

Automatic Sprayer for Crops Using Arduino and Bluetooth

Prof. B.S. Thube¹ Patel Parvez Jamil² Shaikh Arbas Abdulraheman³ Thete Amol Baban⁴

¹Faculty ^{2,3,4}Student

^{1,2,3,4}Department of Electronics & Telecommunication Engineering

^{1,2,3,4}IET Kannad Dist. Aurangabad, Maharashtra, India

Abstract— Crop yield is reduced by mainly due to attack of pests, diseases and weed. Chemical control is the popular method adopted for controlling most insects, weed and diseases. The chemicals are applied either by spraying, sprinkling or on the crop with help of pump or dusting. Spraying is one of the most effective and efficient techniques for applying small volume of spray liquid to protect crops. In conventional methods, manually operated low and high volume hydraulic sprayer and power operated hydraulic sprayer with long boom, long lances or spray gun are used to carry fluid at different targets. In this method, the time and labor required is more. It is difficult to spray the pesticide uniformly and effectively throughout the tree by conventional method of spraying. Though this method gives good pest control, it consumes large volume of liquid per plant, great amount of time and labor are required. Also drip losses are more. The normal farmers does not follows the instructions provided on the seals of pesticides and insecticides and due to these reasons the accidents happens. This machine will help to the normal farmer to spray pesticides and insecticides of crops without any human interception or human effort. Just use a mobile phone or a tablet to control the machine through the Bluetooth link.

Keywords: Automatic Sprayer, Crops, Arduino and Bluetooth

I. INTRODUCTION

Spraying of pesticides is done to control pest and diseases for that purpose sprayer are used. Sprayer must break liquid in to droplet of effective size, also distribute them uniformly over the plants and regulate the amount of liquid to avoid excessive application controlling pest, diseases is one serious problem faced by the farmers everywhere.

Most of farmer in India are small and marginal land holder. The spraying operation done by Knapsack sprayer which consumes more time and energy. Tractor operated sprayers are difficult for adaption by the farmer due to existing cropping patterns, available field size, field condition during the rainy season. To overcome these problem requirements for better adaptability. In the view self-propelled small engine operated sprayer is better option due to its medium cost and small size implying better performance in the small land holding. Self-propelled walking type sprayers can full fill the mechanization gap to do spraying operation at the faster rate. This shows there is an urgent need to introduce mechanical sprayer in Indian agricultural field. The engine operated self-propelled sprayer should be easily available and less expensive for farmers. Present pattern of row cropping concept widely adopted by Indian farmer and development of spraying vehicle type sprayer is the need of today's agricultural field. Keeping the above point of view, the present investigation was under taken to evaluate field performance of self-propelled boom

sprayer in the field crops and workout the cost of spraying operation.

II. LITERATURE SURVEY

1) Backpack (Knapsack) Sprayer:

One type of backpack sprayer is a compressed air sprayer with a harness that allows it to be carried on the operator's back. Another type of backpack sprayer has a hand-operated hydraulic pump that forces liquid pesticide through a hose and one or more nozzles. The pump is usually activated by moving a lever. A mechanical agitator plate may be attached to the pump plunger. Some of these sprayers can generate pressures of 100 pounds per square inch (psi) or more. Capacity of both these types of backpack sprayers is usually 5 gallons or less. Hydraulic sprayers consist of a tank, a pump, a lance (for single nozzles) or boom, and a nozzle (or multiple nozzles). Sprayers convert a pesticide formulation, often containing a mixture of water (or another liquid chemical carrier, such as fertilizer) and chemical, into droplets, which can be large rain-type drops or tiny almost-invisible particles. This conversion is accomplished by forcing the spray mixture through a spray nozzle under pressure. The size of droplets can be altered through the use of different nozzle sizes, or by altering the pressure under which it is forced, or a combination of both.

