

DESIGN ANALYSIS OF LAND SURVEYING ROBOT USING

ARDUINO UNO

Submitted in partial fulfillment of the requirements for the award of

Bachelor of Engineering Degree in
Electrical and Electronics Engineering

by

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

SCHOOL OF ELECTRICAL AND ELECTRONICS ENGINEERING

SATHYABAMA

INSTITUTE OF SCIENCE AND TECHNOLOGY

(DEEMED TO BE UNIVERSITY)

Accredited with Grade “A” by NAAC

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BONAFIDE CERTIFICATE

This is to certify that this Project Report is the bonafide work of
RAMATHOTA MADHU (Register No. 38140043)

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who carried out the project entitled "**DESIGN ANALYSIS OF LAND SURVEYING ROBOT USING
ARDUINO UNO**" under our supervision from November 2021 to May 2022.

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Submitted for Viva voce Examination held on _____

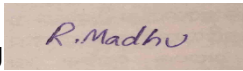
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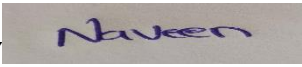
DECLARATION

We **RAMATHOTA MADHU (Register No. 38140043)** and **P NAVEEN REDDY (Register No. 38140704)** hereby declare that the Project Report entitled done by us under the guidance of **Dr.D.N.S RAVI KUMAR** is submitted in partial fulfillment of the requirements for the award of Bachelor of Engineering degree in Electrical and Electronics Engineering.

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Abstract:

This report is the outcome of our idea to undertake a field survey using a robot equipped with cutting-edge technology, the Arduino uno. We've built a robot that will survey the land. It was created with the sole purpose of estimating the area of a certain piece of land. The robot is fully controlled by a wi-fi module, allowing it to survey the entire ground surface. Timer concept is used to calculate area, and the results are presented on an LCD panel. The second phase comprises determining the area of the land to be surveyed using an area measurement module and Arduino uno software. The goal of Land Surveying using a Robot is to make quick responses, specifically area measurement. A robot is used to measure the size of the area. Surveying or land surveying is the study and method of precisely finding the distances of terrestrial land, forest land and any other agricultural lands. To achieve their purpose, surveyors use mathematics (including geometry and trigonometry), as well as physics, engineering, and law. This involves the employment of a wide range of surveying tools.

TABLE OF CONTENTS

CHAPTER NO	TITLE	PAGE NO
	ABSTRACT	I
	LIST OF FIGURES	III
	LIST OF SYMBOLS AND ABBREVIATIONS	IV
1	INTRODUCTION TO DOMAIN	
	1.1 INTRODUCTION OF EMBEDDED SYSTEM	10
	1.2 DEFINATION OF AN EMBEDDED SYSTEM	11
	1.3 FEATURES OF EMBEDDED SYSTEM	11
	1.4 TYPES OF EMBEDDED SYSTEM	14
2	INTRODUCTION	16
3	LITERATURE SURVEY	20
4	HARDWARE AND SOFTWARE REQUIREMENTS	
	4.1 POWER SUPPLY	24
	4.2 ARDUINO	26
	4.3 ULTRASONIC SENSOR	30
	4.4 LCD	33
	4.5 L293D DRIVER	38
	4.6 WORKING OF L293D	40
	4.7 MOTOR	41
	4.8 SOFTWARE REQUIREMENTS	43
5	RESULT AND CODE	
	5.1 PROGRAM CODE	51,52
6	HARDWARE EQUIPMENTS	53-58

CONCLUSION	53
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REFERENCES	53
-------------------	----

TABLE OF FIGURES

FIGURE NO	TITLE	PAGE NO
4.1	BLOCK DIAGRAM	23
4.2	CIRCUIT DIAGRAM OF REGULATED POWER SUPPLY	25
4.3	STRUCTURE OF ARDUINO BOARD	26
4.4	ULTRASONIC SENSOR	30
4.5	WORKING MODEL OF ULTRASONIC SENSOR	31
4.6	LCD BACKGROUND	34
4.7	MOTOR	42

LIST OF SYMBOLS AND ABBREVIATIONS

T1	-	transformer
D1	-	Diode
R	-	Resistor
V _c	-	Capacitor Voltage
C1 C2 C3	-	Capictor
V _{in}	-	Input Voltage
V _{out}	-	Output Voltage
GND	-	GROUND
AC	-	Alternating Current
API	-	Application Program Interface
CPU	-	Central Processing Unit
CTR	-	Current Transfer Ratio
DC	-	Direct Current
ASIC	-	application specific integrated circuit
LED	-	light emmiting diode
LCD	-	liquid crystal display
PWM	-	pulse width modulation
ADC	-	analog to digital convertor
CMOS	-	Complementary metal oxide semiconductor

CHAPTER 1

INTRODUCTION TO DOMAIN

1.1 Introduction to embedded system

'Embedded systems,' or digital information technology that is used in our surroundings, are becoming most important in our lives. Embedded systems, which are no longer visible to users as "computers" in the classic sense, use more than 98 percent of today's CPUs. An embedded system is a computer that is completely encased in or dedicated to the item or system it controls. Unlike a general-purpose computer like a personal computer, an embedded system only performs one or a few pre-defined functions with extremely specific requirements. Designers may optimise the system because it is dedicated to a single activity, resulting in a smaller and cheaper product. In order to take advantage of economies of scale, embedded systems are routinely mass-produced. In recent years, growing use of PC hardware has been one of the most significant advances in high-end embedded systems. As a result of this trend, the cost of high-end system hardware has dropped dramatically, allowing projects that were previously unachievable due to the high cost of non-PC-based embedded technology to be completed. The embedded PC platform's software alternatives, on the other hand, are less enticing than the hardware.

Embedded systems are frequently built around a single microprocessor board, with programmes stored in read-only memory (ROM). Embedded systems are found in practically every digital equipment, such as watches, microwaves, VCRs, and automobiles. Although some embedded systems include an operating system, many are so specialised that all of the functionality can be implemented in a single application.

We use embedded system in various places like traffic lights, digital watches and media players etc.. In terms of complexity, embedded systems can range from a single microcontroller chip to numerous units, peripherals, and networks housed inside a huge chassis or enclosure.

1.2 Definition of an Embedded System

The term "embedded system" refers to the use of software code to interact directly with hardware that has been created for a specific application. Performance is provided by hardware (processors, ASICs, memory, and so on), whereas functionality and flexibility are provided by software (& sometimes security)

Although there are various definitions for embedded system, they can all be integrated into a single concept. An embedded system is a special-purpose computer system that is used for a specific task.

1.3 Features of Embedded Systems

The term "embedded system" refers to the use of software code to interact directly with hardware that has been created for a specific use. Performance is provided by hardware (processors, ASICs, memory, and so on), whereas functionality and flexibility are provided by software (& sometimes security) Although there are various definitions for embedded system, they may all be integrated into a single concept. An embedded system is a special-purpose computer system that is used for a specific task.

The versatility of the embedded computer system makes it beneficial in a variety of industries, from product simplicity to cost reductions in research and production. In complicated systems with a lot of functionality, special operating systems that take into consideration the primary characteristics of embedded systems are utilised. Embedded operating systems need up little space and may run in real time.

Because the embedded system is committed to a particular task, designers may optimise it to minimise the size and cost of the product while also increasing its reliability and performance. Embedded systems may be mass-produced, which saves money. Some embedded systems must function in severe conditions, such as intense heat and humidity.

Cost reduction is frequently the most important design factor for high-volume devices like portable music players or mobile phones. Engineers typically select hardware that is "good enough" to accomplish the functions required.

By restricting the programmes or replacing the operating system with a real-time operating system, general purpose computers can be repurposed for low volume or prototype embedded systems.

1.3 Characteristics of Embedded Systems

- Embedded computer systems normally contain a lot of features, which is why CPUs are frequently integrated in the design. However, they face a number of non-functional limitations that make the job much more difficult: Deadlines that must be reached in real time or the system will collapse; Multi-rate operation;
- In many cases, low power consumption;

- Low manufacturing cost, which often means limited code size.

Workstation programmers are frequently concerned with functionality. They may examine the performance of a few computational kernels in their programme, but they very never examine the complete application. Consumption of energy and production expenses are almost never considered. Embedded system programming is particularly challenging due to the need to balance all of these requirements, which is why embedded system designers should be knowledgeable with computer architecture.

Overview of an Embedded System Architecture

Every Embedded system consists of a custom-built hardware built around a central processing unit. This hardware also contains memory chips onto which the software is loaded.

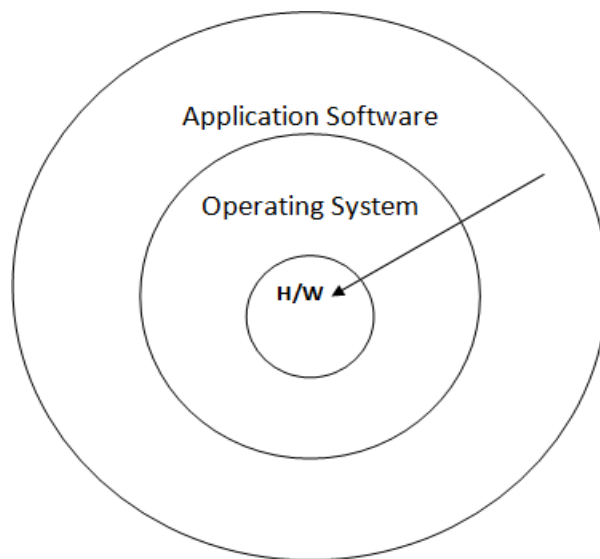


Fig 1.1 overview of an embedded system architecture

The application software is installed on top of the operating system, whereas the operating system is installed on top of the application software. The same architecture may be used by any computer, including desktop PCs. Nonetheless, these are significant variances. An operating system is not required for every embedded system. Air conditioners, toys, and other modest uses are examples.

1.3 Applications of Embedded Systems

We use several applications in our day to day life those are as follows:

Small embedded controllers: 8-bit CPUs are the most common, whether the

operating system is basic or not. (e.g., thermostats)

Control systems: Control computations frequently involve a DSP chip. (e.g., automotive engine control)

Distributed embedded control: On a real-time basis, there is a mix of big and tiny nodes.

Networks that are embedded in other networks
(e.g., cars, elevators, factory automation)

System on chip: ASIC design that is specific to the application

(e.g., consumer electronics, set-top boxes)

Network equipment: Data flow/packet flow is emphasised.

(e.g., network switches; telephone switches)

Critical systems: Computing for mission-critical

applications and safety (e.g.,

pacemakers, automatic trains)

Signal processing: DSP chips are often used in vision, audio, and other signal processing applications. Processing (e.g., face recognition)

Robotics: Uses various types of embedded computing (especially

Vision and control) (e.g., autonomous vehicles)

Computers:	CPU, keyboards, printers, etc.
Wireless systems:	Wireless network-connected “sensor networks” and “Motes” to gather and report information
Embedded PCs:	Palmtop and small form factor PCs embedded into Equipment
Command and control:	Often huge military systems and “systems of systems” (e.g., a fleet of warships with interconnected Computers)

1.4 TYPES OF EMBEDDED SYSTEMS

Based on the performance it has been classified into 4 types.

