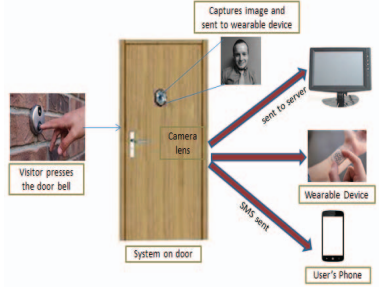
**PiCam: IoT based Wireless Alert System for Deaf and Hard of Hearing**

**Abstrac**t-

Deaf and people with hearing impairment face everyday challenges in identifying the occurrence of household sounds like door bell, child crying or phone ringing. The objective of this paper is to design and implement a low cost stand-alone device for deaf people to notify doorbell ringing who live alone in their house. The system is based on Raspberry pi which includes camera, vibrator, wireless GSM and bluetooth. When the visitor presses the doorbell, captured image is transferred to the wearable device which helps to know the right person at the door or intruder. After transferring image, wearable device vibrates to notify. Also, the message is sent to the owner through GSM. Visitor’s image along with the date and time is sent to the server for retrieving information later. The system is reliable, effective, and easy to use and also enhances the security of the user. Keywords--- Alert System, Raspberry Pi Camera, Server, Bluetooth, Global System for Mobile Communication (GSM), Vibrator, TFT.

1. INTRODUCTION –
2. Hearing loss presents many everyday challenges. Communication may be the biggest challenge of allgetting and giving information, exchanging ideas, sharing feelings-whether in one-to-one contact or in groups. Sometimes there are small disruptions of daily life that result from reduced hearing. For example, how do you know when there is someone at the door? Or the phone is ringing? Or the baby is crying? With the present set of concept of hearing disability, the Census of India, 2001 counted 1,261,722 people in whom hearing disability existed (Males 53.4% and Females 46.59%) [1].Many devices and systems are available to help deaf and hard of hearing people improve communication, adapt to their environment, and function in society more effectively. Alert systems, or simply signalers, are designed to help notify different events, such as the phone ringing, the doorbell, a baby's cry, motion, weather alerts, or smoke alarms. It usually happensthat the deaf people are unaware of the visitor to the home and also the old age people have difficulties in walking or moving to go and see who is at the door. So it would be of great help for those people if they have alert about the visitor to home and can know who is at the door?. This paper describes the study of various systems and technologies available for deaf and old age people. The proposed system here is designed to alert the hearing impaired and old age people about the visitor. The system consists of two modules- a transmitter and a receiver. The transmitter is the device installed at the door. The transmitter consists of Raspberry Pi, RPi camera, switch or doorbell, GSM, and Bluetooth. The receiver is the wearable device which includes Raspberry Pi, Bluetooth, LCD or screen to display the image and message and vibrator to alert. Visitor’s image along with date and time will be sent to the server for retrieving information later. The major advantage of the system is that it reduces the visitor’s waiting time and can also help in the security of the deaf/elderly. The paper is structured as follows. In section II the review of various papers or systems and technologies is done that are especially for deaf and elderly. In section III proposed work is described. In section IV describes the system implementation in detail and interfacing of hardware components is shown. Finally, the results, conclusion and future work discussed. II.
3. LITERATURE REVIEW-
4. A robot using dog–inspired visual communicational signals to communicate intention is designed by K. L. Koay et al.[2]. Robot was able to lead participants to the microwave door and front door sound source. Head movements and gaze directions were important for communicating the robot’s intention using visual communication signals. Gopinath Shanmuga Sundaram[3] attempted to build a low cost standalone device which transmits data using the Raspberry Pi with Bluetooth and has a resistive touch screen display providing a user interface. Error handling techniques were used to catch the exceptions and were able to retransmit till the acknowledgement was received. Chao-Huang Wei and Shin-An Chen[4] employed a novel power line communication chip to develop a networked digital video door phone system to replace the conventional ones. Door Phone is used to identify visitor or for simple voice interlocution. They transfer audio visual information and enhance the entrance guarding functions additionally. Mahdi Safaa A. et al.[5]designed the handheld device for obstacle detection using ultrasonic sensor and generate voice alert for blind and vibration alert for deaf person by keeping his finger on the button at the top of the device. The device is suitable and easy for blind & deaf with 40-150cm range and can be used in three dimensions. Huiping Huang, et al.[6] presented a solution for establishing a low power consumption remote home security alarm system developed by applying WSN and GSM technology is presented. It can detect the theft, leaking of raw gas and fire, and send alarm message remotely. The advantages of system is reliability, easy usage, complement wireless, low power consumption and the system also has practical value in other fields. The design and implementation of a low cost, low power consumption, and GSM/GPRS based wireless home security system is presented by Yanbo Zhao and Zhaohui Ye[7].The system include three kinds of wireless security sensor nodes that are door security nodes, infrared security nodes and fire alarm nodes with easy installing nodes. It has a friendly user interface including a LCD and a capacitive sensor keyboard. Jayashri Bangali1 and Arvind Shaligram[8] suggest two methods for home security system. The first system uses web camera. Whenever there is a motion in front of the camera, it gives security alert in terms of sound and a mail is delivered to the owner. The second method sends SMS which uses GSMGPS Module (sim548c) and Atmega644p microcontroller, sensors, relays and buzzers. The web camera based security system is very easy, user friendly and software has many features. Chun-Liang Hsu et al.[9]developed DIY home-security so as to cost down the expenditure as well as to improve the mechanism of traditional ones with brand-new techniques co-constructed with phone-net, speech-function, and Bluetooth modules that was not only easy to accomplish the security work of people’s houses, but also save much money .It is easily used for intelligent system such as digitalhouse in the future. Ming Xu et al.[16] developed a WSN system to construct smart home systems. A monitoring system is built by taking advantage of the GPRS network and Zigbee technology to support multi-hop communications
5. III. PROPOSED WORK-
6. This paper proposes a low cost, reliable and efficient system to alert the deaf or hearing impaired person consisting of two modules- a transmitter installed at the door and another is the receiver, a wearable device.When the visitor presses the doorbell, RPi Camera captures the image and transfers it to the wearable device through bluetooth. After sending the image, the GSM Modem sends a message that there is a visitor at the door to the owner. The database is also created which is sent to the server.Figure1 shows the architectural diagram of the system. When the image is received on the wearable device through bluetooth, the vibrator vibrates to alert that there is a visitor at the door. The image of the visitor is displayed on the device along with a message on the LCD/ Screen. The image along with the date and time is sent to the server for later retrieval. The system basically consists of:
7. A. Raspberry Pi Board Model B -
8. The Raspberry Pi[10] is a credit card-sized singleboard computer developed in the UK by the Raspberry Pi Foundation. The Raspberry Pi has a Broadcom BCM2835 system on a chip (SOC), which includes an ARM1176JZF-S 700 MHz processor, Video Core IV GPU, and was originally shipped with 256 megabytes of RAM, later upgraded (Model B & Model B+) to 512 mb.



