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# Internet of Things (IOT) based Attendance and Intrusion Detection System

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**ABSTRACT:** An organization is fundamentally dependent on its workforce, with it being its biggest expense as well as its chief reason for generating revenue, growth and profit. As such it becomes essential to maintain reliable time and attendance information to make human resource management a lot easier. Also security is an essential issue and care has to be taken to insure that there is no breach or ambiguity in organizations and no unnecessary people enter in any workforce premises. As such it becomes essential to have an attendance/intrusion detection system in every industry, institution and company. The idea behind this project is to develop an attendance maintenance system for schools, colleges and well as organizations which also has the provision to detect any form of intrusion in restricted areas and report it immediately. This system is realized using a PIR sensor (to detect human presence in room), a RFID reader (to confirm the identity of the person in room) and a camera. Raspberry pi B+ is used to control the communication between these peripherals and the whole setup is connected to the internet in order to optimize it.

**KEYWORDS:** PIR, RFID, Raspberry Pi B+, intrusion detection, camera

### I. INTRODUCTION

For any organization, its workforce and for schools and colleges, its pupils are its biggest assets. Thus, maintaining accurate and reliable attendance information is among its utmost priority. There are many different methods which can be used for attendance monitoring.

Radio Frequency Identification (RFID) based attendance management system is one such method, along with a camera to optimize it. The camera is utilized for intrusion detection in restricted areas whereas the motion detection is done by the PIR, making the whole system more efficient. A significant upgrade worked upon here is about making it global so that the concerned authorities can monitor it from a web site from any device; as well as the security can look for intruders.

The first point of interaction of any person with this design would be the PIR, which would detect any motion within its specified range. This in turn would activate the RFID and the person who has come within the PIR's range would then have to show his/her tag to the RFID sensor.

The microcontroller would then match the tag number with the list of approved tags stored in its memory and if validated would allow entry, if not then a camera attached would click a picture of the person assuming him/her to be an intruder and an alarm would be sent via email to the concerned authority.

All the information would also be uploaded to a web page so as to avoid any ambiguity and enable easy access to a person in charge.

### II. OBJECTIVE

The project aims at designing an attendance maintenance system for schools, colleges and well as organizations which also has the provision to detect any form of intrusion in restricted areas and report it immediately. To achieve this:

- A PIR is required to detect the presence of any human being in the room.

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- An RFID is required to validate the presence of the person in the room by tallying his identity with those in the database.
- A camera is required to click the picture of the room and send it via email as an alarm.
- An internet connection is required to register all these movements on a website so that it can be accessed from any place and any device.

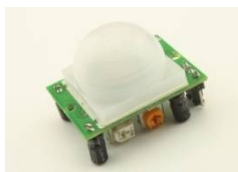
## III. BACKGROUND

### ➤ Raspberry pi B+



Raspberry pi is a portable and powerful mini computer. The board length is only 85mm and width is only 56mm. Its size only as big as a credit card but it is a capable little PC. It can be used for many of the things that your desktop PC does, like high-definition video, spreadsheets, word-processing, games and more. Raspberry Pi also has more wide application range, such as music machines, parent detectors to weather stations, tweeting birdhouses with infra-red cameras, lightweight web server, home automation server, etc. It enables people of all ages to explore computing, learn to program and understand how computers work.

### ➤ PIR HC-SR501



PIR sensors allow you to sense motion, used to detect whether a human has moved in or out of the sensor's range. They are small, inexpensive, low-power, easy to use and don't wear out. For that reason they are commonly found in appliances and gadgets used in homes or businesses. They are often referred to as PIR, "Passive Infrared", "Pyroelectric", or "IR motion" sensors.

PIRs are basically made of a pyroelectric sensor which can detect levels of infrared radiation. Everything emits some low level radiation, and the hotter something is, the more radiation is emitted. The sensor in a motion detector is actually split in two halves. The reason for that is that we are looking to detect motion (change) not average IR levels. The two halves are wired up so that they cancel each other out. If one half sees more or less IR radiation than the other, the output will swing high or low.

