ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering
(An ISO 3297: 2007 Certified Organization)

Vol. 2, Issue 10, October 2013

Smart Phone Controlled Wireless Home Appliances Monitoring and Control System Using Raspberry Pi

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ABSTRACT: In recent years, home automation has become more popular due to its numerous advantages. This paper aims at designing a basic home automation system which can be monitored and accessed from anywhere in the world with low cost. The technology incorporates Raspberry Pi and the web server. The raspberry pi smart card is used to monitor the home environment appliances, and the readings are passed to the web server designed, by the control algorithm developed. The commands or parameters sent through web page are monitored frequently and if any threats found the android mobile connected to this web server is alerted through an alarm. The user can access this application from anywhere in the world. The result produced is absolute and low cost advantageous.

KEYWORDS: Security, Home Automation, Web server, Raspberry Pi, control algorithm

I. INTRODUCTION

Home appliances automation systems are developed in recent years using the emerging technologies developed in the electronics world. 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 affordability. 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. Several definitions are available in the literature for home Automation. Bromley et at (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 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. Kushirioet at (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 at (2000) defined a home gateway as the point of ingress between a personal area network and a public access network. Yoon et at (2008) implements a home gateway that accepts mobile phone signals and activates or deactivates an LED representing a home device. Ok et at (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.

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The existing model aims at designing a basic home automation application on Raspberry Pi through reading the subject of E-mail and the algorithm for the same has been developed in python environment which is the default programming environment provided by Raspberry Pi. Results show the efficient implementation of proposed algorithm for home automation. LEDs were used to indicate the switching actions. This also uses arduino microcontroller to control the actions of the home automation system. The access of E-mail is a complicated and a tedious process. The chances of error is high in the case of E-mail. The arduino microprocessor is slower and is limited to only particular functions.
The paper proposes a Raspberry Pi based home automation system through web server and smart phones.

This model uses a simple user friendly interface for the access of the raspberry pi. The email is replaced by the Web page. This model aims at designing a basic home automation application on Raspberry Pi through commands sent through web page and the algorithm for the same has been developed in python environment which is the default programming environment provided by Raspberry Pi. The android phone connected to the web server then alerts the user. Thus user can access the device from anywhere in the world. Results show the efficient implementation of proposed algorithm for home automation. LEDs were used to indicate the switching action.

II. SYSTEM DESIGN

The proposed model incorporates basically with the following four modules.

- Raspberry Pi GPIO connection.
- Web server module.
- User Interface.
- Linking module.

A. Raspberry Pi Gpio Connection

A fully functioning Raspberry Pi running a reasonably recent build of Raspbian Linux that is connected to home network through wired or wireless that home network has internet access through a router that uses NAT that is comfortable using Pi's command line interface. We need 3 LED and a resistor .Connect the LED and resistor in series between the Pi's ground pin and one of its GPIO pins.

B. Web Server Module

A web server is needed to create a link between the remote user and the Raspberry Pi.A Web server is a program that, using the client/server model and the World Wide Web's Hypertext Transfer Protocol (HTTP), serves the files that form Web pages to Web users (whose computers contain HTTP clients that forward their requests).The user can access the webserver using the port number of the respective raspberry PI. The webserver used here is the lighthtpd and the FastCGI is used for the linking.

C. User Interface

The user interface is a combination of HTML, JavaScript and CSS. the user interface(UI) is everything designed into an information device with which a human being may interact including display screen, keyboard, mouse, light pen, the appearance of a desktop, illuminated characters, help messages, and how an application program. Later the user interface is linked with the webserver. The webserver hosts the user interface as a web page.

D. Linking Module

The last module is to link the python script with the web module. This link is done by using FastCGI. FastCGI is a binary protocol for interfacing interactive programs with a web server. FastCGI is a variation on the earlier Common Gateway Interface (CGI); FastCGI's main aim is to reduce the overhead associated with interfacing the web server. and CGI programs

III. SYSTEM CONFIGURATION

A. WEB SERVER:

The primary function of a web server is to store, process and deliver web pages to clients. The communication between client and server takes place using the Hypertext Transfer Protocol (HTTP). Pages delivered are most frequently HTML documents, which may include images, style sheets and scripts in addition to text content. A user agent, commonly

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a web browser or web crawler, initiates communication by making a request for a specific resource using HTTP and the server responds with the content of that resource or an error message if unable to do so.

