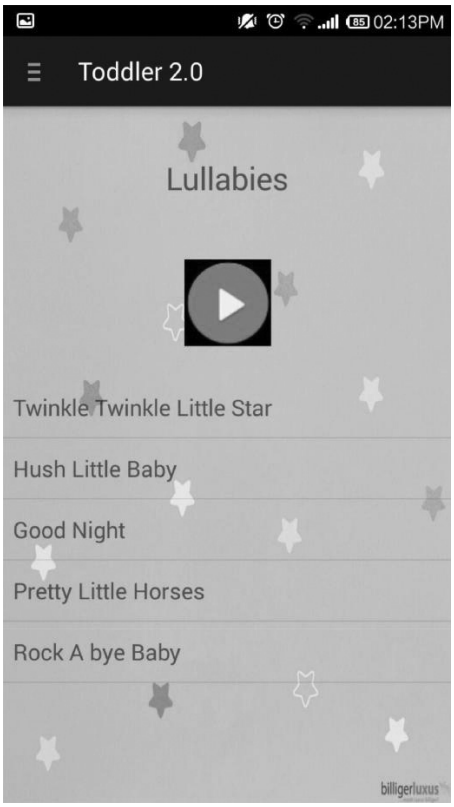

Fig. 5. Lullabies

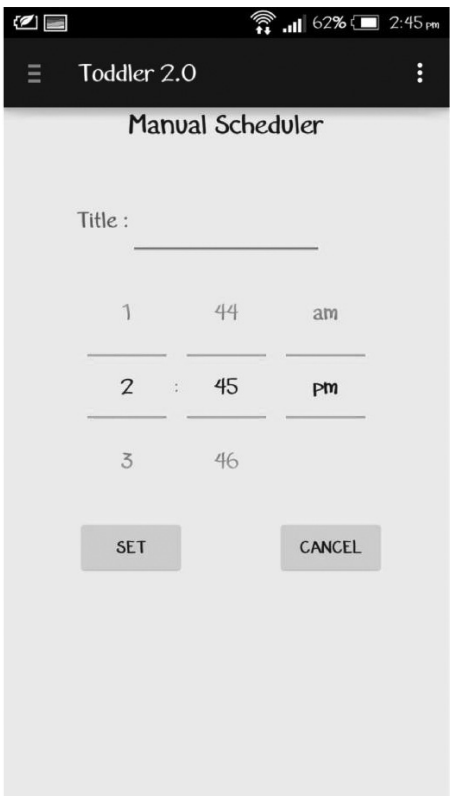

Fig. 6. Manual Scheduler

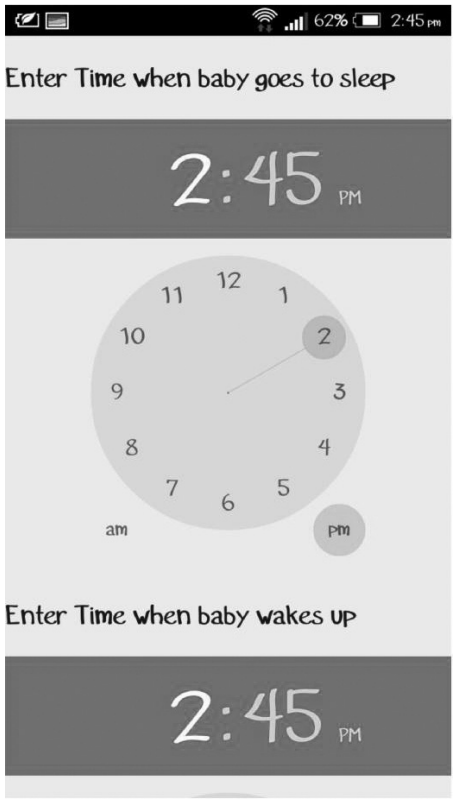

Fig. 7. Pattern Log (Enter time)

Fig. 8. Pattern Log (Sleep log)

7. Child pattern log
   This feature requires the parents to log the time when the baby is hungry and when the baby is sleep up to a specific duration and then an automatic pattern is generated which will tell when the baby is going to feel hungry and sleepy. So if the child behaves very differently than that generated in the generated pattern then parents can take it as an indicator; there could be certain problems which need to be taken care of.

8. Lullabies
   The primary purpose of a lullaby is probably obvious: to soothe and put a distressed baby to sleep. Lullabies have long been used in this fashion in every single human culture. Lullabies from the greatest composers and spontaneous melodies sung and hummed by loving caregivers have brought comfort and sleep to countless babies. In this application we provide all these compositions at the touch of a button.

V. CONCLUSION

Child care has always been an important aspect of any household. From ages there have been different practices and trends adopted throughout the world. Each community and geographic location has a different practice making child care a very diverse field of study. We have incorporated the best of both these aspects by taking the care and practices from the past and amalgamated it with the technology and swiftness of the present to design the application of tomorrow, “Toddler”.

We studied the various problems and challenges in child care and handling. We also studied existing postnatal child care applications and their features. We found that all the features required for Indian environment were not available in one application. Our application integrates the features available in different applications and also introduces various new features that are location specific that helps evolve virtual child care into a whole new different level.

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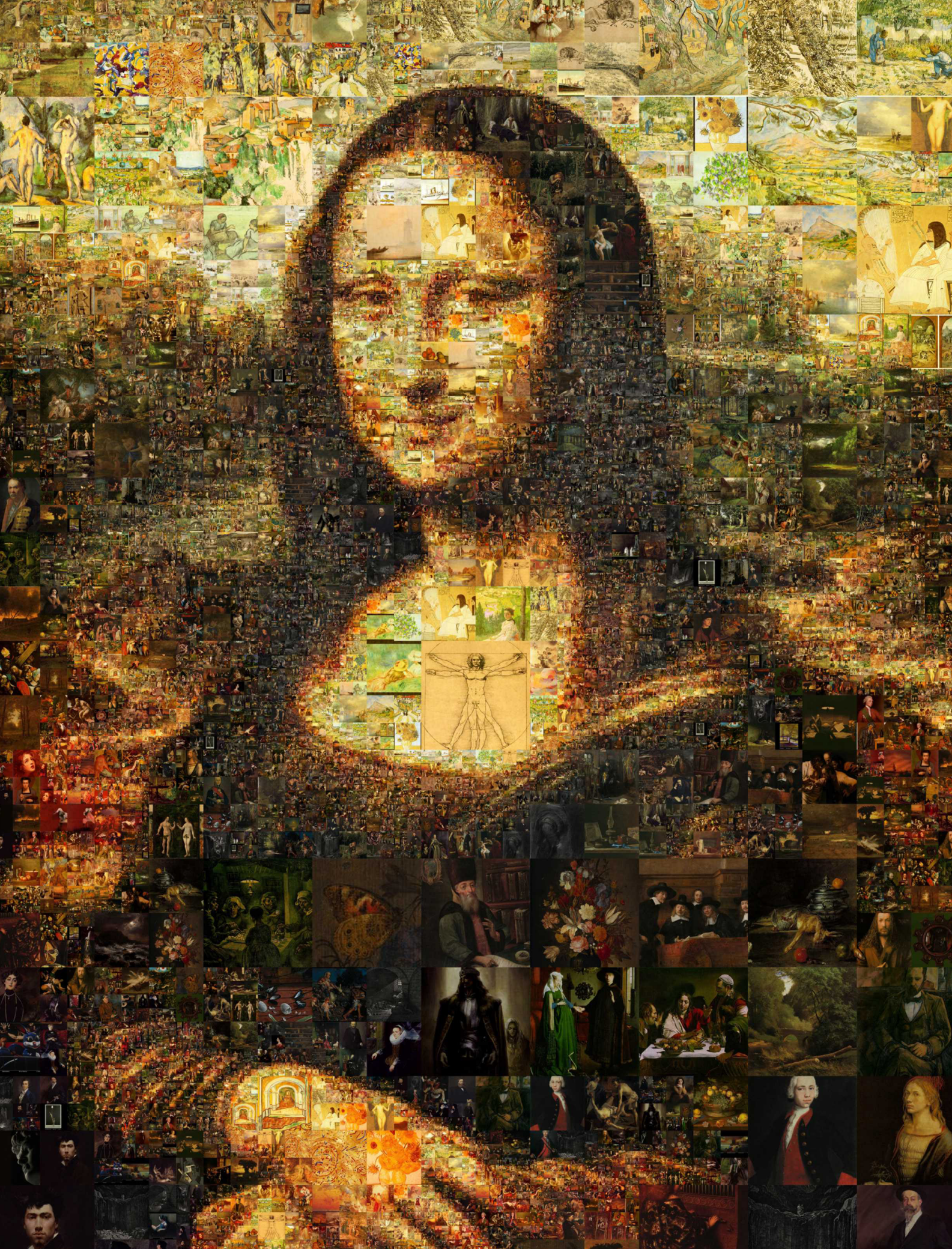

Near Real Time Monitoring of Autistic Children

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Abstract: **Autism Spectrum Disorder is a lifelong developmental disability characterized by difficulties in social interaction, communication, sensory sensitivities, restricted, repetitive interests and behaviors. The word 'spectrum' describes the range of difficulties that people with autism may experience and the degree to which they may be affected. Children with Autism tend to wander off innocently from their environment. This may lead to fatal accidents. In an attempt to combat this, the system proposes a near real time system, an arm band, which will continuously monitor an autistic child. The system is composed of hardware i.e. GPS, GSM/GPRS and Camera, and software i.e. Arduino IDE for coding the Arduino. It also comprises a database where location of the child is continuously stored at regular intervals. The system includes GPS chip for location acquisition and GSM/GPRS module for message transmission. The arm band would be strapped to the arm of the child and tampering would be detected. The proposed system will thus be monitoring an autistic child round the clock.**

Keywords: Mobile Computing and Communication; Database; Autism.

I. INTRODUCTION

Wandering is the tendency for an individual to try to leave the safety of a responsible person's care or a safe area, which can result in potential harm or injury. This might include running off from adults at school or in the community, leaving the classroom without permission, or leaving the house when the family is not looking. This behavior is considered common and short-lived in toddlers, but it may persist or re-emerge in children and adults with autism. Children with autism have challenges with social and communication skills and safety awareness. This makes wandering a potentially dangerous behavior.

Autism has its roots at an early stage of brain development. However, the most obvious signs of autism and symptoms of autism tend to emerge between 2 and 3 years of age. Increasing autism awareness is a key aspect of this work and one in which our families and volunteers play an invaluable role. First and foremost, it is known that there is no one cause of autism just as there is no one type of autism. There is little that has been done to create awareness about Autism. [7]

The increasing prevalence of children wandering has left many parents concerned as it may lead to fatal accidents . There have been a fair share of stories about children with Autism innocently wandering from their homes. Most of these stories have had tragic endings. Autism is much more common than most people think. With such a large number of innocent children wandering off, it's high time for some action to be taken. If such children can be tracked continuously by their parents, there would be an assurance of safety of the child.

The system that we have proposed will continuously monitor an autistic child. This includes tracking the location of the child with the help of an arm band. The arm band will be strapped to the arm of the child. It will give the location of the child using GPS integrated in it and if the child moves out of the safety zone, provisions are made to alert the parents as well. This is done with the help of GSM/GPRS which sends an alert message to the parents on crossing of the geo fence by the child. In this way, safety of the child would be assured.

II. LITERATURE SURVEY

GPS tracking system is used around the world in various fields for anti-theft monitoring, fleet management systems, vehicle tracking systems, etc.

Sunsirikul and Achalakul, (2010) observed that ASD or Autism Spectrum Disorder is another term used commonly which is similar to Autism. It discusses data mining techniques which provides tools to help the doctors analyze the symptoms and behavior of the patients effectively. [1].

Nainan et.al., (2012) stated that tracking systems were developed to track shipped goods in the olden days. The paper introduces various tools for autism-affected individuals. [2].

Verman and Bhatia (2013) found that a lot of mishaps occur daily on the roads. The paper proposes to develop a web application which will help the owner of the vehicle track and monitor his vehicle in case of theft. The idea adopted by us from this paper is the creation of a website for anyone who wishes to keep track of their loved ones. The GPS and GSM technologies is also another idea which will help us develop and implement our system in a better way [3].

Singleton et.al. (2014) observed that despite the growing incidence and costs of autism, little has been done to apply

technology advancements to the challenges faced by autistic individuals. The main aim is to reduce the overall cost of tracking system based on Global Positioning System (GPS) which is an satellite system based service. [4].

Chaudhari et.al., (2015) investigated that various technologies and systems (codes and commands) are readily available for tracking vehicles. [5].

III. PROPOSED SYSTEM

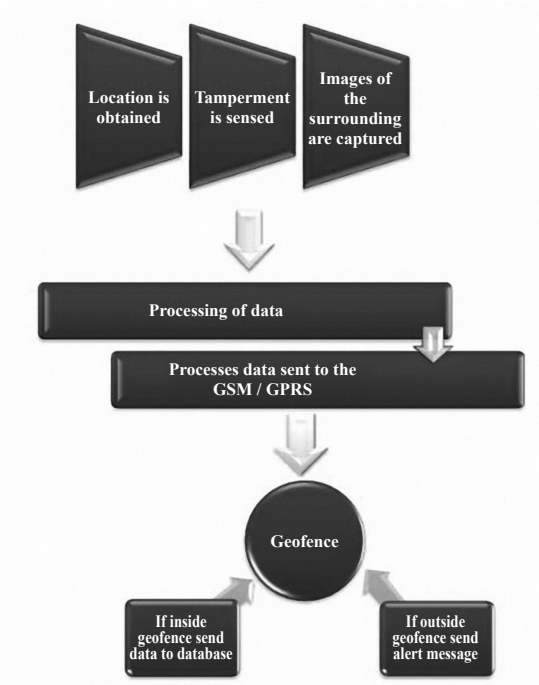

Fig. 1. System Flow

The system consists of the following modules:

1. Data Acquisition

The process of gathering information is data acquisition. As shown in Figure 1, GPS will acquire the latitude and longitude positions of the child via the satellite and send it to the Arduino. The Arduino is coded to sense tampering to the arm band. The data acquired in this manner is processed by the Arduino and further action is taken. The Arduino is coded to check the child's location i.e. compare the child's location to the geo fence to see if he/she is within the geo fence or has crossed it. This module will only gather the data. Further action is taken by the following modules.

