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International Journal OF Engineering Sciences& Management Research

Home Automation using Raspberry Pi through Wi-Fi

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ABSTRACT

In this proposed system, we have developed a system for the home automation and to monitor the surrounding areas with the pi camera.To visualize the situation happened in remote areas with internet based communication with the concept of controlling devices with web server to operate with a webpage based controlling home automation system with the help of Wi-Fi. This technology will also play a prominent role for the better surveillance through the Polaroid. So now we are interfacing these automation system with the web server. Automation field got a good revolution in the industries for their enhancement in production of various products. With the combination of monitoring system, Polaroid with the internetworking through the webpage, insecure issues will be solved.

This system can improve the field of telerobotics through web server, not only this application we use this technology in the automation but also in the defence system at borders to not enter the intruders into the country. So the main advantage of this gadget is we can operate this from anywhere in the world through webpage and within in the Wi-Fi premises.

INTRODUCTION

Robotics along with the automation system is one of the important field in the concern of industrial usage and daily life and the robotics may effect on the various fields in the technological manipulations and that can be intelligent with advancement of various areas like sensors, memories and the early robots are controlled through Infrared Technology but later the advancement areas in the technology to lead robotics as embedded to the fields of service, security, safety and they can be vastly used in the distributed computer systems, surveillance cameras and these robotic intelligent system can be used till now in the pick and place, combining subsystems and these systems can be used where the hazardous places to complete the works where human can be affected by that work environments.

As many of researchers are interested on web based robotics as these are very new interest. It became an open research to all web based robotics Unless for operating in hazardous environments that are traditional tele robotic areas, Internet robotics has opened up a completely new range of virtual world applications, namely tele-manufacturing, tele-training, tele-surgery, museum guide, traffic control, space exploration, disaster rescue, house cleaning, and health care. Automated video monitoring is an important research area in the commercial sector as well.

With the rapid growth of the Internet, more and more intelligent devices or systems have been embedded into it for service, security and entertainment, including distributed computer systems, surveillance cameras, telescopes, manipulators and mobile robots. Although the notion of Internet Home Automation is relatively new and still in its infancy, it has captured the huge interest of many researchers worldwide. Automated video surveillance is an important research area in the commercial sector as well. Technology has reached a stage where mounting cameras to capture video imagery is cheap, but finding available human resources to sit and watch that imagery is expensive. Surveillance cameras are already prevalent in commercial establishments, with camera output being recorded to tapes that are either rewritten periodically or stored in video archives.

The rapid growth of industry and advancement of technology has resulted in reduction of human efforts, the main reason for which being machines!! Machines are playing an important role in our life. A machine might be anything, be it a cell phone or a bike or even a robot. Robots have found an increasing demand in a wide range of applications in our life. Their use in defence has increased by the day. Our paper includes one such instance

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of how a robot can be of use to human race in general. Robots ensemble human beings in many ways be it looks or functioning, but previously robots were not controlled by computer programs or electronic circuitry. Back then they were built using principle of mechanics improving over time with the coming of electronic age.

The latest incarnation of the Raspberry Pi, 'model B+' is here. Here's whats new in this tiny, cheap, low power hobbyist computer which is the final advancement of the original Raspberry Pi! The Raspberry Pi foundation recently launched the last evolution of the original Raspberry Pi called 'The new Rasberry Pi Model B+'.the raspberry pi
Model B+ has 26 GPIO Pins,L293 motor driver used for driving the fan

MATERIALS AND METHODS

2.1. Raspberry Pi:

Raspberry Pi is a low power consumption, lower cost and it is a single board computer with small size like pocket size mini computer.It can be used for a many applications like audio,HD video,games etc.Raspberry pi has advantage of running like a desktop pc,it can consists of operating systems like raspbian,pidora,Arch Linux these softwares are included in the NOOBS(New Out Of the Box Software) and the latest development in raspberry pi models is model A,model B can be remodified as a Model B+.

