

# **Microcontroller Based Floating Waste Collector.**



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## **Declaration**

It is declared hereby that this project paper or any part of it has not been submitted to anywhere else for the award of any degree.

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# **Certification**

I certify that I have read this project and that, in my opinion, it is fully adequate, in scope & quality as a dissertation for the degree of BSc in Engineering.

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# **Abstract**

Protecting environment from various sources of pollution is imperative to ensure the sustainability of the earth. Water pollution has also become one of the significant issues due to increasing water-related activities such as transportation, fisheries, entertainment and many others. It threatens the well-being and prosperity of human and nature as well as the quality of water in the surrounding. Wastes which are thrown on water areas are the main causes of water pollution. It greatly impacts the life on water and the place it is surrounding. People going on water to collect wastes can sometimes be dangerous and risky for their health. This project helps clean and collects wastes on water areas by using a wireless controlled Robot prototype. This prototype which has a conveyor belt in front of it will collect the trash it encounters.

The aim of this study is to collect the wastes on water without risking the health of a person. The present design of this prototype is to minimize human effort on manual picking of wastes. In this project we have fabricated the remote operated river cleaning machine. The main aim of the project is to reduce the man power, time consumption for cleaning the river. In this project we have automated the operation of river cleaning with help of a motor and chain drive arrangement. Some needs of automation are described below. Here using Arduino, motor driver and Bluetooth receiver are used to control the cleaning machine.

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# CHAPTER I

## INTRODUCTION

### 1.1 Introduction

Over two thirds of Earth's surface is covered by water; less than a third is taken up by land. As Earth's population continues to grow, people are putting ever-increasing pressure on the planet's water resources. In a sense, our oceans, rivers, and other inland waters are being "squeezed" by human activities so their quality is reduced. Poorer water quality means water pollution. This invention relates to skimmer boats, i.e., work boats for collecting and disposing of floating solid waste materials in harbors and waterways. The invention is more specifically directed to highly maneuverable vessels equipped with means for picking up floating debris, means for storing the debris on the vessel, and means for discharging the debris from the vessel to a storage area, which may be ashore or which may be another vessel such as barge. Many work boats and vessels have been proposed for collection of floating solid waste and other debris. These may typically be formed as a catamaran-type hull, i.e., a pair of pontoons or sponsors, or as a monohull, with paddle wheel or screw driver propulsion, and an operator station. In one typical trash skimmer design, one or more hydraulically powered open mesh conveyors are positioned between the pontoons of a catamaran-type twin-hull vessel. The problem of flooding and climate change has become outrageous because of its recent trends in our environment today. This has become a cause of major concern to the world, especially the developing countries. Water running through a water drainage system mostly carries along waste materials most which are non-biodegradable which not only cause flooding but also climate change. Overflow of water drainage system occurs when there is a blockage of an end of the drainage system forcing the water to find its way elsewhere apart from the mapped out drainage system, therefore the running water spills over the horizontal height of the drainage systems spreading to regions alongside the drainage system, thereby causing problems such as pushing down of structures such as fences, water logging of farm lands and residential building, etc. The impurities present in water can cause hazardous and disease. As long as the draining system is considered the function of the main drainage system is to collect, transport and dispose of the water through an outfall or outlet. Impurities in drainage water can be only like empty bottles, polythene bags, papers, etc



Fig 1.1 Garbage in river

Floating bottles, plastic bags and even toys have become a part of the marine environment in recent times. Pitiful photographs of such plastic debris washed ashore on remote shorelines have frequently made headlines.

Most of this plastic pollution is attributed to an increase in tourism, shipping and fishing activities. But according to a recent study, a considerable portion of plastic garbage afloat in the open waters originates on land, and is drained into the seas by rivers.



Fig 1.2: Manual Cleaning process

But this is not just about the environment and the wildlife that live underwater—aquatic pollution affects everything from species, ecosystems, human health, coastal tourism, and contributes to climate change.

## **1.2 Background of the Study**

Water waste is a common problem in different water areas around the world. Clean water and sanitation are very important matter to be monitored to avoid water contamination, fish killing, and extinction of different water species. All these contaminations and wastes on water can affect both the wildlife and people living around it.

Many people are irresponsible when it comes to waste disposal. The most common areas that people are irresponsibly throwing out their wastes are on rivers near bridges, tourist spot beaches, and ship terminals. When a major increase of water level happens in river, all the wastes are deposited to the canals on rural and urban areas. These events result in flooding of areas and major catastrophes both on the environment and on the people living in the area. Not only these wastes can block the canals, but they can also spread harmful and deadly diseases. People going through the flood would have high risk of infection, especially if they have an open wound on them and would also cause skin irritations on people with sensitive and allergic skin. Also, the fouling smell coming from the wastes is one of the major causes of health problems, especially on children who have significantly lower immunity to these things.

The wastes on the water areas are not only causing trouble on the people around it but also on the living organisms in the water. The fish and other living organisms are affected by the lack of oxygen because of the wastes scattered along the river. The waste results in the incapability of the water to sustain marine wildlife. According to Geer (2007), around 100 million tons of plastic is produced every year, of which 10 percent ends up in the sea. Ocean litter comes from many sources including wastes that washes off city streets, waste blown in from landfills and containers that fall off ships during heavy storms. Once in the water, the debris accumulates in large patches, travels with currents and washes up onshore. This litter is frequently consumed often with fatal effects on marine mammals.

Picking up wastes around water can be very tiring if it is done manually and it will take a lot of time. It is hard to see water areas that is packed with wastes especially when people are imagining how a water species can survive if some waste are poisonous for them and it can lead to water contamination. A simple plastic waste can influence different water species.

Seeing all these happenings led us to a study that can help not only the people but also the living organisms on the water struggling on their current state.

The study focuses on collecting water wastes that can prevent the destruction and waste contamination of the different water areas. With the used of an Arduino Uno, Motor Drive Shield and Radio Module, the prototype has a wireless controller and a conveyer belt to lift up the wastes directly to the bin. The GSM module and a sensor installed would indicate if the bin is already full. All these features can make a technological advancement in collecting wastes without the people going on water areas.

People may think that it is only plastics, straws and other things, but this can affect people and wildlife on the area. Flooding of areas and diseases are the major effects of these wastes on water areas. These things are the reason why the proponents want to push this project. This one is a possible solution on the current problems that our society is facing.

### **1.3 Problem Statement**

The study aims to lessen wastes existing in different water areas as much as possible to attain waste reduction. This helps the people living nearby water areas to have a clean water environment and for having good health. It also helps the species living under water to clean their habitat and for them to prevent eating harmful substances. The proponents provide questions for this study

### **1.4 Methodology**

In this chapter, the proponents give synopsis of the research methodology that was done and conducted for the study of Arduino Based Garbage Collector with Wireless Controller and Monitoring System for Water Waste. The proponents labeled the preferred research design and the reasons for this study. Representing information on selected respondents that meets the criteria needed for the study and on how the proponents sampled the respondents. The methods and instruments that was used for gathering of necessary data is defined and added by its step by step procedure that was done to implement this study.

# CHAPTER II

## THEORY OF THE PROJECT

### 2.1 Introduction

This chapter includes the total over view of the device. In this chapter we have followed-up the theory of Arduino UNO, Motor Driver, Bluetooth and other components. Here we can know that the total system overview of the projects. And we will also know that how the equipment are working with each other.

### 2.2 Theory

The system architecture of the automatic output appliance can be divided into 3 main Modules. They are:

1. CPU
2. Communication system
3. Control system

We've developed the system that can monitor waste bin and environment. Our system has several IR obstacle sensor to detect the level. Based on the input signal microcontroller operate light and sent sms. For example when bin is empty then microcontroller detect it by IR sensor and display Bin Empty. Beside this, there are also smoke and dust sensor which detect smoke from surrounding area and sent sms to authority if there are any air pollution.

