Design & Construction of Automatic Drainage Cleaning System

Submitted by

Md. Azim Shordar	ID: BME 1901017422
Faysal Ahmmed	ID: BME 1901017328
Md. Sohag Hossain	ID: BME1901017423
Md. Shohel Rana	ID: BME 1901017515
Tahmina	ID: BME 1803016151

SUBMITTED TO THE:

Md. Ahatashamul Haque Khan Shuvo

Lecturer and Course Coordinator

Department of Mechanical Engineering

SONARGAON UNIVERSITY (SU)

In partial fulfillment of the requirement for award of the degree

Of

Bachelor of Science in Mechanical Engineering

September, 2022

i

LETTER OF TRANSMITTAL

September, 2022

To

Md. Ahatashamul Haque Khan Shuvo

 Lecturer and Course Coordinator

Department of Mechanical Engineering.

Sonargaon University

Subject: Submission of Project Report**.**

Dear Sir,

We are pleased to submit the project report on "Design & Construction of Automatic Drain Cleaner System**".** It was a great pleasure to work on such an important topic. This project has been done as per instruction of your supervision and according to the requirements of the Sonargaon University.

We expect that the project will be accepted by the concerned authority we will remain happy to further explanation that you may feel necessary in this regard.

Thank You

Sincerely yours,

Md. Azim Shordar   Faysal Ahmmed

ID:BME 1901017422   ID: **:** BME 1901017328

Md. Sohag Hossain   Md. Shohel Rana

ID: BME1901017423   ID: BME 1901017515

Tahmina

ID: BME 1803016151

DECLARATION

We do hereby solemnly declare that, the work presented here in this project report has been carried out by us and has not been previously submitted to any University/ Organization for award of any degree or certificate

We hereby ensure that the works that has been prevented here does not breach any existing copyright.

We further undertake to indemnify the university against any loss or damage arising from breach of the foregoing obligation.

Md. Azim Shordar   Faysal Ahmmed
ID:BME 1901017422   ID: **:** BME 1901017328

Md. Sohag Hossain   Md. Shohel Rana
ID: BME1901017423   ID: BME 1901017515

Tahmina
ID: BME 1803016151

ACKNOWLEDGEMENT

ABSTARCT

In this project the proposed concept is to replace the manual work in drainage cleaning by automated system controlled by micro-controller. Now-a-days even though automation plays a vital role in all industrial applications in the proper disposal of sewage from industries and commercials are still a challenging task. Drainage pipes are using for the disposal and unfortunately sometimes there may be loss of human life while cleaning the blockages in the drainage pipes. To overcome this problem and to save human life we implement a design and construction of Automatic Drain Cleaner System. We designed our project to use this in efficient way to control the disposal of wastages and with regular filtration of wastages, clearance of gaseous substance are treated separately and monitor the disposal in frequent manner.

TABLE OF CONTENTS

LIST OF FIGURES

CHAPTER 1
INTRODUCTION

1.1 Introduction

The proper disposal of common wastes is still a challenge faced nowadays, even though automation plays a vital role in the industrial and commercial applications. Usually what we see in a country like India is that common wastes like plastic bottles, covers, sanitary pads, etc and others are left in the streets and in the open drains. These waste particles obviously cause blockage of the drainage system during monsoon season when there is a flow of water through the roads and drainage systems. Also where the closed drainage system open near a river causes the pollution of river. This blockage of drainage system can cause accumulation of waste water in these drains.

Several water borne diseases such as cholera, worm disease, typhoid, malaria etc will occur due to the contamination of these stagnant water. This can cause many health issues and may even lead to deaths, other than the local common issues caused by the blockage of drainage. In India, there is no existing automated mechanism by which this blockage of drainage can be removed. Currently these blocked drains are cleared with the help of manual workers were the workers have to get into the drains and manually remove the wastes. In such situations the rate of diseases spread among these workers are high and this affects their life's and reduces their immunity.

Since the world is fast approaching towards the technology of digitalization and automation, humans want every task and operations to be performed quickly and easily. Now the time is for advanced techniques which can perform tasks efficiently and with minimum time. The human wants to apply minimum effort in order to accomplish its tasks. To achieve this there has to be automated techniques which can fulfill these objectives. Hence in this project we tried to add this automation technology with the knowledge of drainage systems in order to make the drainage cleaning system easy and efficient tool for the cleaning of the drainage systems and hence save the environment. For this we are using system by which drainage cleaner can do his work smartly using communication through application.

The problem of the sewage disposal coming from the industries is growing rapidly day by day and thus it needs to be resolved urgently since this problem is causing various

environmental issues and is very harmful to the human life. This is a real time problem and it needs to resolved and overall speaking this proposed concept is very much efficient in this work to be accomplished. Also, there is one more important advantage of this drainage cleaning system is that the health of the workers working in drainage scavenging can be improved and maintained since they have to no longer be in drainage for its scavenging process. One more very useful and important advantage of our system is that this system can replace the manual work done in sewage scavenging by a semi-automatic scavenging system and the worker can access this system very easily and efficiently.

1.2 Background Study

Automatic Drainage Water cleaning and Control System Using auto mechanism proposed to overcome the real time problems. With the continued expansion of industries, the problem of sewage water must be urgently resolved due to the increasing sewage problems from industries of the surrounding environment. The waste and gases produced from the industries are very harmful to human beings and to the environment. the proposed system is to cleaning and control the drainage level using auto mechanism technique. auto mechanism is the major controlling unit and the drainage level is monitor by municipal . In this system we used motor, chain, driver, bucket, frame. Before examine the function of a drive, we must understand the basic operation of the motor. It is used to convert the electrical energy, supplied by the controller, to mechanical energy to move the load. There are really two types of motors, AC and DC. The basic principles are alike for both. Magnetism is the basis for all electric motor operation. It produces the force required to run the motor.

1.3 Problem Statement

In today's era automation plays a very important role in all industrial applications for the proper disposal of sewage from industries and household is still a challenging task. Drain pipes are used for the adequate disposal of waste and unfortunately sometimes there may be a threat to human life during the cleaning of blockage in the drain pipes or it can cause serious health issues because of the pertaining problems like malaria, dengue, etc.

In order to overcome this problem as well as to save human life we implement a design "Automatic Drainage Cleaning System". We designed our project in order to use it in an

efficient way to control the disposal of waste along with regular filtration of drains, removal of solid waste in order to avoid blockage in drains to promote continuous flow of drainage water which ultimately reduces the threat to human life.

1.4 Objective

We have some specific objectives for this project and they are pointed below:

- To design & construction of Automatic Drain Cleaner system.
- To implementation of micro-controller based Automatic Drain Cleaner system.
- To take some output for future modification in our work.
- To study the system performance for future reference and improvement purposes.

1.5 Structure of the Project

This Project is organized as follows:

Chapter 1 Introduction**:** The first chapter contains the statement of the introduction, our background study for the project, problem statement, objectives of the study and the project outline.

Chapter 2 Literature Review**:** The chapter two contains our introduction, literature review part.

Chapter 3 Hardware and Software Analysis**:**Chapter three describes the theoretical model. Here we mainly discuss about proposed system Hardware and software development of our project etc.

Chapter 4 Methodology**:** Chapter three describes the theoretical model. Here we mainly discuss about proposed system architecture in details with having block diagram, circuit diagram, structural diagram, project working principle, complete project image etc.

Chapter 5 Result and Discussion**:** Chapter four deals with the result and discussion and discuss about our project advantages and application.

Chapter 6 Conclusion**:** Chapter five all about our project conclusion and future scope.

CHAPTER 2
LITERATURE REVIEW

2.1 Literature Review

Ganesh U L, et.al. [1] Showed the usage of mechanical drainage cleaner to replace the manual work required for drainage cleaning system. Drainage pipes are very dirty. Sometimes it is harmful for human life while it is need for cleaning drainage system. To overcome this problem, they implemented a mechanical semi-automatic drainage water cleaner and so the water flow is efficient because of regular filtration of wastages with the help of that project. Different kinds of environment hazards reduced with the help of Drainage system machine.

Elangovan K., et.al. [2] Reviewed about drainage cleaning to replace manual work to automated system because manually cleaning system it is harmful for human life and cleaning time, is more so to overcome this problem they implemented a design "Automatic drainage water pump monitoring and control system using PLC and SCADA". PLC and SCADA were designed. In this project to use efficient way to control the disposal of wastage regularly, treatment of disposal in different way toxic and non-toxic gases. PLC controller from Siemens was used in the treatment system of drainage wastewater control by the stepper motor, compressor, gas exhauster, pressure valve and the liquid level, flow and other analog variables to achieve automatic control of sewage waste water treatment.