B. Bluetooth HC-05 40 HC-05

module [11] is an easy to use Bluetooth SPP (Serial Port Protocol) module, designed for transparent wireless serial connection setup. Serial port Bluetooth module is fully qualified Bluetooth V2.0+EDR (Enhanced Data Rate) 3Mbps Modulation with complete 2.4GHz radio transceiver and baseband. It uses CSR Blue core 04-External single chip Bluetooth system with CMOS technology and with AFH (Adaptive Frequency Hopping Feature). It has the footprint as small as 12.7mmx27mm. Hope it will simplify your overall design/development cycle.

C. SIMCOM SIM 900A

GSM Module GSM/GPRS[12] Modem-RS232 is built with Dual Band GSM/GPRS engine- SIM900A, works on frequencies 900/ 1800MHz. The Modem is coming with RS232 interface, which allows you connect PC as well as microcontroller with RS232 Chip (MAX232). The baud rate is configurable from 9600- 115200 through AT command. The GSM/GPRS Modem is having internal TCP/IP stack to enable you to connect with internet via GPRS. It is suitable for SMS, Voice as well as DATA transfer application in M2M interface. The on board Regulated Power supply allows you to connect wide range unregulated power supply. Using this modem, you can make audio calls, SMS, Read SMS; attend the incoming calls and internet etc. through simple AT commands.

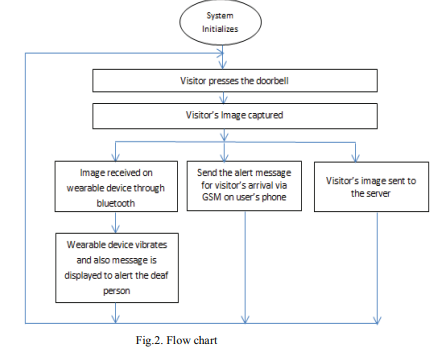
D. LCD (16 X 2) 5X8 dots with cursor 16 characters\* 2 lines display[13] 4-bit or 8-bit MPU interfaces Built-in controller (ST7066 or equivalent) Display mode and backlight variations ROHS compliant E. RPi Camera Module The Raspberry Pi Camera [14] Board features a 5MP (2592×1944 pixels) Omnivision 5647 sensor in a fixed focus module. The module attaches to Raspberry Pi, by way of a 15 Pin Ribbon Cable, to the dedicated 15-pin MIPI Camera Serial Interface (CSI), which was designed especially for interfacing to cameras. The CSI bus is capable of extremely high data rates, and it exclusively carries pixel data to the BCM2835 processor.

F. Vibration Motor

The Precision Micro drives 304-002 Pico Vibe 4mm vibrating motors[15] is based on a coreless motor design, with precious metal commutation circuitry and a toroidal neodymium magnet. Rated at 3V nominal, they are designed for alerting functions in handheld applications powered by either dual cell alkaline primary / nickel based rechargeable batteries, or single cell lithium primary / lithium rechargeable batteries.

IV. IMPLEMENTATION

The Raspberry Pi board is used to implement the system. Raspbian OS image is burnt in 8GB SD card to boot RPi. Figure2 describes the flow of data.The operating system wheezy Raspbian image is downloaded from the website raspberry.org/downloads. Fig.2. Flow chart Now, writing the image to the SD card as following Insert the SD card into SD card slot of PC/laptop. Extract the executable from the zip file of downloaded image win32diskimager and run the win32diskimager utility. Select the image file extracted above. Select the drive letter of SD card in the device box. Be careful to select drive. Click on write and wait for write to complete. Exit the imager and eject the SD card. Raspberry Pi is connected with the display via HDMI and for input, connected with the keyboard and mouse. Figure 3 and 4 shows the interfacing of the components on the door system and wearable device respectively.



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