### 2.3 Microcontroller

A microcontroller is a compact integrated circuit designed to govern a specific operation in an embedded system. A typical microcontroller includes a processor, memory and input/output (I/O) peripherals on a single chip. Sometimes referred to as an embedded controller or microcontroller unit (MCU), microcontrollers are found in vehicles, robots, office machines, medical devices, mobile radio transceivers, vending machines and home appliances among other devices. Microcontroller is a single chip microcomputer made through VLSI fabrication.

### 2.3.1 Arduino UNO

Arduino Uno is one of the microcontroller boards manufactured by the Arduino and it is a microcontroller board based on Atmel's ATmega328P microcontroller. "Uno" means one in Italian and the Uno board is the latest in a series of USB (Universal Serial Bus) Arduino boards which is the reference model for the Arduino platform. The Arduino Uno board has a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, a reset button, 6 analog inputs and 14 digital input/output pins (of which 6 can be used as PWM outputs). It uses the Atmega16U2 programmed as a USB – to - serial converter instead of FTDI USB – to – serial driver chip which was used in all the pre-ceding boards. The board has 32 KB flash memory of which 0.5 KB is used by boot-loader, 2 KB of SRAM, 1 KB of EEPROM and 16 MHz clock speed.

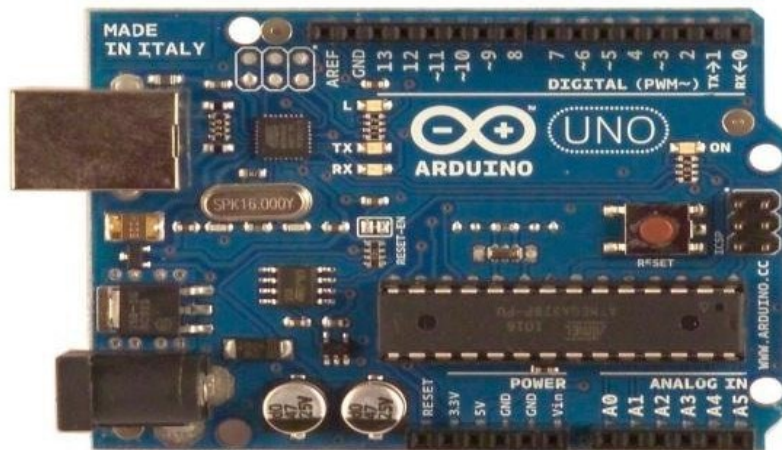


Fig 2.1: Arduino UNO

Reprinted from the Arduino Board Uno Figure 1 shows the Arduino Uno Board manufactured by the Arduino in Italy. It can be powered via a USB connection or with an external power supply. As can be seen in figure 1, pins A0 to A5 are the analog input pins, pins 0 to 13 are 14 digital input/output pins and the pins with a “~” sign can be used as digital pins PWM o can be used as input or output pins by selecting the mode by using the function Pin-Mode() and then using the function digital Read() or digital Write() according to the necessity. Pins 0(RX) and 1(TX) are

used for serial communication while pins 10(SS), 11(MOSI), 12(MISO) and 13(SCK) are used for SPI (Serial Peripheral Interface) communication. In addition to pin 0 and 1, a Software Serial library allows serial communication on any of the Uno's digital pin.

The microcontroller is a low-power CMOS (Complementary Metal Oxide Semiconductor) 8-bit microcontroller based on the AVR enhanced RISC (Reduced Instruction Set Computer) architecture. The powerful execution of instructions in a single clock cycle leads to the achievement of 1 MIPS per MHz throughputs allowing the designer to optimize power consumption versus processing speed.

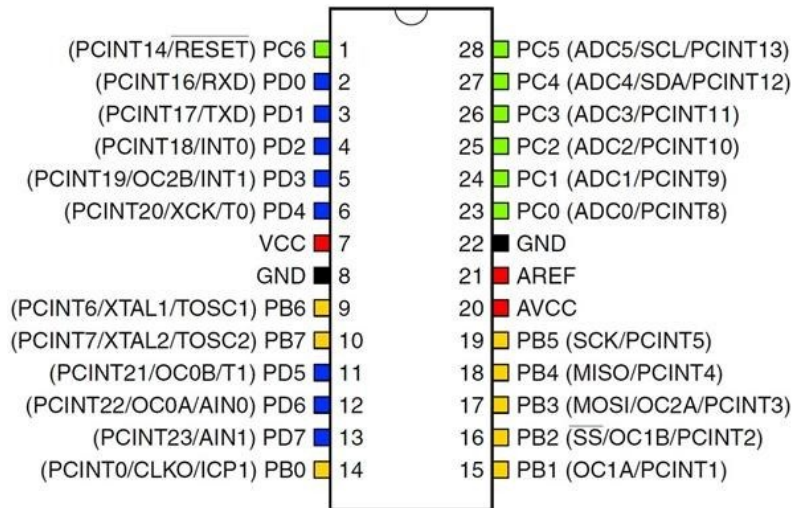


Fig 2.2: ATmega328P Microcontroller

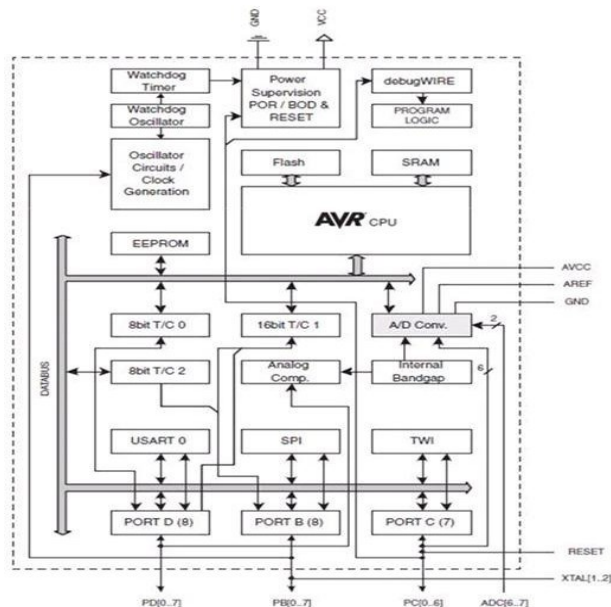


Fig 2.3: ATmega328 Microcontroller Architecture

Reprinted from Datasheet of ATmega328 the internal architecture of the microcontroller is shown in Fig 2.3.3 (02). The central processing unit (CPU) is the brain of the microcontroller which controls the execution of the program. The MCU (Microcontroller unit) consists of



4K/8K bytes of in-system programmable flash with read-while-write capabilities, 256/412/1K bytes EEPROM along with the 512/1K/2K bytes of SRAM. Along with this, the MCU consists of many other features

- 23 general purpose I/O lines and 32 general purpose working registers
- flexible timer/counters with compare modes, internal and external interrupts and a serial programmable USART
- A byte-oriented 2-wire serial interface, an SPI serial port, a 6-channel 10-bit ADC (8 channels in TQFP and QFN/MLF packages), a programmable watch-dog timer with an internal oscillator and 5 software -selectable power saving modes.

The five, software selectable, power saving modes are idle mode, Power-down mode, Power-save mode, ADC Noise Reduction mode and the Standby mode. As mentioned in section 2.1.2, the CPU is the brain of the microcontroller which controls the execution of the program. Therefore the CPU is able to access the memories, perform calculations, control peripherals and handle interrupts. The AVR uses the Harvard architecture with separate memories and buses for program and data to maximize the performance as well as the parallelism. The principle of execution of instructions in the program memory is the single-level pipelining. The concept of pre-fetching the next instruction while executing one instruction enables the instructions to be executed in every clock cycle and the program memory is in the System Reprogrammable Flash memory.