Dr.K.KUMARESAN [3] explained manual work converted to automated system. Drainage pipe using for disposal and it may be loss for human life while cleaning the blockage in the drainage pipes. To overcome this problem they implemented "Automatic Sewage Cleaning System". They designed their project different way clearance of gaseous substance are treated separately so the flow of water efficiently. This project may be developed with the full utilization of men , machines, and materials and money. They made their project economical and efficient with the available resources. They used automation technology concerned with his application of mechanical, electronics, and computer based systems to operate and control production.

Sathiyakala, et.al. [4] explained E bucket (electronic bucket) use for drainage cleaning system because E-bucket lifted a sewage and used evaporation treatment for this sewage wet sewage was converted into dry matters, with the of ARM board (ARDUINO) this process was performed. After this process they were add this waste a government bank without any kind of affection of the bacteria.

S D Rahul Bharadwaj, et.al. [5] Proposed with the automatic cleaning of waste water in order to prevent global warming and melting of glaciers. The results emphasize the need of waste water treatment plants, through which the water is treated before suspending in rivers. Firstly power is generated and that power is used for waste water cleaning process.

NitinSall, et.al. [6] Explained flow of used water from homes, business industries, and commercial activities is called waste water. 200 and 500 liters wastage water are generated each person every day. So using waste water technology that removes, rather than destroys, a pollutant in a drainage system.

Mr. Nikhil S. Pisal1, et.al. [7] Proposed safe load for the chain and the ability of the same to withstand the use of Finite Element Modeling would be the core objective of the work. An existing chain link was used for benchmarking the research work. Finite Element Analysis tools like Hyper Mesh and ANSYS were suitable to find the performance of the link under tensile loads. The design for the chain would be subjected to F.E Analysis to find the effect of loads (tension) on the link. The proposed method utilizes software in the FEA domain for analyzing the effects of the variation in the values of the design parameters influencing the performance criterion. The FEM method is used to analyze the stress state of an elastic body with a given geometry, such as chain link.

NDUBUISI C. Daniels, et.al. [8] Showed the Drainage system cleaner machine used to remove garbage and sewage automatically which helped to protect the environment from different kinds of environmental hazards. The drainage system cleaner has three major parts which are the Propeller, the Cleaner and the Pan all makes up for its effective functioning.

Shao-Wu-Zhang, et.al. [9] Introduced three drainage devices about the ceramic filter dewatering system, improved the design according to the short coming of drainage device and working mechanism of automatic drainage device. This device have stable performance, low cost and low failure rate. They compared the working processes of three drainage devices, and analyzed its future development. Their aim was the shortcomings of the three types of drainage devices and their application situations, the automatic drainage device was improved.

Prof S.D.Anap, et.al. [10], showed blockage is the major cause of the pollution and flooding in the metro cities. They have designed the drainage blockage detection system to avoid such problems. The system provides monitoring of drainage condition and to inform authorities of these condition. This design preset an implementation wireless sensor network in the monitoring of drainage system using GSM system. To detecting blockage and monitoring water level condition we use level sensor. They explained about the design of the cost effective, easy method to control the water level of the tank wirelessly and automatically. They used level and IR sensor to monitor and control drainage blockage. They also used solenoid valve for bypass purpose.

James C.Y. Guo, et.al. [11] Showed roadway sanding is a common practice in cold regions because sand increases the roadway friction when mixing with snow. In this study, a snow storage element is introduced to the renascence project of a mountainous highway which is running through an environmental sensitive forest area in Colorado. Recovery of winter sanding material from the highway was designed to be a joint effort of surface runoff and sweeping machines. As a tradeoff exist between sand recovery and size of snow storage area. This study also presented a maximization methodology by which the size of snow storage area can be determined by the diminishing return of sand recovery.

James C. Conwell, G. E. Jhonson [12] proposed the design and construction of a new test machine configuration that offers same advantages over the traditional one. The new machine and attendant instrumentation provide more realistic chain loading and allow link tension and roller sprocket impact monitoring during normal operation. The incorporation of idle sprocket allows independent adjustment of test on length and preload.

Prabhushankar, et.al. [13] Showed dewatering of drainage is generally done using centrifugal pump, but using centrifugal pump is not much effective in complete removal of the suspended and heavy solids and also it consumes lot of electric power for its operation. The main aim of the proposed work was to remove drainage water by the pneumatic operated spring return reciprocating pump. It reduced the man power required for the drainage cleaning activity. Instead of slider crank mechanism the pneumatic and spring system with reciprocating cylinder was used which discharged the large sized drainage particles easily and there was no need of external power supply.

Gregor Burger, et.al. [14] Described the concept and software design of an innovative general purpose platform for network based model development and look at some of crucial computational design issues. They developed the improvement in the design of very fast, easy to use, easy to integrate and extensible general purpose simulator platform. It was running up to 40 times faster than its MATLAB based predecessor and allowing it to be flexibly applied. They included features such as the hot-start mechanism and the extension interfaces have proven to be extremely useful when linking city drain 3 as a sub-model into larger software project.

MsT.Deepiga, et.al. [15] Defined the water monitoring systems such as Tank water pollution monitoring and water pipeline leakage sensing monitoring. They avoided huge amount of water wasted by uncontrolled use of large apartments. They used the PID based water level monitoring to indicate the level of water in the tank.

2.2 Summary

We try to do this project by reading the above literature, and we have been able to make our project successful by reducing the mistakes of last year's project.

CHAPTER 3
HARDWARE AND SOFTWARE ANALYSIS

3.1 Arduino Pro Mini

The Arduino Pro Mini is a micro-controller board based on the ATmega168. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, an on-board resonator, a reset button, and holes for mounting pin headers. A six pin header can be connected to an FTDI cable to provide USB power and communication to the board.
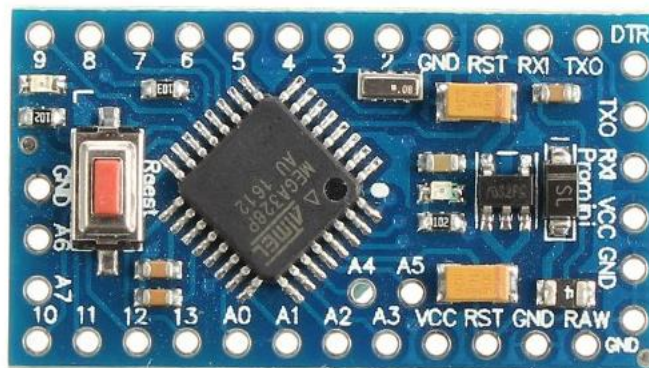
Figure 3.1: Arduino Pro Mini

Specification

- Micro-controller ATmega168

- Operating Voltage: 3.3V or 5V (depending on model)

- Input Voltage: 3.35 -12 V (3.3V model) or 5 - 12 V (5V model)

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

- Analog Input Pins: 6

- DC Current per I/O Pin: 40 mA

- Flash Memory: 16 KB (of which 2 KB used by boot loader)

- SRAM: 1 KB

- EEPROM: 512 bytes

- Clock Speed: 8 MHz (3.3V model) or 16 MHz (5V model)

Pin Out

Each of the 14 digital pins on the Pro Mini can be used as an input or output, using pin Mode(), digital Write(), and digital Read() functions. They operate at 3.3 or 5 volts (depending on the model). Each pin can provide or receive a maximum of 40 mA and has an internal pull-up resistor (disconnected by default) of 20-50 kOhms. 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 TX-0 and RX-1 pins of the six pin header.

- 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 attachInterrupt() function for details.

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

- SPI: 10 (SS), 11 (MOSI), 12 (MISO), 13 (SCK). These pins support SPI communication, which, although provided by the underlying hardware, is not currently included in the Arduino language.

- 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 Pro Mini has 6 analog inputs, each of which provide 10 bits of resolution (i.e. 1024 different values). Four of them are on the headers on the edge of the board; two (inputs 4 and 5) on holes in the interior of the board. The analog inputs measure from ground to VCC. Additionally, some pins have specialized functionality:

- I2C: 4 (SDA) and 5 (SCL). Support I2C (TWI) communication using the Wire library.

There is another pin on the board:

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

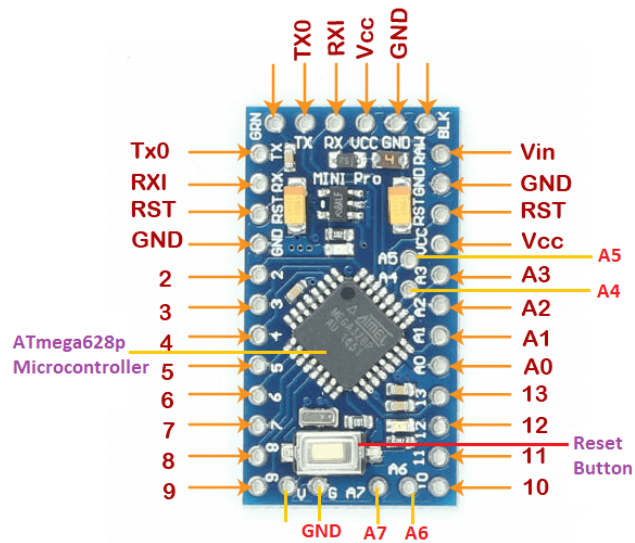See also the mapping between Arduino pins and ATmega168 ports.

