Raspberry Pi based Robotic Arm with Wi-Fi Controlled Visual Feedback

M.Shailaja[#1]
[#]*PG Scholar*
Malla Reddy Engineering College (Autonomous), Jawaharlal Nehru Technological University, Hyderabad, India,
shailaja.kotthapelli@gmail.com

***Abstract*— This paper proposes a method for controlling a Robotic arm using an application build in the android platform. The android phone and raspberry pi board is connected through Wi-Fi. As the name suggests the robotic arm is designed as it performs the same activity as a human hand works. A signal is generated from the android app which will be received by the raspberry pi board and the robotic arm works according to the predefined program. The android application is the command centre of the robotic arm. The program is written in the python language in the raspberry board.the different data will control the arm rotation.**

***Keywords*: - Robotic Arm, Raspberry pi, Android, Live video**

I. INTRODUCTION

Robots are increasingly being integrated into working task to replace humans especially to work on repeated actions. In general robots can be classified into different fields industrial and service robotics. On the other hand internet and WI-FI are becoming most common resource for everything. People like to buy things online rather than getting them manually.Internet is now everywhere, compare to the last decades where internet is only wired, and people needs to be in front of the computer to access the internet but nowadays, internet is just at the tip of your finger. This is an advantage where we can to introduce robot to household works. The robot body is build mechanically and electrical components were also used to build the robotic arm. Mostly the internet controlled robots will be wired these wired robots occupy more space. So to avoid the limitation, the robotic control is made wireless that is, it is controlled by Wi-Fi. Wirelessly also means using Bluetooth but the advancement used here is the WI-FI which is most widely used nowadays.

The Raspberry pi is a tiny super computer capable of performing various functionalities.The Raspberry Pi has 17 GPIO pins.The Robotic Arm is controlled through the GPIO pins, using L293 motor driver boards. A USB camera is used for visual feedback by providing live video streaming through the Wi-Fi.

The robotic arm is then controlled from an Android application build in android platform in a smart phone. Through the wifi connection the control is given to the robotic arm.

This robotic arm can be controlled through a smart phone and RASPBERRY PI acting as communication media between them. An android applications is developed in the android platform.Here Android application commands the robotic arm to move or grab specific things as the instruction is transferred to the arm through android JAVA language. The controlling board that is the Raspberry Pi has 17 GPIO pins.The Robotic Arm is controlled from the GPIO pins, using L293 motor driver boards.

II. BLOCK DIAGRAM OF THE SYSTEM

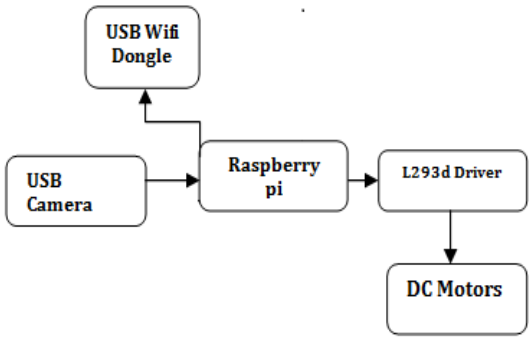

Fig. 1 System block diagram

A. Raspberry Pi

Raspberry pi is a tiny super computer capable of performing various functionalities.

Fig. 2 Raspberry pi board

B.USB Camera

A camera is an optical instrument that records images that can be stored directly, transmitted to another location, or both. The visual feedback is provided by the USB camera with 5.0 MP. It has a still resolution of 5.0MP, video resolution of 2.0MP and a smooth video is given by 5G wide angle lenses.A USB slot is used to interface camera with raspberry pi.

C.L293D Driver

L293D is a dual H-bridge motor driver integrated circuit (IC). Motor drivers act as current amplifiers since they take a low-current control signal and provide a higher-current signal. This higher current signal is used to drive the motors.

D. Wi-Fi Module

The raspberry pi is connected to the android using the Wi-Fi network. The Digisol DG HR1400 150mbps router is connected to the raspberry pi to support the Wi-Fi network.

III. HARDWARE IMPLEMENTATION

Figure 3 shows entire hardware of the system which includes Raspberry pi,USB camera,WiFi router,gear motors,L293D driver.At first, we have to set up an operating system in Raspberry Pi. The debian distribution was installed onto an SD card. We need a mouse and keyboard to work, with the 2 USB ports available.

