

IOT Based Control and Security System using Embedded Linux Board

^{#1}Mr. Nitesh Nakate, ^{#2}Ms. Sukanya T. Titame, ^{#3}Ms.Snehal Mane,
^{#4}Mrs. Kalpana Amrutkar



¹nakatenitesh@gmail.com,
²sukanyatitame@gmail.com,
³snehalmane800@gmail.com,
⁴kalpana.amrutkar@sinhgad.edu

^{#123}Dept. of Electronics & Telecommunication,
^{#4}Professor of Dept. of Electronics & Telecommunication

RMD Sinhgad School of Engineering Pune, India.

ABSTRACT

Automation is a technique of controlling a process by electronic devices with reducing human involvement to a minimum. As the technology is advancing everyone tries to automate most of the possible things to take advantage in providing ease in life, secure and save electricity. The paper deals with the design and implementation of smart and secure surveillance home automation using Raspberry pi, Webcam and various sensors via IoT. The introduced system operation is supported by WiFi module which enables the image transmission to the owner. The project presents a low cost and flexible home control and monitoring system using an embedded microcontroller, with IP connectivity for accessing and controlling various devices and appliances remotely using Smart phone application.

Keywords- Internet of Things, Raspberry pi, WiFi, Home automation.

ARTICLE INFO

Article History

Received: 6th January 2017

Received in revised form :

6th January 2017

Accepted: 9th January 2017

Published online :

15th January 2017

I. INTRODUCTION

Today, technology has become an vital part of our lives. It has, and continues to influence many aspects of daily life and has allowed better social interaction, ease of transportation, the ability to indulge in entertainment and media and has helped in the development of medicine. The creation of many devices such as mobile phones and computers have caused many people to rely on technology to communicate with their friends, store information such as pictures, movies, documents, and music. The internet has become a common interface that many devices use in order to simplify the daily life of many people. Internet helps us to bring in with immediate solution for many problems and also able to connect from any of the remote places which contributes to overall cost reduction and energy consumption.

The Internet might even be utilized in home automation that offers several decisions from economical use of energy to additional console, protection and safety. Even over great distances the user can monitor and manage their home gate, various appliances without any human intervention. Despite these advantages, home automation has however received extensive approval and an attention owing to its high significance and complexness [1]. This paper will describe an approach in which we implement a controlling and continuous monitoring system to control various home appliances with Android smart phone.

In this article we are focusing on how to do home automation that could be done by a common person. By common person we mean someone who has a basic knowledge in programming and electronics, but he/she should have average level of using of computers. This could be a student at high school or university, an engineer, or any kind of profession with do it yourself enthusiasm etc. Using Raspberry Pi is one way to do first steps in home automation that can be done by common person.

II. INTERNET OF THINGS

The Internet of things (IoTs) can be defined as connecting the various types of objects like smart phones, personal computer and Tablets to internet, which brings in very newfangled type of communication between things and people and also between things. With the introduction of IoTs, the research and development of home automation are becoming popular in the recent days. Many of the devices are controlled and monitored for helps the human being. Additionally various wireless technologies help in connecting from remote places to improve the intelligence of home environment. An advanced network of IoT is being formed when a human being is in need of connecting with other things. IoTs technology is used to come in with innovative idea and great growth for smart homes to improve the living standards of life.

A. IoT Architecture

The IoT-based architecture provides high-level flexibility at the communication and information. It is an approach which is relevant in many different environments such as patient monitoring system, security, traffic signal control or controlling various applications. The IoT project aims to bring out the various opportunities of using IPv6 and other related standards to overcome the disadvantages using of the Internet of Things [2]. The IoT projects proves a dominant and thorough study of all sensible functionalities, mechanisms and various protocols that can be used for building IoT architectures however interconnections may occur between all totally different IoT applications. As in the networking field, where several solutions emerged at his infancy to leave place to a common model, the TCP/IP protocol suite, the emergence of a common reference model for the IoT domain and the identification of reference architectures can lead to a faster, more focused development and an exponential increase of IoT related solutions. These solutions can provide a strategic advantage to mature economies, as new business models can leverage those technological solutions providing room for economic development.

III. PROPOSED SYSTEM

Every user who is experienced in the existing system may think of a system that may add more flexibility and run with some common applications such as android. This work is designed in such a way to avoid the disadvantages of the existing system.