Figure 3.2: Arduino Pro Mini Pin Out

Micro controller IC ATmega328p

Figure 3.3: Micro controller IC AT Mega 328p

The high-performance Microchip Pico Power 8-bit AVR RISC-based micro controller 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.

3.2 L293D Motor Driver IC

The L293D is a popular 16-Pin Motor Driver IC. As the name suggests it is mainly used to drive motors. A single L293D IC is capable of running two DC motors at the same time; also the direction of these two motors can be controlled independently.

Figure 3.4: Motor driver ic L293D
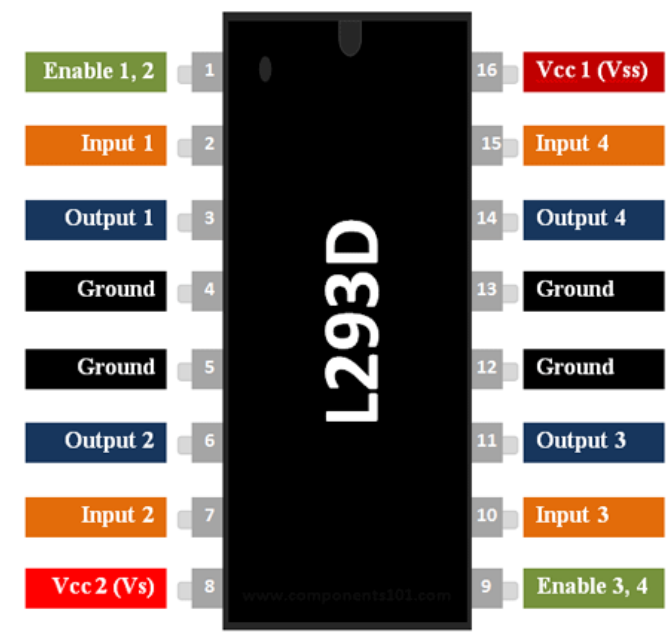
Working Process:

L293D IC is a typical Motor Driver IC which allows the DC motor to drive on any direction. This IC consists of 16-pins which are used to control a set of two DC motors instantaneously in any direction. It means, by using a L293D IC we can control two DC motors.

Features

- Can be used to run Two DC motors with the same IC.
- Speed and Direction control is possible

- Motor voltage Vcc2 (Vs): 4.5V to 36V
- Maximum Peak motor current: 1.2A
- Maximum Continuous Motor Current: 600mA
- Supply Voltage to Vcc1(vss): 4.5V to 7V
- Transition time: 300ns (at 5Vand 24V)
- Automatic Thermal shutdown is available

L293D Pin Configuration

Pin Number	Pin Name	Description
1	Enable 1,2	This pin enables the input pin Input 1(2) and Input 2(7)
2	Input 1	Directly controls the Output 1 pin. Controlled by digital circuits
3	Output 1	Connected to one end of Motor 1
4	Ground	Ground pins are connected to ground of circuit (0V)
5	Ground	Ground pins are connected to ground of circuit (0V)
6	Output 2	Connected to another end of Motor 1
7	Input 2	Directly controls the Output 2 pin. Controlled by digital circuits
8	Vcc2 (Vs)	Connected to Voltage pin for running motors (4.5V to 36V)
9	Enable 3,4	This pin enables the input pin Input 3(10) and Input 4(15)
10	Input 3	Directly controls the Output 3 pin. Controlled by digital circuits
11	Output 3	Connected to one end of Motor 2
12	Ground	Ground pins are connected to ground of circuit (0V)
13	Ground	Ground pins are connected to ground of circuit (0V)
14	Output 4	Connected to another end of Motor 2
15	Input 4	Directly controls the Output 4 pin. Controlled by

		digital circuits
16	Vcc2 (Vss)	Connected to +5V to enable IC function

Use of a L293D Motor Driver IC:

Using this L293D motor driver IC is very simple. The IC works on the principle of HalfH-Bridge, let us not go too deep into what H-Bridge means, but for now just know that H bridge is a set-up which is used to run motors both in clock wise and anti-clockwise direction. As said earlier this IC is capable of running two motors at the any direction at the same time, the circuit to achieve the same is shown below.
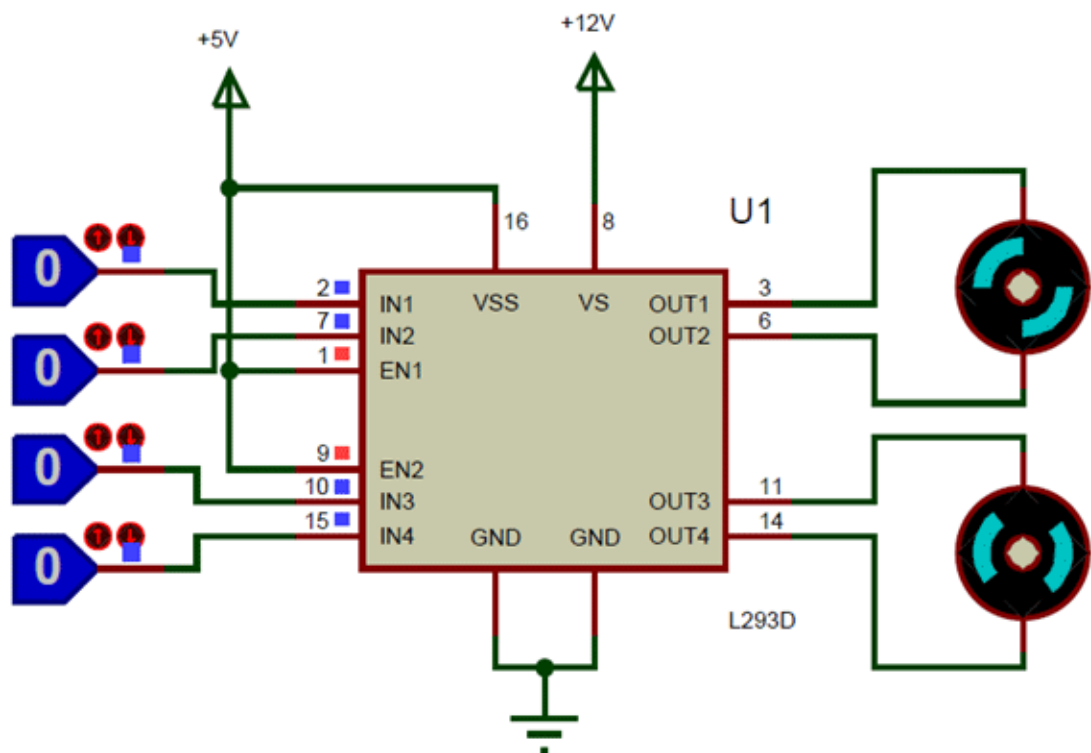

Figure 3.5: L293D circuit Diagram

All the Ground pins should be grounded. There are two power pins for this IC, one is the Vss(Vcc1) which provides the voltage for the IC to work, this must be connected to +5V. The other is Vs(Vcc2) which provides voltage for the motors to run, based on the

specification of your motor you can connect this pin to anywhere between 4.5V to 36V, here I have connected to +12V.

The Enable pins (Enable 1,2 and Enable 3,4) are used to Enable Input pins for Motor 1 and Motor 2 respectively. Since in most cases we will be using both the motors both the pins are held high by default by connecting to +5V supply. The input pins Input 1,2 are used to control the motor 1 and Input pins 3,4 are used to control the Motor 2. The input pins are connected to the any Digital circuit or microcontroller to control the speed and direction of the motor.

