ISSN 2349-6193
Impact Factor (PIF): 2.243

IJESMR

International Journal OF Engineering Sciences & Management Research

RASPBERRY PI BASED ROBOTIC VEHICLE WITH CONTINUOUS VISUAL FEEDBACK

Ravi Sankar A V[*1], Naresh Manda[2] M.Tech**, Dr.M.Narsing Yadav[3]** M.S.,Ph.D(U.S.A)
[*1]PG Scholar, Department of Electronics and communication Engineering, MRIET.
[2]Asst.Professor, Department of Electronics and communication Engineering, MRIET.
[3]Head of the Department, Department of Electronics and communication Engineering, MRIET.

Keywords: Raspberry Pi, webpage, Polaroid, Robotic system, Surveillance, Wi-Fi dongle.

ABSTRACT
In this paper ,we have developed a system for the continuous surveillance and to monitor remote areas with the telerobotic mechanism to visualize the situation happened in remote areas with internet based communication with the concept of controlling a telerobotic system with web server to operate with a webpage based controlling automation system. This technology will also play a prominent role for the better surveillance through the Polaroid. So now we are interfacing these Polaroid with the Robotic systems. Robotic field got a good revolution in the industries for their enhancement in production of various products. With the combination of Robotic system, Polaroid with the internetworking through the webpage insecure issues will be solved. This paper can improve the field of Tele robotics through web server, not only this application we use this technology in the defense system also at the 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.

INTRODUCTION
Robotics 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 affect 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 popularity of internet, users can start thinking with widespread of technology advancement to usage of network related applications and that can also users can spent more time on internet compared to their sleep also.it can reflect the design such an applications for purpose of remote surveillance and it can reduce the hazardous work environment to humans. Imagine the case where the robot is controlled with remote area accessing through webpage is the advancement of such technically improve the tasks of controlling from remote end, in this robotic field tele-robotics is such a wonderful platform to improve the usage of robotics in every field. here telerobotics is the mechanism of controlling a mobile robot with web server to corresponding visual feedback approach methodology.

The Tele-Robotics is the combining a robotic arm and web server with real time visualization of range of distance based applications. Tele-operation can be effect to improve robotics vastly improve or enhance the quality or value of the range of practical use or relevance..Tele-robotics is referred to control a robot from remote end .mainly the robotics are used in the field of space, underwater, power plants, hazards handling and medicine. One way of controlling robots through wirelessly by zigbee technology and Radio frequency. But robot cannot be controlled from remote end is not possible.

Another method of robotic arm controlled by the haptic technology and it is also referred as tactile feedback technology and this technology has expensive because haptic devices are cost effective . A web server is setup

ISSN 2349-6193
Impact Factor (PIF): 2.243

IJESMR
International Journal OF Engineering Sciences & Management Research

on the single board computer named Raspberry Pi, a tight VNC Server is to controlling remote end applications. the applications can be controlled by pi with a web server to remote client computers to access the data and web page by remote server.

The latest incarnation of the Raspberry Pi, 'model B+' is here. Here's what's 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 Raspberry Pi Model B+'. the raspberry pi Model B+ has 26 GPIO Pins,L293 motor driver used for controlling robot and Robotic Arm can control from server.

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 minicomputer. It can be used for a many applications like audio,HDvideo,gamesetc.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,MoreUSB,microSD,low power consumption, better Audio, Better Performance measure compared to model B.

