HOME AUTOMATION USING IoT

Bushra Patni[1], Aditya Parandekar[2], Panchapushpa Shetty[3], Aishwarya Vhatkar[4], Prof. D. S. Kale[5]

[1234] *Student, Computer Engineering, Rajiv Gandhi Institute of Technology, Maharashtra, India*
[5] *Faculty, Computer Engineering, Rajiv Gandhi Institute of Technology, Maharashtra, India*

ABSTRACT

Home Automation aims at making our lives as comfortable as possible. IoT allows us to complete important tasks & share information while a person is busy performing other activities. Due to the proliferation of Internet users, it has become important, almost prudent, to have technologies that make use of the Internet. Home Automation using IoT enables us to connect various home appliances & devices with each other by making use of the Internet. This helps to conserve human energy & electricity thereby aiding our everyday lives with ease. Our project presents a Home Automation System using Raspberry Pi which operates on WiFi technology. It deals with controlling various home appliances efficiently & in a user friendly manner. This system will allow us to control devices remotely from anywhere around the world. The key objective is to make a cost efficient system in order to control home appliances from anywhere thus saving human effort & energy.

KEYWORDS*- Home Automation, IoT, Raspberry Pi, WiFi.*

1. INTRODUCTION

Developing systems that make use of the Internet has become very popular aided by the fact that we live in an Internet driven society. Today the use of WiFi & internet services has become a major part & parcel of the metropolitan society & has catapulted technological advancements especially in the domain of automated systems. Automated systems are preferred because it gives the user complete control & liberty to access the given devices at any time or place without physically being present to operate them. This also gives way for cost efficiency & user friendly interaction with various devices. It provides a safer way to operate home appliances & even reduce the consumption of electricity. Suppose we leave the fans & lights in a hurry & remember later we could always directly operate it through phones or tabs. We could switch on the air conditioner minutes before reaching home so that our rooms are cool when we enter. It also covers security concerns. Burglary alarms or smoke detectors can be installed to detect mishaps if any.

1.1 DESCRIPTION

Due to various technological advancements, present day home automation makes use of PC based servers. Firstly, devices are required to be interfaced to these PC's for purpose of controlling the governed parameters. The production cost of the system increases & more energy is consumed as the systems server is constantly kept on. To solve this problem, we use "Embedded web server" in place of "PC based server".
An embedded web server can be designed by the implementation of Ethernet standards & by using Raspberry Pi. Communication takes place by embedding Ethernet standards in the Pi. Remotely controlling devices is possible because of this server. All it requires is a local web browser & IP address of the Pi.

1.2 PROBLEM FORMULATION

By means of internet connection, we can control devices from anywhere making the Home Automation System a viable system. In the system that we present, Home Automation using Raspberry Pi employs wireless communication that provides remote control over various domestic appliances. Gas sensor is used in order to detect gas leakage. The system is expandable since it allows a large variety of devices to be controlled.

1.3 MOTIVATION

The motivation behind this project is the large utility of the wireless technology and internet of things concept for controlling various parameters in varied areas. The various parameters of our home can be supervised from a very long distance by users without being personally present on site to control that particular device. It will be of great

use at the time where a dangerous situation has taken place & the admin is not available; instead now they can monitor their house automatically.

1.4 ADVANTAGES OF OUR SYSTEM

The advantages of our system are as follows:

1. Reduced Cost- The cost of the implemented system decreases as we are using energy efficient components & wireless technology.
2. Reduced Response Time-Response Time decreases as we are making use of relay circuit which helps in automatic controlling.
3. Data transmission over the Internet- We will be able to transfer the acquired data via Internet which can be observed by the system admin as we are using the WiFi modem.

2. LITERATURE SURVEY

In the paper published by Bhuvaneswari.S & Sahaya Anselin Nisha.A design & implementation of web server is presented which is used for electrical equipment monitoring system. Raspberry Pi from Xbee is used for hardware design. Parameters such as gas are measured & transmitted to PC through serial protocol SPI. Received values in PC are uploaded in Internet by Ethernet cable. Client can monitor all devices in industry from remote places via its own local web browser by typing the IP address in the web server [1]. From this paper, we can infer that when embedded devices are provided with internet access, the demand will rise undoubtedly due to the remote accessing capabilities of the devices. Instead of monitoring, we have implemented the controlling of devices .In the paper authored by Eleni Isa & Nicolas Sklavos, the operation of the introduced system is supported by a GSM embedded mobile module, which enables the alert messages transmission to both mobile devices of end users. Their proposed system is implemented on a microcontroller module, through an embedded platform [2]. In our system, we have enabled the alert messages transmission in the form of emails to the end users. By the authors Ramlee, Ridza Azri & LEONG, their published paper the main control system implements wireless bluetooth technology to provide remote access from PC/laptop or smart phone. The design remains the existing electrical switches with low voltage activating method. The switches status is synchronized in all control system whereby every user interface indicates the real time existing switches status[3]. This system has helped to shed light on the importance of a user friendly interface & low cost design which is what we have adapted for our system as well. Through this survey, we were able to make a system which has low-cost, good openness, portability & is easy to maintain & update. It is possible to interface different kinds of sensors with these modules & make various applications.

