Wireless Water Cleaning Robot

A Project Report
Submitted By

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In partial fulfilment for the award of the degree
Of
BACHELOR OF TECHNOLOGY
IN
ELECTRONICS AND COMMUNICATION ENGINEERING

Under the Guidance of
MR. ANIRBAN GHOSAL
ASSISTANT PROFESSOR

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(An Autonomous Institute)
Block "A" Phase III, Kalyani, Nadia-741235
MAY, 2022

DECLARATION

We hereby declare that the project entitled **"Wireless Water Cleaning Robot"** submitted for the B. Tech. (ECE) degree is our original work and the project has not formed the basis for the award of any other degree, diploma, fellowship or any other similar titles.

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CERTIFICATE

This is to certify that the students mentioned below have completed their project entitled **"Wireless Water Cleaning Robot",** under the guidance of **MR. Anirban Ghosal** inpartial fulfilment of the requirements for the award of the **Bachelor ofTechnology** in**Electronics and Communication Engineering** from **JIS college of Engineering** (An Autonomous Institute) is an authentic record of their own work carried out during the academic year 2018-19 and to the best of our knowledge, this work has not been submitted elsewhere as part of the process of obtaining a degree, diploma, fellowship or any other similar title.

Students Concerned:

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We also express our sincere gratitude to **Mr. BISWAROOP NEOGI**, HOD of the Department of Electronics and Communication Engineering of JIS College of Engineering and all the respected faculty members of Department of ECE for giving the scope of successfully carrying out the project work.

This report may contain errors and shortcomings. Thus, we remain open to all criticisms and suggestions which could present us with new sources of inspiration as we develop in our ability to research and learn.

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ABSTRACT

Many countries lack the infrastructure to prevent plastic pollution such as: sanitary landfills; incineration facilities; recycling capacity and circular economy infrastructure; proper management and disposal of waste systems. This leads to 'plastic leakage' into rivers and the ocean. The legal and illegal global trade of plastic waste may also damage ecosystems, where waste management systems are not sufficient to contain plastic waste. The main sources of plastic debris found in the ocean are land-based, coming from urban and storm water runoff, sewer overflows, littering, inadequate waste disposal and management, industrial activities, tyre abrasion, construction and illegal dumping. Ocean-based plastic pollution originates primarily from the fishing industry, nautical activities and aquaculture and its primary source is from the local water bodies.

INTRODUCTION

Waste is an environmental problem that always arises from year to year and still cannot be resolved entirely. We frequently found garbage from various places dumped into rivers, waterways, or reservoirs. The rubbish can clog the flow of water, causing water to become dirty and smelly so that it often overflows and causes disasters, including flooding. How to clean waste from water areas requires extensive resources, for example, by cleaning staff and using excavators. This study aims to provide an alternative solution to the problem of waste in water areas by developing robotics technology capable of operating in water areas. The proposed applied research is expected to be an alternative solution to prevent disasters, especially floods. Robotics technology developed in the form of eco-robot with the main task of collecting waste. The robot is designed to be controlled r manually by remote control. The development method of this research refers to ADDIE. This method including of analysing of the robotic cleaning system, designing the robot, developing the robot, implementing robot to clean waste in limited water areas, evaluating the effectiveness of robot in cleaning up trash for the more extensive area.

Study on recent investigations:

Shocking reports of plastic pollution have prompted concerted global efforts to mitigate its effects, yet the research-base that underpins this important subject is embryonic when it comes to understanding the complexities of this growing environmental challenge. In response to this need, under The Pew Charitable Trusts leadership and SYSTEMIQ project coordination we collaborated to co-develop the P2O model in order to understand the flows of plastic and plastic waste through global society.

Many works in literature have focused on building embedded systems for ensuring safe and clean India mission Towards achieving Smart city mission in India, a smart E-dustbin has been designed in [6]. IoT based solution was proposed for monitoring the status of the dustbin and e-mail notification is sent to the user.

In an automatic robot was designed for garbage collection in water bodies. A robot was implemented using AT- MEGA 16 micro controller with DC and servo motors and sensors. Testing was done on all the modules to check the effectiveness of the proposed robot.

A metallic waste collection robot was proposed in for automating waste removal in factories. An end to end robotic system was developed using Arduino Mega micro controller interfaced with sensors and actuators. Grippers, motors, wheels and chassis are used for locomotion of the robot. Object detection and sensing is done using IR and ultrasonic sensor.

An Automatic garbage segregation robot to classify waste was developed in. Image processing is employed to classify the wastes into degradable/bio-degradable, followed by which the robot dumps the waste into the specific bin. Software implementation is done using MATLAB and the robot is programmed using PIC micro controller supported with motors, relay circuits and sensor.

A remote controller based sewage cleaning embedded system is done using Radio Frequency (RF) transmitter and receiver modules in conjunction with relays, switches, motors and a metallic casing setup.

A multi robot aquatic system for lake cleaning using various sensors and communication technology was proposed in. The robot is autonomous and traverses the path and collects the waste using recruitment navigation algorithm. The proposed algorithm is tested on simulation for varying lake sizes using C++ Enki robotic library and MATLAB.

A low cost automation framework for cleaning river surface using RF Transmitter and receiver is experimented in. A Computer Aided Design (CAD) model of river cleaning machine is simulated using motors, collecting plates, chain drives and conveyer belt. Furthermore, a clear requirement specification for the proposed CAD model is also explained in detail.

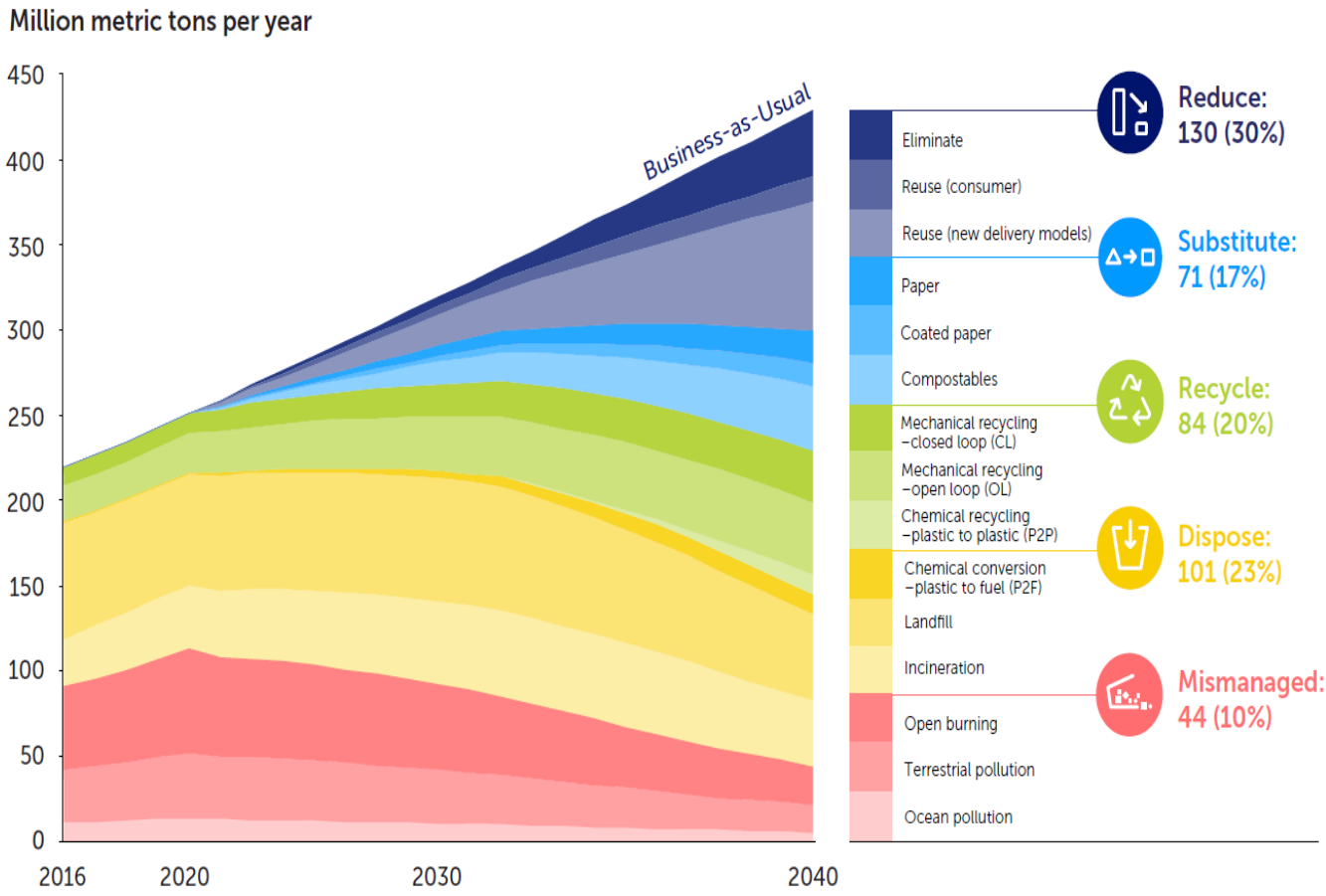
A mechanical model for drainage system cleaning using propeller, cleaner, belt drives and pan is proposed in. The system was tested on rainy days in three different months to evaluate the effectiveness of the developed system. The system performed to a considerable extent in all possible test conditions.

