POOL SURFACE CLEANER USING ROBOTIC ARM

Submitted in partial fulfillment of the requirements

of the degree of

Bachelor of Engineering

in

Electronics and Telecommunication

by

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2018-19

CERTIFICATE

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This is to certify that the project entitled **Pool Surface Cleaner Using Robotic Arm** is a bonafide work of **Rakhangi Rehan Anwar (16DET115),Ansari Mohd Rashid Absar (16DET50),Shah Anas Amin (16DET119),Khan Shamshul Haque Noor (11ET14)** submitted to the University of Mumbai in partial fulfillment of the requirement for the award of the degree of Bachelor of Engineering in Department of Electronics and Telecommunication Engineering.

Supervisor	Examiner
Head of Department	Director

Project Report Approval for Bachelor of Engineering

This project entitled **"POOL SURFACE CLEANER USING ROBOTIC ARM"** by RAKHANGI REHAN ANWAR , ANSARI MOHD RASHID ABSAR , SHAH ANAS AMIN , KHAN SHAMSHUL HAQUE NOOR is approved for the degree of **Bachelor of Engineering in Electronics and Telecommunication** .

Examiner

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Supervisor

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Date:

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Declaration

I declare that this written submission represents my ideas in my own words and where others ideas or words have been included, I have adequately cited and referenced the original sources. I also declare that I have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any idea/data/fact/source in my submission. I understand that any violation of the above will be cause for disciplinary action by the Institute and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been taken when needed.

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ABSTRACT

In order to replace traditional manual cleaning method and Reduce labour force and cleanup efficiency. It focus on system of surface leaning robot. It is connected and control designed using arduino. I Simply the robot is controlled through wireless Remote control that uses RF waves .I The garbage is collected by ARM of Robot then it will be pushed to the bucket. I There both as the advantage of high degree of automation , simple operation ,safe ,efficiency .

In modern industry, innovation by automating processes provides companies with competitive advantages in speed, efficiency, and production value. This Major Qualifying Project studied the potential of a robotic, palletizing arm to help replace their manpower-driven operation of moving and stacking unpainted and painted blocks of scrap metal. Focus areas of the project included work area design, block distinction, alarm systemization, as well as robotic arm and end of arm tool selection.

Keywords: arduino uno, mechanical joint , RF remote, robotic arm.

CHAPTER 1
INTRODUCTION

INTRODUCTION

These days' people always needed additional help systems. With the rapid increase in the flow of information, people are now guided to search for different markets and people have entered the competition to manufacture quality products cheaply. Automation systems are also needed to realize this. Because standardized automation systems are required to minimize errors as well as to have experienced and well-trained employees for quality products. Because of their physical characteristics, people needed to use auxiliary machines in places where their strength was not enough. These machines, which are operated with the need for human assistance in advance, have been made to operate spontaneously without the need of human power with the progress of technology. One of the most used components of automation systems is robots

In the project, researchers have been done and implemented in order to have knowledge about mechanics and software during the operations carried out by the robot arm which is designed to ful fill the tasks determined in accordance with predetermined commands.

The project, Arduino Nano microcontroller written in Java language is programmed and servo motor control is provided. Thus, it is possible to perform the desired operations by means of the elements located on the without any circuit construction other than the circuit where the servo motor inputs are located. For the mechanical In part, the robot arm is drawn with the SolidWorks program and the dimensions of the robot arm are specified. A 5V power supply is also preferred for the robot to work.

1.1 OBJECTIVE AND GOALS

The main objective of this project is to develop a system to clean the thrash from surface of water bodies using arduino uno to ease the method for cleaning and also result in saving of time and labour requirement. Status of robot is controlled by RF remote from a certain distance. Thus it also reduces pollution due to garbages in water bodies.

The pool surface cleaner using robotic arm can be designed by making use of Hardware such as Arduino, Beagle Bone Black boards etc. which can inter- act with rf waves. Here we are focusing on less power consumption and more performance device. So we are using arduino uno which is more suitable with our requirement.

The goal of this work is to,

Instead of hiring someone to clean your pool or using a more labor-intensive machine, a pool cleaner is the best option for the budget conscious pool owner. It is a one-time investment ,meaning it will be beneficial in the long run period of time.

This means that it lets you save on energy, right after finishing. It also requires minimal maintenance.

Most automated cleaners in the market have a built-in function that automatically turns off after a it's job.

Some flooring stand to wear out easily if left unkempt hence , proper maintenance is important. Consistent cleaning helps maintain the proper alkalinity, pH levels and calcium hardness.

Some corner sand pool wall most care , and pool cleaners can provide youth is service. They have bristles and suction that are capable of reaching even those are as in your pool that are quite difficult to reach.

Most automated cleaners in the market have a built-in function that automatically turns off after a period of time. This means that it lets you save on energy, right after finishing its job.

1.2 NEED OF POOL SURFACE CLEANER

The development of new technologies in urban automation has increasingly intensified in recent decades. Among the research initiatives in the area, there is the study and design of service robots for use in urban areas. It is believed that a robotic society may arise in future, where various types of robots assume security functions, environmental monitoring, construction, education, entertainment, personal assistance, among other tasks.

Currently, the several types of robots sold, with application sin house hold asks, mainly aimed at cleaning, such as vacuum cleaners robots, floor scrubbers, window cleaners, pool cleaners, etc.He diversity of robots, this type of technology depends on specific features and high values, and consequently, the price of the so high, restricting the use of such robots to people with high purchasing power.

The primary idea of the project linked to this work is to study way so making robots for urban services, with a cost-effective, taking in mind the Brazilian reality, trying to level on mechanisms that can cheapen production, and thus such technology can been joyed by a greater number of people. Based on this assumption, the goal of the work presented here is to develop a robot that operates autonomously and submerged for cleaning pools.

This research involves the implementation of various activities, such as studying the loco motion system and floating of the robot, the specification of sensors and actuators, the definition of aspects related to pumping and filtering water, etc.

In all activities, the use of CAD can aid in visualization and analysis of the robot by means of a model and systems constructed computationally. This model can be used for testing and simulations, assisting decision-making project, and avoiding the loss of resources in manufacturing disabled proto-types. All work presented here is part of a larger project that aims to develop new technologies in urban automation.

1.3 PROBLEM STATEMENT

The statement of the project is "Design of River Cleaning System" to remove the waste debris, plastic waste garbage from Rivers and pools.

This causes harm to acoustic human life. To achieve clean water body for reduction of river pollution to achieve the beauty of water bodies by cleaning water bodies.

The control task is to move the robot arm from an initial position to a final position.

To achieve that we require prior knowledge of either desired position or angle of each joint, where using the angels is called forward kinematic while using the position is call de inverse kinematic.

This is done using many types of controllers. The controller is used to minimize the error between the desired and the actual positions. In doing so, the controller must meet certain specifications.

These specifications such as reducing overshoot, minimizing rising time and eliminating steady state error. In addition reducing the load disturbances, which model on each position.

1.4 EXISTING DESIGN

The "River clean up machine" used in that places where there is wasted in the water body which are to be removed. This machine is consists of water wheel driven conveyer mechanism which collect remove the wastage, garbage plastic wastages from water bodies.

The major drawbacks of the conveyer belt cleaning method are,

If the material is sticky, belt cleaning can be difficult and generally not very successful.

There is almost always material carry over from the belt discharge and this becomes a house keeping problem.

If the material being conveyed is sticky it will ultimately to the return side of the belt and then to the rolls, idlers and pulleys, then belt tracking can be an on going issue.

The convert has limited range and which is too short. It uses lots of energy and can't get little deep Perform surface.