1. Stand alone embedded systems
2. Real time embedded systems
3. Networked information appliances
4. Mobile devices

1.4.1 Stand Alone embedded systems:-

Stand-alone systems, as the name suggests, are self-contained. They take in data, process it, and then deliver the required result. The i/p might be an electrical signal from a transducer, a temperature indicator, or human commands. An electrical signal can be used to control a led or LCD display in another system, such as a digital camera, microwave oven, CD player, or air conditioner.

1.4.2 Real time embedded systems:-

In this system there would have to be completed a task in a particular time

Hard Real time systems: - IT is used in missiles

Soft Real time systems: - DVD players

1.4.3 Networked information appliances:-

Network Information Appliances are embedded systems having network interfaces that may be accessed over a network, such as a local area network or the internet.

Ex A web camera is a camera that is connected to the internet. Any computer with an internet connection may get real-time photos from the camera.

1.4.4 Mobile devices:-

Actually, it's a hybrid of VLSI and embedded systems.

Mobile phones, personal digital assistants, smart phones, and other mobile devices are examples of embedded systems.

CHAPTER 2

INTRODUCTION

Land surveying is required for this conversion. The SURVOBOT (Survey Robot) is being developed to address the challenges of existing area measuring and field survey processes. Area measurement module. The robot's distance travelled is determined using the timer concept, and the value is sent to the LCD display via Bluetooth. The benefits of this robot include a significant reduction in the quantity of labour and equipment required to execute such area calculation activities. It reduces time and improves accuracy when compared to older methods. Bluetooth is a low-complexity, low-cost, and low-power bi-directional wireless communication technology. This technique is mostly employed because of the low data rate.

Land surveying is a technique for determining the locations of objects on the ground or in three dimensions, as well as the distances and angles between them. The points are often located on the surface of the ground. They're typically used to establish ownership, limits, and locations, such as the required placements of structural components for a construction or the surface position of subterranean parts, or for real estate sales. A land surveyor is a skilled professional. Surveying has been a significant part of the evolution of the human environment from the beginning of recorded history. It is required in the design and implementation of almost all forms of building.

It's also utilized in transportation, communications, mapping, and setting legal property ownership borders, among other things. It's also useful for study in a wide range of other subjects. In recent years, every industry, from manufacturing to banking, has grown increasingly automated. Despite the fact that it is rarely highlighted, field surveying is becoming more mechanized with the use of sophisticated robots. The first surveying robots were constructed more than two decades ago. They were bots with total stations and other surveying equipment that could determine the size of a territory more precisely than a human surveyor.

While many modern robots do similar tasks, surveyors have access to more complex models. Several reputable surveying companies employ aerial drones to acquire a full perspective of a place. Drones also enable us to do a 3D boundary analysis by giving us a panoramic view of the area we're surveying. Drones have the drawback of being unable to manoeuvre within structures.

Structures may be required in some surveying projects, which might be a vital necessity. A 360-degree camera can now be attached to a surveyor's hardhat, which surveys the region while tracking their movements via GPS. The mix of human involvement and robot automation is crucial to any surveyor. A robotics firm named Boston Dynamics is developing a robot called SpotWalk that is significantly more sophisticated than anything we've seen previously. This machine is self-contained and capable of independently exploring a plot. While this may save a surveyor a lot of time, it also removes the human element from the equation.

The population of our country is continuously increasing, necessitating more effective service management. For example, a hospital must be monitored 24 hours a day, seven days a week. Inadequate staffing and nursing incompetence can jeopardise patients' lives [2]. Transporting medications, food, linens, and other equipment from one site to another is often a challenge. Adding more personnel is an easy solution, yet it is ineffective. This is the age of technology and automation. The healthcare business will be substantially more effective if automation is implemented. Incorporating automation into hospitals may be done with the help of a line following robot.

In the event of an emergency, a line-following robot can act as a stand-in nurse for medical personnel. In operating rooms, where doctors may demand extra equipment in the event of an emergency, this sort of robot will also act as a delivery robot. Quick service, availability 24 hours a day, dependability, and efficiency are all advantages of this sort of robot. This robot [1] is a kind that follows the user's white or black path. In this research, IR sensors are used to identify the route [6]. This sensor was chosen because it can detect lines from a distance of 100cm to 500cm, consumes little power, and fits into small spaces. The Arduino and the automobile module are also utilized to control and run the robot.

To better understand the full operation of the line following robot, prior understanding of IR sensors, Arduino, and Motor driver modules is essential. An infrared sensor is a type of electrical gadget that senses environmental factors. It either transmits or senses infrared light to detect it. In 1800, F.W.Herschel discovered the infrared sensor. The functioning of an IR sensor is governed by three laws: Planck's radiation law, Stephan Boltzmann law, and Wein's displacement law [6]. Light is partly reflected back to the source when it reaches a coloured surface.

In the case of a white surface, the light is entirely reflected. When light is incident on a black surface, it is totally drawn up due to the black color's absorption property. Infrared sensors are designed with this principle in mind. When light strikes a normal or regular surface, it returns to

the photodiode, however when it strikes a dark item, it is absorbed, and so no light rays are collected by the photodiode. The operating of IR sensors explains the entire system. Based on Atmel, the arduino IDE is free to use.

This library is used to programme the Arduino board. It has the ability to simulate input and produce an output. The input gets high when the sensors come into touch with a white item and low when they come into contact with a black object. A standard motor driving IC [4] may drive the DC motor in either direction. The 16 pins on this IC are used to operate a pair of DC motors. The motor driving IC connects the controller (in this example, the Arduino) with the motor [8]. This IC takes the Arduino's output as its input.

Land measurement is a broad term that encompasses the science and practise of land measurement in the broadest sense possible. This also includes land conversion, which is defined as the process of determining the size of a piece of land or a piece of property. It's the process of turning a piece of land or property into a different unit. To put it another way, one acre equals how much land, and so on. Land surveying is required for this conversion. The Survey Robot, also known as SURVOBOT, is being developed to overcome the challenges of conventional area measurement and field survey processes. A key task of the survey team in traditional survey operations is to determine the distance between two sites. The surveyor has a variety of tools for measuring distance. From 30-meter steel tape to electronic instruments, there's something for everyone.

CHAPTER 3

LITERATURE SURVEY

1. Artificial Intelligence in the path planning optimization of mobile agent navigation:

Computational intelligence is required to solve many complex problems. The creation of efficient computational intelligence methods, such as evolutionary algorithms and neural networks, is one of the key directions in artificial intelligence. Systems that act independently or cooperatively, such as mobile robots, might employ computational intelligence methods to solve various problems/tasks; yet, through their behaviour, an intelligence termed system's intelligence, or intelligence of a system, could arise. TSP provides a wide range of applications for the travelling salesman dilemma. It's a well-known problem in the corporate world. Maximum advantages TSP, or time series pricing, has a wide range of economic applications. TSP is also employed in Raja's (2012) transport logic. It also has a wide variety of applications in the optimization of mobile robotic agent path planning. The route planning of a mobile robotic agent will be described in this study, with unsupervised neural networks used for TSP solution and the determination of a nearly optimum path between two places in the agent's working region based on the TSP findings. A change of the winning neuron selection criterion function will also be given in the study. The results of the measurements will be reported towards the conclusion of the paper.

2. Design and Fabrication of Robot for Surveillance using Arduino:

The world is full of surveillance, most of which is being observed by hostile nations. For example, every country's border region was controlled and watched by its own country for security reasons, and several technologies were employed to monitor the region. Previously, human monitoring was used, which resulted in many fatalities on the part of the opposing country. To solve the problem, the technique of robot-assisted surveillance was devised. However, technology has advanced, requiring us to develop a new surveillance robot, as well as a bomb detector with an automatic pistol. This project used an Arduino with a Wi-Fi module to control it. The camera was fixed and captures the video and monitored through it.

3. Line Following Robot Using Arduino for Hospitals:

This study explains the use of an Arduino-based line-following robot for surveying, checking, and improving the transportation of vital commodities within healthcare facilities and companies. The suggested system would detect the black route and follow it on the ground. This technology makes material transportation easier while also reducing human requirements. This technology focuses on the safe, timely, and efficient delivery of commodities. This work tries to obtain improved performance by implementing controlled robot movement by tweaking control settings. This robot is primarily designed to follow a predetermined course. Two sensors are utilised to locate this route. This type of robot is often seen in industrial operations with a pick-and-place facility. This robot follows a predetermined course to transport components from one location to another. A lot of study has recently been done to enable automation in hospitals and industry. This robot is designed to deliver critical items such as injections, medication, and other medical supplies. This work is broken into two sections: hardware and software.

4. Design and Implementation of a Land Surveying Robot:

Land measuring is a broad terminology that is used to convey the understanding and use of land measurement in an absolute manner. This also involves land conversion, which is the process of determining the value of land or property. It refers to the process of converting a piece of land or property from one unit to another. The suggested idea is to conduct the land survey with the help of a robot equipped with the most up-to-date technologies. A robot is created and programmed to undertake a land survey, especially to determine the length travelled and size of a given piece of land, as well as to subdivide the plot into subplots if necessary. The survey robot follows the predetermined course and provides the distance and area computed information. The robot's speed was reduced to 0.5 meters per second after adjusting the power delivered to the motors for good simulation, which was desirable for successful robot control and sub plotting. After sending the ASCII code for the plotting information to the survey robot over bluetooth, the micro controller successfully deciphered the code, and the sub plotting was completed. When calculating the distance measured, there was a 3% inaccuracy, and when calculating the area measured, there was a 6% error.