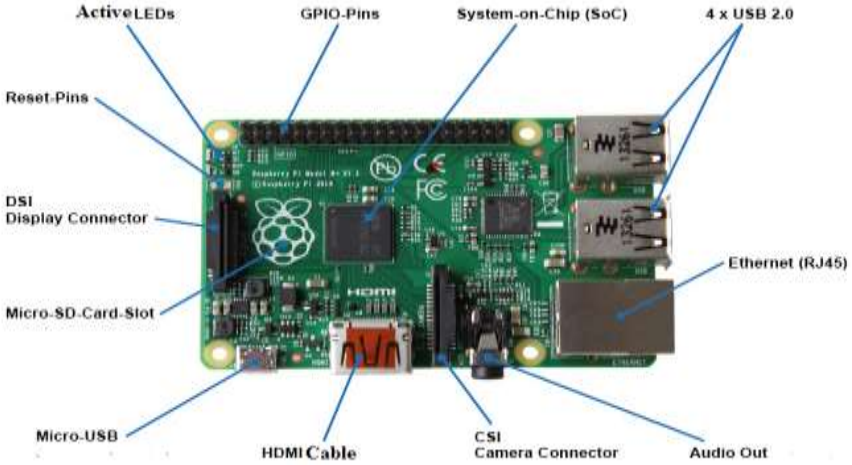

Figure 1:Raspberry Pi Model B+

The chip developers of Raspberry Pi by Broadcom BCM2835 SoC. the architecture to develop 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 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,EthernetPort,HDMIport,Audiojack,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 thenenable click finish to operate camera. After enabling camera then we suppose to develop code for motion streaming through MJPG Streamer.

ISSN 2349-6193
Impact Factor (PIF): 2.243

IJESMR
International Journal OF Engineering Sciences & Management Research

2.3.Robotic Arm:
A robotic arm is a mechanical manipulator with the usually programmable with similar functions of human arm with the rotation of wrist and moving hand with appropriate gripper. Robotic arm can have two joints with an appropriate mechanism and that can have various directions like forward, backward, upward, downward and gripper can be open and close purpose and these all are controlled through DC Motor here the parts can be connected with DC Motors and these are interfaced with Motor driver IC i.e.,L293D. this IC can be connected to raspberry pi GPio Pins and it can be operated with programming languages like Python C. To control the robot through the program to Pi as user related applications. the complete Arm setup can controlled through webpage according to user choice and that can improve the mechanical feasibility to operate these devices.

2.4. 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 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.

2.5.PuTTy:
PuTTy is a standalone tool, open source terminal emulator ,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. Whenever 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 the windows 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

2.6.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.

ISSN 2349-6193
Impact Factor (PIF): 2.243

IJESMR
International Journal OF Engineering Sciences & Management Research

2.7.Wi-Fi dongle:

The Wi-Fi module that is attached to the wlan port of the pi is configured to the address 162.148.43.9.8080 such that by enabling to this IP address we can the image that is captured by the pi. And by using the IP address generated by the pi we can control the robot with the help of the webpage.

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.

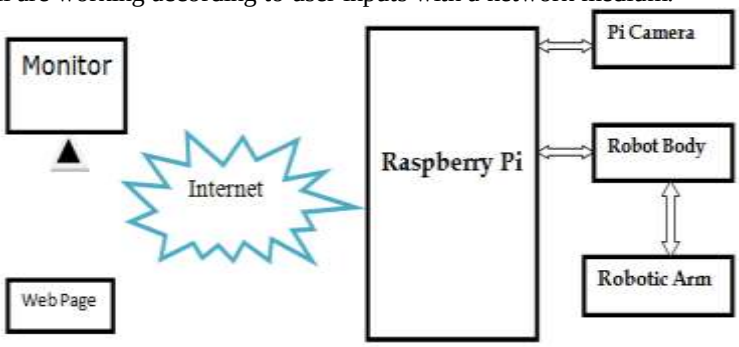

Figure 3:Block diagram

Hardware &Software Requirements:

[1] Raspberry pi
[2] SD memory card Minimum 8 GB (class 10 is preferable)
[3] Micro USB power cable or micro USB type mobile charger (5 V)
[4] Ethernet cable
[5] Pi camera
[6] Robot Body
[7] Robot Arm
[8] Raspbian Wheezy Operating System
[9] SD Formatter Tool
[10] PuTTy
[11] Win32 Disk imager
[12] Wi-Fi dongle

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 develop 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 web server 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 develop whatever the data within the directory they can be served on the request of path name to client.

