International Journal of Future Generation Communication and Networking
Vol. 13, No. 3, (2020), pp. 895–901

Android Based Robotic Arm

P.Arunagiri
Associate Professor, Dept of Electronics and Comm Engg
Sri Manakula Vinayagar Engineering College
Puducherry, India

Aroop Siddharth A.S
B.Tech (Final Year Electronics and Comm Engg Student)
Sri Manakula Vinayagar Engineering College
Puducherry, India

Dhileep Kumar.R
B.Tech (Final Year Electronics and Comm Engg Student)
Sri Manakula Vinayagar Engineering College
Puducherry, India

Govindharaj.T
B.Tech (Final Year Electronics and Comm Engg Student)
Sri Manakula Vinayagar Engineering college
Puducherry, India

Abstract

The technology keeps on evolving and the control system of instruments gets evolved and everything can be controlled under one roof. Nowadays android application is an important tool for controlling devices and instruments. In our project we choose to automate and ease the control of robotic arm which plays an important role in various industries. At present, industries use robotic arms which are controlled by individual control units and each arm needs a I individual to operate. This requires more manpower even though multiple arms have same functionality.

As a solution to this, we propose a system in which the robotic arm is controlled by using an ***android application*** *for multiple operations. The user gives the command from an android application and the command is decoded with the help of Node MCU. It has an inbuilt wi-fi module which helps to receives the various commands from the application by the microcontroller. IC L293D is used to interrupt the command from the microcontroller. The system is designed in a way where two or more robotic arms performing the same task can be operated simultaneously from an single application.*

Keywords: *Android Application, Node MCU, Robotic Arm*

I. INTRODUCTION

A robotic arm is a type of mechanical device which can be programmed to work in a particular way. The arm may be the sum total of the mechanism or may be part of a more complex robot. The links of such a manipulator are connected by joints allowing either rotational motion or translational displacement. At present in industries the robotic arm [1] is operated by mechanical system. PLC (Programmable Logic Unit) is used in some advanced industries to control the arm. Microcontrollers and Micro processors are also used to control the arm. The robot body is constructed in a mechanical manner and electrical components were also used to build the robotic arm. Mostly they are controlled

ISSN: 2233-7857 IJFGCN

by using a connected network and their working space is limited. In order to overcome this the control of the arm is made wireless that is, it is controlled by Wi-Fi.

II. EXISTING SYSTEM

At present, there are some robotic arm that are used to handle the missiles in space research centre to launch which is controlled by the micro controller. The industrial arm are controlled by various control units and separate mechanism with low efficiency.

Many robotic arms are performed by using the same methods in their background functions. Below mentioned are the methods followed in many robotic arm

1) **Mechanical systems** [6] **are** used relatively to accomplish the work done by robotic arm similar to human like movements. There are three kinds of coordinate system in mechanical system - Cartesian, cylindrical and spherical. This coordinate system is used based on their degree of freedom.

2) **Programmable Logic Controller (PLC)** [7] is an electronic device which is used to control and monitor the process in the production units in many industries. It can be used in many application as the PLC programs are written in computer and download in the microcontroller.

3) **Microprocessor and Microcontroller** [12] are used to interface with the stepper motors which is used to control and process the operations led by the robot. Mostly 8051- based microprocessor and microcontroller are used to perform the functions.

4) **MATLAB Application** [13] are used to tune the algorithms and generate the automatic code which is done in one software environment. This application can connect with sensors and control. It can be connected to low cost hardware like Arduino and Raspberry Pi.

A. Problems with the Existing System

1) **MORE HUMAN POWER:**

Many industries which uses robotic arm for drilling, welding, handling material, etc., acquire human power to manipulate. This cause an increase of human strength in industries.

2) **REQUIREMENT OF PLC:**

The use of PLC requires some limitations under high temperature and pressure. The cost is high and causes some accidents when power is shut down as it turns on.

3) **REQUIREMENT OF MICROPROCESSOR AND MICROCONTROLLER:**

If there is an increase in robotic arm, there is need of separate microprocessor and microcontroller [12] to monitor and control the motors and due to this additional space is required.

4) **KNOWLEDGE OF MATLAB:**

Prior knowledge is required to code a program in MATLAB [13] environment as it is not user friendly. It is very costly in which the user has to buy every module and pay for it

IV. PROPOSED SYSTEM

As technology develops day by day, we introduce the new concept where the user interfaces with the android application where the user controls activities of the arm [11]. This proposed system aims in reducing the man power.