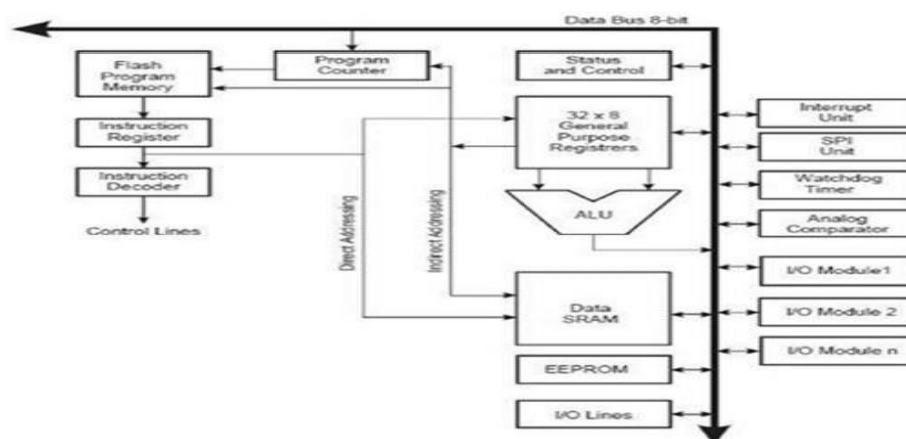


Fig 2.4: Block diagram of the AVR CPU Core architecture

Reprinted from Datasheet of ATmega328, The block diagram of AVR CPU Core architecture is shown in figure 3. The fast-access Register File contains 32 x 8 bit general-

purpose working registers with a single cycle access time which results in a single -cycle ALU operation. The arithmetic and logical operations between the registers or between the constant and a register are supported by the ALU. The status register is updated to reflect information about the result of the operation after an arithmetic operation. The boot program section and the application program section are the two main sections of the program flash memory. Stack stores the return address of the program counter during the interrupts and subroutine calls which is allocated in the general data SRAM. The size of the stack is limited by the total size and usage of the SRAM. The data SRAM is accessible through five different addressing modes supported in the AVR architecture while the stack pointer is read/write accessible in the I/O space. The memory spaces in the AVR architecture are all linear and regular memory maps.

## **Specifications**

Microcontroller: Atmel ATmega328

Operating Voltage (logic level):5 V

Input Voltage (recommended):7-12 V

Input Voltage (limits):6-20 V

Digital I/O Pins: 14 (of which 6 provide PWM output)

Analog Input Pins: 8

DC Current per I/O Pin: 40 mA

Flash Memory: 32 KB (of which 2KB used by boot loader)

SRAM : 2 KB

EEPROM: 1 KB

Clock Speed: 16 MHz

Dimensions: 0.70" x 1.70"

## **Features**

- Automatic reset during program download
- Power OK blue LED
- Green (TX), red (RX) and orange (L) LED
- Auto sensing/switching power input
- Small mini-B USB for programming and serial monitor
- ICSP header for direct program download

- Standard 0.1 spacing DIP (breadboard friendly)
- Manual reset switch

## Microcontroller IC ATmega328p

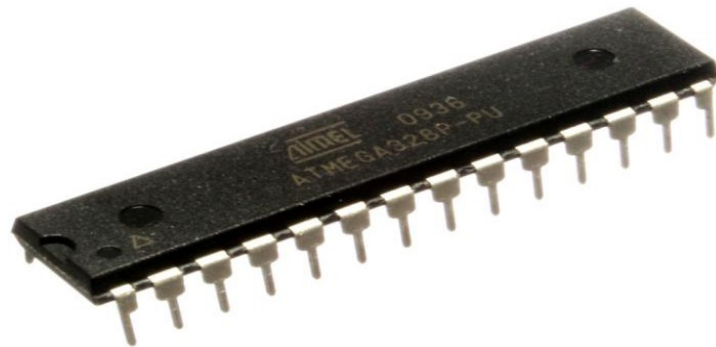


Fig 2.5: Microcontroller IC ATmega 328p.

The high-performance Microchip picoPower 8-bit AVR RISC-based microcontroller combines 32KB ISP flash memory with read-while-write capabilities, 1024B EEPROM, 2KB SRAM, 23 general purpose I/O lines, 32 general purpose working registers, three flexible timer/counters with compare modes, internal and external interrupts, serial programmable USART, a byte-oriented 2-wire serial interface, SPI serial port, a 6-channel 10-bit A/D converter (8-channels in TQFP and QFN/MLF packages), programmable watchdog timer with internal oscillator, and five software selectable power saving modes. The device operates between 1.8-5.5 volts. By executing powerful instructions in a single clock cycle, the device achieves throughputs approaching 1 MIPS per MHz, balancing power consumption and processing speed.

### 2.3.2 Power supply, inputs and outputs

Either Arduino is supplied with USB connection or with an external power supply (recommended with 7-12V), outputs are going to have a continuous voltage due to voltage regulators and stabilization capacitors present on the board. These power supply pins are:

- **VIN:** it is the input power supply that will have the same voltage that we are supplying the Arduino with the external power supply
- **5V:** power supply of 5V, this voltage may come from VIN pin and a voltage regulator or from the USB connection.

- **3.3V:** power supply that will provide 3.3V generated by an internal regulator, with a maximum current of 50 mA.
- **GND:** grounding pins

### 2.3.3 Digital inputs and outputs

Each of the 14 digital pins can be used as an input or output. Besides, each pin can supply or receive a maximum of 40 mA and has a pull-up resistance from 20 to 50 kOhm. In addition, some pins have specialized functions such as:

- Pin 0 (RX) and 1 (TX). They are used to receive (RX) and transmit (TX) in TTL serial communication.
- Pin 2 and 3. External interruptions. Pins in charge of interrupting the sequential program established by the user.
- Pin 3, 5, 6, 9, 10 and 11. PWM (pulse width modulation). They form 8 output bits with PWM with the function `analogWrite()`.
- Pin 10 (SS), 11 (MOSI), 12 (MISO), 13 (SCK). These pins support SPI (Serial peripheral interface) communication.
- Pin 13. LED. There is a LED connected to the digital pin 13. When the pin value is HIGH, the LED is on, and when the value is LOW, the LED is off.

### 2.3.4 Analog inputs

Arduino UNO has 6 analogical inputs, from A0 to A5, and each one offers a resolution of 10 bits (1024 states). By default, there is a voltage of 5V, but that range can be modified using the pin AREF and using the function `analogReference()`, where the user introduces the DC external signal he wants to use as reference.

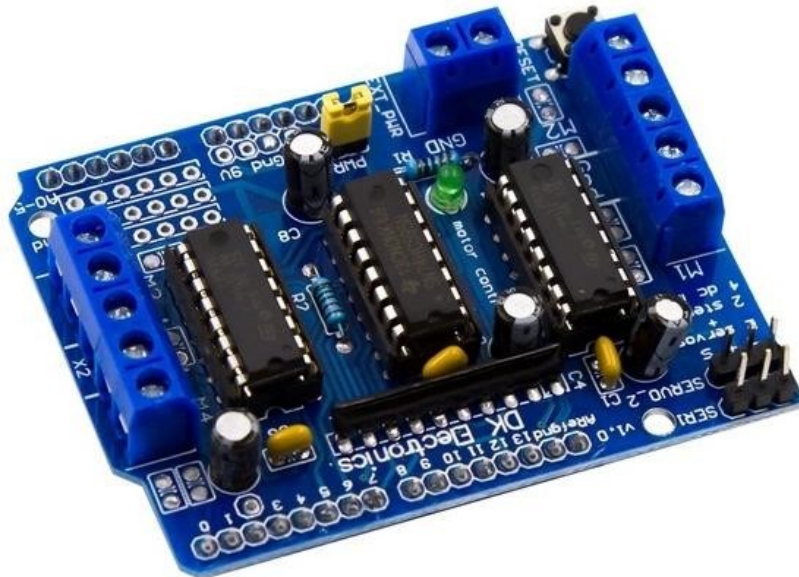
## 2.4 Output System

Output system of Robot consists of motor driver and motor. Output signal goes to motor driver and then this driver operates motor.

