ISSN XXXX XXXX © 2017 IJESC

Research Article Volume 7 Issue No.5

IoT Based Home Automation System using Raspberry Pi

K. Venkata ramana[1], T. Siva Sankara Phani[2], T. Saran kumar[3]
Department of Electronics & Communication Engineering
BVC Engineering College, Odalarevu, India

Abstract:
Home automation is becoming more and more popular day by day due to its numerous advantages. This can be achieved by local networking or by remote control. This paper aims at designing a basic home automation application on Raspberry Pi that employs the integration of cloud networking, wireless communication, to provide the user with remote control of various lights, fans, and appliances within their home and storing the data in the cloud. This system is designed to be low cost and expandable allowing a variety of devices to be controlled. Results show the efficient implementation of proposed system for home automation. LEDs and Camera were used to indicate the switching action and live streaming.

Keywords: Raspberry Pi, Cloud, Home Automation, Python.

I.INTRODUCTION

A. Overview

Home automation refers to the application of computer and information technology for control of home appliances and domestic features. Its application varies from simple remote control of lighting to complex computer/micro-controller based networks involving varying degrees of intelligence and automation. Home automation results in convenience, energy efficiency, and safety benefits leading to improved quality of life. The popularity of network enabled home automation has been increasing greatly in recent years due to simplicity and much higher ffordability. Moreover, with the rapid expansion of the Internet, there is the potential for the remote control and monitoring of such network enabled appliances. However, the new and exciting opportunities to increase the connectivity of devices within the home for the purpose of home automation through internet are yet to be explored.

B. Advantages of IoT based Home automation systems

In recent years, wireless systems like cloud have become more and more common in home networking. Also in home and building automation systems, the use of cloud technologies gives several advantages that could be achieved using a wired network also.

1) Data: The more the information, the easier it is to make the right decision. Knowing what to get from the grocery while you are out, without having to check on your own, not only saves time but is convenient as well.

2) Tracking: The computers keep a track both on the quality and the viability of things at home. Knowing the expiration date of products before one consumes them improves safety and quality of life. Also, you will never run out of anything when you need it at the last moment.

3) Time: The amount of time saved in monitoring and the number of trips done otherwise would be tremendous.

4) Money: The financial aspect is the best advantage. This technology could replace humans who are in charge of monitoring and maintaining supplies. For all these reasons, wireless technology is not only an attractive choice in renovation and refurbishment, but also for new installations.

II. RELATED WORK

First, Several definitions are available in the literature for home Automation. Bromley *et al* (2003) describes home automation as the introduction of technology within the home to enhance the quality of life of its occupants, through the provision of different services such as telehealth, multimedia entertainment and energy conservation". There has been significant research into the field of home automation with many other communication protocols like bluetooth, hand gestures, DTMF etc. The XlO industry standard, developed in 1975 for communication between electronic devices, is the oldest standard identified from the author's review, providing limited control over household devices through the home's power lines. Sriskanthan et al (2002) introduced a Bluetooth based home automation system, consisting of a primary controller and a number of Bluetooth sub-controllers. AI-Ali *et al* (2004) developed a Java based home automation system. The use of Java technology, which incorporates built-in network security features, produces a secure solution. However, the system requires an intrusive and expensive wired installation and the use of a high end Pc. Baudel *et al* (1993) proposed a novel control network, using hand gestures. The controller uses a glove to relay hand gestures to the system. Ardam *et al* (1998) introduced a phone based remote controller for home and office automation. The system differs in that all communications occur over a fixed telephone line and not over the Internet. The system can be accessed using any telephone that supports dual tone multiple frequency (DTMF).

