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Robotic Arm Wirelessly Controlled By Android Application

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***Abstract*— In this paper, pick and place robotic arm is designed and implemented. This robotic arm is based on android application controlled for remote operation. In this paper, commands are sent to the receiver to control the movement of the robot either to move forward, backward and left or right etc using android application device. Four motors are interfaced to the microcontroller where two motors are used for arm and gripper movement of the robot while the other two motors are used for the body movement. The android application device transmitter acts as a remote control that has the advantage of adequate range, while the receiver end Bluetooth device is fed to the microcontroller to drive DC motors via motor driver IC for necessary work. Remote operation is achieved by any smart-phone/Tablet etc., with Android OS; upon a GUI (Graphical User Interface) based touch screen operation. This system can be enhanced by interfacing it with a wireless camera so that the person controlling it can view operation of the arm and gripper remotely.**

***Index Terms*— Robotic Arm, DC Motor, Bluetooth, Microcontroller, Graphical User Interface, Android Application Device**

I. INTRODUCTION

Robot is an integral part in automating the flexible manufacturing system that is greatly in demand these days. Robots are now more than a machine, as robots have become the solution of the future as cost labor wages and customers' demand [1]. Even though the cost of acquiring robotic system is quite expensive but as today's rapid development and a very high demand in quality with IS0 (International Standard Organization) standards, human are no longer capable of such demands. Research and development of future robots is movingly at a verv rapid face due to the constantly improving and upgrading of the quality standards of products. Robot and automation is employed in order to replace human to perform those tasks that are routine dangerous, dull and in a hazardous area. Today In the world of advanced technology, automation greatly increases production capability; improve product quality and lower production cost.

In this paper, firstly related work is explained followed by hardware design and software design. Experimental results and conclusion is explained in the end of this paper.

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II. RELATED WORK

Robots have their historical past though they came into existences in 1961. A. Che Soh, S.A. Ahmad, A.J. Ishak and K. N. Abdul Latif introduced a paper, "Development of an Adjustable Gripper for Robotic Picking and Placing Operation" in which adjustable gripper for robotic system is designed to identify the shape and size of an object which is needed in many applications especially for picking and placing operation [2]. The main objective is to design a robust gripper that can perform easier and faster picking and placing operation for multiple shapes and sizes objects. This adjustable gripper for robotic system can to improve the picking and placing operation in manufacturing field in producing more outputs without the needs to. P.S.Ramaiah, M.Venkateswara Rao, Raghu and G.V.Satyanarayana presented a system entitled "A Microcontroller Based Four Fingered Robotic Hand". In this paper, design and development of a Four Fingered Robotic Hand (FFRH) using 8-bit microcontroller, sensors and wireless feedback is explained. The design of the system is based on a simple, flexible and minimal control strategy.

This system has 14 independent commands for all the four fingers open and close, wrist up and down, base clockwise and counters clockwise, Pick and Place and Home position to move the fingers. The tendering system of the double revolute joint mechanism and wireless feedback network provide the hand with the ability to confirm to object topology and therefore providing the advantage of using a simple control algorithm. Finally, the results of the experimental work for pick and place application is enumerated. Author Girish Patel, and Devendra Chauhan introduced a paper entitled "SIFT Based Approach: Object Recognition and Localization for Pick-and-Place System". In this paper, the system typically employs machine vision to analyze the scene, identify and locate the specified object and provide feedback to the robot arm for subsequent operations. For successful picking, the vision system needs to recognize the position and the orientation of the objects, the Scale Invariant Feature Transform (SIFT) is used for this purpose.

The proposed system is based on android application controlled for remote operation. In this method, robotic arm is designed and developed with a soft catching gripper.

III. HARDWARE IMPLEMENTATION

The hardware implementation of pick and place arm system consists of AVR microcontroller, DC motor, Bluetooth, Motor Driver, Android application device and power supply. The block diagram of proposed method is shown in Fig 1.