2. Data Processing

As shown in Figure 1, once the data from the GPS is acquired, the Arduino processes it. On checking whether the child is within the geo fence or not, or whether the arm band is tampered with or not, the Arduino will trigger the GSM to send an alert message to the parents. The Arduino is coded to send this message automatically on detecting that the child has moved out of the geo fence. The message sent to the parents also consists of a Google maps link. On clicking this link, the parents will be able to see the exact location of the child on Google maps. The parents need to have internet enabled on their phone in order to see the location on Google maps.

3. Image Identification

The camera captures images of the surroundings of the child and sends this data to the Arduino. The Arduino receives data from the GPS and camera. So when the camera sends images to the Arduino to store it in the database, the Arduino simply distinguishes the images from the data i.e. .jpg, .jpeg and other image formats. Once the Arduino successfully determines the images from the data, it forwards the images to the GPRS module to be sent to the database. The GPRS module is responsible to store the images in the database. This will help the parents to have a better view of the child's environment. The parents can view the images of the surrounding of the child anytime they wish. The pictures will be stored in the database for a certain period of time. Until then, the parents can view the history of the child's location.

4. GUI

This module comprises the front end and the back end of the system. The parents need to view the location history of their child. Thus, the GUI comes into picture. The parents can easily visit the website that will be created using HTML to view the whereabouts of the child. On this interface, the latitude and longitude of the child along with the time it was obtained will displayed. The images captured by the camera also will be incorporated into the website. The easy to use GUI will enable the parents to view the past history of the child anytime when needed. The database will store the position and the images of the child's location at regular intervals. The history will be cleared automatically after every two months, thus making space for new data. This would make our database flexible.

IV. ARCHITECTURE

The architecture of the proposed system is depicted below:

In Figure 2, all the components are synchronized with

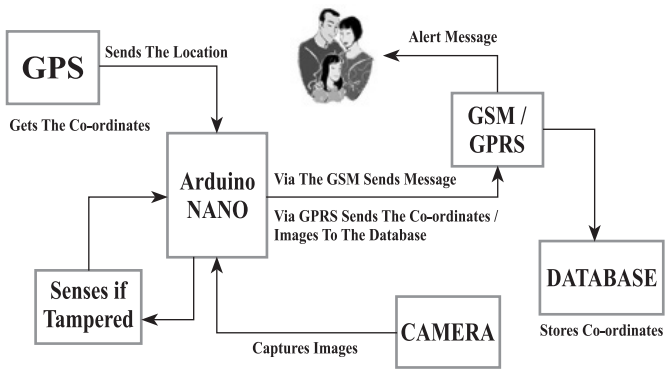

Fig. 2. System Architecture

the Arduino using jumper wires. The Arduino board is interfaced with the GSM/GPRS and GPS board with the required connections. A lithium ion battery is connected in order to power the device. The device is then placed into a compact small box. This box is stuck onto a wide leather band which can be worn on the arm of the child. The Arduino is coded to detect if the arm band is removed at any time.

The camera will be interfaced with the Arduino board. A small opening will be made in the compact box for the camera.

The Arduino Nano is interfaced with the GPS chip. It requests the GPS to obtain the latitude and longitude of the child's location. GPS obtains the latitude and longitude and sends it to the Arduino.

The Arduino Nano is also interfaced with GSM/GPRS module. It is coded to set up a geo-fence which is a virtual barrier defined by the parents. On crossing the geo-fence, the GSM module will send a message to the parents giving them the location of the child. As the module consists of GPRS, the Arduino Nano enables the module to store the location of the child at regular intervals onto the database.

In case the child tries to take off the arm-band or the arm-band is tampered with, the connection between the Arduino and the power is cut off and this triggers a warning message to be sent to the parents.

The Arduino Nano is interfaced with a camera which will capture the view of the child's environment which can be accessed by the parent when needed.

Finally, the integration of all these components will enable the child to be monitored easily.

V. RESULTS AND DISCUSSION

In the first module Data Acquisition consists of two sections, that is the GPS integrated with the Arduino and the second the sensing of tampering. In Figure 3, the circled data shows that the GPS was successfully connected with the Arduino to be able to acquire a lock on the child's positions and send the acquired data for processing to the Arduino even when connected with external power supply to make it portable. As shown in Figure 4 and Figure 5, the arm band is configured in such a way that the Arduino itself is coded to sense the tampering. In Figure 4 the circuit was complete due to which the LED light on the Arduino turns on. In Figure 5, the circuit is broken so the LED light on the Arduino turns off. The Arduino was successfully triggered when tampering was sensed.

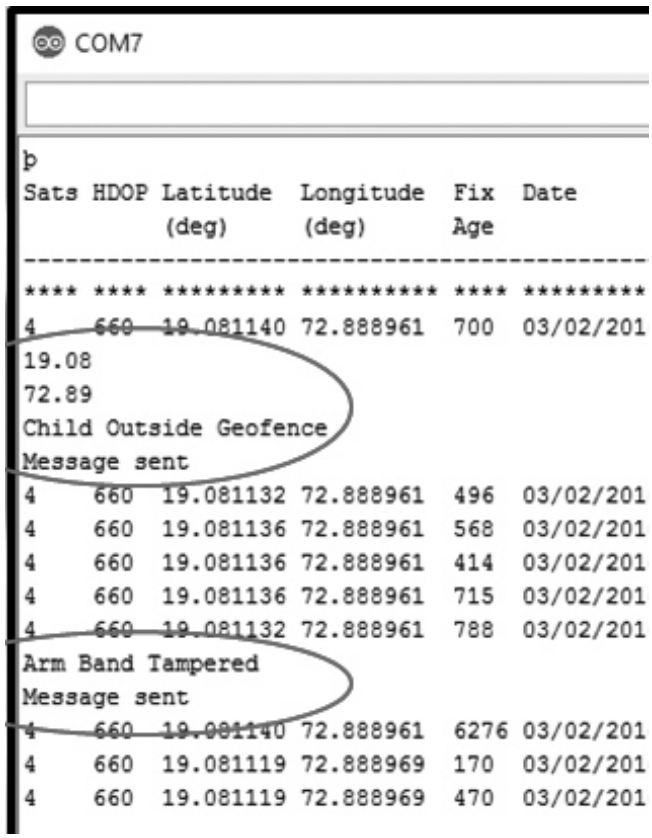

Fig. 3. GPS integration with Arduino output

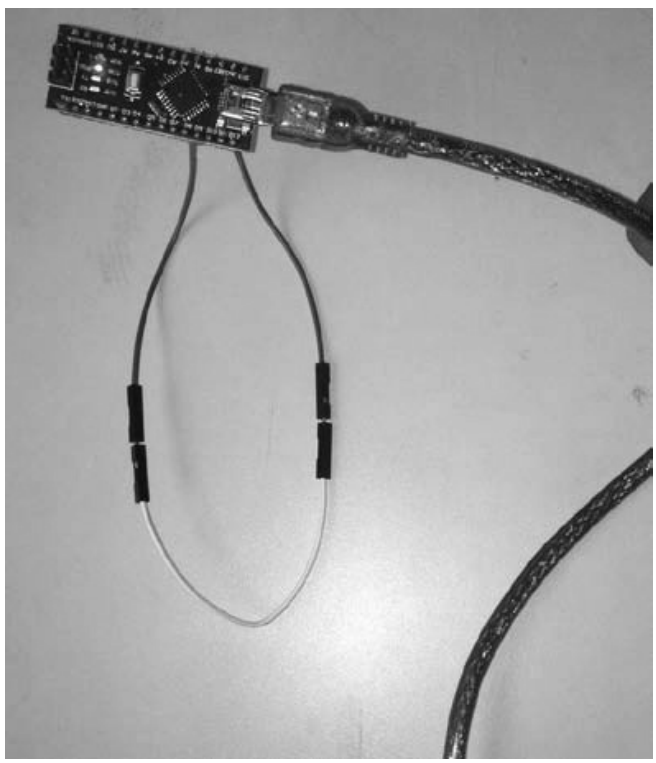

Fig. 4. Arm Band Untampered

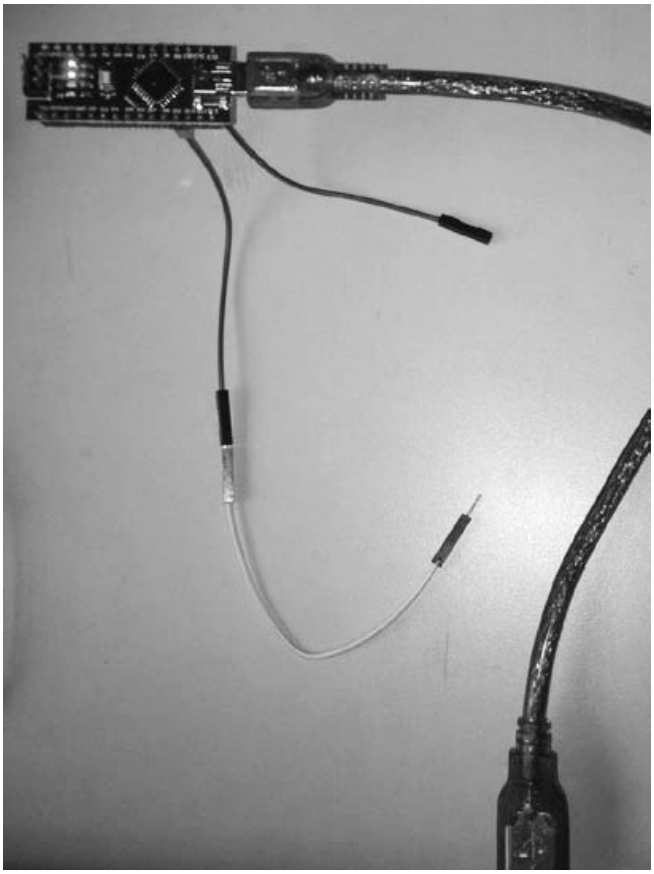

Fig. 5. Arm Band Tampered

In the second module Data Processing consist of integration of the GSM with the Arduino. From Figure 6, the GSM is able to successfully send the necessary data to the required location through the coding of the Arduino. The GSM was successfully triggered to inform the parent/guardian via the message which informs the parent of the child's co-ordinates up to 6 decimals precision. The link provided in the message opened in Google maps as shown in Figure 7.Google maps can be accessed only if it is supported by the cell phone. Also the cell phone should have internet connection.

Fig. 6. Message output

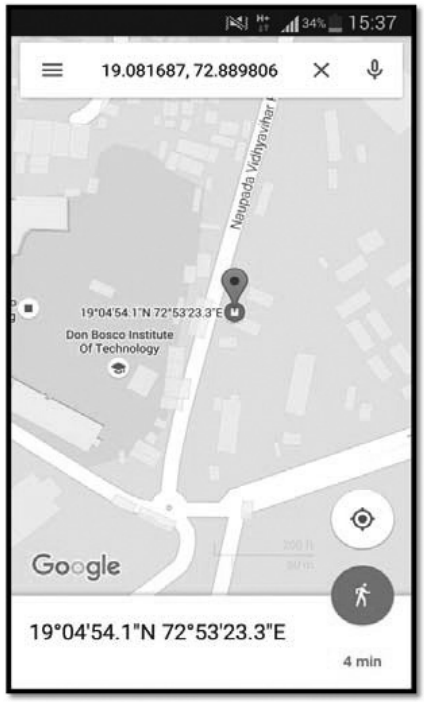

Fig. 7. Google maps

In the third module Imaging Processing which consists of integration of the camera with the Arduino, the Arduino was successfully programmed to trigger the camera to capture images of the surrounding when the child performs the action of crossing the geo-fence.

In the fourth module, GUI consists of two sections, that is, the front end and the back end. A user friendly website was created so that the parent/guardian could periodically monitor on the child as shown in Figure 8, Figure 9 and Figure 10. The website has form validation for every field to ensure that incorrect information is not entered. The website is currently being hosted on a free hosting site so as to provide access to all from any computer at any location.

