A Major-Project report

On

AGRICULTURAL PESTICIDE SPRAYING ROBOT

Submitted in the partial fulfillment of the requirements for the awardof the degree of

BACHELOR OF TECHNOLOGY

IN

ELECTRONICS AND COMMUNICATION ENGINEERING

SUBMITTED BY

VANGALI MOUNIKA	**18P61A04L2**
THOTA AJAY	**18P61A04N1**
VALLAMDAS SHIVA	**18P61A04L0**

Under the Esteemed Guidance of

Mr. Md Mohsin Ali

Assistant Professor

VIGNANA BHARATHI Institute of Technology

(Affiliated to JNTU Hyderabad, Approved by APSCHE &AICTE)Aushapur (v), Ghatkesar(m), Medchal Dist, Hyderabad-501301

2018-2022

(Affiliated to JNTU Hyderabad, Approved by APSCHE &AICTE)Aushapur (v),
sGhatkesar(m), Medchal Dist, Hyderabad-501301

2018-2022

CERTIFICATE

This is to certify that the Major Project report **"AGRICULTURAL PESTICIDE SPRAYING ROBOT"** being submitted by **Vangali Mounika(18P61A04L2), Thota Ajay (18P61A04N1), Vallamdas Shiva (18P61A04L0)** in partial fulfillment for the award of the Degree of Bachelor of Technology in ELECTRONICS & COMMUNICATION ENGINEERING to Jawaharlal Nehru Technological University is a record of a Bonafidework carried out by them under my guidance and supervision. The result embodied in this project report has not been submitted to anyother University/Institution for the award of any Degree/Diploma.

INTERNAL GUIDE | **HEAD OF THE DEPARTMENT**

Mr. Md Mohsin Ali | **Dr. U. Poorna Lakshmi**

Assistant professor | **Professor**

EXTERNAL EXAMINER

CANDIDATES DECLARATION

We hereby declare that this Major Project Report titled **"AGRICULTURAL PESTICIDE SPRAYING ROBOT"** submitted by us to the Department of **Electronics and Communication Engineering,** VBIT, Aushapur, Under JNTUH, is a Bonafide work undertaken by and it is not submitted to any other University or Institution for the award ofany degree or diploma.

By

VANGALI MOUNIKA 18P61A04L2

THOTA AJAY 18P61A04N1

VALLAMDAS SHIVA 18P61A04L0

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At the outset we sincerely thank God for having got our Major project report completed in time. Firstly we would thank our parents who have been a motivating factor throughout our lives. Secondly we sincerely thank our principal **Dr. PVS Srinivas** and our Head of the department **Dr. U. Poorna Lakshmi** for their kind cooperation and Encouragement for the successful completion of Project work and providing the necessary facilities.

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By

VANGALI MOUNIKA 18P61A04L2

THOTA AJAY 18P61A04N1

VALLAMDAS SHIVA 18P61A04L0

ABSTRACT

Pesticide spraying is considered a very important activity in farming and from many years this activity has claimed a lot of lives. Nowadays the farmers are playing the crucial role by working hard in the agriculture lands and planting the crops for the societies living in different regions for earning their minimum needs. In India the pesticide usage is higher which 70% is whereas the world-wide pesticide usage is 44% only. Air is getting polluted by using these pesticides. This is the major problem in agriculture. For this, a robot is developed to spray the pesticides by its own and it is less harmful to the environment. The project is under wireless sensor network. The application of wireless sensor network agricultural, Bio- medical, Environmental etc. This bot will help the farmers very effectively. This bot will spray the pesticides over entire the crop with the help of mobile phones. This bot can be easily controllable. The bot sprinkles the pesticides covering all plants in the farm. This will use in pest control and disease prevention application forms. By using this bot, the time and work of the farmer will be reduced. The main component of the circuit is Arduino UNO controller and it is also known as Heart of the robot. A driver circuit is connected to Arduino, which is used for the movement of the robot. A pesticide pump is also used for transferring of liquid pesticide to the sprayer head from the storage tank. The output unit consists of direction control unit whichis used for controlling the directions via wirelessly. As per our directions, the spraying unit will spray the fertilizers to the plants. Hereby, it is concluded that the machine learning and image processing is very much useful to reduce the plant diagnosis disease. With the help of this system, the diseases in plant and leaves are removed by spraying the pesticides. Since, this machine is operated with the help of mobile and the distance between farmer and plants is high, the farmer will not get effect by any disease and this machine is user-friendly also. In future if any upgrade is required in this machine, the solar power source can also be implemented.