A pedal operated boat to clean the surface wastes and debris is described in. The setup consists of a pedal operated boat with propellers attached to the shaft and conveyer belt for collecting the wastes. A prototype model with design specifications is also explained.

This ‘first of a kind’ study used the ‘wedges approach’, first introduced in 2004 as a method of communicating potential interventions required to stabilise anthropogenically driven global warming. Dr Velis’ research team provided thought leadership in the waste and resource management aspects of the modelling effort.

Open burning of waste, a core yet under-reported aspect of plastic pollution is also under focus here. Ed Cook, Research Fellow at the Leeds team explained:

“During open burning, the combustion is often incomplete, and all sorts of potentially toxic emissions are released, which can result in a range of negative health outcomes. Those obnoxious substances are being breathed in by people who are working with waste and also in the communities that live nearby.”



Basic Components:

I. ARDUINO UNO:

The Arduino Uno is an open-source microcontroller board based on the Microchip ATmega328P microcontroller and developed by Arduino.cc. The board is equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits. The board has 14 digital I/O pins (six capable of PWM output), 6 analog I/O pins, and is programmable with the Arduino IDE (Integrated Development Environment), via a type B USB cable. It can be powered by the USB cable or by an external 9-volt battery, though it accepts voltages between 7 and 20 volts. It is similar to the Arduino Nano and Leonardo. The hardware reference design is distributed under a Creative Commons Attribution Share-Alike 2.5 license and is available on the Arduino website. Layout and production files for some versions of the hardware are also available.

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 crystal oscillator, 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. A maximum of 40mA is the value that must not be exceeded on any I/O pin to avoid permanent damage to the microcontroller. The Arduino/Genuino Uno has a number of facilities for communicating with a computer, another Arduino/Genuino board, 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. Arduino Software (IDE) includes a serial monitor which allows simple textual data to be sent to and from the board.

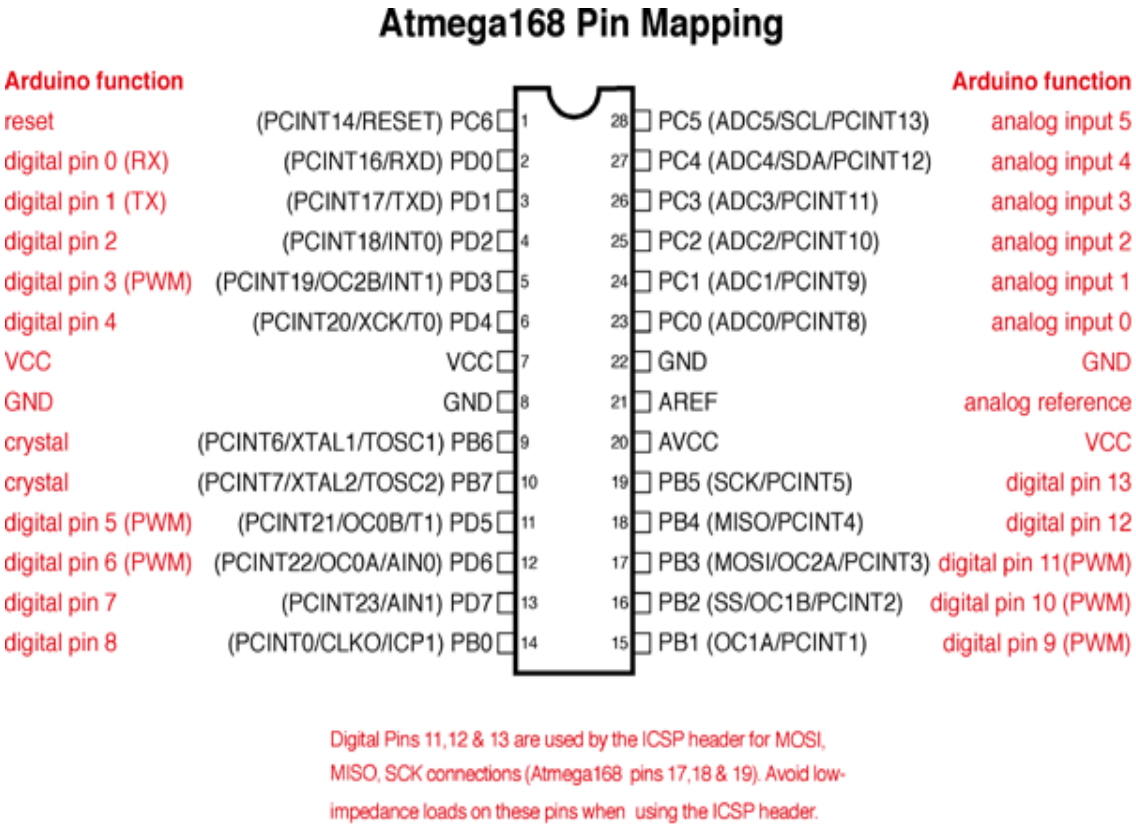


Fig1 : Pin Diagram of Arduino Uno

Technical specifications:

- Microcontroller: MicrochipATmega328P
- Operating Voltage: 5 Volts
- Input Voltage: 7 to 20 Volts
- Digital I/O Pins: 14 (of which 6 provide PWM output)
- Analog Input Pins: 6
- DC Current per I/O Pin: 20 mA
- DC Current for 3.3V Pin: 50 mA
- Flash Memory: 32 KB of which 0.5 KB used by bootloader
- SRAM: 2 KB
- EEPROM: 1 KB
- Clock Speed: 16 MHz
- Length: 68.6 mm
- Width: 53.4 mm
- Weight: 25 g

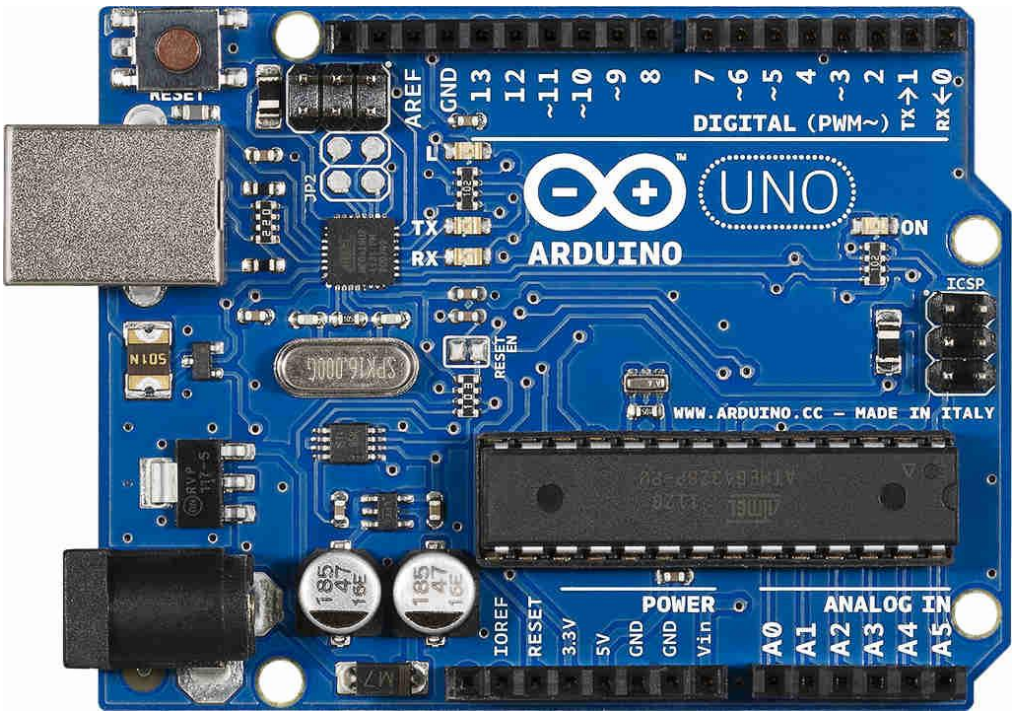


Fig 2: Arduino Uno

II. BLUETOOTH MODULE HC05:

HC-05 is a Bluetooth module which is designed for wireless communication. This module can be used in a master or slave configuration. Bluetooth serial modules allow all serial enabled devices to communicate with each other using Bluetooth. It has 6 pins,