CHAPTER 2
HARDWARE SPECIFICATION

HARDWARE SPECIFICATION

2.1 ARDUINO UNO

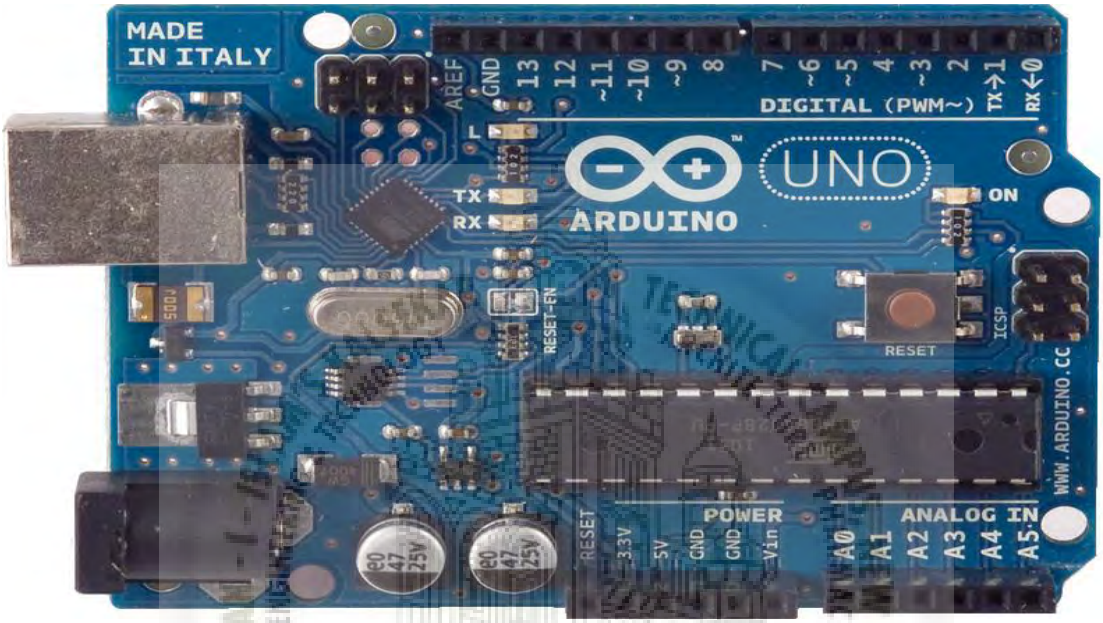


Fig. 2.1

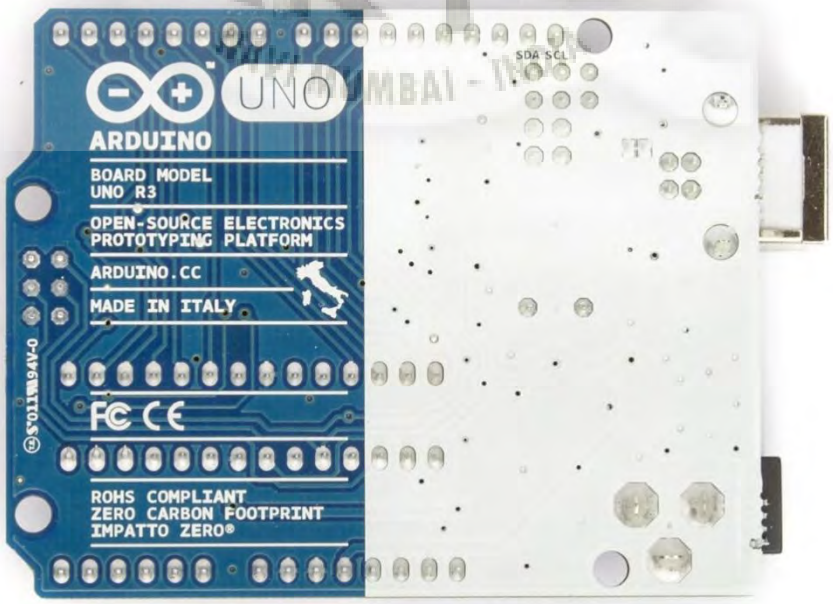


Fig .2.2

2.1.1 OVERVIEW

The Arduino Uno is a microcontroller board based on the ATmega328 (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.

The Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega16U2 (Atmega8U2 up to version R2) programmed as a USB-to-serial converter.
"Uno" means one in Italian and is named to mark the upcoming release of Arduino 1.0. The Uno and version 1.0 will be the reference versions of Arduino, moving forward. The Uno is the latest in a series of USB Arduino boards, and the reference model for the Arduino platform; for a comparison with previous versions, see the index of Arduino boards.

2.1.2 SUMMARY

Microcontroller ATmega328	
Operating Voltage	5V
Input Voltage (recommended)	7-12V
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 for 3.3V Pin	50 mA
Flash Memory	32 KB (ATmega328) of which 0.5 KB Used by bootloader
SRAM	2 KB (ATmega328)
EEPROM	1 KB (ATmega328)
Clock Speed	16 MHz

2.1.3 POWER

The Arduino Uno can be powered via the USB connection or with an external power supply. The power source is selected automatically.

External (non-USB) power can come either from an AC-to-DC adapter (wall-wart) or battery.

The adapter can be connected by plugging a 2.1mm center-positive plug into the board's power jack. Leads from a battery can be inserted in the Gnd and Vin pin headers of the POWER connector.

The board can operate on an external supply of 6 to 20 volts. If supplied with less than 7V, however, the 5V pin may supply less than five volts and the board may be unstable. If using more than 12V, the voltage regulator may overheat and damage the board. The recommended range is 7 to 12 volts.

The power pins are as follows:

- VIN: The input voltage to the Arduino board when it's using an external power source (as opposed to 5 volts from the USB connection or other regulated power source). You can supply voltage through this pin, or, if supplying voltage via the power jack, access it through this pin.

- 5V:This pin outputs a regulated 5V from the regulator on the board. The board can be supplied with power either from the DC power jack (7 - 12V), the USB connector (5V), or the VIN pin of the board (7-12V). Supplying voltage via the 5V or 3.3V pins bypasses the regulator, and can damage your board. We don't advise it.

- 3V3: A 3.3 volt supply generated by the on-board regulator. Maximum current draw is 50 mA.

- GND: Ground pins.

2.1.4 MEMORY

The ATmega328 has 32 KB (with 0.5 KB used for the bootloader). It also has 2 KB of SRAM and 1 KB of EEPROM (which can be read and written with the EEPROM library).

4.1.5 INPUT &OUTPUT

Each of the 14 digital pins on the Uno can be used as an input or output, using pin Mode(), digital Write(), and digital Read() functions.

They operate at 5 volts. Each pin can provide or receive a maximum of 40 mA and has an internal pull-up resistor (disconnected by default) of 20-50 k Ohms. In addition, some pins have specialized functions:

- Serial: 0 (RX) and 1 (TX). Used to receive (RX) and transmit (TX) TTL serial data. These pins are connected to the corresponding pins of the ATmega8U2 USB-to-TTL Serial chip.

- External Interrupts: 2 and 3. These pins can be configured to trigger an interrupt on a low value, a rising or falling edge, or a change in value. See the attach Interrupt() function for details.

- PWM: 3, 5, 6, 9, 10, and 11. Provide 8-bit PWM output with the Analog Write() function.

- SPI: 10 (SS), 11 (MOSI), 12 (MISO), 13 (SCK). These pins support SPI communication using the SPI library.

- LED: 13. There is a built-in LED connected to digital pin 13. When the pin is HIGH value, the LED is on, when the pin is LOW, it's off.

