

# Raspberry Pi based Home Surveillance and Security using Cloud Server

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## Abstract

Internet of Things is playing a crucial role for connecting the things through internet connectivity. At present requirement of home surveillance and security is demanding. In this paper we are proposing internet of things-based home surveillance system using raspberry pi controller and cloud server. With the assistance of PIR sensor, RFID reader, the unusual human activities are recorded and communicates the information to the local home controller via XBee modem. The local home controller sends the received information to the cloud server via Wi-Fi modem. Through cloud server, the user monitors the surveillance and security of the home through UI mobile app.

**Keywords:** Raspberry Pi, Cloud server, RFID reader

## 1. Introduction

Raspberry Pi based monitoring system is gaining more popularity for capturing the motion of human activities. Detection of motion of human activities is sensing through PIR sensor. Internet of things is connecting the physical things through internet connectivity. Internet of things transmits the information from the end nodes to the cloud server through wireless communication protocol. As they is availability of advanced communication protocol and wireless sensor, we can frame a power efficient system for any application. **Chowdhury et al. (2013)**, Internet of things based real time monitoring home security system is proposing for enhancing the security at door lock. With the assistance of integrated camera and internet, the authorised person monitoring the visitors to their house from any location [1]. **Sapes and Solsona (2016)** The purpose of embedding devices on Raspberry-Linux systems is to create cost effective prototype. In this study with the assistance of Raspberry Pi, a fingerprint recognition system is developing. The developing system integrate with web server through Wi-Fi modem [2]. **OTHMAN and AYDIN (2018)** A vision-based system is proposing for detecting the movement of human. Raspberry Pi is integrating with the PIR sensor for detecting the human presence. After detecting the human, with the assistance of camera, the visuals are sent to the smartphone via telegram application [3]. **Nath et al. 2016**, RFID (Radio Frequency Identification) technology-based door unlocking system is proposing using 433 MHz RF signal. With the assistance of RF signal, the information is transmitting to the web server for real time surveillance [4]. **Pavithra and Balakrishnan (2015)**, Internet of Things based smart home appliance is proposing with the integration ZigBee network and Wi-Fi. Raspberry Pi act as server for controlling the home appliance via zigbee network [5]. **Stojanoski et al. 2017** Raspberry Pi based server is utilizing for controlling the embedded home appliance. With the assistance of android application, the appliance is developing for cost effective and energy efficient system [6]. **Ansari et al. 2015** Internet of Things (IoT) based framework is proposing for creating real time home security system. With the assistance of Raspberry Pi, the human movement is detected and stored in the device. This raspberry pi communicates the human activities to the cloud server for real time monitoring from any place [7]. **Patchava et al. 2015** Raspberry Pi module-based home security system is proposed with computer vision technique. Motion of human is detecting with the assistance of motion sensor and uploading the human detection activities to the web server via internet [8]. **Frank et al. 2019** Image processing techniques are applying for monitoring the traffic density. For identifying the density of traffic by comparing the captured image with real time images [9]. **Kamelia et al. 2018** integrating the RFID (Radio Frequency Identification), PIR sensor and LDR sensor for house security system. PIR sensor triggers the RFID for reading the RFID tag and entering the password. Unusual human activity is identifying if the user is trying to unlock the door without RFID tag [10]. **Wadhvani et al. 2018** Arduino and IoT based smart automation and security system is proposing for creating a smart environment. Integrating the different sensors and Wi-Fi module for implementing the smart environment [11]. **Balani et al. 2018**, wireless sensor node and Wi-Fi based surveillance system is proposing for implementing the internet-based surveillance. The events and alerts are sent to the user through email and can also monitoring using web server [12]. **Jain et al. 2018**, Face identification system is proposing using computer vision and raspberry pi. In this, the vision device is integrating with the PIR sensor, the PIR sensor activates the

vision device for detecting the human presence [13]. Kumar *et al.* 2017 implementing the face detection using open CV (Haar Cascades) and Raspberry pi. In this the human detection sensor is integrating with the raspberry pi for identifying the different activities and triggering the events into client dashboard [14].

Using the advantage of Raspberry Pi controller and cloud server, we are proposing a system for a home surveillance by integrating XBee communication, Wi-Fi modem network and cloud server. With the assistance of PIR sensor, RFID reader, the unusual human activities are recorded and communicates the information to the local home controller via XBee modem. The local home controller sends the received information to the cloud server via Wi-Fi modem.