3. HARDWARE AND SOFTWARE REQUIREMENTS

i. Gas sensor: A gas sensor recognizes the existence of gasses in a particular zone, regularly for security purpose. It is utilized to identify a gas leak and inform the same to the controlling devices. This gas sensor can also send the signal to alarm causing it to ring in the territory where the leakage is taking place. It also sends an email to the concerned person once the leakage is detected.

ii. Relay Circuit: A relay is a switch. It is electrically operated. It works on electromagnetic principle. Relays work the low control signals. Relays are used where it is important to maintain segregation between the controlling device and the device being controlled. By using relay we can control different circuits by using single signal. When current flows through the relay coil, it generates magnetic field inside it. This magnetic field attracts the lever and thus it changes the switch positions.

iii. Opto Isolator Circuit: It is an electrical circuit used to convert AC to DC that needs to be supplied to the RPI for controlling input and output voltages.

iv. Raspberry Pi: Selected Raspberry Pi module u**ses** Broadcom BCM2836ARMv7 Quad Core Processor which controls Single Board Computer running at 900MHz. It has 1GB RAM so can now run greater and all the more capable applications. It is HAT compatible. It has 40pin stretched out GPIO to upgrade “real world" projects. It has 10/100 Ethernet Port to rapidly interface the Raspberry Pi to the Internet.

v. Linux: Linux is basically a kernel. It is the basic software which gives low-level access to equipment. With help of this we can perform errands likewise transferring of information over the system, displaying graphical images, sound yields, beginning & halting programs, perusing & composing records and so on.

vi. Raspbian: Raspbian is informal port of Debian wheezy armhf with arrangement settings altered to generate a code that utilizes "hardware floating point", the "hard float" ABI and work on the RPi. The port is important on the grounds that the authority Debian wheezy armhf release is good just with forms of the ARM architecture later than the one utilizes on the Raspberry Pi.

vii. Python: Python is an object oriented programming language. It joins modules, exemptions, dynamic writing, high end dynamic information sorts, and classes. Python is a strong language which also provides clear linguistic structure. It has interfaces to numerous framework calls and libraries, different window frameworks, and is extensible in C or C++. It is likewise usable as an expansion language for applications that need a programmable interface.

4. PROPOSED SYSTEM

Here the sensors send the digital values to the Raspberry Pi. In Raspberry Pi Board coding is done using Python Language. Relay will be connected with the Raspberry Pi which will do the work of controlling. Raspberry Pi sees sensors value and accordingly it will give the instruction to the Relay circuit which will perform ON/OFF action depending upon requirement so as to control the device. This data will also be monitored by the user through the PC by using local browser raspberry pi's particular IP address. Gas Sensor attached to Raspberry Pi will detect any gas leakage and send an email to concerned person automatically. Here Raspberry Pi will be connected to the Wi-Fi which will send this data over the Internet by which the user will be able to see the data and can keep a watch on proper functioning of his system.

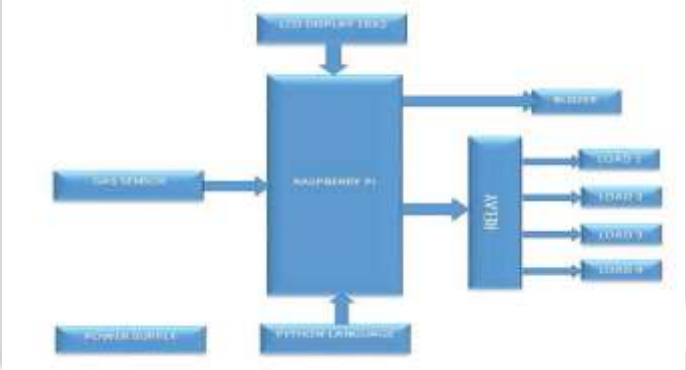

Figure 4.1: Block Diagram of Proposed System

5. IMPLEMENTATION

In the proposed home automation system, light and fan will be controlled so as to maintain the home environment. The devices will transmit the present value to the RPI. This action will be transmitted to the relay circuit. Relay circuit performs the action such as ON/OFF for the devices. Here the controlling action will be performed directly by the relay circuit so it will provide advantageous to the system as no human source will be required or forced for controlling. The components which are utilised to build this system are :- MQ6 Gas sensor, RBP board, Relay Circuit, Power Supply, WiFi modem, User machine. The programming language used is Python and for webpage desigining is Java Script.Working is shown with the following steps:

Figure 5.1:- Access to Pi by using Remote desktop connection

- Use android mobile and get ip address.
- Then enter IP address and press connects.
- Ignore warning or dialog boxes.