The Uno has 6 analog inputs, label A0 through A5, each of which provide 10 bits of resolution (i.e. 1024 different values). By default they measure from ground to 5 volts, though is it possible to change the upper end of their range using the AREF pin and the analog Reference () function. Additionally, some pins have specialized functionality:

- TWI: A4 or SDA pin and A5 or SCL pin. Support TWI communication using the Wire library.

There are a couple of other pins on the board:

- AREF: Reference voltage for the analog inputs. Used with analog Reference().

- Reset: Bring this line LOW to reset the microcontroller. Typically used to add a reset button to shields which block the one on the board.

2.1.6 COMMUNICATION

The Arduino Uno has a number of facilities for communicating with a computer, another Arduino, or other microcontrollers. The ATmega328 provides UART TTL (5V) serial communication, which is available on digital pins 0 (RX) and 1 (TX). An ATmega16U2 on the board channels this serial communication over USB and appears as a virtual com port to software on the computer. The '16U2 firmware uses the standard USB COM drivers, and no external driver is needed. However, on Windows, a .inf file is required. The Arduino software includes a serial monitor which allows simple textual data to be sent to and from the Arduino board. The RX and TX LEDs on the board will flash when data is being transmitted via the USB-to-serial chip and USB connection to the computer (but not for serial communication on pins 0 and 1).

A Software Serial library allows for serial communication on any of the Uno's digital pins. The ATmega328 also supports I2C (TWI) and SPI communication. The Arduino software includes a Wire library to simplify use of the I2C bus; see the documentation for details. For SPI communication, use the SPI library.

2.1.7 PHYSICAL CHARACTERISTICS

The maximum length and width of the Uno PCB are 2.7 and 2.1 inches respectively, with the USB connector and power jack extending beyond the former dimension.

Four screw holes allow the board to be attached to a surface or case. Note that the distance between digital pins 7 and 8 is 160 mil (0.16"), not an even multiple of the 100 mil spacing of the other pins.

2.1.8 ADVANTAGES

Ready to use

The biggest advantage of Arduino is its ready to use structure. As Arduino comes in a complete package form which includes the 5V regulator, a burner, an oscillator, a micro-controller, serial communication interface, LED and headers for the connections.

Example of codes

If you want to measure voltage using ATmega8 micro-controller and want to display the output on computer screen then you have to

go through the whole process. The process will start from learning the ADC's of micro-controller for measurement, went through the learning of serial communication for display and will end at USB - Serial converters.

Effortless Function

During coding of Arduino, you will notice some functions which make the life so easy. Another advantage of Arduino is its automatic unit conversion capability. You can say that during debugging you don't have to worry about the units conversions. Just use your all force on the main parts of your projects.

Large Community

There are many forums present on the internet in which people are talking about the Arduino. Engineers, hobbyists and professionals are making their projects through Arduino. You can easily find help about everything. Moreover the Arduino website itself explains each and every functions of Arduino.

2.1.9 DISADVANTAGES

Sturcture

There are many forums present on the internet in which people are talking about the Arduino. Engineers, hobbyists and professionals are making their projects through Arduino. You can easily find help about everything. Moreover the Arduino website itself explains each and every functions of Arduino.

Cost

The most important factor which you cannot deny is cost. This is the problem which every hobbyist, Engineer or Professional has to face. Now, we must consider that the Arduino is cost effective or not.

2.2 JOYSTICK

Fig.2.3

2.2.1 OVERVIEW

A joystick is an input device consisting of a stick that pivots on a base and reports its angle or direction to the device it is controlling. A joystick, also known as the control column, is the principal control device in the cockpit of many civilian and military aircraft, either as a center stick or side-stick. It often has supplementary switches to control various aspects of the aircraft's flight.

Before discussing the advantages and disadvantages of using a joystick, I believe it is best to gain an overall concept as to what exactly constitutes a 'good' joystick.

A gaming-joystick is primarily used as a gaming device that users can control in order to operate commands and navigational capabilities to the gaming interface.

A good quality joystick consists of a solid base encompassed with a flexible pivoting stick along with additional reliant buttons and triggers - such examples of quality joysticks one would include are the Logitech

942-000005 3D Pro Joystick (for PC) and the Thrustmaster T-Flight Hotas Joystick (for PC & PS3).

It is important to bear in mind that every joystick and model type is unique and will therefore come with its own individual benefits and weaknesses, however this article hopes to conjure up an 'advantages and disadvantages' (tongue in cheek) list of using joysticks for gaming as a whole, compared to that of other gaming devices (such as control pads and gaming mouses etc.

2.2.2 ADVANTAGES

More Comfortable and Funtional

That will certainly divide some of you, as different people prefer different things, but some of you may prefer the controls and functionality of a particular (certainly the more modern - leather fitted) joystick to that of the modern gaming pads or a gaming mouse for PCs.

Nostalgic Feel (The Original Classic Arcade Gaming Style)

That it certainly gives you back that 'arcade' feel, being reunited with the classic gaming style of how games were originally played - it may give you a different 'type' of enjoyment and experience from a game.

2.2.3 DISADVANTAGES

Joystick Compatibility

The main issue and drawback that comes with joysticks and some other gaming devices is that they are not compatible with all gaming systems, where some will work on computers they may not work on Macs and obviously the other way around. They may have even been especially designed to suit just a particular games console and nothing else. Some have been exclusively made just for specific games and even there they are not compatible.

Functionality Issues and Problems

It is rigid and not flexible it can obviously spoil your gaming experience. Poor quality joysticks only allow you perhaps a four directional movement that of left, right, up (forward) and down (backward), where as in the game you may have access to a 360 degree access. They may not be comfortable or simply just darn ugly.

2.3 SERVO MOTOR

2.3.1 OVERVIEW

A servo motor is an electrical device which can push or rotate an object with great precision. If you want to rotate and object at some specific angles or distance, then you use servo motor.

It is just made up of simple motor which run through servo mechanism. If motor is used is DC powered then it is called DC servo motor, and if it is AC powered motor then it is called AC servo motor.

We can get a very high torque servo motor in a small and light weight packages. Doe to these features they are being used in many applications like toy car, RC helicopters and planes, Robotics, Machine etc.

Servo motors are rated in kg/cm (kilogram per centimeter) most hobby servo motors are rated at 3kg/cm or 6kg/cm or 12kg/cm. This kg/cm tells you how much weight your servo motor can lift at a particular distance.

For example: A 6kg/cm Servo motor should be able to lift 6kg if the load is suspended 1cm away from the motors shaft, the greater the distance the lesser the weight carrying capacity.

It is a closed loop system where it uses positive feedback system to control motion and final position of the shaft. Here the device is controlled by a feedback signal generated by comparing output signal and reference input signal.

It is a closed loop system where it uses positive feedback system to control motion and final position of the shaft. Here the device is controlled by a feedback signal generated by comparing output signal and

reference input signal.

More sophisticated servomotors use optical rotary encoders to measure the speed of the output shaft and a variable-speed drive to control the motor speed. Both of these enhancements, usually in combination with a PID control algorithm, allow the servomotor to be brought to its commanded position more quickly and more precisely, with less overshooting.

2.3.2 WORKING PRINCIPLE

A servo consists of a Motor, a potentiometer, gear assembly and a controlling circuit. First of all we use gear assembly to reduce RPM and to increase torque of motor. Say at initial position of servo motor shaft, the position of the potentiometer knob is such that there is no electrical signal generated at the output port of the potentiometer. Now an electrical signal is given to another input terminal of the error detector amplifier. Now difference between these two signals, one comes from potentiometer and another comes from other source, will be processed in feedback mechanism and output will be provided in term of error signal. This error signal acts as the input for motor and motor starts rotating.