Fig. 8. Sign up page

Fig. 9. Login page

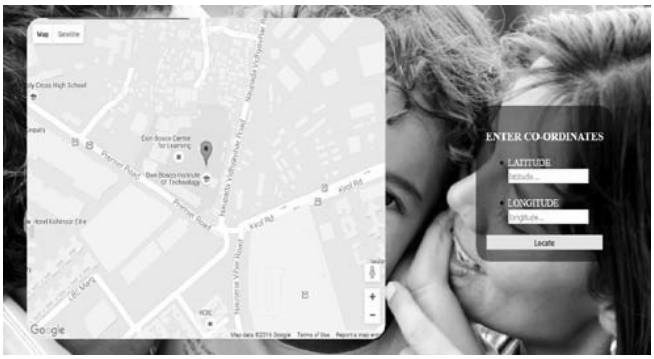

Fig. 10. Maps page

The database where all the information is stored was implemented and integrated with the hardware is shown in Fig. 11. The data stored in the database can be viewed on the website. The yes or no values in the table below indicate if the child is inside the geo-fence or not. If at a certain location, date and time the child was within the geo-fence then the value of inside_geofence column will be yes and if the child is not within the geo-fence then the value of inside_geofence will be no.

uid	id	latitude	longitude	date	time	inside_geofence
0	1	19.130552	72.87042	2016-02-02	12:20:10	yes
1	2	19.0997105	72.9164254	2016-02-03	10:20:50	no
0	3	19.0857512	72.8886991	2016-02-04	09:10:15	no
1	4	18.55868	73.910821	2016-02-06	05:23:12	yes
1	5	19.1849222	72.8340406	2016-02-07	15:23:45	yes
1	6	0	0	2016-02-09	03:15:20	yes

Fig. 11. Database output

Fig. 12. Database output

Fig. 13. Arm band

Fig. 14. Final setup

VI. TEST CASE

Case 1 (total sky view):- The device was first tested with total sky view available so that the conditions of fast and accurate lock on the positions, full network connectivity and full data connection, are available. The device was taken on a playing field so that all the conditions were met. Here the device was able to acquire the lock relatively faster as it had full view of the satellites in the sky. As the connectivity was optimal the message sent to the parents/guardian notifying about the arm band and whether or not the child is outside the geofence was sent with little to almost no lag. The data connection was also optimal so the data collected by the device could be sent to the database easily and relatively faster. The notification message was successfully received by a user present in a different location compared to the location of the device for both situations when the arm band is broken and the child is outside the geofence. The data updation on the website was also checked and confirmed by any random computer in a cyber.

Case 2(limited sky view):- The device was tested with limited sky view available where the conditions of fast and accurate lock on the positions, full network connectivity and full data connection, are not optimal. The device was taken inside a class room where conditions are limited. Here the device was able to acquire the lock slower compared to the first case as it had full view of the satellites in the sky was not available. As the connectivity was also limited the message sent to the parents/guardian notifying about the arm band and whether or not the child is outside the geofence was sent with a certain amount of lag. The data connection being restricted the data collected by the device could not be sent to the database easily and considerate amount of time lag was there. The notification message was successfully received by a user present in a different location compared to the location of the device for both situations when the arm band is broken and the child is outside the geofence. The data updation on the website was also checked and confirmed by any random computer in a cyber.

VII. FINAL DESIGN

The device is properly placed with insulating material and secured into place with insulation tape. The device is then placed into a pouch as shown in Fig.12. An elastic band are stitched to the pouch and wires are to welded to the buttons on the band to detect if the arm band is removed at any time as shown in Fig. 13. The entire set up is then strapped on the arm of the user as shown in Fig.14.

VIII. CONCLUSION

This project helps to provide a small window gap for parents/guardians to take the necessary action no matter how small to save a child's life. It also helps to spread the awareness of Autism, the difficulties and complications the child goes through. It also gave us a brief idea regarding the use of upcoming devices and technologies to facilitate better security towards autistic children.

IX. FUTURE SCOPE

The proposed system would help in increasing knowledge regarding hardware and controlling hardware device through programming. This project could not only be used by autistic children but also by the elderly or people suffering from Alzheimer's or Parkinson's disease.

This project could be further extended in the following ways:
Enabling verbal communication between parent and child.
Developing a mobile based application to get the real time view of the child's surrounding instead of checking on the PC.

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Pratibhojana: An Alarm Based Personalized Nutrition Recommendation System

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Abstract: **There is lack of awareness amongst older women about importance of good nutrition which is based on the appropriate, balanced intake and utilization of nutrients. Deficiencies in nutrition lead to long-term damage to both individuals and society. The proposed system is a personalized nutrition recommendation system supported with an alarm reminder which aims to provide diet recommendations to women in the age group of 40-50.**

Good health is paramount especially when we have women suffering from diseases such as anemia, osteoporosis and heart disease in India. In order to tackle conditions like these by improving the daily diet of women, the system begins with taking some basic medical input such as BMI, allergies and illnesses if any. After this, a recall/ diet history is taken so that the diet recommendations will modify the current daily diet routine of the user as per the required condition. The system recommends a list of dishes along with its recipe based on the medical inputs and also on the calories and nutrient contents of the user's diet history. The user has to select one dish for each meal namely - Breakfast, Morning snacks, Lunch, Evening snacks, Dinner and set an alarm reminder for the same. The system thereby relieves women from the burden of having to identify the right diet for their condition and will thereby help improve the nutritional status of households. Investing in nutrition in women is vital because it reduces health care costs, improves productivity and economic growth, and promotes education, intellectual capacity, and social development for present and future generations.

Keywords: Diet Recommendation system, Diet history; Alarm reminder.

I. INTRODUCTION

Nutrition focuses on how to protect the body from disease with a healthy diet. Human body receives nutrition from the food consumed. The major classes of nutrients are: carbohydrates, fats, minerals, protein, vitamins, fiber and water. All these nutrients are necessary for the human body but in varying quantities. Poor health or nutritional deficiency occurs due to inadequate amount of a particular nutrient or group of nutrients.

For a woman, working at home, taking care of her children and the elderly as well as working outside the home can greatly affect her physical and mental well being. Nowadays, working women tend to neglect their health. Fast life and unhealthy eating habits are leading to various health problems. Due to these changing trends, illnesses that used to usually occur during later stages of life are now arriving at an early age. And as a result women are facing a constant pressure of being health conscious. Due to this they feel the urge to obtain a quick access to information with respect to their health and are therefore resorting to the internet for the same. Also there are many women who lack appropriate knowledge of the right nutrition needed for the body.

Anemia and osteoporosis are the health issues commonly prevalent amongst women. Cultural factors in India deprive the female child of nutritious food and that is the reason why Indian women are mostly anemic and prone to osteoporosis in old age. It is a major concern of health problems related to ageing amongst women. Particularly at the onset of ageing which is probably at 40, women are easily prone to numerous ailments such as heart diseases, menopause and others. Indian middle class women often tend to ignore their health and visit a doctor only when certain disease symptoms occur, which later might turn out to be incurable. Doctors and nutritionists have thus mentioned lack of awareness amongst women as the major cause which leads them to greater disease states. Prevention is better than cure. Therefore, it is best if women adopt a healthy lifestyle which could help them keep such health issues at bay.

To promote a healthy lifestyle by correcting diet now-a-days we have a lot of information available on the internet. But this can also be confusing at times. Also mobile being a handy source of information the availability of nutrition apps these days has greatly increased.

But despite all this the information available is not crisp in various ways as they are not age specific, they do not cater to the Indian population, they do not take the diet history of a person into account and also the diet recommended does not consider the availability of ingredients.

Therefore a system was proposed that would enable women to gain access to diet recipes based on some standard inputs.

The proposed system is designed to take in general inputs such as the height, age, weight, type of lifestyle and all the allergies and disease inputs specific to a person. Based on these inputs, the system recommends diet recipes for each meal to be eaten at the appropriate time selected. Amongst all the categories of individuals, the ones that require utmost attention are women particularly in the age group of 40 to 50 years as they are most likely prone to diseases. The proposed system aims at providing good nourishment to these individuals. An additional advantage of the proposed system is the alarm reminder for food. With the help of this system, women will be able to obtain proper diet recommendations at the right time, thus helping them eat proper food as per their body condition and nutritional needs.

II. RELATED WORK

Four systems that were related to the proposed system were reviewed. These are [4]SapoFitness: A Mobile Health Application for Dietary Evaluation, [4] Implementation of a Goal-Oriented Recipe Recommendation System Providing Nutrition Information, [1]SmartDiet: A Personal Diet Consultant for Healthy Meal Planning, [5]iCare: A Mobile Health Monitoring System for the Elderly.

A. SapoFitness: A Mobile Health Application for Dietary Evaluation

SapoFitness is a mobile health application for a dietary evaluation and the implementation of challenges, alerts, and constantly motivates the user to use the system and keep the diet plan. The main goal of this application is to offer a motivation tool for weight reduction and increase physical activity. The application offers a continuous alert system activity, sending alerts/messages concerning the user diet program taking into account also his/her physical activity. It is a challenged mobile application that delivers the action to the user, motivating for a healthier life style. SapoFitness is customized to its user keeping a daily record of his/her food intake and daily exercise. The user enters all the necessary information such as his/her height, weight, age, and sex, for determining the BMI (body mass index) and the maximum daily calories must consume. Thus, the system automatically sets a sort of user profile and the system basically tells the user if he/she is or not on overweight and some more information surrounding, such as weight target, date for the purpose, and calories to consume.

B. Implementation of a Goal-Oriented Recipe Recommendation System Providing Nutrition Information

This system proposes a goal-oriented recipe recommendation system that utilizes information about nutrition on the Internet.

Their system enables users without knowledge about nutrition to search easily for recipes with natural language to improve specific health conditions. The natural language includes “I want to cure my acne” and “I want to recover from my fatigue”. The measure of the effectiveness of the system was done using F-Measure and the average F-measure was 0.64 respectively. Based on the input of a particular diseased condition, the system enables users without knowledge about nutrition to search easily for recipes. The most impressive field of this system was on the real time basis it gives recipes which cures everyday health problems through suggestion of food recommendation. The dishes in this system are only japan based and in their own national language as this system is just available for their own nation.

C. SmartDiet: A Personal Diet Consultant for Healthy Meal Planning

SmartDiet is a location-aware interactive diet consultant named SmartDiet based on the multi-objective optimization. Jen-Hao Hsiao, the main author of this paper says that, the objective of their research was to achieve nutrient-balanced food recommendations for each individual, while considering individual’s requirements at the same time. To reach this goal, they developed a location-aware interactive diet consultant named SmartDiet based on the multi-objective optimization. The proposed personalized diet planning approach not only translates nutrient recommendations into realistic dish choices, but also accepts feedbacks from users to fine-tune their meal plans. The results showed that daily nutrition needs can be fulfilled by the designated meals, and the interactive diet planning scheme helps a user adjust the plan in an easier way. The guidelines generated by SmartDiet are expected to potentially improve the overall health and reduce the risk of chronic diseases of individuals.

D. iCare: A Mobile Health Monitoring System for the Elderly.

Ziyu Lv, the main author of the system says, this paper describes a mobile health monitoring system called iCare for the elderly. Wireless body sensors and smart phones are used to monitor the wellbeing of the elderly. It can offer remote monitoring for the elderly anytime anywhere and provide tailored services for each person based on their personal health condition. When detecting an emergency, the smart phone will automatically alert preassigned people who could be the old people’s family and friends, and call the ambulance of the emergency center. It also acts as the personal health information system and the medical guidance which offers one communication platform and the medical knowledge database so that the family and friends of the served people can cooperate with doctors to take care of him/her. The system also features some unique functions that cater to the living demands of the elderly, including regular reminder, quick alarm, medical guidance, etc. iCare is not only a real-time health monitoring system for the elderly, but also a living assistant which can make their lives more convenient and comfortable. Remotely it

monitors the elderly person. Interesting innovation is that the new technology (wireless) sensors remotely monitor the BP and pulse rate and when it goes above the threshold value and when it goes above a particular level, an alarm and message is signaled by the application to the emergency contacts that is the family person, hospitals and or police as the concerned people are notified.

III. PROPOSED SYSTEM

A. System Configuration

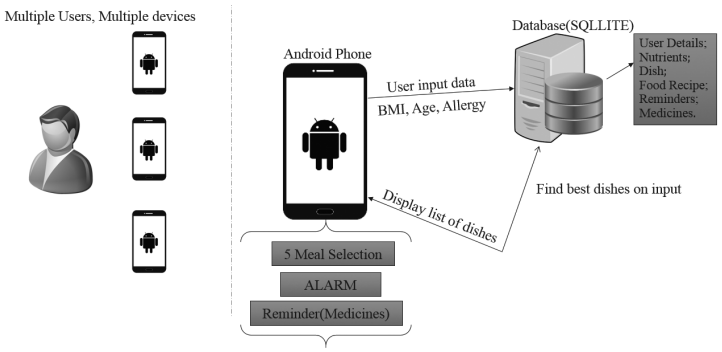


Fig. 1. System Configuration

The Android App supports multiple users and can be used simultaneously in multiple devices. As shown in Figure 1, the system asks for the required medical input from the user. Here, the user needs to input his / her name, age, height and weight for calculation of BMI, lifestyle followed and also the illness she is suffering from along with allergies if any. A recall/diet history is now taken to know the current daily diet routine of the user. Based on these inputs, the app provides a five meal selection for which the user needs recipes. The proposed system has 5 categories for meal selection, namely- Breakfast, Morning snacks, Lunch, Evening snacks and Dinner. Then, the system processes the input and applies data mining algorithm on the built-in SQLite database. The next stage is the output phase where the system displays a list of recommended dishes to the user. The user can choose any of these dishes and view their recipe. The final stage of the system is the alarm. Here, the user inputs a specific time along with any medicine name (optional) to set a reminder for the meal he/she has chosen.

B. Data Collection

Data collection first involved conducting a survey of general physicians and nutritionists to find out the most commonly existing diseases and allergies amongst women in the age group of 40-50 years. This gave the list of allergies and diseases which we included in the system. From the internet, the most common levels of the diseases was found out and considered. Also one factor that was highlighted was that BMI plays an important role when it comes to diet recommendation because it gives the amount of body fat. We thereby included it in the system thus providing users an insight of their BMI value and which category they belong to, namely; underweight, normal or overweight. Data related to the amount of nutrients contained in every ingredient was obtained from the book [2] which also gave the 9 categories of food to be considered.

