

# Raspberry Pi Based Anti-Theft Security System using Home Automation for Multi-Level Authentication

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**Abstract:** *The main objective of this project is to illustrate the technology used for security systems. This work presents the development process in security system that uses CCTV for security purpose. This security system is implemented using Raspberry Pi 3B. In home automation security system, once the person enters the building, the lights will be turned on automatically. We use face recognition systems which detects the liveliness of the person for the authorizations for the restricted section of the building and is secured by motion sensors and sound detection sensors. When any motion or sound is detected there without authorization, then the alarm is triggered, the camera is activated and a message is sent to the security. Further, if smoke or fire is detected, the fire will be extinguished automatically by the water sprinkler system.*

**Keywords:** *Alarm; Face recognition; Fire Alarm; Motion Sensing; Raspberry Pi 3B; Security System*

## I. INTRODUCTION

IoT or the internet of things is the interconnection of devices within the existing internet infrastructure. Generally, the Things in Internet of Things can be of any sort of device with any kind of built in different types of sensors with the ability to collect and also transfer the data at a faster rate over the different types of networks without the human intervention. The latest embedded technology in the different objects helps them to interconnect and have interact with internal state and also with the external environment which in turn helps us in the decision making process. In the nutshell, Internet of Things is a concept that connects with all the possible devices to the internet. Internet of Things is also trying maximum to expand the interdependence in humans i.e., interact, contribute and also collaborate to all things.

Since Internet of Things allows all types of devices that need to be controlled remotely across the internet, it creates different opportunities to connect the system directly and then integrate with the physical world to computer-based

systems using different type of sensors and internet. Some of the common sensors include accelerometer, temperature sensor, magnetometer, proximity sensor, gyroscope, image sensor, acoustic sensor, gas RFID sensor, humidity sensors and micro flow sensors. The interconnection of these multiple embedded devices will result in automation in nearly all fields, also enabling advanced applications. The obtained results indicates the improved accuracy, system efficiency and also socio economic benefits with the reduction in human intervention. It also encompasses the technologies such as smart systems, smart grid, smart phones, smart technology, smart applications, intelligent transportation and smart cities.

Internet of Things generally uses the latest multiple technologies and different available network protocols to communicate and coordinate with devices based on the system requirement. The major technologies and protocols are Bluetooth, Wireless Fidelity (Wi-Fi), Near Field Communication (NFC), Radio-Frequency Identification (RFID) and other protocols.

Raspberry Pi is a small credit card sized computer developed in the United Kingdom by the Raspberry Pi Foundation. It is used for multiple purposes. It can be used as a general computer, for browsing the internet, playing HD videos, making spread sheets and word-processing or playing games. It is mostly used for making Internet of Things project like infrared cameras, security systems, music systems, monitoring weather conditions these days. It is also used in the field of robotics due to its portable size and good processing power required for stand-alone system.

In this project we describe about “Anti-theft home automation”. The proposed design is a system which provides security to the building and protects the building from thieves. Firstly, the building is automated. Whenever a person enters the building, the lights and fans will be turned on automatically. It will be turned off automatically when there is no one inside.



The restricted section of the building is secured with face recognition and access is granted only if the person is authorized. The security system mainly consists of piezo-electric sensors, sound sensors and a CCTV camera. If any unauthorized person enters inside the restricted area, the piezo-electric sensors detect the vibrations and the alarm will be triggered. This also activates the camera and the camera starts recording. A message will also be sent to the owner of the building.

Further, there will also be smoke sensors placed throughout the building which senses smoke or any fire breakout within the building. If the sensor detects any smoke, it triggers an interrupt, which in-turn is sent to the water sprinkler system. The sprinkler system puts off the fire by spraying water in a controlled manner. Once fire is completely put off, the sprinkler system stops spraying the water automatically.