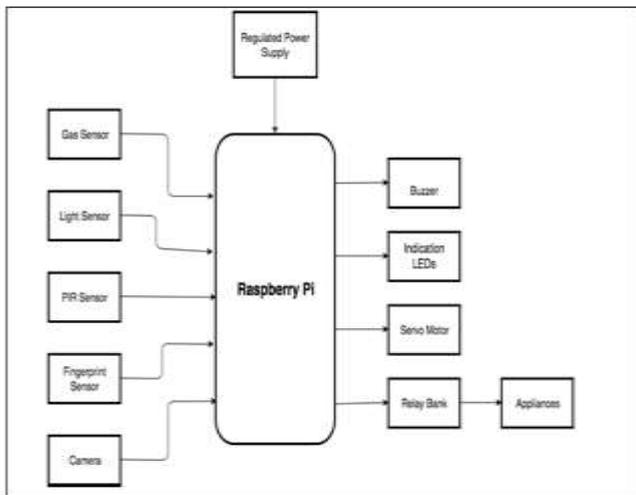


Fig.1. Block Diagram of proposed system

The proposed system supports more elasticity, comfort capacity and safety. The main objectives is to design and to execute an cost effective and open source home automation system that's capable of leading most of the home and sustain the house automation system. The predictable system contains a great elasticity by using wireless reliable technology to interconnecting various modules to the server of home automation system. This in turn reduces the deployment cost; will add to the flexibility of advancement, and system reconfiguration. The projected system can make use of wireless LAN(Local space Network) connections between various sensor, hardware modules and server, and various communication protocols between users and

server[3]. The block diagram of the proposed system is shown in figure 1. The main aim of our project is to provide security to the home. For this purpose we have used fingerprint sensor and webcam initially outside the door. Some fingerprints will be stored of the owner and his family members living in there. Now if the fingerprint gets matched the servo will become ON and the door gets opened. In the case if the person is outsider i.e. unknown then the image will be captured through web cam and will be sent to the owner. Thus in this case door stays closed as servo is OFF. Hence helps us in giving maximum security.

When the person enters into the house the sensor named PIR is used to detect his presence. Then LDR is used for lights ON/OFF. If there is darkness in the room the lights will get ON, else light will stay OFF. Also the application that can be implementing is that of fan. Thus we are not only providing the security but also controlling the ac home appliances that will provide human ease and comfort.

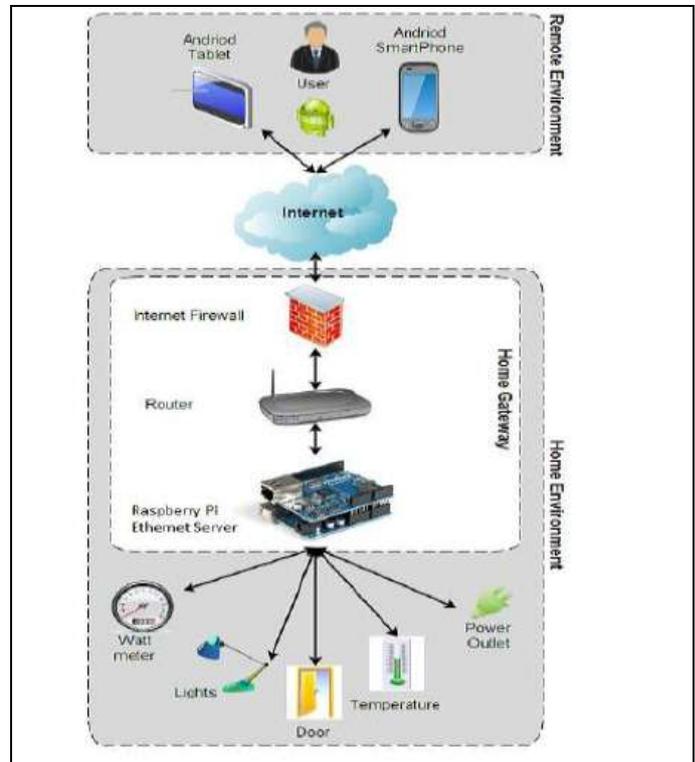


Fig.2. Hardware block diagram

Suppose at some instance if the gas leakage occurs and no one's there, so what to do?? The solution to this is the sensor will detect the amount of smoke/gas and thus servo motor will get ON creating beep sound as an alarm to the neighbours. Hence the system will now get access to everyone and the message will be delivered to the owner.

For controlling appliances we use web sever which is fetched from Raspberry pi (Apache). The server will be interfaced with relay hardware circuits that control the appliances running at home. The algorithm is developed in Python language, which is default programming language of Raspberry Pi.

IV. SYSTEM DESIGN

I. RASPBERRY PI

Raspberry Pi (Figure 2) is a simple one-board computer (device) on sale since February 29, 2012 [4] for 30\$. So it is a good candidate for cheap option to build home automation around it. Raspberry Pi is small device so it does not take much space and it does not use up much electric energy. Raspberry Pi is open to be used with many operating systems (OS), but mostly it is used with some Linux OS distribution (e.g. Raspbian). Linux versions prepared for Raspberry Pi can be downloaded from the Raspberry Pi home page [5]. Raspberry Pi is constantly upgraded and current there are five versions of Raspberry Pi: Model A, Model A+, Model B, Model B+, and Model B – generation 2. There is also a compute module that can be used for more professional work. Raspberry Pi software is mostly open source and various programming languages can be used like C, C++, Python, and Java. Almost half of them have been written in Python.



