

RASPBERRY PI: HOME AUTOMATION SYSTEM

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Abstract— Raspberry pi is a small card sized computer aiming to provide an affordable basic computer science education to every person in the world. Eben Upton's (Creator) main aim was to create a low-cost device that would help develop programming skills and hardware knowledge. The aim of this paper is to develop a household automation system using Raspberry Pi. In recent years, there has been a rapid increase in digital technology to control house automation to prevent our homes from intruders. The system discussed below is low cost and flexibly designed. Any smart phone can communicate with home automation network via internet and Raspberry Pi board. Raspbian and Pidora are two operating systems upon which Raspberry system can work apart from Linux OS.

Keywords— Raspberry Pi, Home Automation, Relay circuit

I. INTRODUCTION

Added intelligence to the house gives quality of life. This Home Automation system is based upon Raspberry Pi 3, which is supported by 1 GB RAM running at 1200 MHz quad core speed. The power capacity of this Raspbian model is 800mA. This system is controlled using Wi-Fi enabled smart phones or tablets. In this, electrical appliances such as light and fan are connected to the MCU (Main Control Unit) which is controlled remotely from a phone or a computer. And this is done by using a simple GUI. We can also add a web cam to MCU to monitor live fee. This project can be customized in lot of ways as it has multiple GPIO ports. These GPIO ports can be programmed to get to give the user control over various things as per requirements.

II. SYSTEM REVIEW

We connect a PIR (Passive Infrared Sensor) sensor to the door whose range is 180 degree of 1 -2 km. Whenever a person comes in the range of PIR, it sends a trigger pulse which activates an LED and the camera. . As soon as camera gets activated, it captures the image of the person or thing in front of it and sends it as a message to the user via FTP server . We can install PIR sensors wherever we requires at any point of the house. In place of camera, webcam can also be installed over Raspberry Pi board whose main connection will be provided inside the house into the TV screen or computer

screen. Any person who tries to come in contact with the house will be visible live through it. Once the person is recognized by the user, he will be allowed to enter otherwise not. This is how it works.

III. HARDWARE DESCRIPTION

The various hardware components used in this automation system are described below:

A. Pi Board:

The Raspberry pi 3 board (model B) with a 1200 MHz Quad core processor and 1 GB RAM which acts like a mini computer. NOOBS is installed on the board with which we can boot the Pi board with any operating system like Linux or Pidora. The Linux based OS is known as Raspbian which is generally best suited for Pi board. There are 40 GPIO pins which can be used as input and output to control and interface many devices. Also it has 4 USB ports, 1 HDMI port, micro SDHC slot for storage and connection slots for camera, display, LED and USB power supply. All this together makes it a multipurpose and multiuse board.

B. GPIO:

General purpose input/output (GPIO) is the most powerful component of Raspberry pi. We can also refer those to as on/off switches. These pins can be used for programming to develop real life projects.

Pin#	NAME		NAME	Pin#
01	3.3v DC Power		DC Power 5v	02
03	GPIO02 (SDA1, I ² C)		DC Power 5v	04
05	GPIO03 (SCL1, I ² C)		Ground	06
07	GPIO04 (GPIO_GCLK)		(TXD0) GPIO14	08
09	Ground		(RXD0) GPIO15	10
11	GPIO17 (GPIO_GEN0)		(GPIO_GEN1) GPIO18	12
13	GPIO27 (GPIO_GEN2)		Ground	14
15	GPIO22 (GPIO_GEN3)		(GPIO_GEN4) GPIO23	16
17	3.3v DC Power		(GPIO_GEN5) GPIO24	18
19	GPIO10 (SPI_MOSI)		Ground	20
21	GPIO09 (SPI_MISO)		(GPIO_GEN6) GPIO25	22
23	GPIO11 (SPI_CLK)		(SPI_CE0_N) GPIO08	24
25	Ground		(SPI_CE1_N) GPIO07	26
27	ID_SD (I ² C ID EEPROM)		I ² C ID EEPROM) ID_SC	28
29	GPIO05		Ground	30
31	GPIO06		GPIO12	32
33	GPIO13		Ground	34
35	GPIO19		GPIO16	36
37	GPIO26		GPIO20	38
39	Ground		GPIO21	40

Fig. 1. GPIO Pins

C. Relay Circuit:

A Relay is electrically is electrically operated switch. It is used in low power circuits to provide high voltage/current on or off. If LOGIC 1 is labelled on the PORT of pi, this circuit provides a necessary current. As soon as LOGIC is 0, the relay turns off.