2) Lite-Trac:

Lite-Trac is a trading name of Holme Farm Supplies Ltd, a manufacturer of agricultural machinery registered in England and based in Peterborough. The Lite-Trac name comes from "lite tractor", due to the patented chassis design enabling the inherently very heavy machines manufactured by the company to have a light footprint for minimum soil compaction. All rights reserved by www.ijirst.org 46 Holme Farm Supplies Ltd agricultural products, sold under the Lite-Trac name, include tool carriers, self-propelled lime and fertilizer spreaders, sprayers, granular applicators and tank masters. Lite-Trac is currently the manufacturer of Europe's largest four-wheeled self-propelled crop sprayers. The company's products are identifiable by the combination of unpainted stainless steel tanks and booms with bright yellow cabs and detailing. A Lite-Trac crop sprayer, or liquid fertilizer applicator, mounts onto the SS2400 Tool Carrier centrally between both axles to maintain equal weight distribution on all four wheels and a low centre of gravity whether empty or full. The stainless steel tanks are manufactured in capacities of up to 8,000 liters, whilst Pommieraluminium booms of up to 48 meters can be fitted, making these Europe's largest four-wheeled self-propelled sprayers.

3) Motorcycle Driven Multi-Purpose Farming Device (Bullet Shanti):

In 1994, Mansukhbhai Jagani, developed an attachment for a motorbike to get a multi-purpose tool bar. It which addresses the twin problems of farmers in Saurashtra namely paucity

of laborers and shortage of bullocks. This motor cycle driven plough (Bullet shanti) can be used to carry out various farming operations like furrow opening, sowing, inter-culturing and spraying operations. Mansukhbhai intermediate-technology contraption proved efficient and cost-effective for small-sized farms. It could plough one acre (0.4 ha) of land in less than half an hour on just two liters of diesel oil. Using motorbike-shanti, the cost of weeding a typical field was found to be just Rs 8/ha because as much as 10 ha land could be covered in a single day. But, this spraying equipment needs fuel for its running and proper operation which increases its operating cost.

4) Aerial Sprayer:

Aerial sprayer is another type of spraying; it is beneficial for the farmers having large farms. This technique is not affordable by farmers having small and medium farm. It is modern technique in agricultural field. In aerial spraying the spraying is done with the help of small helicopter controlled by remote. On that sprayer is attached having multiple nozzles and sprayed it on the farm from some altitude. It is less time consuming and less human effort required to spray fertilizers.

III. SCOPE OF PROJECT

As we know in farming there are lots of works are harmful, risky and should be done properly otherwise there is a chances of an accidents, which could result in an unfortunate deaths also. The spraying pesticides is also a complex but important stage of farming which should be done properly and carefully because the pesticides and insecticides are poisonous and due the misuse or any mishandling could result in the accident. So to overcome this problem we have to implement some idea or some technology by our automation. So to overcome this problem we have tried to develop the automatic sprayer for crops.

As we know in farming there are lots of works are dangerous or should be done properly otherwise there is a chances of an accidents, which could result in an unfortunate deaths also. The spraying is also a complex but important step or stage of farming which should be done properly and carefully because the pesticides and insecticides are poisonous and due the misuse or any mishandling could result in the accident .So, to overcome this problem we have to implement some idea or some technology by our automation .So, due to overcome this problem we have tried to develop the automatic sprayer for crops.

So, if we use the wireless technology such as Bluetooth for controlling the sprayer then there is no direct or physical contact of the farmer take place with the sprayer and the chances of accidents will reduce. And safety of farmers increase. By using same concept but using different mechanism we can develop automatic fertilizer distributor machine or harvesting and weeding machines also.

IV. METHODOLOGY

A. Controlling the movement of sprayer

To control the movement of sprayer we have used a Bluetooth module (HC 05) to receive the commands from

the software loaded smartphone and send that commands to the Arduino board and then the Arduino will take the decision as per the Arduino code that has been uploaded by the user. As per the command from the user the sprayer will move in several directions such a FORWARD, BACKWORD, LEFT, RIGHT or it will STOP

B. Spraying the liquid (Pesticides & Insecticides)

The main motto of our project is to spray the pesticide & insecticides on the crops without any manual intervention. So, we have used here the Bluetooth communication to turn ON and OFF the sprayer pump through the mobile when the sprayer will move in the forward direction the PUMP will be ON and the spraying will begin and for any other movement it will be OFF .

C. Controlling the sprayer pump

To control the spraying of the sprayer we have to use some technique or we have to provide some conditions. Because if it does not have a proper spraying then the pesticides will be waste and we have to reduce the wastage if we want to develop a proper machine. So we have given a condition to sprayer that it will spray the liquid only when it will move in the forward direction otherwise the pump will be off and spraying will stop.

