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Implementation of Smart Home Automation System through E-mail using Raspberry Pi and Sensors

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Abstract: As the technology improves day by day everyone seems to automate most of the possible things to take advantage in providing ease in life, secure and save electricity. The main objective of this paper is to automate all the devices i.e. home appliances through E-mail using Raspberry Pi, as well as we can have the security for the system by using sensors like PIR, LPG, temperature sensors. So by using this system we can avoid the problems coming in day to day life. The algorithm is developed in Python language, which is default programming language of Raspberry Pi. The system sends the E-mail to the newly generated E-mail Id regarding current status of the devices. The output is stored in the E-mail Id. LEDs are used to indicate the switching action of the devices and sensors.

Keywords: Raspberry Pi, E-mail, LAN, Home Automation, Display, Sensors, Relay.

I. INTRODUCTION

Today the technology is getting improved and used for the ease in our day to day life. The life is getting automated for the simplicity, security, saving electricity and time. In this, home automation is the major things to automate the home appliances. Home automation can be done without human efforts. In home automation we can control the devices which can be ON and OFF with a single switch like fans, tubes, air conditioner, security of door lock system, also the sensor helps in gas leakage and saves electricity. It provides convenience, comfort, security and saves energy.

The idea of home automation is been coming from many years ago, it was started with connecting two wires to the battery and close the circuit with the load. Later many of the organization developed it with devices like actuators, sensors, microcontroller, buses and interfaces. Also it came with the two types of system depending on hardware systems and wireless systems. In hardware systems it includes the Ethernet, fiber optics, telephone lines and coaxial wires. This comes under the part of home automation. Now in wireless systems includes radio frequencies, Bluetooth, Wi-Fi. Now a days there are many new systems for home automation which includes hardware and wireless systems, as it is the combination of both the systems. This system will be having the hardware part and the software programming setup for the knowledge systems.

The home automation is getting expanded because of the new techniques, easiness and straightforwardness through the smart phones, internet and wireless communication.

Quality of services is getting improved by

Automation facilities provided through the Internet of Things.

There are many proposed systems for the home automation developed by different authors, so we can ON and OFF the home appliances. In that, [1] "Bluetooth Remote Home Automation System Using Android Application", the system is easy to install and cost effective. This system executes remote Bluetooth innovation to give remote access from PC or with cell phones. This system has few limitations that are less area coverage, less flexibility and security. [2] "Raspberry Pi based Interactive Home Automation System through E-mail", this system uses Raspberry Pi to control home appliances through E-mail. [3] "Design and Development of Activation and Controlling of Home Automation System through SMS using Micro-controller", this system uses 8051 controller and GSM module to control home appliances when user is at far distance from home. The system is too expensive and less reliable. [4] "Android Based Home Automation Using Raspberry Pi", this system automates through Android mobile using Wi-Fi as a communication network and Raspberry Pi acts as a processing unit. The system is too expensive and less reliable. [5] "Design and Implementation of Home Automation system using Raspberry Pi", the system is programmed to home appliances using Raspberry Pi through internet. Thus the system is complex and expensive. [6] "Control of Door and Home Security by Raspberry Pi through Internet", the system is designed to work a system is being created to join any entryway with the web, so that the entrance control that system can be controlled from anyplace on the planet. Thus the system is difficult to operate and highly expensive.

II. PROPOSED SYSTEM

The proposed system is designed to overcome the drawbacks of previous system and to improve security, flexibility, efficiency. The system is interactive to provide ease in day to day life, also saves electricity, human efforts. This system includes Raspberry Pi, sensors like LPG gas, PIR, temperature, HDMI display, LAN, relay board, Keyboard and mouse, comparator and driver. The proposed system block diagram is shown below.