The research available into home automation in public domain lies predominantly in the academic arena, with little industrial research being available in open literature. The adoption of home automation technologies into commercial systems has been limited, and where available consumer uptake has been slow. The aforementioned systems offer little in the way of interoperability. Attempts have been made to provide network interoperability and remote access to home automation systems through the development of home gateways. Kushirio

et al (1998) proposed a home energy management focused home gateway, which connects the home network with the Internet. The system was installed in twenty houses in the Tokyo area. Saito *et al* (2000) defined a home gateway as the point of ingress between a personal area network and a public access network. Yoon *et al* (2008) implements a home gateway that accepts mobile phone signals and activates or deactivates an LED representing a home device. Ok *et al* (2006) proposed a home gateway based on the OSGI (Open Service Gateway Initiative), which allows service providers to access home automation systems for administration and maintenance services. These systems have made a significant contribution to the development of a home gateway. However, the existing network infrastructure within the home environment has not been taken into consideration when selecting the networks for integration with the respective home gateways. The paper proposes a Raspberry Pi based home automation system through Cloud.

III. SYSTEM CONFIGURATION

Fig. 1 describes the configuration of the proposed system. Raspberry Pi has been chosen as the processing unit for the system because of its user friendly features and economical benefits. Further, python coded algorithm has been fed into the raspberry Pi and is connected to the internet through Modulator Demodulator (MODEM) interface to access and update data to the consumer. The Devices to be controlled have been interfaced with raspberry Pi using relay driver circuit due to different power ratings of devices and raspberry Pi. A remote display is also connected through cloud inorder to view the instantaneous status and processing of raspberry Pi.

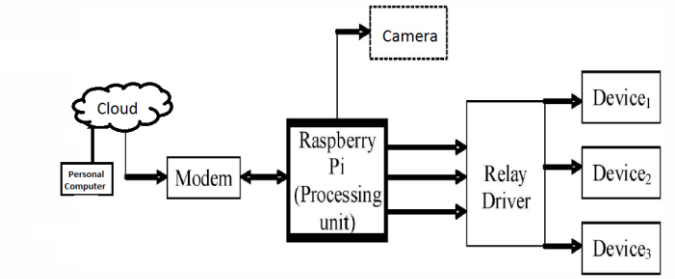

Figure. 1. Layout of the proposed system configuration

IV. HARDWARE SETUP

Raspberry Pi (shown in Fig.2) is a credit-card-sized singleboard computer developed in the UK by Raspberry Pi foundation with the intention of stimulating the teaching of basic computer science in schools. It has two models; Model A has 25 6Mb RAM, one USB port and no network connection. Model B has 5 12Mb RAM, 2 USB ports and an Ethernet port. It has a Broadcom BCM2835 system on a chip which includes an ARMl176JZF -S 700 MHz processor, Video Core IV GPU, and an SD card. The GPU is capable of Blu-ray quality playback, using H.264 at 40MBits/s. It has a fast 3D core accessed using the supplied OpenGL ES2.0 and Open VG libraries. The chip specifically provides HDMI and there is no VGA support. A Raspberry Pi board with a prepared operating system SD card, USB keyboard, mouse, HDMI display, power supply and cables it is possible to make the Raspberry Pi to work like a normal general purpose computer..

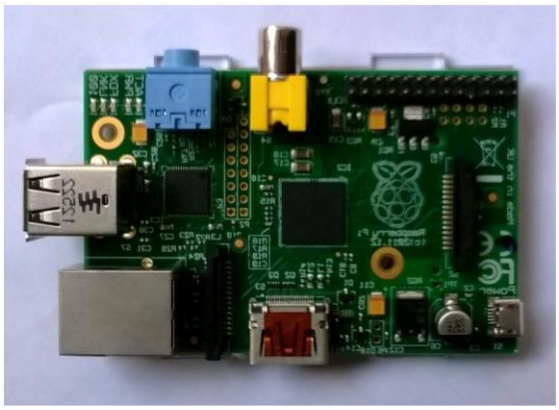

Figure. 2. Raspberry Pi board.

A. OS Installation

Raspberry Pi does not have internal storage or built-in operating system and it requires an SD-card that is set up to boot the Pi. An SD-card has to be connected to the normal windows machine using a card reader. From the Raspberry Pi's official website NOOBS has to be downloaded and unzipped the same in the SD-card after which the SD-card serves as the internal storage for the Raspberry Pi and using the NOOBS main menu Raspbian OS can be installed in it. As soon as the SD-card is inserted in the Raspberry Pi, the device boots up.