### 2.4.1 Motor Driver

A Motor Driver or motor controller is a device that serves to govern in some predetermined manner the performance of an electric motor. A motor controller might include a manual or

automatic means for starting and stopping the motor, selecting forward or reverse rotation, selecting and regulating the speed, regulating or limiting the torque, and protecting against any condition.



**The motor driver:** The L293D is a dual-channel H-bridge motor driver that can control two DC motors or a stepper motor at one time. As there are two L293D ICs on the shield, it's technically capable of controlling a total of four DC motors.

This is ideal for two and four-wheel robot platforms. The IC consists of two H-bridge to control the motors, each delivering up to 0.6A to a motor.

**The shift register:** The 74HC595 is an 8-bit serial input and serial/parallel output shift register. It's used to extend four Arduino GPIO (or another microcontroller) to eight direction control pins for two of the L293D motor driver ICs.

**The power supply:** The power supply to the shield can be used for both the shield and Arduino or the two can use separate power supplies. If sharing a common power supply, a power jumper must be placed on the shield. The power supply can be provided through Arduino's USB port, its DC jack, or from the shield's 2-pin EXT-PWR block.

#### 2.4.2 IC L293D (DC motor driver)

The 4 input pins for this L293D, pin 2, 7 on the left and pin 15, 10 on the right as shown on the pin diagram. Left input pins will regulate the rotation of motor connected across left side and right input for motor on the right hand side. The motors are rotated on the basis of the inputs

provided across the input pins as LOGIC 0 or LOGIC 1. In simple you need to provide Logic 0 or 1 across the input pins for rotating the motor.

L293D is a bipolar motor driver IC. This is a high voltage, high current push pull four channel driver compatible to TTL logic levels and drive inductive loads. It has 600 mA output current capabilities per channel and internal clamp diodes. The L293 provide bidirectional drive currents of up to 1A at voltages from 4.5 V to 36 V.

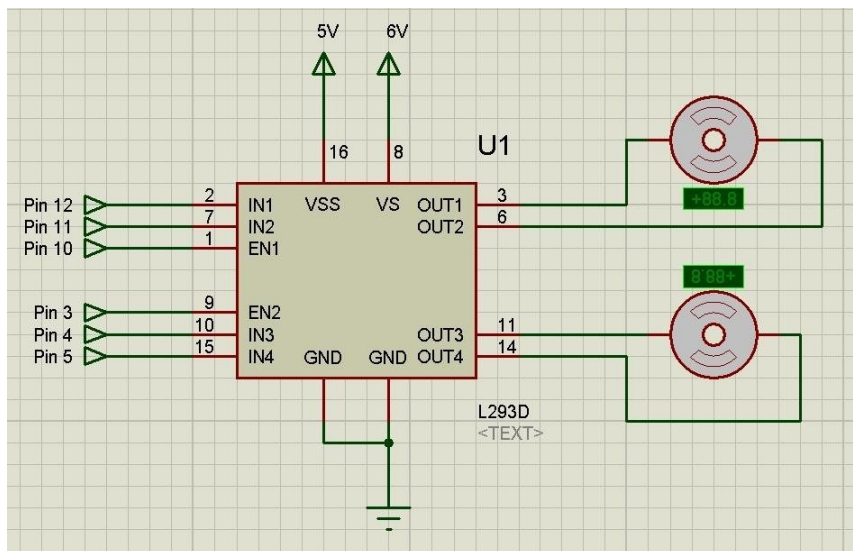


Fig 3.7: Circuit Diagram of connection between driver and motor.

All inputs are getting from microcontroller. When an enable input is high, the associated drivers are enabled, and their outputs are active and associate motor will start rotating. When the enable input is low, those drivers are disabled, and their outputs are off and in the high-impedance state. With the proper data inputs, each pair of drivers forms a full-H (or bridge) reversible drive suitable for motor applications.

Enable	In 1	In 2	Motor status
1	1	0	Reverse Rotation
1	0	0	Stopped
1	0	1	Reverse Rotation

Table 3.6.2: Operation of Motor Driver

## 2.5 Bluetooth Module

A number of signal detecting devices are available in the market. These devices include:

- Ethernet Module
- Wifi Module
- Bluetooth Module

All of the devices have their own advantages and disadvantages but we will be targeting that particular device which best suits our requirement. There are certain features that should be considered when choosing the Bluetooth module for use. The features are

- Wireless transceiver
- Function description
  - Can work at the low voltage (3.1V~4.2V).
  - The current in communication is 8mA.
  - This module can be used in the SMD.
  - It's made through RoHS process.
  - The board PIN is half hole size.
  - Has a 2.4GHz digital wireless transceiver.
  - Small (27mm×13mm×2mm)
  - Peripherals circuit is simple.
  - It's at the Bluetooth class 2 power level.
- Low power consumption
- Has high-performance wireless transceiver system
- Low Cost

This Bluetooth module can easily achieve serial wireless data transmission. Its operating frequency is among the 2.4GHz frequency band. In Bluetooth 2.0, signal transmit time of different devices stands at a 0.5 seconds interval so that the workload of bluetooth chip can be reduced substantially and more sleeping time can be saved for bluetooth. This module is set with serial interface, which is easy to use and simplifies the overall design.

It need to download a bluetooth debugging assistant from play store for mobile phone to connect phone with the Bluetooth HC-06 module, after download and install the package on mobile it needs to enable Bluetooth and open app by click connect it appear hc-06 and

click. A window will pop up asking for a PIN, the password is: 1234, click ok to connect by thus the mobile is able to send data to controller.



Fig 2.5: HC-06 Bluetooth Module

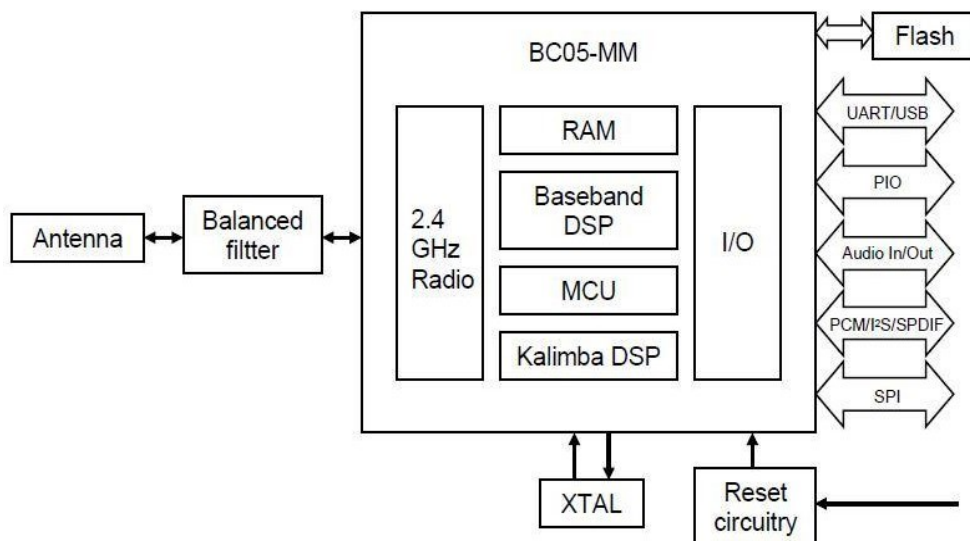


Fig 2.6: Schematic Diagram of Bluetooth Module

## 2.6 Electric motors

Another part that we will be approach is the use of motor. Firstly, we should know the definition of an electric motor. An electric motor is a device that converts electrical energy to



mechanical energy. For the reverse task, the device converts mechanical energy to electrical energy. This is not related to electric motor but this function always known as generator or dynamo. Frequently, an electric motor will apply the electromagnetism concept. The fundamental principle upon which electromagnetic motors are based is that there is a mechanical force on any current-carrying wire contained within a magnetic field. The force is described by the Lorentz force law and is perpendicular to both the wire and the magnetic field. The motor will have two types. First is rotary motor and second one is linear motor.