V. SYSTEM DESIGN

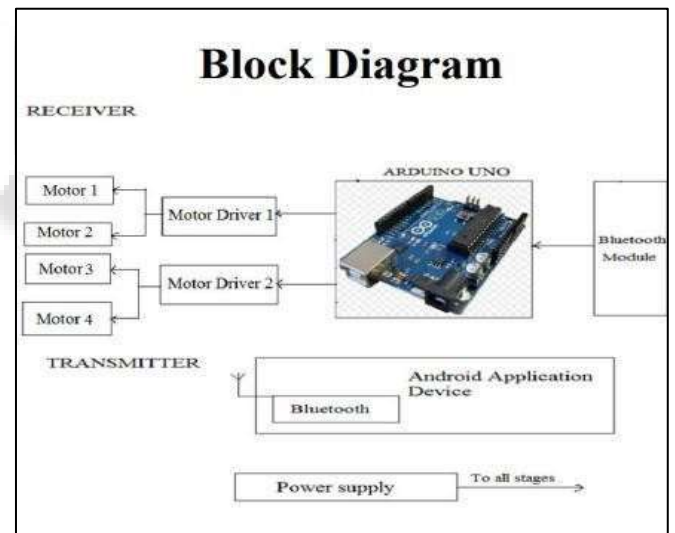
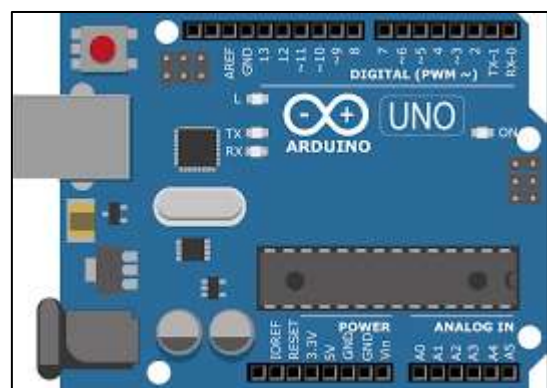


Fig. 1: Block Diagram of Robot

VI. ARDUINO UNO



Arduino is an open-source electronics platform based on easy-to-use hardware and software. Arduino boards are able to read inputs - light on a sensor, a finger on a button, or a Twitter message - and turn it into an output - activating a motor, turning on an LED, publishing something online. You can tell your board what to do by sending a set of instructions to the microcontroller on the board. To do so you use the Arduino programming language (based on Wiring), and the Arduino Software (IDE), based on Processing.

Over the years Arduino has been the brain of thousands of projects, from everyday objects to complex scientific instruments. A worldwide community of makers - students, hobbyists, artists, programmers, and professionals - has gathered around this open-source platform, their contributions have added up to an incredible amount of accessible knowledge that can be of great help to novices and experts alike.

Arduino was born at the Ivrea Interaction Design Institute as an easy tool for fast prototyping, aimed at students without a background in electronics and programming. As soon as it reached a wider community, the Arduino board started changing to adapt to new needs and challenges, differentiating its offer from simple 8-bit boards to products for IoT applications, wearable, 3D printing, and embedded environments. All Arduino boards are completely open-source, empowering users to build them independently and eventually adapt them to their particular needs. The software, too, is open-source, and it is growing through the contributions of users worldwide.

A. Characteristics of Arduino:

- Microcontroller Atmega328 Operating Voltage 5V
- Input Voltage (Recommended) 7-9V Input Voltage (Limits) 6-20V
- Digital I/O Pins 14 (Of Which 6 Provide PWM Output)
- Analog Input Pins 6
- DC Current per I/O Pin- 40 ma
- DC Current per I/O pin- 3.3V 50 ma
- Flash Memory 32 KB (Atmega328) (0.5 KB Used By Bootloader)
- SRAM 2 KB (Atmega328) EEPROM 1 KB (Atmega328)
- Clock Speed 16 MHz.