CHAPTER 4

HARDWARE AND SOFTWARE REQUIREMENTS

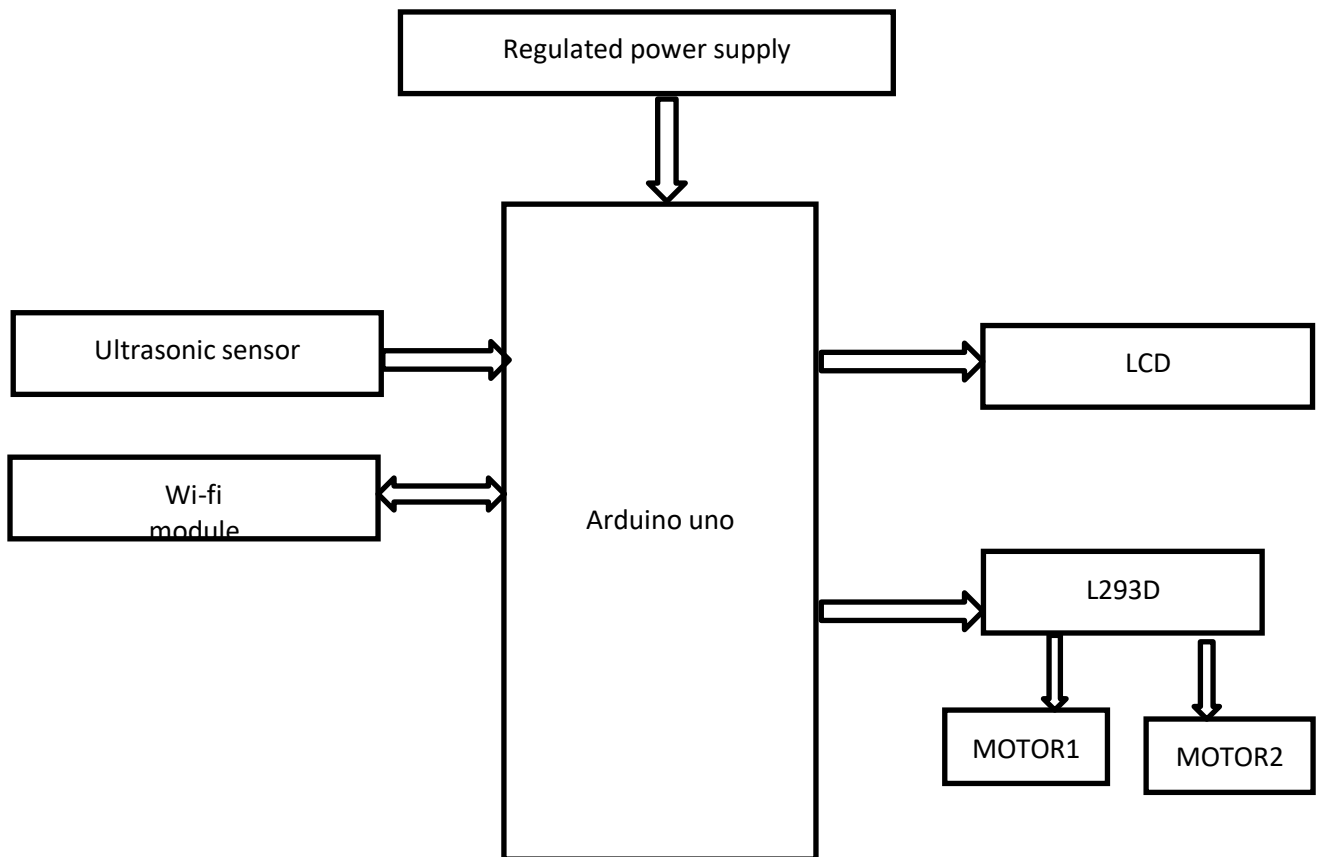


FIG 4.1 BLOCK DIAGRAM

Hardware requirements:

- Power supply
- Arduino
- Ultrasonic sensor
- Battery
- Lcd
- L293d driver
- Motor

4.1 Power supply:

In all the electronic applications, the input AC voltage should be converted into a DC voltage with the same value and degree of stabilization. In these basic setups, the maximum voltage across the load is equal to the maximum value of the AC voltage delivered by the transformer's secondary winding. In Most of the applications, the output ripple produced by circuits is too high. They are, nonetheless, sufficient for some tasks, such as controlling small motors or lights. When a filter capacitor is placed after the rectifier diodes, the output voltage waveform is substantially improved.

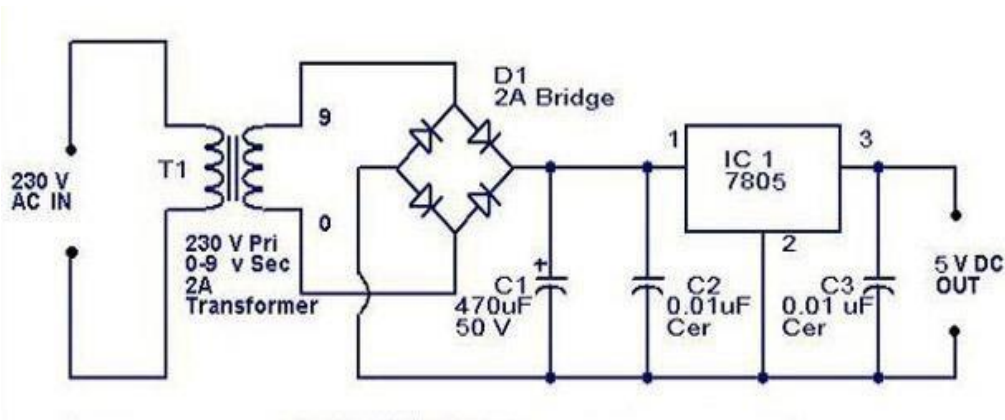
If the slope of the line increases then automatically current increases, lowering point c. As a result, the diode conduction time (c-d) increases, which increases ripple. The DC output voltage is equal to the rectified AC voltage's peak value when there is no load current. The graphic shows how to generate both positive and negative outputs with the same common ground. They come in handy for estimating voltage ripple for a particular load current and filter capacitor value. The voltage ripple which results in proportional to the load current and inversely proportional to the value of filter capacitor. +

The above-mentioned circuits' level of stability is usually insufficient, necessitating the employment of a stabiliser circuit. This circuit is widely used to boost the output current by applying a reference voltage to the base of a transistor or the input of an op amp. The simplest basic example of a series regulator is shown in Figure. In this circuit, the transistor is connected as a voltage follower, and the output voltage is around 600-700mV lower than the Zener value.

The resistor R must be dimensioned to ensure that the Zener is appropriately biased and that the base current to Q1 is sufficient. The base current of Q1 is no longer insignificant at large load currents. A Darlington may be used in place of the transistor to prevent the current in the Zener from dropping to the point where effective control is no longer possible. The op amp circuit depicted in Figure is recommended when improved performance is desired. The output voltage of this circuit is equal to the reference voltage provided to the op amp's input. Higher currents can be achieved with the use of an appropriate output buffer. Zener diode is connected in parallel with the variable divider and its wiper to the op amps, the output voltage of the Figure 14 circuit may be changed. The design of stabilized supplies has been simplified dramatically by the introduction of voltage regulator

ICs which provide a very constant output and use as current limiter such and thermal protection functions are as the L78xx and L79xx. Regulated power supply is mainly used to providing

4.2: Circuit diagram of regulated power supply section



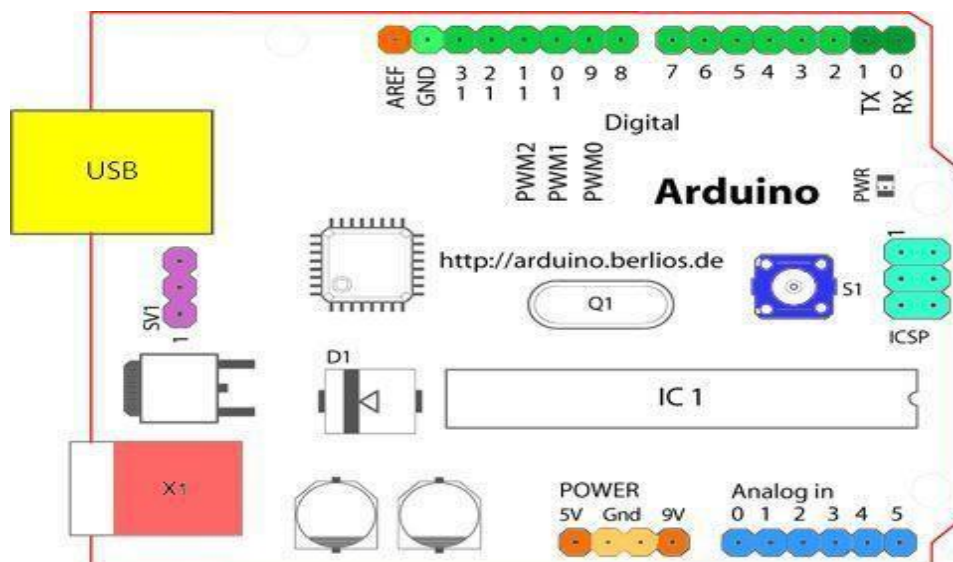
(1) AC Input: this is the main supply where we give for whole equipment and we get it from the public utility and after giving the supply device will be energized. It is also supplied directly to the relay contacts in the device which connects the load to the supply when the supply is within 200V – 240V range.

(2) Step down transformer: here we are using step down transformer to reduce the voltage to 5v on the secondary side. Therefore it becomes 230/5 v transformer. If we change any voltage levels in primary side there will also a change in secondary. So any fluctuations in the input are also reflected as a fluctuation in the output.

(3) Rectifier: a center tapper transformer is used to convert the AC voltage into pulsating DC with four diodes to become a full wave rectification, followed by a filter consisting of a capacitor to filter out (smooth) the pulsation. A sample of the output voltage is provided to the microcontroller after rectification and smoothening. This voltage is unregulated, hence it fluctuates with the input mains voltage. The transformer was developed and the windings were chosen such that the device could sense and tolerate input mains voltage up to 600Vac, since the system was meant to avoid overvoltage.

4.2 Arduino:

The Arduino is a series of microcontroller boards that make electrical design, prototyping, and experimenting easier for artists, hackers, hobbyists, and many professionals. It's been used to create new digital music instruments and a system that lets your house plants tweet you when they're dry. The ATmega microcontroller is a single-chip computer with a CPU, RAM, Flash memory, and input/output connectors. Arduinos (we use the basic Arduino Uno) are based on it. It differs from the Raspberry Pi in that it can link to a wide range of sensors, LEDs, miniature motors and speakers, servos, and other devices. directly to these pins, which can read and output digital and analogue voltages in the 0-5 volt range. The Arduino connects to your computer through USB, and you programme it in a simple language (C/C++, which is similar to Java) by uploading your compiled code to the board using the Arduino IDE, which is available for free. The Arduino may work with or without a USB connection to your computer once configured, requiring simply power and no keyboard or screen.



4.3 Figure Structure of Arduino Board

4.2.1 Arduino Board

This is an outline of what you will see if you look at the board from the top down

Starting clockwise from the top center:

- Orange colored pins are the analog pins
- Light green colored pins are the digital pins
- Digital pins are marked from 2-13
- S1 is the reset button which is marked in dark blue
- In-circuit Serial Programmer (blue-green)
- light blue colored pins are the analog In pins from 0-5
- orange and light orange are the power and ground pins
- External Power Supply In (9-12VDC) - X1 (pink)
- Toggles External Power and USB Power - SV1(purple)
- USB (used for uploading sketches to the board and for serial communication between the board and the computer; can be used to power the board) (yellow)

4.2.2 Digital Pins

- There are some main function listed below, the pin Mode (), Digital Read (), and Digital Write () instructions may be used to utilize the digital pins in the Arduino board for general purpose input and output. When a pin is used as an input, it has a built-in pull-up resistor that will on and off using the digital Write () command (with a value of HIGH or LOW, respectively). 40 milliamperes is the maximum current per pin (mA).
- **Serial: 0 (RX) and 1 (TX).** This device receives (RX) and sends (TX) TTL serial data. The corresponding pins on the FTDI USB-to-TTL Serial chip are connected to these pins on the Arduino Diecimila. They are connected to the Arduino BT's analogous pins for the WT11Bluetooth module. For the Arduino Mini and Lily Pad Arduino, they are meant to be utilised with an external TTL serial module (Eg: the Mini-USB Adapter).
- **External Interrupts: 2 and 3.** These pins can be configured to produce an interrupt on a low value, arising or falling edge, or a change in value. See the attach Interrupt () function for further information.
- **PWM: 3, 5, 6, 9, 10, and 11** The analogue Write () method generates an 8-bit PWM signal. PWM output is only accessible on pins 9, 10, and 11 on ATmega8 boards.
- **BT Reset: 7.** (Arduino BT-only) Connected to the reset line of the bluetooth module.
- **SPI: 10 (SS), 11 (MOSI), 12 (MISO), 13 (SCK).** These pins provide SPI communication, which is supported by the underlying hardware but not yet supported by the Arduino language.
- **LED: 13.** Digital pin 13 of the Diecimila and Lily Pad is connected to a built-in LED. When the pin has a HIGH value, the LED is turned on, and when the pin has a LOW value, the LED is turned off.

