

Development of Secured Home Automation using Social Networking Sites

M. R. Navya* and Prakash Ramachandran

School of Electronics Engineering, VIT University, Chennai - 600127, Tamil Nadu, India;
rajareddigari.navya2013@vit.ac.in, prakash.r@vit.ac.in

Abstract

Background/Objectives: Home automation is becoming more important day by day due to its numerous advantages. Home automation technology provides essential security to homes and associated control operations. This paper deals with the design and implementation of secure home automation using Raspberry Pi. **Methods/Statistical Analysis:** The proposed technology is to design a basic home security application on Raspberry Pi through reading and posting of messages in social networking sites. This data can be shared to authorized user via social networking sites to achieve home automation. **Findings:** Raspberry Pi board is a flexible embedded processor and with the support of open source packages the required camera system and systems for Facebook management and one time pass word management are implemented. The GPIO pins are sufficient for external control. **Conclusion/Improvements:** The system developed provides user friendly automation for security of home using Facebook and can be enhanced in future using bio metric authentication.

Keywords: Home Automation, Real Time Control, Social Networking Sites, One Time Password , Raspberry Pi

1. Introduction

The Automated security system is very useful for today's various applications like home and banks where the authorized security is a critical issue. The paper aims at designing a smart embedded system for secured applications. High security is an extremely important feature and the Raspberry Pi has the ability to provide that. The Raspberry pi is a small sized single board computer which is capable of performing various functionalities in automation systems, surveillance systems, military applications, etc. The design is combination of automation and camera security system with low cost. This setup is a high security automated system with camera using a Raspberry Pi.

Raspberry Pi is used to develop the system because Raspberry Pi is a single board computer and it has the highest performance to cost ratio. It is one of the smallest

and useful single board computers available in the market. The software which is present in the board consists of a standard programming language compiler and the boot loader that runs on the board. Raspberry Pi equipment uses Linux kernel-based operating system.

This automation is a link up with social networking sites. User can monitor from the remote place i.e. bank or home and can control using social networking sites. Proposed system is designed as a general purpose application. As a proof of concept, home automation through social networking sites considered for implementation.

2. Background Work

A several examples are available in the literature survey for home security automation. Many automated systems has been developed which informs the owner in a remote location about who comes to the house. However, the

*Author for correspondence

proposed system looks into the development of embedded system which sends an image to user and user can control it. Modern developments in the area of home automation have shifted the technology away from the realms of study and into the homes of consumers. Together with the rapid implementation of the internet anywhere and anytime accessible home environment has been brought closer to reality. Security challenges arise from making the home environment accessible to anyone with internet access from anywhere. Hence, providing sufficient security to offer a reasonable level of protection for homeowner's privacy and safety is crucial for successful adoption of this technology. This study examines the security issues raised by the anywhere and anytime accessible home environment¹.

Performance evaluation of wireless home automation networks in indoor scenarios². The developed system has large no. of sensors like temperature humidity, pressure, noise, dust and pressure. The system can continuously update the data to the internet using wireless sensor networks. The design of home automation as the application on Raspberry Pi through reading the subject of email and the algorithm for the same has been developed in python environment which is the default programming environment provided by Raspberry Pi.

Using Raspberry pi other important application is developed for the home automation which can be controlled through internet i.e. by reading the subject of the received mail the board can perform the actions according to the subject. The switch which is corresponds to home appliances can be turned off by sending mail with subject "OFF" to the raspberry Pi board. This work consists of two more switches which can be controlled by sending mails which are having the subject of "ON2" and "ON3" to turn on the switch2 and switch3 respectively. Using Raspberry pi another system is designed which integrates the cameras and motion detectors into web application³. This system provides easy access to the remote user with the help of mobile application to control their home appliances in secured way.