ISSN: 2233-7857 IJFGCN

The proposed system uses a software application which is used to control the robotic arm. The system consists of the Node MCU which is a microcontroller device, 9G servo motors, 10V adaptor and acrylic material. The node MCU acts an interface between software and hardware parts whereas the application acts as an interface within user and robotic arm [10].

ADVANTAGES OF PROPOSED SYSTEM

1) REDUCES MAN POWER:

The proposed system will reduce use of human strength in industries. As there is no need of operating the robotic arm manually everytime. This can lead a company growth extensively.

2) EASE OF CONTROL:

Performing tasks which are dangerous for humans can be operated easily using the application and can improve the working condition and safety in the production unit.

3) HIGH EFFICIENCY:

With the help of application, robotic arm can be able to complete the tasks faster than humans do with higher level of accuracy, which means there can increase in the production unit as previously it might have taken some time to restart the automate process.

4) COST FOR CONTROL SYSTEM:

The cost which is required for control the main system will cost maximum. But as we use the application to control the arm movement, there is no need of separate cost for the control system unit.

5) SIMPLE AND EASY TO REPAIR:

The design looks very simple and if there is any change to be made in the robotic arm and the process need to be installed in the application, then it is easy to change in the application by adding the latest process of the arm.

V .WORKING

The working of the system is divided into three categories:

i. Construction of Robotic Arm (hardware)
ii. Building of Android Application (software)
iii. Interfacing the hardware and software

