IOT Based Home Security System Using Raspberry Pi

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ABSTRACT: In today's rapidly moving world where almost everything is driven by technology, it has become the central and essential part of living. With increasing rate of crime, protecting our loved ones and our belongings has become important. Such situations can be solved by exploiting the latest functionalities that current technology has to offer i.e. IOT which provides seamless data communication, remote control ability makes it easier to automate the process of security. Automation of security can be achieved by designing an application on Raspberry Pi through various sensors such as motion sensor -PIR (Passive Infrared) sensors for detection of any intruder in the house, upon detection an alarm is raised and the owner of the house and law enforcements are notified.

KEYWORDS: Intrusion Detection; Motion Sensor; Alarm; Notification.

I. INTRODUCTION

IOT is a domain of technology which stands for internet of things that is used for connecting growing number of devices such as Internet TV's, smart phones and sensors to the internet.
It has become an essential factor when it comes to providing seamless communication and exchanging of data with connected devices. IOT provides means to control these factors from any remote location in the world.
Here IOT is used for communicating various sensors to the controller where the controller checks the status of sensors and takes it as an input for further processing. It is as well as used for remote monitoring of homes from anywhere in the globe or without an indoor presence.

There are various existing systems that are used for Security purposes such as Bluetooth-based systems, Microcontrollers, Arduino boards etc. But they have some disadvantages like limited range, limited accessibility etc.
One of the problem that we constantly face is the threat dangling above our heads, i.e. do our loved ones are safe at home or not, do our belonging are safe or not. Living a secure and peaceful life has become everyone's fundamental goal. Technology has become most essential and dependent factor in every human's life.
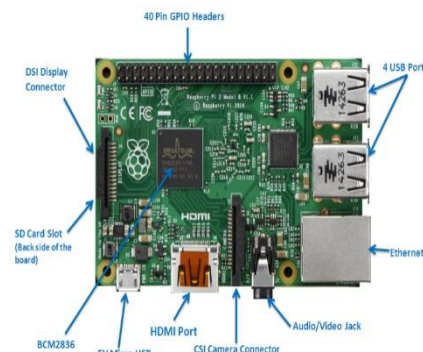
Fig .1. Raspberry PI

Automation can be achieved by designing an application on Raspberry Pi through various sensors for purpose of automated intrusion detection system to provide security.

Raspberry PI is a single board computer that supports multiple functionalities such as home automation, security etc. It is an embedded controller that controls the operations of sensors and other various devices connected to it. It connects all the devices through GPIO pins and is known as heart of the entire system.

II. **RELATED WORKS**

In [1] the author has come up with the technology for home automation and security by using a Bluetooth based system. The home appliances that are to be controlled are connected to the input/output ports of the Arduino BT board via relays. Passwords are provided for the purpose of protection so that only the authorized users can access the home appliances. The python script is used for programming purpose as it is portable and can run on any platform. A feedback circuit is used to indicate the status of the home appliances after receiving a command from the phone. The disadvantages includes: Less Range (<50) for controlling Devices, Pairing Process, and Requires Human Involvement for control. No Remote Control or Monitoring.

In [2] the author's implements home automation system using Arduino board that comes along with various sensors such as PIR motion sensor etc. and uses a GSM technology. The status of all the devices connected is sensed by the Arduino board for further processing. This system ensures home automation and security. Arduino board is an advanced version of microcontroller. It has various disadvantages similar to microcontrollers:Less Friendly Environment for development, Less Flexible,Maintenance Overhead.

In [3] the author's has proposed a home automation system using Arduino board based on IOT domain. This particular system uses an internet protocol-based communication. This system makes use of three operating modes: manual mode, automated mode and security mode. The manual mode is based on web supporting device, automated mode is based on sensor reading and security mode is based on safety. The simple execution is provided by Arduino microcontrollers that are used in this project as compared to other controllers. This particular prototype also uses Wi-Fi routers. The shortcomings are: Less Friendly Environment for development, Less Flexible,Maintenance Overhead.

In [4] the author presents the implementation of WiFi based home automation system. WiFi technology is used for connecting various parts of the infrastructure. The proposed system includes a server where the status of each connected device is updated anytime it changes so that the user or system administrator can remotely control as well as monitor the system. It also includes hardware interface modules for connecting various sensors and actuators. This system provides power management and security. The disadvantages are: since WiFi usage involves a range, it is not possible for remote monitoring. It is not much reliable since the WiFi may go down at any point of time.

In [5]the author has designed a PIC microcontroller using ZigBee technology. The home appliances are controlled by using two technologies namely GSM network technology and speech recognition. In case smoke is detected in the house the SMS is sent to the mobile by using a GSM modem which is connected to the PIC controller. The ZigBee and GSM technologies are used for wireless communication among various modules. The microcontroller senses the

signals generated at its pins based on the command received by ZigBee modules. This system is useful in case of fire accidents. It has disadvantages such as: use of Microcontroller – Requires Burning of Code for every Changes, Interface Problems, Maintenance overheads, Low processing power, Less Flexible due to complex architecture.