The other approach instigated a hardware design of smart home energy management system⁴ which includes applications such as communication, sensing technology. This design consists of sensors to detect human activities and machine-learning algorithm is implemented accordingly with the help of this data. This implementation helps users to reduce the total electricity payments without any human involvement. Raspberry contains

the software to detect the motion by using camera module, will be enable to capture the image as well as live streaming. A python script directs the Raspberry Pi to send email notifications every time when the motion is detected. There is another application designed which is sensor based Surveillance monitoring system developed using Raspberry Pi⁵. Another approach implemented java based home automation system to monitor and control the home appliances based on java server pages⁶. In this PIR Sensor is used to detect the motion. In this Raspberry pi operates and controls video cameras and motion detectors for live video streams, remote sensing and smart surveillance. This approach is to use social networks as communication medium for security, which has not been reported in literature survey.

3. System Design

The required hardware to build the system is as follows

- Raspberry Pi Model B+
- Web Camera which is compatible with the board -5Volts 1A power supply
- Micro SD memory card and an output device like LED.

Proposed system is a generalized embedded system so the output is indicated with the help of LED which can be changed to different output devices like relays, door control, motor control etc. Figure 1 describes the block diagram of the proposed system. This setup consists of input device as web camera, and output device as LED. Controlling is done with the help of social networking sites.

The components required to build the system and developed modules are listed below.

3.1 Raspberry Pi

Raspberry Pi B+ model is chosen because it is inexpensive, widely supported for the client needs⁷. Raspberry Pi Model B+ has 512 Mb RAM, 4 USB ports and an Ethernet port. Raspberry Pi model B+ has 26 GPIO pins out of 40. Using GPIO pins it is possible to control the output hardware devices like LEDs motors and relays. Regarding input devices, raspberry pi can access the keypad, switches. GPIO pins can read the data from sensors like temperature, light, motion and proximity sensors. Some GPIO pins also have an alternate function like UART, SPI and I2C etc. Various functionalities of the components are given below.

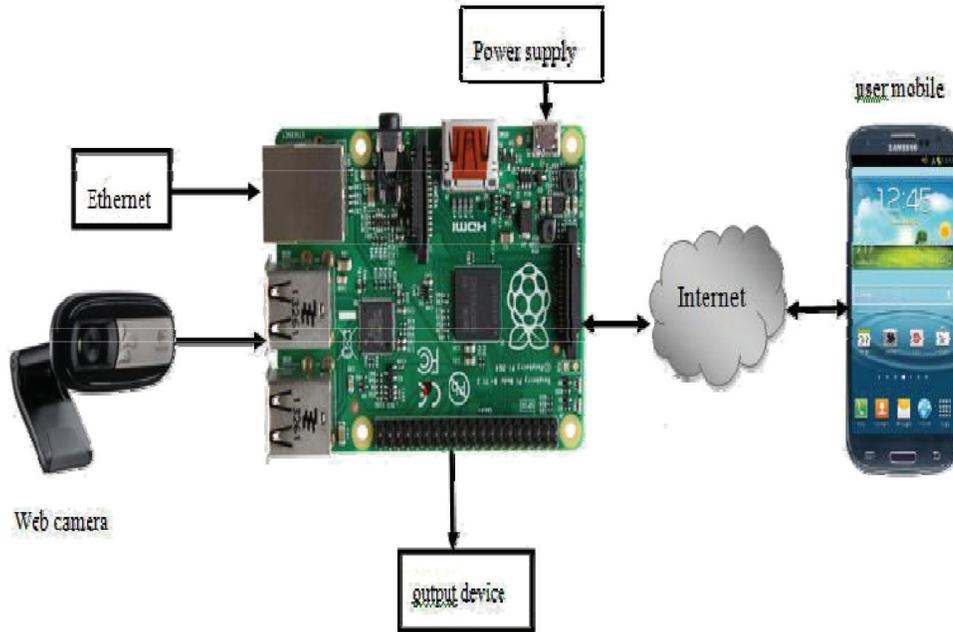


Figure 1. Block diagram of system.

- SD Card is used to install OS and long term storage. The total memory of the SD card is about 4GB. Micro USB Power cable is used to give the power supply. It provides 700 mA at 5V.
- Ethernet Port is used to connect board with the laptop and for the internet.
- GPIO pins can allow to control and interact with real world.