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CHAPTER 1

INTRODUCTION

Agriculture is considered as backbone of Indian Economy as about 25% population of India is directly attached to Farming. Farming involves a lot of activities from Preparation of the farming land till selling of farm products. Spraying pesticides is required to keep the corps safe from the insects. While spraying pesticides farmers inhale pesticides which is hazardous totheir health. According to the Government of India in 2015 only, around 6800 people died due to accidental intake of pesticides. In these days in agriculture industry the main problem is less yield and pesticides are not sprinkled in entire crop which leads to less income in fields. India occupies the first position in the agriculture sector and it contributes the 18% of the gross domestic product (GDP) of the country. So, it plays an important role in the entire process of the Indian Economy. Other than this so many things that will affect the crops. To get rid of getting sick and affecting by so many diseases by using gloves while spraying pesticides in the fields and other lot of safety measurements. In this case the robots are playing the vital role. Autonomous Pesticide Spraying Robot is the engineering solution by spraying the high toxic chemicals for the defected plants at exact location of the plant by taking all the health hazards and saves the farmer from the prevention of harm chemicals with in a confined space.

The Robots will do many operations when compared to human beings, because it can perform many operations at a time where human being can't. The bot used in this will do operation like Spraying the Pests, Water, Seeding, Ploughing, and it can also cut the Grass scanning, defecting the waste plants and within less time it can cover entire crop. This system will work under even in unstable conditions. When the vehicle is passed by any obstacles it will identify it and immediately intimate to us. This bot helps farmers while sprinkling pesticides over the crops with a specified dosage. This bot will move in any direction like front, backward, left and right sides also. It is mainly proposed for reducing Manual farming techniques, which is useful for society. To increase the yield also. It requires very less space.

The system is basically divided into two important sections - First part is referred as user section and second important part is the robot section. The first part consists of a laptop or mobile

device for the purpose of communication with the second part i.e. robot section. Hence a Laptop computer or a mobile phone will make the user section more handy and portable when compared to those that use a typical bulky computer system.

Pesticide spraying is considered a very important activity in farming and from many years this activity has claimed a lot of lives. Nowadays the farmers are playing the crucial role by working hard in the agriculture lands and planting the crops for the societies living in different regions for earning their minimum needs. In India the pesticide usage is higher which 70% is whereas the world-wide pesticide usage is 44% only. Air is getting polluted by using these pesticides. This is the major problem in agriculture. For this, a robot is developed to spray the pesticides by its own and it is less harmful to the environment. The project is under wireless sensor network. The application of wireless sensor network agricultural, Bio-medical, Environmental etc. This bot will help the farmers very effectively. This bot will spray the pesticides over entire the crop with the help of mobile phones. This bot can be easily controllable.

The bot sprinkles the pesticides covering all plants in the farm. This will use in pest control and disease prevention application forms. By using this bot, the time and work of the farmer will be reduced. The main component of the circuit is Arduino uno controller and it is also known as Heart of the robot. A driver circuit is connected to Arduino, which is used for the movement of the robot. A pesticide pump is also used for transferring of liquid pesticide to the sprayer head from the storage tank. The output unit consists of direction control unit which is used for controlling the directions via wirelessly. As per our directions, the spraying unit willspray the fertilizers to the plants. Hereby, it is concluded that the machine learning and image processing is very much useful to reduce the plant diagnosis disease. With the help of this system, the diseases in plant and leaves are removed by spraying the pesticides.

Agriculture is humankind's oldest and still important economic activity, providing the food, feeder, fiber and fuel necessary for our survival. The current trend in agricultural robot development is to build more smart efficient machines that reduce the expense of the farmer while still providing one more services and higher quality which is precisely what we have done in this paper. Development of a robot that can perform automated ploughing and seeding operation can be manually navigated by the farmer and stabilizes the humidity in the environment.