III. PROPOSED SYSTEM

The Proposed implementation overcomes the disadvantages of the existing system by:
a. Eliminating the overhead associated with the traditional controller such as burning the code to the microcontroller every time an update is made to the system.
b. Also reducing the down time associated with the system when it is under repair or maintenance.
c. Raspberry PI has no interface problem whatsoever like the one we can find in traditional system such as Arduino based controller.
d. Since Raspberry PI is a full-fledged computer it provides room for more improvement in near future because of its compatibility with the latest technology at both at the software and hardware end.

Since security is of prime importance and given the fact that Raspberry PI is the controller used in this proposed system, Firewalls and other security measure can be implemented to avoid the potential hackers or intruders from tampering in to the system.
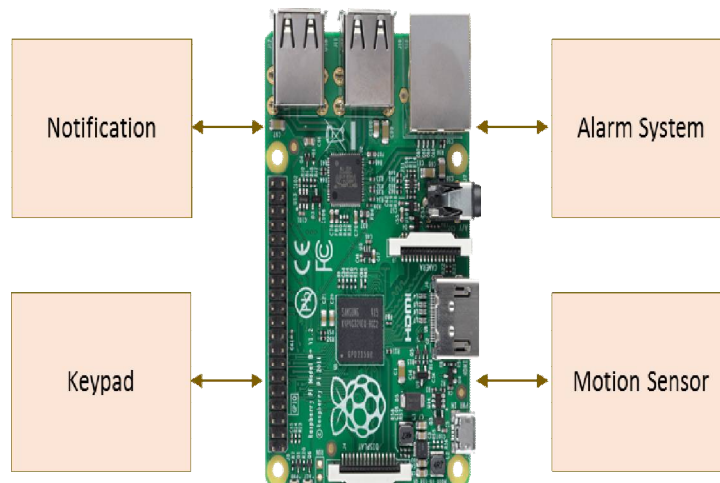
A. Design and Architecture:

Fig. 2. Architecture Diagram

Components associated with Home Security (Such as Passive Infrared Sensor –PIR and piezo buzzer etc.) are connected to the R-PI as depicted in the figure above.
The Motion sensor i.e. PIR sensor which stands for Passive Infrared Sensor is used to detect the presence of intruder in the home.
Piezo Buzzer is used to raise an alarm when the presence of an intruder is detected in the house with the help of PIR Motion sensor.
Keypad is used to arm or disarm the security of the system with the help of unique passcode for both of them respectively.
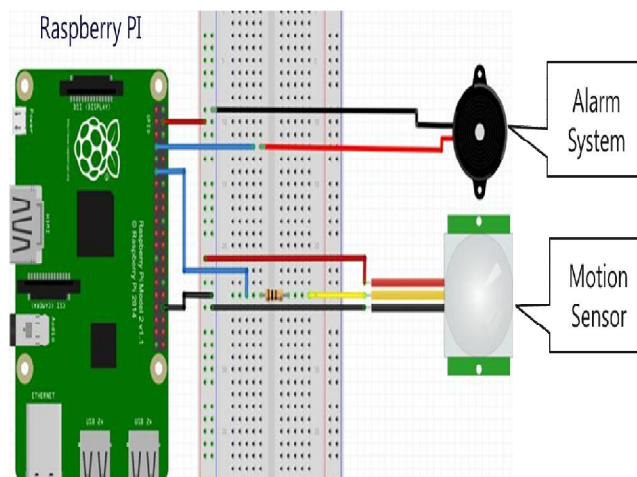
Fig .3. GPIO Configuration

The above figure shows the sensors and devices (PIR, Piezo Buzzer) is connected to the R-PI's GPIO PINS.

IV. IMPLEMENTATION

The System contains various modules such as intrusion detection, motion detection and alarm are discussed in detail below:

1. Intrusion Detection:
Humans emit heat in form of radiation which is not visible to the naked eye, even though they can't be seen it can be detected. Passive Infrared Sensor detects this radiation to detect the presence of any human being. Therefore PIR sensor is utilized to detect the presence of intruder in the house.

2. Alarm:
As soon as the presence of any human is detected via PIR Motion Sensor and the current time is verified i.e. if the current time is past 11:00 PM, then the alarm is raised.