The resource is typically a real file on the server's secondary storage, but this is not necessarily the case and depends on how the web server is implemented. While the primary function is to serve content, a full implementation of HTTP also includes ways of receiving content from clients. This feature is used for submitting web forms, including uploading of files. Many generic web servers also support server-side scripting using Active Server Pages (ASP), PHP, or other scripting languages. This means that the behavior of the web server can be scripted in separate files, while the actual server software remains unchanged. Usually, this function is used to generate HTML documents dynamically ("on-the-fly") as opposed to returning static documents. The former is primarily used for retrieving and/or modifying information from databases. The latter is typically much faster and more easily cached but cannot deliver dynamic content. Web servers are not always used for serving the World Wide Web.

B. Lighttpd Webserver

Lighttpd is an open-source web server optimized for speed-critical environments while remaining standards-compliant, secure and flexible. It was originally written by Jan Kneschke as a proof-of-concept of thec10k problem - how to handle 10,000 connections in parallel on one server, but has gained worldwide popularity. The low memory footprint small CPU load and speed optimizations make lighttpd suitable for servers that are suffering load problems, or for serving static media separately from dynamic content. Lighttpd is free software/open source, and is distributed under the BSD license. It runs natively on like operating systems as well as Microsoft Windows. Lighttpd supports the FastCGI, SCGI and CGI interfaces to external programs, permitting web applications written in any programming language to be used with the server.

C. Raspbian Os

Raspbian is a free operating system based on Debian optimized for the Raspberry Pi hardware. An operating system is the set of basic programs and utilities that make your Raspberry Pi run. However, Raspbian provides more than a pure OS: it comes with over 35,000 packages, pre-compiled software bundled in a nice format for easy installation on your Raspberry Pi. The initial build of over 35,000 Raspbian packages, optimized for best performance on the Raspberry Pi. However, Raspbian is still under active development with an emphasis on improving the stability and performance of as many Debian packages as possible.

D. GPIO Configuration

The GPIO pins for input and output have been defined to control different devices. The Raspberry Pi board has GPIO pin layout as shown in fig. Out of the 26 pins, 3 pins have been used to control three devices in this project which have been represented by 3 LEDs for testing the switching signal. For practical purposes a relay driver circuit and relays can be interfaced with Raspberry Pi and appliances, respectively, for their controlling.

E. Android Application

The android application acts as the front end of the home automation system. The android application provides an interface for the consumer to control the home appliances connected to the automation system. The application enables the consumer to check the current status of the appliances and also provides the option to switch ON or OFF the same.

IV. PERFORMANCE EVALUATION

For verification of the practicality of the proposed algorithm, LEDs were used to indicate the switching signal of the interfaced devices. The fig.1 represents the prototype of the home automation system. The LED is controlled using the web interface through the web server. The web server controls the GPIO pins by which the LED is accessed.

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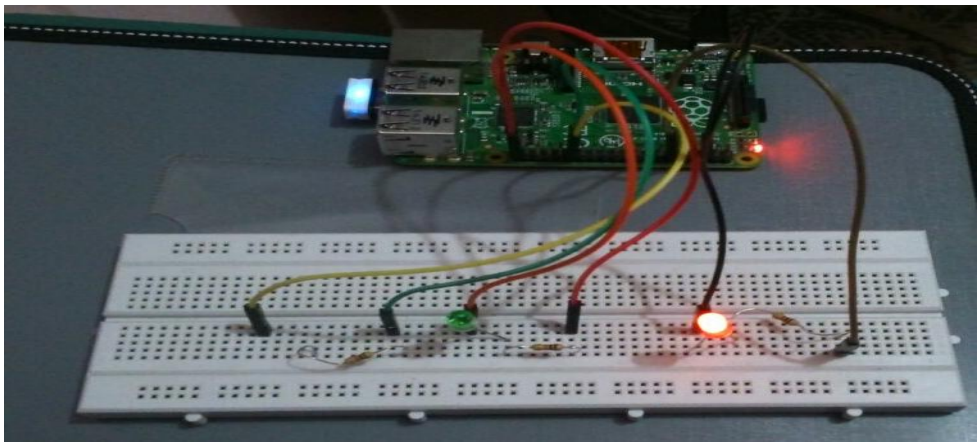

Fig.1: Prototype of an home automation System

V. CONCLUSION

Therefore using this project user can be provided with the higher range of security which can be free from hacking. Because, Raspberry Pi proves to be a smart, economic and efficient platform for implementing the home automation via web server where user can analysis their home from anywhere in the word. This technique therefore provides world wide home access for the user than any other home automation system. In future this application can be developed for use of surveillance system, industrial automation etc, easily.

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