2.3.3 SG90

Servo Moter SG90 Tiny and lightweight with high output power.Servo can rotate approximately 180 degrees (90 in each direction), and works just like the standard kinds but smaller. You can use any servo code, hardware or library to control these servo. Good for beginners who want to make stuff move without building a motor controller with feedback & gear box, especially since it will fit in small places. It comes with a 3 horns (arms) and hardware.

2.3.3.1 SPECIFICATION

- Operating voltage: 4.8 V (~5V)
- Operating speed: 0.1 s/60 degree
- Stall torque: 1.8 kgf.cm
- Dead band width: 10 µs
- Temperature range: 0ºC – 55ºC

2.3.3.2 HARDWARE CONNECTION

- Red wire-5V
- Brown wire-Ground
- Yellow wire-digital pin 9

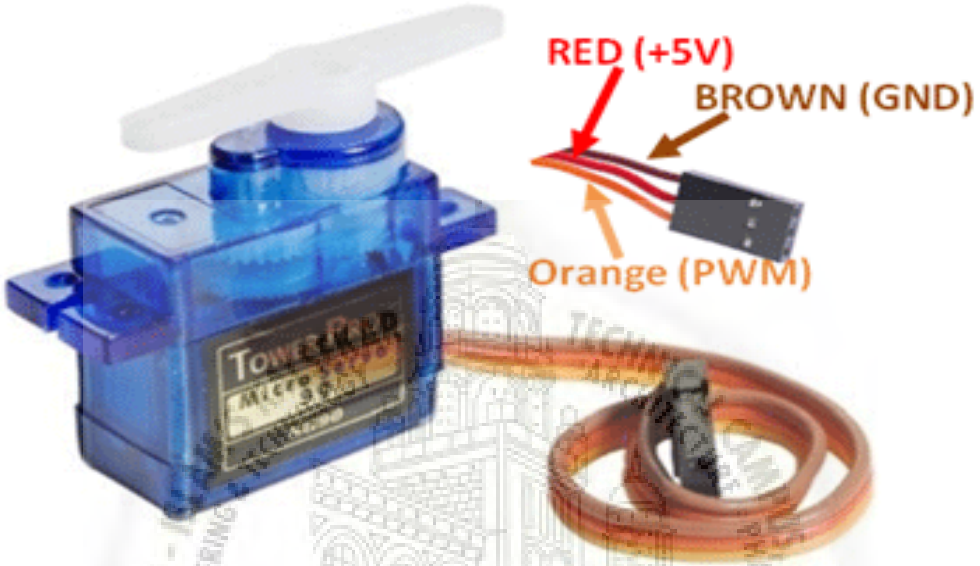
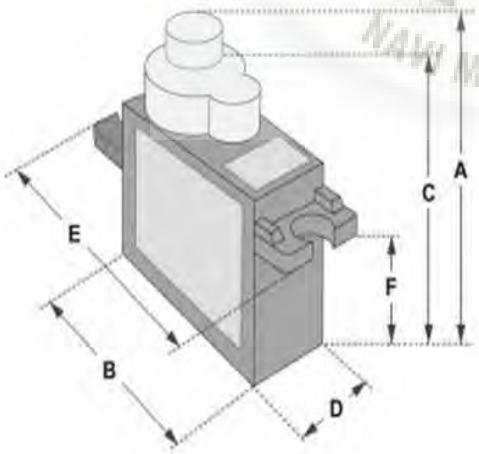


Fig.2.4



Dimensions & Specifications
A (mm) : 32
B (mm) : 23
C (mm) : 28.5
D (mm) : 12
E (mm) : 32
F (mm) : 19.5
Speed (sec) : 0.1
Torque (kg-cm) : 2.5
Weight (g) : 14.7
Voltage : 4.8 - 6

Fig.2.5

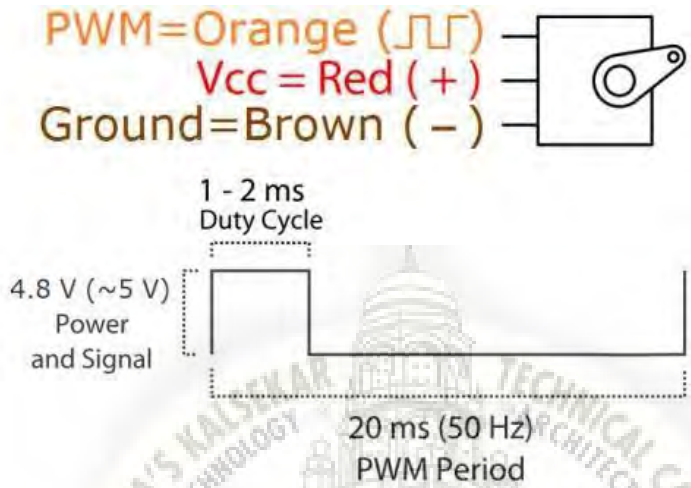


Fig.2.6

Position "0" (1.5 ms pulse) is middle, "90" (~2ms pulse) is middle, is all the way to the right, "-90" (~1ms pulse) is all the way to the left.

2.3.4 MG995

This is the most famous servo made by TowerPro.MG995 is a digital metal gear high torque servo for airplane, helicopter, RC-cars from 10 to 6-th scale truggy and monster and many RC model. We are the original manufacturer of Tower Pro MG995 servo.

There are many counterfeit servos of Tower Pro from China dealers selling on eBay, Amazon and Ali baba websites. If the suppliers removed "**Tower Pro**" logo from the photos and the products description, they are selling counterfeits low quality servo. Please identify the supplier before you purchased the goods. Only our authorized dealers who provide reliable quality servos and after services.

2.3.4.1 SPECIFICARTION

- Weight: 55 g
- Dimension: 40.7 x 19.7 x 42.9 mm approx.
- Stall torque: 8.5 kgf cm (4.8 V), 10 kgf cm (6 V)
- Operating speed: 0.2 s/60º (4.8 V), 0.16 s/60º (6 V)
- Operating voltage: 4.8 V a 7.2 V
- Dead band width: 5 µs
- Stable and shock proof double ball bearing design
- Temperature range: 0 ºC – 55 ºC