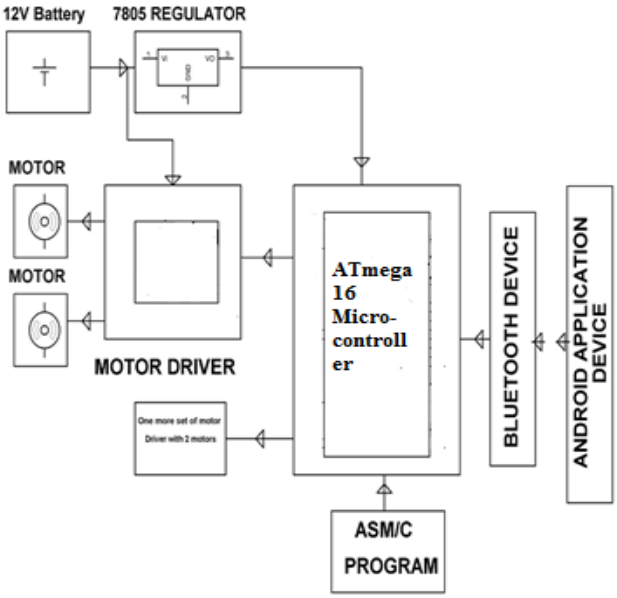

Fig. 1. Block Diagram of Proposed Method

A. AVR Microcontroller

In this paper, AVR microcontroller ATmega16 is used for data acquisition. The high-performance, low-power Atmel 8-bit AVR RISC-based microcontroller combines 16KB of programmable flash memory, 1KB SRAM, 512B EEPROM, an 8-channel 10-bit A/D converter, and a JTAG interface for on-chip debugging. The device supports throughput of 16 MIPS at 16 MHz and operates between 4.5-5.5 volts. By executing instructions in a single clock cycle, the device achieves throughputs approaching 1 MIPS per MHz, balancing power consumption and processing speed. It has 1 programmable serial USART (universal synchronous asynchronous receiver transmitter) and 32 programmable I/O pins [3]. To write a program for microcontroller, AVR studio software is used. Sinaprog is used to burn the program into the microcontroller's flash memory. Fig 2 and Fig 3 shows the pin diagram and IC of ATmega16 respectively.

