

Smart Electronic Home Security System

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Abstract—In this paper we propose a combined system with two different modules that will together act as a video doorbell or a video doorphone, a surveillance system and an intruder alert system. This system will overcome the shortcomings of traditional video door phones by giving remote access and adding a surveillance system and proximity trigger.

The proposed system also contains an intruder alert system which works in conjunction with the video doorbell to create a two layered home security system. An android based application design is suggested for controlling the system, viewing the feed from video doorbell and receiving notifications from both the devices.

This paper aims at proposing a foolproof home security system with intruder alert and surveillance features using minimum resources and creating a product with minimum price.

Index Terms— video door phone system, home security, intruder alert, android notifications.

I. INTRODUCTION

In past few years with development of embedded electronics and advances in networking has been a boost to development in Home automation systems. The concept of Home Automation was a topic of interest in the Academic arena since the late 1970s, with time and advancement of technology people's expectations about Home Automation and how they should access their home has dramatically changed. The affordability and popularity of electronic devices and internet were contributing factors to this change [1-8]. Wireless control or remote control is gaining popularity due to its remote access features. In recent times, home automation efforts are being exercised intensively as to setup standards for building efficient smart homes suited to custom and regional requirements. Remote control of appliances is an important aspect to be considered for implementing home automation and home security systems [4].

Internet of things (IoT) has revolutionized the concept of Home automation and Security. The emergence of smart devices has boosted the concept of connecting everyday objects via the existing networks. The drastic increase of connected devices has outreached the boundaries of the conventional networks, resulting the renaissance of the web as

the third wave "Internet of Things (IoT)". IoT is rapidly growing network of heterogeneous devices and objects, which are uniquely addressable within the network and capable of identifying and sharing information with or without human interaction [9-14]. The development of web based embedded devices has enabled the controlling of various devices and

Most of the times home security is considered to be an integral part of Home automation systems. Proposed system contains two of such home security modules in a combined system

II. RELATED WORK

Home security systems work on the simple concept of securing entry points into a home with sensors that communicate with a control panel or command center installed in a convenient location somewhere in the home. The sensors are typically placed in doors that lead to and from a house as well as easily accessible windows, particularly any that open, especially those at ground level. Open spaces inside of homes can be secured with motion sensors. Security systems are designed to perform certain tasks when a secured zone is breached

The Home security systems should not only consist of alarms and monitoring system but also a proper locking mechanism at the entry points. Traditional door locks are not very safe and safety failure occurs in case of key compromise. Electronic door lock solutions can be suggested in that case. Fingerprint or RFID scan can be introduced with the electromagnetic door lock. Video doorbell can be implemented for visitor interaction and offline surveillances. A typical home security system includes: A control panel, which is the primary controller of a home's security system, Door and window sensors, Motion sensors, both interior and exterior Wired or wireless security cameras and a high-decibel siren or alarm.

Home automation and security can be implemented in various combinations of embedded systems and networking. Local devices involved in home automation and security use different protocols like WiFi and Zigbee networking with high encryption standards and anti-collision provisions. Advances in Internet have opened up the option of controlling devices from the internet which enables user to control and manage the home appliances and security systems at remote places

with internet connectivity[15-19].A typical Home security system must contain camera monitoring system, smart electronic door locks with at least two step verification systems, intruder alert and alarm system with control panel to control the home security modules.

III. OVERVIEW OF THE PROPOSED SYSTEM

- The system is divided in to two sub units-
1. Video Doorbell and Surveillance System
 2. Intruder AlertSystem

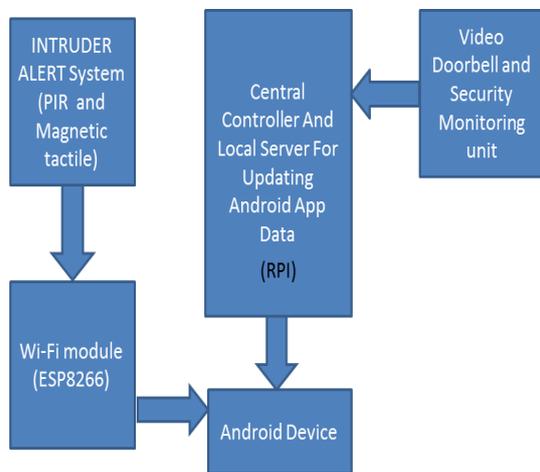


Fig.1. Block diagram of the complete system

1. Video Doorbell and Surveillance System –

This unit proposes a video doorbell with one way video feed and two way audio feed. When the doorbell button is pressed along with the bell user will also get a video feed call from the bell on his android device and also a notification message of the same. Raspberry pi 3 and pi camera will be used for this. When put in lockdown mode the video doorbell will act as surveillance system and intruder alert by using a PIR sensor to detect any motion outside the door over 180 degree angle and 10 feet radius. On detecting any motion in surveillance mode the doorbell will snap a picture of the moving object/person and save it on the server; it will also send a notification to the user’s mobile phone on our android app[20-23]. Now the user may check the picture saved on the server whenever he likes or stream the live feed from video doorbell. User can also manually enable or disable alarm from his phone.

2. Intruder AlertSystem-

The second proposed unit, a subsystem is the intruder alert system. The intruder alert is set only in lockdown mode, and when set the tactile magnetic sensors and PIR sensors are activated for input using an AVR microcontroller. With any movement in the PIR sensing region or breaking of windows or door locks, sensed by magnetic tactile sensors the microcontroller sets the alarm which has an audible range radius of 50 feet[24-29]. The intruder alert unit also contains a Wi-Fi module which is used to communicate with the android app on the users mobile. The AVR controller communicates with the user’s android device via the Wi-Fi module which acts as the bridge. Due to possible two way communication the user can remotely check the status of the system and receive notifications from the system. The user can also set-reset the intruder system using the android app as well as control the alarm status in case of emergency situations.