C. Formulae And Algorithm

Consultation with a nutritionist helped in the inclusion of diet history as part of the recommendation because that is how they begin their recommendation to patients visiting them.

1. *BMI is calculated in the following way:*
   BMI = Weight (kg) / Height (m^2)[6]
   After calculation of BMI, the value falls into one of the three categories;
   Underweight; Normal; Overweight

2. *Calorie needs for the day is calculated in the following way:*

   Calorie needs = BMR * Activity Factor[7]
   BMR = (10 × weight (kgs)) + (6.25 × height (cm)) – (5 × age (years)) – 161
   Activity Factor:
   Sedentary: 1.2
   Moderately active: 1.55
   Active: 1.725

3. *Amount of nutrients consumed are calculated in the following way:*
   Nutrient consumed = Multiplication factor * Nutrients contained in 100 grams/ 1tsp

4. *Recommendation of dishes:*
   According to the user's BMI category and diseases, the dishes for recommendation are identified.

   In the database, each disease has a set of dishes for recommendation. If the user has more than one disease, the common dishes from each of these sets are selected.

   These set of common dishes are compared with allergy provided by the user. The dishes which contain ingredients that the user is allergic to, are removed from the list, to get the final set of dishes for recommendation.

Algorithm:

Step1: Start.

Step2: Take BMI ,recall , disease and allergy input from user

Step3: Filter dishes from already present dishes in the database based on BMI and recall thereby forming a refined set of dishes.

Following steps will recommend dishes from the refined list based on the disease and allergy the user is suffering from.
Step4: For a particular disease , add the nutrient deficiency to the database along with its quantity needed in 2 arrays namely NUTRIENTS and QUANTITY.

Step5: If a person has more than one disease repeat the above step for each disease.

Step6: For a particular dish present in the refined list check whether it has its nutrients present in the NUTRIENTS array. If yes goto step 6. Else goto step 7.

Step7: Check if the quantity of nutrients in the dish is greater than or equal to the value present in the QUANTITY array respectively. If yes, save the dish name in the array RECOMMENDATION. Else discard the dish.

Step8: If not end refined list, move to the next dish present in the list and goto step 5.

Step9: From the recommended set of dishes in the RECOMMENDATION array eliminate those dishes that contain ingredients which the user is allergic from. Form a new array of dishes named FINAL.

Step10: Display the FINAL array as the set of recommended dishes to the user.

Step11: Ask the user to select one dish under each category and set an alarm for the same.

Step12: End.

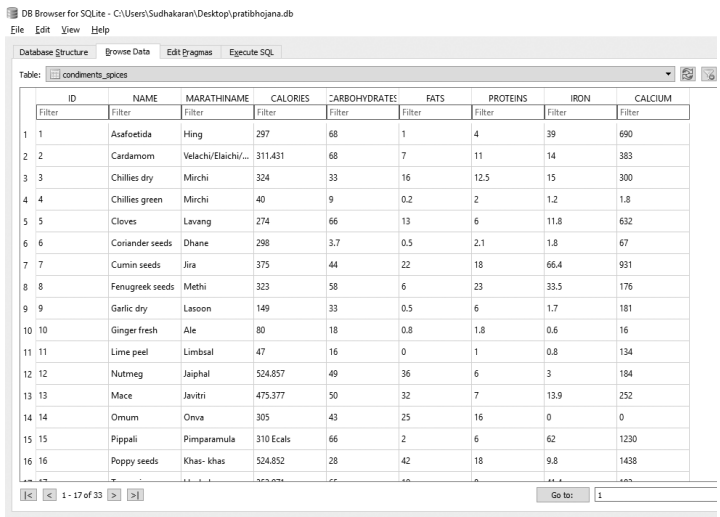
D. Nutritional Information Database
Any food item that we eat, consists of ingredients that fall under the nine categories of food; namely 1) Cereals and grains 2)Pulses and legumes 3)Vegetables 4)Fruits 5)Fats, sugars and edible oils 6)Condiments and spices 7)Nuts 8) Dairy products 9)Meat and seafood. The nutritional part of the database consists of these nine tables, one for each category of food.

Amongst all the ingredients available and used, the ones included in the ingredient tables were those that are commonly available in an Indian household.

Each table consists of ingredient names with the amount of nutrients (proteins, carbohydrates, fats, iron and calcium) contained in them in a given specific quantity. This information was collected from standard nutrition websites such as WHO and others.

Also the amount of calories obtained from every ingredient has an entry in the ingredient table.

This data was used to calculate the amount of calories consumed and nutrients contained in the diet of the user the previous day which helps in getting an idea of the diet lifestyle.


DB Browser for SQLite - C:\Users\Sudhakaran\Desktop\pratibhojana.db
File Edit View Help
Database Structure | Browse Data | Edit Pragmas | Execute SQL
Table: condiments_spices

	ID	NAME	MARATHINAME	CALORIES	CARBOHYDRATES	FATS	PROTEINS	IRON	CALCIUM
1	1	Asafoetida	Hing	297	68	1	4	39	690
2	2	Cardamom	Velachi/Elaichi/...	311.431	68	7	11	14	383
3	3	Chillies dry	Mirchi	324	33	16	12.5	15	300
4	4	Chillies green	Mirchi	40	9	0.2	2	1.2	1.8
5	5	Cloves	Lavang	274	66	13	6	11.8	632
6	6	Coriander seeds	Dhane	298	3.7	0.5	2.1	1.8	67
7	7	Cumin seeds	Jira	375	44	22	18	66.4	931
8	8	Fenugreek seeds	Methi	323	58	6	23	33.5	176
9	9	Garlic dry	Lasoon	149	33	0.5	6	1.7	181
10	10	Ginger fresh	Ale	80	18	0.8	1.8	0.6	16
11	11	Lime peel	Limbsal	47	16	0	1	0.8	134
12	12	Nutmeg	Jaiphal	524.857	49	36	6	3	184
13	13	Mace	Javitri	475.377	50	32	7	13.9	252
14	14	Omum	Onva	305	43	25	16	0	0
15	15	Pippali	Pimparamula	310 Ecals	66	2	6	62	1230
16	16	Poppy seeds	Khas- khas	524.852	28	42	18	9.8	1438

1 - 17 of 33 Go to: 1

Fig. 2. Nutritent breakup

I. SYSTEM OVERVIEW

A. System Flow

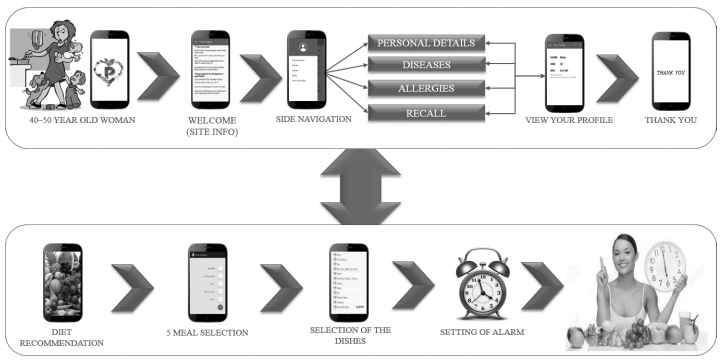


Fig. 3. Flowchart of System

As shown in Figure 3 the system starts by asking the users who are Indian Maharashtrian women in the age group of 40 to 50 years of age, to give inputs such as name, age, height, weight and their cuisine choice, which is vegetarian or non-vegetarian. In the next step, the app asks for the name and levels of the disease and allergies if any, which the woman is suffering from. Followed by basic inputs the user is now asked to give their diet history in recall activity in which they input what they have eaten the previous day, which helps us

to know their regular diet routine. After completion of the input procedure, the system applies algorithm to the offline database to display the recommended list of dishes. The user has a free choice to choose any of the dishes that are recommended to her. After selecting the dish, the app shows an option for reminder for the intake of the dish.

II. DESIGN AND IMPLEMENTATION OF THE SYSTEM

A. User Interface for the Nutrition recommendation system

Fig. 4. First activity of android app Pratibhojana

Figure 4 shows the first activity of the proposed app which consists of the official logo and title of the app. It displays the name of the proposed system which is Pratibhojana. The word Pratibhojana is derived from the Sanskrit word prescribed diet. Just as a doctor prescribes medicines to patients, in the same way, the proposed system aims at recommending healthy nutritious food to women based on some standard inputs. The proposed system enables women without knowledge about good nutrition to search for simple Indian recipes filtered on the basis of some standard input conditions taken by the system.

Fig. 5. Personal Details activity of android app Pratibhojana

Figure 5. Asks the user to input her name, cuisine preference, age, height and weight. The age of the user should be in the age group of 40-50 years as the app is intended for this age group only. The height and weight specified by the user must be in metres and kilograms respectively. Usually from the height and weight, the BMI is calculated which is then used for deriving certain health results. All the inputs must be properly filled. On clicking the SAVE button all the information given by the user are inserted into the database after the above constraints are satisfied successfully.

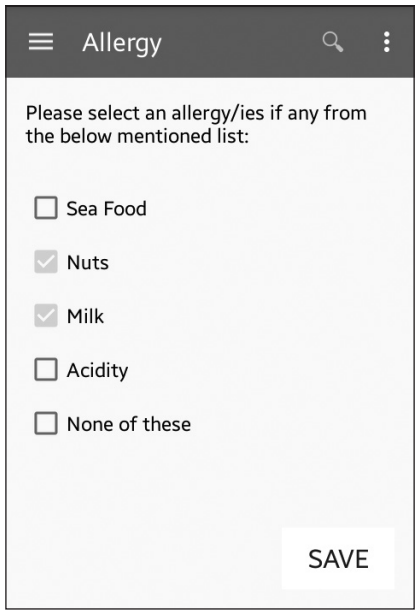


Fig. 6. Allergies activity of android app Pratibhojana

Figure 6 shows the allergies taken into account. This list is based on the survey of doctors conducted to find the most common allergies prevalent amongst women in the age group of 40-50 years. The user is expected to select the allergy names that she has, else 'none of these' option.

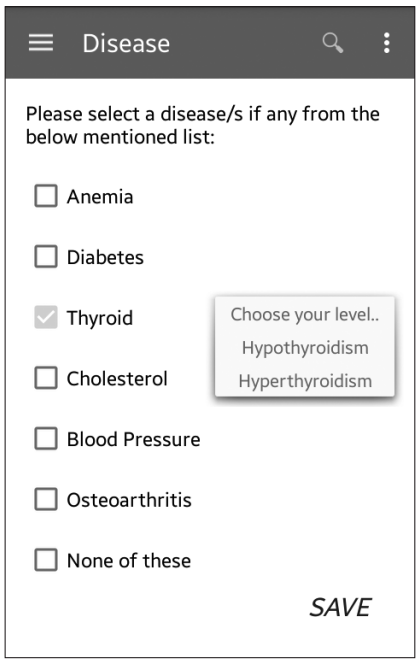


Fig. 7. Diseases activity of android app Pratibhojana

Figure 7 shows the second set of input categories which are illnesses. This list is based on the survey of doctors conducted to find the most common illnesses prevalent amongst women in the age group of 40-50 years. The user is expected to select the allergy names that she might be suffering from else 'none of these' option.

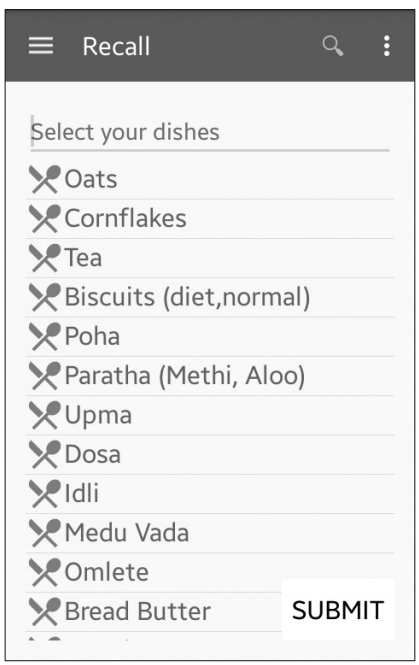


Fig. 8. Recall/Diet history activity of android app Pratibhojana

Figure 8 displays the recall activity wherein the system asks the user what she has eaten the previous day. The search bar at the top of the page helps the user to search and select the dishes efficiently.

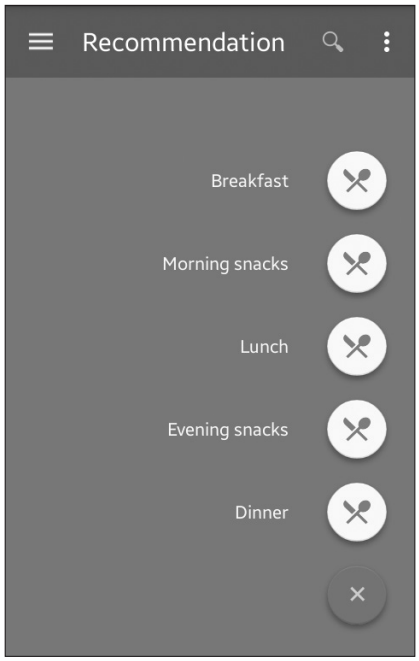


Fig. 9. Five meal selection page of android app Pratibhojana

Figure 9 shows the user interface for the 5-Meal Selection plan. For viewing the list of dishes the user has to select a meal and then based on the inputs provided by the user the system accesses database to retrieve the set of dishes to be recommended to the user who can now set an alarm reminder for the same.