ISSN 2349-6193
Impact Factor (PIF): 2.243

IJESMR
International Journal OF Engineering Sciences & Management Research

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 localhost 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 *sudoraspi-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

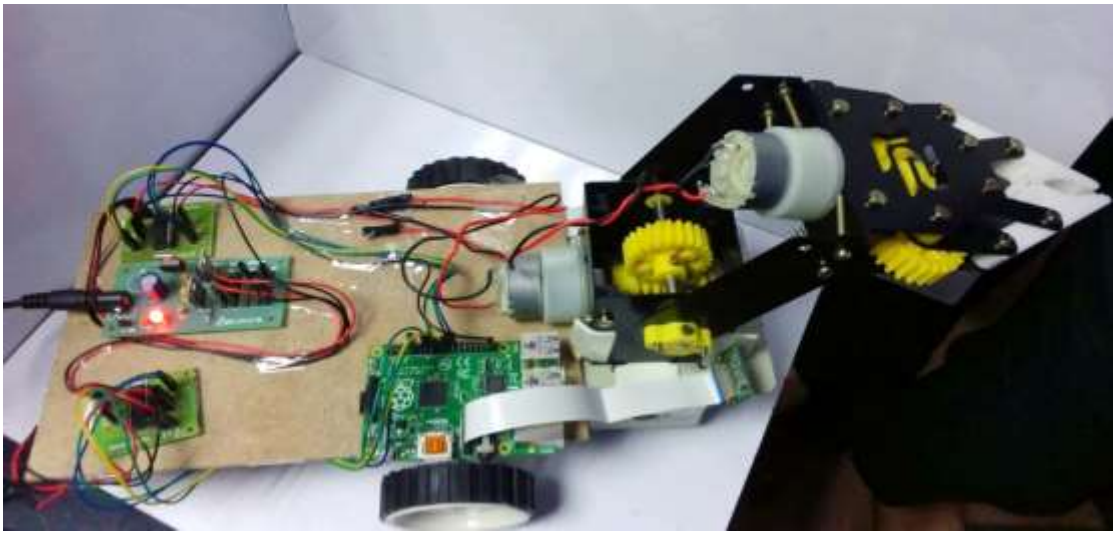

Figure 4:Hardware implementation of the system

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 ,robot body , robotic arm the usage of these modules in this project can be correlate to develop an application to operate robot with motion streamer continuously to control robot. here robot setup can be shown in figure. the connections of motors of robotic body and robotic arm can be shown in figure.

ISSN 2349-6193
Impact Factor (PIF): 2.243

IJESMR
International Journal OF Engineering Sciences & Management Research

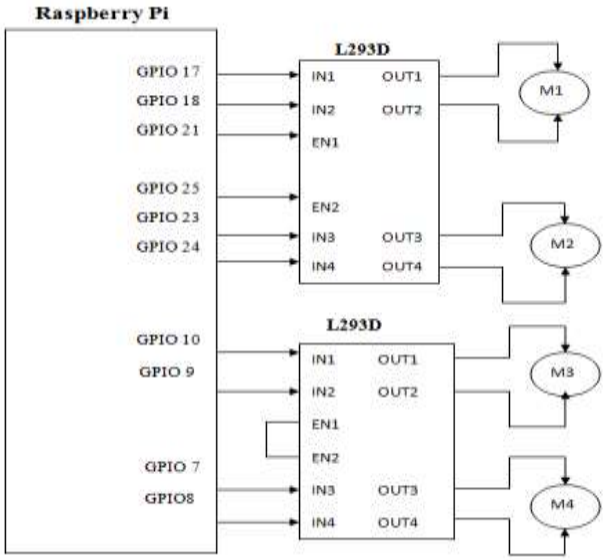

Figure 5:Dc motor driver IC's connecting with GPio pins of Raspberry Pi

The whole setup of robot body and robotic arm having 4 motors that are connected to l293D motor driver.L293D is interface between raspberry pi GPIO pins and robot body & robotic arm L293D board can be used to operate the motor in various directions like forward and backword.In L293D enable is set high for motor operations.Atotal of 10 GPio pins used for motors controlling 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