The robot starts its function by ploughing the field, then sows the seeds in the ploughed area and ends the process. It uses basic components like DC motors, stepper motor, relay and PSoC as the main controller. The mechanical design of the robot is also simple. It is programmed to carry out the above functions simultaneously. To perform the function of ploughing it is equipped with spiked wheels which are fixed in the anterior end of the robot, to sow seeds it has a container with seeds and its bottom contains a perforation to drop the seed and finally the posterior end of the robot has a sloping metal sheet touching the ground to cover the sown seeds with soil as it moves forward.

Robotics and automation can play a significant role in enhancing agricultural production needs. Automation can be done by man in operations such as pruning thinning and harvesting, as well as mowing, spraying and weed removal. We can also implement with the advancement in sensors and control systems that allow for optimal resource and integrated disease and pest management.

Agriculture is the major provider of employment to people in many parts of the world. But, still there are millions of small and marginal farmers whose awareness levels are low as many live in remote areas. Traditionally field officers visit the fields and interact with farmers in villages and provide them training and advisory on best practices in farming and aspects of agriculture In the current scenario, the government is collecting data about the rainfall, crops production but only in its raw form, and this data is of no use to the end user, that is mainly the farmers. Collecting this raw data, standardizing it, analyzing it, and feeding it to a system that will provide relational trends can be useful to the farmers. The technology in the field of agriculture is developing day-by-day.

Also, a large number of software is being simultaneously developed to educate the farmers with this technological information. Most of them provide static information about farming, they require large number of searching steps to get the accurate information and they don’t provide an interactive way of query and response. The proposed system overcomes the above mentioned drawbacks by providing a user interface, where farmers or any other users can interact effectively to get the desired responses with lesser number of steps This system Agribot is a web application (app), which is a virtual assistant that enables farmers a very portable and handy tool which would both assist them with their farming methods as well as recommend them the best suitable

crop as per given conditions so that they can decide what crops they can grow so as to get maximum yield in a better way. A web app is developed which has a dedicated User Interface for farmers of specific location. The User Interface has various features like crop recommendation, query section, weather forecasting as well as assistance to Kisan helpline centers. There can be an option of choosing local language to communicate with the chatbot in speech format would make app very feasible for use even to the farmers having very low exposure to mobile technology and chatting.

This is basically run with the programmable computer which is run and does the performance and activities automatically. The robotics systems can be done with the integrated systems built inside or it may be done by the external controlling mechanism. It is not mandatory that a robot always looks like a human being. It could be of any form and designing or shape, however, the things in robotics is that it is operated automatically. Robots are applicable in diverse areas and sectors and among these important are include healthcare, business, agriculture, transportation, manufacturing, etc.

Initially in harvesting only the robotics were used but currently, there are more concerns where robotics can be applicable viz. drone for the weed controlling, plant seeding, environmental assessing and monitoring, soil mapping and analysis, etc. Initially, only basic Information Technology tools were common in agricultural practices but in recent past, many technologies are using in agriculture and among these important are Cloud Computing, Big Data, HCI, Usability Engineering, Robotics and AI, etc.

A robotic control system designed for agriculture field applications has four main capabilities: intelligence, recognition, action, and mapping. Soil moisture is an important parameter for controlling the trading of water and heat exchange between the land surface and the climate through dissipation and plant transpiration. Soil moisture sensors evaluate the amount of water in the soil. According to the market analysis companies the growth of the robotics is very increasing and will touch the high very soon. Development of a robot that can perform automated ploughing and seeding operation can be manually navigated by the farmer and stabilizes the humidity in the environment.

CHAPTER 2

LITERATURE SURVEY

2.1 SOLAR E-BOT FOR AGRICULTURE

P.Jothimurugan, J.Muthu Saravanan, R.Sushanth, V.Suresh, H.Siva Subramaniam, S.Vasantharaj., S.Yogeswaran "*Solar E-Bot for Agriculture*"

The main motivation of the project is to do a machine which will be useful in field of agriculture that works on green energy. The idea of applying robotics in agriculture is very new. The agricultural industry is behind other industries in using robot because the sort of jobs involved in agriculture are not straight forward and many repetitive tasks are not exactly the same every time. This paper is based on a prototype for "AGRICULTURE" an agricultural robot for pest control, fertilizer spraying in outdoor environments entirely powered by solar energy.