4.2.3 Analog Pins

According to the features of analog pins the main working is listed below, used for 10-bit analog-to-digital conversion (ADC) through the analogue Read () function. The most of the analogue inputs can be used as digital pins: digital pin 14 for analogue input 0, digital pin 19 for analogue input 5, and so on. The analogue inputs 6 and 7 of the Mini and BT are not usable as digital pins.

Power Pins:

The Arduino board's input voltage when using an external power supply (as opposed to 5 volts from the USB connection or other regulated power source).

If power is supplied via the power jack, this pin can be used to supply or access voltage. It's also worth mentioning that the Lily Pad doesn't have a VIN pin and can only take regulated input. A 5V regulated power supply powers the CPU and other components on the board.

This can come from VIN or another controlled 5V source, or it can come from USB or another regulated 5V supply.

- **3V3** (Diecimila-only) :A 3.3 volts of supply will be generated from the FTDI chip.
- **GND:** these are the Ground pins.

Other Pins

- **AREF:** Reference voltage for the analog inputs. Used with analog reference().
- **Reset:** (Diecimila-only) Bring this line LOW to reset the microcontroller. Typically used to add a reset button to shields which block the one on the board.

.

4.3 Ultrasonic sensor:

Ultrasonic sensor is a device which is used to detect the objects in front of the robot. It produces a waves that can travel through the air and the waves can be returned to the sensor. There are two module in it one is to transfer the waves and the another one is to receive the transmitted waves.



4.4 ultrasonic sensor

The transferred waves can be travelled through any medium like air, solid, liquid and gases. Depending on the medium the waves will be generated and sent. These waves can be travelled at various speed at different medium.

Laws of physics for sound waves

Sound waves have a distinct frequency, or number of vibrations per second. Noises in the 20Hz to 20KHz frequency range can be heard by humans. Ultrasonic detection, on the other hand, normally employs a frequency range of 100 KHz to 50 MHz. The velocity of ultrasound in a medium remains constant at any given time and temperature.

4.3.1 Transducers for Wave Propagation and particle detection

To send sound waves and receive echo, ultrasonic sensors, also known as transceivers or transducers, will be employed. They work in the same way as radar, transforming electrical energy into mechanical energy in the form of sound and back.

Transducers such as contact transducers, angle beam transducers, delay line transducers, immersion transducers, and dual element transducers are all common. Contact transducers are commonly used to locate cavities and fractures on a part's exterior surface, as well as to measure distances.

The Delay line transducers are the single element longitudinal wave transducers they are used in conjunction with a changeable delay line. One of the advantages of employing a delay line transducer is the possibility to improve near-surface resolution. The delay allows the element to cease vibrating before the return signal from the reflector is received.

How Ultrasonic Sensors Work.

The frequency that produces from sensor is very higher than the human hearings. transducers are often used to receive the sound waves. Many other sensors like ultrasonic sensors use a transducer to produce a pulse and receive echo. These sensors will measure the distance between the transmitted and received waves of ultrasonic pulse.

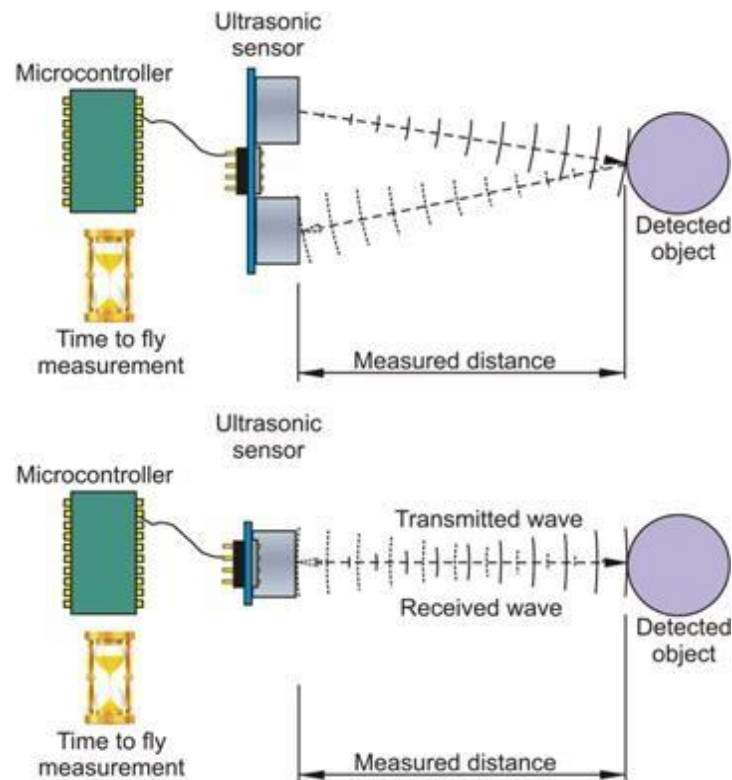


Fig 4.4 working model of ultrasonic sensor

4.3.2 Why use an ultrasonic sensor?

Ultrasound can be used in indoors and outdoors it will not depend upon the state of purpose. Ultrasonic sensors can overcome collision avoidance and constant movement as long as the robot isn't travelling too quickly. Ultrasonics may be found in difficult sensing applications like, water level sensing applications, drone applications, and automotive sensing applications at your local drive-thru restaurant or bank since they are so frequently used. As collision detection devices, ultrasonic rangefinders are often used.

Ultrasonic sensors can be used in various ways:

- Presence
- Level
- Position
- Distance

contactless sensors are also referred as proximity sensors.

These sensors are Independent of :

- Light
- Smoke
- Dust
- Color

Applications Involving Ultrasonic Detection

Ultrasonic Distance Measurement

Ex. While parking a vehicle in the garage it will be help full, sensing when a vehicle is drafted completely into a garage.

4.4 Lcd:

The LCD Module is used to display correct messages. Analyzing Directors use a clever two-line LCD display with 16 letters per line. The following is the outcome of the (handshake) presentation session. RS, RW, and EN pins are merely control rods and anchors, thus + 5V, - 5V, and GND should be provided to feed, even if D0 to D7th bit are data lines. The Select Register is RS, the Read Write is RW, and the EN pin Allow is EN.

The most popular type t LCD regulator is a HITACHI 44780 that provides a visual interface in the middle controller and LCD. These LCDs are very easy to work with regulator as they have financial knowledge

The LCD requires three control lines (RS, R / W and EN) and 8 (or lines of information. The number in the information lines depends on the operating system. Whenever it works in 8-bit mode and then 8+ information lines and three control lines for example 11 lines are required. In addition, whenever a 4-bit mode is used and then 4+ information lines and three control. lines for example 7 lines are required. How can we choose which mode to use? It is straightforward with the possibility that you have enough information lines to go in 8-digit mode and if there is a binding time.

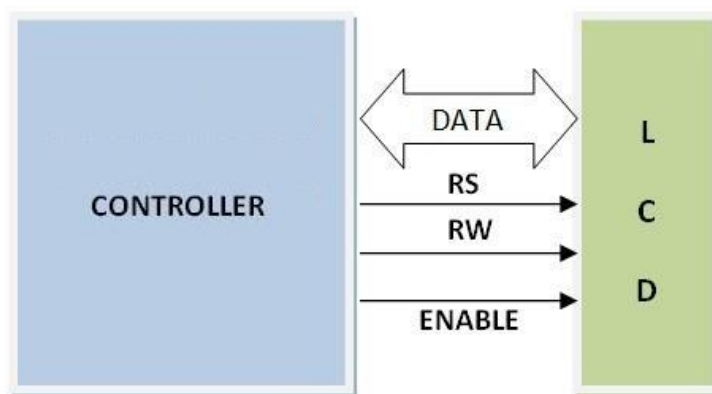


Figure 2.10: 2x16 Line Alphanumeric LCD Display

4.5 Figure

The ENABLE pin is used to link existing information to information pins.

A low-level signal is needed to connect the data. LCD deciphers also make our order right now the EN line is dropped down. If you do not lower EN, your lead will never be implemented.



i. Description:

This is the 16th feature in the 2-line display. Dark content on Green foundation. It uses the same HD44780 optical chipset. Interface code is clearly accessible. We will need 11 standard I / O pins to connect to this LCD screen. Includes LED backlight.

ii. Pin:

Most LCDs with 1 controller have 14 pins and LCDs with 2 regulators with 16 pins (two pins are added to both LED backlights). The display of the pin appears in the table below.



Figure:4.6 LCD Background

4.4.1 LCD BACKGROUND:

Fortunately, there is a widely used standard that allows us to communicate with various LCDs that are unconcerned about their manufacturer. The HD44780U standard is named after the controller chip that accepts data from an external source (8051) and communicates with the LCD directly.

Pin No.	Name	Description
Pin no. 1	VSS	Power supply (GND)
Pin no. 2	VCC	Power supply (+5V)
Pin no. 3	VEE	Contrast <u>adjust</u>
Pin no. 4	RS	0 = Instruction input 1 = Data input
Pin no. 5	R/W	0 = Write to LCD module 1 = Read from LCD module
Pin no. 6	EN	Enable signal
Pin no. 7	D0	Data bus line 0 (LSB)
Pin no. 8	D1	Data bus line 1
Pin no. 9	D2	Data bus line 2
Pin no. 10	D3	Data bus line 3
Pin no. 11	D4	Data bus line 4

i.Circuit Description:

The software shown above is extremely simple. Control Port is a producer of open source / open channels. While several of the ports have internal pull-out pins, there isn't much that isn't present. As a result of combining two 10K external pull-outs, the circuit is more compatible with a broader range of PCs, some of which may not be compatible.

Pin No.	Name	Description
Pin no. 1	D7	Data bus line 7 (MSB)
Pin no. 2	D6	Data bus line 6
Pin no. 3	D5	Data bus line 5
Pin no. 4	D4	Data bus line 4
Pin no. 5	D3	Data bus line 3
Pin no. 6	D2	Data bus line 2
Pin no. 7	D1	Data bus line 1
Pin no. 8	D0	Data bus line 0 (LSB)
Pin no. 9	EN1	Enable signal for row 0 and 1 (1 st controller)
Pin no. 10	R/W	0 = Write to LCD module 1 = Read from LCD module
Pin no. 11	RS	0 = Instruction input 1 = Data input

4.4.3 INTERFACING LCD WITH AN ARDUINO

A wiring circuit for connecting an LCD to an Arduino to display a text message as shown above. The RS pin on the LCD module is to be connected to digital pin 12 on the Arduino. The R/W pin on the LCD is grounded. The enable pin on the LCD module is connected to digital pin 11 on the Arduino. In this project, the LCD module and Arduino are linked in 4-bit mode. There are just four digital input lines available (DB4 to DB7 of the LCD are used). This method is simple, requires fewer connections, and allows you to almost completely utilise the LCD module's capabilities. The Arduino's digital pins 5, 4, 3, and 2 are linked to the digital lines DB4, DB5, DB6, and DB7. The 10K potentiometer is used to adjust the contrast of the display. The 560ohm resistor R1 limits the current flowing through the rear light LED. The Arduino may be powered through the board's external power connector. The Arduino board's 5V supply may be used to provide the +5V necessary in other parts of the design. The Arduino can alternatively be powered by a PC through USB.