However, most of magnetic motor, it will rotate. In a rotary motor, the rotary part is called as rotor and the stationary part is called as stator. When the rotor rotate, the torque will be developed based on the rotor's axis. The motor contains electromagnets that are wound on a frame. This frame is often called as armature. Correctly, the armature is that part of the motor across which the input voltage is supplied. Depending upon the design of the machine, either the rotor or the stator can serve as the armature.

### **2.6.1 DC motor**

A DC motor is a mechanically commutated electric motor powered from direct current (DC). The stator is stationary in space by definition and therefore the current in the rotor is switched by the commutator to also be stationary in space. This is how the relative angle between the stator and rotor magnetic flux is maintained near 90 degrees, which generates the maximum torque.

DC motors have a rotating armature winding (winding in which a voltage is induced) but non-rotating armature magnetic field and a static field winding (winding that produce the main magnetic flux) or permanent magnet. Different connections of the field and armature winding provide different inherent speed/torque regulation characteristics. The speed of a DC motor can be controlled by changing the voltage applied to the armature or by changing the field current. The introduction of variable resistance in the armature circuit or field circuit allowed speed control. Modern DC motors are often controlled by power electronics systems called DC drives.

The introduction of DC motors to run machinery eliminated the need for local steam or internal combustion engines, and line shaft drive systems. DC motors can operate directly from rechargeable batteries, providing the motive power for the first electric vehicles. Today DC motors are still found in applications as small as toys and disk drives, or in large sizes to operate steel rolling mills and paper machines.

Operation of a DC motor can be shortly explain below,

When the coil is powered, a magnetic field is generated around the armature. First, the left side of the armature is pushed away from the left magnet and drawn toward the right, causing rotation. Second, the armature continues to rotate.

### 2.6.2 DC Gear motor

Geared DC motors can be defined as an extension of DC motor which already had its Insight. A geared DC Motor has a gear assembly attached to the motor. The speed of motor is counted in terms of rotations of the shaft per minute and is termed as RPM .The gear assembly helps in increasing the torque and reducing the speed.

In a geared DC motor, the gear connecting the motor and the gear head is quite small, hence it transfers more speed to the larger teeth part of the gear head and makes it rotate. The larger part of the gear further turns the smaller duplex part. The small duplex part receives the torque but not the speed from its predecessor which it transfers to larger part of other gear and so on. The third gear's duplex part has more teeth than others and hence it transfers more torque to the gear that is connected to the shaft.

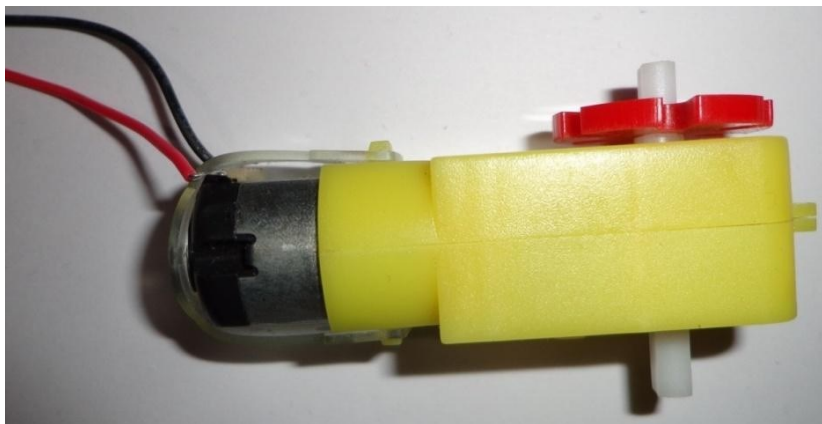


Fig 2.7: DC Gear motor

Mobile robot have been developed and applied by many company and other university. Otherwise, the past projects also make their project as their research and development. This chapter is likely to approach about the technical and engineering development of mobile robot. Therefore, the study of many issues about past project is important. To develop this project, the knowledge about the processor and controller are needed which they will be useful for future. This project will use ATMEGA328p microcontroller as the processor.

Besides that, the implementation should consider the concept of the project. Past project always give new idea whether it can be used as improvement or new development for future project.

## 2.7 Wheel

Wheel is the main parts to move a Robot. Here we use plastic wheel covered with rubber tire measuring 1.65" (42 mm) in diameter and is fit the output shafts on our gear motors. These gear motors should be mounted onto the side of the hub with the protruding teeth. The output shaft will slide into the socket easily at first but will achieve a snug fit when pressed through to the other edge of the hub.



Fig 2.9: Wheel of Robot

### Specifications of wheel:

Diameter: 1.65" (42 mm)

Width of tire: 0.75" (19 mm)

Weight: 0.66 oz. (19 g)

## 2.8 Rechargeable battery

Rechargeable lithium ion batteries commonly found in home appliances, high-end toys, laptops and similar devices that require light and powerful source of electricity. They are even often used in electric and hybrid cars. The 3.7 volts is just the nominal voltage for the lithium battery; chargers for them charge up to 4.2 volts. Here we used rechargeable battery is an electrical device that provides instant power to the microcontroller (For continuous connected to the internet application system) and DC motor.



Fig 2.11: Rechargeable battery

## 2.9 Buck Converter Module

A buck converter (step-down converter) is a DC-to-DC power converter, which steps down voltage from its input to its output. The basic operation of the buck converter has the current in an inductor controlled by two switches. In the idealised converter, all the components are considered to be perfect. Specifically, the switch and the diode have zero voltage drop when on and zero current flow when off, and the inductor has zero series resistance. Further, it is assumed that the input and output voltages do not change over the course of a cycle

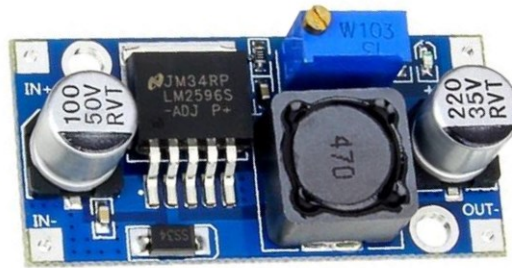


Fig 2. 12: DC-DC Buck Converter

## 2.10 Diode

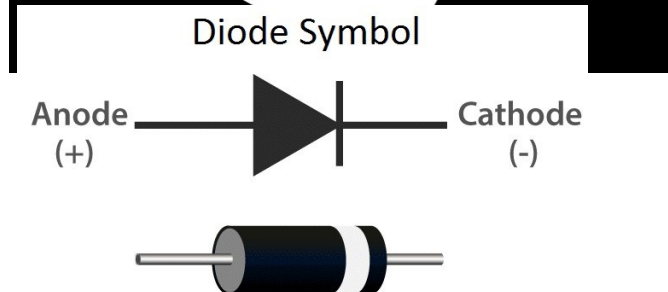


Fig 2.16: Diode.

A diode is a specialized electronic component with two electrodes called the anode and the cathode. Most diodes are made with semiconductor materials such as silicon, germanium, or

selenium. Some diodes are comprised of metal electrodes in a chamber evacuated or filled with a pure elemental gas at low pressure. Here we used converted AC into DC using a bridge-wave rectifier that consists of four diodes

# CHAPTER III

## DESIGN & FABRICATION

### 3.1 Introduction

The implementation of the project is done after simulating the schematic circuit properly. In this chapter, the function of every section in the circuit is investigated with coding and also with physical outlook. To give a proper and clear concept about the operation the entire system is separated into different parts. In this chapter also discusses the working process of the circuits used in various parts with following chart, block diagram and corresponding designed diagram.

### 3.2 Block and Circuit Diagram

This project is basically based on both the arduino uno and Bluetooth module. In this project we control our microcontroller by input of bluetooth. Boat contains two motor for movement and two motor for waste collection.