Applications

- Used to drive high current Motors using Digital Circuits
- Can be used to drive Stepper motors
- High current LED's can be driven
- Relay Driver module (Latching Relay is possible)

3.3 Relay

A relay is an electrically operated switch. Many relays use an electromagnet to mechanically operate a switch, but other operating principles are also used, such as solid-state relays. Relays are used where it is necessary to control a circuit by a separate low-power signal, or where several circuits must be controlled by one signal. The first relays were used in long distance telegraph circuits as amplifiers: they repeated the signal coming in from one circuit and re-transmitted it on another circuit. Relays were used extensively in telephone exchanges and early computers to perform logical operations.
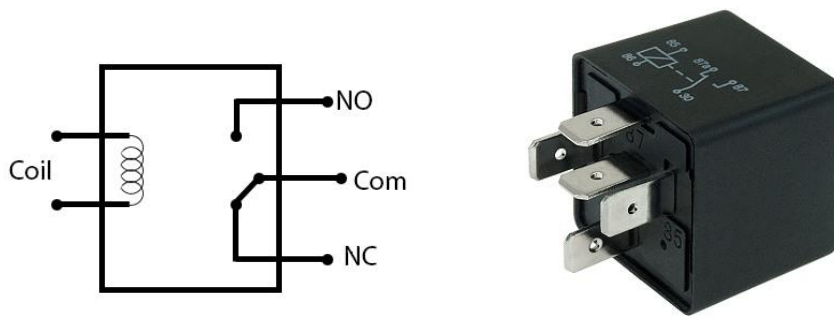
Figure 3.6: Relay

A type of relay that can handle the high power required to directly control an electric motor or other loads is called a contactor. Solid-state relays control power circuits with no moving parts, instead using a semiconductor device to perform switching. Relays with calibrated operating characteristics and sometimes multiple operating coils are used to protect electrical circuits from overload or faults; in modern electric power systems these functions are performed by digital instruments still called "protective relays".

Magnetic latching relays require one pulse of coil power to move their contacts in one direction, and another, redirected pulse to move them back. Repeated pulses from the same input have no effect. Magnetic latching relays are useful in applications where interrupted power should not be able to transition the contacts. Magnetic latching relays can have either single or dual coils. On a single coil device, the relay will operate in one direction when power is applied with one polarity, and will reset when the polarity is reversed.

On a dual coil device, when polarized voltage is applied to the reset coil the contacts will transition. AC controlled magnetic latch relays have single coils that employ steering diodes to differentiate between operate and reset commands. The circuit above is called a low-side switch, because the switch – our transistor – is on the low (ground) side of the circuit. Alternatively, we can use a PNP transistor to create a high-side switch: Similar to the NPN circuit, the base is our input, and the emitter is tied to a constant voltage.
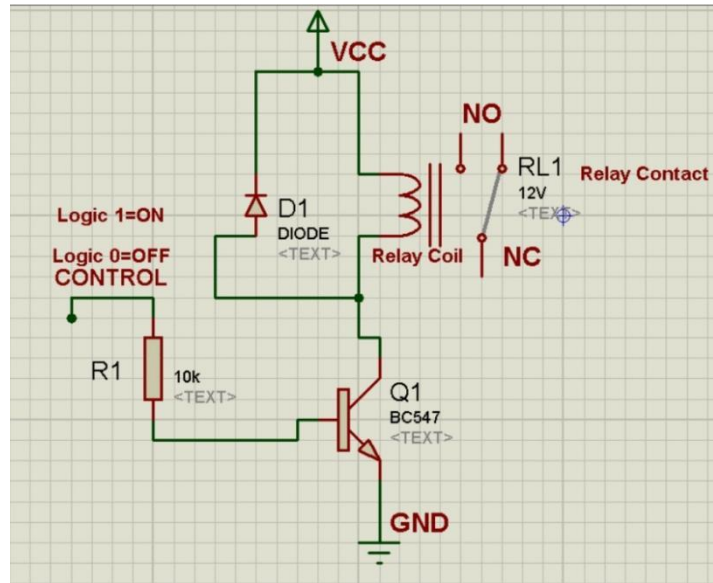
Figure 3.7: Transistor Switching Circuit.

A relay is an electrically operated switch of mains voltage. It means that it can be turned on or off, letting the current go through or not. Controlling a relay with the Arduino is as simple as controlling an output such as an LED. The relay module is the one in the figure below.
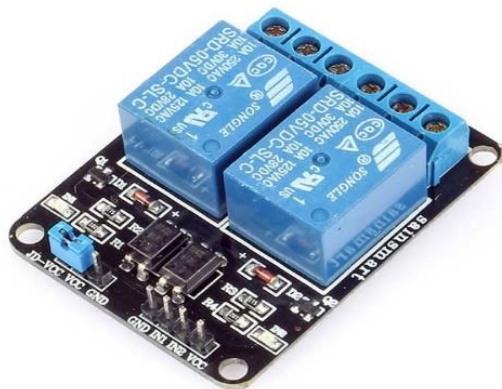

Figure 3.8: Relay Module

This module has two channels (those blue cubes). There are other varieties with one, four and eight channels.

Mains voltage connections:

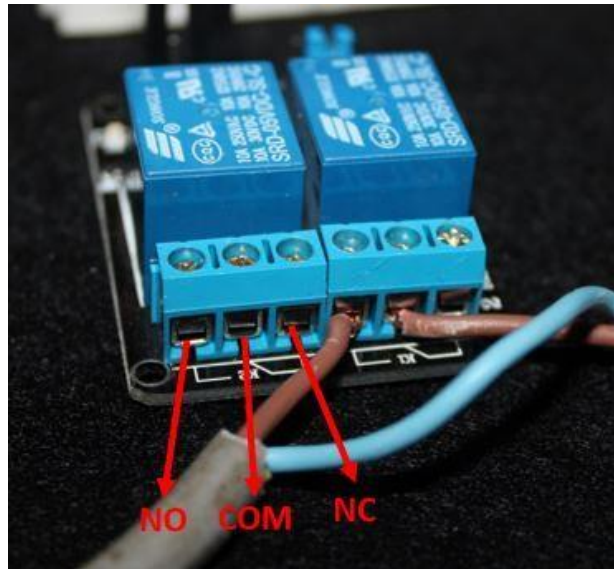In relation to mains voltage, relays have 3 possible connections:

Figure 3.9: Pin diagram of Relay Module

COM: common pin

NO (Normally Open): there is no contact between the common pin and the normally open pin. So, when you trigger the relay, it connects to the COM pin and supply is provided to a load

NC (Normally Closed)**:** there is contact between the common pin and the normally closed pin. There is always connection between the COM and NC pins, even when the relay is turned off. When you trigger the relay, the circuit is opened and there is no supply provided to a load.

If you want to control a lamp for example, it is better to use a normally-open circuit, because we just want to light up the lamp occasionally.

Pin wiring:

The connections between the relay module and the Arduino are really simple:

Figure 3.10: Main Voltage Connection

- GND: goes to ground

- IN1: controls the first relay (it will be connected to an Arduino digital pin)

- IN2: controls the second relay (it should be connected to an Arduino digital pin if you are using this second relay. Otherwise, you don't need to connect it)

- VCC: goes to 5V

3.4 DC Gear Motor

Description:

A DC motor is any motor within a class of electrical machines whereby direct current electrical power is converted into mechanical power. A 12v DC motor is small and inexpensive, yet powerful enough to be used for many applications.

Specification:

- Voltage: 12V DC
- Gear ratio: 1/31
- No-load speed: 200 RPM
- Rated Speed: 140 RPM
- Rated torque: 10 kg.cm
- Rated current: 2.5 Amp
- Length of Motor(including spindle): 106 mm/4.17″
- Diameter: 37 mm/1.45″
- Shaft length: 21 mm/0.82″
- Shaft diameter: 6 mm/0.24″

Figure 3.11: DC Gear Motor

3.5 Regulator IC

Voltage sources in a circuit may have fluctuations resulting in not providing fixed voltage outputs. A voltage regulator IC maintains the output voltage at a constant value. 7805 IC, a member of 78xx series of fixed linear voltage regulators used to maintain such fluctuations, is a popular voltage regulator integrated circuit (IC). The xx in 78xx indicates the output voltage it provides. 7805 IC provides +5 volts regulated power supply with provisions to add a heat sink.
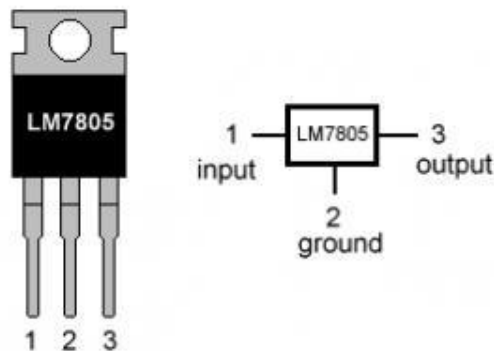
LM7805 PINOUT DIAGRAM

Figure 3.12: 5V Regulator IC

7805 IC Rating:

- Input voltage range 7V- 35V
- Current rating Ic = 1A
- Output voltage range V. Max=5.2V ,V. Min=4.8V

3.6 Ultrasonic Sensor

An ultrasonic sensor is an electronic device that measures the distance of a target object by emitting ultrasonic sound waves, and converts the reflected sound into an electrical signal. Ultrasonic waves travel faster than the speed of audible sound (i.e. the sound that humans can hear). Ultrasonic sensors have two main components: the transmitter (which emits the sound using piezoelectric crystals) and the receiver (which encounters the sound after it has travelled to and from the target).