E-Bot completely works on solar energy. Solar energy is stored in DC battery which is connected to the Microcontroller MSP430 which is common power supply to the vehicle. From the Microcontroller the power supply goes to the Sprayer Pump, Weed removing DC motor and to the DC motor of wheel driving system. The entire vehicle is controlled by MSP430 Microcontroller. E-Bot can be used in certain type of fields in which the each plant has a distance of 30cm distance between each. For example: All type of Shrubs (Tomato plantation, Brinjal) etc. The ultrasonic pest repellent we designed was not working properly, even though many reference was made we were not able to produce the proper output. The entire above mentioned process are controlled by MSP 430 Microcontroller.

E-Bot vehicle is made up of metal sheet of 18Kg thickness, in which this could hold weight up to 20Kg. the dimension of the vehicle is 55mm in length 30mm in breadth and 20mm in height. We designed the vehicle in a way that the vehicle can balance its weight equally over it.

2.2 SMART PESTICIDE SPRAYING DRONE

Kalpana Murugan; B.Jaya Shankar; A.Sumath; C.Venkat sudharshan; G. VigandharReddy "*Smart automated pesticide spraying Drone*" 2020.

ARM- Based Pesticide Spraying Robot proposed a system that will having a wireless camera mounted on it and it is connected to the central system, the bot will scan every plant completely and sends that image to the central station, the people who are in the station will intimate the robot the plants which are defective and the plant will immediately spray the pesticides on it, the main advantage of this bot is it will scan the plants totally and it built usingthe ARM. A bionic electric spraying rod is created that performs two operations the first thing is spraying the water to the entire farm and at the same time it will sprinkle the pesticides, as it is in snake like structure it will easily undergo to entire farm.

The snake bot having bone arm and muscles which is made up of multiple set of thin wires and it can be controlled by the driver module for pesticide spraying purpose a snake arm is used which is connected to the spray nozzle. Nowadays the farmers are playing the crucial role by working hard in the agriculture lands and planting the crops for the societies living in different regions for earning their minimum needs. In India the pesticide usage is higher is 70% whereas the world-wide pesticide usage is 44% only.

The development of a smart sensor-based environment monitoring system is developed for that. In the low population areas and mainly in the farmlands etc, in that places the weather monitoring is not possible at all time so this project will help us to monitor the weather, temperature and all other climatic condition with the help of an IOT device. "Precision Agriculture", it is one of the challenging to the people in 21st Century. It is mainly based on the defected plants, soil compaction. So, they introduced a system which is available in the spherical shape, so it will move in any direction in between the crops and the damage occurred to the farmer is also very less.

2.3 AGRICULTURAL ROBOT FOR AUTOMATIC, PLOUGHING AND SEEDING

Amrita Sneha.A, Abirami.E, Ankita.A, Mrs.R.Praveena, Mrs.R.Srimeena "*Agricultural Robot for Automatic, Ploughing and Seeding"*

This paper strives to develop a robot capable of performing operations like automatic ploughing, seed dispensing. It also provides manual control when required and keeps tabs on the humidity with the help of humidity sensors.

The field is fitted with humidity sensors placed at various spots that continuously monitor the environment for humidity levels. It checks these levels with the set point for humidity and alerts the farmer. The alerting mechanism is GSM module that sends a text message to the farmer informing him about the breach in set point. The farmer then responds via SMS to either switch on the water sprinklers or ignore the alert. The water sprinklers, if on, bring down the humidity level thus providing an ideal growing environment to crop. The concept of fruit picking and pesticide spraying is described under the process domain. Farmers today spend a lot of money on machines that help them decrease labor and increase yield of crops but the profit and efficiency are very less. Hence automation is the ideal solution to overcome all the shortcomings by creating machines that perform one operations and automating it to increase yield on a large scale.

Agriculture is humankind's oldest and still important economic activity, providing the food, feeder, fiber and fuel necessary for our survival. The current trend in agricultural robot development is to build more smart efficient machines that reduce the expense of the farmer while still providing one more services and higher quality which is precisely what we have done in this paper. Development of a robot that can perform automated ploughing and seeding operation can be manually navigated by the farmer and stabilizes the humidity in the environment.