## II. MOTIVATION

Since thefts and robberies are increasing day by day, the proposed system implements a multi-level authentication to protect important sections of a building. This system can very well be implemented in bank's strong rooms, lockers and other places where the confidential data are stored. In software companies, this system can be implemented in server rooms where access is given only to certain people. We have proposed this model to protect the society from thieves that are on the rise day by day.

## III. PROBLEM STATEMENT

The system primarily depends on internet access. The system needs to have constant internet connectivity. If the network connectivity is lost, the function of the system is affected. The security implemented in this system is low. Hence, hackers can break into the system and could steal vital information pertaining to the security of the building.

## IV. LITERATURE SURVEY

[1] We here use IOT for the web based GUI of IOT system which sounds an alert and shows the image captured to user. Security and safety have always become a basic necessity for the urban population. With increase in the rapid urbanization and development of big cities and towns, the graph rate of different types of crimes is also rising, The basic anti-theft security systems uses different set of sensors on the walls or with the motion detection sensors so that it can be avoided to an extent by using Infrared blocking clothes and hiding behind the different objects or just simply identify the objects and disable them.

[2] The main objective of this project we designed is an advanced electronic security system using small PIR and IR sensors built around the Node MCU controller. PIR sensor senses the presence of intruder & controller reads the signal from the sensors. If an intruder is detected, it compares the detected image with predefined images in the database, then it turns on the buzzer and also sends a notification to predefined number. At the same time, the

video of intruder can also be monitored and sent to the concerned authorities.

[3] This paper proposes a novel security system based on Open source cloud server things speak.com and a very low cost ESP8266 Wireless-Fidelity module. The paper also includes a Passive Infrared module which will constantly monitor the home or the work space which to be monitored, When the Passive Infrared module detects any type of intruder, it immediately sends an alert signal to the ATmega328P microcontroller and the controller is connected to a ESP8266 Wireless-Fidelity module and also to an alarm system. The System transmits an high alert signal to the open source cloud platform which generally provides an alert signal indicated on the end user's mobile phone.

[4] In this paper the Internet of Things mainly focuses on building a smart wireless home security system which will send the alert message to the registered owner by using Internet in case of any type of trespass, it raises an alarm immediately. Besides, by the same can also be utilized for home automation application by making use of the same set of available sensors, the microcontroller used in the current prototype is the TI-CC3200 Launch pad board which comes with an advanced type of embedded micro controller and an onboard Wireless Fidelity shield using which all the different set of electrical appliances inside the home can also be controlled, coordinated and managed.

## V. EXISTING METHOD

The block diagram of the proposed method is shown in Fig. 1.

### A. Hardware Components

The block diagram of the proposed system consists of the following components – Raspberry Pi, camera module, infrared sensor, sound sensor, smoke sensor and so on. This system is also equipped with a sprinkler system in case of fire emergencies.

#### a) Raspberry Pi

The Raspberry Pi is a credit card sized single board computer. In this project we are using a Raspberry Pi Model 3B which comes with 1GB of RAM. Here, the Raspberry Pi is the main controller of the system which takes input from all the sensors and gives appropriate actions as the output.

Raspberry Pi 3 Model B was released in February 2016 with a 1.2 GHz 64-bit quad core ARM Cortex-A53 processor, on-board 802.11n Wi-Fi, Bluetooth and USB boot capabilities. On Pi Day 2018, the Raspberry Pi 3 Model B+ was launched with a faster 1.4 GHz processor and a three-times faster gigabit Ethernet (throughput limited to ca. 300 Mbit/s by the internal USB 2.0 connection) or 2.4 / 5 GHz dual-band 802.11ac Wi-Fi (100 Mbit/s).



