



# **Wireless Control of Pick and Place Robotic Arm Using an Android Application**

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**ABSTRACT:**The work is designed to develop a pick and place robotic arm vehicle with a softcatching gripperthat is designed to avoid extra pressure on the suspected object (Like Bombs) for safetyreasons. The robotic vehicle is android application controlled for remoteoperation. At the transmitting end using android application device, commands are sentto the receiver to control the movement of the robot either to move forward, backwardand left or right etc. At the receiving end four motors are interfaced to the microcontrollerwhere two of them are used for arm and gripper movement of the robot while the othertwo are for the body movement of the vehicle. The main advantage of this robot is its softcatching arm that is designed to avoid extra pressure on the suspected object for safetyreasons. The android application device transmitter acts as a remote control that has the advantage of adequate range, while the receiver end Bluetooth device is connectedto the microcontroller to drive DC motors via motor driver IC for necessary operation.Remote operation is achieved by any smart-phone/Tablet etc., with Android OS; upon aGUI (Graphical User Interface) based touch screen operation.

**KEYWORDS:**Pick and Place Robot, Soft catching Arm, Atmega328, Android, Blue Control.

## **I.INTRODUCTION**

Robots are indispensable in many manufacturing industries. The reason is that the costper hour to operate a robot is a fraction of the cost of the human labour needed to performthe same function. More than this, once programmed, robots repeatedly perform functionswith a high accuracy that surpasses that of the most experienced human operator. Humanoperators are, however, far more versatile. Humans can switch job tasks easily. Robotsare built and programmed to be job specific. Today's most advanced industrial robotswill soon become dinosaurs.Robots are in the infancy stage of their evolution. As robots evolve, they will become more versatile, emulating the human capacity and ability to switch job tasks easily.While the personal computer has made an indelible mark on society, the personal robot hasn't made an appearance. Obviously there's more to a personal robot than a personalcomputer. Robots require a combination of elements to be effective: sophistication ofintelligence, movement, mobility, navigation, and purpose. In the beginning, personal robots will focus on a singular function (job task) or purpose.Building a useful personal robot is very difficult. But recent days Robots occupies a goodplace in community.The main functioning of robotics in recent days are.

### **Hazardous duty**

Without risking human life or limb, robots can replace humans in some hazardous dutyservice (see Fig1.2). Take for example bomb disposal. Robots are used in many bombsquads across the nation. Typically these robots resemble small armoured tanks and areguided remotely by personnel using video cameras attachedto the front of the robot. Robotic arms can grab a suspected bomb and place it in anexplosion-proof safe box for detonation and/or disposal.Similar robots can help clean up toxic wastes. Robots can work in all types of pollutedenvironments, chemical as well as

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nuclear. They can work in environments so hazardous that an unprotected human would quickly die. The nuclear industry was the first to develop and use robotic arms for handling radioactive materials. Robotic arms allowed scientists to be located in clean, safe rooms operating controls for the robotic arms located in radioactive rooms.

## Relevance

There are so many hazardous situations in day to day life. There are so many occasions where the human can't work. In that situations without a considerable amount of safety precautions like, the disposal of hazardous wastes, radioactive substances, remote handling of explosive devices and rioting and hostage situations among others. It can safely work at hazardous conditions. These robots ensure the human safety and replace massive human work force. It can be also applied in medical science, surgeries, and defence purposes, with artificial intelligence, super market field, and manufacturing field. These are compact and efficient robotic systems.

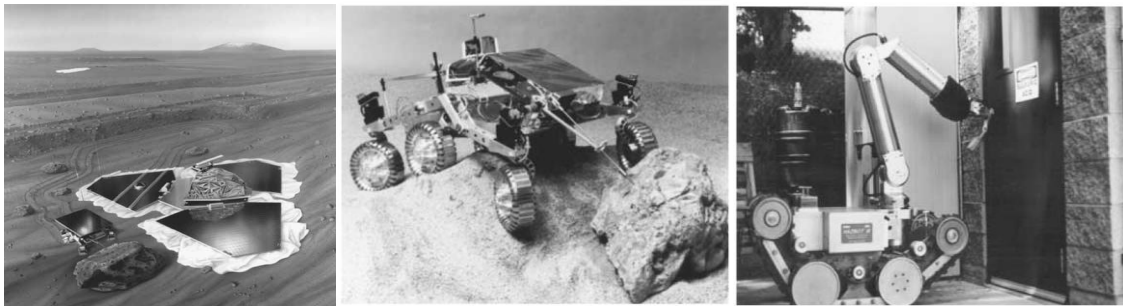


Figure1: Some first robot in the world. From left: Mars Path Finder, Sojourner Rover, Hazbot. Photo courtesy of NASA

## Literature Survey.

John Iovine [1], in this book various aspects of designing a Robot is described. It deals with different types of Arm design, controlling techniques, vehicle design etc... In the remaining references different types controlling technique are explained. The Idea about the Android software 'Blue control' and its application in controlling Robotics is described in the Google play store website. From all these we find a different controlling technique using android device and software with a different approach for soft catching arm (electronic pressure sensor).