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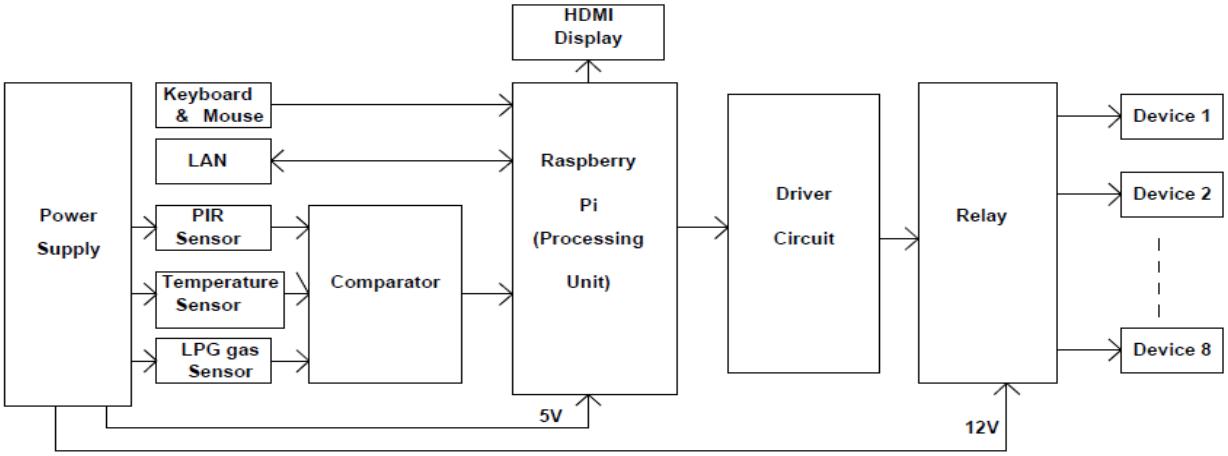

Fig.1. Block Diagram of Proposed System

III. IMPLEMENTATION

[i] Raspberry Pi:

The Raspberry Pi is a credit card sized, single board computer developed in the UK by the Raspberry Pi Foundation. The Raspberry Pi has a Broadcom BCM2835 System on a Chip (SoC), which includes an ARM1176JZF-S 700 MHz processor. It has an internal storage of 512 MB, external storage supported up to 32 GB, 1 Ethernet port, 4-2.0 USB ports, 1 micro SD card slot, DSI display connector, 1 HDMI out port, 1 CSI Camera connector, 5V USB power, RCA video and audio jack as shown in the below figure.

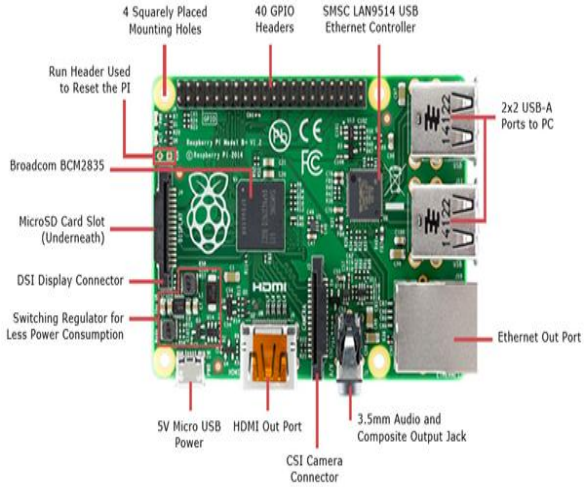

Fig.2. Raspberry Pi B+ Model

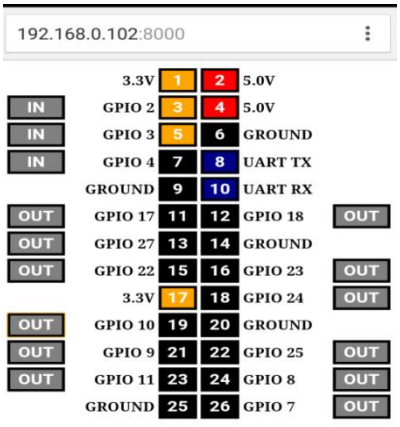

Fig.3. GPIO Header files of Raspberry Pi

The Raspberry Pi B+ model CPU is of ARM 11 family, operates at 700MHz. The GPU having Broadcom Video core-IV, open GLES 2.0, 1080p30, H.264/MPEG-4, AVC high profile decoder and capable of 1Gpixel/s, 1.5 G Texel/s (or) 24 GFLOPs of general-purpose (GPIO) compute. It operates 1mA at 5V power supply. With the help of GPIO pins we can control the devices sitting at home.