3. Notification:
Once the alarm is raised a 30 seconds time frame is allotted to turn off the alarm, if the disable code is entered and if it matches the right disabled code fetched from the database within the time frame(30 secs) then the alarm is turned off else the Owner and Law Enforcements are notified.
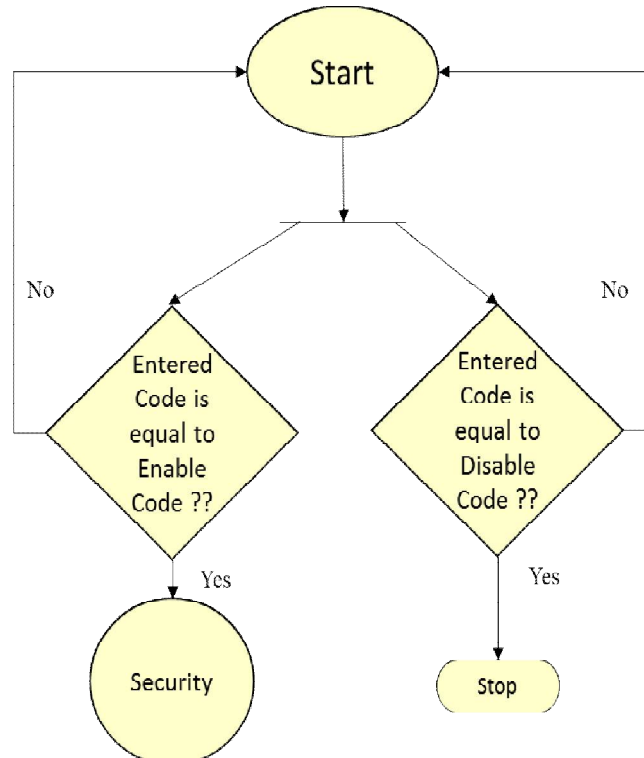
A. System Flow Diagram:

Fig.4.Enabling/Disabling Security

The above figure shows the flow of control about enabling and disabling of the automated security.The System Starts by checking if the entered code is enable or disable code.If the entered code is enable code then flow passes on to the security process, however if the entered code is disable code then the security process is stopped.
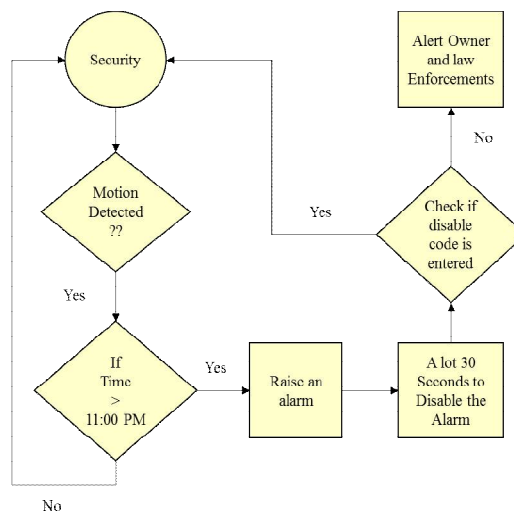

Fig.5.Security Process

B. Security:

The above figure shows automated security.
The working of automated security is discussed below:

STEPS:
1. The system checks in a loop if the motion sensor is triggered indicating a presence of intruder in home.
2. If presence of any human is not detected then the flow goes back to step 1.
3. If presence of any human is detected then the system verifies if the current time is 11:00 PM or above, if so the alarm is raised, else the flow goes back to step 1 for sensing the presence of human again.

If the alarm is raised, then 30 seconds time frame is allotted to disable the alarm using the keypad matrix, failing to do so will result in owner and law enforcement being notified using email.
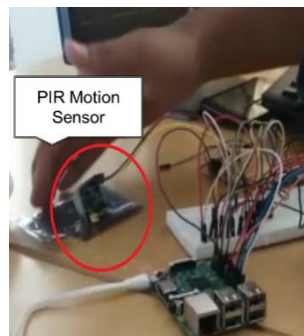
C. Results:

Fig.6. Triggering of Motion.

Fig 6 represents triggering of the motion sensor resulting in the alarm being raised.

Fig.7.Alarm raised using Piezo Buzzer.

Fig 7 represents alarm being raised via a piezo buzzer as a result of intruder being detected.
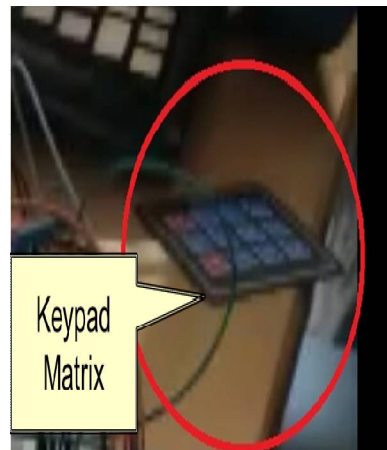
Fig.8. Keypad to disable the alarm.

Fig 8 represents a keypad matrix using which the alarm can be disabled.

V. CONCLUSION

Security is of essential importance in today's world, traditional system has attempted to provide the same using technologies such as microcontroller and updated versions of the same i.e. Arduino Boards. The Proposed System provides Security to the house by detecting the presence of any intruder. If any intruder is detected, an alarm is raised and the owner and law enforcements are notified via email. The proposed work eliminates the overhead associated with traditional system such as high down time during repair and maintenance and any kind of device tampering that an intruder or hacker can do to the system. The proposed work makes use of Raspberry PI as the controller and since it being the latest technology it provides more compatibility with the latest devices and sensor and also provides more room for future enhancement such as exploiting more of Raspberry PI's functionality in areas of efficient consumption of electricity by automating the control of lights for much efficient power management.

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