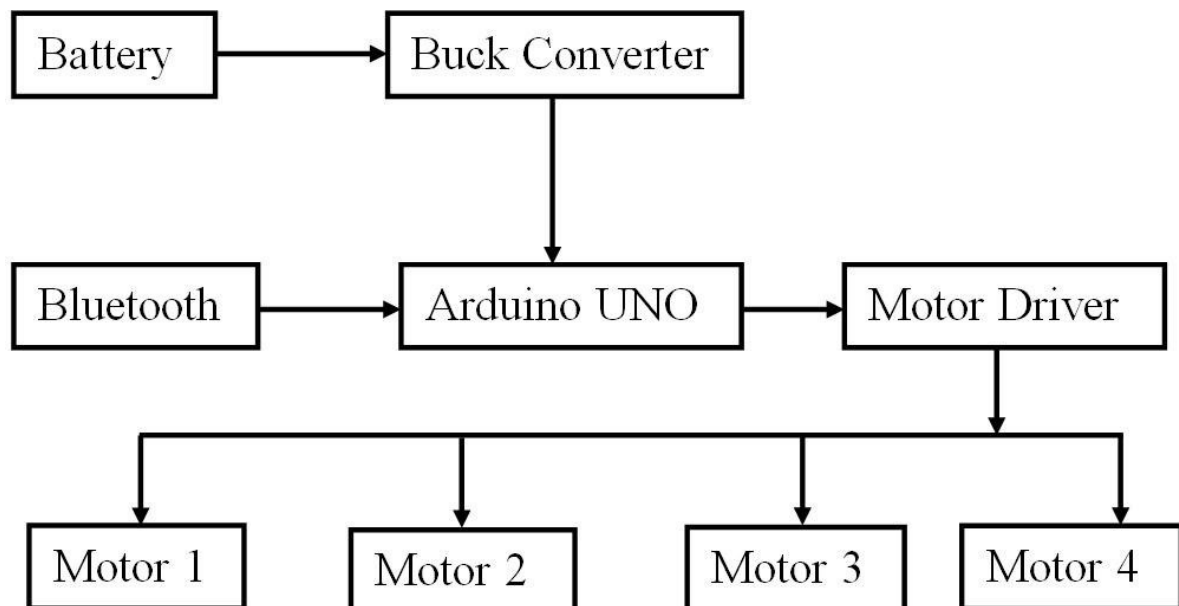


Fig 3.1: Block diagram of project

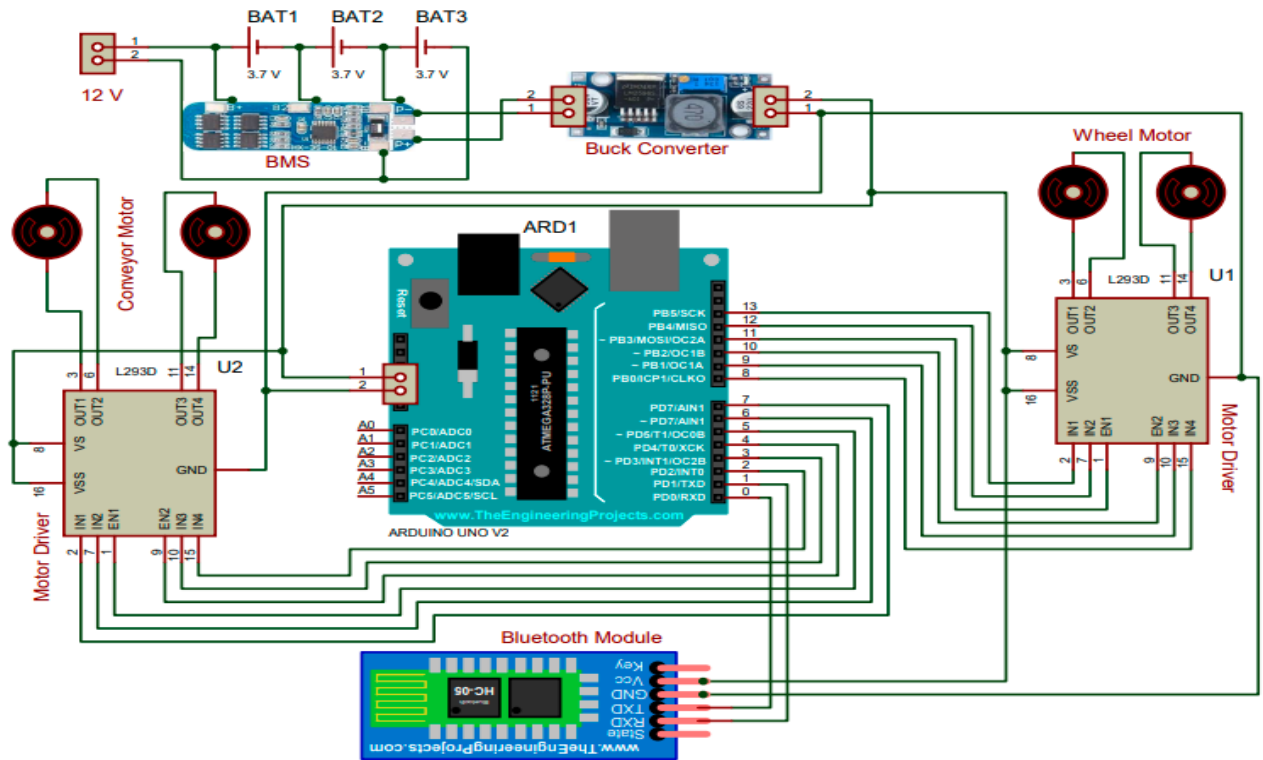


Fig 3.2: Circuit diagram of our project

### 3.3 Hardware Design

The project will help people who want to do something or make something with the help of Arduino. The project is designed in two parts, these are the software part and another one is the hardware designing. In this project we have used some basic components like IR (Inferred Ray) sensor as a density detector, LED and Microcontroller.

As a microcontroller we have used Arduino Nano Board here, which is perfect for building a new project or doing anything in the field of robotics or something that is smart to use. To use an Arduino we have to use the Arduino Software which free for all users and can be downloaded from <http://www.arduino.cc>. The Arduino program is based on C/C++ Programming language. And a huge collection of example is provided in their websites which are also free for all. And the software is one of the easiest software to use.

The hardware design of this project is very simple and efficient also. First of all we have designed the IR sensor. The IR sensor generally works as counter. And counter passes a signal after a significant number of gesture or movement is detected. Then we have designed

the whole circuit in the breadboard by the aid of microcontroller. Arduino Nano plank is the perfect choice to make the project more efficient and easy also.

In this control system we have used some basic components to design this circuit. These components are found easily at any electronics shops or markets. For counting we have made a light sensor with some basic components. The output of this circuit is connected to the Yellow, Green and Red lights of Traffic Signal.

The system was designed to be simple and the experimental setup included the prototype model of traffic lights showing lights from the four sides of a junction. The model included traffic lights each on the four sides; depicting red, yellow and green colors. These are designed using colored bulbs of red, yellow and green color. The input signal was given through four different switches to control the timings of four directions.

### **3.4 Working with Arduino Software**

First download and install the Arduino IDE for Mac, Linux or Windows to [arduino.cc](http://arduino.cc). Windows users also necessity to install a driver. Gather your plank via USB, start the Arduino application and elect Arduino Uno to the tools to plank menu. Bare the design table. Bare Examples: 01. Basics: Blink. Click the toolbar button to upload it to your plank.

#### **The Integrated Development Environment (IDE):**

Microcontroller needs software for programming. The Arduino plank has its own integrated development environment (IDE). It is gratis and anybody can download it from its official. That gives Arduino Plank to reach much users and it also helps it to get.