Fig.3 Raspberry Pi

This is not oddly because from the beginning Raspberry Pi has been promoted as “little device that enables people of all ages to explore computing, and to learn how to program in languages like Scratch and Python.”

II. DIFFERENT SENSORS

Fingerprint sensor and Webcam

We have used fingerprint sensor and webcam initially outside the door. Some fingerprints will be stored of the owner and his family members living in there. Now if the fingerprint gets matched the servo will become ON and the door gets opened. In the case if the person is outsider i.e. unknown then the image will be captured through web cam and will be sent to the owner.

LDR and PIR Sensor

When the person enters into the house the sensor named PIR is used to detect his presence. Then LDR is used for lights ON/OFF. If there is darkness in the room the lights will get ON, else light will stay OFF.

Gas Sensor

The sensor will detect the amount of smoke/gas and thus servo motor will get ON creating beep sound as an alarm to the neighbours. Hence the system will now get access to everyone and the message will be delivered to the owner.

WEB SERVER

Various applications located at home can be remotely controlled or monitored by implanting the devices with the web server. The static and dynamic information are stored in embedded system and it fulfils the demands on web browsers. Such type of web servers are called embedded web server.[6]. It's not solely that we will use the Raspberry Pi to induce the information from servers via the web; however it also can act as a server itself.

There are many alternative web servers that may be installing on the Raspberry Pi. Ancient web servers, like Apache, serve the files from Raspberry pi board to purchasers. Raspberry pi also can serve sound, video, workable programs, and far a lot . However, there's a new breed of tools that reach programming languages like Python, Ruby, and JavaScript to make net servers that dynamically generate the hypertext mark-up language once they receive communications protocol requests from an online browser. A sample web page is shown in the Fig. 4.



Fig.4 Sample web page

V. IMPLEMENTATION DETAILS

The implementation of this work starts with selecting the operating system that we prefer. In this project we have selected raspbian operating system [7]. Now, we have to boot the operating system that we have selected with the necessary configurations. The various configurations which can be done are such as changing the password for default user, choosing whether to boot into a desktop environment, scratch, or the command line, enabling camera etc. The configuration settings are done according to the users need.

VI. CONCLUSION AND FUTURESCOPE

In this paper, we have introduced the event of a home management and security system exploitation using Raspberry pi and Internet of Things technology. The system is suitable for real-time home safety monitoring and for remotely controlling the home appliances and protection from fire accidents with immediate solutions. Present paper sought to design a smart home using various sensors to be controlled and monitored by the Raspberry Pi via the IoT. It is focused on two aspects of smart home i.e. home security and home automation. The system may be employed in many places like server room security, greenhouse control and condition measurement. Proof may be given to the safety department if any theft issue happens.

Full functionality of prototype indicates that devices like Raspberry Pi can play very important role in designing smart home of the future at very low cost. An energy aware smart home can be developed using Raspberry Pi and other sensors.

VII. ACKNOWLEDGEMENT

We also convey our sincere thanks to our guide Prof. K. J. Amrutkar for her invaluable suggestions and for her technical support rendered during the course of our project.

We would like to thank all faculty members and staff of the Department of Electronics and Communication Engineering, RMDSSOE for their generous help in various ways for the guidance of this project.

REFERENCES

1. Al-Ali, Abdul-Rahman, and Mohammad Al-Rousan. "Java-based home automation system." *Consumer Electronics, IEEE Transactions on* 50.2 (2004): 498-504.
2. Kelly, Sean Dieter Tebje, Nagender Kumar Suryadevara, and Subhas Chandra Mukhopadhyay. "Towards the implementation of IoT for environmental condition monitoring in homes." *Sensors Journal, IEEE* 13.10 (2013): 3846-3853.
3. Zhang, Weizhe, and Baosheng Qu. "Security Architecture of the Internet of Things Oriented to Perceptual Layer." *International Journal on Computer* 2 (2013): 2-13.
4. BBC, "The Raspberry Pi computer goes on general sale," 2012. [Online]. Available: <http://www.bbc.com/news/technology-17190918>. [Accessed: 01-Jan-2015].
5. Raspberry Pi Foundation, "Raspberry Pi," 2014. [Online]. Available: <https://www.raspberrypi.org/>. [Accessed: 17-Apr-2015].
6. Fang, Shifeng, et al. "An Integrated System for Regional Environmental Monitoring and Management Based on Internet of Things." *IEEE Trans. Industrial Informatics* 10.2 (2014): 1596-1605.
7. Download the Required Operating System in <http://www.raspberrypi.org/downloads/>.