1. Key/EN: It is used to bring Bluetooth module in AT commands mode. If Key/EN pin is set to high, then this module will work in command mode. Otherwise by default it is in data mode. The default baud rate of HC-05 in command mode is 38400bps and 9600 in data mode.

HC-05 module has two modes,

a. Data mode: Exchange of data between devices.

b. Command mode: It uses AT commands which are used to change setting of HC-05. To send these commands to module serial (USART) port is used.

2. VCC: Connect 5 V or 3.3 V to this Pin.

3. GND: Ground Pin of module.

4. TXD: Transmit Serial data (wirelessly received data by Bluetooth module transmitted out serially on TXD pin)

5. RXD: Receive data serially (received data will be transmitted wirelessly by Bluetooth module).

6. State: It tells whether module is connected or not.

HC-05 module Information

HC-05 has red LED which indicates connection status, whether the Bluetooth is connected or not. Before connecting to HC-05 module this red LED blinks continuously in a periodic manner.

When it gets connected to any other Bluetooth device, its blinking slows down to two seconds.

This module works on 3.3 V. We can connect 5V supply voltage as well since the module has on board 5 to 3.3 V regulator. As HC-05 Bluetooth module has 3.3 V level for RX/TX and microcontroller can detect 3.3 V level, so, no need to shift transmit level of HC-05 module. But we need to shift the transmit voltage level from microcontroller to RX of HC-05 module.

Fig 3: Bluetooth Module HC05

III. Mini Water Pump - 3-6V DC:

This is a low cost mini submersible type water pump that works on 3-6V DC. It is extremely simple and easy to use. Just immerse the pump in water, connect a suitable pipe to the outlet and power the motor with 3-6V to start pumping water. Great for building fire-extinguishers, fire-fighting robots, fountains, waterfalls, plant watering systems etc. This motor is small, compact and light. It can be controlled from a micro controller/Arduino using our DC Motor Drivers or one of our Relay Boards. You may use our 5V SMPS Power Supply Adapter to run this pump. You may also use our 6V Solar Panel to run the pump with appropriate a 6V voltage regulator.

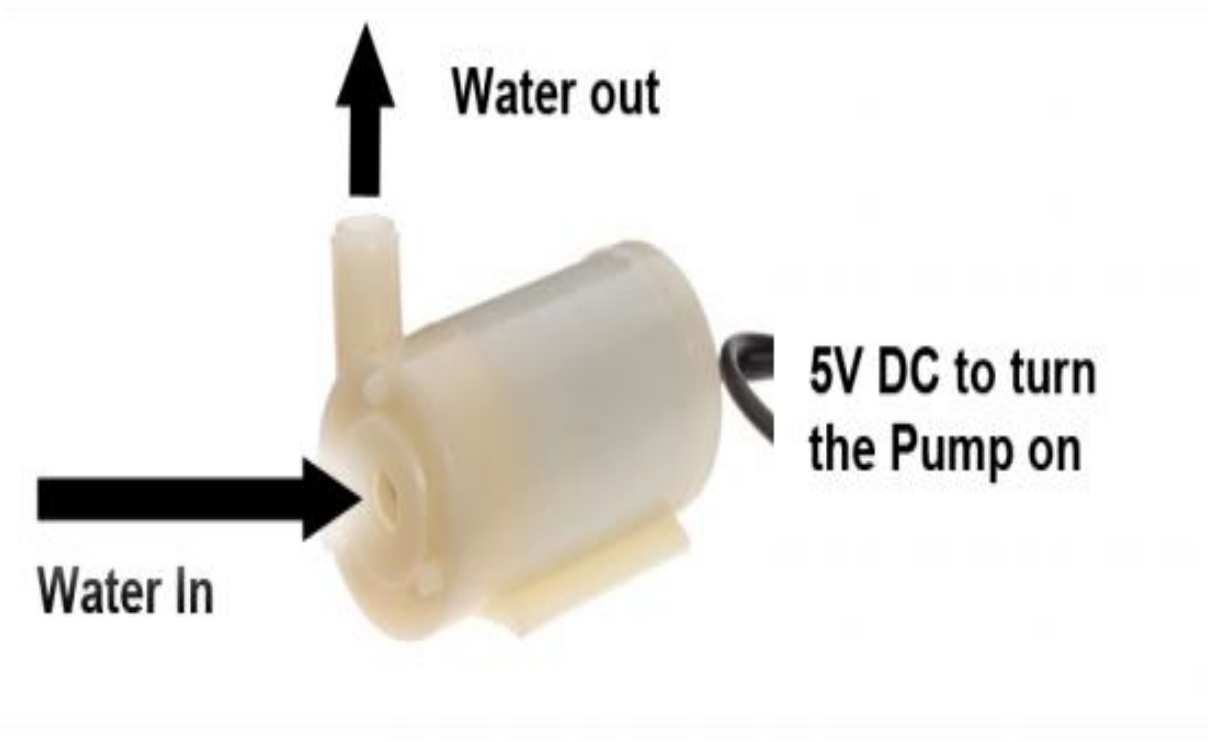


Fig 4: Mini Water Pump - 3-6V DC

IV. L298N Motor Driver Module:

The L298N is a dual H-Bridge motor driver which allows speed and direction control of two DC motors at the same time. The module can drive DC motors that have voltages between 5 and 35V, with a peak current up to 2A.

The module has two screw terminal blocks for the motor A and B, and another screw terminal block for the Ground pin, the VCC for motor and a 5V pin which can either be an input or output. This depends on the voltage used at the motors VCC. The module have an onboard 5V regulator which is either enabled or disabled using a jumper. If the motor supply voltage is up to 12V we can enable the 5V regulator and the 5V pin can be used as output, for example for powering our Arduino board.

This module uses two techniques for the control speed and rotation direction of the DC motors. These are H-Bridge – For controlling rotation direction and PWM – For controlling the speed.

H-Bridge Techniques

L298n motor driver module uses the H-Bridge technique to control the direction of rotation of a DC motor. In this technique, H-Bridge controlled DC motor rotating direction by changing the polarity of its input voltage.

An H-Bridge circuit contains four switching elements, like transistors (BJT or MOSFET), with the motor at the center forming an H-like configuration. Input IN1, IN2, IN3, and IN4 pins actually control the switches of the H-Bridge circuit inside L298N IC.

We can change the direction of the current flow by activating two particular switches at the same time, this way we can change the rotation direction of the motor.

Case 1

When S1, S2, S3, and S4 all switches are open then no current goes to the Motor terminals. So, in this condition, the motor is stopped (not working).

L298N Motor Driver Module Working of H-Bridge Case 1

L298N Motor Driver Module Working of H-Bridge Case 1

Case 2

When the switch S1 and S4 are closed, then the motor left terminal is getting a positive (+) voltage and the motor right terminal is getting a negative(-) voltage. So, in this condition motor start rotating in a particular direction (clockwise).

L298N Motor Driver Module Working of H-Bridge Case 2

L298N Motor Driver Module Working of H-Bridge Case 2

Case 3

When S2 and S3 switches are closed, then the right motor terminal is getting a positive (+) voltage and the left motor terminal is getting a negative (-) voltage. So, in this condition motor start rotating in a particular direction (anticlockwise).