## II. WORKING OF PICK AND PLACE ROBOT

The block diagram of the proposed system is shown in Figure2. It consists of an Atmega328 Micro controller IC, Bluetooth module, four DC Motors with driver IC and power supply. The pick and place robotic arm consists of a robotic arm placed on a moving vehicle. The vehicle is able to move along any type of surfaces irrespective of it is smooth or rough. It uses two motors for the operation and a belt type tyre is attached to the vehicle like in the tanks, for the smooth and reliable operation. The pick and place robot uses four motors for the operation of the system, two for the operation of moving vehicle and two for the pick and place operation. The pick and place arm consists of an arm assembly with a jaw, which is only able to move in up and down direction. There are two motors are for the arm assembly, one for the up and down motion and other for jaw opening and closing. The maximum upward and downward motion is limited by a mechanical push button type switches. It breaks the motor circuit when the arm is at its maximum position beyond which the motor does not rotate.

For the controlling of motor, motor driver IC and Atmega328 micro controller is used. The input signal or controlling signal is given from an android device, which is interfaced with the microcontroller by a blue tooth module. L293D has 2 set of arrangements where one set has input 1, input 2, output 1 and output 2 and other set has input 3, input 4, output 3 and output 4, according to block diagram if pin no 2 and 7 are high then pin no 3 and 6 are also high.

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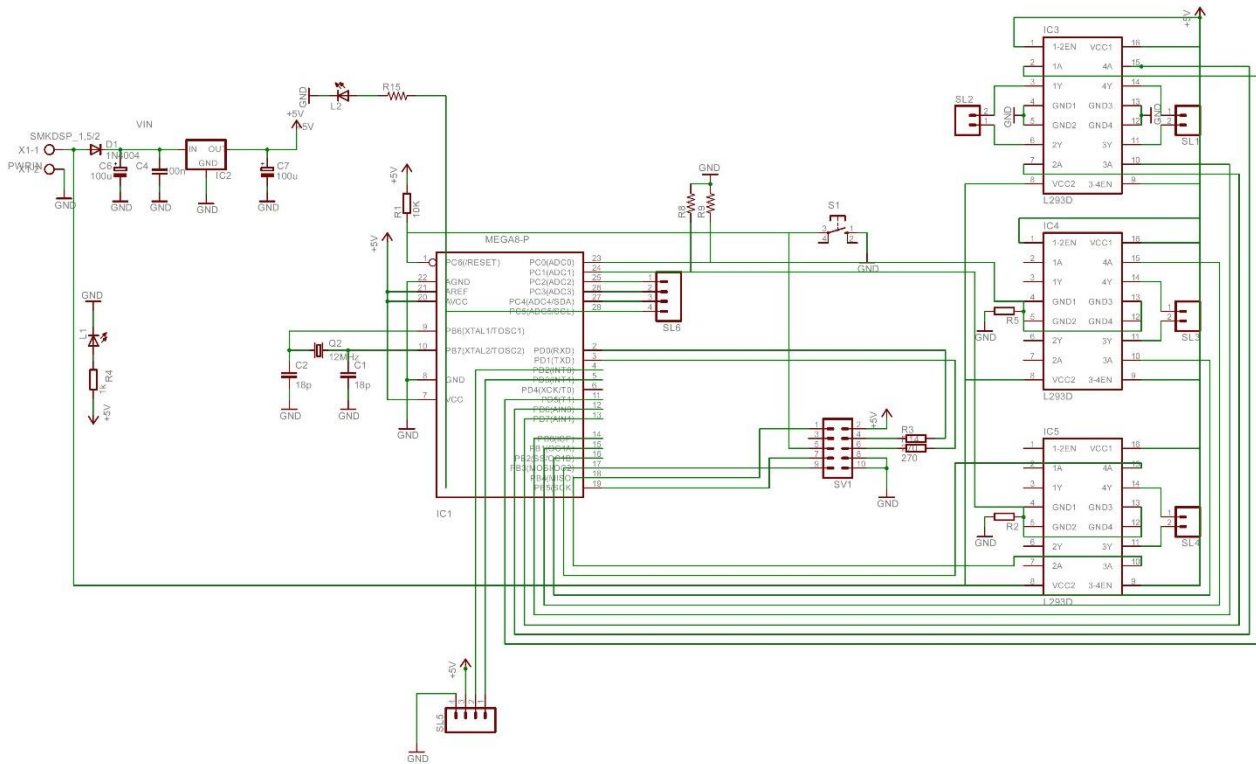