B. Internet Settings

The quickest way to get the Raspberry Pi connected to the internet is to connect an Ethernet patch cable and to just plug into the network router. For this to work, the router should be configured for DHCP (Dynamic Host Configuration Protocol).

- Wired network configuration can be done by making changes in the configuration file in the path /etc/network/interfaces. To open the file and see, using the following command, sudo nano /etc/network/interfaces iface eth0 inet dhcp

- Wireless network configuration can be done using USB Wi-Fi adapters, which are compatible with the Raspberry Pi. There is a list of USB Wi-Fi adapters supported by default by the Raspberry Pi.

V. IMPLEMENTATION

A. Software design Front End Design:

HTML is a format that tells a computer how to display a web page. The documents themselves are plain text files with special "tags" or codes that a web browser uses to interpret and display information on your computer screen. HTML stands for Hyper Text Markup Language; an HTML file is a text file containing small markup tags. The markup tags tell the Web browser how to display the page. An HTML files must have an htm or html file extension.

B. Home Controller Illustration:

Home controller in the home end. The primary home controller comprises not only a basic power supply and home networks but also home appliances and camera.

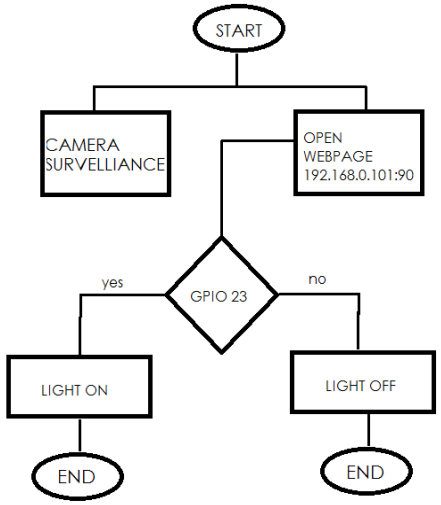

Figure. 3. Flow chart of the proposed system

After the successful connection to the server, the data of sensor are sent to the web server for monitoring of the system. The figure 4 shows the web server page which will allow us to monitor and controll the system. By entering the assigned IP address in the web browser this web server page will appear. The web server gives the informaton about the temperature in different places of the house and motion state in the house. It also gives the status of the various electrical appliances like light, fan etc which we can control remotely. The control is show in fig 3

VI. PERFORMANCE EVALUATION

For verification of the practicality of the proposed system, LEDs were used to indicate the switching signal of the interfaced devices. The experimental setup is shown in Fig. 4. There are two GPIO Pins 23 and 24 connected to the buttons of the Web Page. initially the two buttons are turned OFF and when the first button is clicked the GPIO Pin 24 is high and the bulb will ON. similarly the second button which is linked to the GPIO pin 23 will be high when the second button is clicked. the respective state of each GPIO Pin is shown in the web page as GPIO 24 is currently off / on and GPIO 23 is currently off / on on the top of each clickable button.

Figure. 4. Working Experimental setup

VII. CONCLUSION & FUTURE SCOPE

The home automation using Internet of Things has been experimentally proven to work satisfactorily by connecting simple appliances to it and the appliances were successfully controlled remotely through internet. The designed system not only monitors the appliances, like light, fan and also captures the video around the house. This will help the user to analyze the condition of various parameters in the home anytime anywhere. Using this system as framework, the system can be expanded for energy monitoring, or weather stations. This kind of a system with respective changes can be implemented in the hospitals for disable people or in industries where human invasion is impossible or dangerous, and it can also be implemented for environmental monitoring.