### ➤ RFID Mifare RC522



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A Radio-Frequency identification system has three parts:

- A scanning antenna
- A transceiver with a decoder to interpret the data
- A transponder - the RFID tag - that has been programmed with information.

The scanning antenna puts out radio-frequency signals in a relatively short range. The RF radiation does two things:

- It provides a means of communicating with the transponder (the RFID tag) AND
- It provides the RFID tag with the energy to communicate (in the case of passive RFID tags).

This is an absolutely key part of the technology; RFID tags do not need to contain batteries, and can therefore remain usable for very long periods of time (maybe decades).

When an RFID tag passes through the field of the scanning antenna, it detects the activation signal from the antenna. That "wakes up" the RFID chip, and it transmits the information on its microchip to be picked up by the scanning antenna.

In addition, the RFID tag may be of one of two types:

**Active RFID tags** have their own power source; the advantage of these tags is that the reader can be much farther away and still get the signal.

**Passive RFID tags**, however, do not require batteries, and can be much smaller and have a virtually unlimited life span.

RFID tags can be read in a wide variety of circumstances, where barcodes or other optically read technologies are useless.

- The tag need not be on the surface of the object (and is therefore not subject to wear)
- The read time is typically less than 100 milliseconds
- Large numbers of tags can be read at once rather than item by item.

## ➤ Camera omnivision 5647



The OV5647 is OmniVision's first 5-megapixel CMOS image sensor built on proprietary 1.4-micron OmniBSI™ backside illumination pixel architecture. OmniBSI enables the OV5647 to deliver 5-megapixel photography and high frame rate 720p/60 high-definition (HD) video capture in an industry standard camera module size of 8.5 x 8.5 x ≤5 mm, making it an ideal solution for the main stream mobile phone market.

The superior pixel performance of the OV5647 enables 720p and 1080p HD video at 30 fps with complete user control over formatting and output data transfer. Additionally, the 720p/60 HD video is captured in full field of view (FOV) with 2 x 2 binning to double the sensitivity and improve SNR. The post binning re-sampling filter helps minimize spatial and aliasing artifacts to provide superior image quality.

OmniBSI technology offers significant performance benefits over front-side illumination technology, such as increased sensitivity per unit area, improved quantum efficiency, reduced crosstalk and photo response non-uniformity, which all contribute to significant improvements in image quality and color reproduction. Additionally, OmniVision CMOS image sensors use proprietary sensor technology to improve image quality by reducing or eliminating common lighting/electrical sources of image contamination, such as fixed pattern noise and smearing to produce a clean, fully stable color image. *It delivers RAW RGB Imagery to the RaspberryPi through the onboard camera connector interface.*

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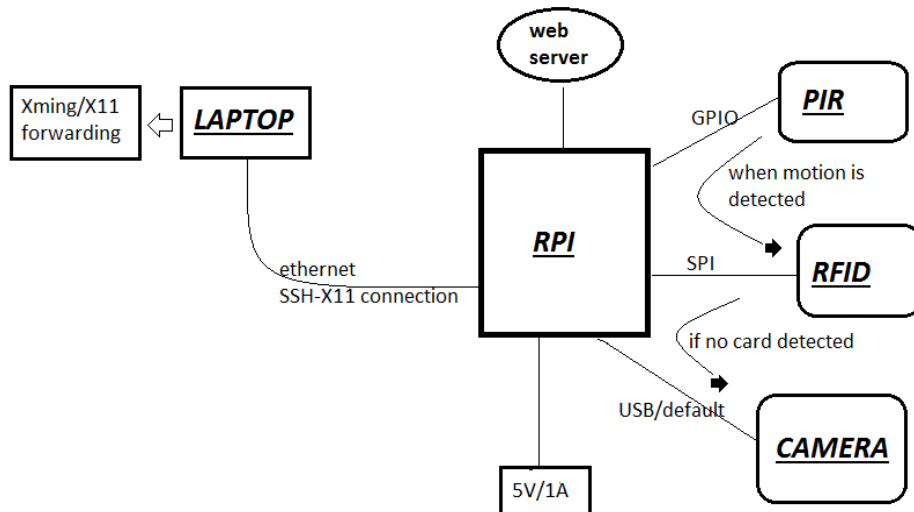
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## IV. DESCRIPTION