2.3.4.2 HARDWARE CONNECTION

- Red wire-5V
- Brown wire-Ground
- Yellow wire-digital pin 9

Fig.2.7

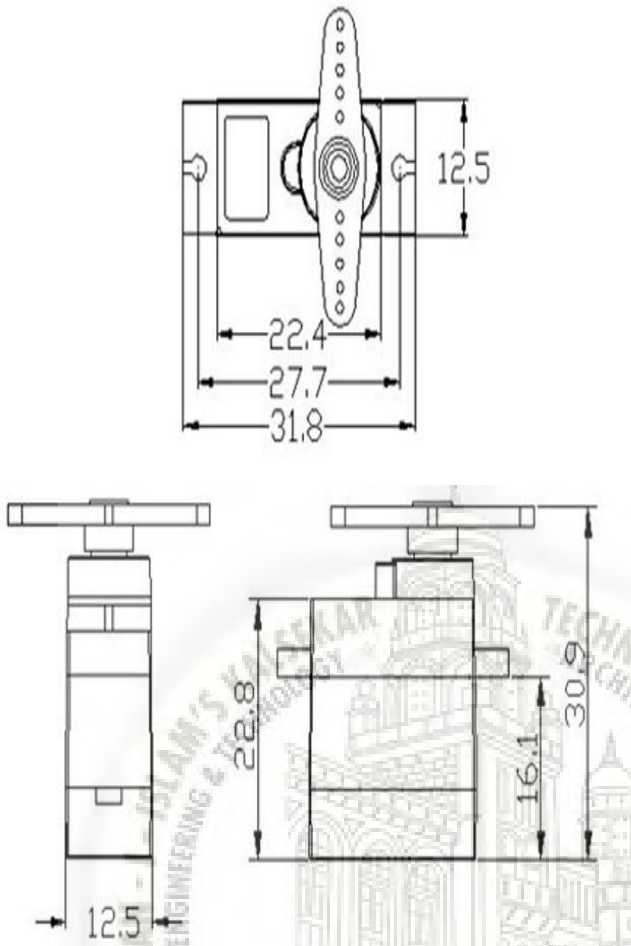


Fig.2.8

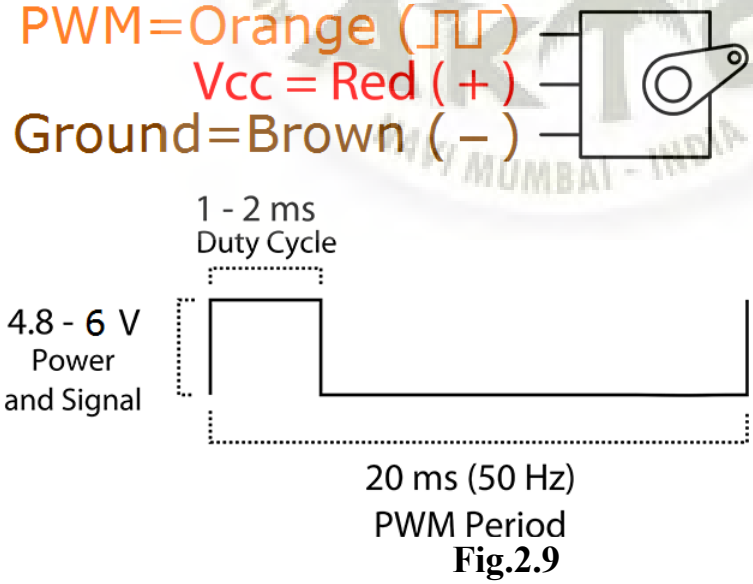


Fig.2.9

Position "0" (1.5 ms pulse) is middle, "90" (~2 ms pulse) is all the way to the right, "-90" (~1 ms pulse) is all the way to the left.

2.4 PRINTED CIRCUIT BOARD

2.4.1 OVERVIEW

A PCB is a thin board made of fiberglass, composite epoxy, or other laminate material. Conductive pathways are etched or "printed" onto board, connecting different components on the PCB, such as transistors, resistors, and integrated circuits.

PCBs are used in both desktop and laptop computers. They serve as the foundation for many internal computer components, such as video cards, controller cards, network interface cards, and expansion cards. These components all connect to the motherboard, which is also a printed circuit board.

While PCBs are often associated with computers, they are used in many other electronic devices besides PCs. Most TVs, radios, digital cameras, cell phones, and tablets include one or more printed circuit boards. While the PCBs found in mobile devices look similar to those found in desktop computers and large electronics, they are typically thinner and contain finer circuitry.

PCB may also stand for "Process Control Block," a data structure in a system kernel that stores information about a process. In order for a process to run, the operating system must first register information about the process in the PCB.

The pattern to be etched into each copper layer of a PCB is called the "artwork". The etching is usually done using photo resist which is coated onto the PCB, then exposed to light projected in the pattern of the artwork. The resist material protects the copper from dissolution into the etching solution. The etched board is then cleaned. A PCB design can be mass-reproduced in a way similar to the way photographs can be mass-duplicated from film negatives using a photographic printer.

Fig.2.10

In multi-layer boards, the layers of material are laminated together in an alternating sandwich: copper, substrate, copper, substrate, copper, etc.; each plane of copper is etched, and any internal via (that will not extend to both outer surfaces of the finished multilayer board) are plated-through, before the layers are laminated together. Only the outer layers need be coated; the inner copper layers are protected by the adjacent substrate layers.

FR-4 glass epoxy is the most common insulating substrate. Another substrate material is cotton paper impregnated with phenolic resin, often tan or brown.

When a PCB has no components installed, it is less ambiguously called a printed wiring board (*PWB*) or *etched wiring board*. However, the term "printed wiring board" has fallen into disuse. A PCB populated with electronic components is called a *printed circuit assembly* (*PCA*), *printed circuit board assembly* or *PCB assembly* (*PCBA*). In informal usage, the term "printed circuit board" most commonly means "printed circuit assembly" (with components). The IPC preferred term for assembled boards is *circuit card assembly* (*CCA*), and for assembled back plane sit is *backplane assemblies*. "Card" is another widely used informal term for a "printed circuit assembly".

A PCB may be "silkscreen" printed with a legend identifying the components, test points, or identifying text. Originally, an actual silkscreen

printing process was used for this purpose, but today other, finer quality printing methods are usually used instead. Normally the screen printing is not significant to the function of the PCBA.

A minimal PCB for a single component, used for prototyping, is called a *breakout board*. The purpose of a breakout board is to "break out" the leads of a component on separate terminals so that manual connections to them can be made easily. Breakout boards are especially used for surface-mount components or any components with fine lead pitch. Advanced PCBs may contain components embedded in the substrate.

2.4.2 DATASHEET

ROHS COMPLIANT PCB

The European Union bans the use of lead (among other heavy metals) in consumer items, a piece of legislature called the RoHS, for Restriction of Hazardous Substances, directive. PCBs to be sold in the EU must be RoHS-compliant, meaning that all manufacturing processes must not involve the use of lead, all solder used must be lead-free, and all components mounted on the board must be free of lead, mercury, cadmium, and other heavy metals.

LAMINETS

Laminates are manufactured by curing under pressure and temperature layers of cloth or paper with thermoset resin to form an integral final piece of uniform thickness. The size can be up to 4 by 8 feet (1.2 by 2.4 m) in width and length. Varying cloth weaves (threads per inch or cm), cloth thickness, and resin percentage are used to achieve the desired final thickness and dielectric characteristics. Available standard laminate thickness are listed in ANSI/IPC-D-275.

COPPER THICKNESS

Copper thickness of PCBs can be specified directly or as the weight of copper per area (in ounce per square foot) which is easier to measure. One ounce per square foot is 1.344 mils or 34 micrometers thickness. *Heavy copper* is a layer exceeding three ounces of copper per ft^2, or approximately 0.0042 inches (4.2 mils 105 μm) thick. Heavy copper layers are used for high current or to help dissipate heat.

