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# Internet of Things (IoT) Enabled Smart Class Room with Real Time Data Monitoring

**K. Umapathy, S. Chandramohan**

***Abstract:*** ***Internet of things (IoT) has become common, each and every thing applies Internet, and everyone is familiar with internet and mobile phones. This paper is all about implementation of a smart classroom. A smart classroom is one which has Automatic Attendance, Safety, Security, Surveillance and teaching methods, also Energy i.e., Power management. The system uses up an efficient setup which has a Raspberry pi (Instructor/Commander) for the system and sensors like Fire Sensor, Face Detector, LDR, Motion Sensor, Finger-Print Sensor are being utilized. The system becomes smart since it is automatic, uses IoT and easy to access by a common man. The system is capable of monitoring and taking attendance, Security alert, Fire alarm and rescue.***

***Keywords: IoT, Wi–Fi, Sensors, Raspberry Pi, Smart Classroom.***

## I. INTRODUCTION

IoT has become common, each and every thing applies Internet, and everyone is familiar with internet and mobile phones[1]. This paper is all about implementation of a smart classroom. A smart classroom is one which has Automatic Attendance, Safety, Security, Surveillance and teaching methods, also Energy i.e., Power management. The system uses up an efficient setup which has a Raspberry pi (Instructor/Commander) for the system and sensors like Fire Sensor, Face Detector, LDR, Motion Sensor, Finger-Print Sensor are being utilized[2]&[3]. The system becomes smart since it is automatic, uses IoT and easy to access by a common man[4]. All these sensors are integrated with Raspberry pi. The system is capable of monitoring and taking attendance, Security alert, Fire alarm and rescue and also switch off light and fan when not in use[5].

Teaching method is enhanced by showing more videos, and making the session interactive, also in the absence of teacher, students can have a Skype call/other application with the Professor (in the presence of internet) and recorded video can be utilized (in the absence of internet)[6]&[7].

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The IoTshown in the fig.1 is the network of vehicles, classroom, home appliances, physical devices, agricultural fields and other items embedded with sensors, software, electronics, connectivity, actuators ,exchange and collect data[8]&[9].

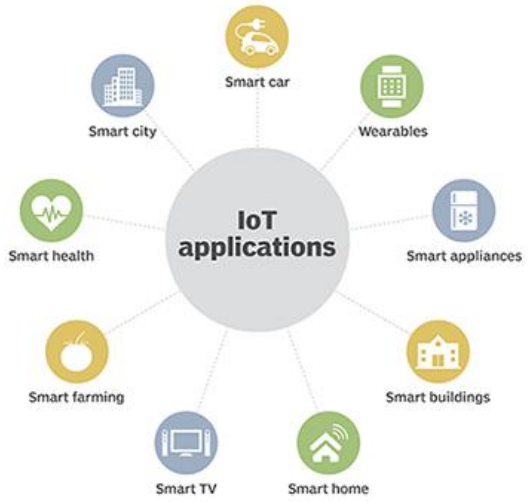


**Fig. 1.IoT MOdel**

## II. PROBLEM IDENTIFIED

1. Implementation of Fire alarm system
2. RFID tags could be misplaced and Proxy attendance are possible when RFID tags are used
3. Cost effective Security management system is essential.
4. Efficient Power management system must be implemented.
5. Efficient Attendance monitoring could be implemented.

## III. PROPOSED SYSTEM

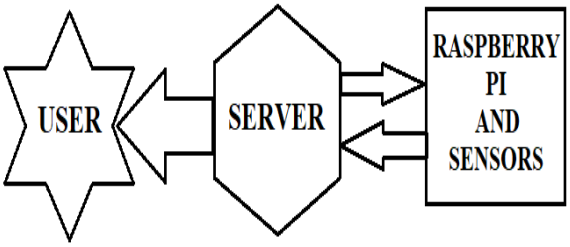


**Fig. 2.Proposed System.**

Figure 2 shows the propsoed system block diagram

## IV. COMPONENTS DESCRIPTION

### A. Power Supply

Each and every device must be given with a power, but in this we are using a supply of 5V-2A which will be given to Raspberry pi which will act as a energy supply intended for other elements when they are interfaced with it which is shown in the figure 3.