2.4 EXISTING SYSTEM

Robotics in agriculture has been a target for agricultural aspirants for many years. The first report was published from the February 1934 Modern Mehanix journal. This concept tries to establish crisis that a farmer could be separated from a machine's field operation where initially there was only little progress in the automation of Agrobots or indeed an automotive sector. It was after this gradual development in the field of agriculture began to take place. Also unlike in the present scenario which requires large manpower and investment for fruit picking process we can replace it with few numbers of this device, thus paving way for precision agriculture.

Already existing methods include plowing, seed sowing which are invented individually and the source of supply is through Solar panels or through the AC adaptor where those have many disadvantages. In previously existing methods they have used the Microcontroller which is a bit outdated thing, by using the present technology and updated controllers we have created a BOT using Arduino and it is the combination of all(Seeding, Pesticide Spraying, Grass Cutting).

Several Projects like User friendly fuzzy logic based farm automation using arduino and Lab view using x bee controller are being undertaken. Also automatic milking systems, irrigation and harvesting systems, Tank farming automation using several meter designs are practised in most of the western countries. According to many researchers, the agricultural robot market should have an annual growth rate of over 20% until 2022. Today, a vast majority of robotics on farms are for milking cows or indoor machines. But soon, robots will start working outdoors in the future.

Previously they made different BOT's which perform tasks individually like seeding only, pesticide spraying and grass cutting. No one have created a BOT which is combination of everything, so we thought of implementing the entire thing together.

2.5 PROPOSED SYSTEM

The proposed system is handy and easy to use when compared to the existing systems. The farming using this kind of device is called precision farming. To overcome the problems faced by the farmers we have created a BOT which performs the operations like Seeding, Grass cutting and Pesticide spraying which is controlled by humans using an application which is connected through Bluetooth. Basically, it's easy to operate comparative to Drones. We have instructed the Arduino and this arduino performs all the tasks.

The chassis of the robot is fixed to two wheels and the movement of these wheels is controlled using DC motors, four dc motors are attached to wheels strung on either side such that each side is driven by two motors each. A DC motor for grass cutting, pump for lifting the water to the nozzle, servo motor for spraying the pesticide and another servo motor for seeding purpose. Servo motor for precise angular movement of the Sprayer. The servo motor serves its optimum purpose in the speed dispensing box where it is placed to slide the opening exactly for few inches in order to let the seeds fall in the soil.

Our BOT can be operated at a range of 10 meters as the Bluetooth range is 10metres. To operate at longer range you can use an advanced thing like Node MCU or the Wi-Fi module. We have used the source of supply as the rechargeable battery and also due to close interaction with the pesticides farmers are facing side effects like rashes on the body.Here we can eliminate the back mounting of sprayer and there will be elimination of heavy load on the farmer shoulders and preventing side effects due to pesticides.