Figure 5.2 :- Entry IP address into RDC

- Then you will see the xrdp manager screen which will ask for username and password
- Username:pi
- Password: raspberry
- Press ok button and you will see this screen below.

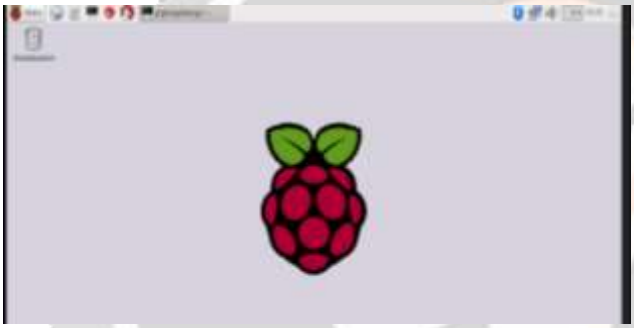

Figure 5.3: Entering into Pi's OS

Figure 5.6: Running the code

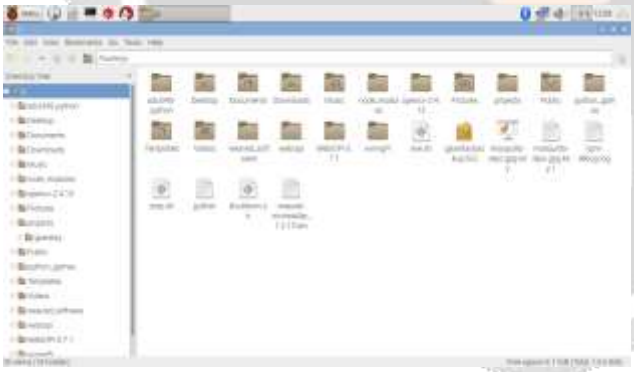

Figure 5.4: Selection of pi folder

Figure 5.7: Gas Sensor's Leakage Output

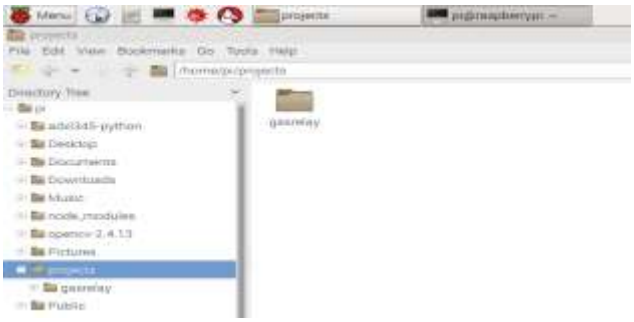

Figure 5.5: Selection of gas relay folder

Figure 5.8: Email is sent to client

Figure 5.9: Top View of Project

6. TEST RESULTS

TEST ID	Procedure	Expected Result	Actual Result	Pass?
1	Using Webpage, switch ON fan	Fan should switch ON	Fan is switched ON	Yes
2	Using webpage, switch ON light	LED should glow	LED glows	Yes
3	Using mobile, operate the webage from another room in the house	Devices should switch ON/OFF	Devices Switch ON/OFF accordingly	Yes
4	Spray aerosol near gas sensor	Buzzer should go off when gas is detected	Buzzer goes off on gas detection	Yes
5	Spray aerosol near gas sensor	Email should be sent on gas leakage	Email is sent with delay of 3 seconds to concerned person on gas detection	Yes

7. CONCLUSION:

The system employs the integration of hardware and software components along with wireless communication to provide users with remote control of devices present in their home. The home automation system using Internet of Things was implemented and has proven to give successful results. The system was tested by connecting simple devices like fan and light which were successfully controlled through the relay circuit connected with the Raspberry Pi board. This system supports a variety of devices that need to be controlled remotely as and when possible. The devices were controlled through a Webpage which helps user to check the status of various appliances anywhere anytime. The gas sensor was proven to be successful in detecting gas leakage and immediately alerting the user through continuous emails. The system thus implemented is low cost, secure, efficient and user friendly.

8. REFERENCES

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