The model B+ uses the same processor and it consists of BCM2835 Application processor and it consists of 512 MB of RAM and also so many improvements compared to model B.In model b+ it can advanced features like more GPIO Pins,More USB,micro SD,low power consumption,better Audio,Better Performance measure compared to model B.
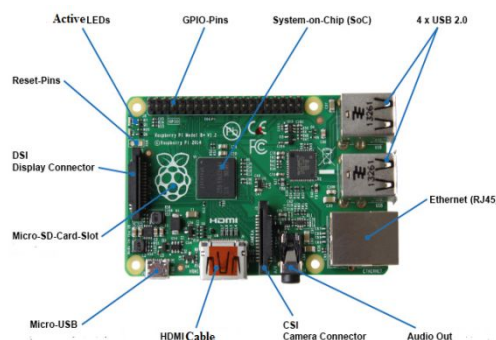
Figure1.Raspberry Pi Model B+

The chip developers of Raspberry Pi by Broadcom BCM2835 SoC.the architecture to develope pi is ARM 11 with the cpu speed of 700 MHz low power ARM1176JZFS core.mainly raspberry pi acts as a mini computer through their internal developments of operating system boots from microSD card,running a version of linux operating system.It consists of 40 Pin providing, In terms of control and interface, it has 27 GPIO, 2 UART, 4 I2C and 5 SPI [6] and remaining power supply,ground pins and 4 USB ports with 2*2USB2.0 and power source cable is like a micro USB and it also includes Micro SD Card slot,Ethernet Port,HDMI port,Audio jack,camera interface.

2.2. Pi camera:
Pi camera is the interface module related to raspberry pi hardware pi camera has the advantage of high-definition video enabled service and this can be enable to operate through raspberry pi with the command *sudo raspi-config* and click camera module then enable click finish to operate camera. After enabling camera then we suppose to develop code for motion streaming through MJPG Streamer.

2.3. Operating System:
Raspberry pi essentially uses linux kernel based systems software but ARM11 can't be working on the popular versions of linux includes ubuntu.now raspberry pi developers can suggest the some supportive software

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i.e.,NOOBS. The NOOBS can include Archlinux ARM, pidora, puppy linux, Raspbian but depending on user's choice exclude the software from Noobs and that can acts as operating system. raspbian linux operating system is recommended for the robotic applications. raspbian can be extracted as a image file to write on SD card. if the SD card can be used as a image file reader first we can convert SD card to read image file through SD card Formatter. after completing the formatting then the image file of operating system that can be read through win32 Disk imager.

2.4.Putty:

Putty is a standalone tool,opensource terminal emulator [7],network file transfer application. It supports several network protocols including SCP,SSH,Telnet,rlogin and raw socket connection.it can be used for the interlinking of raspberry pi to a windows PC and its main purpose is to connecting server through secure shell(SSH) and port address.when ever login through putty the raspberry pi ip address and windows pc ip address matches then communication path could be established and it can be familiar in thewindows pc with usage of linux operating system through ip address and port addressing.putty layout can be as shown below figure
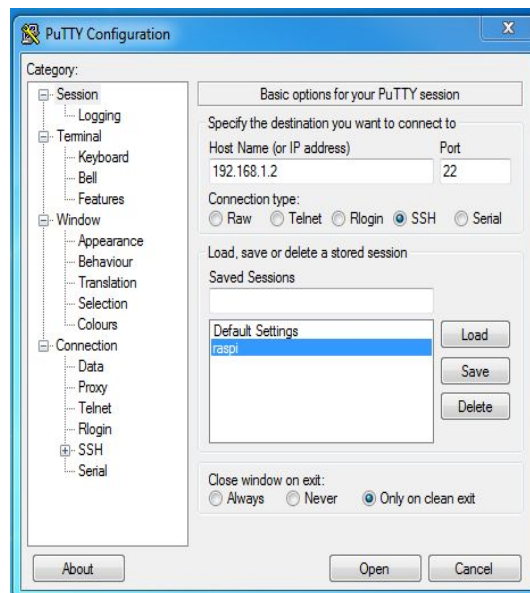

Figure 2.Putty configuration

2.5.Tight VNC server:

Tight VNC server is a platform to manage raspberry pi in remote accessing purpose and it can be act as remote desktop software and it is a cross platform and open source remote desktop software .virtual network computing to control another computers screen remotely. it is also traditional client server model how it can act as a server software is working on the host and it is accessed through it and client software runs on local machine that is pc.client can control the server through Tight VNC Server.