D. PIR Sensor:

A PIR sensor (passive infrared sensor) is an electronic sensor that measures the amount of infrared light radiating from an object in its view. It can have input of 3-9 volts; 5 volt being ideal one. It has a 3 volt output but can vary slightly from sensor to sensor. It has a sensitivity upto 1 to 12 ft (3 mtr).

E. Raspberry Pi Camera:

The Raspberry Pi camera can be used to make HD video, as well as capture pictures. It attaches to one of the two small sockets on the pi board surface. It has a 5 MP fixed-focus CMOS (complementary metal-oxide semiconductor). A 15 cm ribbon cable is connected to the camera used to attach it to the pi board.



Fig. 2. Raspberry Pi Camera

IV. SOFTWARE DESCRIPTION

The following set of languages and OSs can be used to develop home automation system using Raspberry pi:

- PHP
- HTML/CSS

- Python
- Linux/Raspbian
- Android

V. IMPLEMENTATION OF THE SYSTEM

- 1) All the components are assembled onto the Raspberry pi board.
- 2) Raspberry Pi detects a person or object by the help of the PIR sensor.
- 3) Then it activates the array of LED for the favourable conditions during capturing or recording of the image.
- 4) As soon as the PIR sensor gets triggered, the camera captures the picture and sends it to the user's phone.

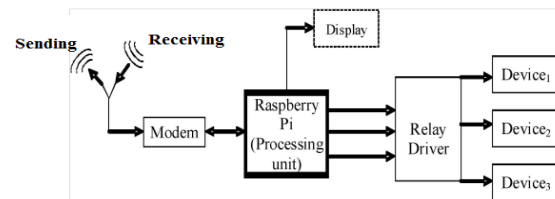


Fig. 3. Block Diagram of home automation

V. ADVANTAGES

This Home Automated System developed using Raspberry Pi has following pros:

- 1) This system is energy efficient and saves money.
- 2) It is totally noise free.
- 3) Apart from android or smart phone device, e-mail, social accounts, radio connection can also be used to make this system.
- 4) Easily connectable to web services.
- 5) It mainly focuses to help the old and handicapped people for their ease of use.

VI. DISADVANTAGES

- 1) Since the system is very small in size and delicate, it may get damaged with a slight misuse.
- 2) Some human errors.
- 3) The system may not be reliable as much as actual automation system.

VII. CONCLUSION

In this technologically developing era, Raspberry Pi proves to be a smart, economic and efficient platform for performing home automation system. Furthermore, this system can also be used in the small-office environments. The interfaces are intuitive and easy to use. The devices can also be easily integrated into existing applications to develop more refined system. To end with, Raspberry Pi is emerging network technology and is capable of satisfying any requirement.

VIII.FUTURE SCOPE

Making homes smarter has become a new step. Our homes can be interfaced with much technology like motion sensor, light sensor and temperature sensors which can provide automatic handling of devices under certain conditions. Raspberry pi is the future we can bet upon. It is really a compact processor. It is large enough to fit easily into pre-existing electrical systems. Raspberry pi is a remarkable piece of hardware as it combines the features of a conventional computer and latest embedded devices. However it still needs to find the way to make it compatible with windows processor. Raspberry Pi is surely going to be big step towards providing a technological connect to every far and wide user, especially children.

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- [8] *International Journal of Computer and Information Technology (ISSN: 2279 – 0764) Volume 04 – Issue 02, March 2015 www.ijcit.com* 410 Energy Efficient Computing: A Comparison of Raspberry PI with Modern Devices Waqas Anwaar*, Munam Ali Shah Department of Computer Science COMSATS Institute of Information technology Islamabad, Pakistan *Email: waqasanwaar [AT] hotmail.com