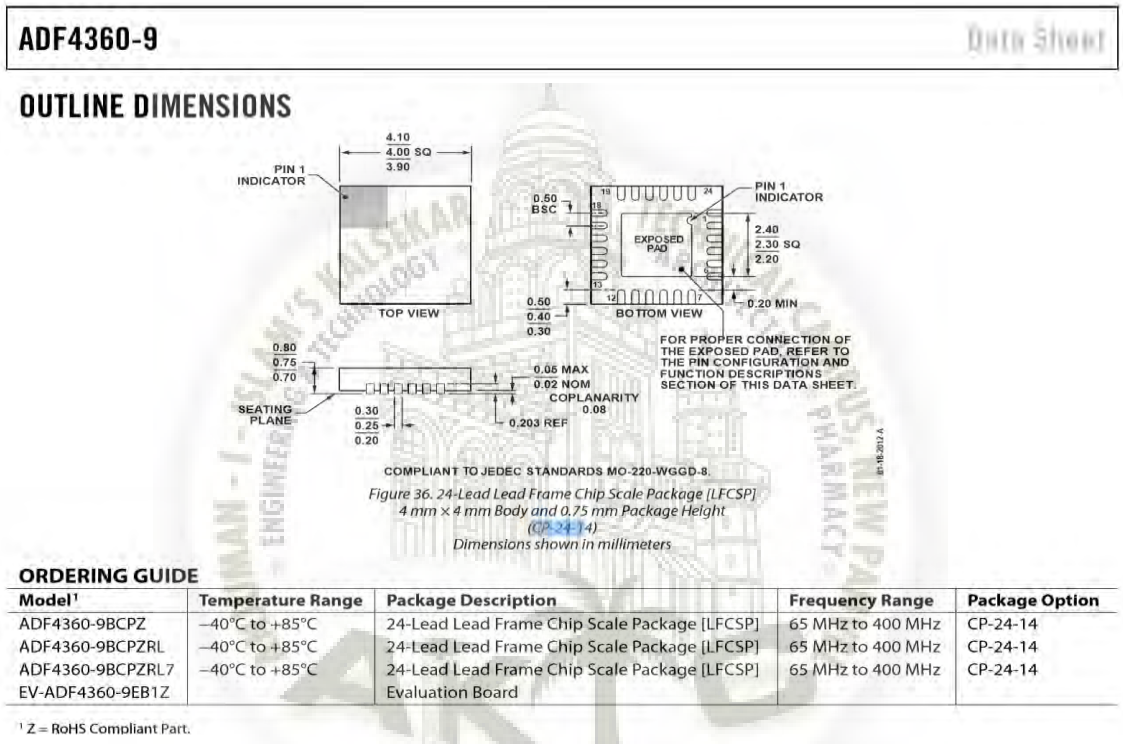


Figure 36. 24-Lead Lead Frame Chip Scale Package [LFCSP]
4 mm × 4 mm Body and 0.75 mm Package Height
(CP-24-14)
Dimensions shown in millimeters

ORDERING GUIDE

Model[1]	Temperature Range	Package Description	Frequency Range	Package Option
ADF4360-9BCPZ	−40°C to +85°C	24-Lead Lead Frame Chip Scale Package [LFCSP]	65 MHz to 400 MHz	CP-24-14
ADF4360-9BCPZRL	−40°C to +85°C	24-Lead Lead Frame Chip Scale Package [LFCSP]	65 MHz to 400 MHz	CP-24-14
ADF4360-9BCPZRL7	−40°C to +85°C	24-Lead Lead Frame Chip Scale Package [LFCSP]	65 MHz to 400 MHz	CP-24-14
EV-ADF4360-9EB1Z		Evaluation Board		

[1] Z = RoHS Compliant Part.

Fig.2.11

2.5 BLUETOOTH MODULE

2.5.1 OVERVIEW

HC-05 module is an easy to use Bluetooth SPP (Serial Port Protocol) module, designed for transparent wireless serial connection setup. The HC-05 Bluetooth Module can be used in a Master or Slave configuration, making it a great solution for wireless communication. This serial port

Bluetooth module is fully qualified Bluetooth V2.0+EDR (Enhanced Data Rate**)** 3Mbps Modulation with complete 2.4GHz radio transceiver and baseband. It uses CSR Bluecore04-External single chip Bluetooth system with CMOS technology and with AFH (Adaptive Frequency Hopping Feature).

The Bluetooth module HC-05 is a MASTER/SLAVE module. By default the factory setting is SLAVE .The Role of the module (Master or Slave) can be configured only by AT COMMANDS. The slave modules cannot initiate a connection to another Bluetooth device, but can accept connections. Master module can initiate a connection to other devices. The user can use it simply for a serial port replacement to establish connection between MCU and GPS, PC to your embedded project, etc. Just go through the datasheet for more details.

2.5.2 HARDWARE SPECIFICATION

- Typical -80dBm sensitivity.
- Up to +4dBm RF transmit power.
- 3.3 to 5 V I/O.
- PIO(Programmable Input/Output) control.
- UART interface with programmable baud rate.
- With integrated antenna.
- With edge connector.

2.5.3 SOFTWARE SPECIFICATION

- Slave default Baud rate: 9600, Data bits:8, Stop bit:1,Parity:No parity.
- Auto-connect to the last device on power as default.
- Permit pairing device to connect as default.

Aut.

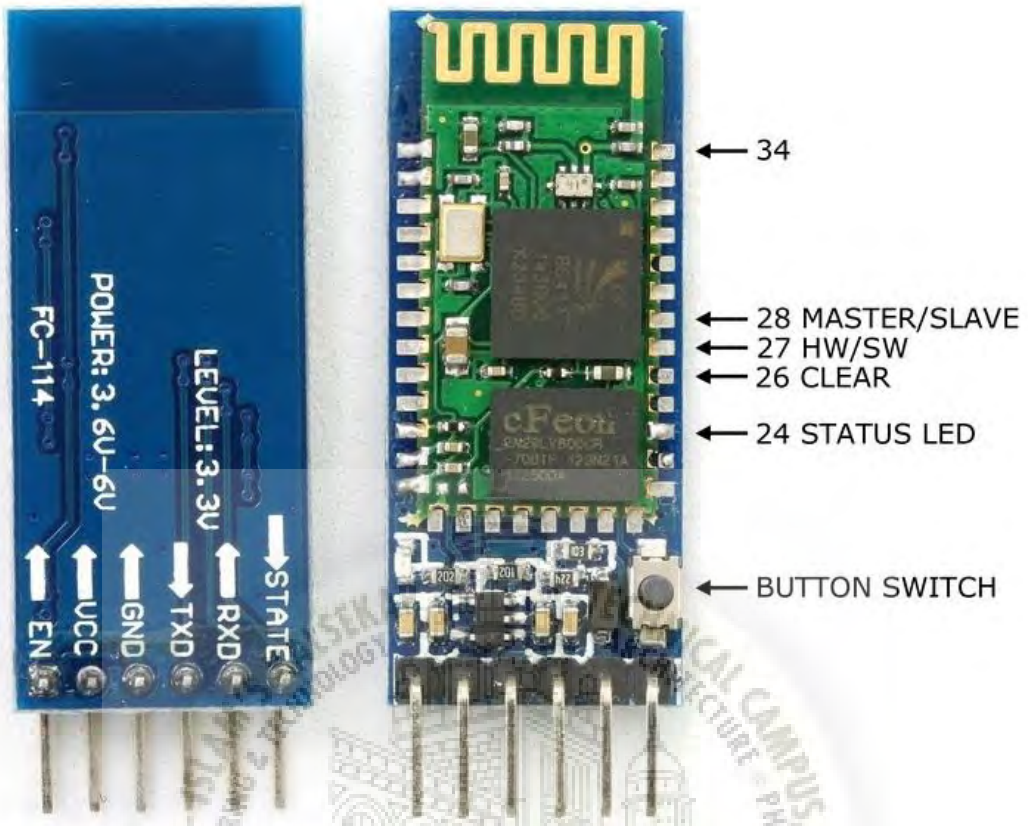


Fig.2.12

2.5.4 PIN DISCRIPTION

The HC-05 Bluetooth Module has 6pins. They are as follows:

ENABLE:

When enable is pulled **LOW**, the module is disabled which means the module will **not turn on** and it **fails to communicate**. When enable is **left open or connected to 3.3V**, the module is enabled i.e the module **remains on** and **communication also takes place**.

Vcc:

Supply Voltage 3.3V to 5V

GND:

Ground pin

TXD & RXD:

These two pins acts as an UART interface for communication

STATE:

It acts as a status indicator. When the module is **not connected to paired** with any other Bluetooth device, signal goes **Low**. At this **low state** ,the **led flashes continuously** which denotes that the module is **not paired** with other device. When this module is **connected to/paired** with any other Bluetooth device, the signal goes **High**. At this **high state**, the **led blinks with a constant delay** say for example 2s delay which indicates that the module is **paired**.