#### **IDE Parts:**

- a) Compile: Before program “code” can be sent to the board, it needs to be converted into instructions that the board understands. This process is called Compiling.
- b) Stop: This stops the compilation process.
- c) Create new Sketch: This opens a new window to create news ketch.
- d) Open Existing Sketch: This loads a sketch from a file on our computer.
- e) Save Sketch: This saves the changes to the sketch.
- f) Upload to Board: This compiles and then transmits over the USB cable to our board.



- g) Serial Monitor: Until this point when our programs (sketches) didn't work, we just pulled out our hair and tried harder.
- h) Tab Button: This lets you create multiple files in your sketch. This is for more advanced programming than we will do in this class.
- i) Sketch Editor: This is where write or edit sketches
- j) Text Console: This shows you what the IDE is currently doing and is also where error messages display if make a mistake in typing program.
- k) Line Number: This shows what line number your cursor is on.

The smart microcontroller unit named as Arduino nano can be programmed with the Arduino software. There is no any requirement for installing other software rather than Arduino. Firstly, Select "Arduino Uno from the Tools , Board menu (according to the microcontroller on your board).The IC used named as ATmega328 on the Arduino Uno comes pre burned with a boot loader that allows you to upload new code to it without the use of an external hardware programmer.

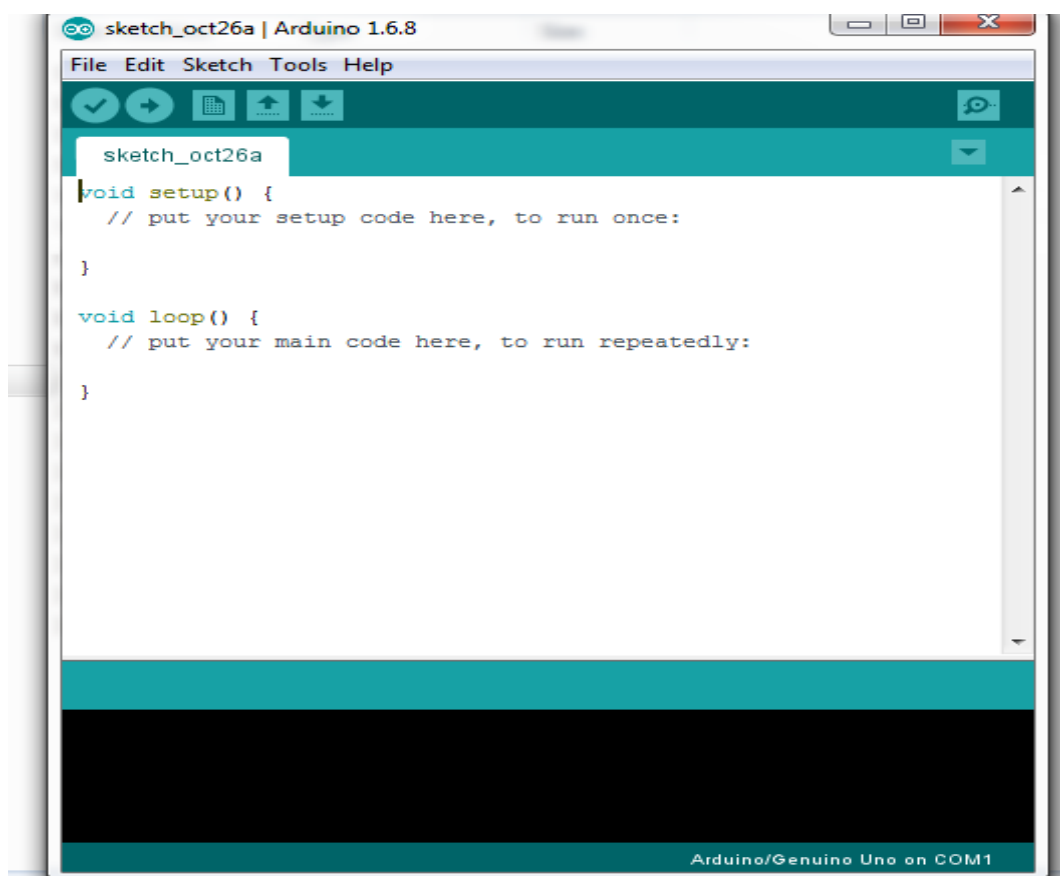


Fig 3.4: Programming platform for ARDUINO

Programming software of this line follower is known as ARDUINO-1.6.8. This is open source programming platform. The open-source ARDUINO environment makes it easy to write code and upload it to the input/output board. Here we use ARDUINO-1.6.8 platform.

To configure software, we have to use ARDUINO -1.6.8 named arduino.exe

To configure this programmer with computer we need a USB cable then check serial port and select the programmer from Arduino-1.6.8 platform such as,

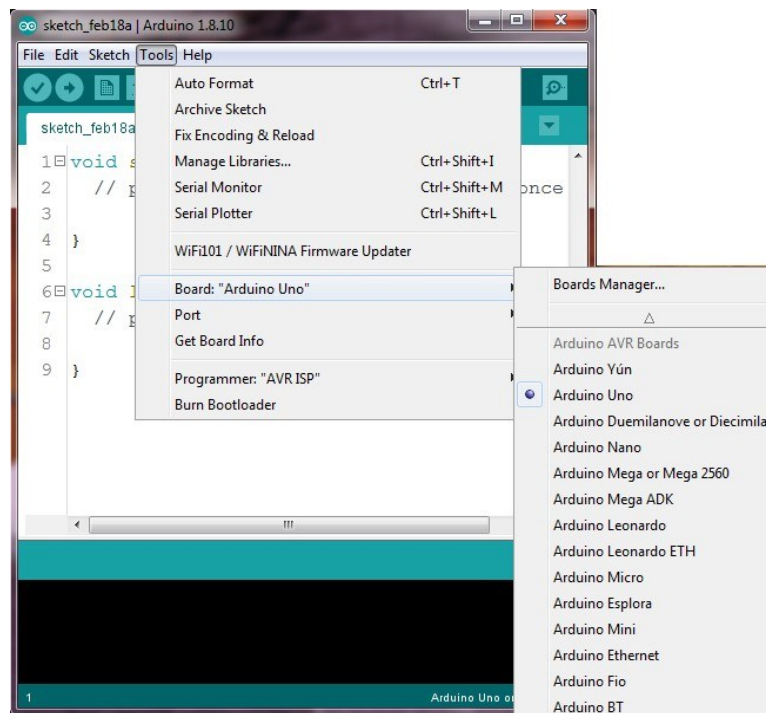


Figure 3.5: IDE configuration for ARDUINO UNO Programmer

## Serial communication

It is used for the communication between Arduino and a computer or other devices. Every Arduino board has at least one serial port. This ports communicates thanks to the digital pins 0 (RX) and 1 (TX), and with the computer thanks to the USB connection.

*Serial.begin(speed)*

It establishes the speed of data in bits per second (bauds) for the transmission of data in serial communication.

*Serial.read()*

It reads the data from the serial port.

*Serial.print(val,[format])* It prints the data to the serial port as ASCII text

*Serial.println(val,[format])*

It prints the data to the serial port as ASCII text but it jumps to a new line. *Serial.available()* It gives back the number of available bytes to be read by the serial port. It refers to data that has already been received and is available in the buffer of the port.