BLOCK DIAGRAM

The raspberry pi is connected via Local Area Network (LAN) and client device can connect through LAN or Wifi and pi camera is used for the purpose of visual feedback to control robotic arm through webpage with different ways and these all are working according to user inputs with a network medium.

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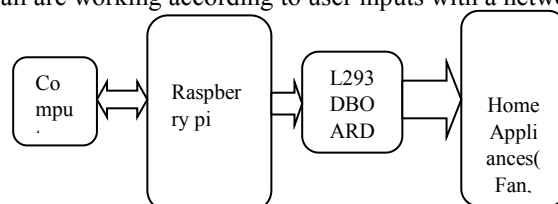
Figure 3.Block diagram

Hardware & Software Requirements:

- ✓ Raspberry pi
- ✓ SD memory card Minimum 8 GB (class 10 is preferable)
- ✓ Micro USB power cable or micro USB type mobile charger (5 V)
- ✓ Ethernet cable
- ✓ Pi camera
- ✓ Bulb set up
- ✓ Fan
- ✓ Raspbian Wheezy Operating System
- ✓ SD Formatter Tool
- ✓ Putty
- ✓ Win32 Disk imager

WEB SERVER
The main role of web server to implement the relation with hardware module through the internet.here the web server can be developed through the apache,MySql,PHP.Webpage can be developed through HTML,it can have images,styles,scripts relate to text content. The different web servers are Apache,Nginx,lighttpd,LAMP

Raspberry pi web server:
If we are used to develope a cheap web server,to create testing environment or to store the data,the raspberry pi is perfect.once the configuration of raspberry pi is completed then it is linked with static web io address that can be hosted in raspberry pi server through SSH and port address.the host address can be written as 192.168.1.2 and port address 22 and set SSH in the putty configuration tool.once the ip config completes then raspberry pi can be command through the local host address.web server is also supports as a backend system for storing and retrieving data.apache webserver is setup in the project for the purpose of communicating with hardware with the following command sudo apt –get install apache2 php5 lipapache2-mod-php5.similarly php also installed though above command then after reboot raspberry pi to change the settings.then after we develop MySql server for the data base of running applications with the command sudo apt –get install mysql-server mysql-client php5-mysql.the default directory for storing web server files is /var/www.if we develope what ever the data with in the directory they can be served on the request of path name to client.

RESULTS AND ANALYSIS
Design of this project may includes various modules raspberry pi can be setup with the wheezy operating system was installed on SD card, because of internal memory of raspberry pi is 512 MB .so an external memory can be requested for the operations perform in the system. Raspberry pi B+ is a single board, credit card sized computer with the 4 usb slots to use for external accessories and the HDMI slot for connecting any display module or TV. Ethernet cable can be used to connecting raspberry pi to laptop with LAN cable. after connecting pi, we create a local host address with Internet protocol version4(IPV4) in the network and sharing center, click on IPV4,then properties and gave a static IP address 192.168.1.2,then this address is local host for LAN cable connected to raspberry pi. now communication can be established with putty, putty is a communication tool for connection among raspberry pi and PC or Laptop. now raspberry pi can be connecting through putty with username as pi and password as raspberry.after connection established between raspberry pi and system click *sudo raspi-config*.and then after *sudo apt update* and *sudo apt upgrade* to convert raspberry pi as a new version of tools required to development applications.

Raspberry pi acts as webserver for the application of webpage controlled robotics.web server can be developed through different scripting language .here main implementation relate to video streaming. the entire experimental setup as shown in fig

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Figure 4.Hardware implementation of the system

The experimental setup can be revealed that raspberry pi acts as server for our application and develop the code for interfacing various hardware modules like pi camera ,bulb setup, DC 5V fan,L293D IC,LED's, the usage of these modules in this project can be correlate to develop an application to operate devices with motion streamer continuously to control the remote devices. here the setup is shown in figure. the connections of devices is as shown in figure.

The whole setup of the exeriment consisits of bulb set up , 5V DC fan and two LED's which rembles four devices.The DC motor is driven by L293D driver IC which is connected to the Gpio of the raspi, the bulb set up is connected to the raspi Gpio with the help of relay circuit..A total of 4 Gpio pins are used for controlling the devices and a power supply board is used for giving power supply to L293D board to operate motors.DC motors operate through 5v or 12V.then adapter can be connected to powersupply board then whole setup can be enabled.a microUSB slot can be used to giving power supply to raspberry pi.