VII. ATMEGA328P MICROCONTROLLER:

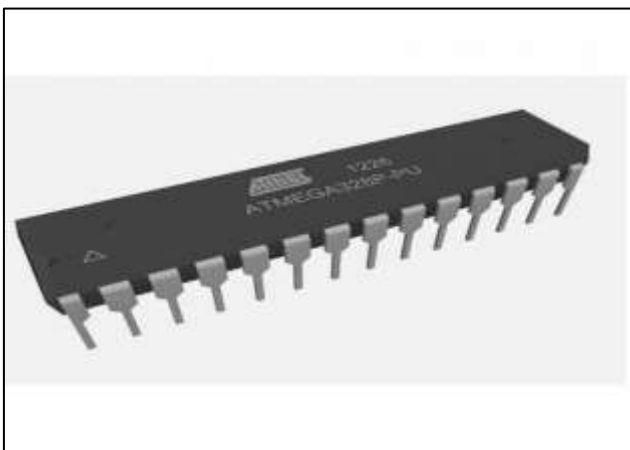


Fig. 2: Atmega328p

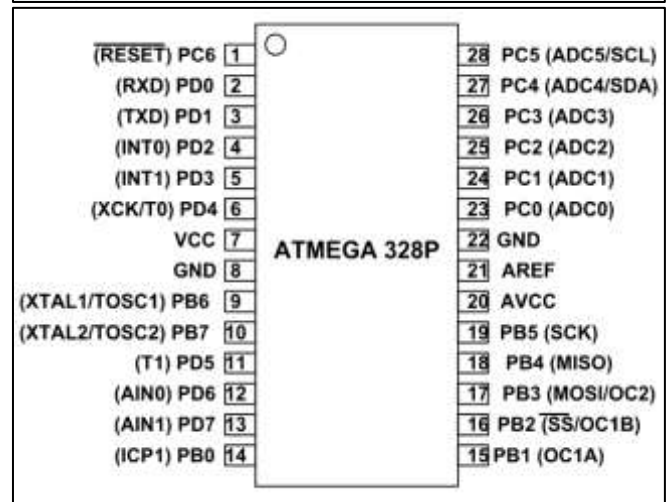
The ATmega328 is a single-chip microcontroller created by Atmel in the mega AVR family (later Microchip Technology acquired Atmel in 2016). It has a modified Harvard architecture 8-bit RISC processor core.

The Atmel 8-bit AVR RISC-based microcontroller combines 32 KB ISP flash memory with read-while-write capabilities, 1 KB EEPROM, 2 KB SRAM, 23 general purpose I/O lines, 32 general purpose working registers, three flexible timer/counters with compare modes, internal and external interrupts, serial programmable USART, a byte-oriented 2-wire serial interface, SPI serial port, 6-channel 10-bit A/D converter (8-channels in TQFP and QFN/MLF packages), programmable watchdog timer with internal oscillator, and five software selectable power saving modes. The device operates between 1.8-5.5 volts. The device achieves throughput approaching 1 MIPS per MHz.

The Arduino Uno uses the Atmel manufacturer company's Atmega328p model microcontroller chip. For interest sake the 32 stands for the max program size it can store (32K), the 8 for the processing speed (8 bits) and the p for Pico Power (very low power).

A. Features of Atmega328:

Parameter	Value
CPU type	8-bit AVR
Performance	20 MIPS at 20 MHz ^[2]
Flash memory	32 KB
SRAM	2 KB
EEPROM	1 KB
Pin count	28 or 32 pin: PDIP-28, MLF-28, TQFP-32, MLF-32 ^[2]
Maximum operating frequency	20 MHz
Number of touch channels	16
Hardware QTouch Acquisition	No
Maximum I/O pins	23
External interrupts	2
USB Interface	No
USB Speed	-



VIII. HC 05 BLUETOOTH MODULE



Fig. 3: HC 05 Bluetooth Module

The HC-05 is a very cool module which can add two-way (full-duplex) wireless functionality to your projects. You can use this module to communicate between two microcontrollers like Arduino or communicate with any device with Bluetooth functionality like a Phone or Laptop. There are many android applications that are already available which makes this process a lot easier. The module communicates with the help of USART at 9600 baud rate hence it is easy to interface with any microcontroller that supports USART. We can also configure the default values of the module by using the command mode. So if you looking for a Wireless module that could transfer data from your computer or mobile phone to microcontroller or vice versa then this module might be the right choice for you. However do not expect this module to transfer multimedia like photos or songs; you might have to look into the CSR8645 module for that.