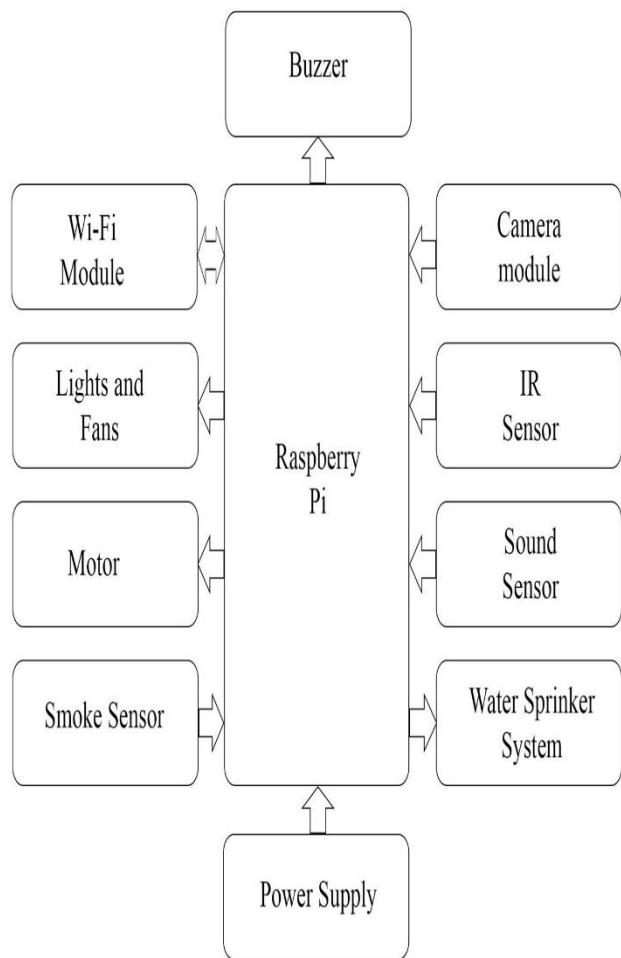


Fig 1. Proposed method for visitor tracking system



Fig 2. Raspberry Pi

*b) Camera Module*

The Raspberry Pi camera module v2 is a high quality 8MP Sony IMX219 image sensor which is a custom designed add-on board for the Raspberry Pi featured a fixed focal length. In this project we are using a camera sensor to record the entire restricted area as soon as motion is detected.



Fig 3. Raspberry Pi Camera Sensor

*c) Infrared Sensor*

An infrared sensor is an electronic device, that emits infrared waves in order to sense some aspects of the surroundings. An IR sensor can measure the heat of an object as well as detect the motion. In this project, we are using IR sensors for motion detection in the restricted section of the building.



Fig 4. Infrared Sensor

*d) Sound Sensor*

Sound sensors are used to detect any sound variations in the environment. It consists of a microphone that is used to pick up any kind of noise variations in the surrounding. In this project we are using sound sensors to improve security of the restricted sections of a building by sending an interrupt as soon as the threshold value of the sound is exceeded.

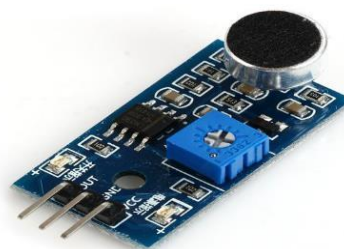


Fig 5. Sound Sensor

*e) Smoke Sensor*

A smoke detector or sensor is a device that is typically used to sense smoke or fire. In this project, we use smoke sensors to detect any fire or smoke that can be caused due to short circuits or any other causes. If the sensor detects smoke, it triggers an interrupt which in-turn activates the water sprinkler system.



Fig 6. Smoke Sensor

f) *Motor driver and DC Motor*

The motor driver is used to connect a DC Motor to the Raspberry Pi. This works in conjunction with the face recognition system. If the user is authorized to use the restricted area, the door is automatically opened. The controlling of the door can be achieved using a DC Motor.