3.2 Configuration of Camera

Raspberry Pi supports different types of video capturing devices like USB webcams and wireless cameras. Proposed system consists of a USB web camera as input device. The camera chosen to develop the system is small and easy to configure. To configure the camera, enable camera drivers and install required packages which are able to take photo. It takes the image and stores that image in working directory. This data storage and retrieval of taken images are stored in memory card of the board and these images can be shared to the user⁸.

3.3 Home Security with Internet

This work is an attempt to combine home automation and home security into one application⁹. The developed system communicates with the internet using Wi-Fi. To work with the internet it is needed to set an IP address to the board. When the user sends a message to the system,

then system will compare with the default stored message and it will notify the camera system to take image and send it to the user. For high security purpose system would be generate a onetime password which can be send to registered mobile number and it will valid up to T seconds. Based on user requirement T can be changed.

3.4 Installed Packages

To design this system board need to install some packages which are given below. Streamer: This is used to take the snapshots from web camera and the syntax is as follows.

```
Streamer -f jpeg -o name.jpeg
```

In this image can be stored in current working directory with the format of jpeg with name given in syntax. Fbcmd: This command is used to check the Facebook from command line. The syntaxes which are used in the program are as follows.

fbcmd INBOX unread: It is used to check the unread messages in Facebook.

fbcmd ADDPIC image.jpeg 'description': This is used to send the images to the user

Smscmd: It is used to send text messages for mobile number from command line. Syntax is as follows. smscmd1 'message' 'mobile number' 'mailid@gmail.com' 'password'.

Here mail ID and password is about what the user given at the time of registration to work with this command.

4. Design and Implementation

Proposed system took an application which enables the user to open his door remotely after conforming the face identity of a person who is standing before his home door. As the security measure OTP is used to associate with user’s mobile phone which can be generated and sent automatically.

4.1 Hardware Connections

Figure 2 shows hardware setup of the proposed system. Raspberry board and laptop connected with the help of Ethernet cable. Web camera is interfaced with the Raspberry Pi and the output device LED is connected to GPIO pin of board.

The control flow is explained with the help of flow-chart given in Figure 3.

4.2 Control Flow

Figure 3 shows the control flow of proposed system. The code for implementing the control strategy for home security was written in shell scripting in Raspberry Pi¹⁰.

Initially, the program was set to initialize the system and start checking of incoming messages. Raspberry Pi starts reading the subjects of messages from the account. The subject of the messages is compared with the default subject (default subject is already defined) and the control



Figure 2. Hardware setup of the system.