HC-SR04 Ultrasonic Sensor - Working

As shown above the HC-SR04 Ultrasonic (US) sensor is a 4 pin module, whose pin names are Vcc, Trigger, Echo and Ground respectively. This sensor is a very popular sensor used in many applications where measuring distance or sensing objects are required. The module has two eyes like projects in the front which forms the Ultrasonic transmitter and Receiver. The sensor works with the simple high school formula that

$$\text{Distance} = \text{Speed} \times \text{Time}$$

The Ultrasonic transmitter transmits an ultrasonic wave, this wave travels in air and when it gets objected by any material it gets reflected back toward the sensor this reflected wave is observed by the Ultrasonic receiver module as shown in the picture below-
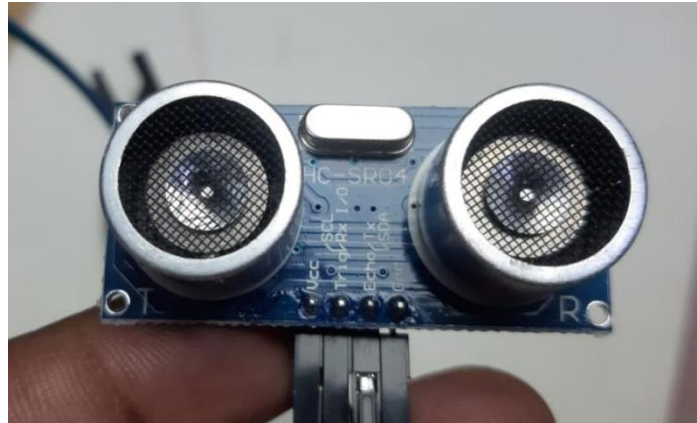

Figure 3.13: Working of sensor

Now, to calculate the distance using the above formulae, we should know the Speed and time. Since we are using the Ultrasonic wave we know the universal speed of US wave at room conditions which is 330m/s. The circuitry inbuilt on the module will calculate the time taken for the US wave to come back and turns on the echo pin high for that same particular amount of time, this way we can also know the time taken. Now simply calculate the distance using a micro controller or microprocessor.

How to use the HC-SR04 Ultrasonic Sensor

HC-SR04 distance sensor is commonly used with both micro controller and microprocessor platforms like Arduino, ARM, PIC, Raspberry Pie etc. The following guide is universally since it has to be followed irrespective of the type of computational device used. Power the Sensor using a regulated +5V through the Vcc ad Ground pins of the sensor. The current consumed by the sensor is less than 15mA and hence can be directly powered by the on board 5V pins (If available). The Trigger and the Echo pins are both I/O pins and hence they can be connected to I/O pins of the microcontroller. To start the measurement, the trigger pin has to be made high for 10uS and then turned off. This action will trigger an ultrasonic wave at frequency of 40Hz from the transmitter and the receiver will wait for the wave to return.

Once the wave is returned after it getting reflected by any object the Echo pin goes high for a particular amount of time which will be equal to the time taken for the wave to return back to the sensor.The amount of time during which the Echo pin stays high is measured by the MCU/MPU as it gives the information about the time taken for the wave to return back to the Sensor. Using this information, the distance is measured as explained in the above heading.

Applications

- Used to avoid and detect obstacles with robots like biped robot, obstacle avoider robot, path finding robot etc.
- Used to measure the distance within a wide range of 2cm to 400cm
- Can be used to map the objects surrounding the sensor by rotating it
- Depth of certain places like wells, pits etc can be measured since the waves can penetrate through water

Ultrasonic Sensor Pin Configuration

Pin Number	Pin Name	Description
1	Vcc	The Vcc pin powers the sensor, typically with +5V
2	Trigger	Trigger pin is an Input pin. This pin has to be kept high for 10us to initialize measurement by sending US wave.
3	Echo	Echo pin is an Output pin. This pin goes high for a period of time which will be equal to the time taken for the US wave to return back to the sensor.
4	Ground	This pin is connected to the Ground of the system.

Table: Ultrasonic Sensor Pin Configuration

HC-SR04 Sensor Features

- Operating voltage: +5V

- Theoretical Measuring Distance: 2cm to 450cm

- Practical Measuring Distance: 2cm to 80cm

- Accuracy: 3mm

- Measuring angle covered: <15°

- Operating Current: <15mA

- Operating Frequency: 40Hz

3.7 Battery

A twelve-volt battery has six single cells in series producing a fully charged output voltage of 12.6 volts. A battery cell consists of two lead plates a positive plate covered with a paste of lead dioxide and a negative made of sponge lead, with an insulating material (separator) in between.

Figure 3.14: 12V Battery

3.8 The Smoothing Capacitor

When there is a potential difference across the conductors (e.g., when a capacitor is attached across a battery), an electric field develops across the dielectric, causing positive charge (+Q) to collect on one plate and negative charge (-Q) to collect on the other plate. If a battery has been attached to a capacitor for a sufficient amount of time, no current can flow through the capacitor. However, if an accelerating or alternating voltage is applied across the leads of the capacitor, a displacement current can flow.

Figure 3.15: Capacitor

An ideal capacitor is characterized by a single constant value for its capacitance. Capacitance is expressed as the ratio of the electric charge (Q) on each conductor to the potential Difference (V). The SI unit of capacitance is the farad (F), which is equal to one coulomb per volt (1 C/V). Typical capacitance values range from about 1 pF ($10-12$ F) to about 1 mF ($10-3$ F). The capacitance is greater when there is a narrower separation between conductors and when the conductors have a larger surface area.

In practice, the dielectric between the plates passes a small amount of leakage current and also has an electric field strength limit, known as the breakdown voltage. The conductors and leads introduce an undesired inductance and resistance. Capacitors are widely used in electronic circuits for blocking direct current while allowing alternating current to pass. In analog filter networks, they smooth the output of power supplies. In resonant circuits they tune radios to particular frequencies. In electric power transmission systems, they stabilize voltage and power flow.

The full-wave bridge rectifier however, gives us a greater mean DC value (0.637 Vmax) with less superimposed ripple while the output waveform is twice that of the frequency of the input supply frequency. We can improve the average DC output of the rectifier while at the same time reducing the AC variation of the rectified output by using smoothing capacitors to filter the output waveform. Smoothing or reservoir capacitors connected in parallel with the load across the output of the full wave bridge rectifier circuit increases the average DC output level even higher as the capacitor acts like a storage device as shown below. Too low a capacitance value and the capacitor has little effect on the output waveform. But if the smoothing capacitor is sufficiently large enough (parallel capacitors can be used) and the load current is not too large, the output voltage will be almost as smooth as pure DC.
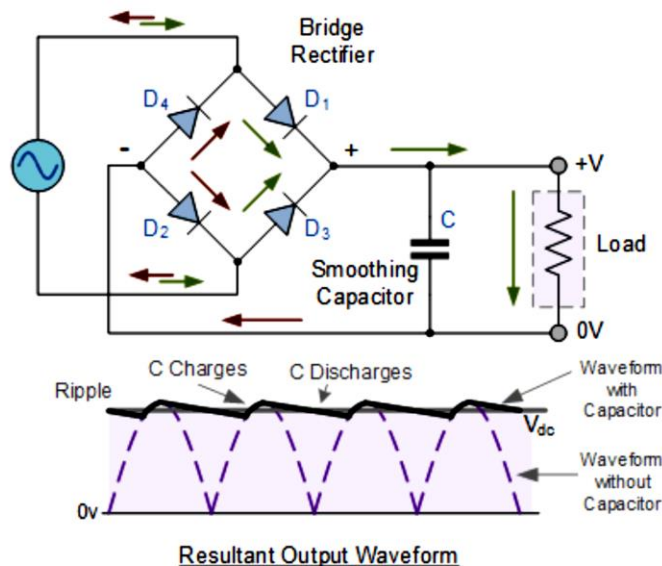

Figure 3.16: The Smoothing Capacitor with Full Bridge Rectifier

3.9 Resistor

A resistor is a passive two-terminal electrical component that implements electrical resistance as a circuit element. Resistors act to reduce current flow, and, at the sometime, act to lower voltage levels within circuits. Resistors may have fixed resistances or variable resistances, such as those founding thermostats, visitors, trimmers, photo resistors, hamsters and potentiometers. The current through a resistor is in direct proportion to the voltage across the resistor's terminals. This relationship is represented by Ohm's law.

Figure 3.17: Resistor

Theory of operation**:**

The behavior of an ideal resistor is dictated by the relationship specified by Ohm 'slaw:

$V = I.R$

Ohm's law states that the voltage (V) across a resistor is proportional to the current (I), where the constant of proportionality is the resistance (R).