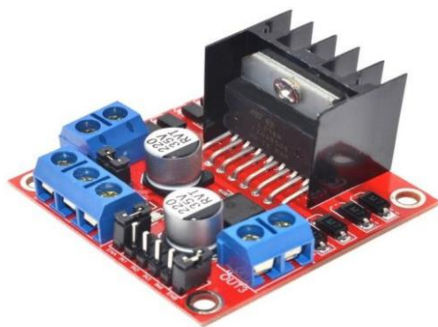


Fig 7. Motor Driver

g) *Wi-Fi Module*

This module is a part of the Raspberry Pi and is used to connect the system to the Internet. The lights and fans in the building can be controlled from the Internet. This also provides the entire system with Internet access. Hence the data from the video camera can be sent to the owner using the internet access.

h) *Water Sprinkler System*

This system consists of sprinklers placed at different sections of the building. If an interrupt is triggered by the smoke sensor, the water sprinkler system sprays water in a controlled manner in order to put out the smoke or fire. Once the smoke or fire is put out, the water sprinkler system shuts down automatically.

i) *Buzzer*

A buzzer is an audio signaling device, which may be mechanical, electromechanical or piezoelectric. In this project, the buzzer is used to indicate an alarm. When an unauthorized person tries to access the restricted section of a building, the buzzer gets activated.

j) *Power Supply*

The component that supplies power to a computer is called power supply. One purpose of power supply is to convert AC to DC so that the computer has proper power to run its components, another is to distribute proper

voltage to each component. The Raspberry Pi uses a 5V DC power supply. It can either be a mobile charger, a power bank or batteries connected to a power booster module to supply constant voltage.

B. *Software*

a) *LINUX*

Linux is one of the most reliable, secure and worry-free operating system. It is used in cars, supercomputers, smartphones, home appliances, home desktop to enterprise servers, refrigerators, Roku devices and televisions. The Raspberry Pi runs on a Linux distribution called Raspbian OS. Raspbian is the official OS for the Raspberry pi that is also the most common OS. Raspbian is a version of Linux specifically built for the Raspberry Pi. The latest version of Raspbian OS is Raspbian Buster.

b) *Python*

This entire project will be programmed using Python language. Python is used as the programming language for Raspberry Pi. Python is used for general purpose applications and high level machine learning algorithms and programming language, mainly it was developed for the emphasis on code readability and also its syntax allows the unknown programmers to express the related coding algorithms and concepts in fewer lines of code. Python also lets the programmer to write the code in faster rate, effectively and accurately. Python is also used to control system hardware. The latest available released version of Python is version 3.8.

## VI. APPLICATIONS

- a) This can be implemented in banks where only authorized personnel are allowed to certain sections of the banks.
- b) This system can be implemented in schools and colleges.
- c) It can also be implemented in homes and offices.
- d) This system can be implemented in Museums.
- e) It can be used to provide security to temple treasury.
- f) Hospitals can also adopt this technology for securing certain rooms that contain medicines.
- g) This system can also be used in Military bases.

## VII. ADVANTAGES

- a) Multiple layers of security for restricted areas.
- b) The system can be monitored from anywhere in the world.
- c) High degree of accuracy.
- d) The entire building can be automated.
- e) There is no wastage of electricity since the building is automated.
- f) The system can be controlled from a remote location.





## VIII. ISSUES

- a) The entire system depends on Internet access. So, if the network goes down, the system becomes inactive.
- b) The system is vulnerable to hackers who can penetrate the system and control it without the knowledge of the owner

## IX. CONCLUSION

The proposed system uses IoT for anti-theft security system and home automation. It can be implemented in places where high security is needed to protect documents or other assets. The system also includes home automation features so as to make the lives of the people much easier. A lot of energy can be saved due to automation as it turns off devices and equipment automatically when they are not in use. The entire system can be monitored from a remote location. The system can also be controlled using internet enabled devices from anywhere in the world. Hence, IoT can revolutionize the way a system interacts with the environment and provide multiple layers of security in places where it is needed the most. IoT can also revolutionize the way we interact with our daily devices by fully automating our environment and thus making our lives much easier.

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