Pin Configuration		
Pin Number	Pin Name	Description
1	Enable / Key	This pin is used to toggle between Data Mode (set low) and AT command mode (set high). By default it is in Data mode
2	VCC	Powers the module. Connect to +5V Supply voltage
3	Ground	Ground pin of module, connect to system ground.
4	TX	Transmits Serial Data. Everything received via Bluetooth will be given out by this pin as serial data.
5	RX	Receive Serial Data. Every serial data given to this pin will be broadcasted via Bluetooth Receiver
6	State	The state pin is connected to on board LED, it can be used as a feedback to check if Bluetooth is working properly.
7	LED	Indicates the status of Module <ul style="list-style-type: none"> ▪ Blink once in 2 sec: Module has entered Command Mode ▪ Repeated Blinking: Waiting for connection in Data Mode ▪ Blink twice in 1 sec: Connection successful in Data Mode
8	Button	Used to control the Key/Enable pin to toggle between Data and command Mode

Table 1: Pin Configuration of HC 05 BT Module

IX. MOTOR DRIVER

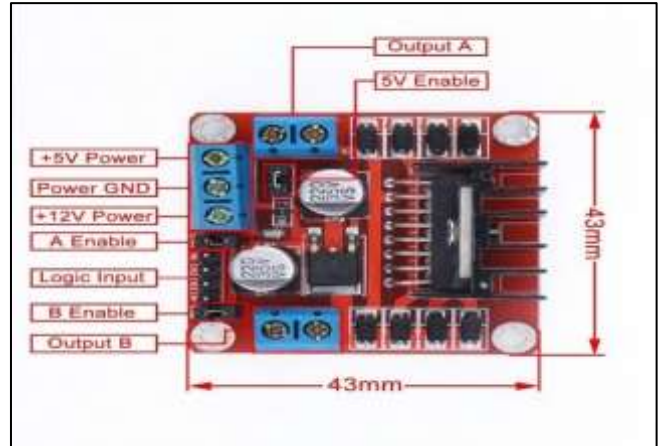


Fig. 4: L298N Module

Double H driver module uses ST L298N dual full- bridge driver, an integrated monolithic circuit in a 15- lead Multiwatt and PowerSO20 packages. It is a high voltage, high current dual full-bridge driver designed to accept standard TTL logic levels and drive inductive loads such as relays, solenoids, DC and stepping motors. Two enable inputs are provided to enable or disable the device independently of the input signals. The emitters of the lower transistors of each bridge are connected together and the corresponding external terminal can be used for the connection of an external sensing resistor. An additional supply input is provided so that the logic works at a lower voltage.

X. DC MOTORS

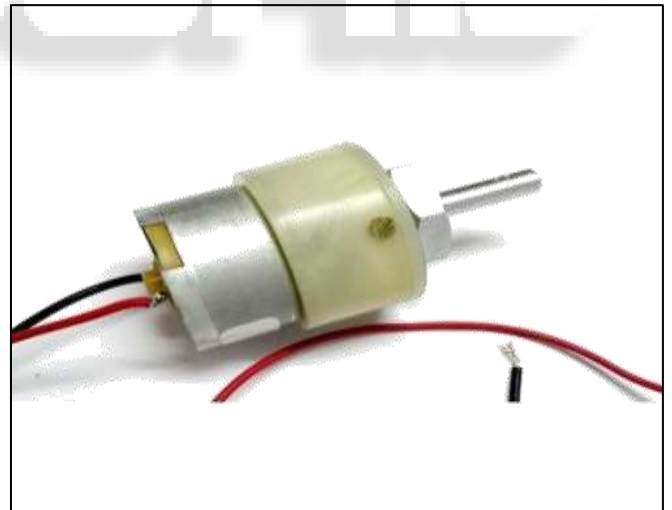


Fig. 5: Dc Motors

DC motors are seldom used in ordinary applications because all electric supply companies furnish alternating current. However, for special applications such as in steel mills, mines and electric trains, it is advantageous to convert alternating current (AC) into direct current (DC) in order to use DC motors. The reason is that speed/torque characteristics of DC motors are much more superior to that of AC motors. Therefore, it is not surprising to note that for industrial drives, DC motors are as popular as 3-phase induction motors. Like DC generators, DC motors are also

of three type's viz., series-wound, shunt-wound and compound wound. The use of a particular motor depends upon the mechanical load it has to drive.

XI. BATTERY



The DC battery is used to provide the power supply to the electronic device and this is a main part of any electronics device. As there is a 12 volt battery is used in our project as given above function.

XII. RELAY MODULE



A. Working Principle of Relay:

It works on the principle of an electromagnetic attraction. When the circuit of the relay senses the fault current, it energizes the electromagnetic field which produces the temporary magnetic field. The current flows through the coil produces the magnetic field around it.