An organization is fundamentally dependent on its workforce, with it being its biggest expense as well as its chief reason for generating revenue, growth and profit. An organization here can refer to any industry, institution or company which employs people. As such it becomes essential to maintain reliable time and attendance information to make human resource management a lot easier. Also security is an essential issue and care has to be taken to insure that there is no breach or ambiguity in organizations and no unnecessary people enter in any workforce premises.

As such it becomes essential to have an attendance/intrusion detection system in every industry, institution and company. Most organizations have an automatic system to deal with this work. There are many reasons for doing so. Firstly, an automatic system reduces the probability of error, it increases productivity as it saves employee time which would be spent in case of manual attendance system and in the long run it saves money as it reduces labor cost. Here we will be implementing one such attendance/intrusion detection system.

There are many algorithms and methods used to create attendance systems, each of them have some advantages and some or the other disadvantages. The idea behind the attendance/intrusion detection system used in this project is based on detecting a person's presence near the entry point where the system is placed via motion detection. Once motion is detected in its certified range, the system then asks for a person's id card and upon matching the id card with the verified id list in its database, the system allows entry and in case on any ambiguity it clicks a picture of the person in front of the entry door and alerts the necessary authorities about the situation. All the information would also be stored on a web page so that people with the right access can view the page from anywhere in the world and also to ensure that there would be no discrepancy or altering of information in the system on site itself.



This diagram describes the method implemented to create the attendance/intrusion detection system implemented in this project. The microcontroller used is called as Raspberry Pi B+. The microcontroller is the brain of the system which ensures that every peripheral attached to it implements the function it is responsible for and therefore the whole system works efficiently and smoothly. For the Raspberry Pi to do the above mentioned functions it needs to be told, or rather coded as to how to do these functions and in which order every peripheral attached to it must function. We code into the Raspberry Pi by attaching it to a computer via RJ45 Ethernet cable. The Pi is powered by a 5V/1A power source. SSH( Secure Shell) is a network protocol used to provide a secure connection over an insecure network in a client server architecture, connecting an SSH client with an SSH server. The SSH client used is called PuTTY and the server used is Xming which is an X11 server for Microsoft Windows Operating System, Using this client-server interaction allows a Microsoft Windows user to open the Linux based Raspberry Pi Graphical User Interface( GUI ). The GUI possesses IDLE ( Integrated Development Environment) for the Python Language. The code can be written here and on running it the result can be seen on the peripherals attached to our microcontroller. In order of use, the first peripheral attached is the PIR (Passive Infrared) sensor which is used for motion detection. The model used in this



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project is the HC- SR501 which has a range of 3-5 meters. Upon detecting motion the PIR is activated which triggers the RFID sensor into activation. The RFID sensor used is called the Mifare RC522 sensor and it can detect the UID (Unique Identification) of any RFID tag which works at the specified frequency of the RFID sensor, which in this case is 13.56 MHz. The Raspberry Pi GUI also provides the option of downloading a software for Database management and hence MySQL was downloaded and used to make a database of the UIDs which would be made available for attendance system. When the RFID is activated, the person in front of the system brings his/her RFID tag near the RFID sensor where it automatically reads the UID of the tag in question. The Raspberry Pi then matches the UID with the list of UIDs provided in the MySQL database. If the UID is present in the database then the information regarding that person is displayed and he/she is allowed entry. However, if the UID does not match with the list of UIDs present in the database then a message reading 'unauthorized' is displayed and a camera attached to the Raspberry Pi clicks a picture. The camera used is named Omnivision 5647 and it is a Raspberry Pi compatible camera. A condition remains when a person does not have a RFID tag along with him/her. When such a person comes in front of a camera, then motion is detected but no card is presented. Therefore, the Raspberry Pi is programmed in such a way that if no card is placed in front of the RFID within 2 seconds, the camera is again activated to click a picture and it is stored with the name 'intruder'. This is the basic on-the-spot working of the system.