CHAPTER 3

BLOCK DIAGRAM

3.1 BLOCK DIAGRAM

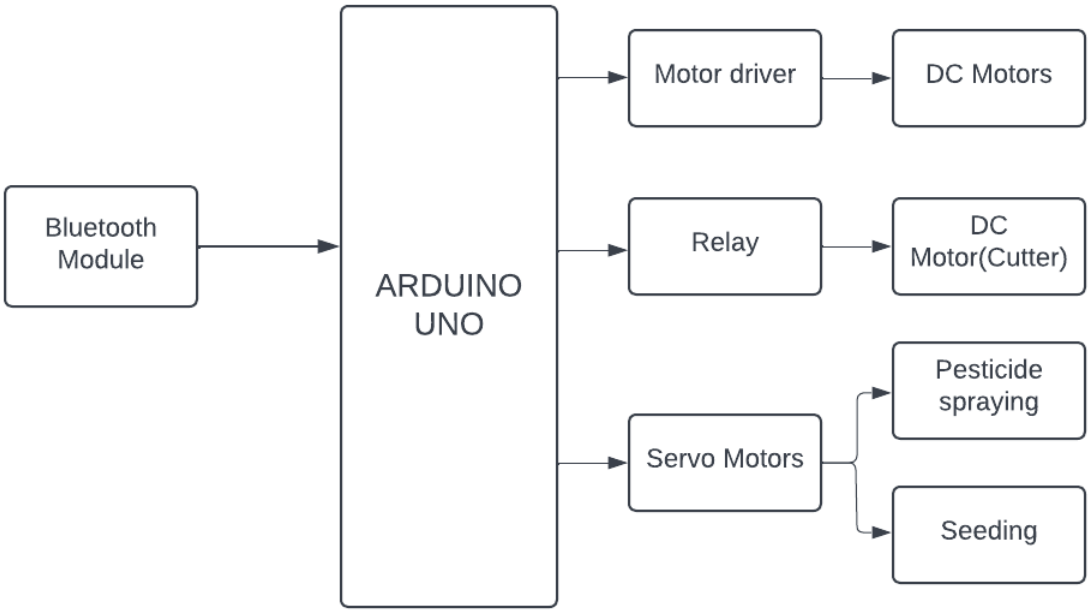

Fig 3.1: Block diagram

3.2 CIRCUIT DIAGRAM

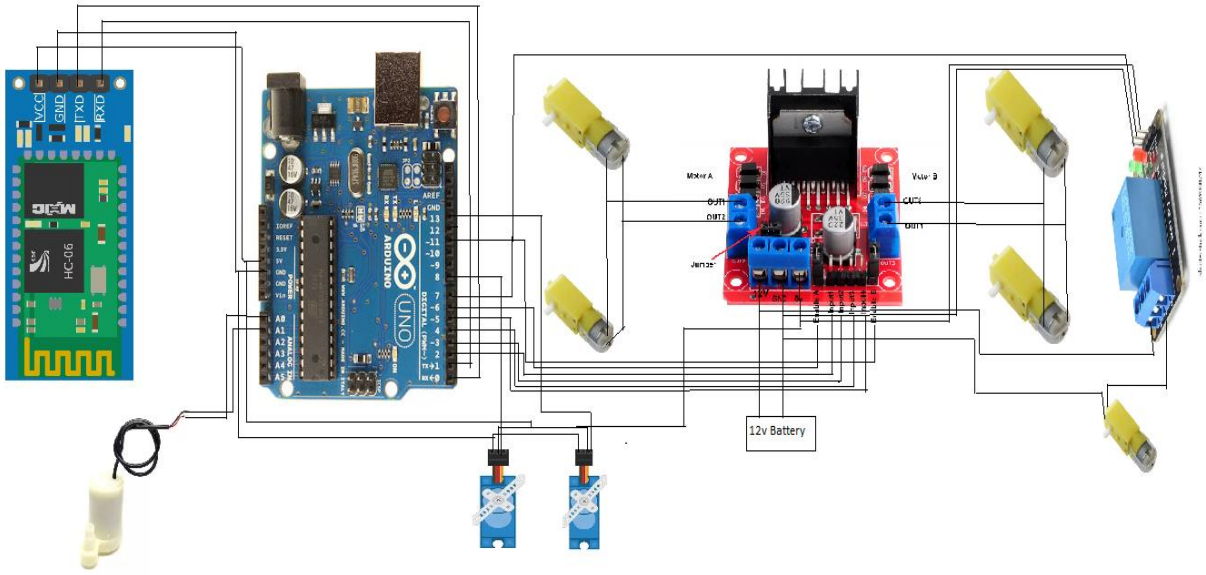

Fig 3.2: Circuit diagram

The circuit diagram explains about the connections which we have made to prepare the BOT. Basically the system is divided into two important sections first part is the user section and second part is the robot section. The first part consists of a mobile device for the purpose of communication with the second part i.e, robot section. There are various methods of communication between the user and robot end. Required signals can be transmitted with the help of Radio frequency using Bluetooth technology. In the BOT we're using Arduino UNO for giving the commands to the BOT which performs various tasks, we have connected 4 wheels with DC motors via L298N Motor driver for movement of the BOT, two servo motors are used for seeding purpose and spraying the pesticide, for grass cutting we have used a DC motor and connected it via a relay. The position of the shaft gets moved according to the PWM output from the Arduino to the motor.

3.3 WORKING PRINCIPLE

Basically our BOT contains two sections first thing is the user section and the other is the robot section. The user section is operated using an application via bluetooth and the robot section contains all the motors(DC Motors and servo motors) relay, submersible pump, with L298N we have interfaced the DC motors with arduino. Our BOT performs few operations like pesticide spraying, grass cutting, seeding.