A relay is an electrically operated switch that can be turned on or off, letting the current go through or not, and can be controlled with low voltages, like the 5V provided by the Arduino pins.

We can control high voltage electronic devices using relays. A Relay is actually a switch which is

electrically operated by an electromagnet. The electromagnet is activated with a low voltage, for example 5 volts from a microcontroller and it pulls a contact to make or break a high voltage circuit.

In our project we have used a 5 volt relay module to control the pump motor through the signals from the Arduino board and act as a switching device for the pump motor. To turn ON and turn OFF the pump motor as per the conditions given in the program code.

XIII. PUMP MOTOR

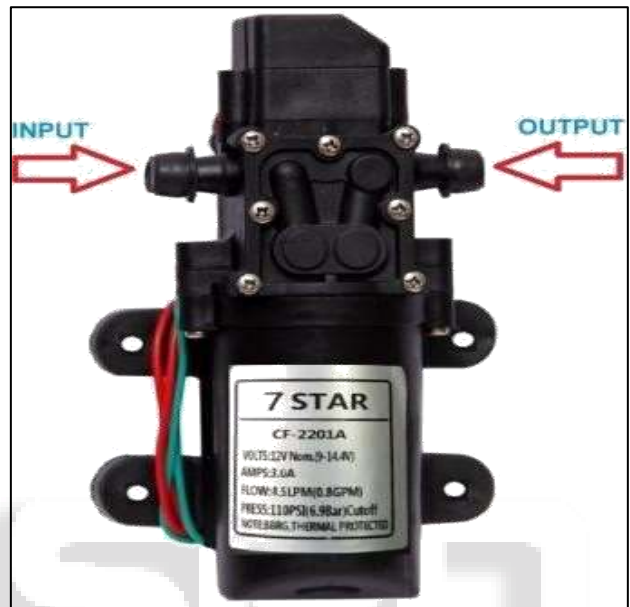


Fig. 6: PUMP MOTOR

DC powered pumps use direct current from motor, battery, or solar power to move fluid in a variety of ways.

Motorized pumps typically operate on 6, 12, 24, or 32 volts of DC power.

The pump is powered by an electric motor that drives an impeller, or centrifugal pump. The impeller moves water, called drive water, from the well through a narrow orifice, or jet, mounted in the housing in front of the impeller its function is to slow down the water and increase the pressure.

In our project we have used a 12 volt operated dc pump motor to spray the liquid (pesticides and insecticides) on the crops and it is powered by the 12 volt battery through the 5 volt switching relay which is controlled from the Arduino board.

XIV. RESULTS

From above project we have successfully developed an automatic fertilizer spreader machine using some automation elements like Arduino. And we have used the principle of Bluetooth communication over a wireless media. And we also have successfully run and operated the fertilizer in actual agricultural field for distributing the fertilizers also.

XV. APPLICATIONS

- It can use in various industries where environment is hazardous for human beings.

- Robot can be used in home and industry for washing purposes also.
- It can be used to spray the pesticides and insecticides on the crops.
- With tremendous smart phone in market, it bound to have many more application in near future.

XVI. CONCLUSION

The purpose of this system is to use the mobile phone inbuilt Bluetooth facility for the automation. With the help of this Bluetooth facility to make control with the sprayer by a smartphone android application.

Different and software unit of the system are described. The complete application has been designed using android, using C language.

With the help of this system the farmers can get a device or a machine which can make the spraying process more convenient and easy as well as secure. Due to this the chances of accidents and unusual deaths of farmers will reduce.

REFERENCES

- [1] Robotic Engineering by Richard D Klafter, Thomas A chmielewski, Michael Negin
- [2] Atmel AVR Microcontroller Primer: Programming and Interfacing By: Steven F. Barret, Daniel J. Pack
- [3] Ratheesh Rajan “Foundation Studies for an Alternate Approach to Motion Planning of Dynamic Systems” M.S.E., the University of Texas at Austin, 2001
- [4] RK Mittal and IJ Nagarath “Robotics and Control” BITS Pilani, 2003

A. Websites

- [1] <http://developer.android.com>
- [2] <http://android.com>
- [3] <http://en.wikipedia.org>
- [4] Shop.evergreengroups.co.in
- [5] www.nex-robotics.com
- [6] www.rscomponents.co.in