L298N Motor Driver Module Working of H-Bridge Case 3

L298N Motor Driver Module Working of H-Bridge Case 3

PWM Techniques L298n motor driver module uses the PWM technique to control the speed of rotation of a DC motor. In this technique, the speed of a DC motor can be controlled by changing its input voltage. Pulse Width Modulation is a technique where the average value of the input voltage is adjusted by sending a series of ON-OFF pulses. The average voltage is proportional to the width of the pulses, these pulses known as Duty Cycle. If the duty cycle higher, then the average voltage is applied to the DC motor (High Speed), and the lower the duty cycle, the less the average voltage being applied to the dc motor(Low Speed).

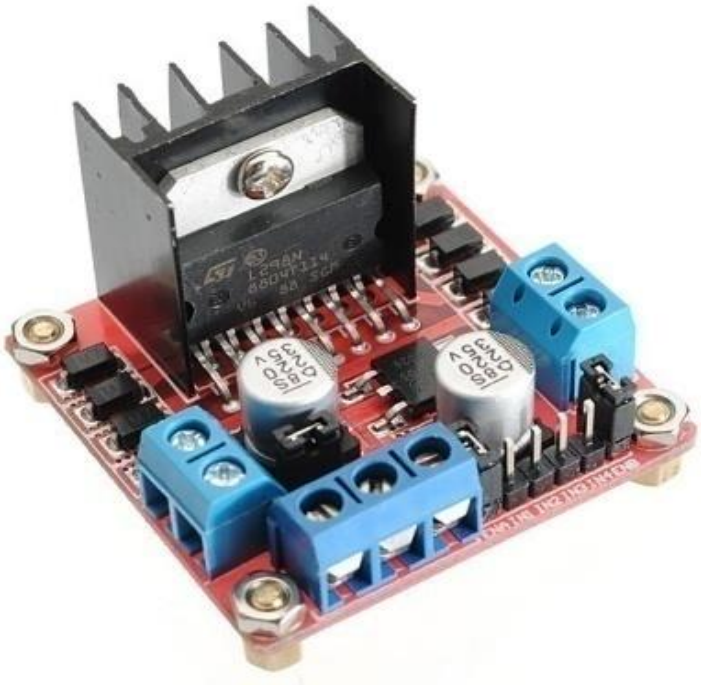


Fig 5: L298N

V. **Li-Battery(3.7V)** :

A **lithium-ion battery** or **Li-ion battery** (abbreviated as **LIB**) is a type of rechargeable battery. Li-ion batteries use an intercalated lithium compound as one electrode material, compared to the metallic lithium used in a non-rechargeable lithium battery. The batteries have a high energy density, no memory effect (other than LFP cells) and low self-discharge. They can however be a safety hazard since they contain a flammable electrolyte, and if damaged or incorrectly charged can lead to explosions and fires.

Fig 6: Li-ion Battery

VI. Jumper Wire:

A **jump wire** (also known as jumper, jumper wire, jumper cable, DuPont wire, or DuPont cable – named for one manufacturer of them) is an electrical wire, or group of them in a cable, with a connector or pin at each end (or sometimes without them – simply "tinned"), which is normally used to interconnect the components of a breadboard or other prototype or test circuit, internally or with other equipment or components. Though jumper wires come in a variety of colors, the colors don't actually mean anything. This means that a red jumper wire is technically the same as a black one. But the colors can be used to your advantage in order to differentiate between types of connections, such as ground or power.

Jumper wires typically come in three versions: male-to-male, male-to-female and female-to-female. The difference between each is in the end point of the wire. Male ends have a pin protruding and can plug into things, while female ends do not and are used to plug things into. Male-to-male jumper wires are the most common and what you likely will use most often. When connecting two ports on a breadboard, a male-to-male wire is what you'll need.

Fig 7: Jumper Wire

VII. Servo motor

A servomotor (or servo motor) is a simple electric motor, controlled with the help of servomechanism. If the motor as a controlled device, associated with servomechanism is DC motor, then it is commonly known as a DC Servo Motor. If AC operates the controlled motor, it is known as a AC Servo Motor.

A servomotor is a linear actuator or rotary actuator that allows for precise control of linear or angular position, acceleration, and velocity. It consists of a motor coupled to a sensor for position feedback. It also requires a relatively sophisticated controller, often a dedicated module designed specifically for use with servomotors.

A servo consists of a Motor (DC or AC), a potentiometer, gear assembly, and a controlling circuit. First of all, we use gear assembly to reduce RPM and to increase torque of the 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 the difference between these two signals, one comes from the potentiometer and another comes from other sources, will be processed in a feedback mechanism and output will be provided in terms of error signal. This error signal acts as the input for motor and motor starts rotating. Now motor shaft is connected with the potentiometer and as the motor rotates so the potentiometer and it will generate a signal. So as the potentiometer's angular position changes, its output feedback signal changes. After sometime the position of potentiometer reaches at a position that the output of potentiometer is same as external signal provided. At this

condition, there will be no output signal from the amplifier to the motor input as there is no difference between external applied signal and the signal generated at potentiometer, and in this situation motor stops rotating.

Servo motor is controlled by PWM (Pulse with Modulation) which is provided by the control wires. There is a minimum pulse, a maximum pulse and a repetition rate. Servo motor can turn 90 degree from either direction form its neutral position. The servo motor expects to see a pulse every 20 milliseconds (ms) and the length of the pulse will determine how far the motor turns. For example, a 1.5ms pulse will make the motor turn to the 90° position, such as if pulse is shorter than 1.5ms shaft moves to 0° and if it is longer than 1.5ms than it will turn the servo to 180°.

Servo motor works on PWM (Pulse width modulation) principle, means its angle of rotation is controlled by the duration of applied pulse to its Control PIN. Basically servo motor is made up of DC motor which is controlled by a variable resistor (potentiometer) and some gears. High speed force of DC motor is converted into torque by Gears. We know that WORK= FORCE X DISTANCE, in DC motor Force is less and distance (speed) is high and in Servo, force is High and distance is less. The potentiometer is connected to the output shaft of the Servo, to calculate the angle and stop the DC motor on the required angle.

Fig.8: Servo Motor

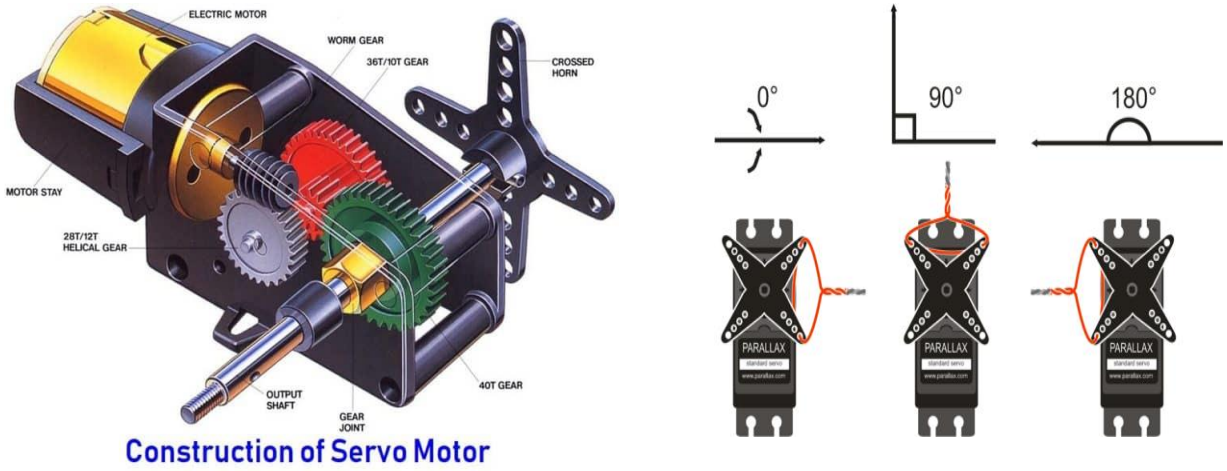


Fig.09: Construction & Working of the Servo Motor

CONSTRUCTION OF THE WATER WASTE CLEANING ROBOT:

The three crucial consideration for designing the robot is a cost-effective solution along with robustness, and durability. Considering the function of cleaning work, the robot structure is designed in order to provide high stability, excellent manoeuvrability and can easily collect all the waste flowing around.