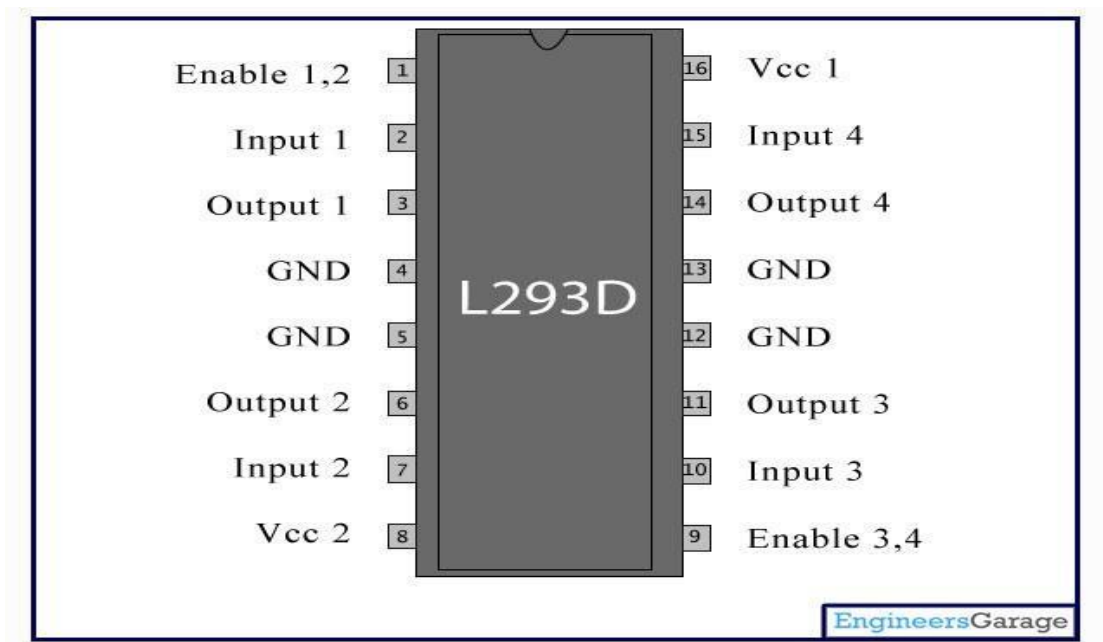
4.5 L293d driver:

The L293D is a motor driver used for IC and can give or receive the commands from the main part, capable of driving a DC motor in either direction. The L293D is a 16-pin IC it can control two DC motors at a time in any direction. It means that a single L293D IC may control two DC motors at the same time. Dual H-bridge motor drivers integrated circuit (IC).

The l293d can drive small and quiet big motors as well, check the Voltage Specification at the end of this page for more info.

Concept:

It's built on the concept of an H-bridge. The H-bridge is a two-way current flow circuit. H-bridge ICs are ideal for regulating DC motors since voltage must change direction to drive them in either a clockwise or anticlockwise way.



Two H-bridge circuits are used on a single L293D chip that can independently rotate two dc motors. Because of its compactness, it is frequently used in robotic applications to operate DC motors. Below is a pin schematic for an L293D motor controller.

TIP: by connecting the pin16 VCC (5v) to pin 1 and pin 9 to make them high.

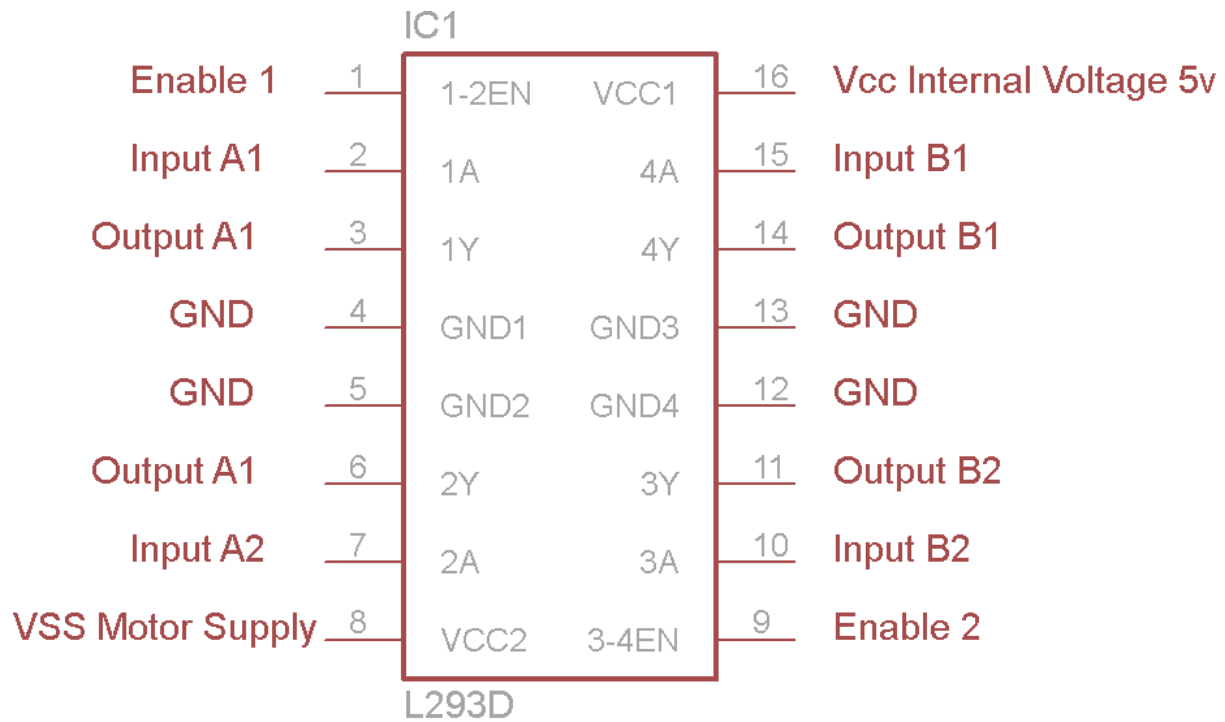


Fig 4.6 block diagram of L293D driver www.rakeshmondal.info

4.6 Working of L293D

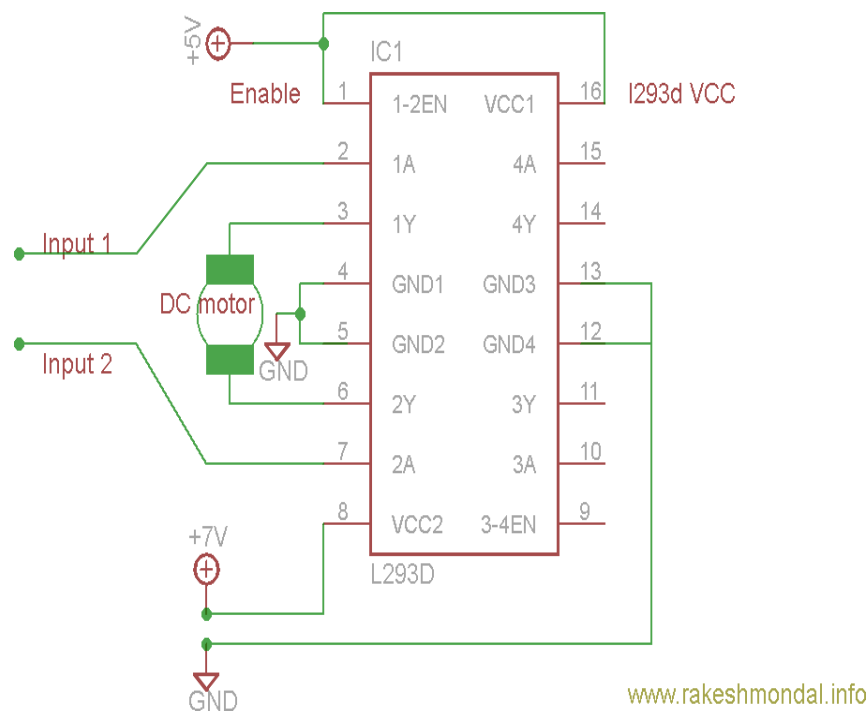
As a part of pin diagram there are 4 input pins two are located on the right and another two are on the left. Right side pins are used to handle the right hand of motor and while other pins are used to handle left side. The motors rotate in response to LOGIC 0 or LOGIC 1 inputs sent through the input pins.

L293D Logic Table.

Let's consider if the Motor is connected to left side of output pins (pin 3,6). For rotating the motor in clockwise direction the input pins has to be provided with Logic 1 and Logic 0.

- Pin 2 = Logic 1 **and** Pin 7 = Logic 0 | Clockwise Direction
- Pin 2 = Logic 0 **and** Pin 7 = Logic 1 | Anticlockwise Direction
- Pin 2 = Logic 0 **and** Pin 7 = Logic 0 | Idle [No rotation] [Hi-Impedance state]
- Pin 2 = Logic 1 **and** Pin 7 = Logic 1 | Idle [No rotation]

In a very similar way the motor can also operate across input pin 15, 10 for motor on the right hand side.



Voltage Specification

VCC is the voltage that it needs for its own internal operation 5v; L293D will not use this

voltage required to drive the motor. It features a separate facility to offer motor supply VSS for operating the motors (V supply). This will be used by L293d to operate the motor. It implies that if you wish to run a motor at 9V, you must deliver 9V via the VSS Motor supply.

The maximum voltage for VSS motor supply is 36V. It can supply a max current of 600mA per channel. Since it can drive motors Up to 36v hence you can drive pretty big motors with this l293d.

VCC pin 16 is the voltage for its own internal Operation. The maximum voltage ranges from 5v and upto 36v.

4.7 Motor:

Although this sort of DC motor is great for battery-powered toys (such as model trains, radio-controlled autos, or electric shavers), it is not commonly seen in household devices. Universal motors, which can function on either AC or DC power, are commonly used in small appliances like coffee grinders and electric food blenders. Unlike a typical DC motor, a universal motor employs an electromagnet instead of a permanent magnet and is powered by the DC or AC current you provide:

- When DC is fall into the electromagnet, it acts as a regular permanent magnet, producing a magnetic field which constantly points in the same direction. Every time the coil flips over, the commutator reverses the coil current, exactly like in a simple DC motor, ensuring that the coil spins in the same direction.
- When you feed in AC, however, the current going through the electromagnet and the current flowing through the coil both reverse, perfectly in step, resulting in a force on the coil that is always in the same direction and the motor spinning clockwise or counterclockwise. Isn't there a commutator somewhere? Because the field and current are constantly in phase, it doesn't matter what position the commutator is in at any one time because the frequency of the current varies far quicker than the motor turns.

