Implementation of an Intelligent Door Bell System Using Internet of Things

P. Ratna Kamala[1], P. Pavan Kumar[2] and A. Anish[3]
[1]Professor, [2]Assistant Professor, [3]UG Student,
[1,2&3]Department of Electronics and Communication Engineering, SIETK, Puttur, Andhra Pradesh, India
E-Mail: ratnapkamala@gmail.com, pavan.android961@gmail.com, amanishmadhu@gmail.com

Abstract - **Security has become the most important issue in this modernised world. Especially in cases where nobody is available at home, residences dwelled with old age people and the residences of working citizens needs security as the residents and things within the home has become a severe issue of concern as many intruders are concentrating on these type of residences for easy way of earning. To eradicate such activities by the intruders to certain extent, several strategies and systems were developed and been into market. Most of the proposed smart home systems try to bring solutions for security problem, at the cost of usage of numerous sensor devices. Also threats to these security solutions are also increasing as technology is developing. Internet of Things (IoT), a giant network of connected devices is the latest technology being used everywhere. With the increasing threats to security issues, it is necessary to use such new technologies to achieve the same with increased security. This paper presents a real time Image based intelligent door system for home security that uses a pi camera. This is an efficient approach in providing security and thereby a reliable embedded system device developed utilising the technology to meet the complex and challenging tasks. If a person clicks the door bell, picture of the person is captured and the image is sent to the owner through SMS and e-mail. Owner of the house can respond by opening the door if he is available in the house. If he is out of the house, a message is sent back to the person in the form of an audible voice and is made audible through a speaker. Proposed system offers several advantages in providing safety and security in terms of visualization and identification of people who visits the home.**
Keywords: **Security, Internet of Things, Raspberry Pi-3, Pi-Camera, Wi-Fi Technology, Embedded Systems**

I. INTRODUCTION

Internet of Things (IOT) is the network of "things" which are connected to a common network path in order to communicate, exchange data or control each other. Network path can be interconnected with the "things" that may be embedded software, hardware or any sensor. It refers to the state where the things will have more data and information associated with them and has an ability to communicate, produce new information and become integral part of the free world wide web. It not only features internet connectivity but also features cloud and data management, security management and all other fields concerned with the era of internet. Over the world, IOT and M2M (Machine to Machine Interpersonal Communication) technologies developed for smart home system has become much popular these days. With increasing safety and security issues, the use of smart door system increased consistently with the advent of security related electronics, such as digital door locks, advanced video conversation devices, and wireless home security networks, etc. Many smart systems are proposed to provide safety and security at homes and offices.

In the proposed system, to provide home security two different techniques are implemented. One is to use image technology to see the front door in real time even if none is available at home and another is to provide communication between the door system and smart phone device. By connecting the smart door system with the mobile phone through the cellular network, the owner of the house have several opportunities such as controlling the house, getting instant images, receiving and sending message for alerting the owner. Supported mobile communication and safety powered multifunctional smart door system has aided in achieving intense Security.

This system will allow visual communication between visitors and owners of the house. Features such as video camera system, instant message notification, SMS / MMS notification and dual audio / single sided process are provided with video phone. In addition, cloud storage of image data with a high resolution will be provided using this system.

II. METHODOLOGY

This system comprises of two stages: 1. Smart system using phone management and 2. Foreign individual identification i.e., detection of person/ people. It is an intelligent door system with camera-based identification. Main facilities available in this project are:

1. It provides Administration Level-Owner management.
2. It sends details of every person which come in front of door via notification.
3. This system is very useful for handicapped and physically disabled persons.
4. Image capturing.
5. If human rings the bell, then only system is activated.
6. If owner is not there, then image and info will be forwarded to owner's number.

The Block diagram of the proposed system is shown in Fig. 1.
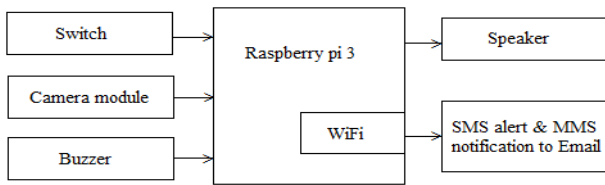
Host side

Recipient side

Fig. 1 Block diagram of proposed smart door bell

The proposed smart door system shown in Fig. 1 provides security, early warning and communication to the residents and thereby preventing potential security problems. This system developed with new features will distinguish itself from existing systems.

Fig. 2 shows the flow chart of proposed project. Interfacing Raspberry pi to switch, pi-camera, speaker &Buzzer is done and when calling Bell is pressed series of actions will be performed to detect the person or visitor before the doorsteps. The system is idle until the button is pressed. If button is pressed then pi-camera captures the image of the visitor and alerts the owner by sending SMS alert along with the image of the visitor through email. After sending SMS &e-mail alerts the system and waits for the owner's reply. After receiving the reply from owner through e-mail in the form of text, the raspberry pi converts that text into speech and gives an audio output through speaker.

Fig. 2 Flow chart of proposed system

III. TECHNICAL DETAILS

Hardware for the proposed system includes: Raspberry pi, Camera module, Speakers and Buzzer. In the proposed system Raspberry pi 3 is used. Fig.3 shows the picture of Raspberry pi and Fig.4 shows the Pi-Camera Module. It's a very small PCB on which exists an Omni vision OV5647 camera module. It connects to raspberry Pi using a 15cm 15 way ribbon connector.