- While making the robot model we faced one major problem regarding the buoyancy of the robot in water, and it was necessary to make it light weight as well as sustainable. For this we used light weight and sustainable square ply wood planks and Styrofoam to make the outer structure of the prototype. Styrofoam was attached to the side facing the water of the ply wood planks by aqua-proof and resin.
- The second task was to make the electronic equipment waterproof. For that we used plastic casing and sealed it using gum with the wooden ply. All the electronic equipment are kept in this space of plastic casing to make it perfectly waterproof.
- To make the water cleaning robot move we have used two mini water pumps(3-6V) which are precisely attached to the lower side of the robot and remains submerged in water. Mini submersible water pump is a centrifugal water pump, which means that it uses a motor to power an impeller that is designed to rotate and push water outwards. The motor is located in a waterproof seal and closely connected to the body of the water pump which it powers.
- For removal and collection of surface waste, a motor-driven arm manipulator system has been designed for collecting the wastes in a section covered with a net. We have attached this arm to the front side of the robot with the help of a servo motor.

- A servo motor rotates in 0-180 degree, and we have interfaced it with the arduino and the minimum inclination is given 40 degree. When It is in minimum inclination it is in water and collects garbage; and in maximum inclination i.e. 180 it drops the garbage in a basket attached to the robot.
- This design provides simple and effective waste removal and accommodates large amounts of trash within a small space.