## 2. Raspberry Pi

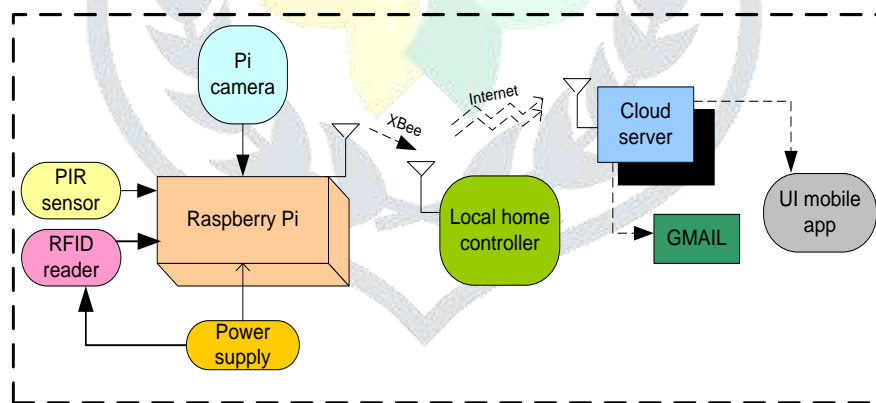
Raspberry Pi controller is a system on chip (SoC) device which comes with a single-core 700 MHz CPU and 256 GB RAM. This controller consists of GPIO (general purpose input/output) pins for controlling the physical devices using physical computing. Through the GPIO pins, the PIR sensor, RFID reader are embedded. Due to these features, the Raspberry pi controller is integrating with the cloud server for real time monitoring of the home surveillance.

### 2.1. Pi Camera

Raspberry Pi camera is useful for capturing high definition images. It connects to the CSI port on the Raspberry Pi via a 15 cm ribbon cable. This pi camera is implementing in many applications for visualizing the different activities.

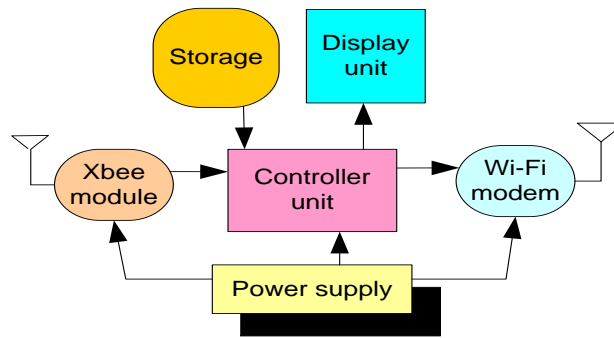
## 3. Description of Architecture

Home surveillance is gaining more popularity in present scenario for implementing automation security system. In this paper, we are proposing cloud server-based home surveillance and security system and it is shown in figure.1. The system comprises of Raspberry Pi controller, pi camera, PIR (Passive Infrared Sensor) and cloud server. With the assistance of PIR (Passive Infrared Sensor), the unusual human activities are detected. Now, the raspberry pi controller triggers the pi camera for capturing the visuals of the human activities.



**Figure 1. Architecture of Home Surveillance and Security System**

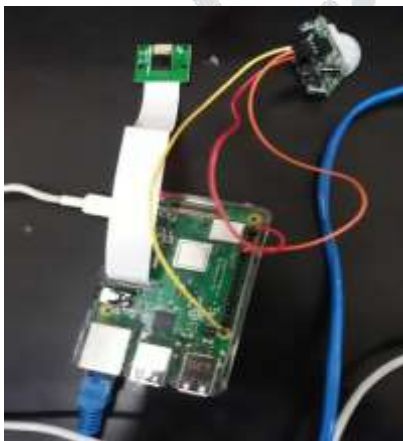
As Raspberry pi controller is integrating with the XBee module, the visuals of the activities is communicating to the local home controller. Local home controller is integrating with XBee module and Wi-Fi modem. In case of interruption in Wi-Fi, the local controller stores the information of the activities and sent it to the cloud server after the availability of the Wi-Fi connectivity.



**Figure.2. Architecture of Local Home Controller**

The local home controller unit is useful for storing and communicating the information to the cloud server via Wi-Fi modem and it is show in figure.2. The unit comprises of Xbee module for receiving the information from the raspberry pi node, display unit is useful for displaying the address of the information, storage unit act as back up storage for overcoming the loss of the data during transmission. Wi-Fi modem uploads the data to the cloud server for further assistance.

The real time implementation of this system is shown in figure.3 and figure.4. In figure.3, raspberry pi controller is integrating with different sensors and Pi Camera module. Figure.4 presents the python-based IDE for embedding the instructions to the raspberry pi controller through FTDI cable.



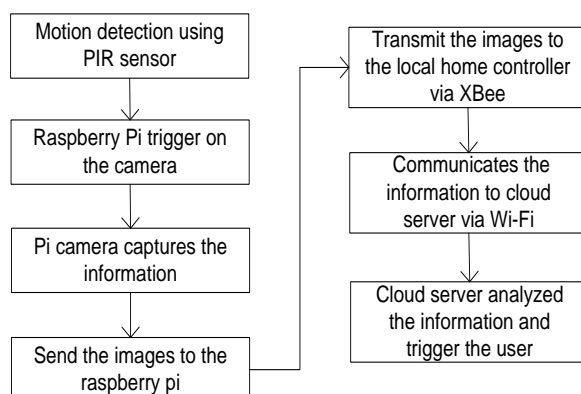
**Figure.3. Raspberry Pi with camera**



**Figure.4. Python based IDE**

**3.1. Flow chart**

Figure.3 shows the flow of the proposing home surveillance system. Initially the PIR sensor triggers the controller to power on the camera for visualizing the unusual human activities. The captured images are communicating to the cloud server via XBee and Wi-Fi connectivity. Cloud server analyse the information and trigger the alerts to the user in GMAIL and UI mobile app.