**Fig. 3.Power Supply.**

### B. Raspberry Pi:

Third generation of Raspberry pi is Model B of Raspberry pi 3 shown in the figure 4..For various applications this dominant credit-card sized single board computer is utilized and then replacing the model B of raspberry pi 3 as well as model B+ of original raspberry pi[10]. Compare to the first generation, the Model B of raspberry pi 3 offers 10 times faster with more powerful processor. Furthermore to enhance the dominant design it includes blue tooth as well as wireless LAN connectivity as a ultimate solution.

**Fig. 4.Raspberry pi 3.**

### C. LDR

By means of spectral response related to the human eye two models of cadminum sulphide photo conductive cells is included. By raising the light intensity, resistance of cell falls. Automatic light control, burglar alarm, batch counting and smoke detection are the applications incorporated.LDR is shown in the figure 5.

**Fig. 5.LDR**

PIN CONFIGURATION:
VCC: 3.3V
Ground: GND
Output: GPIO Pin 21

### D. Motion Sensor:

To sense the motion, the PIR sensors are used which is shown in the figure 6. Also it is utilized to identify if the human has moved out or in of the sensor range. It is less power, small, and easy to use, don't wear out and economical. Because of this concern they are normally available in gadgets as well as appliances utilized in business and homes. They are frequently named ad passive infrared, IR motion, PIR or Pyro-electric sensors.

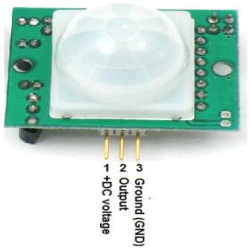


**Fig. 6.Motion Sensor.**

PIN CONFIGURATION:
VCC: 5V
Output: GPIO Pin 4
Ground: GND

### E. Flame Sensor:

Flame sensor is shown in the figure 7.and its description is shown in the Table I.

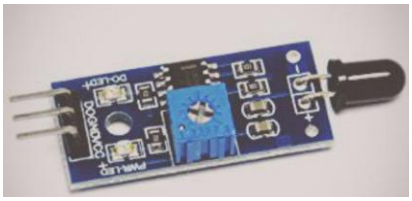

**Fig. 7.Flame Sensor.**

**Table- I: Flame Sensor Description**

| | | | |
|---|---|---|---|
| **Power** | DC 3.6V-6.0V | **Interface** | UART(TTL logical level)/ USB 1.1 |
| **Working current** | Typical: 100mA<br>Peak: 150mA | **Matching Mode** | 1:1 and 1:N |
| **Baud rate** | (9600*N)bps,<br>N=1～12 (default N=6) | **Character file size** | 256 bytes |
| **Image acquiring time** | <0.5s | **Template size** | 512 bytes |
| **Storage capacity** | 256 | **Security level** | 5 (1, 2, 3, 4, 5(highest)) |
| **FAR** | <0.001% | **FRR** | <0.1% |
| **Average searching time** | < 1s (1:1000) | **Window dimension** | 18mm*22mm |
| **Working environment** | Temp: -10℃- +40℃ | **Storage environment** | Temp: -40℃- +85℃ |
| | RH: 40%-85% | | RH: <85% |
| **Outline Dimention** | Split type | Module: 32*23*7mm<br>Sensor:56*20*21.5mm | |
| | Integral type | 54.5*20.6*23.8mm | |

### F. RFID

13.56MHZ for less contact communication, the MFRC522 is extremely integrated with writer/reader. The MFRC522 reader maintain ISO MIFARE/14443A mode. To drive a writer/reader antenna, the MFRC522 is the internal transmitter module.