FIG 10: FLOATING BASE

Fig.11: Strainer as the Robot Arm

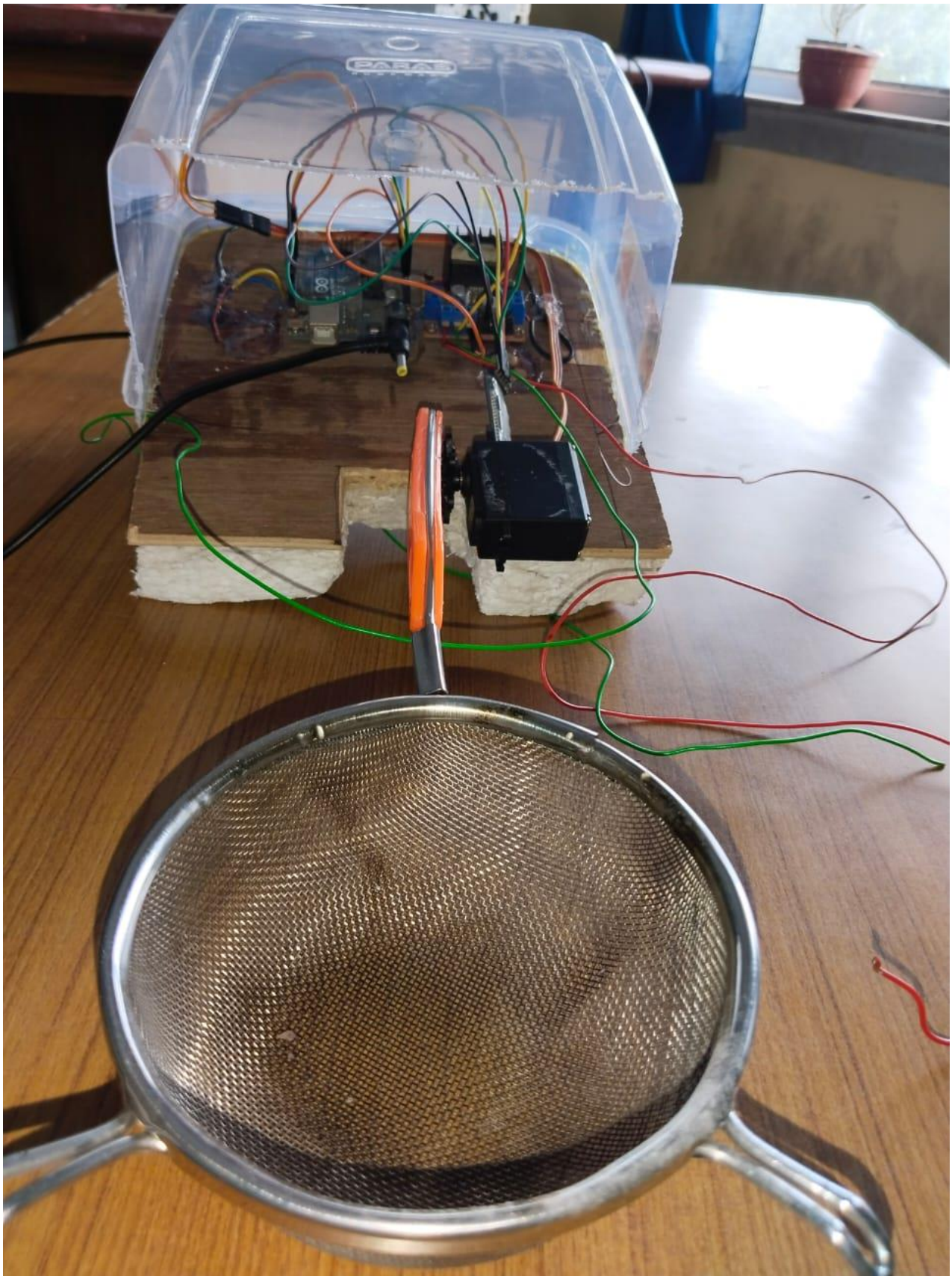


Fig.12: Front Side of the Water Waste Cleaning Robot

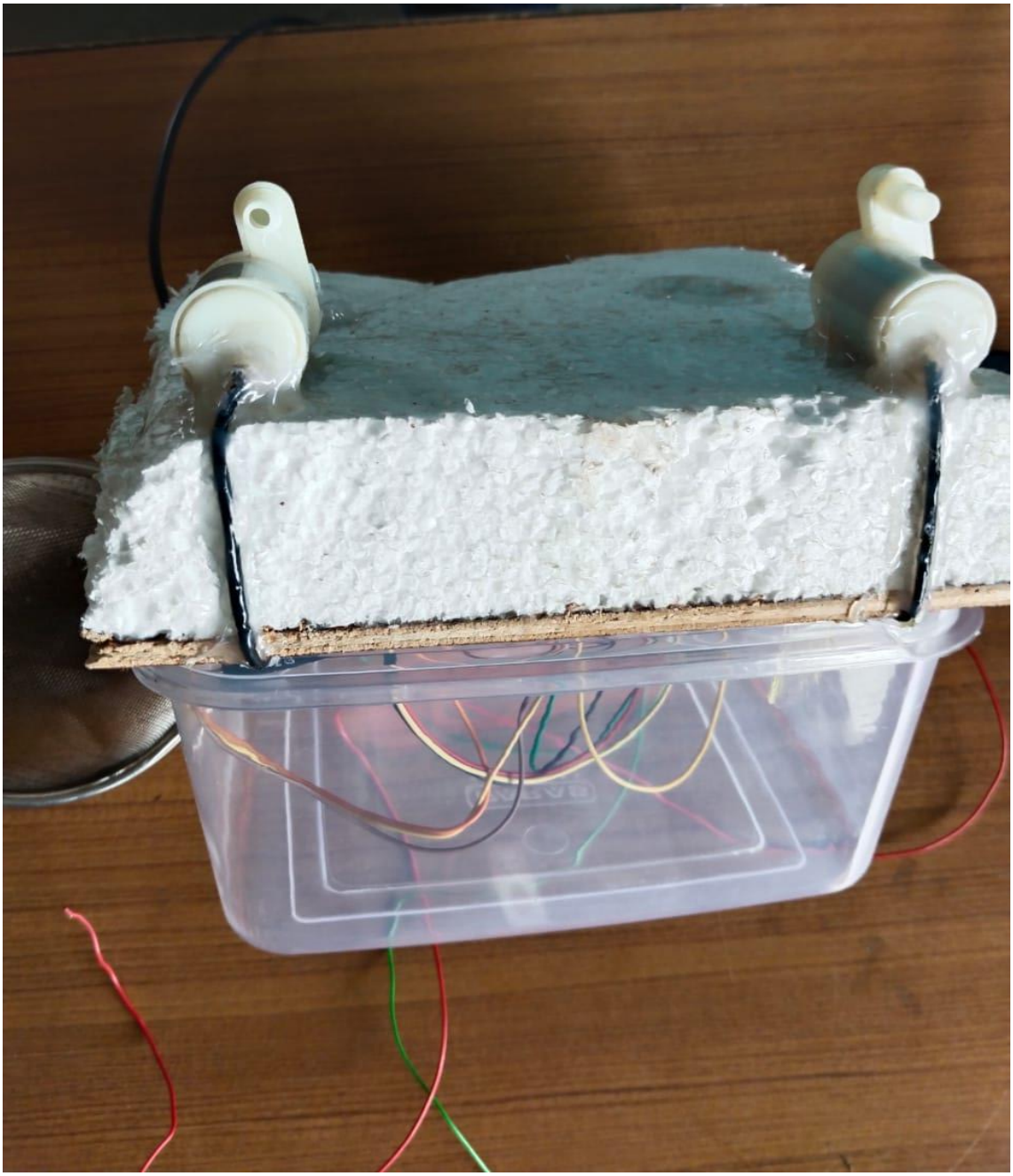


Fig.13: Back Side of the Water Waste Cleaning Robot

Working Principle:

At first when we switch on the power supply, the Arduino check for Bluetooth device connectivity. After successfully connecting the Bluetooth device with the android application RC car the device is ready to use. When we click on the forward button our device sends a signal to the Bluetooth module. Then this signal is collected by the Arduino and later processed. By fetching our code Arduino will understand what to do next. So, as per the code Arduino set one of the digital pin HIGH and this caused to start the motor driver module and open two channels. Through motor driver channels power will go into pumps. The Left and right movements is following the above principle, but the difference is for the right movement we open only the left pump and at that time left pump will be inactive. Same and opposite is for left movement.

Finally pulling garbage is the servo motor's job. When we click the button in the app the mobile sends a signal to the Bluetooth module and it will go to Arduino. Then as per the code, the servo will rotate and equally the hand attached to the servo will also pull up collecting the garbage.

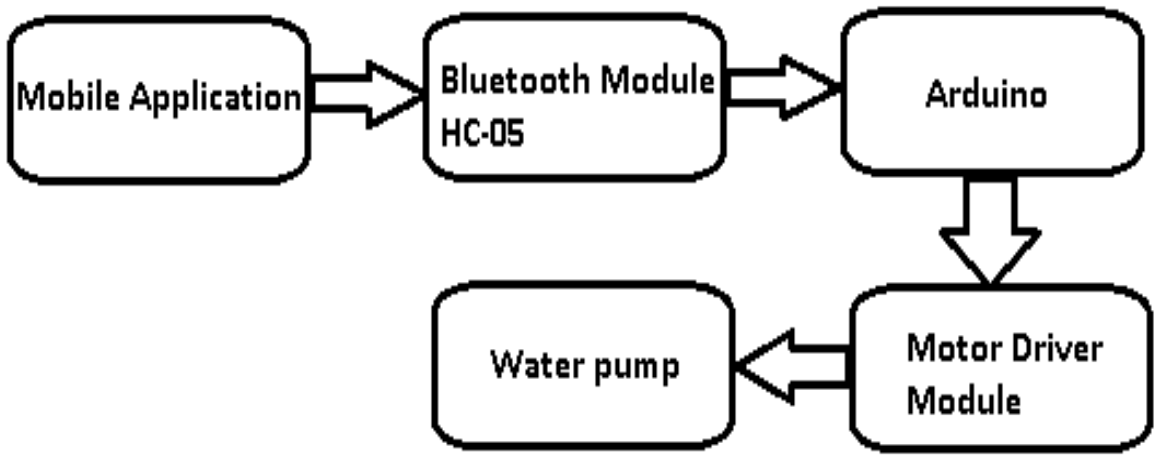


Fig 14: Block Diagram of this project

At first we connect Bluetooth module with arduino. We connect Bluetooth module's transmitter pin(Tx) with arduino's Receiver pin(Rx) 0. After that we will connect Bluetooth module's receiver pin(Rx) with arduino's Transmitter pin(Tx) 1. These all are digital pins. We are connecting receiver with transmitter because when Bluetooth module want to send some data to arduino, arduino should able to receive the data. So that if we don't connect with the receiver pin, the arduino will not be able to receive any kind of digital signal. As this follows, the receiver pins are also connect with transmitter pins. Then comes the motor driver module. The motor driver module has 4 digital pins. This 4 digital pins are basically connected with the H bridge of L298 H bridge IC. When we apply 5v power supply to one of the digital pin, one channel will be HIGH and current will be flown through that channel. There are 4 pins naming In1 In2 In3 and In4. Apart from that 2 channels are there CH1 and CH2. When we apply 5v into In1, Channel 1 is high and current will flow clockwise direction. When In2 is HIGH, current flow through Channel 2 in anticlockwise direction. Same for In3 and In4 for Channel 2. So our pumps are attached with those channel. As per the code for a certain value arduino set one or more digital pins at HIGH state. Those pins are connected with the motor driver module's digital pins. So now when we click Forward button the signal goes to arduino through Bluetooth module and then arduino takes decision and set pin no. 9 HIGH. Pin no. 9 is connected with in 1. So as per above discussion the Channel 1 should be high and so that the pump will be also on. The same is also done with the pin no.11. So for moving forward both pins are HIGH and for moving right digital pin 9 will be HIGH and for left digital pin 11 will be HIGH. So according that for forward movement both pumps are on and for right movement left motor will be on. For left movement right motor will be on. The pumps are taking water and spray it in force and that's how this robot moves.