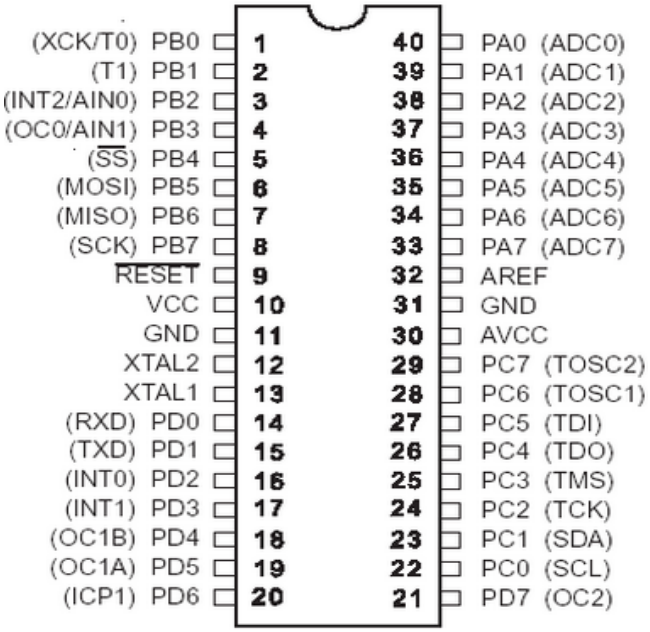

Fig. 2. Pin Diagram of ATmega16

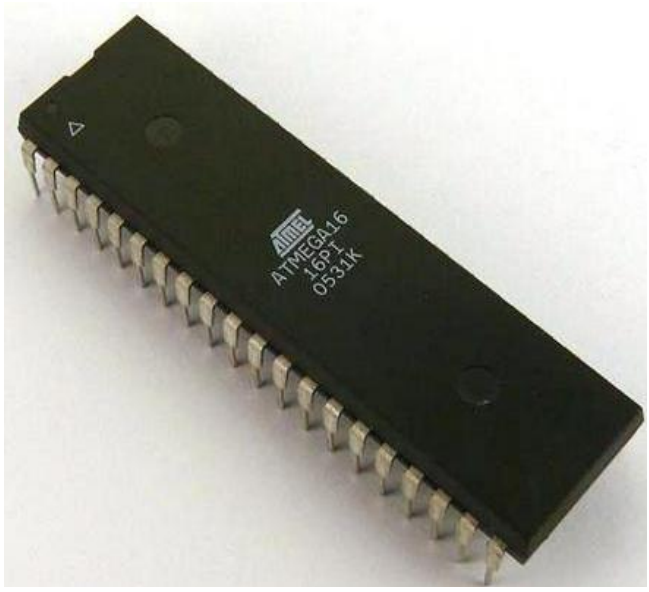

Fig. 3. IC of ATmega16

B. DC Motor

In this paper, four Stepper DC motor is used to move the arm, gripper and vehicle forward or backward. A stepper motor is a brushless DC electric motor that divides a full rotation into a number of equal steps. The position of motor can be commanded to move and it holds one of these steps without any feedback sensor. It is an open-loop controller. When DC voltage is applied to their terminals, it rotates continuously. It converts a train of input pulses known as square wave pulses into a precisely defined increment in the shaft position. Each pulse moves the shaft through a fixed angle.

Fig. 4. DC Stepper Motor

C. Motor Driver

Motor driver is used to drive the motors used in this paper. Motor driver is connected to the microcontroller. Microcontroller gives the 5 miliamp output which is not sufficient enough to drive the DC motors that's why we use motor driver. Fig 5 shows the diagram of motor driver.

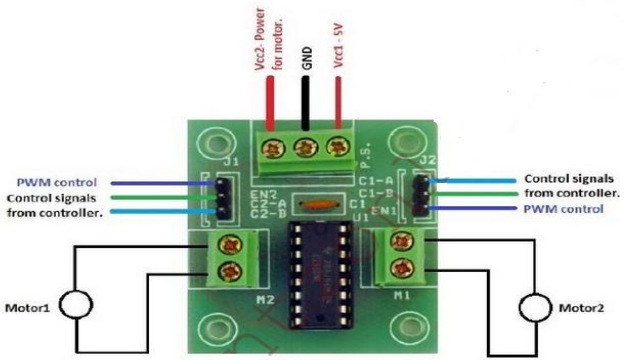

Fig. 5. Motor Driver

D. Bluetooth Module

Bluetooth is a packet-based multi-layer wireless protocol with Master-slave model. In Bluetooth, one Master may communicate upto 7 slaves in a 'piconet'. In this, RF Layer operates in unlicensed ISM band of 2.4GHz. In this paper, Bluetooth HC-05 is used which has a Chipset CSR BC417143. The Bluetooth version is V2.0+EDR. It has Flash 8Mbit and operates at voltage 3.3V [5]. The size of Bluetooth module is 26.9mm*13mm*2.2mm. The pin diagram of Bluetooth and Bluetooth module are shown in Fig 6.

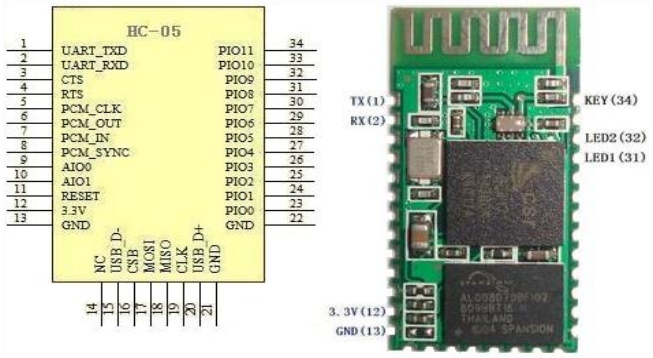

Fig. 6. Pin Diagram and Module of HC-05 Bluetooth

E. Power Supply

In this paper, 12V power supply is given to the system using the batteries. 7805 voltage regulator is used which regulates the voltage to 5V.