**Figure.3. Flowchart of Surveillance System**

## 4. Conclusion

Home surveillance and security system is necessity for enhancing the security system of the home. With the advancement of internet of things, every appliance is able to monitor via internet connectivity. By considering the advantage of internet of things, Raspberry pi controller and cloud server, a system is proposing for creating a smart security system. Through PIR sensor and RFID reader, the unauthorized user is detected, and the pi camera captures the image of the user. XBee communication and Wi-Fi modem communicates the information to the cloud server. With this system, the information regarding the images and activities are stored in the cloud server. As information is storing in the cloud server, it assists the user to track the activities on daily basis. Hence it improves the security system and can also monitor the home security system from any place with internet.

## References

- [1] Chowdhury, M. N., Nooman, M. S., & Sarker, S. (2013). Access Control of Door and Home Security by Raspberry Pi Through Internet. *Int. J. Sci. Eng. Res.*, 4(1), 550-558.
- [2] Sapes, J., & Solsona, F. (2016). Fingerscanner: Embedding a fingerprint scanner in a raspberry pi. *Sensors*, 16(2), 220.
- [3] Othman, N. A., & AYDIN, I. (2018, October). A New Deep Learning Application Based on Movidius NCS for Embedded Object Detection and Recognition. In *2018 2nd International Symposium on Multidisciplinary Studies and Innovative Technologies (ISMSIT)* (pp. 1-5). IEEE.
- [4] Nath, S., Banerjee, P., Biswas, R. N., Mitra, S. K., & Naskar, M. K. (2016, December). Arduino based door unlocking system with real time control. In *2016 2nd International Conference on Contemporary Computing and Informatics (IC3I)* (pp. 358-362). IEEE..
- [5] Pavithra, D., & Balakrishnan, R. (2015, April). IoT based monitoring and control system for home automation. In *2015 global conference on communication technologies (GCCT)* (pp. 169-173). IEEE.
- [6] Stojanovski, H., Bogatinoska, D. C., Salem, A. B. M., & Srebrenkoska, V. (2017, December). Practical, cheap Smart Home implementation with general purpose embedded hardware Raspberry Pi. In *2017 Eighth International Conference on Intelligent Computing and Information Systems (ICICIS)* (pp. 335-341). IEEE.
- [7] Ansari, A. N., Sedky, M., Sharma, N., & Tyagi, A. (2015, January). An Internet of things approach for motion detection using Raspberry Pi. In *Proceedings of 2015 International Conference on Intelligent Computing and Internet of Things* (pp. 131-134). IEEE.
- [8] Patchava, V., Kandala, H. B., & Babu, P. R. (2015, December). A smart home automation technique with raspberry pi using iot. In *2015 International Conference on Smart Sensors and Systems (IC-SSS)* (pp. 1-4). IEEE.
- [9] Frank, A., Al Aamri, Y. S. K., & Zayegh, A. (2019, January). IoT based Smart Traffic density Control using Image Processing. In *2019 4th MEC International Conference on Big Data and Smart City (ICBDSC)* (pp. 1-4). IEEE.
- [10] Kamelia, L., Effendi, M. R., & Pratama, D. F. (2018, July). Integrated Smart House Security System Using Sensors and RFID. In *2018 4th International Conference on Wireless and Telematics (ICWT)* (pp. 1-5). IEEE.
- [11] Wadhvani, S., Singh, U., Singh, P., & Dwivedi, S. (2018). Smart home automation and security system using Arduino and IOT. *Int. Res. J. Eng. Technol.*, 5(02), 1357-1359.
- [12] Balani, S., Swathi, B., & Shrestha, N. B. (2018). Survey on home security surveillance system based on wi-fi connectivity using Raspberry Pi and IOT module. *International Journal of Advanced Research in Computer Science*, 9(2), 452.
- [13] Jain, A. K., Sharma, R., & Sharma, A. (2018, October). A Review of Face Recognition System Using Raspberry Pi in the Field of IoT. In *Proceedings on International Conference on Emerg* (Vol. 2, pp. 7-14).
- [14] Kumar, K. K., Natraj, H., & Jacob, T. P. (2017, April). Motion activated security camera using Raspberry Pi. In *2017 International Conference on Communication and Signal Processing (ICCSP)* (pp. 1598-1601). IEEE.

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