The IN and OUT pins of the GPIO are mentioned, shows the current status of the appliances.8 GPIO pins for external peripheral connections supported by Raspberry Pi. 2- 3.3V, 2-5V pins for power supply connected to the external devices. With the Python is a default programming language for the Raspberry Pi with support of C, C++, Java, Perl and Ruby.

[ii] LAN Cable (Local Area Network):

To access the internet in Raspberry Pi we need LAN connection, with the help of which we can access the incoming and outgoing E- mail services. The LAN speed is much faster than the wireless connection.

[iii] HDMI Display:

To see the current status of the home appliances as well as the sensors (LPG gas, PIR, temperature) and also we will able to check the updates regarding Raspberry Pi.

[iv] PIR sensor:

Passive Infrared sensor is to detect the motion of human being, as a human passes through this sensor, the temperature in the background will rise from room temperature to the body temperature and thus the motion or human will be detected.

[v] LPG gas sensor:

MQ6 is a Liquefied Petroleum Gas detector sensor, which is highly sensitive to LPG and iso-butane. It gives fast response. With the help of this the gas leakage can be identified.

[vi]Temperature sensor:

LM35 is used as the temperature sensor, precision integrated circuit temperature sensors, whose output voltage is linearly proportional to the Celsius temperature. It has many features like 0.5°C accuracy guarantee able, suitable for remote applications, low cost due to wafer level trimming, operates from 4 to 30 volts, less than 60mA current drain.

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[vii] Keyboard and mouse:
Key board and mouse are used to operate the Raspberry Pi, so we can easily do the programming and make changes easily.

[viii] Relay Board:
Relay is an electrically controllable switch which is used in industrial controls, automobiles and home appliances, because of their relative simplicity, long life, and proven high reliability. In the proposed system we are using 8-channel relay for switching and controlling the devices, having 8 independently controlled relays. The Control signals use +5V logic levels and is of TTL compatible.

[ix] Comparator:
Comparator will take in input from the sensors and will compare it with the given voltage limits for the defined sensors. Accordingly the output will be given to the Raspberry Pi.

IV.RESULTS

Case I:
As the device is gets switched ON the following E-mail will be sent to the User.

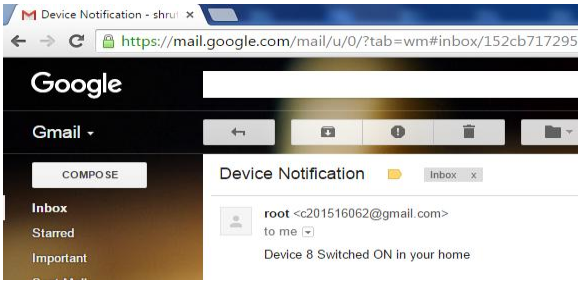

Fig.5. Output of Device getting switched ON

Case II:
When an unauthorised person enters the house, following mail will be sent to the User.

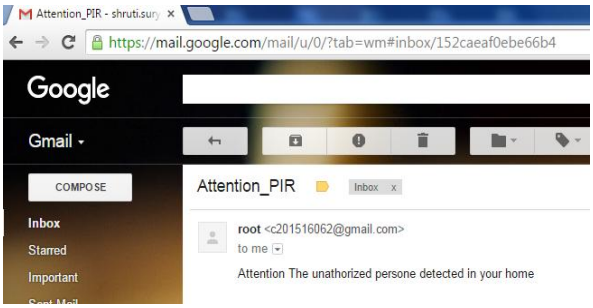

Fig.6. Output of PIR sensor when unauthorized person is detected

Case III:
As there is LPG gas leakage in home, the following E-mail will be sent to the User.

Fig.7. Output when LPG gas is detected

V.CONCLUSION

In this highly developing era, where directly or indirectly everything is dependent on computation and information technology, Raspberry Pi proves to be a smart, economic and efficient platform for implementing the home automation. This paper aims a basic application of home automation using Raspberry Pi which can be easily implemented and used efficiently. The code provided will be generic and flexible in a user friendly manner and can be extended for any future applications like power control, surveillance, etc, easily. Also it will control the security system and gas leakage with the help of given sensors. Thus many problems will get solved and electricity will be saved in large amount.

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