Fig. 7. 12V Battery

F. Android Application Device

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Android is the most popular operating system used in mobile [6]. In this paper, we have developed an android application to control the movement of robotic arm.

G. LCD Display

LCD (Liquid Crystal Display) screen is an electronic display module. In this paper, 16x2 LCD display is used which is very basic module and is very commonly used in various devices and circuits. LCDs are economical, easily programmable and have no limitation of displaying. A 16x2 LCD means it can display 16 characters per line and there are 2 such lines. The command register stores the command instructions given to the LCD. A command is an instruction given to LCD to do a predefined task like initializing it, clearing its screen, setting the cursor position, controlling display etc. The data register stores the data to be displayed on the LCD. The data is the ASCII value of the character to be displayed on the LCD. Fig. shows the LCD

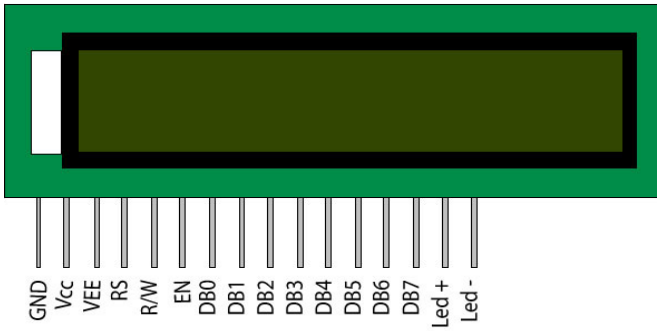

Fig. 8. LCD Display

IV. EXPERIMENTAL RESULTS

In this way, we have implemented a robotic arm controlled wirelessly by an android device. We have controlled the various movements of arm as well as vehicle by sending different commands from android device through Bluetooth, such as on giving command 'L' arm moves left, on giving command 'R' arm moves right, similarly for gripper open command 'M' and for gripper close command 'N' is given from android device. These results can be seen in Fig. 9, Fig. 10, Fig. 11, Fig. 12.