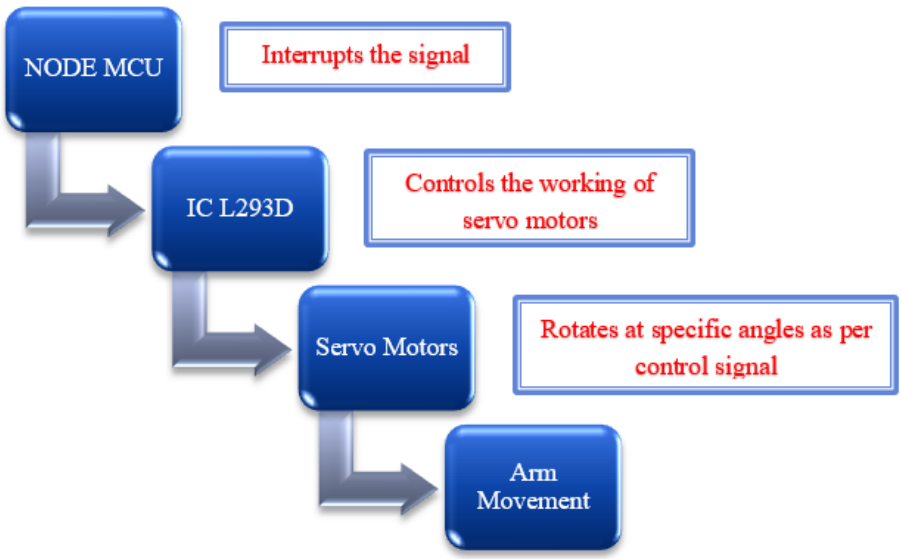

Fig 5.1 Block Diagram of Robotic Arm

ISSN: 2233-7857 IJFGCN

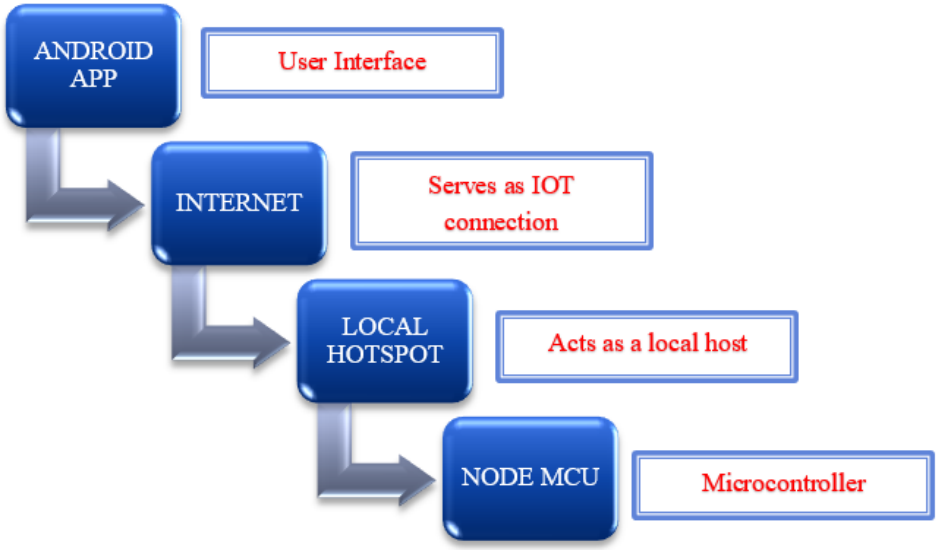

Fig 5.2 Block Diagram of Interface between the hardware and software

The robotic arm [3] contains four main parts - the base, shoulder, elbow and gripper. The 9g servo motor has been introduced at the rotational joints of the main parts. There are some certain limitation where the rotation occurs. The base is aligned to move in left and right whereas the shoulder, elbow and gripper are allowed to move in forward and backward directions. The rotation of the arm is done in three-dimensional concept [7]. The base is rotated in z-axis and shoulder, elbow and gripper are rotated around x-axis respectively. The base has a capability of rotating around 0 degree to 108 degree [5]. The shoulder and elbow can rotate to angle between 0 degree to 108 degree respective to the X and Y axis and moreover the shoulder and elbow are used to adjust the length and height of the robotic arm. The robotic arm parts are made of using acrylic materials as it can be portable due to its light-weighted structure. By using the laser, the required dimension are cut from the acrylic material.

The Smartphone is a device which offer advanced technologies with functions similar to the personal computer. It performs several applications at a time and makes easier for user to operate. In this proposed system, the application acts as an interface between the user and robotic arm. The application is developed using Android Studio 4.0 platform in which it gives the control signals to the microcontroller. The Front end is designed using the XML Code while the Back end is programmed using KOTLIN. The microcontroller now controls the arm to perform the tasks. Here Node MCU is used as a microcontroller in operating unit and power optimising techniques [9] are taken into account.

To interface the hardware and software part, we use Wi-fi network to transfer the data [1]. The pi and android phone wi-fi are connected to a common router. Now by using Wi-fi Direct method, the data are transferred between the application and Node MCU through local hotspot. The arm contain 5 motors, in which 3 motor drivers IC are used to control the joint movement of the robotic arm. The enable pin should be made high to run the motor, and when the input values are changed, the direction of the arm is changed periodically [8]. A triple L293D motor driver IC is interfaced with the arduino and used to control all the motors. This motor driver IC has a limitation where it can control maximum of four motors. The separate power supply has to be initiated to the motor driver IC and the motors. A single 5V supply is given to IC and the motors. send it to the IC L293D which is a DC motor controller. The whole system is designed in such a way that a single application can control multiple arms [4] and vice versa.