Flow Diagram

It represents the operation of controlling robotic arm through webpage
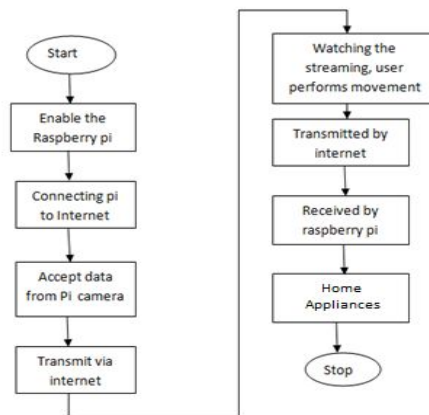
Figure 5.Flow chart for System

**Implementation**

a. Live video streaming:
Here the video streaming is one part of the project to develop the purpose of visual feedback of the hardware operating to the given instructions. the video streaming can be enabled to pi camera. In the programming part of raspberry pi we enable the camera first and the code is developed for the purpose of motion streamer with MJPG-streamer coding. The streaming can be viewed in webpage with local host address is 192.168.1.2:8000 to visualising video streaming of pi camera.

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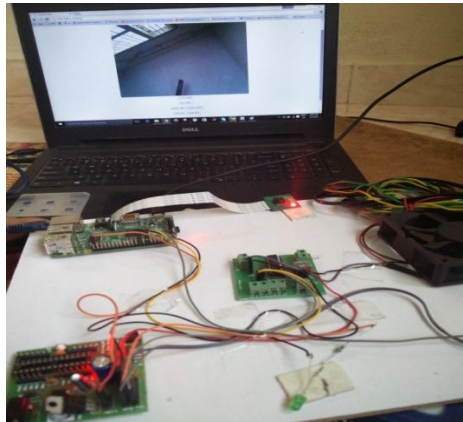
Figure 6. Live Streaming of web server

b. Devices Controlling with Live Streaming:

The whole setup is at remote end and the connection along with GPIO pins and webserver with continuous streaming is possible with the application of WebIOpi. In this application we can importing the data from GPIO pins, here GPIO pins are connected to the devices that are connected to web server with a specific webpage address 192.168.1.2:8000.In this webpage development we create different options to control devices and camera streaming. The buttons can be developed through AJAX and that buttons can be controlled through PHP. we develop the code for devices controlling through python. It is a scripting language to operate raspberry pi. When the buttons can be created using Ajax, the server & streamer can't reload every time, the fig represents the video streaming and device controlling buttons. The development of this application through static ip address. If we develop dynamic IP address we use another mechanism to control it.
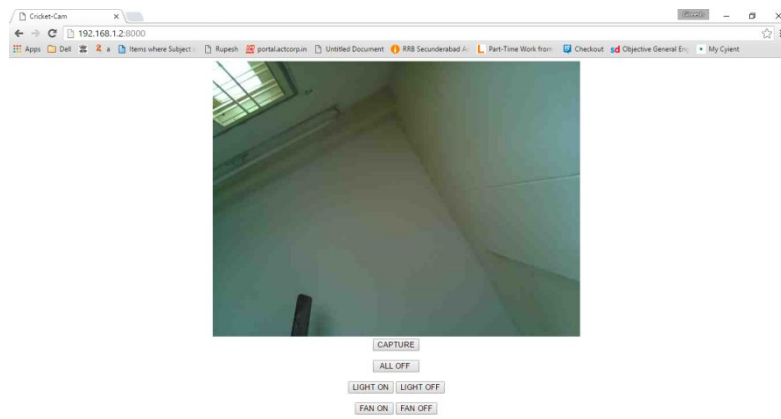
Figure 7 Control devices with Web Page

CONCLUSION

This paper describes controlling of devices from webpage with continuous monitoring of surroundings. Devices can be controlled through webpage and can have the visuals and the acknowledgement with continuous response from remote end with controlling via webpage and also use port forwarding methodology to control devices. In future we can enhance by making this project implemented with the help of android application so that the user can have ease of operating the devices economically.

ACKNOWLEDGEMENTS

I express my sincere gratitude to my guide Naresh Manda who has supported me to complete my project.

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