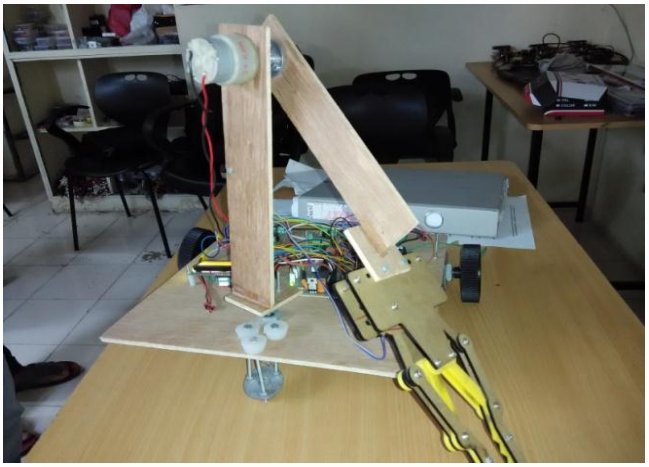

Fig. 9. Gripper Close

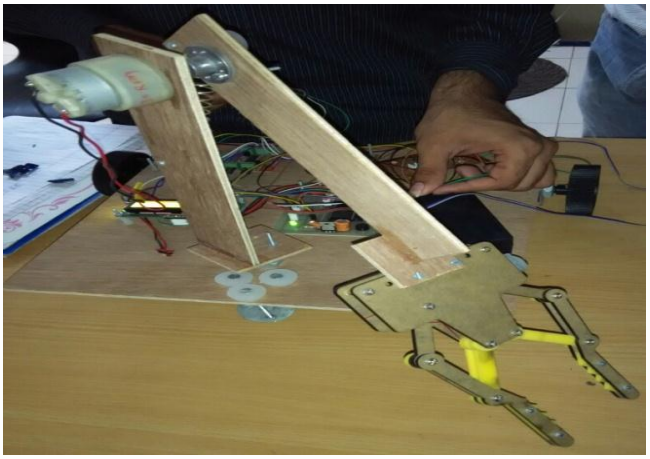

Fig. 10. Gripper Open

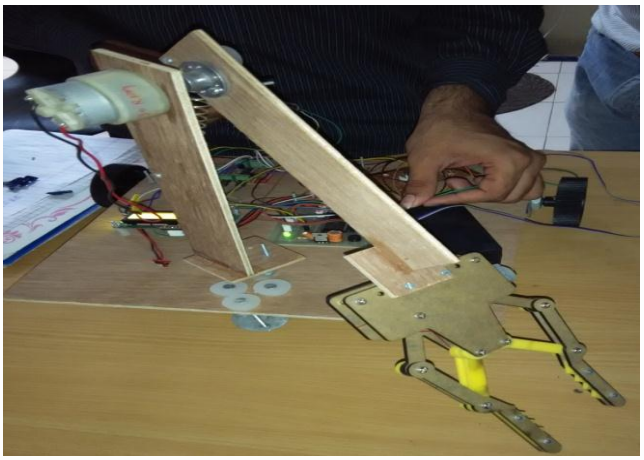

Fig. 11. Arm Left

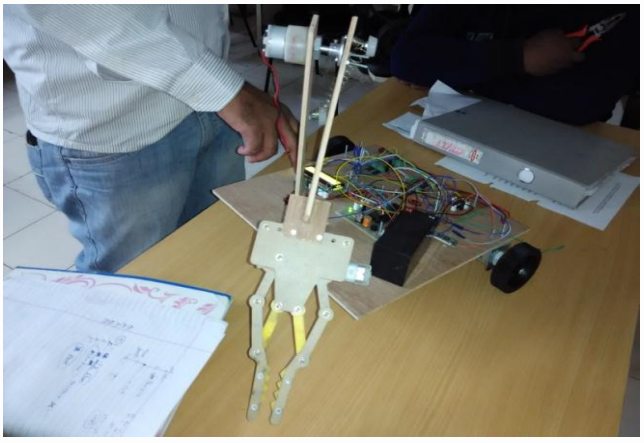

Fig. 12. Arm Right

V. CONCLUSION

An autonomous robot with adjustable gripper that perform pick and place operation has been successfully designed and developed. The robot has been able to pick the object and place it effectively. The robot is also able to perform lifting upward and downward smoothly. By using AVR microcontroller, the robot has performed the task perfectly according to the program that being made. Beside than that, the adjustable gripper with sensors is able to open its grip according to the size of the object. Due to this advantage, the robot can pick. This system can be used in various applications like in gripper, fabrication process, and inspection, processing, spraying, stamping and welding for work piece.

REFERENCES

[1] Jegede Olawale, Awodele Oludele, Ajayi Ayodele, "Development of a Microcontroller Based Robotic Arm", *In Proceedings of the 2007 Computer Science and IT Education Conference* pg: 549-557.

[2] "Robotic Arm" - www. NASA explores. com from Teacher Sheets pg:1-2

[3] Datasheet of ATmega16 Microcontroller

[4] Datasheet of Bluetooth Module

[5] "Robot software" from Wikipedia, the free encyclopedia on 04-3-2012

[6] Andren, Gerald B., "Robot Design Handbook, SRI International, Mitsubishi Electric Company, 1988.