ISSN: 2233-7857 IJFGCN

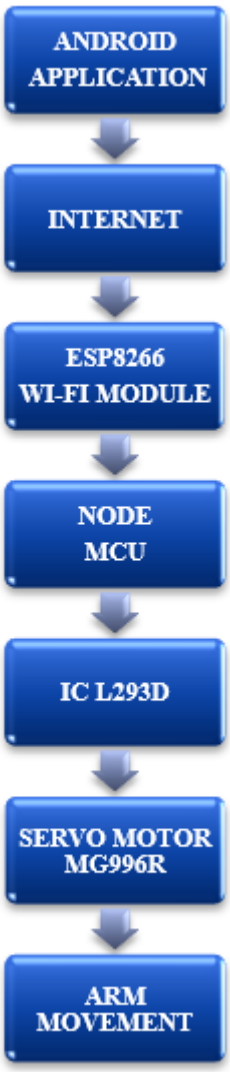

Fig.5.3 Block Diagram of overall system

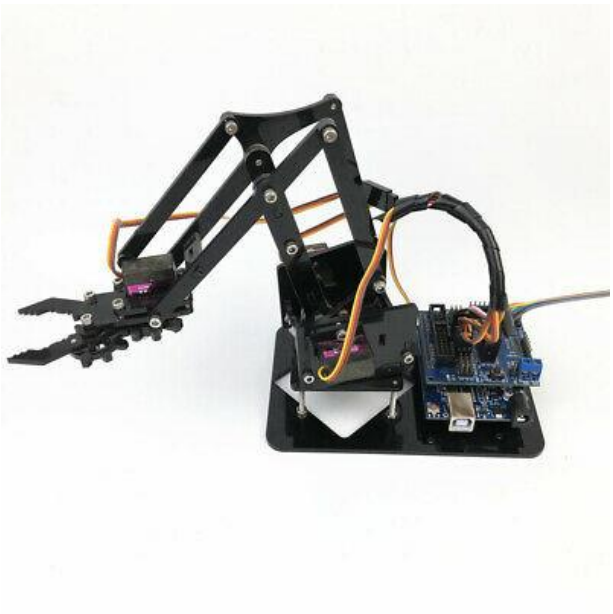

Fig.5.4 Overall Model

ISSN: 2233-7857 IJFGCN

IV. ADVANTAGES

i. Reduces man power
ii. Ease of control
iii. Cost induced for control system is saved
iv. High efficiency can be achieved
v. Multiple arms can be controlled from a single device
vi. Can lift heavy materials with ease

V. CONCLUSION

The proposed system provides a solution in which multiple arms can be controlled under a single roof. The Node MCU can be used for the control of a Robotic Arm with an application. The present scenario internet-controlled robot has several disadvantages such as wired restrictions and server problems. In this smartphone technique the delay and server problems are reduced as the Wi-Fi/ node-MCU is used for the fastest transfer of control signals.

VI. REFERENCES

1. Robotic Arm Control Based on Internet of Things By Shuangquan Fu; Pritesh Chandrashekhar Bhavsar Long Island Systems, Applications and Technology Conference (LISAT), 2019

2. Teaching and Learning Robotic Arm Model By Kadirimangalam Jahnavi; P. Sivraj International Conference on Intelligent Computing, Instrumentation and Control Technologies (ICICCS), 2017

3. GUI Based Pick and Place Robotic Arm for Multipurpose Industrial Applications By Rasika Yenorkar; U.M. Chaskar 2nd International Conference on Intelligent Computing, Instrumentation and Control Technologies (ICICCS), 2018

4. Multi-Robotic Arms Automated Production line By Jeng-Dao Lee; Wei-Chuan Li; Jyun-Han Shen; Ching-Wei Chuang 4th International Conference on Control Automation and Robotics (ICCAR), 2018

5. Stage-Wise Development Remote Controlled Robotic Arm By Shivam sharma; Shashwat Sahai; Jaisal Joshi; N. Hema 5th International Conference on Parallel Distributed and Grid Computing (PDGC), 2018

6. DTMF Based Robotic Arm design and control for Robotic Coconut Tree Climber By Rajesh Kannan Megalingam; Thejus Pathmakumar; Trayesh Venugopal; Gokul maruthiyodan International Conference on Computer Communication and Control (IC4), 2015

7. The Task-level Evaluation Model for a Flexible Assembly Task with an Industrial Dual-arm Robot By Weng Ching-yen; Chen I-Ming 8th International Conference on CIS and RAM, 2017

8. Motion Control of Robotic Arm for Micro positioning in Industrial Application By Prachi P. Sonawane; Gayatri M. Phade International Conference on Advance in Communication and Computing Technology (ICACCT), 2018

9. Functional Mechanism of DRX Parameters for Power Saving and Latency in LTE Network By P. Arunagiri, G. Nagarajan International Journal of Knowledge Engineering and Soft Data Paradigms (IJKESDP), Vol. 5, No. 3/4, 2016

ISSN: 2233-7857 IJFGCN

10. P. Arunagiri and G. Nagarajan, "Optimization of power saving and Latency in LTE network using DRX mechanism," 2016 10th International Conference on Intelligent Systems and Control (ISCO), Coimbatore, 2016, pp. 1-4, doi: 10.1109/ISCO.2016.7727036.

11. 3D Joystick for Robotic Arm Control by Individuals with High Level Spinal Cord Injuries By Hairong jiang, juan p. wachs; Martin pendergast; Bradley S. Duerstock International Conference on Rehabilitation Robotics

12. Computer Controlled Robotic Arm By Nutan Ahuja; R. Sreedaran 16th Symposium on Computer-Based Medical System (CBMS), 2013

13. Gyro-Accelerometer Based Control of a Robotic Arm using AVR Microcontroller By Ariful Islam Bhuyan; Tuton Chandra Mallick 9th International Forum on Strategic Technology (IFOST), 2013

14. Modelling and Simulation of Robotic Arm in MATLAB for Industrial Applications By Juan Liu; Qiang Luo 11th International Conference on Intelligent Human-Machine System and Cybernetics (IHMSC), 2019

ISSN: 2233-7857 IJFGCN