Equivalently, Ohm's law can be stated:

$I = V/R$

This formulation states that the current (I) is proportional to the voltage (V) and inversely proportional to the resistance (R). This is directly used in practical computations. For example, if a 300 ohm resistor is attached across the terminals of a12 volt battery, then a current of12 / 300 = 0.04 amperes flows through that resistor.

3.10 Arduino IDE

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

Communication is using the original STK500 protocol (reference, C header files). We can also bypass the boot loader and programs the micro controller through the ICSP (In Circuit

Serial Programming) header. The ATmega16U2 (or 8U2 in the rev1 and rev2 boards) firmware source code is available. The ATmega16U2/8U2 is loaded with a DFU boot loader, which can be activated by:

On Rev1 boards: connecting the solder jumper on the back of the board (near the map of Italy) and then resetting the 8U2. On Rev2 or later boards: there is a resistor that pulling the 8U2/16U2 HWB line to ground, making it easier to put into DFU mode.

The Arduino Nano is one of the latest digital microcontroller units and has a number of facilities for communicating with a computer, another Arduino, or other microcontrollers. The ATmega328 provides UART TTL at (5V) with serial communication, which is available on digital pins 0 -(RX) for receive the data and pin no.1 (TX) for transmit the data. 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, an .in file is required. The Arduino software includes a serial monitor which allows simple textual data to be sent to and from the Arduino board.
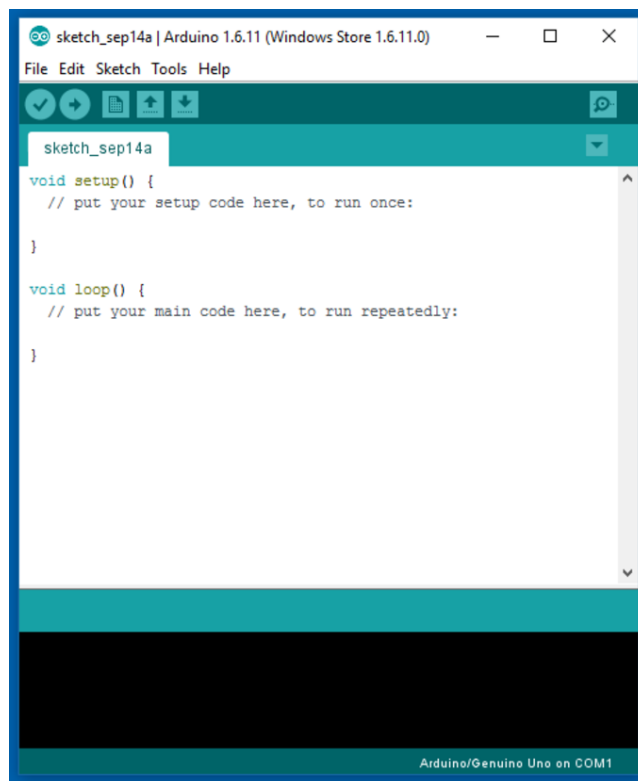

Figure 3.18: Arduino Software Interface IDE

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 Nano'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. Arduino programs are written in C or C++ and the program code written for Arduino is called sketch. The Arduino IDE uses the GNU tool chain and AVR Lab to compile programs, and for uploading the programs it uses argued. As the Arduino platform uses Atmel micro-controllers, Atmel's development environment, AVR Studio or the newer Atmel Studio, may also be used to develop software for the Arduino. The Arduino Integrated Development Environment - or Arduino Software (IDE) - contains a text editor for writing code, a message area, a text console, a toolbar with buttons for common functions and a series of menus. It connects to the Arduino and Genuino hardware to upload programs and communicate with them.

Writing Sketches

Programs written using Arduino Software (IDE) are called sketches. These sketches are written in the text editor and are saved with the file extension .ino. The editor has features for cutting/pasting and for searching/replacing text. The message area gives feedback while saving and exporting and also displays errors. The console displays text output by the Arduino Software (IDE), including complete error messages and other information. The bottom right hand corner of the window displays the configured board and serial port. The toolbar buttons allow you to verify and upload programs, create, open, and save sketches, and open the serial monitor.

Sketchbook

The Arduino Software (IDE) uses the concept of a sketchbook: a standard place to store your programs (or sketches). The sketches in your sketchbook can be opened from the File > Sketchbook menu or from the Open button on the toolbar. The first time you run the Arduino software, it will automatically create a directory for your sketchbook. You can view or change the location of the sketchbook location from with the Preferences dialog. Beginning with version 1.0, files are saved with a .ino file extension. Previous versions use

the .pde extension. You may still open .pde named files in version 1.0 and later, the software will automatically rename the extension to .ino.

Tabs, Multiple Files, and Compilation

Allows you to manage sketches with more than one file (each of which appears in its own tab). These can be normal Arduino code files (no visible extension), C files (.c extension), C++ files (.cpp), or header files (.h).

Uploading

Before uploading your sketch, you need to select the correct items from the Tools > Board and Tools > Port menus. The boards are described below. On the Mac, the serial port is probably something like /dev/tty.usbmodem241 (for a Uno or Mega2560 or Leonardo) or /dev/tty.usbserial-1B1 (for a Duemilanove or earlier USB board), or /dev/tty.USA19QW1b1P1.1 (for a serial board connected with a Keyspan USB-to-Serial adapter). On Windows, it's probably COM1 or COM2 (for a serial board) or COM4, COM5, COM7, or higher (for a USB board) - to find out, you look for USB serial device in the ports section of the Windows Device Manager. On Linux, it should be /dev/ttyACMx , /dev/ttyUSBx or similar. Once you've selected the correct serial port and board, press the upload button in the toolbar or select the Upload item from the Sketch menu. Current Arduino boards will reset automatically and begin the upload. With older boards (pre-Diecimila) that lack auto-reset, you'll need to press the reset button on the board just before starting the upload. On most boards, you'll see the RX and TX LEDs blink as the sketch is uploaded. The Arduino Software (IDE) will display a message when the upload is complete, or show an error.

When you upload a sketch, you're using the Arduino Bootloader, a small program that has been loaded on to the microcontroller on your board. It allows you to upload code without using any additional hardware. The Bootloader is active for a few seconds when the board resets; then it starts whichever sketch was most recently uploaded to the microcontroller. The Bootloader will blink the on-board (pin 13) LED when it starts (i.e. when the board resets).

Libraries

Libraries provide extra functionality for use in sketches, e.g. working with hardware or manipulating data. To use a library in a sketch, select it from the Sketch > Import Library menu. This will insert one or more #include statements at the top of the sketch and compile the library with your sketch. Because libraries are uploaded to the board with your sketch, they increase the amount of space it takes up. If a sketch no longer needs a library, simply delete its #include statements from the top of your code. There is a list of libraries in the reference. Some libraries are included with the Arduino software. Others can be downloaded from a variety of sources or through the Library Manager. Starting with version 1.0.5 of the IDE, you do can import a library from a zip file and use it in an open sketch. See these instructions for installing a third-party library.

Third-Party Hardware

Support for third-party hardware can be added to the hardware directory of your sketchbook directory. Platforms installed there may include board definitions (which appear in the board menu), core libraries, Bootloaders, and programmer definitions. To install, create the hardware directory, then unzip the third-party platform into its own sub-directory. (Don't use "Arduino" as the sub-directory name or you'll override the built-in Arduino platform.) To uninstall, simply delete its directory. For details on creating packages for third-party hardware, see the Arduino IDE 1.5 3rd party Hardware specification.

Serial Monitor

This displays serial sent from the Arduino or Genuino board over USB or serial connector. To send data to the board, enter text and click on the "send" button or press enter. Choose the baud rate from the drop-down menu that matches the rate passed to Serial begin in your sketch. Note that on Windows, Mac or Linux the board will reset (it will rerun your sketch) when you connect with the serial monitor.