Figure 2: Circuit Diagram of Pick and Place Robot

Pin			Description
E	A	B	
1	0	1	1 Motor runs clockwise
1	1	0	Motor runs anti-clockwise
1	0	0	Motor stops or decelerates
1	1	1	Motor stops or decelerates

Table I: Truth table of L293D motor driver

If enable 1 and pin number 2 are high leaving pin number 7 as low then the motor rotates in forward direction.  
 If enable 2 and pin number 10 are high leaving pin number 15 as low then the motor rotates in forward direction.  
 If enable 1 and pin number 2 are low leaving pin number 7 as high then the motor rotates in reverse direction.  
 If enable 2 and pin number 15 are high leaving pin number 10 as low then the motor rotates in forward direction.

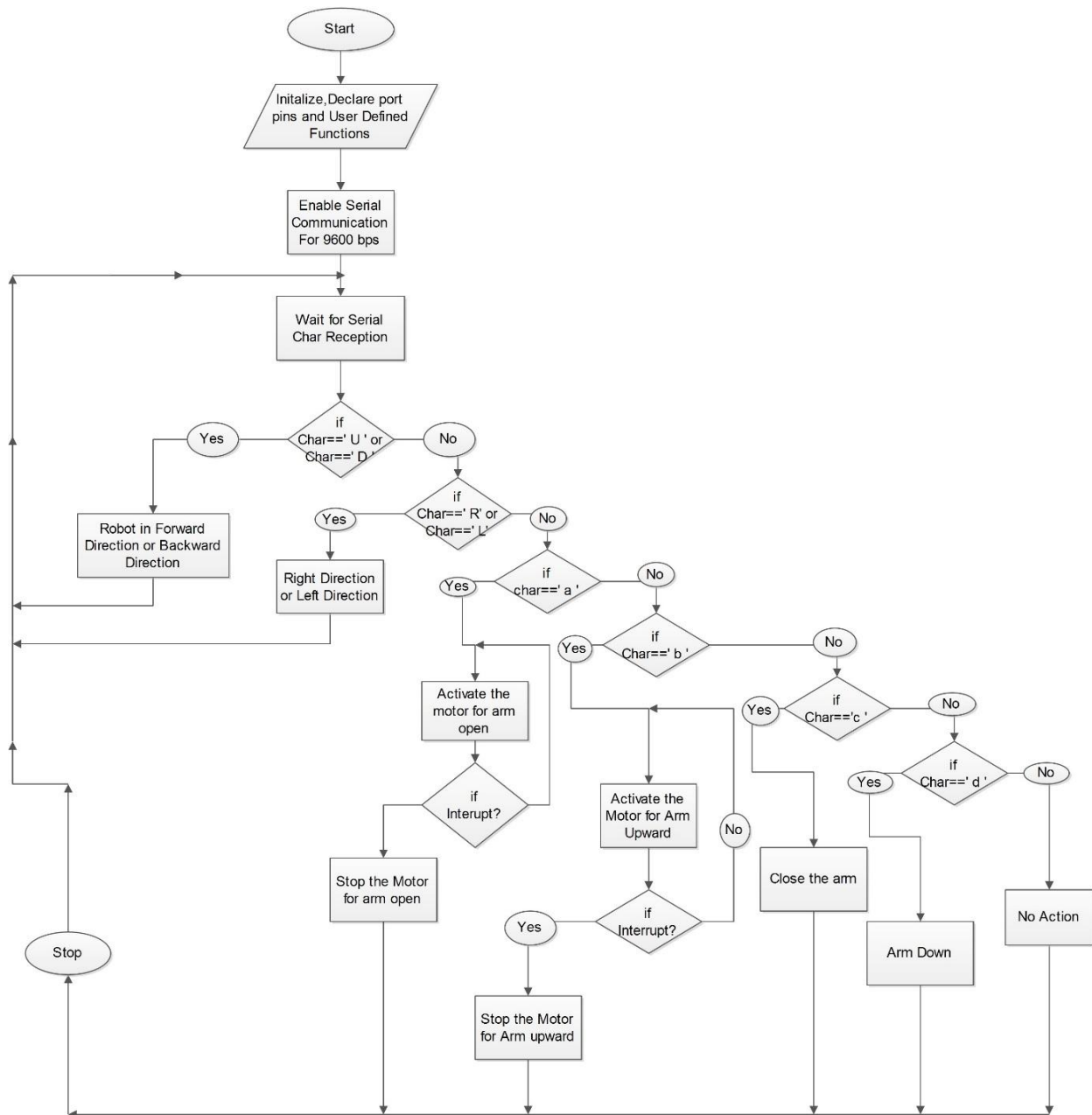


Figure 3. Flow Chart of Pick and Place Robot

The program is so written i.e., while executed it sends commands to the motor driver IC as per its requirement for running the motor for the movement of the robot as explained in the subject above in L293D. The android phone screen is used for sending commands for left, right, forward and backward and centre is for stop through its inbuilt Bluetooth system.

12V battery powers the circuit in series with a diode D2 that nearly provides 5 through regulator IC LM 7805 for the microcontroller which has standard connections like crystal, reset arrangement indication LED etc. A blue tooth device being powered from a reversed biased Zener diode D1, is interfaced to the microcontroller that after being paired

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with any smart phone communicates with this Bluetooth device for taking appropriate actions as per the touch operation made on the smart phone.

The work uses another motor driver IC working on similar technology for the arm up and down / open and close duly interfaced to the microcontroller with duly pulled up resistors. The program is so written that for touch screen operation from the smart phone results in command being sent through the Bluetooth module, on A=open, B=close, C=up and D=down number upon MC developing appropriate rotation of the motor.

Now consider the operation of *soft catching arm*. It sense pressure in the arm by measuring current. The motors used for an operation up and down and gripper operation open and closed pass through series resistor of 10 ohms/ 2 watt from the output of the second motor driver IC L293D. While motor is operating the returning current from Driver IC is grounded through this resistance. And the voltage across it is proportional to the current flowing through it and this current is proportional to the