B. User Interface for the Alarm system

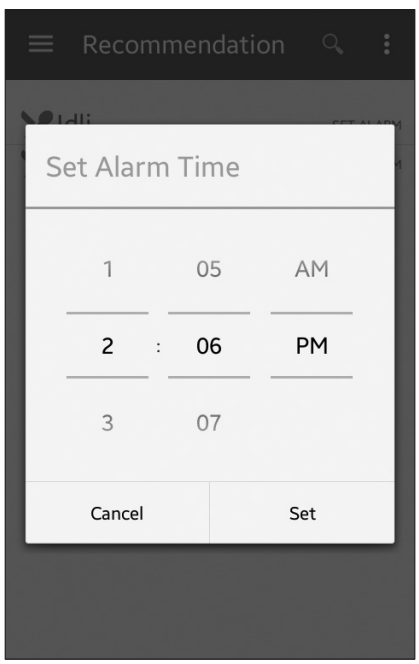


Fig. 10. Alarm clock pop-up

Fig. 11. Basic implementation of Alarm System

The final stage of the system is the alarm reminder with voice output. The user can now select one dish for every meal from the 5-time meal plan suggested and set an alarm reminder for the same. The voice output specifying the dish to be eaten makes it easier for the user to identify the purpose of the alarm. Therefore, at the specified timing, the alarm will ring reminding the user to eat the selected dish.

III. CONCLUSION AND FUTURE WORK

The survey of general physicians threw light on the fact that there is lack of awareness amongst women about the importance of nutrition particularly when they enter the age group of 40-50 where they are most likely to develop unhealthy conditions. The importance of nutrition needs to be realized by every woman. Necessary changes in the lifestyle of every woman has to be incorporated in order to ensure a healthy living. A healthy living comes from a healthy diet.For this reason, women need to get some sort of guidance for the right diet for their condition. And to support that, this project described an alarm based personalized nutrition recommendation system for women in the age group of 40-50 years.

Good nutrition starts with the basics: a well-rounded diet consisting of whole grains, fresh fruits and vegetables, healthy fats, and high quality sources of protein. These kinds of foods provide women with plenty of energy, the means for lifelong weight control, and the key ingredients for looking and feeling great at any age. Instead of obsessing over specific foods or nutrients, it's the overall eating pattern that's most important. Diet has a major effect on an individual's food cravings, stress levels, and energy throughout the day. By making smart food choices and developing healthy eating habits, it's much easier to stay slim, control cravings, and feel energetic all day long.

In this way Pratibhojana aims at playing a good nutritional role in the lives of women in the age group of 40-50 by improving their daily diet. The system relieves users the burden of having to identify the right diet as per their body conditions and nutritional needs and will save them the time of browsing the internet for appropriate diet recipes. An additional advantage of the proposed system is the alarm reminder for food. Therefore, this proposed system, is a fine attempt to build an efficient diet recommendation system that provides home made Indian recipes that will help improve the nutritional status of households. Future work may include the alarm reminder system being made multipurpose and with a better voice output. Also the app can be made online in future to incorporate more amount of data. Another task of future research is to make the system for infants as well as the elderly.

Since, Life can be hectic, and sometimes it's hard to take the time to make healthy food choices. But making wise food choices—along with regular physical activity—can offer big benefits, now and in the future.

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Security Enhancement System For Farmland

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Abstract: **Agriculture is the basic source of income in India. It is one of the largest contributors to the Gross Domestic Product (GDP).Weather changes in Maharashtra have a major impact on the productivity of crops which in turn affects the farmer. Different weather factors such as strong wind, heavy rain and fire can damage the crop. Tomato plant when exposed to strong wind or storm affects the growth and productivity of the plant. Heavy rain gives rise to the problem of water logging which can be detrimental for crops. Fire can also prove to be harmful as it can destroy the crop. Along with the above mentioned problems human theft and stray animal intrusion like sheep, cow and rabbit can also cause a major loss to farmers. Hence, there is a dire need to design a security system for farmland. This paper proposes an idea of providing security to tomato plants. This system will notify farmer in case of flood, strong wind and fire. If fire is detected it will trigger sprinkler and alarm. The farmer can view activities carried out in the farm and daily video recording will be stored. Also authentication is provided for entering the farm.**

Keywords: Farm Security(FS), Agriculture, Internet Of things(IOT), Wireless Sensor Network(WSN), Mobile Communication(MC).

I. INTRODUCTION

Agriculture in India is the largest livelihood provider and mainly contributes to the Gross Domestic Product (GDP). As per the estimates by the Central Statistics Office (CSO), the share of agriculture and allied sectors (including agriculture, livestock, forestry and fishery) was 16.1 per cent of the Gross Value Added (GVA) during 2014–15 at 2011–12 prices (Mitsuyoshi Hori, 2010; Anjum Awasthi, 2013). It ranks third in farm and agriculture outputs. As 10% of the country's exports comes from agricultural product it ranks fourth in the largest exported principal commodity.

As agriculture is greatly influenced by the changing weather condition the growth of the plants is affected which in turn affect the farmers. Even though agriculture accounts for much of its Indian economy it is considered highly inefficient and incapable of solving the hunger problems. Almost 1/5th of the total agricultural output is lost due to deficiencies in harvesting, protection and storage of plants. Due to this it is required to have a system (Drishti Kanjilal, 2014). where farmer can be alerted on time. Also the protection of such farmlands can be challenging as such properties are more likely to be large and cover many acres. It is because of the remoteness of these locations that makes them a target for human theft.

This paper proposes a security system for tomato plants. The system consists of the metal mesh cubical along with a password entered authentication system. The metal mesh cubical surrounding the tomato plants acts as a shield from robbers and stray animals. A low voltage current is allowed to pass through the mesh and this current will stop flowing if the mesh is broken by stray animals or robbers and subsequently a text message will be sent to the farmer notifying the intrusion in the farm. A predefined password entered authentication system prevents strangers from entering the farm. The door of the structure is unlocked and the current flow is stopped only if the farmer enters correct password else the farmer would not be able to enter the farm.

There is a need for sensors which will constatly monitor the surrounding whether conditions and any extreme whether change should be conveyed to the farmer. Flame sensor is used to detect flame within a range of one meter or in direct line of sight (Anjum Awasth, 2013; Sumitha Thankachan, 2014). Once the fire is detected an alarm system and water sprinkler present on the farm is triggered which will help in putting down the fire so that it won't affect the plants and also alert anyone nearby (Hideya Ochiai, 2011; Alexandros Kaloxylos, 2012; Surendra Kumar, 2013). Simultaneously a text message will be sent to the farmer so that he can understand that fire is there if he doesn't check the app. Rain drop sensor is used as a water level sensor which will monitor the water level on the farm (R.Balathandapani, 2015). When increase in water level is detected i.e. when flood is detected the farmer is notified through a text message. And when farmers come to know about it he can take necessary actions. Wind sensor uses work as a switch monitors the rotation of the blades. When there is increase in the number of rotation strong windwill be detected and it will be notified to the farmer through app as well as message would be send in case he doesnt check the (Drishti Kanjilal, 2014; Balathandapani, 2015).

Human theft can also cause major loss to the farmer so to avoid such situation Raspberry-pi can be used with No-IR. It is used to provide live streaming facility through an android app to the farmer to keep track of activities on the farm (Ramesh Chand, 2012; Deshmukh Nilesh, 2012; Anjum Awasthi, 2013). It can also be used to record videos and store it in a on a pen drive. This pen drive will have video recordings of the previous two days after which the video will be replaced by the new ones. This facility will help the farmer in identifying the thief in case of any robbery. An android app will be provided to the farmer which has three features- sensor status, live streaming and help. The sensor status option helps the farmer in identifying the status of the sensor (Sumitha Thankachan, 2014).

II. MATERIALS AND METHODOLOGY

A. Proposed System

The Proposed system consists of four main blocks - Sensors and camera installation, Arduino, Raspberry-Pi, Android App.

Arduino takes output from the sensor send it to raspberry pi. For sensor related information arduino is required. And raspberry pi which takes only information related to sensor is needed to be display it on app and for storing recorded. In the proposed system weather is constantly monitored using the sensors (Flame sensor, Rain sensor, Wind sensor) and extreme weather changes sensed by them are notified to the farmer as soon as possible so that the farmer can take necessary actions to avoid extreme loss.

The sensors are connected with Arduino Uno R3 and then to Raspberry-Pi. When any weather changes are noticed an intimation is sent from Arduino to Raspberry-Pi and then Raspberry-Pi sends a message to the farmer. To notify the farmer an Android App is used.

In case of fire water sprinklers are activated along with the alarm so that nearby people can come to douse the fire. The entire farm will be under surveillance which will be done by using a Raspberry-pi PI-No-IR camera. A facility of live streaming is also provided through the app so that the farmer can have a clear idea of what is actually happening in the farm even if he far away. An authentication system is provided so that only the farmer or his workers can enter the farm.

B. Methodology

1. Interfacing Of Arduino With Sensors
   a) Arduino Uno R3 with KY-026
      KY-026 is a Flame sensor which detects the flame and produces output (0 or 1) on Arduino Uno R3. When flame is detected the sprinkler and alarm are switched ON.
   b) Arduino Uno R3 with Rain drop sensor module
      Rain drop sensor module in this system works as water level sensor. Rain drop sensor is connected to LM393 voltage comparator respectively. LM393 voltage comparator is connected to Arduino Uno R3. Output pin of LM393 is connected to the digital output pin of Arduino Uno R3.
   c) Arduino Uno R3 with Wind sensor module
      Wind sensor module is connected to Arduino Uno R3. Analog output voltage of wind sensor is connected to the analog input pin of Arduino Uno R3.
2. Interfacing Of Camera With Raspberry-Pi
   PI-Camera interfaced with Arduino using a dedicated CSI interface, which was designed especially for interfacing to cameras.

   It connects to Raspberry Pi by way of a short ribbon cable. The camera is connected to the BCM2835 processor on the Pi via the CSI bus.
3. Interfacing Of Arduino With Raspberry-Pi
   Arduino Uno R3 is interfaced with raspberry-pi model B in master slave configuration which uses bidirectional communication.
4. Developing Mobile Application
   An android app is provided to the farmer which will notify the farmer in case of any extreme weather changes. The function of sending the message will performed by Raspberry-Pi.

III. DESIGN DETAILS

A. Block Diagram

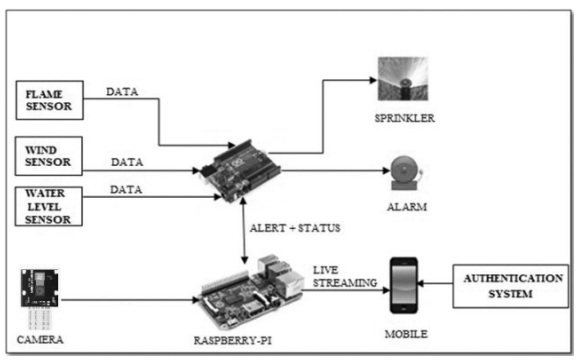

Fig. 1. Block diagram of the system

Fig. 1. shows all the components with their communication paths. There are three sensors used which are Flame Sensor, Wind Sensor and Water Level Sensor. Arduino is connected

between Sensors and Raspberry-pi to provide sensors status as well as any alert message to the user. Live Streaming is provided to the user from camera through Raspberry-pi.

B. Circuit Diagram

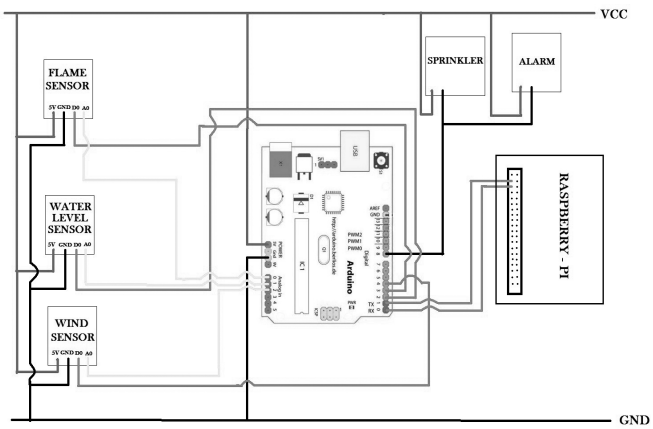

Fig. 2. Circuit diagram of the system

Fig. 2. shows Arduino Uno R3 has 6 Analog input such as A0 , A1, A2, A3, A4, A6 and digital output on pin 0, 1, 2, 3, 4 , 5, 6, 7, 8, 9, 10, 11 , 12, 13.Arduino is connected to Raspberry-pi using RX and TX pins.All three sensors are having VCC, GND , A0 and D0. VCC and GND of all sensors are respectively connected to the VCC and GND pins of arduino. Flame sensor is connected to Arduino analog input A0 and D0 is connected on digital output 3.Sprinkler and Alarm are connected on output pin 8 for output response on fire detection.Water Level Sensor is connected to arduino analog input A1 and D0 is connected on digital output pin 2. Wind Sensor is connected to arduino analog input A2 and D0 is connected on digital output 4.