3.11 Proteus Software

The Proteus Design Suite is a proprietary software tool suite used primarily for electronic design automation. The software is used mainly by electronics design engineers and technicians to create schematics and electronics prints for manufacturing printed circuit boards.
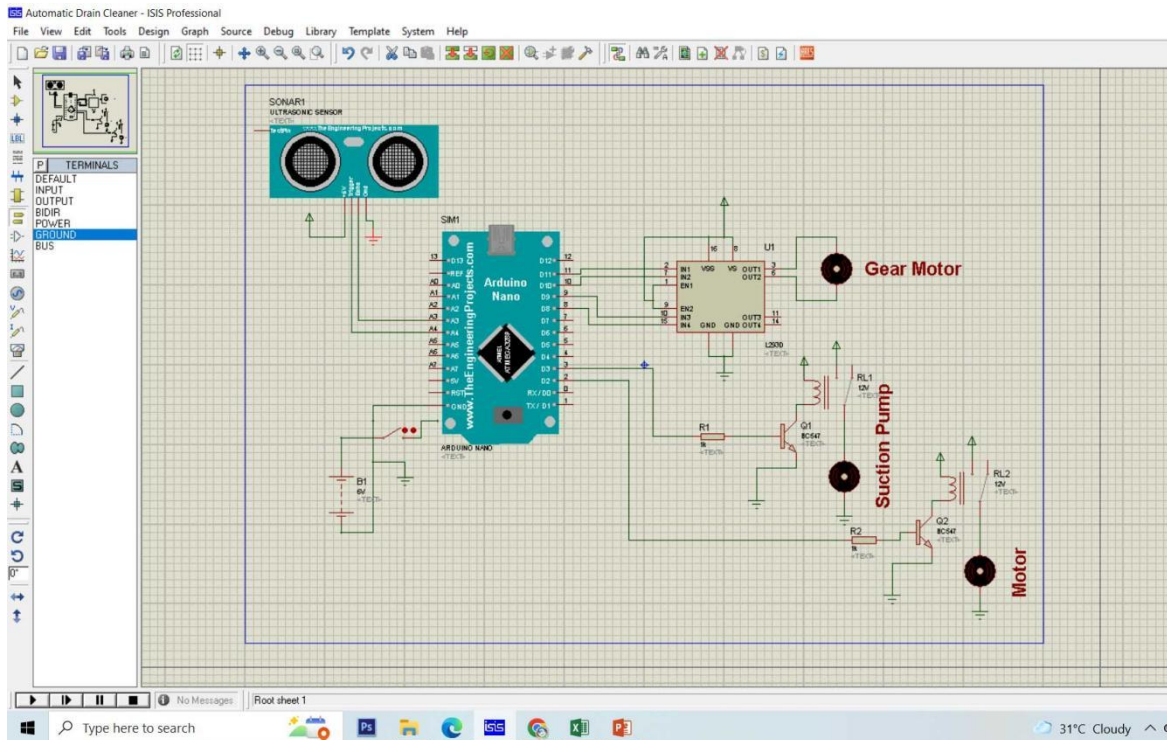

Figure 3.19: Proteus Software Interface

The first version of what is now the Proteus Design Suite was called PC-B and was written by the company chairman, John Jameson, for DOS in 1988. Schematic Capture support followed in 1990 with a port to the Windows environment shortly thereafter. Mixed mode SPICE Simulation was first integrated into Proteus in 1996 and microcontroller simulation then arrived in Proteus in 1998. Shape based auto routing was added in 2002 and 2006 saw another major product update with 3D Board Visualization. More recently, a dedicated IDE for simulation was added in 2011 and MCAD import/export was included in 2015. Support for high speed design was added in 2017. Feature led product releases are typically biannual, while maintenance-based service packs are released as required.

CHAPTER 4

METHODOLOGY

4.1 Our methodologies for the project

Our methodologies for the project:

- Creating an idea for Design and construction of Automatic Drain Cleaner system.
- And designing a block diagram & circuit diagram to know which components need to construct it.
- Collecting the all components and programming for the micro controller to controlled the system.
- Setting all components in a PCB board & soldering. Then assembling the all block in a board and finally run the system & checking.

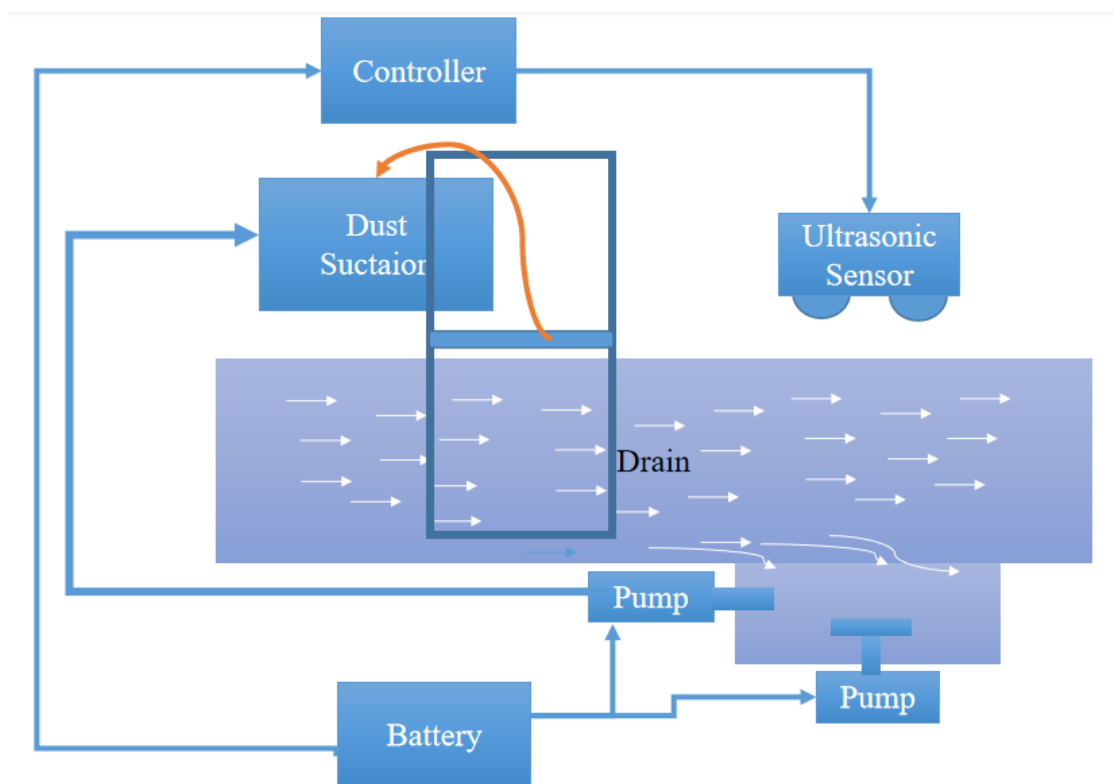## 4.2 Structural Design

Figure 4.1: Our Project Structural View

4.3 Block Diagram

The way of whole project works is that we use battery from the supply voltage and control the all module. We use Arduino micro controller which is mainly control our project. Here we also use various instrument which is visible in this block diagram.
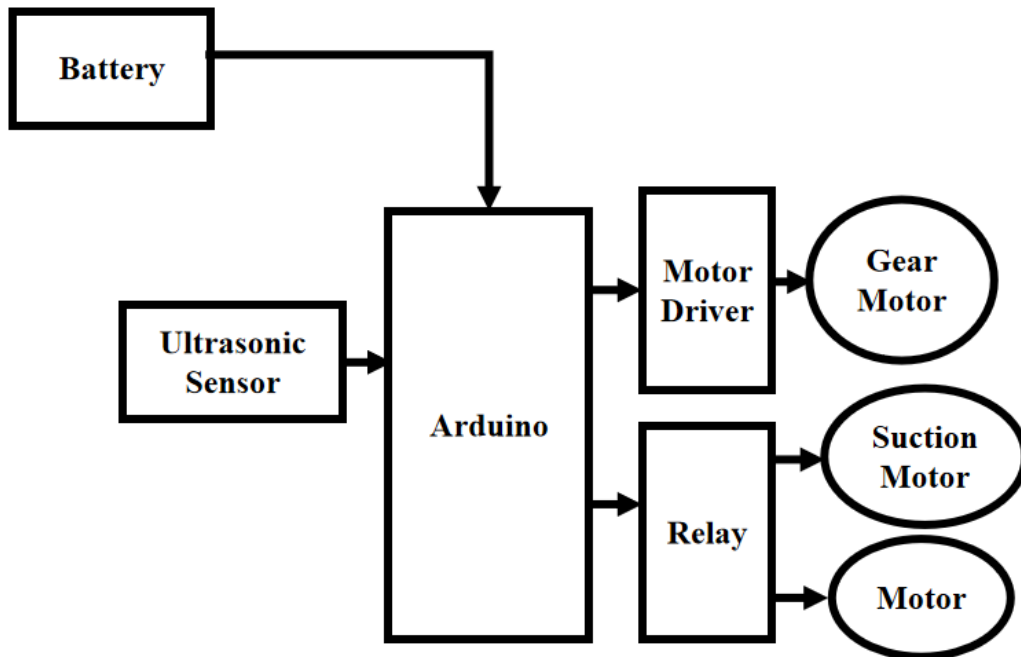