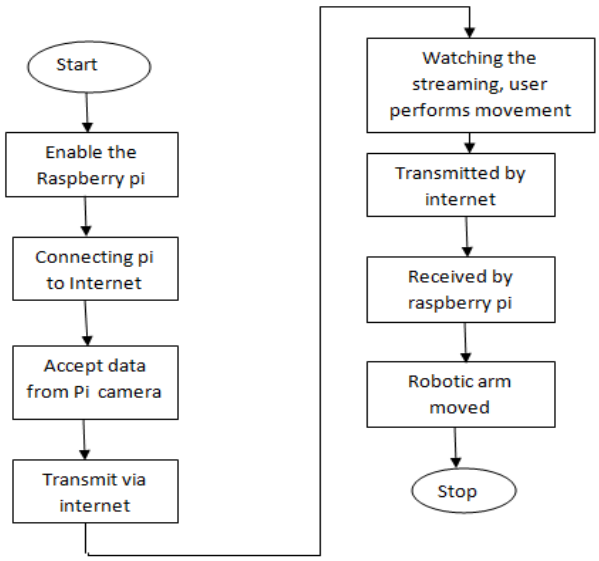

Figure 6:Flowchart for System

ISSN 2349-6193
Impact Factor (PIF): 2.243

IJESMR
International Journal OF Engineering Sciences & Management Research

5.1. 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 ca 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 visualizing video streaming of pi camera.

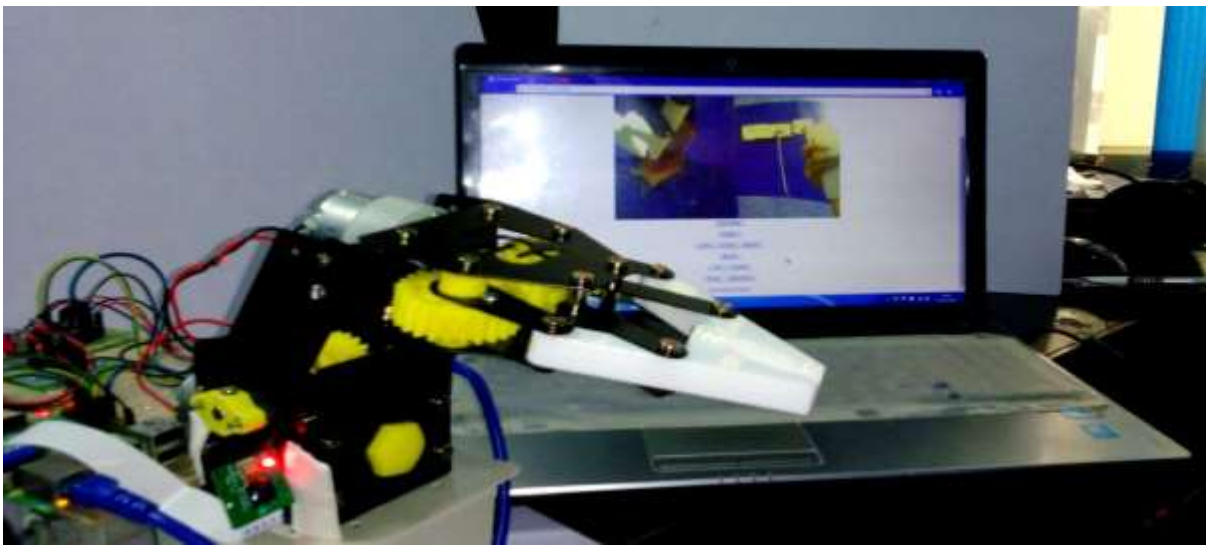

Figure 7:Live Streaming of web server

IJESMR
International Journal OF Engineering Sciences & Management Research

b.Robotic Arm Control with Live Streaming:

The whole robot vehicle setup is at remote end and the connection among 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 connecting with motors and that motors operation can be connected to web server with a specific webpage address 192.168.1.2:8000.In this webpage development we create different options to control robot and camera streaming. The buttons can be developed through AJAX and that buttons can be controlled through PHP. We develop the code for robot body and robotic arm 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 robotic arm controlling. The development of this application through static IP address. If we develop dynamic IP address we use another mechanism to control it.