IV. WORKING MODEL

A. ARDUINO WITH SENSOR INSTALLATION

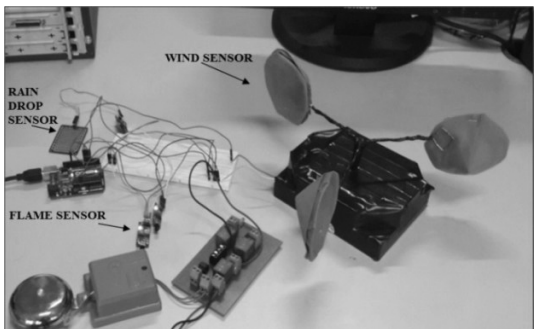

Fig. 3. Arduino with sensor installation

i. Arduino connection with flame sensor
Arduino is connected with the flame sensor KY-026 as it is used for detecting flame easily and interfacing ot with arduino is easy and using the arduino software a C code is written and uploaded to specify the threshold value which will activate the flame sensor and it was then tested. Flame is sensed if it comes in direct line of sight with sensor or it is within 1ft from the sensor.

ii. Arduino connection with Rain drop sensor
For detecting flood, rain drop sensor is used as water level sensor. Rain drop sensor is connected to LM393 voltage comparator respectively. LM393 voltage comparator is connected to Arduino and using the arduino software, a C code is written and uploaded to specify the threshold value which will activate the rain sensor and it was then tested.

iii. Arduino connection with wind sensor
Arduino is connected with the wind sensor and using the arduino software, a C code is written and uploaded to specify the threshold value which will activate the wind sensor and it was then tested.

B. INTERFACING OF CAMERA WITH RASPBERRY-PI

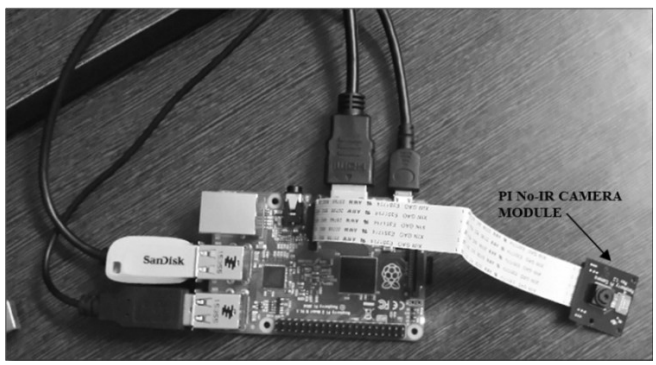

Fig. 4. Raspbery-Pi with Pi-NoIR camera module

The Pi-NoIR camera module is used for two purposes, one for providing live streaming facility and other for storing the video on pen drive for future references. As Pi-NoIR camera is night vision camera and also compatible with raspberry-pi it provides video recording of day as well night time also. The camera provides the feature of live streaming which can be viewed through the app provided to the farmer. The camera captures video and stores it on the pen drive. In case of theft or any suspicious activity the farmer can view the recording. After a period of two days the video gets replaced with the previous ones.

C. INTERFACING OF ARDUINO WITH RASPBERRY-PI

Arduino and raspberry-pi are connected serially using a data transfer cable. This is a bidirectional connection which uses the concept of master slave configuration where the master is raspberry-pi and slave is arduino. Arduino being the slave sends the output to raspberry-pi. Raspberry-pi then sends the data to the mobile application.

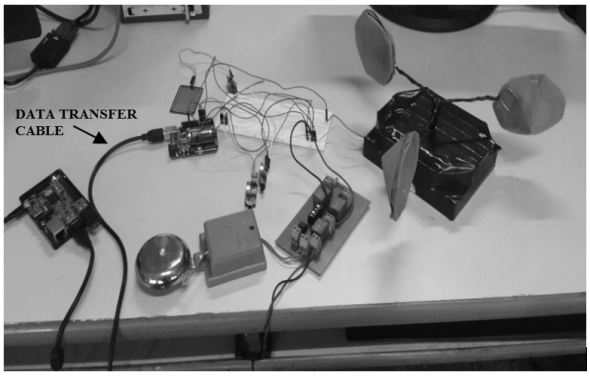

Fig. 5. Interfacing of Arduino and Raspberry-pi

D. DEVELOPING MOBILE APPLICATION

Fig. 6. Home page of mobile app

Fig. 6. shows the home page of the mobile app which will be provided to the farmer. The app already there used for contolling the GPIO pin of the raspberry-pi. Here as the sensors are connected to arduino and data regarding sensors is sent serially through data transfer cable so there is no need to contol the GPIO pin of raspberry-pi. This app has three main features available that are Status, Camera and Help and directly reads he data sored in the text file in raspberry-pi. Here images are used to represent camera status and help for better understanding. If the farmer has any problem related to the app or understanding any icon he can refer to the video of how to operate the app.

i. Status
Fig. 7. shows the status of the sensors present on the farm. Every sensor is represented by an image surrounded by a coloured rim. The colour of the rim indicates the status i.e. in case of flame sensor if the rim colour is red then the sensor has not detected flame and if the rim colour is green then the Sensor has detected flame. In case of flood, fire and strong winds it will notify the farmer through a text message.

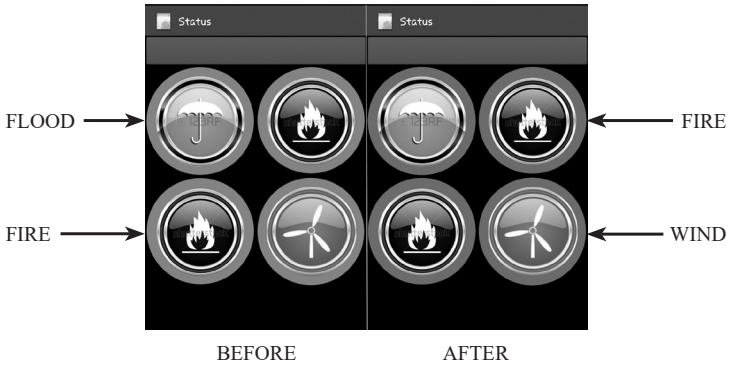

Fig. 7. Status

ii. Camera
The Pi-NoIR camera present in the structure provides the entire view of the farm when viewed through the app.

iii. Help
This option in the app helps the farmer in better understanding of the app.

E. AUTHENTICATION SYSTEM

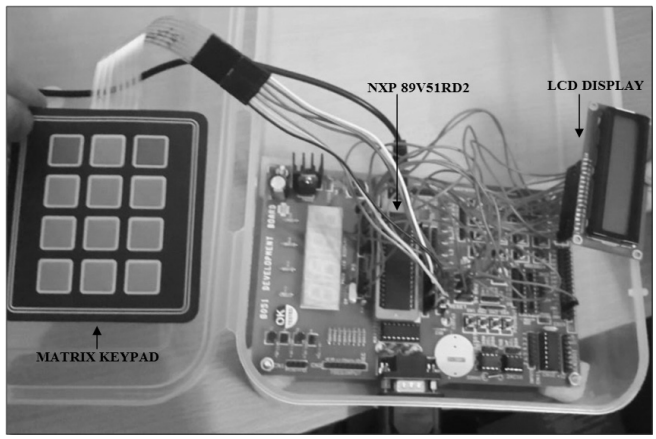

Fig. 8. Authentication system

Fig. 8. shows authentication system which will be present at the door of the cubical structure. This authentication system controls the current as well as the lock at the door. The system will stop the flow of the current and unlock the door only when correct password is entered by the farmer.

F. STRUCTURE

Fig. 9. shows an overview of the structure. It is a six foot mesh cubical through which low voltage current is allowed to pass which will avoid stray animals like goat, sheep, snake etc from entering the farm, it also protects the farm form

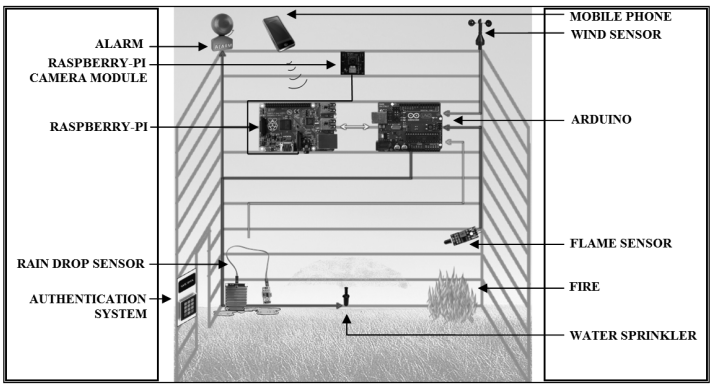

Fig. 9. Basic structure (Overview)

human theft. Inside the structure are three sensors fire sensor, rain drop sensor and wind sensor. Pi-NoIR camera is present at the top of the structure to provide better view of the farm.

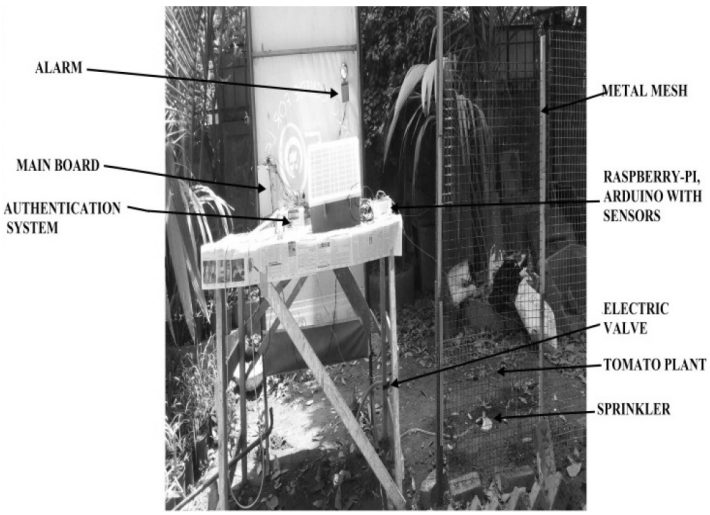

Fig. 10. Final Model

V. RESULT

The structure constructed was metal cubical mesh through which low voltage current was allowed to pass. If any stray animal or a thief tried to enter the farm by tampering the cubical, a text message was sent to the farmer notifying an intrusion into the farm. If the farmer was notified about any intrusion and he wasn't nearby the farm the farmer had an option of viewing the farm through the camera option in the mobile app provided. This facility was provided by making use of Raspberry-Pi No-IR camera. If the farmer came to know about any robbery later on he had an option of going through the videos being captured by the raspberry-pi camera and which was being stored on an external pen drive. The structure included an authentication system which was coded to have a predefined username and password. This system provides complete security in terms of theft and animal intrusion.

Inside the structure there were three sensors connected to the Arduino which constantly monitored the farm and took necessary actions in each case. The first sensor being used was a flame sensor which detected the flame present within one foot and in direct line of sight and triggered an alarm and water sprinkler on the field and simultaneously notified the farmer through a text message. The second sensor being used was rain drop sensor being used as a water level sensor. This sensor detected an increase in the water level on the farm i.e. flood and a text message was sent to the farmer. The third sensor being used was a wind sensor which uses LDR. In this sensor the blades of the wind sensor were monitored and if there was increase in the speed of rotation of the blades which indicated high speed wind or storm then the farmer was notified through a text message. This system makes sure that the farmer is informed immediately as soon as any change in the climate is noticed.

An android app which was provided to the farmer has three features. The app provided the sensor status to the farmer. Each sensor on the farm was represented by an icon on the interface and the colour of the rim surrounding the icon represented the status of the sensor (Red colour rim indicates that the sensor has not detected flame, flood or storm and green colour rim indicates that the sensor has detected flame, flood or wind).

The current system provides a security system and keeps the farmer updated about the farm. The security system constructed can be upgraded by adding more security features to it. The current system works on a single network which can be proceeded to working on different networks. The current system considers heavy rain, fire and flood. Other factors can be considered like monitoring the soil, humidity, etc.

VI. CONCLUSION

The system built will constantly monitor the farm and alert the farmer in case of heavy rain and strong wind. In case of fire along with alert message, alarm system as well as water sprinkler will be triggered. Another threat to farm is due to human theft which can be overcome with the facility of live streaming and updating the farmer about the status of the devices used. At times there is a situation where animals randomly enter the farm which can cause damage to the plant. Hence in order to avoid such situation the system provides a mesh around the farmland so that animals cannot enter the farmland. In order to provide security to the farmland in the absence of farmer an authentication system is provided.

VII. FUTURE SCOPE

The security system constructed can be upgraded by adding more security features to it. The current system works on a single network which can be proceeded to working on different networks. The current system considers heavy rain,

fire and flood. Other factors can be considered like monitoring the soil, humidity, etc.

ACKNOWLEDGEMENT

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Dynamic Load Balancing in Cloud Computing

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Abstract: **Dynamic load balancing in clouds is a mechanism that aims at distributing the excess dynamic workload evenly across all the nodes ensuring that no node is overwhelmed thereby improving the overall performance of the system. The dynamic load balancing algorithm which we have implemented provides a high user satisfaction ratio and resource utilization ratio [3], the available resources are utilized optimally thereby minimizing the resource consumption. Our proposed technique implements failover, enables scalability, avoids bottlenecks and over-provisioning, reduces response time etc. The goal of a cloud based architecture is to provide elasticity and the ability to expand capacity on demand. Cloud computing is a term, which involves virtualization, distributed computing, networking, software and web services. A cloud consists of several elements such as clients, datacenter and distributed servers. Dynamic load balancing is essential for a cloud implementation.**

Keywords: Cloud Computing, Load balancing, Distributed System, OpenStacks, OwnCloud.