BUTTON SWITCH:

This is used to switch the module into AT command mode. To enable AT command mode, press the button switch for a second. With the help of AT commands, the user can change the parameters of this module but only when the module is not paired with any other BT device. If the module is connected to any other Bluetooth device, it starts to communicate with that device and fails to work in AT command mode.

CHAPTER 3
SOFTWARE SPECIFICATION

SOFTWARE SPECIFICATION

3.1 C LANGUAGE

C was originally developed at Bell Labs by Dennis Ritchie, between 1972 and 1973. It was created to make utilities running on Unix. Later, it was applied to re-implementing the kernel of the Unix operating system. During the 1980s, C gradually gained popularity. Nowadays, it is one of the most widely used programming languages, with C compilers from various vendors available for the majority of existing computer architectures and operating systems. C has been standardized by the American National Standards Institute (ANSI) since 1989 (see ANSI C) and subsequently by the International Organization for Standardization (ISO).

C is an imperative procedural language. It was designed to be compiled using a relatively straightforward compiler, to provide low-level access to memory, to provide language constructs that map efficiently to machine instructions, and to require minimal runtime support. Despite its low-level capabilities, the language was designed to encourage cross-platform programming. A standards-compliant C program that is written with portability in mind can be compiled for a wide variety of computer platforms and operating systems with few changes to its source code; the language has become available on various platforms, from embedded microcontrollers to supercomputers.

Like most imperative languages in the ALGOL tradition, C has facilities for structured programming and allows lexical variable scope and recursion. Its static type system prevents unintended operations. In C, all executable code is contained within subroutines(also called "functions", though not strictly the same as in the sense of functional programming). Function parameters are always passed by value. Pass-by-reference is simulated in C by explicitly passing pointer values. C program source text is free-format, using the semicolon as a statement terminator and curly braces for grouping blocks of statements.

The C language also exhibits the following characteristics:

- There is a small, fixed number of keywords, including a full set of control flow primitives: for, if/else, while, switch and do/while. User-defined names are not distinguished from keywords by any kind of signal.
- There are a large number of arithmetic and logic operators.
- More than one assignment may be performed in a single statement.
- Function return values can be ignored when not needed.
- Typing is static, but weakly enforced; all data has a type, but implicit conversions are possible.
- Declaration syntax mimics usage context. C has no "define" keyword; instead, a statement beginning with the name of a type is taken as a declaration. There is no "function" keyword; instead, a function is indicated by the parentheses of an argument list.
- User-defined type def and compound types are possible.
  - Heterogeneous aggregate data types structure allow related data elements to be accessed and assigned as a unit.
  - Union is a structure with overlapping members; only the last member stored is valid.
  - Array indexing is a secondary notation, defined in terms of pointer arithmetic. Unlike structure, arrays are not first-class objects: they cannot be assigned or compared using single built-in operators. There is no "array" keyword in use or definition; instead, square brackets indicate arrays syntactically, for example month.
  - Enumerated types are possible with the e keyword. They are freely interconvertible with integers.
  - Strings are not a distinct data type, but are conventionally implemented as null-terminated character arrays.
- Low-level access to computer memory is possible by converting machine addresses to typed pointers.

- Procedures (subroutines not returning values) are a special case of function, with an return type void.
- Functions may not be defined within the lexical scope of other functions.
- Function and data pointers permit *ad hoc* run-time polymorphism.
- A pre processor performs macro definition, source code file inclusion, and conditional compilation.
- There is a basic form of modularity: files can be compiled separately and linked together, with control over which functions and data objects are visible to other files via static and exterm attributes.
- Complex functionality such as I/O, string manipulation, and mathematical functions are consistently delegated to library routines

3.2 BENEFITS OF C

There are numerous benefits from learning C; however, the most important benefit is that the C programming language is recognized worldwide and used in a multitude of applications, including advanced scientific systems and operating systems. In today's world, a computer programmer needs to be able to communicate with colleagues in different countries. Therefore it's important that even if they don't speak the same verbal language, at least the computer language is understandable to all.

Another benefit of learning the computer language, C, is that it's the basic language of all advanced computer languages. For example, if you want to learn C++, which is an object oriented language, you need to know the C language well beforehand. Once you master C programming, you can easily learn another specified language.

Programming in C is fairly easy because it uses basic commands in English. However C is a compiled language so after you type your commands, in order to execute your program, you need to run it through a compiler to transform the human-readable form into machine-readable language. There are many C compilers available today. If you are a student working on a university UNIX computer, you can use the compiler for free. Otherwise, you can purchase Microsoft's Visual C++

environment, which compiles both C and C++ programs. In addition, there are some free compilers you can use over the Web.

CHAPTER 4
PROPOSED SYSTEM

PROPOSED SYSTEM

Our proposed system has a advantage over the existing system in aspects such as size, cost, wide scope to advancement because we are making use of a Bluetooth to control robot.

The step towards digitization is the wide scope it provides to make better design with the inclusion of wireless control. And also provide stability from any remote location through Internet by using robot. I the make our work simple and also we can attach to it other peripherals as per our wish to modify it will remove the drawback of the traditional cleaning system and improve its Compatibility.

CHAPTER 5
FLOW CHART

FLOW CHART

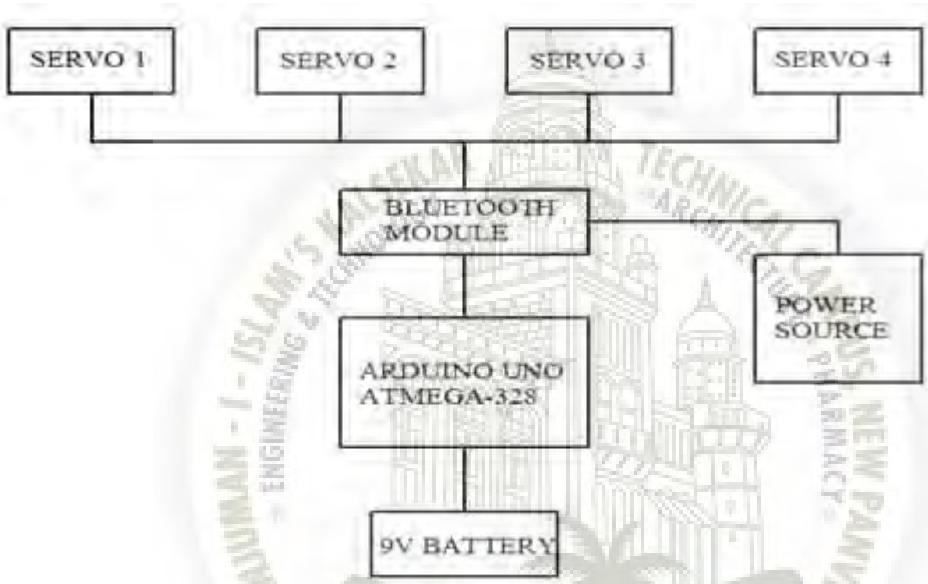


Fig.5.1

CHAPTER 6
WORKING

WORKING

6.1 ROBOTIC ARM

The basic function of a pick and place robot is done by its joints. Joints are analogous to human joints and are used to join the two consecutive rigid bodies in the robot. They can be rotary joint or linear joint. To add a joint to any link of a robot, we need to know about the degrees of freedom and degrees of movement for that body part. Degrees of freedom implement the linear and rotational movement of the body and Degrees of movement in number of axis the body can move.

A typical robotic arm is made up of several metal segments, joined by joints. The computer controls the robot by rotating individual step motors connected to each joint. Unlike ordinary motors, step motors move in exact increments. This allows the computer to move the arm very precisely, repeating exactly the same movement over and over again. The robot uses motion sensors to make sure it moves just the right amount.