Without extra circuitry they designed with the IEC 14443A/ISO/MIFARE cards and transponders.[11] From IEC 14443A/ISO/MIFARE compatible cards and transponders the receiver module offers a vigorous and efficient realization of a decoding and demodulation circuitry for signals. RFID is shown in the figure 8


**Fig. 8.RFID Reader,Tags and key.**

PIN CONFIGURTION:
VCC-5V
SDA- GPIO Pin 8
SCK- GPIO Pin 11
MOSI- GPIO Pin 10
MISO- GPIO Pin 9
IRQ- NC
Ground- GND

### G. Camera:

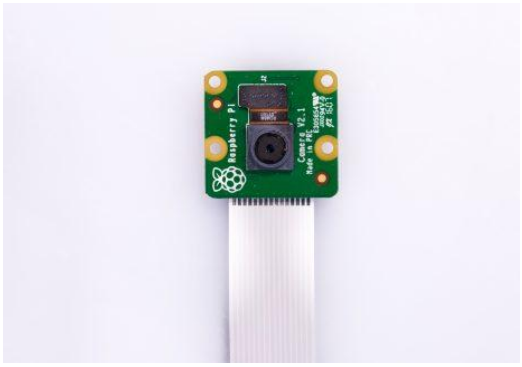

**Fig. 9.Camera Module.**

- Second Generation Raspberry Pi Camera Module with Fixed Focus Lens
- Sony Exmore IMX219 Sensor Capable of, 1080P60, 4K30, 8MP 720P180, Still.
- Active Pixel Count 3280 (H) x 2464 (V)
- In Raspberry pi Maximum of 8MP and
- Highly recommended 2A Power Supply and its module is shown in the figure 9.

### H. Finger-Print Sensor

R308 is a different fingerprint reader which is utilized for high speed unique DSP as core module, compatible several fingerprint sensor shown in the figure 10. This is a smart element which can easily get image processing, fingerprint, storage, search and verified fingerprint and function usually by not including monitors participatory management. For processing finger print it contains two module that is finger print matching (either 1:N or 1:1) and enrolment. Users required to For enrolling fingerprint enter the finger two to four times for each one finger and develop the finger images with many times, accumulate to produce the templates on element[12].

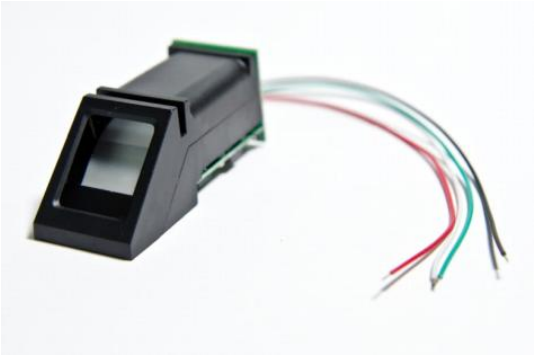

**Fig. 10. Finger-print Sensor.**

PIN CONFIGURATION:
VCC- 5V (TTL Serial USB)
Ground- GND
TX- RX of TTL serial USB
RX- NC

If you wish, you may write in the first person singular or plural and use the active voice (“I observed that ...” or “We observed that ...” instead of “It was observed that ...”). Remember to check spelling. If your native language is not English, please get a native English-speaking colleague to proofread your paper.

### I. TTL Serial USB

**Fig. 11. TTL Serial USB.**

Serial input/output is the tool shown in the figure 11 used regularly for debugging the projects. Realize the serial is simple ant it permits to receive/send some data that is in requirement from the microcontroller to computer serial port. Thus it can be observed by the utilizing a terminal emulator. From the software point of view such two devices are compatible,

though cant fastener the microcontroller up to computer due to non compatible of hardware interfaces[13].