load at the motor or pressure in the arm jaws. Thus by measuring the voltage we can measure the amount of pressure. The built-in ADC in the Atmega328 continuously measuring this voltage. Thus while motor operates in normal condition the running current results normal voltage drop across the 10R/2W ohm resistor as the motor can run in clockwise (or) anti-clockwise. When load increases the voltage across resistor get increased and is continuously monitored by micro controller. When it increases above a certain value, interrupt is produced thus stopping the motor. The program is so written that once interrupt zero occurs low, no such command would generate any input to the motor driver IC for any direction for that motor movement. Only the other direction rotation is possible from the command. This helps in soft catching arrangement of the arm gripper.

### III. DESIGN AND PROGRAMMING

The main components used in this work are the DC motors, Microcontroller (Atmega328), Bluetooth interfacing device and user interfacing device (Android phone) and Android application (Blue control).

#### Atmega328 Micro controller

The Atmel AVR ATmega8 is a low-power CMOS 8-bit microcontroller based on the AVR RISC architecture. By executing powerful instructions in a single clock cycle, the ATmega8 achieves throughputs approaching 1MIPS per MHz, allowing the system designed to optimize power consumption versus processing speed.

#### DC Motors

DC motors with built-in gearing Arrangement is used in this work. It is because it is simple to control and have higher torque compared to servomotors. To use a DC motor, we need motor driver IC. To drive the motor simply connect the one wire to one of the driver terminals and the other to other terminal.

#### Bluetooth Device

The Serial port Bluetooth module is fully qualified Bluetooth V2.0+EDR (Enhanced Data Rate) 3Mbps Modulation with complete 2.4GHz radio transceiver and base band. It uses CSR Blue core 04-External single chip Bluetooth system with CMOS technology and with AFH (Adaptive Frequency Hopping Feature). It has a footprint as small as 12.7mm x 27mm.



Figure 4. DC Motor



Figure 5. Bluetooth device

#### Arduino Programmer

Arduino is an open-source computer hardware and software company, work and user community that designs and manufactures kits for building digital devices and interactive objects that can sense and control the physical world. Arduino boards may be purchased preassembled, or as do-it-yourself kits; at the same time, the hardware design information is available for those who would like to assemble an Arduino from scratch.