The next part is getting the information to be displayed on the internet. The working package for HTML is already present in the Raspberry Pi and changes can hence be made to the python code to display all the information on an html page. A significant upgrade made in this project is to add a software package to allow connection with Gmail so that in case of an intruder or unauthorized person report an immediate mail is sent to the Gmail address of any person specified in the code. Adding these two changes makes the whole project IOT (Internet of Things) based and makes the whole project that much more effective.

## **Goals**

The goal of this project is to design an attendance maintenance system for schools, colleges and well as organizations which also has the provision to detect any form of intrusion in restricted areas and report it immediately. The idea is to make the whole system as clear and easy as possible.

The idea is to make the whole system as portable as possible by adding as few number of peripherals as possible. In the near future it is hoped that by limiting the number of peripherals and by seeking out the best peripherals in terms of optimization of cost and effectiveness the whole attendance system can be improved. The main aim of the system by adding an html page and making the result available online on Gmail was to make the whole system foolproof. Any tampering of the whole attendance system would not be of any use as the result would be immediately made available online.

## **V. CONCLUSION**

The idea behind this project is to develop an attendance maintenance system for schools, colleges and well as organizations which also has the provision to detect any form of intrusion in restricted areas and report it immediately. This system is realized using a PIR sensor (to detect human presence in room), a RFID reader (to confirm the identity of the person in room) and a camera. Raspberry pi B+ is used to control the communication between these peripherals and the whole setup is connected to the internet in order to optimize it.

The proposed framework has the following key steps:

1. As soon as a person enters the room, PIR detects it and passes the control to the RFID.
2. RFID scans for identification of the person.
  - a. If within the given time frame, identity of the person is identified using the tag in his card, his attendance is registered.
  - b. However, if the tag of the card is not identified by the RFID from its registered database, a picture of the room is sent with an 'unauthorized access' alarm.
  - c. Also, if no tag is read by the RFID in the given time frame, a picture of the room is sent with an 'intrusion' alarm.
3. The entire attendance registry is done correspondingly on a website which can be accessed from anywhere.

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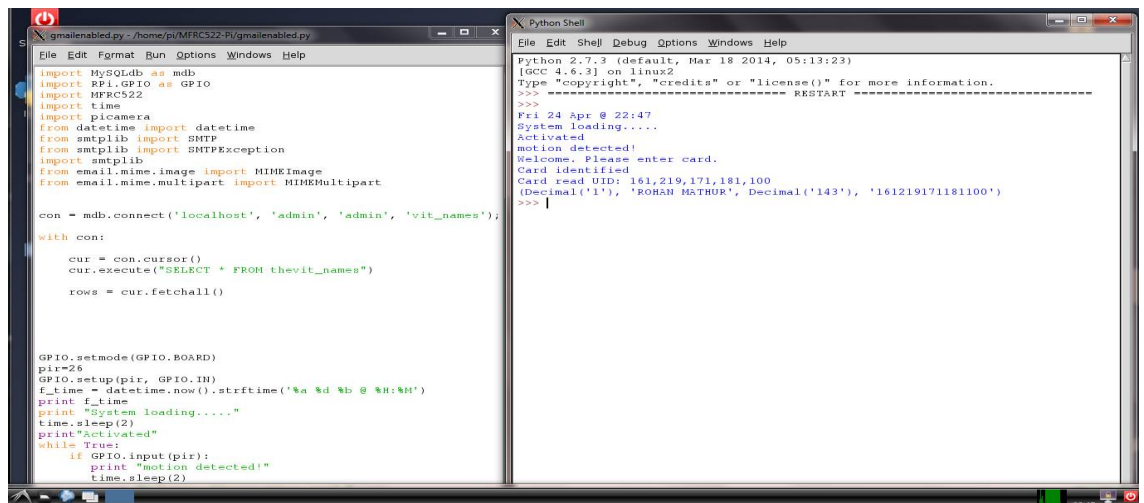
However, in case of any alarm situation, the picture of the room along with the timestamp is sent via email to the concerned authority