PIN CONFIGURATION:

VCC- Finger-Print Sensor VCC

Ground- GND

TX- NC

RX- TX of Finger-Print Sensor

## V. ARCHITECTURE

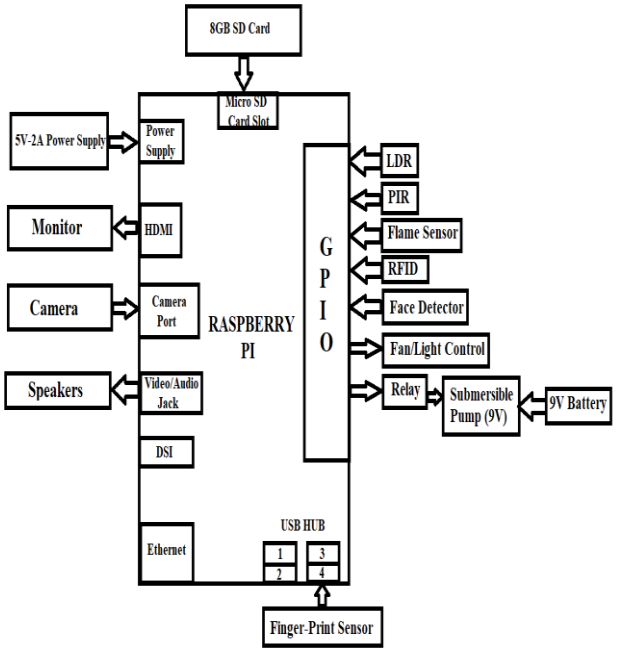


**Fig. 12. Block Diagram.**

Block diagram of the architecture is shown in the figure 12.Sensors are interfaced with Raspberry pi and then through Pi it is linked to the server and finally to the Raspberry pi.Software's like PuTTY, WakeMeOnLan are being used. The OS of Raspberry pi is Raspbian OS. Python is used as a programming Language. Camera is streaming using OpenCV. If the LDR Sensor's value exceed the limit then the system would automatically Switches the light off. Using Motion Sensor the fan operation is controlled.

Finger-Print, RFID helps for automatic attendance, the Face detection also does the same, also when unknown faces are detected an alert is created.

Fire sensor gives fire alert and when fire alert is detected, water is pumped out helps to off the fire. Camera does both surveillance and Face detection. All these data's are stored in the website and can be viewed regularly by end user. Through the monitor video can streamed both online and offline.LDR and PIR comparison is shown in the figure 13 and 14.


**Fig. 13. LDR Comparison.**

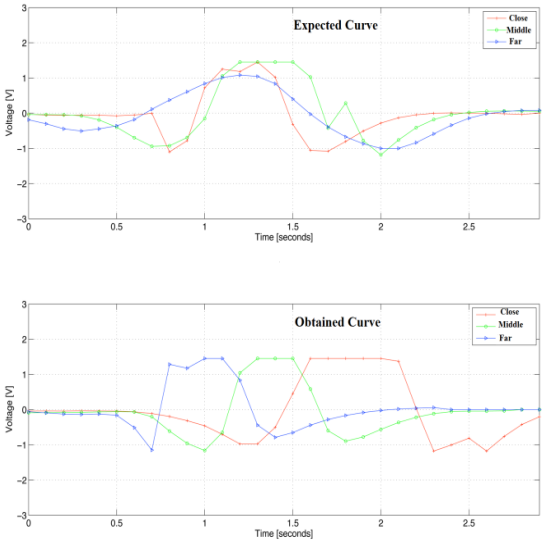


**Fig. 14. PIR Comparison.**

## VI. RESULT AND DISCUSSION

The motion detection,flame detection,video streaming,fringer print detection is shown in the figure 15-18.