In order to do different jobs, a robotic arm get a special 'hand' for each job. There are many types of special 'hands' called 'end effectors'. One common end effector can grasp and carry different objects. To give a robotic hand a sense of touch, it has built-in load cells that tell the computer how hard the robot is gripping a particular object. This keeps the robot from dropping or crushing whatever it's carrying. Other end effectors include blowtorches, drills and spray painters.

A robot might twist the caps onto peanut butter jars coming down an assembly line or drill holes, or pick up a piece and put it on another piece. Robots can often do this repetitive work more efficiently than human beings because they are so precise. A robot always drills in the exactly the same place, and always tightens bolts with the same amount of force, no matter how many hours it's been working. Many industrial robots work in auto assembly lines, putting cars together.

They are very strong, lifting large car pieces easily, and never get tired. Even though robots are capable of great strength, they are also capable of performing very delicate operations as well. This makes them very useful in the computer industry which requires an incredibly precise hand to put together a tiny microchip.

The joystick in this application is essentially two potentiometers. One for the x axis and one for the y axis. As a you push or pull the joystick in any direction you are essentially changing the resistance value of one or both potentiometers.

When resistance changes the joystick outputs a voltage from each of its axis and feeds the variable voltages into two analog to digital converter pins(A0 ,A1) on the Arduino shield and Arduino Uno.

The Arduino uses it's built in analog to digital converter (ADC) to convert analog data to digital data. This conversion is called quantization. Once the data is converted to digital, the code can then use it to determine what position each servo should be in to achieve a desired motion and/or position. See the code comments for explanation of the code.

Primarily, you need to choose the purpose or application of the robotic arm that you are designing so that based on the application, choose the components with appropriate ratings. After collecting the components, design an exact circuit using any software such as Proteus or Lab View to check the circuit operation in detail to evaluate and compare the results of the roboticsprojects. This software designed circuit experimental results are checked to meet intended application requirements and changes are made in the circuit if any. Thus, we can estimate whether the circuit can be realized in real time with maximum efficiency and can also avoid direct practical circuit design cost just for checking and testing purposes.

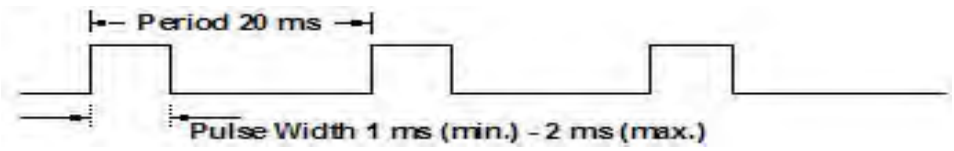
Based on the results obtained from the circuit designed using software, appropriate components are collected and design the PCB (Printed Circuit Board) using the connections made on the software based circuit. Then, arrange these hardware electrical and electronics components on the PCB layout obtained and solder the hardware by taking appropriate soldering techniques. Then, attach all the major parts like robotic arm, wheels of the robots (if any), arm grippers (soft grippers are used for robotics projects intended for diffusing explosion materials), and so on. Then, after designing the entire hardware robotics projects(here, the robotic arm project) do practical testing to check the working of the robotic arm.

Even though the robotic arm is designed using the above steps, it cannot be used practically for the particular applications for which it is intended. For using it in real time we need to obtain controlling mechanism over the robotic arm. This control can be achieved using a microcontroller and mostly 8051 microcontroller is used for executing the desired operation. We can easily understand the working of a robotic arm by considering the following practical example of real time project namely pick and place robotic arm kit.

6.2 SERVO MOTOR

Most modern servomotors are designed and supplied around a dedicated controller module from the same manufacturer. Controllers may also be developed around microcontroller order to reduce cost for large-volume applications.

Servos are controlled by sending them a pulse of variable width. The control wire is used to send this pulse. The parameters for this pulse are that it has a minimum pulse, a maximum pulse, and a repetition rate. Given the rotation constraints of the servo, neutral is defined to be the position where the servo has exactly the same amount of potential rotation in the clockwise direction as it does in the counter clockwise direction. It is important to note that different servos will have different constraints on their rotation but they all have a neutral position, and that position is always around 1.5 milliseconds (ms).

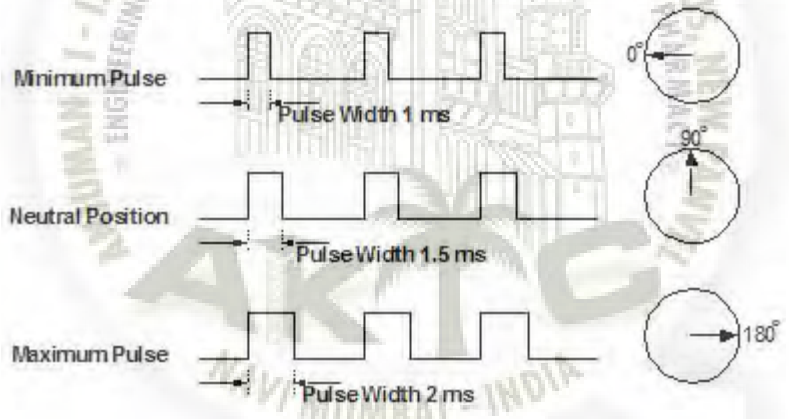


The angle is determined by the duration of a pulse that is applied to the control wire. This is called Pulse width Modulation. The servo expects to see a pulse every 20 ms. The length of the pulse will determine how far

the motor turns. For example, a 1.5 ms pulse will make the motor turn to the 90 degree position (neutral position).

When these servos are commanded to move they will move to the position and hold that position. If an external force pushes against the servo while the servo is holding a position, the servo will resist from moving out of that position. The maximum amount of force the servo can exert is the torque rating of the servo. Servos will not hold their position forever though; the position pulse must be repeated to instruct the servo to stay in position.

When a pulse is sent to a servo that is less than 1.5 ms the servo rotates to a position and holds its output shaft some number of degrees counter clockwise from the neutral point. When the pulse is wider than 1.5 ms the opposite occurs. The minimal width and the maximum width of pulse that will command the servo to turn to a valid position are functions of each servo. Different brands, and even different servos of the same brand, will have different maximum and minimums. Generally the minimum pulse will be about 1 ms wide and the maximum pulse will be 2 ms wide.



Another parameter that varies from servo to servo is the turn rate. This is the time it takes from the servo to change from one position to another. The worst case turning time is when the servo is holding at the minimum rotation and it is commanded to go to maximum rotation. This can take several seconds on very high torque servos.

The purpose of this information is to give an overview of how servos operate and how to communicate with them. Though we have taken steps to assure the quality of information here, Servo City makes no guarantees about the information presented. Servo City cannot be held liable or accountable for any use or misuse of the provided information.

CHAPTER 7
CONCLUSION

CONCLUSION

This paper analyses the design of a surface cleaning robot control system from hardware and software, respectively, and proposes an advance control scheme based on the combination of a host computer and a microcontroller, so that the entire surface cleaning robot control system has features such as fast response, low power consumption, real-time strength, which improves the stability and reliability of the system.

Surface cleaning robots can achieve surface cleaning operation activities under the control of the host computer and achieve good control effects. In order to improve the work efficiency and flexibility of the surface cleaning robot, we will design a camera mechanism, a communication wireless module with a monitoring centre and will integrate a path planning algorithm in the future.

It navigate on rough terrain and under water to accomplish tasks with little or no low-level control. This will greatly simplify the autonomous control problem and give the vehicle a versatility that no amphibious robot has yet enjoyed.

The driver mechanism comprising of an arduino microcontroller in conjuction with a set of potentiometers has been successfully used to control the arm as per the inputs given by the user.

CHAPTER 8

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REFERENCES

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