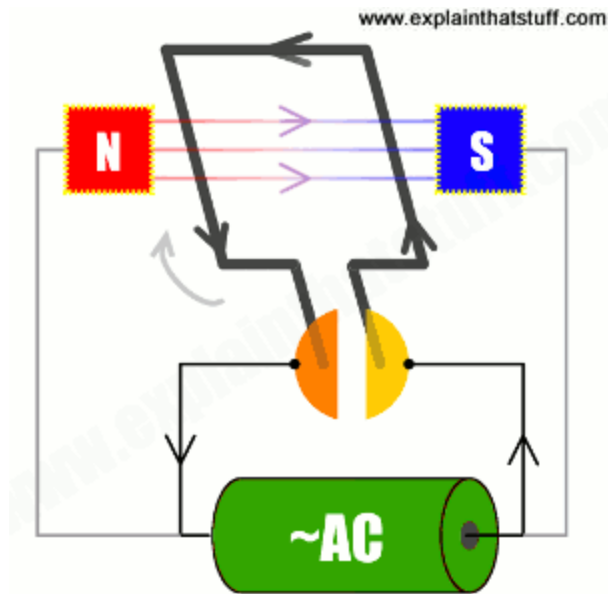


Fig 4.7 motor

There are two ways to cope with this problem. An alternating current, which is an electric current that occasionally reverses direction, is one alternative (AC). Adding a commutator to the coil ends is a preferable method for small, battery-powered motors like the ones we use around the house. (Don't be put off by the technical word; "commutation" sounds a lot like "commute.")

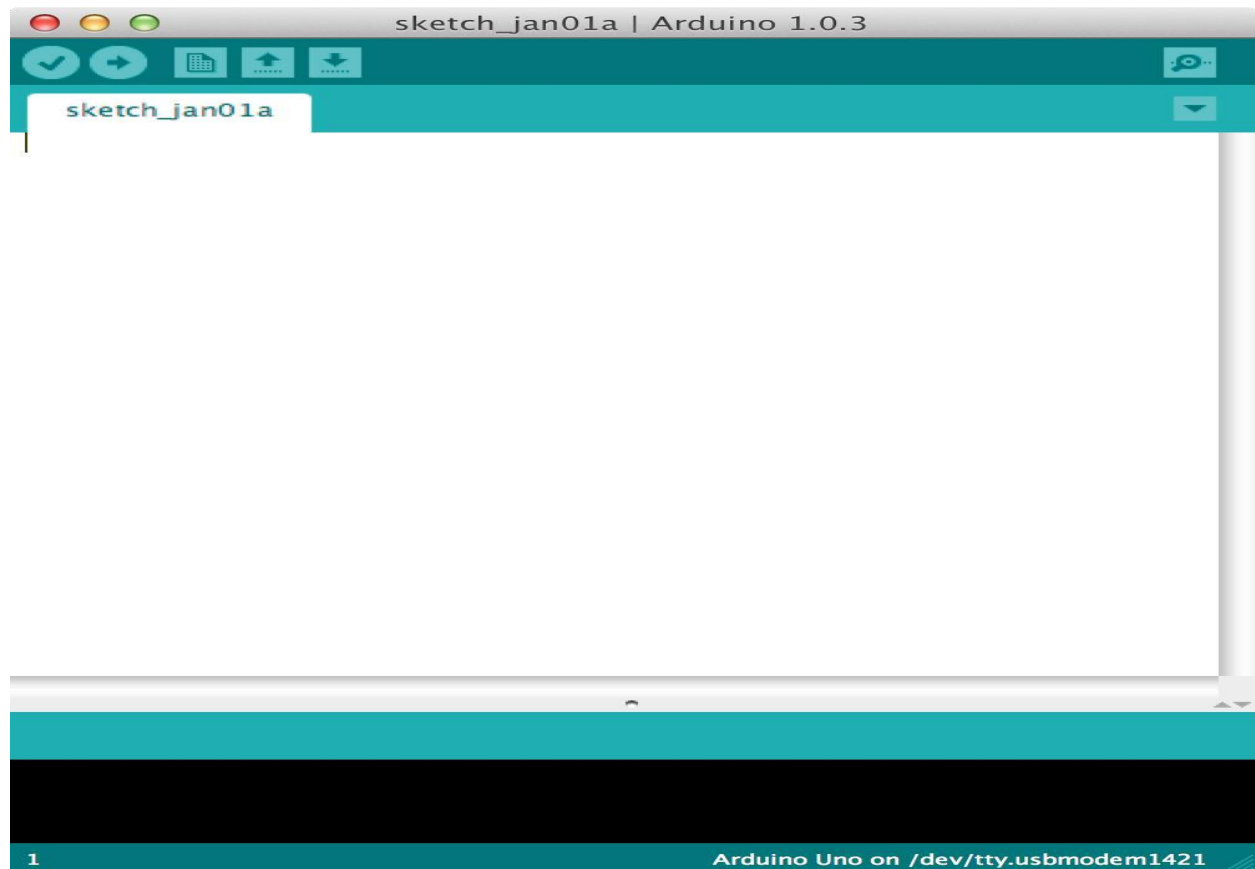
It just implies switching back and forth, similar to how commuting means travelling back and forth.) The commutator is a two-part metal ring that has the purpose of reversing the electric current in the coil every time the coil rotates half a turn. One end of the coil is attached to either side of the commutator. The electric current from the battery is linked to the motor's electric terminals.

4.8 Software requirements:

Download Arduino Software

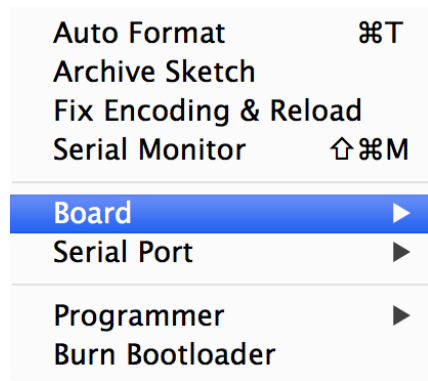
We need to download the Arduino software package to go to the Arduino page

After opening the downloaded software it used to be look like this:



The Initial Setup

We need to select the **Tools** menu and select **Board**.



Tools Menu < Board

Then which type of Arduino you are going work on you can select here, we are using Arduino uno.

✓ Arduino Uno

Arduino Duemilanove w/ ATmega328
Arduino Diecimila or Duemilanove w/ ATmega168
Arduino Nano w/ ATmega328
Arduino Nano w/ ATmega168
Arduino Mega 2560 or Mega ADK
Arduino Mega (ATmega1280)
Arduino Leonardo
Arduino Esplora
Arduino Micro
Arduino Mini w/ ATmega328
Arduino Mini w/ ATmega168
Arduino Ethernet
Arduino Fio
Arduino BT w/ ATmega328
Arduino BT w/ ATmega168
LilyPad Arduino USB
LilyPad Arduino w/ ATmega328
LilyPad Arduino w/ ATmega168
Arduino Pro or Pro Mini (5V, 16 MHz) w/ ATmega328
Arduino Pro or Pro Mini (5V, 16 MHz) w/ ATmega168
Arduino Pro or Pro Mini (3.3V, 8 MHz) w/ ATmega328
Arduino Pro or Pro Mini (3.3V, 8 MHz) w/ ATmega168
Arduino NG or older w/ ATmega168
Arduino NG or older w/ ATmega8

4.8.1 The Code

The code we are writing for our Arduino is are known as **sketches**. It can be written written in **C++**.

Each and Every sketch need to have two *void type functions*, `setup()` and `loop()`. It do not return any value.

The `setup()` method can run once after the arduino gets power source and the `loop()` method will run continuously afterwards. The `setup()` is where you want to do any initialization steps, and in `loop()` you want to run the code you want to run over.

So, your program will be look like this:

```
1
2
3 void setup()
4 {
5 }
6 void loop()
7 {
8 }
9
```

So, if you notice on the to right corner you can able to see **headers**. It make the process easy to connect all components to the Arduino. Where all are connected is called **pins**.

Note down the pin numbers which are next to the headers on the

board in white. We need to control the LED on pin 13.

In our code above the `setup()` method create a variable called `ledPin`. In C++ weneed to state why type our variable is beforehand, in this case it's an integer, so it's of type `int`.

```
int ledPin = 13;
void setup()
{
}
void loop()
```

```
{  
}
```

Each line is must be ended with a semicolon (;).

In the `setup()` method we need to set the `ledPin` to the output mode. We do this by calling a special function called `pinMode()` which takes two variables into it, the first the pin number, and second, it may be an input or output pin. Hence we are working with an output so we need to set it to constant called `OUTPUT`. If you were dealing with a sensor or input it would be `INPUT`.

```
1  
2   int ledPin = 13;  
3  
4   void setup()  
5   {  
6       pinMode(ledPin, OUTPUT);  
7   }  
8   void loop()  
9   {  
10  }  
11
```

Next we have to compile the code and add it to the Arduino.

Compiling the Code

If you are doing this for the first time please make sure to plug out your Arduino plugging it in to the computer go to the **Tools** menu, then **Serial Port** and take note of what appears there.

Here's what it looks like before plugging in the Arduino UNO:

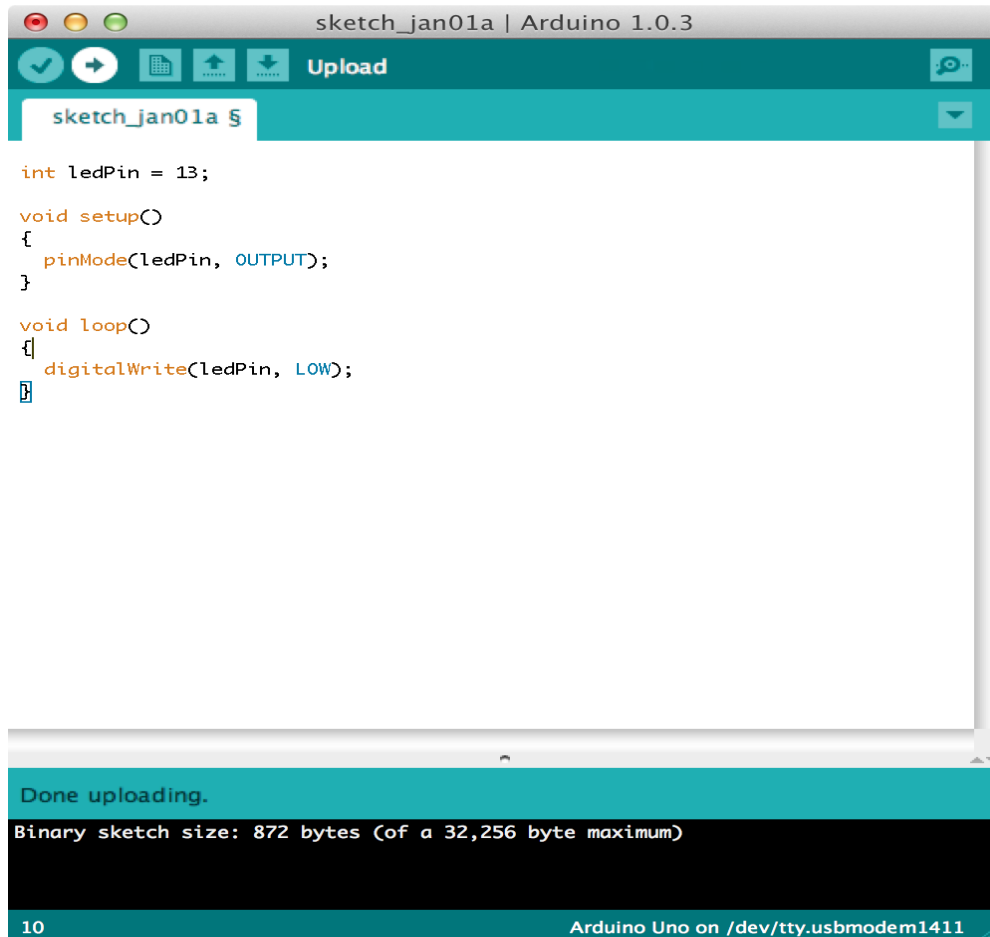
```
/dev/tty.Bluetooth-PDA-Sync  
/dev/cu.Bluetooth-PDA-Sync  
/dev/tty.Bluetooth-Modem  
/dev/cu.Bluetooth-Modem
```