IV. MODULAR DIVISION OF THE SYSTEM

- We will be dividing the system into 6 modules –
- Module1– CameraModule interfacing to the Raspberry pi
 - Module2– PIR and tactile sensor interface to AVR
 - Module3– ESP 8266 Wi-Fi module interfacing to AVR
 - Module4– Alarm triggering using TRIAC and optocoupler
 - Module5– Android Application development
 - Module6–Acrylic External design and development

1. CameraModule interfacing to the Raspberry pi

The Raspberry Pi 3 is the third generation Raspberry Pi which replaced the Raspberry Pi 2 Model. It is one of the smallest Computers. We are going to use it to process the video feed from the Pi camera. A 5 Mega Pixel Pi cam is chosen for recording the video feed in the video doorbell. Raspberry Pi 3 also acts as a central server for the android app. A PIR sensor is also interfaced with the Raspberry Pi which detects movement and enables Raspberry Pi to snap a picture from camera and save in to the onboard memory card.

2. PIR and tactile sensor interface to AVR

PIR and magnetic tactile sensor are used to detect intruder in lockdown condition mode. PIR gives an interrupt on detecting presence of human body movement and magnetic sensors when fit on door and windows can detect if the window is closed or open. Atmega16 microcontroller from the AVR microcontroller family is used to receive the input from PIR and magnetic tactile sensors.

3. ESP 8266 Wi-Fi module interfacing to AVR

ESP8266 smartwifi module is used to communicate to the raspberry pi over the network. ESP8266 is configured by

Atmega16 microcontroller by communicating serially using USART and configuration using AT commands. ESP 8266 is configured to open a Socket (on a specific IP and Port) on which the user latches via the router for communicating with the system.

4. Alarm triggering using TRIAC and optocoupler

The AC alarm is triggered by using BT136 TRIAC IC; the Gate is activated using an optocoupler MOC3021 which isolates the AC and DC switching. MOC3021 is switched by ATmega16 microcontroller. A GPIO pin configured as output on Atmega16 which switches the LED in optocoupler MOC3021 which in turn triggers the Gate of TRIAC BT136 which switches the alarm.

5. Android Application development

The android application is to be designed and programmed using QT creator and PyGame IDE. The basic User interface should contain 3 buttons - Live video stream, lockdown and alarm on/off. Clicking on the Live video stream will stream the video from Pi camera directly to the phone. Lockdown button when on will put the intruder alert system on. Alarm button will be used to on/off the alarm[30-32].

The android application also gives notifications on any intruder alert or when the doorbell is rang as notified by the doorbell system or intruder alert system while in the lock down mode. The user is also free to stream the live stream whenever wished.



6. Acrylic External design and development

The external body design is done using CAD software called CORAL DESIGN. The 3D design is later printed using a 3D printer or is to be cut piece by piece using acrylic sheet cutter. In initial state the material chosen is acrylic but while mass production it can be switched to IP65 HPS plastic material[33-36].

V. SOFTWARE FLOW OF THE SYSTEM

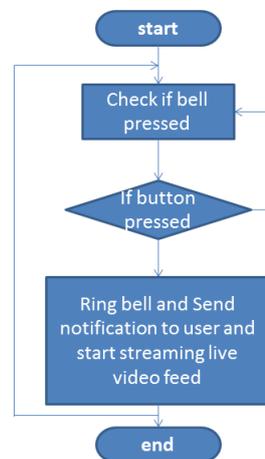


Fig. 2.

1. Video Doorbell:

The python script running on the Raspberry Pi3 runs in a continuous software loop. It will keep checking for the interrupt from the doorbell button and on the button state is pressed the Raspberry Pi3 will start streaming the video feed live from the Pi camera on a specific IP and opened port thus creating a socket. User may access the video feed from the socket.

Fig. 3. Flow of Video doorbell

2. Intruder Alert System

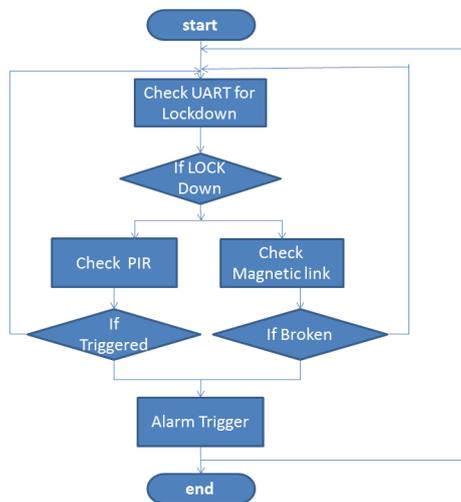


Fig. 4. Flow of Intruder alert system

The Control board with Atmega16 microcontroller keeps on checking for PIR and magnetic tactile triggering in lockdown mode and enables the alarm in case of triggered input from the sensors. When there is no lockdown mode it keeps on checking for the signal of alarm on/off and lockdown. The control board communicates with the raspberry pi and user's android device using Esp8266 module to convey the notifications

VI. CONCLUSION

This paper presents a highly secure home security system in which user has full control over the system functions and feedback from the system with remote accessibility is obtained. Many of the shortcomings of traditional electronic home security systems are overcome by this design.

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