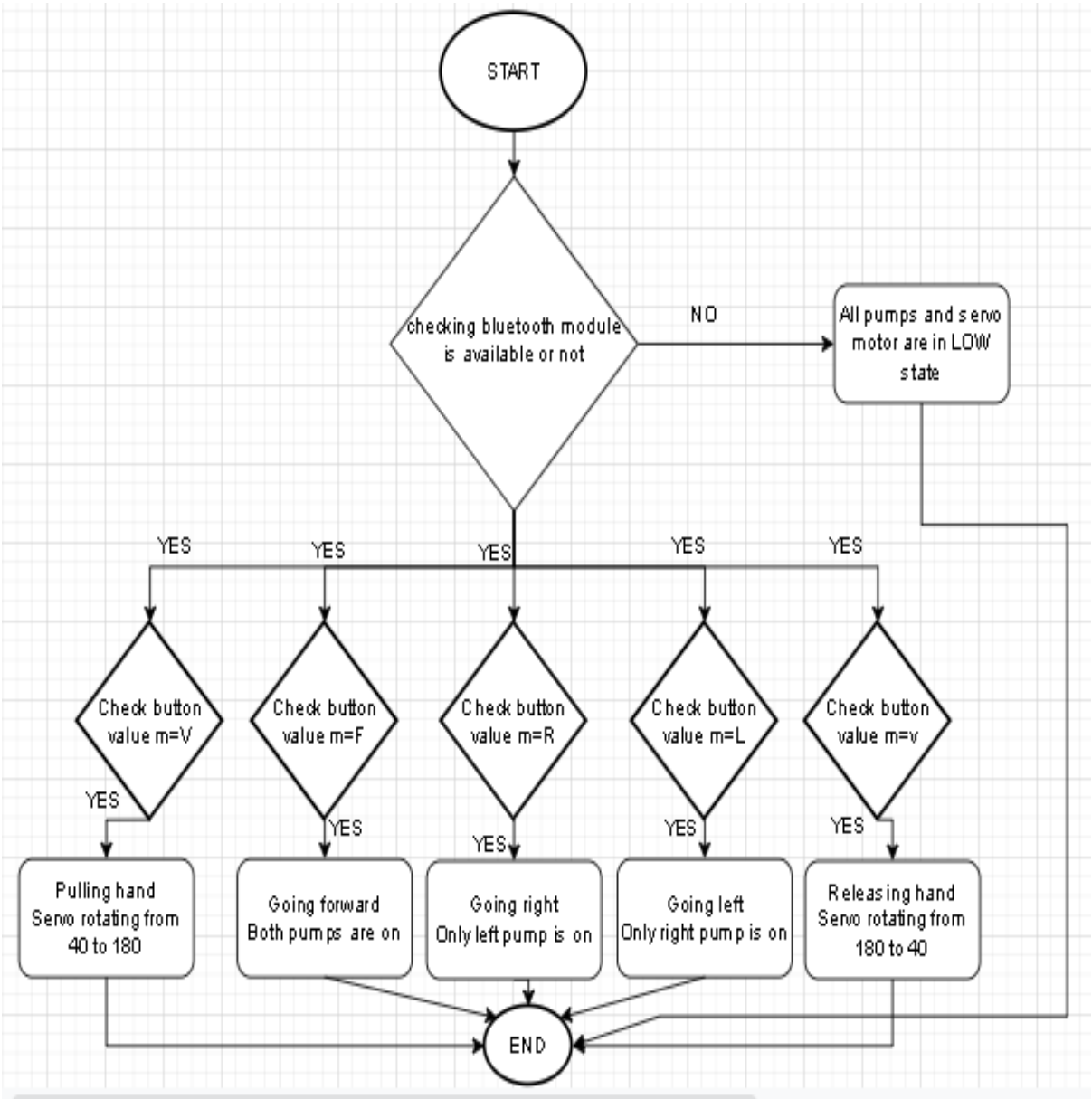


Fig 15: Flow Chart of the entire system

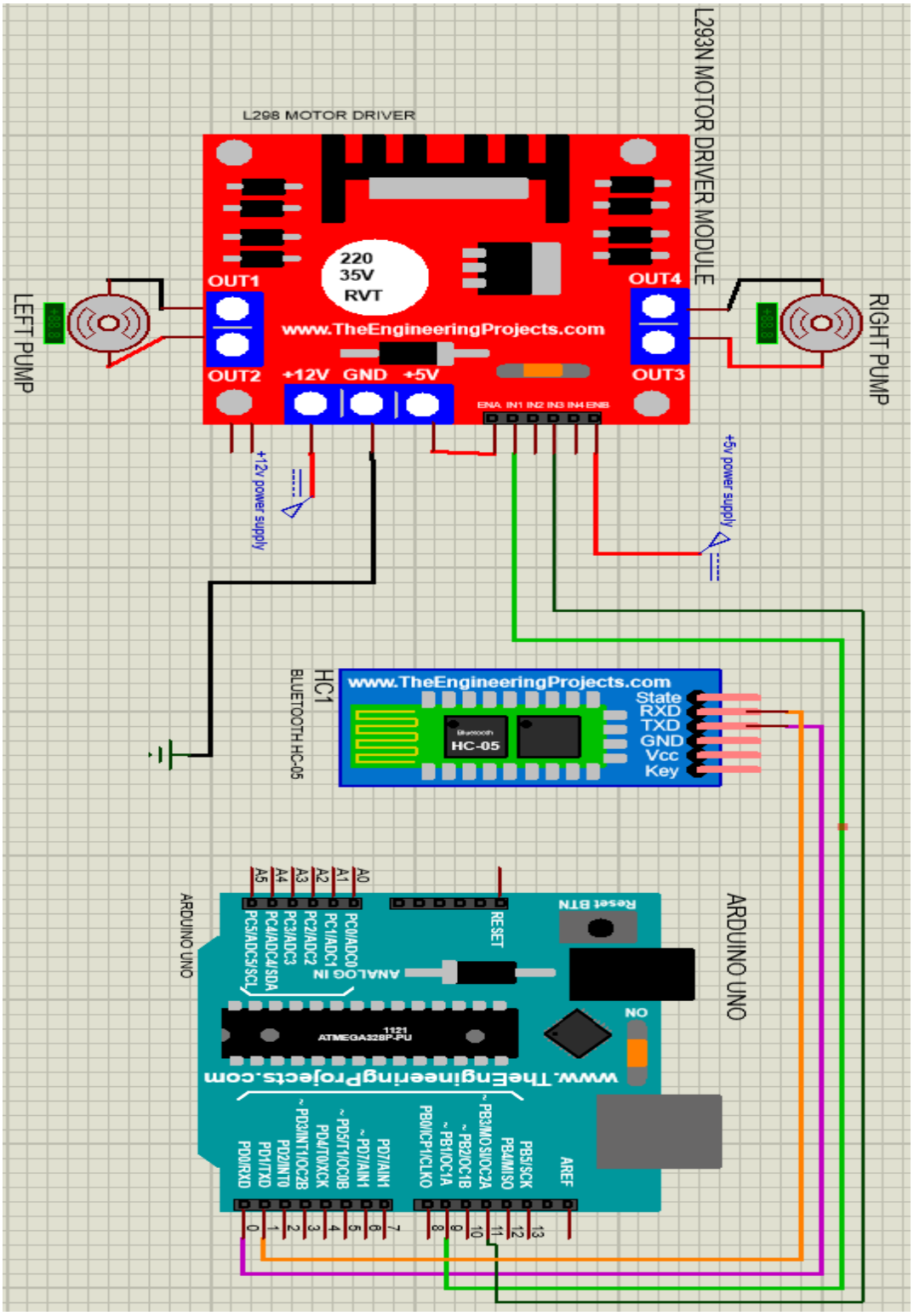


FIG 16: CIRCUIT SCHEMATIC DIAGRAM

Code for Wireless Water Cleaning Robot:

```
#include <Servo.h>
char m=0;
int pos = 0;
Servo myservo;
void setup() {
myservo.attach(7);
pinMode(7, OUTPUT);
pinMode(9, OUTPUT);
pinMode(11, OUTPUT);
Serial.begin(9600);
}
void loop() {
 if (Serial.available()>0)
 {
  m=Serial.read();
  Serial.println(m);
  }
 if (m=='F')
{
  digitalWrite(9, HIGH);
  digitalWrite(11, HIGH);
  }
else if (m=='R')
{
  digitalWrite(9, HIGH);
  digitalWrite(11, LOW);
  }
```

```
 else if (m=='L')
{
  digitalWrite(9, LOW);
  digitalWrite(11, HIGH);
  }
else if (m=='V')
{
for (pos = 40; pos <= 180; pos += 1) {
    myservo.write(pos);
    delay(1);
}
}
else if (m=='v')
{
  for (pos = 180; pos >= 40; pos -= 1) {
    myservo.write(pos);
    delay(1);
}
}
else
{
  digitalWrite(8, LOW);
  digitalWrite(9, LOW);
  digitalWrite(10, LOW);
  digitalWrite(11, LOW);
  }
}
```

Android Application:

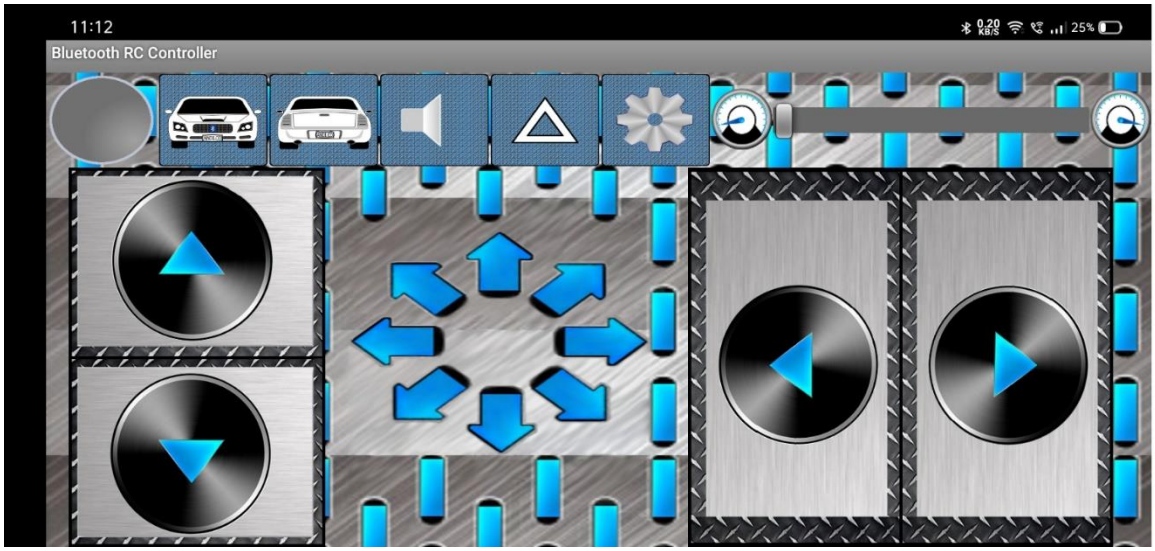


Fig.17: Interface of the App

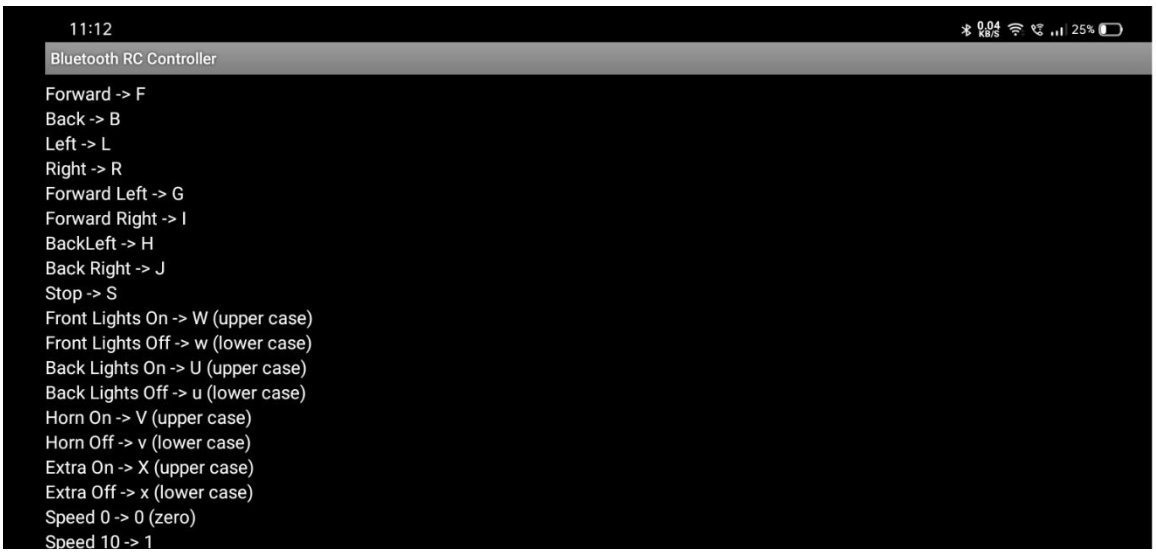


Fig.18: Internal Switch

At first we need to download Bluetooth RC car android application in our device. This application is generally made for controlling Bluetooth controlled Arduino robots. We can see that there are 9 switches in the application, but we have used only 5 buttons to control our robot. These switches are assigned specific values in the backend that we can see in the fig.18.

Results:

- In this system if we use the forward switch then the two water pumps are active, so the prototype of our project moves forward and the hand will be inactive.
- If we use the right switch then the left pump will be on and the right pump will not work, in this situation the prototype of the project will move towards right.
- If we use the left switch then the right pump will be on and the left pump will not work, in this situation the prototype of the project will move towards left.
- When we use upward switch then the servo motor will turn from 40 to 180 degree angle. So the hand position will be upward at that situation.
- When we use the downward switch then the servo motor will turn from 180 to 40 degree angle. So the hand position will be downward at that situation.

Bluetooth Module value (m)	Servo motor position	Left DC Pump	Right DC Pump	Hand Position
F	NULL	ON	ON	NULL
R	NULL	ON	NULL	NULL
L	NULL	NULL	ON	NULL
V	from 40° to 180°	NULL	NULL	Upwards
v	from 180° to 40°	NULL	NULL	Downwards

CONCLUSION

A water surface cleaning Robot was a relative success, the team has created an outline for future improvement in terms of research and theory, and implementation. On a high level, more research should have been done regarding the interfacing between module so the robot not only has single task but also multi task such as selecting trash refer to its material and also monitoring water quality. Consider designing the hull of the robot; there were several technical matters that are geometric design, reducing hydrodynamic resistance, minimizing weight and preventing drown because of leakage. The primary requirement of the hull design is to generate a sufficient force suspending the robot in water.

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symmetric along the moving direction. The two pontoons are placed so that the centre of the floating force is located at the symmetric axis. The weights are placed at the centre of mass of the robot. The application of the control system using XBee wireless to the robot motion system has been successfully carried out by utilizing the control method by wireless communication with the serial data transmission format. The control system is examined by giving instructions on the remote that are well received by the robot with the appropriate motion response with the commands written on the program. The robot is controlled s moves supposed moving with the trajectory as in Figure 3 and collects garbage along the path. The robot can operate well and able to accommodate garbage loads up to 2 kg.

FUTURE SCOPE:

Our future work focuses to improve the project by developing the robot to work in any waters bodies like rivers, oceans, etc. Furthermore, the use of image processing to differentiate the wastes as biodegradable and non-biodegradable may also be implemented in future. This will help to protect the aquatic animals, thus maintaining a balanced ecosystem. The project can be further improved by adding a GPS and wireless communication capabilities to give information to respective authority about the place where the wastes are being stored.

A lake cleaning robot to remove surface wastes and garbage is proposed in this work. The proposed hardware consists of a Raspberry pi 3 board to control the movement of the robot along with gripper, motors, ultrasonic sensor and IR sensor. The developed lake cleaning robot can be used in all lakes and other static water bodies to clean the plastic and other floating wastes. This helps in decreasing the

water pollution and thus providing a balanced environment and ecosystem. The more developed future product can also be made to work in flowing waters. It will also help in creating a balanced aquatic population in the lakes and proper utilization of water resources.

Our future work focuses to improve the project by developing the robot to work in any waters bodies like rivers, oceans, etc. Furthermore, the use of image processing to differentiate the wastes as biodegradable and non-biodegradable may also be implemented in future. This will help to protect the aquatic animals, thus maintaining a balanced ecosystem. The project can be further improved by adding a GPS and wireless communication capabilities to give information to respective authority about the place where the wastes are being stored.

Now day by day the world is facing the biggest problem of floating garbage. And it's increasing in tremendous amounts so it's very difficult to wash all this floating garbage due to more requirement of manpower. so, in future this remote operated floating river cleaning machine has more scope to remove large capacity of garbage automatically as fast as possible. And by making modifications during this machine, this is used for automatically removing the garbage from beaches also.

Robotic Programming : Smart Z programming for Systematic Cleaning Robotic Balance Retains its balance if it turns over Robotic Reverse: If RoboPhelps exits the water in a beach-entry pool, it will reverse & attempt to re-enter water Robotic Injury Protection: The impeller automatically stops within 1 sec if it is taken out of water while it is working Robotic Self Preservation: Stops working in case some large foreign matter is obstructing it impeller Robotic Shut off : Shuts itself at the end of the cycle It can clean both Above Ground & In-ground Residential Pools of all shapes & is suitable for all surface types Tile (large & small), vinyl, Gunite, Fiberglass Cleaning Performance

Maximum cleaning area in about 2 hours is 2100 Sq Ft in 2 hours Filtering or Suction Rate Water which passes through the Robot in a given time 18000 Liters/Hour Operating Cost is Rs 3 per hour Cleaning Features Cycle Time & Timers : Time taken by the pool robot to complete a cycle &timer settings available on the robot You can select from 3 settings 0.5h (Pool size < 500 Sq ft), 1h (Pool Size 50 to 100 Sq ft) or 2h Pool Size > 100 Sq ft) Pool Cleaning Speed is Maximum 120?/h or 1300 Square Ft /h Cleaning Roller roller which scrubs & cleans is 34cm wide Floating Cable Standard Length : This can be extended also. This limits the width & length of cleaning area of the robot is 15m, i.e. 50 ft approximately The maximum height which the pool robot can climb. It also means the maximum depth the pool robot can clean is 180 cm (Approx 6 ft or 1.8 m) Filter Bag Porosity: It is the size of the pores on the filter bag. It is 70 microns which is much smaller than the thickness of human hair. It can be changed according to the needs by selecting different filter. Other Features The main unit has the highest Water 'Ingress Protection' (IP) rating of 68.

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