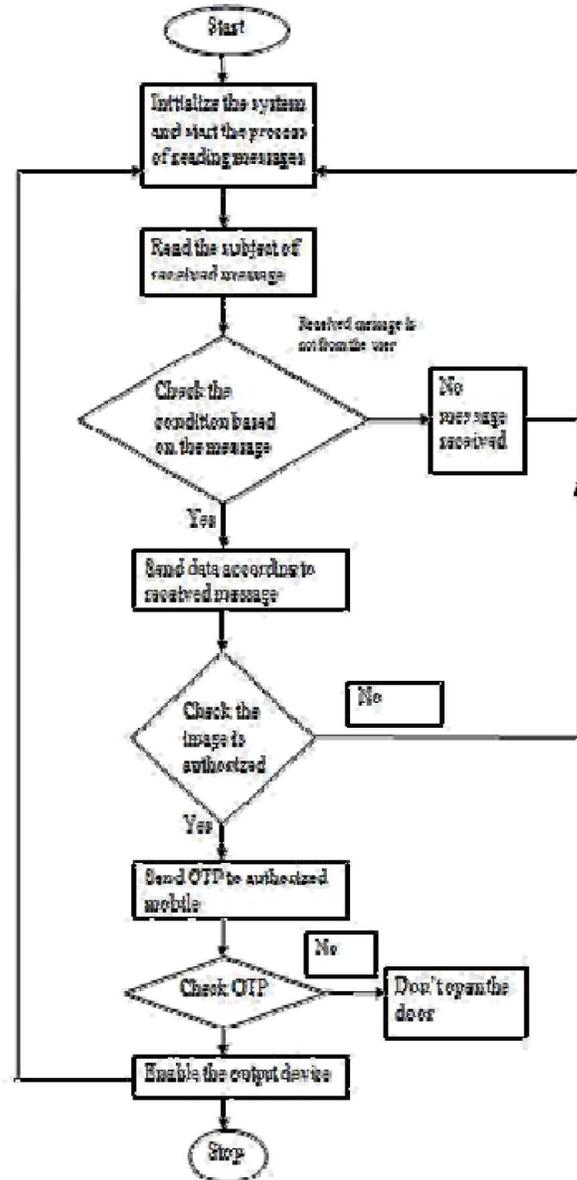


Figure 3. Control flow of the program.

signal is generated according to user’s message i.e. if the incoming message is ‘image’, raspberry Pi generate a control signal to take image and send to the user. Along with image system sends OTP to user’s mobile. Then user sends the password to system and it compares it with generated OTP. If it matches, board gives a control signal to GPIO pins to enable the required pin. This structure is looped for checking new messages continuously. Proposed system is designed for a general purpose application. Some key modules are developed in the system. So any application can be developed by integrating the developed modules. The developed modules are as follows

- Camera module
- GPIO communication
- Automatic internet access
- OTP generation through free SMS.

5. Results

When the system started running, it continuously checks the messages from the user. According to user's message it takes the image and sends it to the user's Facebook. User can see the image from remote location.

Figure 4 shows the image which sent to user. After sending the image system generates onetime password

which is valid for T seconds and send it to the user mobile number. Based on receiving the password user can control the system by sending OTP to the board. System will wait until OTP has received i.e. proper delay is provided. If the OTP matches board gives a control signal to glow led which is connected to GPIO pins of the board.

Figure 5 shows the controlling output device LED from the remote place. The total system flow is follows like this. If the message is from the user then system reads the subject of that message. According to the subject system sends data to the user. Proposed system send image of the person to the user who is in front of the door. Along with the image system send one time password to the

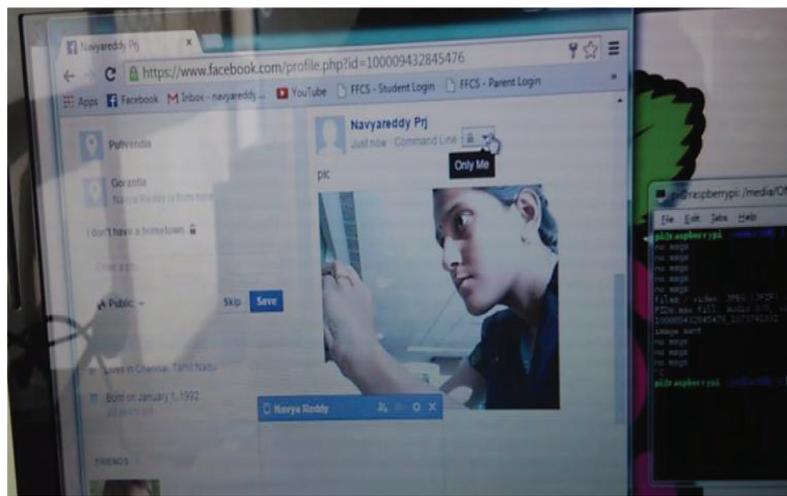


Figure 4. Image sent to the user.