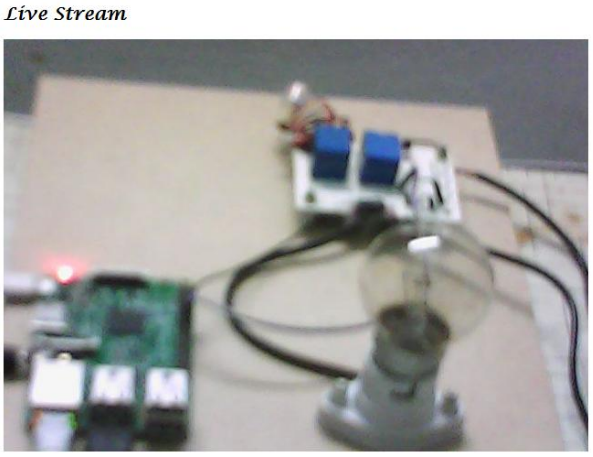

Figure. 4. Live Streaming

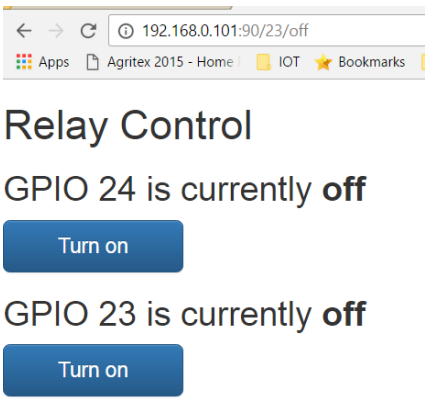

Figure. 5. HTML Pag

VIII. REFERENCES

[1]. AI-Ali A. R. and AI-Rousan M., "Java-based home automation system", IEEE Transactions on Consumer Electronics, vol. 50, no. 2, pp. 498- 504, 2004

[2]. Ali M., V laskamp J.H.A, Eddiny N.N. , Falconer B. and Oramc., "Technical Development and Socioeconomic Implications of the Raspberry Pi as a Learning Tool in Developing Countries", 5th Computer Science and Electronic Engineering Conference (CEEC), pp. 103- 108,2013.

[3].Ardam H. and Coskun I., "A remote controller for home and office appliances by telephone", IEEE Transactions on Consumer Electronics, vol. 44, no. 4,pp. 1291-1297, 1998.

[4]. Baudel T. and Beaudouin-Lafon M., "Charade: remote control of objects using free-hand gestures", Communications of the ACM, voI. 36,no. 7,pp. 28-35, 1993.

[5].Bromley K., Perry M., and Webb G. "Trends in Smart Home Systems, Connectiviy and Services",www. nextwave.org.uk, 2003.

[6]. Kushiro N. , Suzuki S., Nakata M., Takahara H. and Inoue M.," Integrated home gateway controller for home energy management system", IEEE International Conference on Consumer Electronics, pp. 386-387,2003.

[7]. Ok S. and Park H. , "Implementation of initial provisioning function for home gateway based on open service gateway initiative platform", The 8th International Conference on Advanced Communication Technology, pp. 1517-1520,2006.

[8]. Saito T., Tomoda I., Takabatake Y., Ami J. and Teramoto K.,"Home Gateway Architecture And Its Implementation", IEEE International Conference on Consumer Electronics, pp. 194-195,2000.

[9].Sriskanthan N. , Tan F. and Karande A. , "Bluetooth based home automation system", Microprocessors and Microsystems, Vol.26, no.6, pp. 281-289, 2002.www.raspberrypi.orgjarchives/tagjraspberry-pi-userguide.

[10].YoonD. ,BaeD., Ko H. and Kim H., "Implementation of Home Gateway and GUI for Control the Home Appliance", The 9th

[11].YoonD. ,BaeD., Ko H. and Kim H., "Implementation of Home Gateway and GUI for Control the Home Appliance", The 9thInternational Conference on Advanced Communication Technology, pp. 1583-1586,2007.

[12].Y. Yorozu, M. Hirano, K. Oka, and Y. Tagawa, “Electron spectroscopy studies on magneto-optical media and plastic substrate interface,” IEEE Transl. J. Magn. Japan, vol. 2, pp. 740-741, August 1987 [Digests 9th Annual Conf. Magnetics Japan, p. 301, 1982].

[13]. M. Young, The Technical Writer’s Handbook. Mill Valley, CA: University Science, 1989.