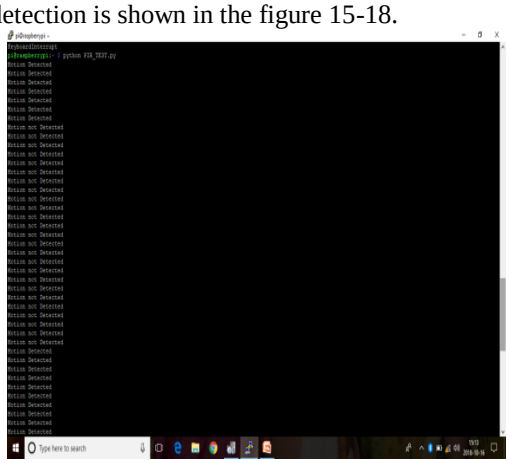

**Fig. 15. Motion Detection.**

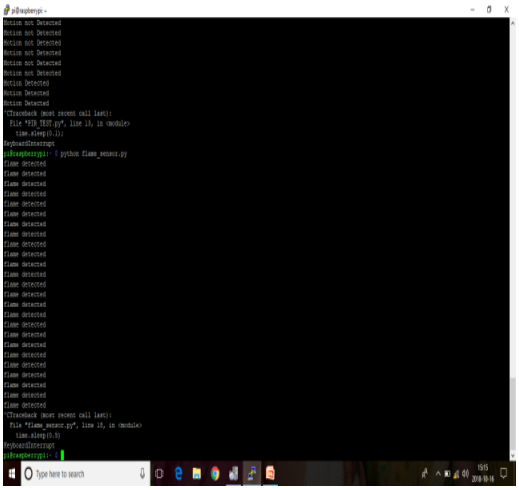

**Fig. 16. Flame Detection.**

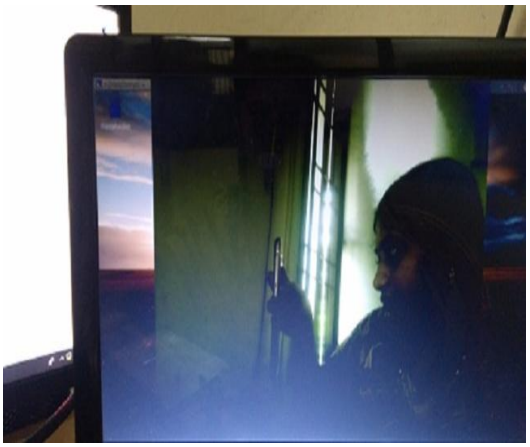

**Fig. 17. Video Streaming.**

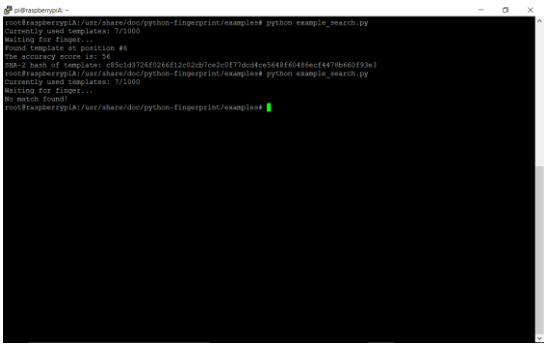

**Fig. 18. Finger Print Detection.**

## VII. CONCLUSION

Thus an efficient system is designed and which helps students and teachers in many aspects. It also helps the Head of the school to locate the strength of the class, teaching methodology and many more. It is treated as a smart classroom. The website can be viewed from anywhere around the world.In future an android application can be developed which helps the head to use it more efficiently.

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**K. Umapathy** is working as Associate Professor in the Department of ECE at Sri Chandrasekharendra Saraswathi Viswa MahaVidyalaya, Kanchipuram. He obtained his UG and PG degrees in Engineering from Madurai Kamraj University and Anna University respectively. He received his PhD degree from JNT Univeristy, Anantapur in the year 2014. He has 24 years of experience in the field of Engineering Eduation and Adminstration. He publihsed more than 100 papers in Journals and Conferences at the level of both National and International. He authored five books in the field of Engiineering. He is a member of various professional bodies such as ISTE, IEEE, IETE etc.

**S. Chandramohan** obtained his BE degree in Electronics and Communication Engineering from ANNA University in the year 2002. He completed his M.Tech degree in Space Technology and Applications from Indian Institute of Science, Bangalore and Pursuing PhD from SCSVMV (Deemed to be University), Kanchipuram. He has nearly '15' years of Experience in the field of Engineering Education and Administration. He has published 07 papers in Journals and Conferences both at the level of National and International. He is a member of various professional bodies such as IEEE and IAENG. Currently he is working as Assistant Professor in the Department of ECE, SCSVMV (Deemed University), Kanchipuram.