I. INTRODUCTION

1.1. CLOUD COMPUTING AND ITS SERVICES

Cloud computing is a quickly developing innovation that hosts processing administrations in unified data server and it gives the access to those administrations through the Internet. Cloud computing is a field which utilizes the multifaced nature of and gives powerfully benefits utilizing vast versatile and visualized assets over the Internet. It is characterized as a disseminated framework containing an accumulation of processing and correspondence assets situated in circulated information enters which are shared by a few end clients. There are two sorts of the cloud; the former is general public cloud in which administrations might be sold to anybody on the Internet. The second sort of the cloud is the private cloud. It is an exclusive system or data centre that provisions facilitated administrations to a set number of customers (end-clients). Cloud computing permits clients to run applications remotely including data innovation administrations called Software-as-a-Service (SaaS) [1]. In addition, Infrastructure-as-a-Service (IaaS) alludes to where the application is completed by means of helpful capacities and organizations gave in the cloud. Among SaaS and IaaS, there are cloud platform services referred to as Platform-as-a-Service (PaaS) deliver operating system, programming language and solution stack. It intends to enhance the applications deployment cost and decrease its complexity.

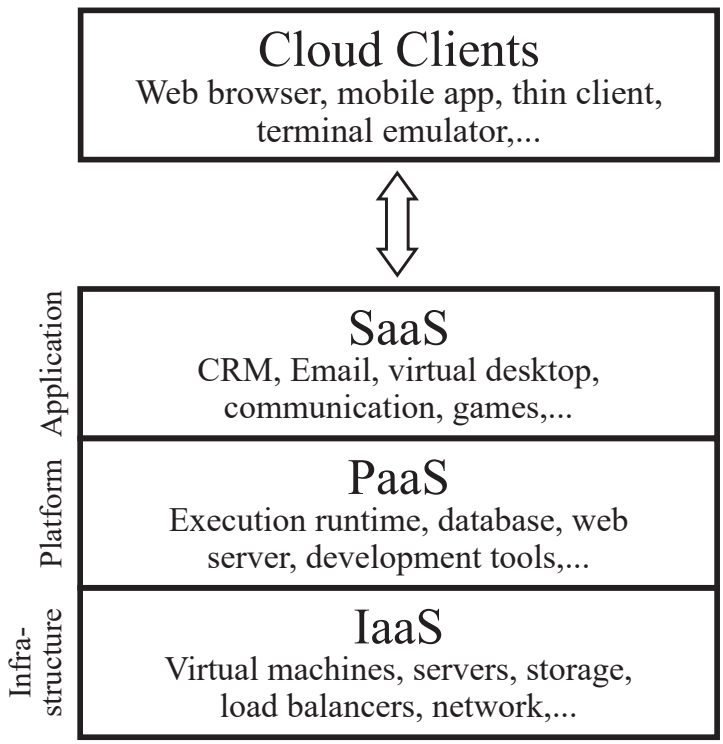

Fig 1.1 Cloud Services

Cloud computing is an on request benefit in which shared assets, data, programming and different devices are given by customer necessity at particular time. It can be seen that the cloud asset utilize can be disentangled and proficiency worked by the booked administrations use in an ideal way in light of a legitimate concern for the end clients. The entire Internet can be seen as a billow of numerous associations less and association –oriented administrations. Cloud computing is a developing worldview with evolving definitions, yet for this examination extend, it is characterized as a virtual base which gives shared data and correspondence innovation administrations, by means of a web "cloud," for "different outer clients" through utilization of the Internet or "expansive scale private systems." Cloud processing gives a PC client access to Information Technology (IT) administrations (i.e., applications, servers, information stockpiling) without

requiring a comprehension of the innovation or even responsibility for framework.

1.2. LOAD BALANCING IN NETWORKING

A load balancer is a purely a networking solution responsible for distributing incoming traffic among servers hosting the same application content. By adjusting application demands requests over different servers, a stack balancer keeps any application server from transforming into a lone reason for frustration, along these lines improving general application availability and responsiveness. For example, when one application server gets the opportunity to be out of reach, the pile balancer just aides all new application sales to other available servers in the pool. Stack balancers furthermore upgrade server utilize and intensify availability. Stack changing is the most direct technique for scaling out an application server structure. As application demand increases, new servers can be easily added to the benefit pool and the store balancer will in a split second begin sending movement to the new server.

Load balancing is the innovation to disperse workload over numerous PCs or a PC bunch, focal handling units, plate drives, RAM, or different assets, to accomplish ideal asset usage, augment throughput, minimize reaction time, stay away from overburden, and minimize application downtime. The heap adjusting administrations is typically given by devoted programming or equipment. The majority of the times a solitary webserver is lacking to handle the measure of movement or load got. Essentially the heap adjusting can be static or element.

1.3. COMPARISON BETWEEN STATIC AND DYNAMIC LOAD BALANCING

The current static Load Balancing procedure has all the planning choices are foreordained, while, in a dynamic load-adjusting (DLB) arrangement, the scheduling decision are made at runtime. In this manner, a DLB approach can be rolled out versatile to improvements in system parameters, for example, the activity in the channel and the obscure qualities of the incoming load. Moreover, DLB can be performed in view of either local information (relating to neighboring nodes), or global data, where finish learning of the whole conveyed framework is required before any activity is executed.

Environment change endorsements are required from administration to include new examples into static environment yet not for dynamic situations. Including new examples into static load adjust design requires some time and testing, however with element stack adjust everything will be programmed. There is a possibility that manual slip-ups can happen in static load adjusting however are not present in dynamic load balancing. The most huge distinction amongst static and dynamic load balancing is that there is no compelling reason to allot sit still assets for dynamic load balancing. Assets are distributed when required and discharged when didn't really required. This minimizes the costly portion of sit still assets. Along these lines dynamic load adjusting has more asset use proportion when contrasted with static load adjusting.

1.4. WHY CLOUD COMPUTING?

The principle preferred standpoint of utilizing cloud computing [2] facility is that clients don't need to pay for base establishment and support cost. As a client of cloud computing you need to pay the administration charges as per your utilization of configuration power and other systems administration assets. You no longer need to pay for somebody to do things such as install and update software, install and manage email servers and fine servers, run reinforcement. The beauty of cloud computing is that all of the business of maintaining the service or application is the responsibility of the cloud vendor, not yours. You no longer need to purchase software. Besides the accommodation of not buying programming programs and introduce them all alone servers/PCs, utilizing cloud applications rather can be less expensive. You might have the capacity to curtail framework hardware. File storage, data backup and software programs all take up a ton of space on servers/PCs. With distributed computing, you utilize another person's servers to store this information rather, arranging for your in-house PC gear for different purposes or notwithstanding giving you a chance to dispose of some of it. A distributed computing application may make combination easier. Because numerous distributed computing applications incorporate an Application Programming Interface (API) you might have the capacity to discover "good" applications as opposed to paying to have the applications you need to be coordinated redone for you.

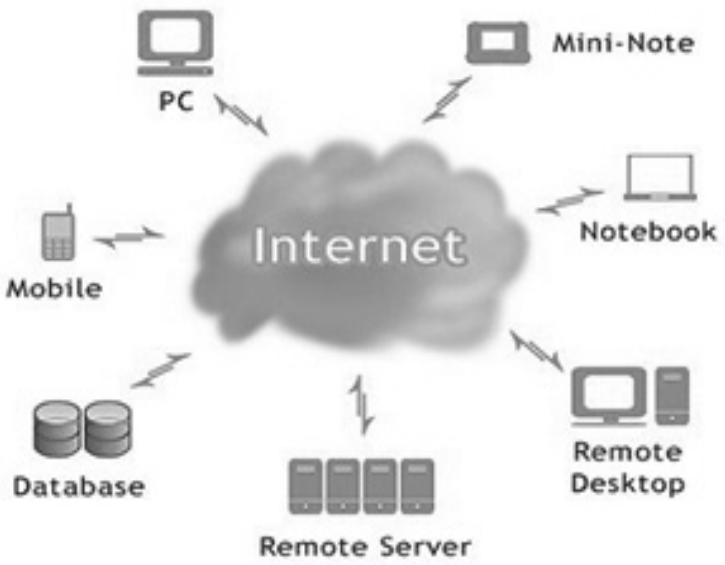

Fig 1.2: Cloud Computing

1.5. NEED OF DYNAMIC LOAD BALANCING IN CLOUD COMPUTING

We will consider a situation where there is one and only web server in operation to handle every single approaching solicitation to your organization site. At first, it might be conceivable to handle the volume of activity your website gets with one web server. Nonetheless, as the business develops, the one server will be inadequate. In the event that we don't include new web server occasions our website pages will stack gradually and the clients will need to hold up till the server is allowed to process customer demands. In this way, the hold up time and the reaction time increments. In nowadays where the market is exceptionally focused clients administration is enormously essential or potential clients will move to the opposition. When you have numerous web servers in your server assemble, the approaching movement can be equally apportioned among the diverse servers. This procedure is called static load adjusting. In any case, it will just appear to the customer as one server just as opposed to a few subsequently accomplishing straightforwardness.

The basic reasons for dynamic load balancing:

- To spread the load amongst a number of machines/ locations dynamically
- To provide redundancy in case one machine / server fails
- To provide zero downtime during patch installations on servers or updates to applications on server
- Apart from the above-mentioned factors, load balancing is also required to achieve Green computing in clouds which can be done with the help of the following two factors:
- Load balancing helps in avoiding overheating by balancing the workload across all the nodes of a cloud, hence reducing the amount of energy consumed. Thus energy consumption is reduced.
- Energy consumption and carbon emission go hand in hand. The more the energy consumed, higher is the carbon footprint. Thus carbon emissions reduced.
- As the energy consumption is reduced with the help of Load balancing, it helps in achieving Green computing.

II. LITERATURE REVIEW

All load balancers are fit for settling on activity choices in light of conventional OSI layer 2 and 3 data. More propelled load balancers can settle on smart movement management choices in view of particular layer 4 – 7 data contained inside the demand issued by the customer. Such application-layer knowledge is required in numerous application situations, incorporating those in which a demand for application information must be met by a particular server or set of servers. Load balancing decisions are made rapidly, for the most part in under one millisecond, and elite load balancers can settle on a huge number of choices every second.

Load balancers also typically incorporate network address translation (NAT) to obfuscate the IP address of the back-end application server. For example, application clients connect directly to a "virtual" IP address on the load balancer, rather than to the IP address of an individual server. The load balancer then relays the client request to the right application server. This entire operation is transparent to the client, for whom it appears they are connecting directly to the application server.

An administrator-selected algorithm implemented by the load balancer determines the physical or virtual server and sends the demand. Once the request is received and handled, the application server sends its response to the client via the load balancer. The load balancer deals with all bi-directional traffic between the client and the server. It maps each application response to the right client connection, ensuring that each user receives the proper response.

Load balancers can likewise be designed to ensure that resulting demands from similar client, and part of similar session, are coordinated to an indistinguishable server from the first demand. Called persistency, this capacity meets a necessity for some applications that must look after "state."

Load balancers likewise screen the accessibility, or well being, of use servers to keep away from the likelihood of sending customer solicitations to a server asset that can't react. There are an assortment of components to screen server assets. For instance, the load balancer can construct and issue application-specific requests to each server in its pool. The load balancer then validates the resulting responses to determine whether the server is able to handle incoming traffic. If the load balancer discovers a server that is unable to respond properly, it marks the server as "down" and no longer sends requests to that server.

Dynamic Load Balancing in clouds is a mechanism that conveys the dynamic neighborhood workload uniformly over every one of the nodes in the entire cloud to stay away from a circumstance where a few nodes are vigorously stacked while others are sit still or doing little work. It accomplishes a high client fulfillment and asset use proportion, subsequently enhancing the general execution and asset

utility of the framework. It additionally guarantees that each figuring asset is appropriated productively and decently. It advance counteracts bottlenecks of the framework which may happen because of load awkwardness. When at least one segments of any administration fall flat, stack adjusting helps in continuation of the administration by actualizing reasonable over, i.e. in provisioning and deprovisioning of cases of utilizations without fizzle. It likewise guarantees that each processing asset is appropriated productively and reasonably. Utilization of assets and protection of vitality are not generally a prime center of talk in distributed computing. In any case, asset utilization can be kept to a base with legitimate load adjusting which helps in diminishing expenses as well as making undertakings greener. Versatility which is one of the essential components of distributed computing is likewise empowered by load adjusting. Consequently, enhancing asset utility and the execution of an appropriated framework in such a way will lessen the vitality utilization and carbon impressions to accomplish Green processing. The inspiration of the review of existing burden adjusting systems in distributed computing is to urge the novice specialist to contribute in growing more productive load adjusting calculations. This will profit intrigued scientists to do advance work in this exploration zone..

2.1. EXISTING LOAD BALANCING TECHNIQUES IN CLOUD COMPUTING

Following are some of the load balancing techniques currently prevalent in clouds:

2.1.1. COMPARE AND BALANCE

Y. Zhao et al. [7] drew nearer the issue of intra-cloud stack adjusting among physical has by versatile live movement of virtual machines. A heap adjusting model is outlined and actualized to lessen virtual machines' movement time by shared stockpiling, to adjust stack among servers as indicated by their processor or IO utilization, and so on and to keep virtual machines' zero-downtime all the while. Look at and adjust is an appropriated stack adjusting calculation which was recommended that depends on examining and achieves harmony quick. This calculation guarantees that the movement of VMs is dependably from high-fetched physical hosts to minimal effort have however expect that each physical host has enough memory which is a feeble presumption.

2.1.2. SCHEDULING STRATEGY ON LB OF VM RESOURCES

J.Hu et al. Z Zhang[4] has proposed a planning procedure on load adjusting of VM assets that utilizations verifiable information and current condition of the framework. This methodology accomplishes the best load adjusting and decreased element relocation by utilizing a hereditary calculation. It helps in determining the issue of load awkwardness and high cost of relocation therefore accomplishing better asset usage.