Figure 8:Control Robotic Arm with Web Page

CONCLUSION AND FUTURE WORK

This paper describes a controlled robotic arm from webpage with continuous surveillance of actions done by the telerobotic arm. Mobile robot can be controlled through webpage connected through wireless dongle and the telerobotic can be visualize the acknowledgement with continuous response from remote end with controlling via webpage and also use port forwarding methodology to use any where to control robot. In future work by making this project with extension of GPS to navigate based on the locations given through the network, we can move telerobot to the multipurpose actions among remote surveillance and user can not present at the work place because mobile robot.

ACKNOWLEDGEMENT

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

REFERENCES

[1] Heng-Tze Cheng, Zheng Sun, Pei Zhang, "Real-Time Imitative Robotic Arm Control for Home Robot Applications", Carnegie Mellon University, " IEEE transactions on cybernetics., vol. 21, no. 6, pp. 1057-7149, March 2011.

[2] V. Ramya, B. Palaniappan, T. Akilan "Embedded System for Robotic Arm Movement Control using Web Server and ZigBee Communication", International Conference on Research Trends in Computer Technologies, Proceedings published in International Journal of Computer Applications® (IJCA) (0975 – 8887), pg 30-34, 2013.

IJESMR
International Journal OF Engineering Sciences & Management Research

[3] S.Hemanth Kumar, B.AnandaVenkatesan "Teleoperation Of Robotic Arm With Visual Feedback"International Journal of Advance Research In Science And Engineering http://www.ijarse.com IJARSE, Vol. No.4, Issue 03, March 2015 ISSN-2319-8354(E)
[4] http://electronicsforu.com/newelectronics/articles/raspberry.asp
[5] https://www.raspberrypi.org/help/what-is-a-raspberry-pi/
[6] V. Meenakshi, Ch. Lakshmi Saketh, K. KalyanKumar " Secured Spy IP Control Robot Using Raspberry Pi", International Journal of Emerging Technology and Advanced Engineering Website: www.ijetae.com (ISSN 2250-2459)
[7] Lung Ngai, Wyatt S. Newman, Vincenzo Liberatore, "An Experiment in Internet-Based, Human-Assisted Robotics", Case Western Reserve University, pg-1011-1015,IEEE, 2002.
[8] Huosheng Hu, Lixiang Yu, PuiWoTsui, Quan "Internet-based Robotic Systems for Teleoperation" International Journal of Assembly Automation, Vol. 21, No. 2, pg 1-10, 2000
[9] Kuk-Hyun Han, Yong-Jae Kim, Jong-Hwan Kim and Steve Hsia, "Internet Control of Personal Robot between KAIST and UC Davis", 2000.
[10] R.A. Kadu, Prof. V.A. More, P.P. Chitte, J.G. Rana, M.R. Bendre . "Wireless Control & Monitoring of Robotic Arm" International Journal of Computer Technology and Electronics Engineering (IJCTEE) Volume 2, Issue 1, pg 28-38, 2010
[11] Zhao Zhang ,"The Internet Remote Robot with Skype Webcam",International Conference on System Science and Engineering,June 30-July 2, 2012, Dalian, China
[12] W. Lao, J. Han and Peter H.N. de With, "Automatic video-based humanmotion analyzer for consumer surveillance system", IEEE Trans Consum Electron, Vol. 55, No. 2, pp. 591-598, 2009.
[13] AakankshaPimpalgaonkar, Mansi Jha, Nikita Shukla ,Kajol Asthana, "A Precision Temperature Controller Using Embedded System",International Journal of Scientific and Research Publications, Volume 3, Issue 12, December 2013