Fig. 3 Hardware setup of the robot

IV. RESULTS

The raspberry pi is connected to the smartphone using the Wi-Fi network. The Digisol DG HR1400 150mbps router is connected to the raspberry pi to support the Wi-Fi network. Then ip address 192.168.2.2 is entered which gives the robot control webpage as shown in figure 4.By Clicking on the butons, the robotic arm is controlled. The eight movements such as forward, backward, left, right, shaft up, shaft down, clip open, clip close can be performed according to the different instructions given.

Fig. 4 Robot control webpage

Video streaming is an integral part of this project as the user can monitor the robotic arm from a remote end, otherwise the user can not be able to determine whether the arm is moving or not, unless he is present at the local site where the arm is present. The live video streaming is shown in the Figure 6. The video can be viewed from any browser by providing the particular IP address 192.168.2.2 in the address bar of the client browser.

The interfacing of the motors of the robotic arm with the Raspberry Pi is shown in the figure 6. The robotic arm has 4 motors, so 2 motor driver ICs are required for the control of the robotic arm. A double L293 driver board which consists of two L293D motor driver ICs is designed to control all the motors and is interfaced with the GPIO pins of Raspberry Pi.

Fig. 5 Live video streaming

The enable pin of the L293D driver should be made high for running the motor and by changing the values of the input pins, we can change the motion direction of the arm. Each driver IC can control a maximum of two motors. A

total of 12 GPIO pins of Raspberry Pi are used for the control of robotic arm. For a motor driver IC like L293D, we need to provide separate power supply for both the IC and motors connected to it. As all the motors of the arm works at 5V, a single 5V supply is given for both the IC and the motor.

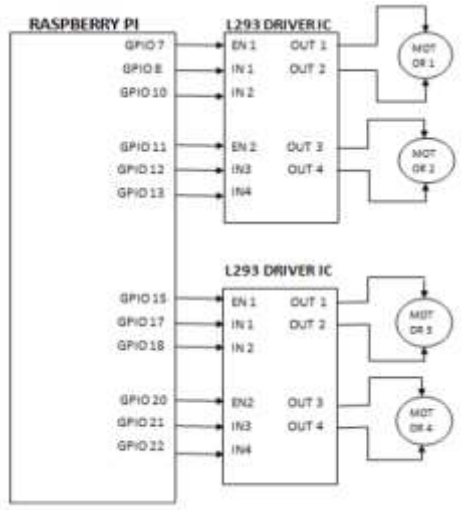

Fig. 6 Driver circuit

V.CONCLUSION

The purpose of this project is to control the robotic arm from internet with live video streaming as a means of visual feedback. This project is almost same as with the advantage that with port forwarding it is possible for a person in a different country to see the robot and control it according to his needs, whereas many other projects require user to be at the station as there is no means of giving a visual feedback. In future, by making a mobile robot with a robotic arm by means of a wireless network, it can be made a multipurpose robot, ranging from surveillance and home security to industrial applications where the user need not be present at the work place in person but can do it from his home itself.

REFERENCES

[1] Zain Anwar Ali1, (2014.)"Android Operated Robotic Arm",Universal Journal of Control and Automation 2(1),13.

[2] Christian Hernández, RacielPoot, Lizzie Narváez, ErikaLlanes and Victor Chi(2010)"Design and Implementation of a System for Wireless Control of a Robot"International Journal of Computer Science,7(5),163-169.

[3] Lung Ngai, Wyatt S. Newman, Vincenzo Liberatore,(2014.)"Android Operated Robotic Arm" UniversalJournal of Control and Automation 2(1): 1-3,

[4] Stephan G¨obel, Ruben Jubeh, Simon-LennertRaesch and Albert Z¨undorf, (2013)"Using the Android Platform tocontrol Robots"

[5]Ramya,B.Palaniappan,T.Akilan (2013International Conference on Research Trends in Computer Technologies Proceedings published in International Journal of Computer Applications (IJCA) ,0975 – 8887.

[6]NeerparajRai,palzorgyatsobhutia,uditpradhan(2014.)"Re mote learning: android operated educational robot arm.

[7] Babul Salam Kader Ibrahim (2012) "Robotic ARM controlling used internet" International Symposium on Robotics and Intelligent Sensors (IRIS),364-370.