# International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

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Vol. 4, Issue 4, April 2015

These systems providesets of digital and analog I/O pins that can be interfaced to various extension boardsand other circuits. The boards feature serial communications interfaces, including USBon some models, for loading programs from personal computers. For programming themicrocontrollers, the Arduino platform provides an integrated development environment(IDE) based on the Processing work, which includes support for C and C++ programming languages.

## Blue control

Blue Control is a basic universal Remote Control for Blue-Tooth enabled serial devicesuch as Blue Tooth modules connected to a micro-controller. For each button pressed the corresponding ASCII code for the label will be sent. For example pressing buttons A-Hwill send the characters "a" - "h". The up, down, left, right, and center buttons will send "U","D","L","R", and "C" characters.

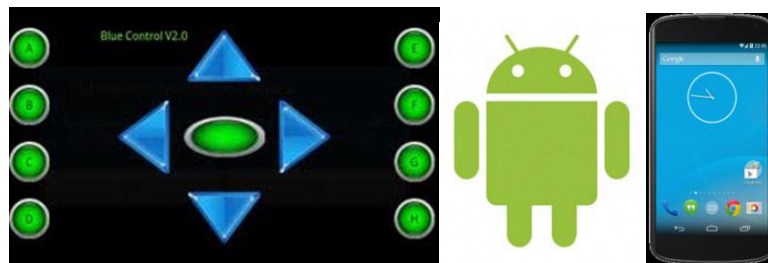


Figure 6 . (From Left)Bluecontrol application,Android symbol and Android phone

## IV. RESULTS AND DISCUSSION

In this work we made a Pick and place robot controlled by an Android application.We know that the whole the digital devices in the world are transformed in to Android OSbased systems ,as it is more versatile ,flexible and easy tocontrol and it is an open sourcesoftware.Here The Pick and place robot is controlled wirelessly by an Android applicationcalled Blue control through a blue tooth module. The Android OS as well as Arduinosoftware are open source soft wares. The main feature of this pick and place robot is the soft catching arm or soft catchingGripper. We know that when handling the explosive items like bomb it should be handledcarefully. Excessive pressure will cause explosion. Soit is very essential to have a softcatching arm .This robot has microcontroller based electrical pressure sensor which has higher sensitivity than mechanical pressure sensors.

The hardware model functioned as desired and is shown in Figure7 .This is designed to handle a maximum weight of 2 kg.The weight handling capacity of Pick andPlace Robot is determined by the capacity of DC motors used. Very useful and interesting can be made by interfacing the 'Pick and Place Robot' withexplosive detectors, metal detectors, wireless cameras, night vision cameras...Etc. forfindingthe bombs and proper visual assistance.

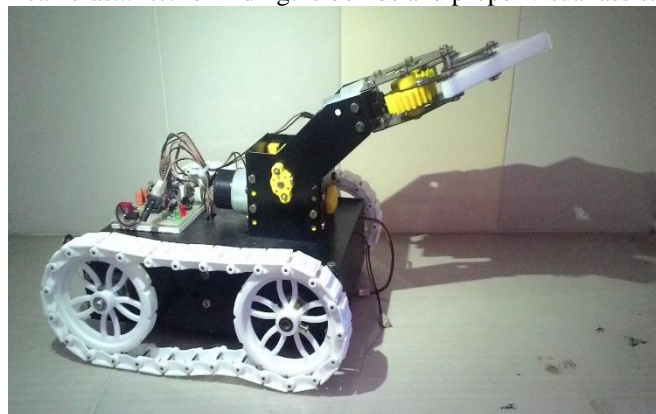


Figure 7. Pick and Place Robot



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## V.CONCLUSION

The aim of this work is the development of wireless control of a pick and place robot using Android application .It is controlled by an android application called *blue control*. The micro controller used is an Atmega328 and Arduino software is used to program it. Number of joints on the arm determines the type of object it can handle.

The main feature of this is the soft catching arm. We know that when handling the explosive items like bomb it will be handled smoothly. Excessive pressure will cause explosion. So this robot has microcontroller based electrical pressure sensor which has higher sensitivity than mechanical pressure sensors. The maximum weight that can be carried by this model is depends on the capacity of DC motors used. Very useful and interesting can be made by interfacing the 'Pick and Place Robot' with explosive detectors, metal detectors, wireless cameras, night vision cameras...Etc. for finding the bombs and proper visual assistance.

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## BIOGRAPHY



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