2.1.3. LOAD BALANCING VIRTUAL STORAGE STRATEGY

H. Liu et al. [6] proposed a heap adjusting virtual capacity system (LBVS) that gives a substantial scale net information stockpiling model and Storage as a Service demonstrate in light of Cloud Storage. Capacity virtualization is accomplished utilizing a design that is three-layered and stack adjusting is accomplished utilizing two load adjusting modules. It helps in enhancing the efficiency of simultaneous access by utilizing imitation adjusting further lessening the reaction time and upgrading the limit of calamity recuperation. This technique additionally helps in enhancing the utilization rate of capacity asset, flexibility and heartiness of the framework.

2.1.4 ACTIVE CLUSTERING

M. Randles et al. [8] explored a self-conglomeration stack adjusting method that is a self aggregation calculation to improve work assignments by interfacing comparative administrations utilizing neighborhood re-wiring. The execution of the framework is upgraded with high assets along these lines expanding the throughput by utilizing these assets viably. It is debased with an expansion in framework assorted qualities.

2.1.5. HONEYBEE FORAGING BEHAVIOUR

M. Randles et al. [8] examined a decentralized bumble bee based load adjusting strategy that is a nature-motivated calculation for self-association. This method accomplishes worldwide load adjusting through neighborhood server activities. Execution of the framework is upgraded with expanded framework assorted qualities however throughput is not expanded with an expansion in framework estimate. It is most appropriate for the conditions where the different populace of administration sorts is required.

2.1.6. TWO-PHASE LOAD BALANCING ALGORITHM (OLB + LBMM)

S. - C. Wang et al. [10] has proposed a two-stage planning calculation that joins OLB (Opportunistic Load Balancing) and LBMM (Load Balance Min-Min) booking calculations to use better executing proficiency and keep up load adjusting of the framework.

OLB booking calculation, keeps each hub in working state to accomplish the objective of load adjust and LBMM planning calculation is used to minimize the execution time of every errand on the hub consequently minimizing the general finishing time. This joined approach helps in a proficient use of assets and improves the work effectiveness.

2.2. REQUIRED CHARACTERISTICS OF THE ALGORITHM

A) Performance checks how effective a framework is. It ought to be enhanced at a sensible cost e.g. reaction time ought to be decreased yet keep worthy postponements.

B) Overhead related decides the measure of overhead included while actualizing a heap adjusting calculation. It is made out of overhead because of development of assignments, between processor and between process correspondence. This ought to be minimized so that a heap adjusting system can work effectively.

C) Resource utilization[12] demonstrates the use of assets. It ought to be advanced for a heap adjusting calculation to be effective.

D) Throughput computes the no. of assignments whose execution has been finished. It ought to be high to enhance the execution of the framework.

E) Scalability implies the capacity of a calculation to perform stack adjusting for a framework with any limited number of hubs. This metric ought to be moved forward.

F) Response time is the measure of time taken to react by a specific load adjusting calculation in a conveyed framework. This parameter ought to be minimized.

G) Fault resilience is the capacity of a calculation to perform uniform load adjusting disregarding self-assertive hub or connection disappointment. The heap adjusting ought to be a superb blame tolerant system.

H) Migration time is an ideal opportunity to move the occupations or assets from one hub to other. It ought to be least to improve the execution of the framework.

III. SYSTEM ARCHITECTURE

The framework requires a reasonable stage that should have the cloud environment and for that OpenStacks is utilized. OpenStacks is predominantly used to deliver the omnipresent open source distributed computing stage that will address the issues of open and private cloud suppliers paying little mind to measure, by being easy to actualize and hugely adaptable. OpenStacks controls substantial pools of register, stockpiling, and systems administration assets all through a datacenter, all oversaw through a dashboard. For OpenStack itself to run it needs some opensource stage subsequently Ubuntu 12.04 server Long Term Support (LTS) will be utilized. Fig 3.1 gives an outline of the framework which has been actualized in our school PC lab.

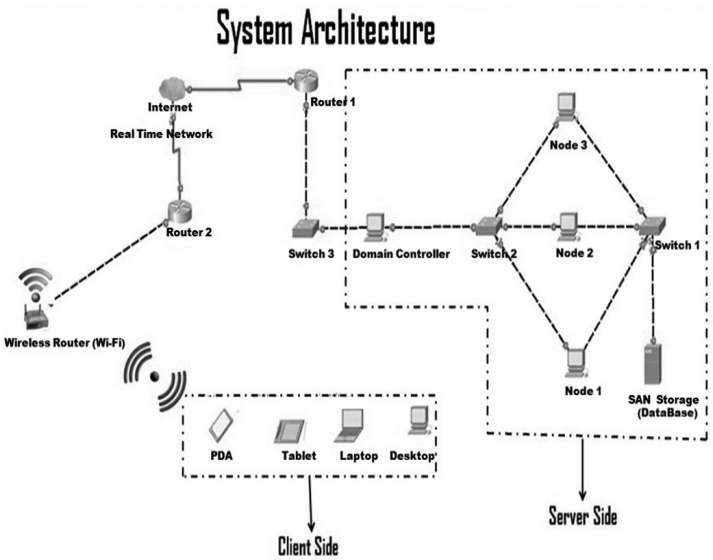

Fig 3.1 Server Side & client side setup

There are by and large four (PCs) each introduced with Ubuntu 12.04 server Operating system.Out of the four PCs there is a different server additionally called as the focal controller.The staying three PCs are the hubs or the servers. The focal controller will control the staying three servers. Every PC ought to have at least 4 GB of slam as each of them will have three hubs – Controller, organize and process.

Fig 3.2 demonstrates the OpenStack design with its three hubs and detailed information of the system and its configuration is given in table 3.1

Every approaching solicitation from the customers will be gotten by the controller PC which will have the dynamic load adjusting calculation running on it. The focal controller is associated with the same number of hubs (servers) here for this situation there are three servers. At the point when a specific demand arrives relying upon the consequence of the calculation that specific server will be doled out by the area controller to prepare the demand.

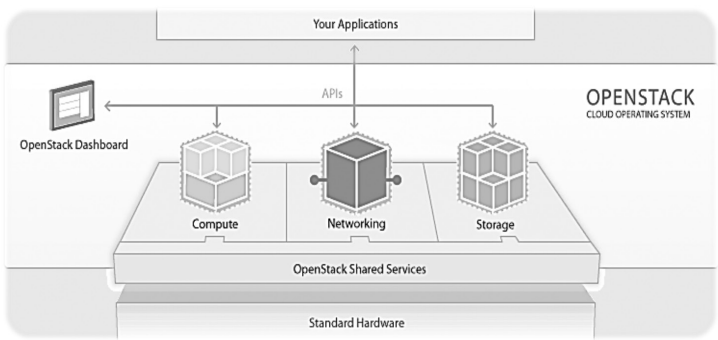

Fig 3.2 OpenStack Architecture

Table 3.1

Hostname	IP address	Underlying support
Server1	10.0.2.87/24	Ubuntu 12.04 LTS
Server2	10.0.2.85/24	Ubuntu 12.04 LTS
Server3	10.0.2.82/24	Ubuntu 12.04 LTS
Server4	10.0.2.83/26	Load Balancer
Cloud OS	10.0.2.84/24	OpenStacks
Cloud Storage	10.0.2.86/24	OwnCloud

Aside from these four PCs there is one more PC that is a distributed storage part and will have OwnCloud introduced in it. OwnCloud gives you general access to your documents through a web interface. It additionally gives a stage to effortlessly see and match up your contacts, timetables and bookmarks over every one of your gadgets and empowers essential altering right on the web. OwnCloud is extendable through a straightforward yet effective API for applications and plugins.The documents and media put away in OwnCloud are available to the three servers specifically by utilizing the web interface. The media components put away in OwnCloud can be gotten to by means of a site that we have facilitated on all the three servers. Customers will visit the site in order to profit the different administrations offered by it.

IV. IMPLEMENTATION

OpenStack is a cloud operating system that controls large pools of compute, storage, and networking resources throughout a datacenter, all managed through a dashboard that gives administrators control while empowering their users to provision resources through a web interface.

Fig 4.1 shows the OpenStack dashboard that we are using after installing Openstack's horizon version.

Fig 4.1 OpenStack dashboard

As shown in the system architecture there is a storage component which has OwnCloud installed. OwnCloud provides quick and easy access to the files and documents stored. Fig 4.2 shows the dashboard that a client gets upon accessing the machine that has OwnCloud installed. The clients can view files and documents that are stored into the storage module. They can also upload/download files, images, songs, videos and documents. OwnCloud provides synchronization, therefore, the files and documents are

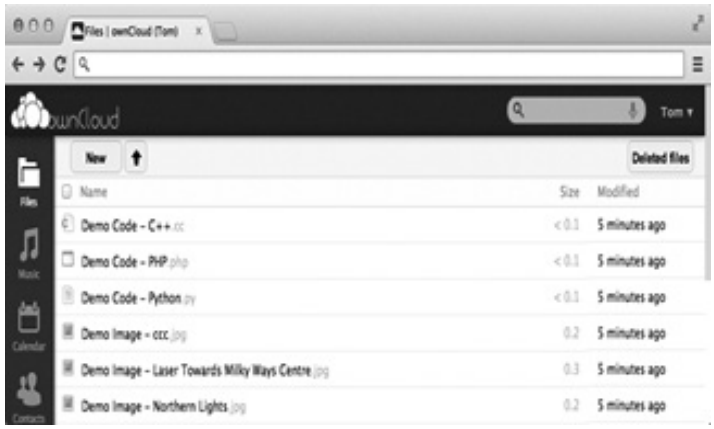

Fig. 4.2 OwnCloud dashboard

updated automatically. There are two services that are offered to the clients. The first one allows clients to check the live traffic status of any place they want. The client can, hence, deduce if the road is congested or whether it will be the best route to take him to his destination faster. A registered client can also get live traffic updates of his location. This service is summarized as smart traffic management system.

Fig 4.3 shows the traffic service that the clients can use. In order to use this service the client has to access one of the nodes IP address. The client request will be redirected to the external server which is actually hosting our website.

Fig 4.3 Smart Traffic Management System

The second service is a music website wherein clients can listen to music, watch videos, download them and get the latest updates of upcoming music events. This website is hosted on all the three servers. A client that wishes to visit the website will have to type the IP address of the node that has the load balancer installed on it. The client may use a laptop, a PDA, a smartphone which are connected to the network via a Wifi router or a PC connected via LAN.

Fig 4.4 CloudMedia

All client requests will have to go through the load balancer which will direct to the appropriate server which has the least load upon it. If a server is down then the load balancer will not forward any incoming requests to that node thus the scheduling decisions are dynamic. This entire process is entirely transparent to the requesting client thereby reducing the overall waiting time. At a time testing has being done with around 27 clients simultaneously trying to access the service. The load balancer could effectively direct these requests to the servers.

Fig 4.5 shows the load statistics at the load balancer.

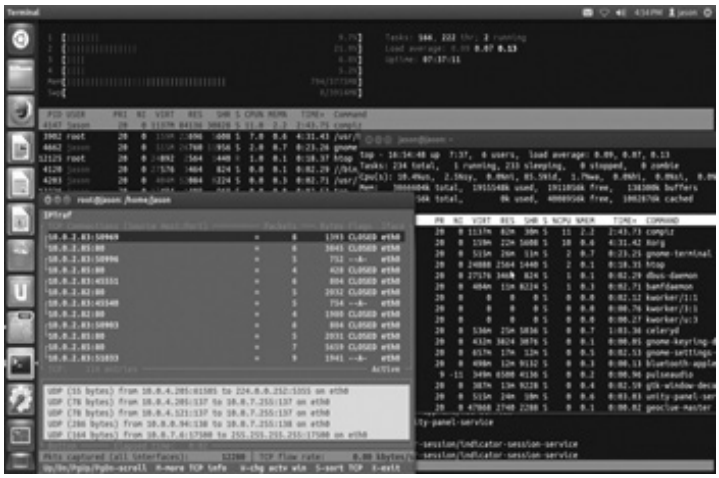

Fig. 4.5 Load balancer statistics

The server4 on which the load balancer was installed receives the incoming 27 client requests simultaneously. The scheduling decisions taken were as follows:

- The first server was assigned 7 requests and the total load on it was only 9.7%, thus, server1 was capable of handling any more client requests directed to it.
- The second server was assigned 15 requests and the total load on it was 21.9%.
- The third server was assigned 4 requests and the total load was 6.0%, thus, server3 was capable of handling any more dynamic requests from the clients.

Server4 needed 794 MB of its total physical memory (3775 MB) to perform load balancing. If, in case, any server goes down then its task of handling the client requests will be assigned to some other server. Thus fault tolerant mechanism was implemented. The load balancer finished executing 166 tasks out of 222 tasks, thus, giving out a high throughput ratio. If, in future, there is a need to setup an extra server to handle the ever increasing load it can be done so and the load balancing algorithm can be updated. The clients, hardly, had to wait for their requests to be processed by the load balancer. Thus, the performance requirement was also met by the algorithm.

V. CONCLUSION

Dynamic load balancing helps with comprehensive failover capabilities in case of server failures, distribution of traffic across multiple servers, and disaster recovery. Cloud Computing is an ever growing concept and load balancing plays a very important role. Cloud Computing has widely been adopted by the industry, though there are many existing issues like Load Balancing, Virtual Machine Migration, Server Consolidation, Energy Management, etc. which have not been fully addressed. Central to these issues is the issue of load balancing, that is required to distribute the excess dynamic local workload evenly to all the nodes in the whole Cloud to achieve a high user satisfaction and resource utilization ratio. It also ensures that every computing resource is distributed efficiently and fairly.

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