Fig. 3 Raspberry Pi 3,   Fig. 4 Raspberry Pi camera Module

The camera module connects to the Raspberry Pi board via the CSI connector designed specifically for interfacing to cameras. The CSI bus is capable of extremely high data rates, and it exclusively carries pixel data to the BCM2837 processor. For input and connectivity other devices were used besides Raspberry. Speakers were used to convey message to the visitor. The message sent by owner to the raspberry pi system through email is converted into voice by text-to-speech mechanism. An electric buzzer is a loudspeaker that uses the piezoelectric effect for generating sound. Interfacing of speakers with raspberry pi is shown in Fig.5.The buzzer module used in this system is shown in Fig. 6.

Fig. 5 Raspberry Pi interfacing with speakers, Fig. 6 Buzzer Module

IV. RESULTS AND DISCUSSION

The final prototype of the proposed system is shown in Fig.7.Once the visitor presses the button as shown in Fig.8, raspberry pi gets activated and alerts the owner. At first, it says "Please wait for the reply from owner" from the speakers connected to it. This is shown in Fig.9. Then it sends the SMS alert and image of the visitor to owner's e-mail by using picamera module as shown in Fig.10 &Fig.11.

Fig. 7 Prototype for proposed system

Fig. 10 SMS alert sent to the owner

Fig. 8 Visitor pressing the Door bell
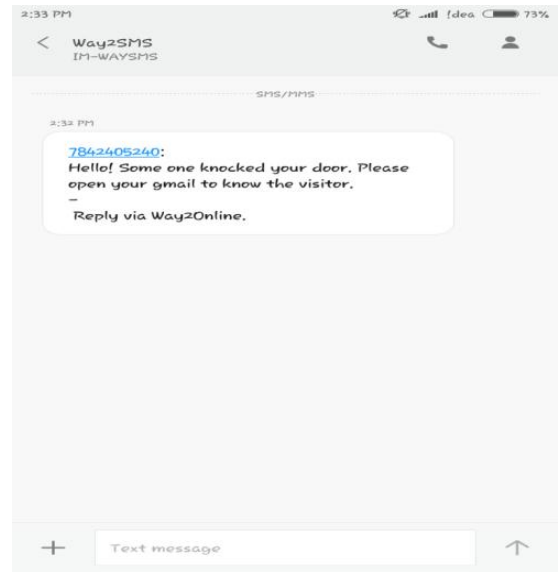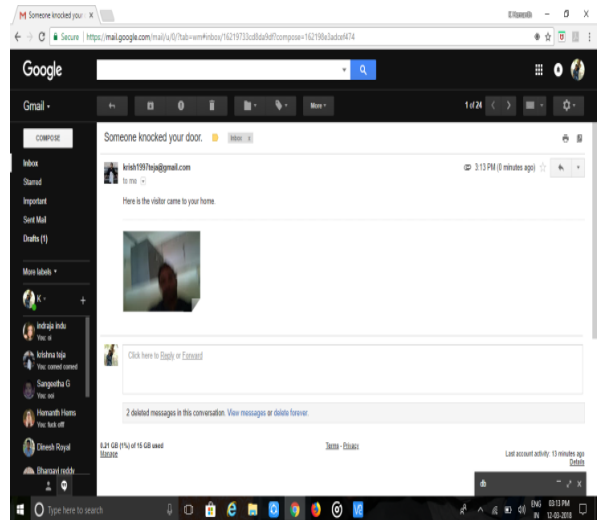

Fig. 11 Image of the visitor sent to owner through e-mail

Once the owner receives the e-mail and is aware of the visitor, he can give reply as shown in Fig.12.

Fig. 9 Speaker's output once the visitor rings the bell
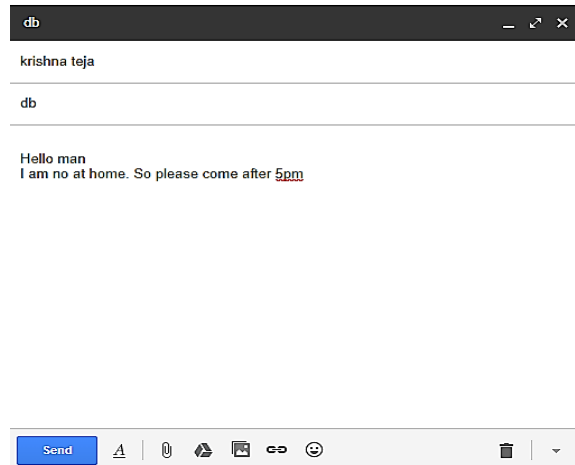

Fig. 12 Owner's reply to the visitor

Whatever the message is typed, it gets converted into speech by Raspberry pi and is made audible to the visitor through the speakers connected to raspberry pi.

V. CONCLUSION

This paper gives basic idea of how to remotely monitor the house and protect it from threats by intruders. It will work when the bell rings at the door and this will act as a trigger to the camera and the camera will capture the image of the person standing in front of the door. The image of the visitor will be shown to the registered user who is away from home through e-mail and sms alert to check the mail is sent to phone. Then identification of the person is done and through e-mail he can reply back to the person standing in front of the door. The experimental results indicate that the proposed system may provide a consistent support and assistance for safe and secure life.

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