Connect the USB cable to your Arduino board and into your computer. Now go back to the **Tools > Serial Port** menu and you can see 1 new option. On my Mark 2 new serial ports will appear.

```
/dev/tty.Bluetooth-PDA-Sync  
/dev/cu.Bluetooth-PDA-Sync  
/dev/tty.Bluetooth-Modem  
/dev/cu.Bluetooth-Modem  
✓ /dev/tty.usbmodem1411  
/dev/cu.usbmodem1411
```

They *tty* and *cu* are two ways to talk the computers to a serial port. Both are used to work Arduino software so I choose the *tty.** one. You can see *COM on window* followed by a number. Select the new one that appears.

Once you have selected your serial or COM port you can then press the button with the arrow pointing to the right.



```
sketch_jan01a | Arduino 1.0.3
Upload
sketch_jan01a $

int ledPin = 13;

void setup()
{
  pinMode(ledPin, OUTPUT);
}

void loop()
{
  digitalWrite(ledPin, LOW);
}
```

Done uploading.

Binary sketch size: 872 bytes (of a 32,256 byte maximum)

10 Arduino Uno on /dev/tty.usbmodem1411

Once it completed you can see the **TX** and **RX** LEDs below the LED flash. It is the communication between the computer and the Arduino. The **L** may flicker too. Once this program is complete your program should be running. And your LED should will be off. Now let's switch it on using **HIGH** constant.

```
digitalWrite(trigger,HIGH);
```

HAPTER 5

RESULTS AND CODE

5.1 PROGRAM CODE

```
#include <LiquidCrystal.h>

#define trigger 8

#define echo 9

LiquidCrystal lcd(2,3,4,5,6,7);

float time=0,distance=0;

void setup()

{

    Serial.begin(9600);

    lcd.begin(16,2);

    pinMode(trigger,OUTPUT);

    pinMode(echo,INPUT);

    lcd.print(" Ultra sonic");

    lcd.setCursor(0,1);

    lcd.print("Distance Meter");

    delay(2000);

    lcd.clear();

}

void loop()

{

    lcd.clear();

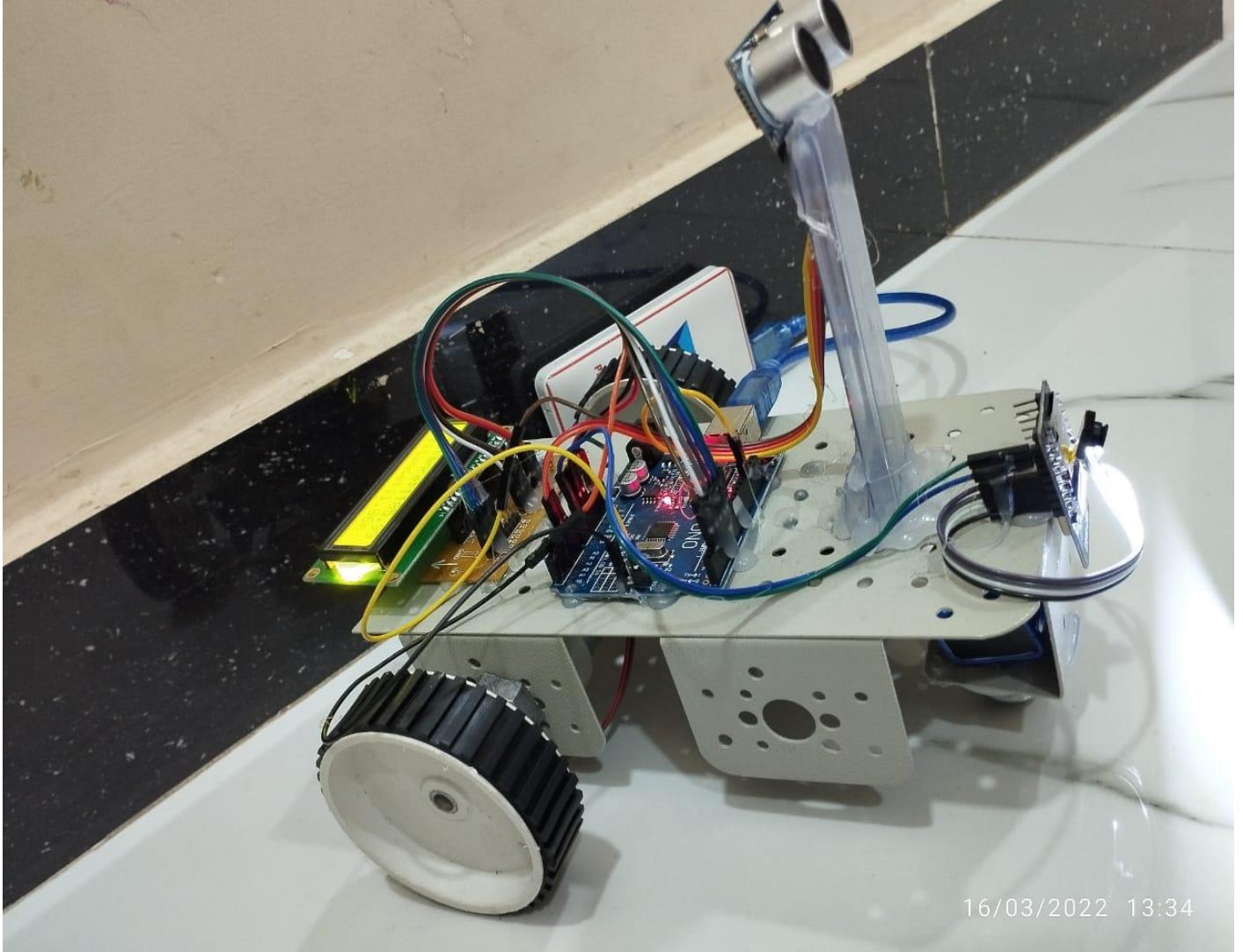
    digitalWrite(trigger,LOW);

    delayMicroseconds(2);
```

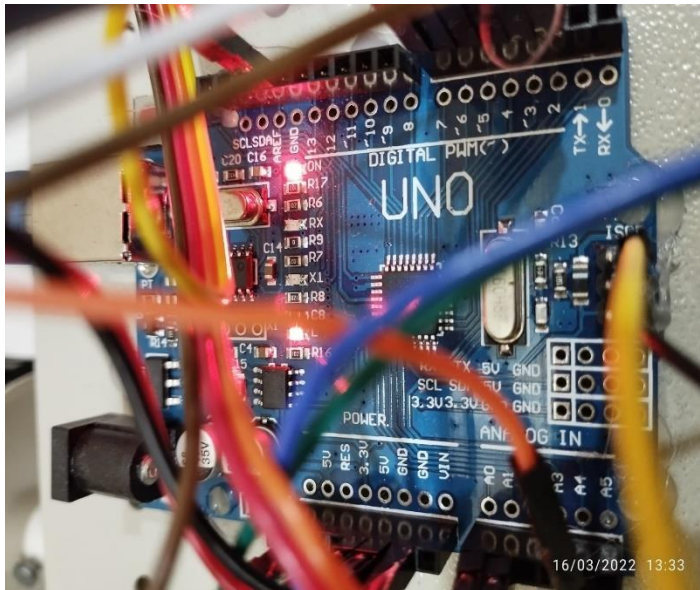
```
delayMicroseconds(10);  
digitalWrite(trigger,LOW);  
delayMicroseconds(2);  
time=pulseIn(echo,HIGH);  
distance=time*340/20000;  
lcd.clear();  
Serial.print("Distance:");  
Serial.print(distance);  
Serial.print("cm..");  
lcd.print("Distance:");  
lcd.print(distance);  
lcd.print("cm");  
lcd.setCursor(0,1);  
lcd.print("Distance:");  
lcd.print(distance/100);  
lcd.print("m");  
delay(500);  
}
```

CHAPTER 6 HARWARE EQUIMENTS

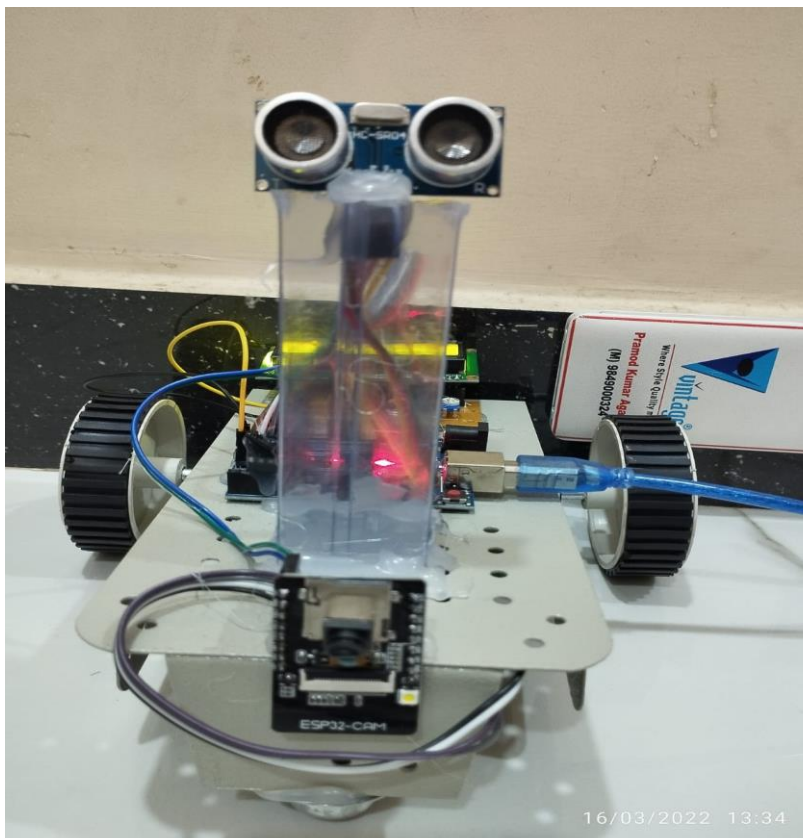
6.1 ROBOT CONNECTIONS:



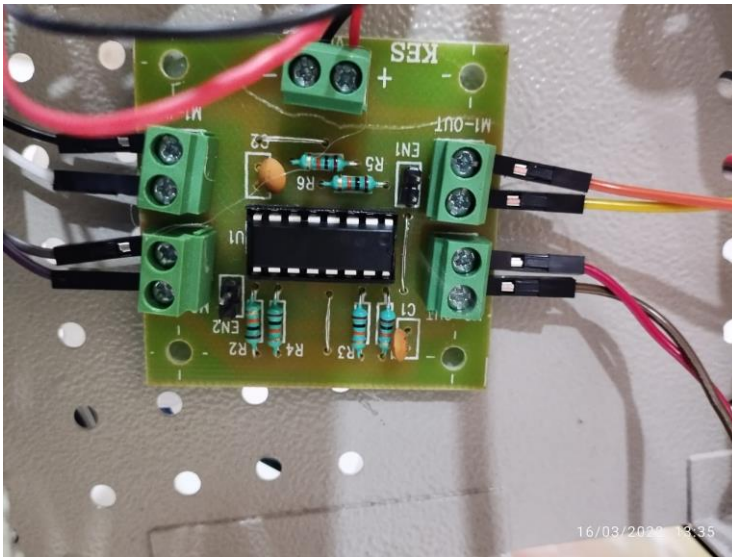
6.1.1 ARDUINO UNO



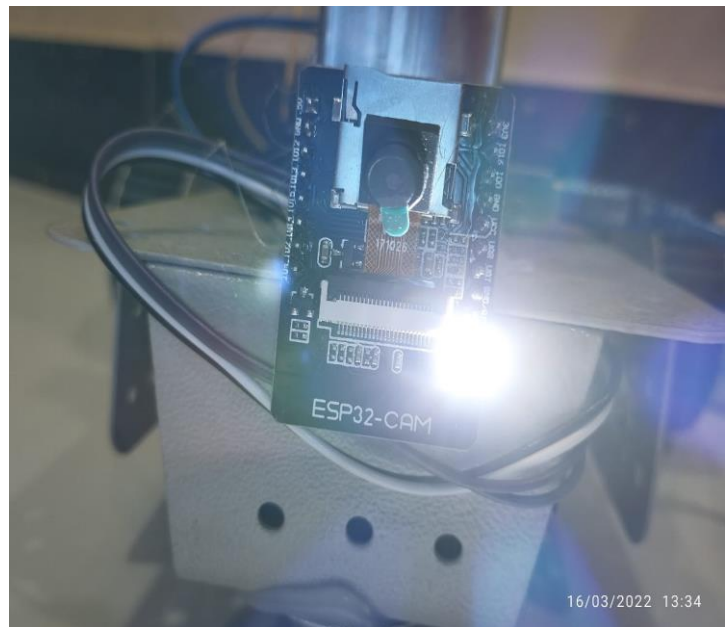
ULTRASONIC SENSOR



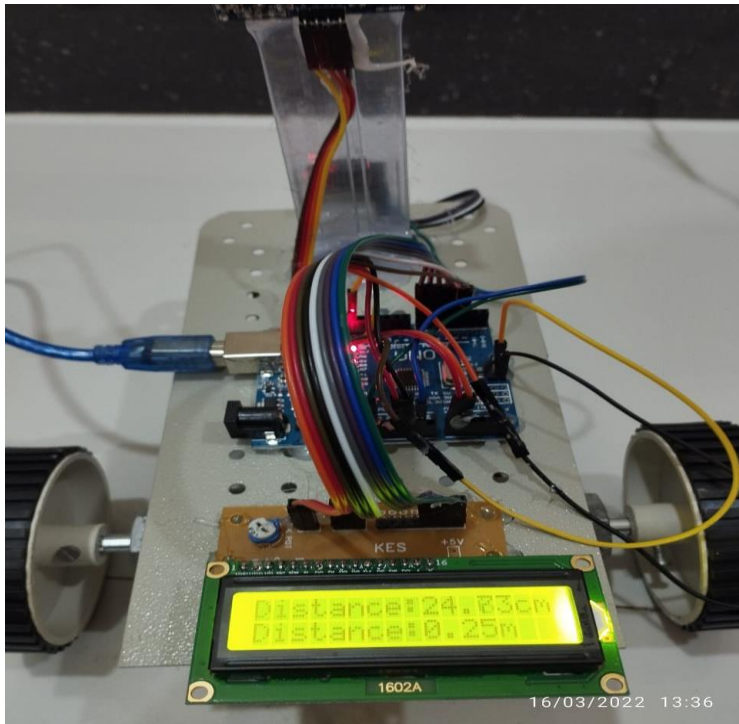
MOTOR DRIVE L293D



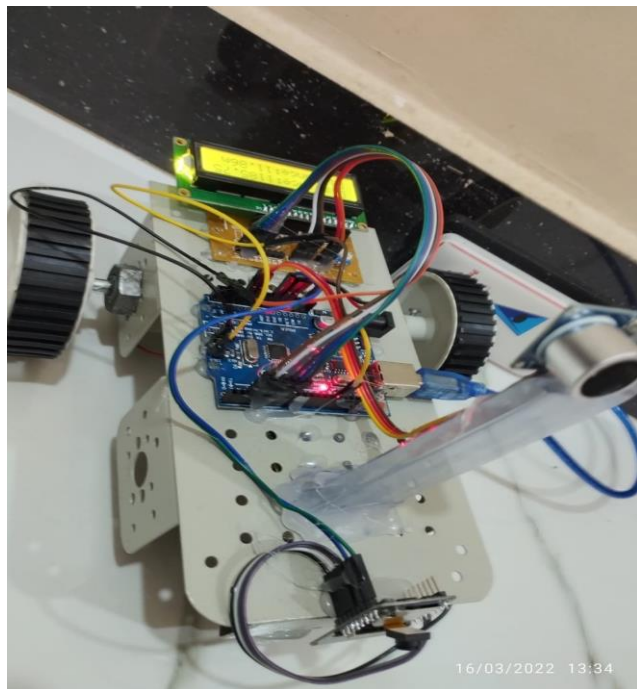
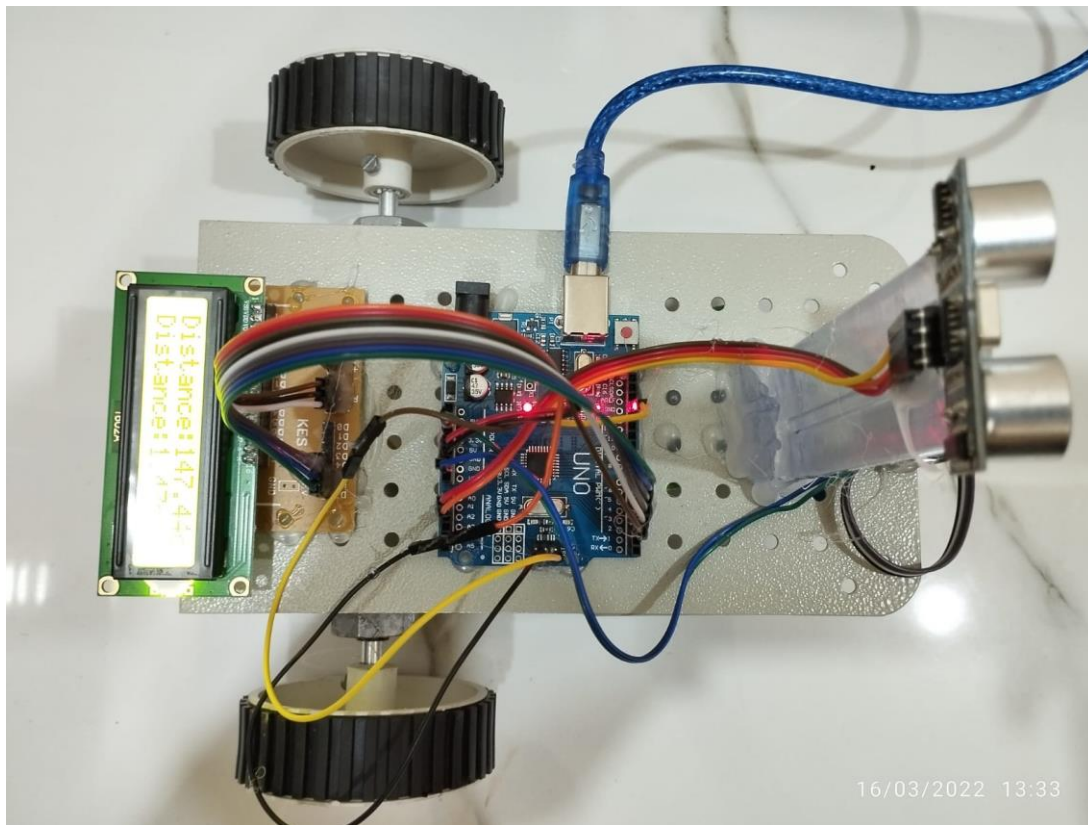
ESP32 CAM



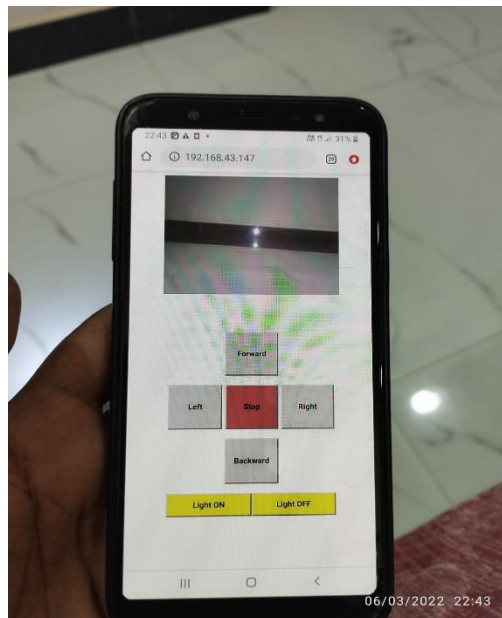
LCD (LIQUID CRYSTAL DISPLAY)



OVERVIEW



BATTERY, MOTORS AND ROBOT CONTROL



IP address for controlling the robot 192.168.43.147

Conclusion:

Here we have an IP address to control the overall robot and we can also handle the robot through our mobile phone. We need to search the IP address in our mobile phone then some of the instructions will appear on the screen for controlling the robot. We can also turn on or off the light which is in front of the robot through that we can able to see if there are any obstacles in front of the robot the ultrasonic sensor detects the objects and send the signals to the Arduino board which can control the overall equipment once the Arduino gets signals it gives commands to the motor drives to move forward, backward or either directions. Through this project we can calculate the smaller areas as well. Even though there are many ways to survey the land this is best method and it's a time saving process and can survey the land very quickly.

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