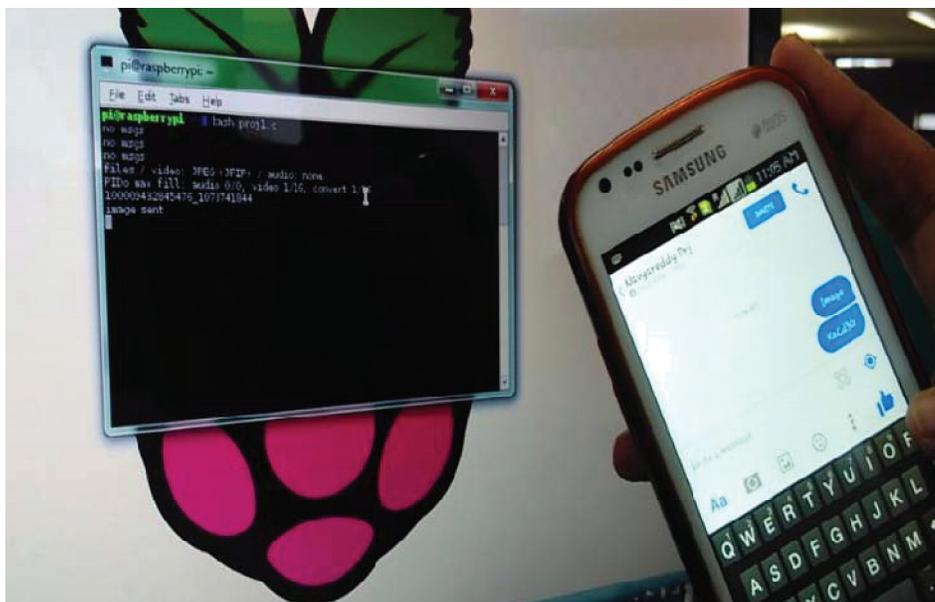


Figure 5. Sending back OTP to the system from Facebook.



Figure 6. Total output of the system.

users mobile. If the user wants to open the door password can be sent back to the system. Proper delay should be provided for the user to send back OTP to the system. If the password matches with generated OTP system can give control signal to the GPIO pins of Raspberry Pi. LED will be glowing which is connected to the GPIO pins. LED glows for some time and it goes to off position. Figure 6 shows the total output of the system.

6. Conclusion

The aim of this design is to create a security interface to a smart phone device through social networking sites that is very simple to use. Here the automation and security aspects are achieved through the usage of web camera and the mobile device. The system is able to enable a pin to lock or unlock a door from remote location by a message from Facebook. This system provides a user friendly automation and security application for homes. The work can be extended with biometric authentication to enhance more security.

7. References

1. Gill K, Wang W-L. Secure remote access to home automation networks. *IEEE Journal IET*. 2013; 7(2):118–25.
2. Langhammer N, Kays R. Performance evaluation of wireless home automation networks in indoor scenarios. *IEEE Journal*. 2012 Dec; 3(4):2252–61.
3. Jain S, Vaibhav A, Goyal L. Raspberry based interactive home automation system through E-mail. *ICROIT*; Faridabad; 2014 Feb 6-8. p. 227–80
4. Hu Q, Li F. Hardware design of smart home energy management system with dynamic price response. *IEEE Transactions on Smart Grid*. 2013 Dec; 4(4):1878–87.
5. Subbaraja K, Viswanathan C. Secured smart home energy monitoring system using raspberry pi. *JATIT and LLS*. 2014; 66(1):305–14.
6. Al-Ali AR, Al-Rousan M. Java based home automation system. *IEEE Transactions on Consumer Electronics*. 2004; 50(2):498–504.
7. Ali M, Vlaskamp JHA, Eddiny NN, Falconer B, Oram C. Technical development and socioeconomic implications of Raspberry as a learning tool in developing countries. *5th Computer Science and Electronic Engineering Conference (CEEC)*; Colchester; 2013 . p. 103–8.
8. Saito T, Tomoda I, Takabatake Y, Ami J, Teramoto K. Home gateway architecture and its implementation. *IEEE International Conference on Consumer Electronics*. 2000; 46(4):1161–6.
9. Kushiro N, Suzuki S, Nakata M, Takahara H, Inoue M. Integrated home gateway controller for home energy management system. *IEEE International Conference on Consumer Electronics*; Tokyo; 2003. p. 386–7.
10. Yoon D, Bae D, Ko H, Kim H. Implementation of home gateway and GUI for control the home appliance. *The 9th International Conference on Advanced Communication Technology*; Gangwon-Do; 2007. p. 1583–6.