### 3.5 Project picture

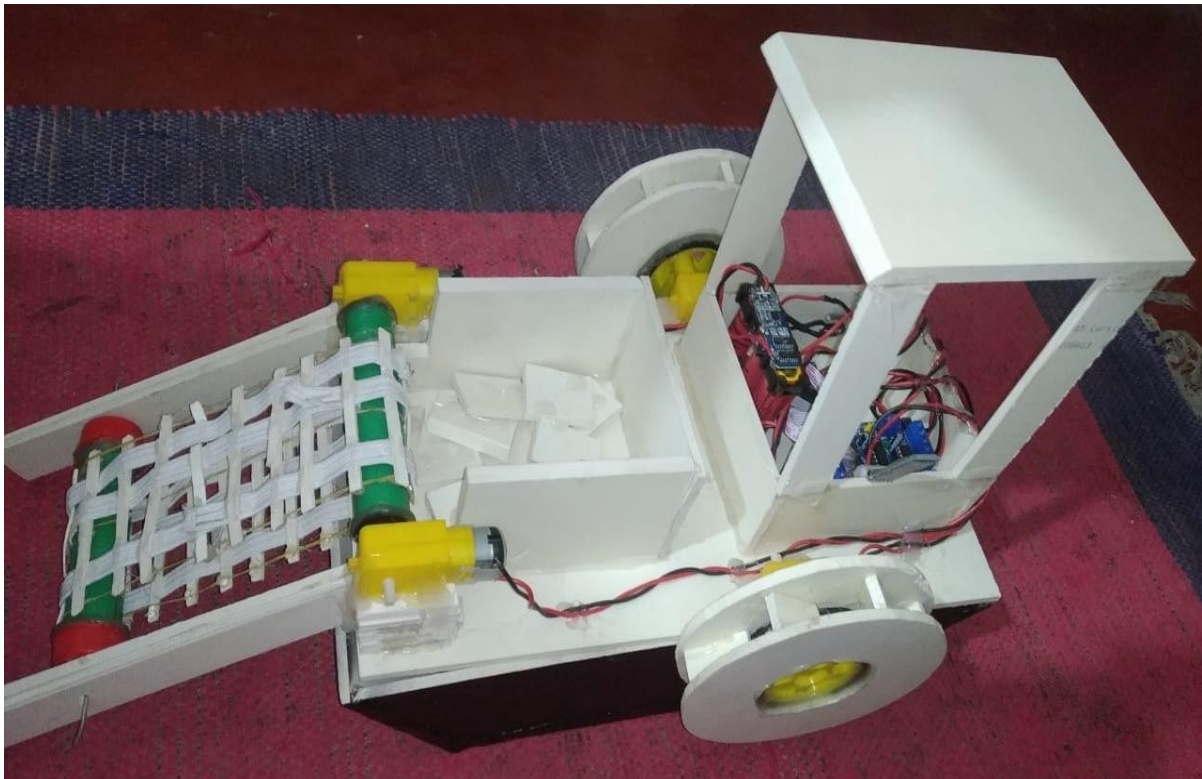


Fig 3.6: Project picture

### 3.6 Summary

This chapter mainly focused on implementation and the design of the system with a block diagram. In this chapter simulation is divided into some parts and operation of each part is discussed briefly. The output of our project shown in that chapter. We also discussed about the research and methodology of our whole project.

# CHAPTER IV

## RESULT & DISCUSSION

### 4.1 Introduction

In this chapter, we will discuss the outputs and the advantages of our project. There is a variation of coding and variation of using the software in this project. We will also discuss the time delay and efficiency and limitations of this project.

### 4.2 Results

The boat system works well with the movements and speed corresponding to the collecting process of floating solids. However, the radio connection is not stable that will result in connection loss for a few times during the testing. For the conveyor system, it was found that that the rotational power is capable to hold a maximum capacity of 200gm per rotation. It is limited due to the strength of wire mesh attached to the conveyor belt. Nevertheless, the speed controller and the relay of the conveyor system is working efficiently.

### 4.3 Advantage

- It is a non-conventional river cleaning system.
- It's initial & maintenance cost is low.
- Skill Worker not required driving the system.
- Environment friendly system.
- Easy in operation.

### 4.4 Application

- It is applicable to reduce water pollution in rivers & ponds.
- It is useful to remove the sediments present in swimming pool to keep it clean.

## 4.5 Costing

Table 4.1: Price list of hardware used at Project

Name	Quantity	Unit Price	Total Price
Arduinoo Uno	1	700	700
Buck converter	1	120	120
DC Motor	4	80	320
Wheel	2	50	100
Motor Driver	1	150	150
Battery	3	80	240
BMS Circuit	1	150	150
Switch	1	20	20
Cable	1	50	50
Glue	5	25	125
PVC Board	1	1000	1000
Others	1	200	200
		<b>TOTAL COST</b>	<b>3,175/- Taka</b>

## 4.6 Discussion

This project design and analysis of river water cleaning machine is fabricated on the basis of literature and research on different journal and paper relevantly available and fabricated in accordance so it can provide flexibility in operation. This innovation is easy and less costly and has lot of room to grow more economical. This project “River water Cleaning Machine” is designed with the hope that it is very much economical and helpful to river and Pond

cleaning. On the basis of its design and estimating cost and availability it is very cheap and very useful for the society

# CHAPTER V

## CONCLUSION AND FUTURE WORKS

### 5.1 Conclusion

Population explosion, increasing industrialization, and rapid urbanization have to lead the world's environment into complete chaos. Due to the increased level of waste generation, gradually, it's getting difficult to survive in the densely populated urban area. Traditional waste management systems are a complete failure to handle such a large amount of garbage. The application of technology and its sophisticated service in every sector have made our life quite easy. It is high time to apply a technology-based approach to handle this increasing level of waste. A lot of research is going on regarding the proper waste management system. This study has successfully developed a prototype of a trash collector boat. The collector boat is small in size compared to available trash collector boat in the market and suitable for small and narrow space cleaning purpose. The trash collector boat was equipped with a rotating conveyor system and monitoring system that can be remotely controlled from afar. Performance test that has been done showed that the collector boat efficiently collected up to 1 kg of floating solid in a single operation. This indicates the good performance of trash collector boat in cleaning water surface. The use of this trash collector boat can reduce the water pollution in small streams and drain clogging problem in an environmental-friendly and user-friendly manner.

### 5.2 Future works

- The machine can be designed for deep cleaning.
- Solar panel can be used for providing power to the machine.
- Capacity of the machine can be increased for cleaning big rivers and lakes.

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## APPENDIX A

### PROGRAM CODE

```
#include <AFMotor.h>
int Rx=0;

AF_DCMotor motor1(1, MOTOR12_64KHZ);
AF_DCMotor motor2(2, MOTOR12_64KHZ);
AF_DCMotor motor3(3, MOTOR34_64KHZ);
AF_DCMotor motor4(4, MOTOR34_64KHZ);
#define MAX_SPEED 255 // sets speed of DC motors
#define MAX_SPEED_OFFSET 20

boolean goesForward=false;

int speedSet = 255;

void setup() {
  motor1.setSpeed(185);
  motor2.setSpeed(185);
  motor3.setSpeed(195);
  motor4.setSpeed(195);
  Serial.begin(9600);
}

void loop() {

  if(Serial.available() > 0)
    Rx = Serial.read();

  if (Rx == '1') { boatForward();}
  if (Rx == '2') { boatBackward();}
  if (Rx == '3') { boatRight();}
  if (Rx == '4') { boatLeft();}

  if (Rx == '5') { roalForward();}
  if (Rx == '6') { roalBackward();}
  if (Rx == '7') { roalStop();}
  if (Rx == '0') { boatStop();}

}

void roalStop() {
```

```
motor3.run(RELEASE);
motor4.run(RELEASE);
}

void roalForward() {
  motor3.run(FORWARD);
  motor4.run(FORWARD);
}

void roalBackward() {
  motor3.run(BACKWARD);
  motor4.run(BACKWARD);
}

void boatStop() {
  motor1.run(RELEASE);
  motor2.run(RELEASE);
  motor3.run(RELEASE);
  motor4.run(RELEASE);
}

void boatForward() {
  motor1.run(FORWARD);
  motor2.run(FORWARD);
}

void boatBackward() {
  motor1.run(BACKWARD);
  motor2.run(BACKWARD);
}

void boatRight() {
  motor1.run(FORWARD);
  motor2.run(BACKWARD);
}

void boatLeft() {
  motor1.run(BACKWARD);
  motor2.run(FORWARD);
}
```