## VI. SIMULATION

```
mysql> USE vit_names;
Reading table information for completion of table and column names
You can turn off this feature to get a quicker startup with -A

Database changed
mysql> SELECT * FROM thevit_names;
+-----+-----+-----+-----+
| serial_no | user_name | id | uid |
+-----+-----+-----+-----+
| 1 | ROHAN MATHUR | 143 | 161219171181100 |
| 2 | ASTHA PURI | 180 | 20636173181242 |
| 3 | ANURAG | 50 | 153871106166 |
+-----+-----+-----+-----+
3 rows in set (0.01 sec)
```

Database creation and storage in SQL

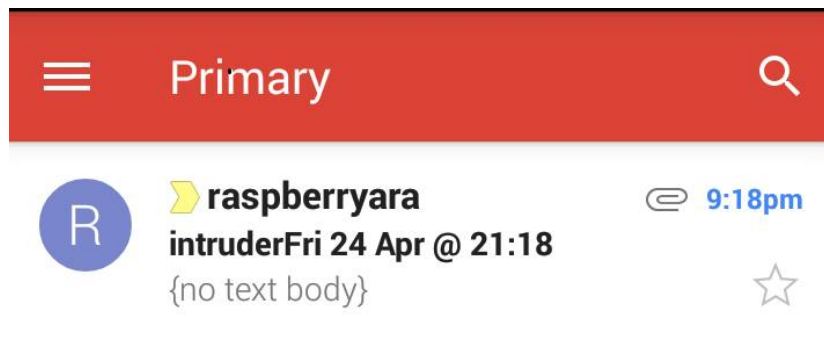


```
import MySQLdb as mdb
import RPi.GPIO as GPIO
import MFRC522
import time
import picamera
from datetime import datetime
from smtplib import SMTP
from smtplib import SMTPException
import smtplib
from email.mime.image import MIMEImage
from email.mime.multipart import MIMEMultipart

con = mdb.connect('localhost', 'admin', 'admin', 'vit_names');
with con:
    cur = con.cursor()
    cur.execute("SELECT * FROM thevit_names")
    rows = cur.fetchall()

GPIO.setmode(GPIO.BOARD)
pir=26
GPIO.setup(pir, GPIO.IN)
f_time = datetime.now().strftime('%a %d %b @ %H:%M')
print f_time
print "System loading....."
time.sleep(2)
print "Activated"
while True:
    if GPIO.input(pir):
        print "motion detected!"
        time.sleep(2)
```

Code output



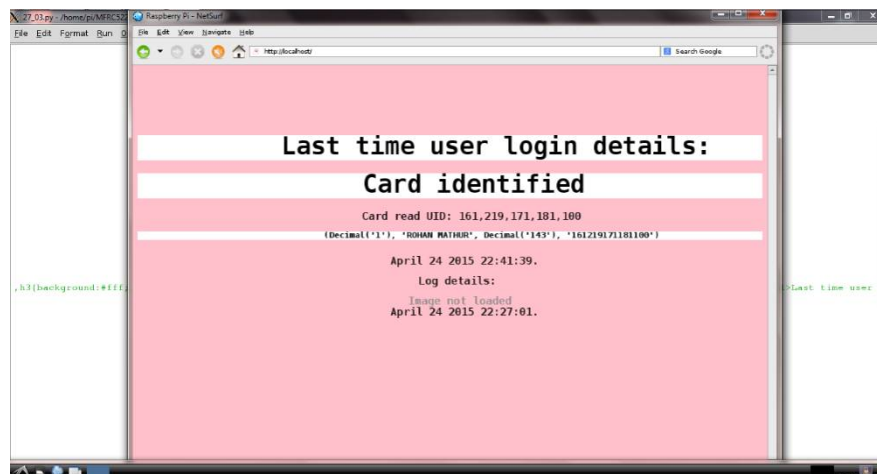
Mail received from Raspberry pi in case of intrusion



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Output display on HTML web page

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## BIOGRAPHY



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