Figure 4.2: Block Diagram of Our System

4.4 Schematic Diagram

The schematic diagram here is representing the electrical circuit and the components of the project. Here we have used standardized symbols and lines.
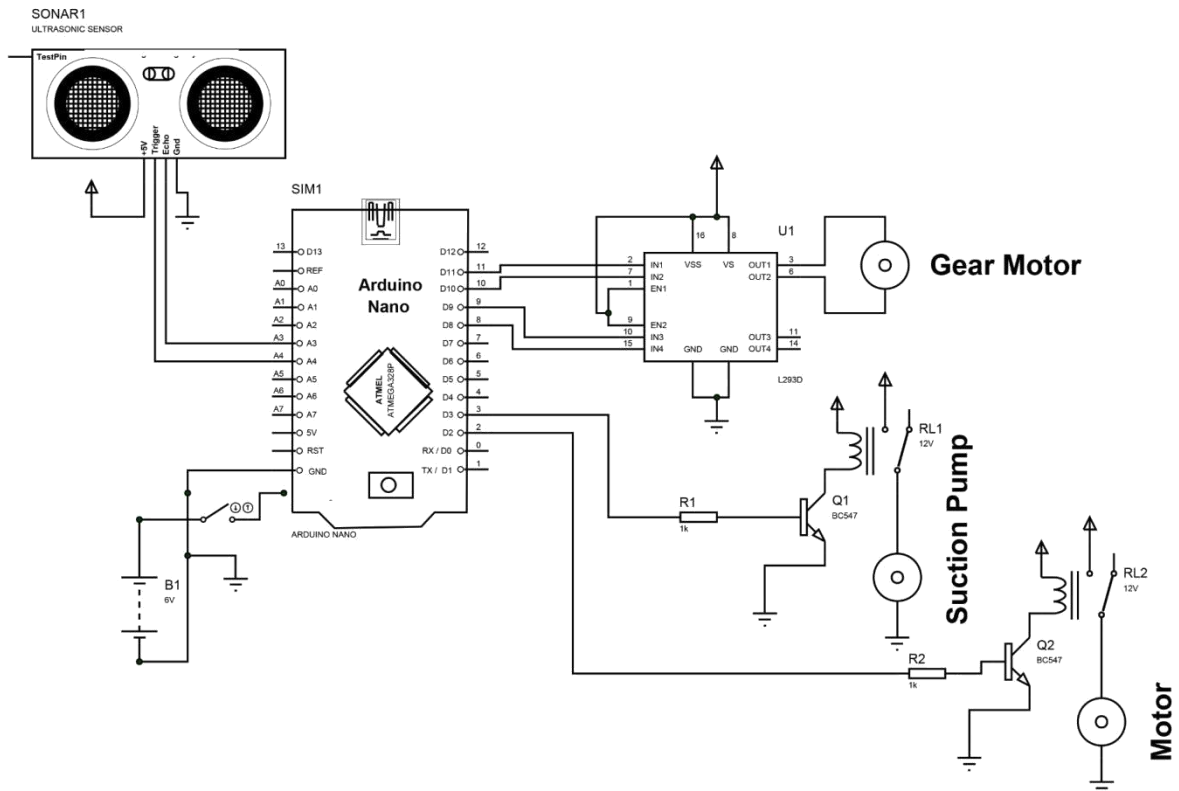
Figure 4.3: Schematic Diagram of the Project

4.5 Working Principle

The Device is place across drain so that only water flow through lower grids. Waste like bottle, etc. Floating in drain are lifted by teeth which is connected to chain. This chain is attached by gears driven by motor. The energy provided to motor is 12V battery connected to it. When motor runs the chain starts to circulate making teeth to lift up. The waste materials are lifted by teeth and are stored in waste storage tank. After some times a motor will be create small cyclone under the drain and One pump motor will suck the dirt up through the suction pump. And an ultrasonic sensor is attached the upper portion of the system, is the drain is overflow with the liquid then the system notified the authors. The entire system is controlled by the micro controller. The motor driver controls the motor with the signal received from the Arduino. In this way the whole system is controlled.

4.6 Our Final System View

Figure 4.4: Our Final System Overview

CHAPTER 5
RESULT AND DISCUSSION

5.1 Discussion

While working on our project, we did face some difficulties as it is a very complex system but the end results, we came up with were quite satisfactory. We have put the whole system through several tasks to validate our work and also have taken necessary notes for future improvements. Some future recommendations that we have involves improvement in system design and wiring, adding features for more efficient.

5.2 Result

Now, it's time to talk about the results. We have written our commands using the Arduino IDE and the following things can happen:

- After power this project then it will be able to operate.
- Then a saw teeth will rotate with a chai.
- Then a motor will such the dust of the water and saw teeth will take it up.
- And ultrasonic sensor will detect the drain water level.

5.3 Advantage

There are many advantages of our project because of its accuracy. Some of the advantages are pointed out below:

- Automatic Cleaning System.
- Automatic Dust Collecting.
- Production cost is very low.
- No need of purchase special machine.
- Its operated and maintenance is simple.
- It is compact and portable.
- It can be efficiently used.
- Totally wireless controlled.

5.4 Application

Some of the application areas of the project have been pointed out below:

- It is used almost in all types if Drainage (Large , Small & medium).

- This machine is mainly used in cleaning system.

- Project to use this in efficient way to control the disposal of wastages and with
  regular filtration of wastages.

CHAPTER 6
CONCLUSION

6.1 Conclusion

In the cleaning system of drainage control by the, motor, roller chain and sprocket, lifter and the collecting bin to achieve automatic control system. Automation is a technology concerned with his application of mechanical, electronic and computer based systems to operate and control production. This system is used to operate automatic drain cleaning system. We have followed thoroughly the study of time motion and made our project economical and efficient with the available resources. This system was designed, fabricated successfully and also tested. It works satisfactorily. We hope that this will be done among the most versatile and interchangeable one even in future. Thus we can able to obtain Automatic drain Cleaning system.

6.2 Future Scope

We are thinking about adding many features to our project in the future to get more desirable outcomes. Some of the steps that we are thinking about taking are given below:

- In the future it can be improved by using more sensors.
- In the future, controlling the Internet can be done to improve it

REFERENCE

[1]   Ganesh U L,et.al. "Semi-Automatic Drain For Sewage Water Treatment Of Floating Materials", International Journal of Research in Engineering and Technology, Vol No- 05, Jul-2016.

[2]   Balachandra, et.al."Automatic Drainage Water Pump Monitoring and Control System Using PLC and SCADA" International Journal of Innovative Research in Technology, Vol No- 1, 2014.

[3]   Dr .K.Kumaresanet.al., "Automatic Sewage Cleaning Equipment", International Conference on Explorations and Innovations in Engineering and Technology , 2016.

[4]   R.Sathiyakalaet.al., "Smart Sewage Cleaning System" International Journal of Innovative Research in Computer and Communication Engineering, Vol No- 4, February 2016.

[5]   S D Rahul Bharadwaj, ShraddhaR Jogdhankar, "Automatic Wastewater treatment process to reduce global warming" International Journal of Environmental Science: Development and Monitoring, Vol No- 2 (2013)

[6]   NitinSall, et.al., "Drain Waste Water Cleaner", Global Journal of Researches in Engineering: J General Engineering Vol No- 16, 2016.

[7]   Nikhil S. Pisal, et.al.,"Structural Analysis Of Motorcycle Chain By Using C.A.E. Software", International Journal Of Advance Research In Scince and Engineering, Vol No-4, Special Issue (02), February 2015.

[8]   NDUBUISI C. Daniels, "Drainage System Cleaner A Solution to Environmental Hazards", International Refered Journal of Engineering and Science, Vol No- 3, March 2014.

[9]   Shao-Wu-Zhang,"Drainage Device's Research and Development in the Ceramic Filters", Journal of Chemical and Pharmaceutical Research, 2013.

[10]   S.D.Anap," Wireless Based Water Level Monitoring and Control System", International Advanced Research Journal in Science, Engineering and Technology, Vol No- 3, April 2016.

[11]   James C.Y. Guo, "Winter Sand Recollection By Highway Drainage", ASCE J. of Drainage and Irrigation Engineering, Vol 125, No 6, November1999.

[12]   James C. Conwell, G.E. Jhonson, "Design, Construction and Instrumentation of a Machine to Measured Tension and Impact Forces in Roller Chain Drives", December 1989.

[13]   N.Prabhushankaret.al.,"Design and Fabrication of Drainage Cleaning Machine with Spring Return Pneumatic System", International Journal For Scientific Research and Development, Vol No-4, 2016.

[14]   Gregor Burger, et.al, "Designing and Implementing a Multi-Core Capable Integrated Urban Drainage Modelling Toolkit: Lessons from CityDrain3", Advances in Engineering Software 100, 2016.

[15]   MsT.Deepiga, et.al., "Smart Water Monitoring System Using Wireless Sensor Network at Home/Office", International Research Journal of Engineering and Technology, Vol- 02, July-2015.