This conventional sprayer causes user fatigue due to excessive bulky and heavy and also due to close interaction with the pesticides farmers are facing side effects like rashes on the body. This motivated us to design and fabricate a model that is basically robot based sprayer. All the tasks are operated using an application by using the arrows.

The position of the shaft gets moved according to the PWM output from the Arduino to the motor. We have instructed the Arduino and this arduino performs all the tasks. We have coded using arduino IDE, our BOT can be operated at a range of 10 meters as the Bluetooth range is 10metres. Here we can eliminate the back mounting of sprayer and there will be elimination of heavy load on the farmer shoulders and preventing side effects due to pesticides. To design a mechanism that automatically spray pesticides in the fields. To help the farmer from lifting heavy tanks of pesticides manually and spraying in fields, to decrease the side effects of pesticides due the direct contact, to decrease the agriculture labor.

This motivated us to design and fabricate a model that is basically robot based sprayer. Initially the robot fills the entire field and proceeds to grass cutting, simultaneously dispensing seeds side by side. A small tank is fixed to base in order to store the pesticide. Servo motors are selected for the sprayer movement around the axel, for Plowing, Grass Cutting and also Seeding. A relay is used to switch ON and OFF the pump, here we are using a Bluetooth module for the wireless connectivity. Finally we have implemented the BOT which we thought of implementing.

3.4 COMPONENTS REQUIRED

- Arduino UNO
- L298N Motor driver
- DC Motors
- Servo Motors
- DC –DC Converter
- Relay
- Submersible pump
- Bluetooth module
- Battery

Arduino UNO for performing the tasks, DC Motors are used for movement of the BOT, Servo motors according to the shaft rotation we have used these for seeding and spraying the pesticide**,**Relay for switching ON/OFF the pump, Submersible Pump for driving the pesticide reach the nozzle, Bluetooth module for interfacing the arduino to control using application, L298N Motor driver for controlling the DC motors.

CHAPTER 4
HARDWARE MODULES

4.1 ARDUINO UNO

Arduino is an open-source electronics platform based on easy-to-use hardware and software. Arduino is an open-source platform used for building electronics projects. Arduino consists of both a physical programmable circuit board (often referred to as a microcontroller) and a piece of software, or IDE (Integrated Development Environment) that runs on your computer, used to write and upload computer code to the physical board. In order to load new code onto the board you can simply use a USB cable. Additionally, the Arduino IDE uses a simplified version of C++, making it easier to learn to program. Arduino UNO features AVR microcontroller Atmega328, 6 analogue input pins, and 14 digital I/O pins out of which 6 are used as PWM output. The unit comes with 32KB flash memory that is used to store the number of instructions while the SRAM is 2KB and EEPROM is 1KB.

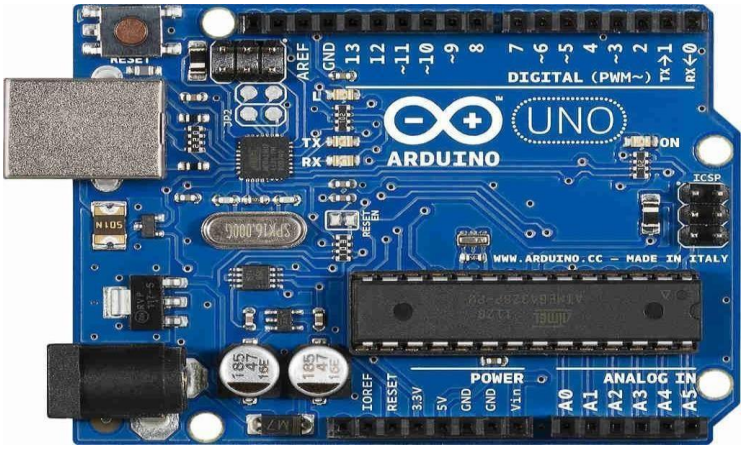

Fig 4.1: Arduino UNO

As we discussed we know that Arduino Uno is the most standard board available and probably the best choice for a beginner. We can directly connect the board to the computer via a USB Cable which performs the function of supplying the power as well as acting as a serial port.

4.1.1 PIN DIAGRAM AND PIN SPECIFICATIONS

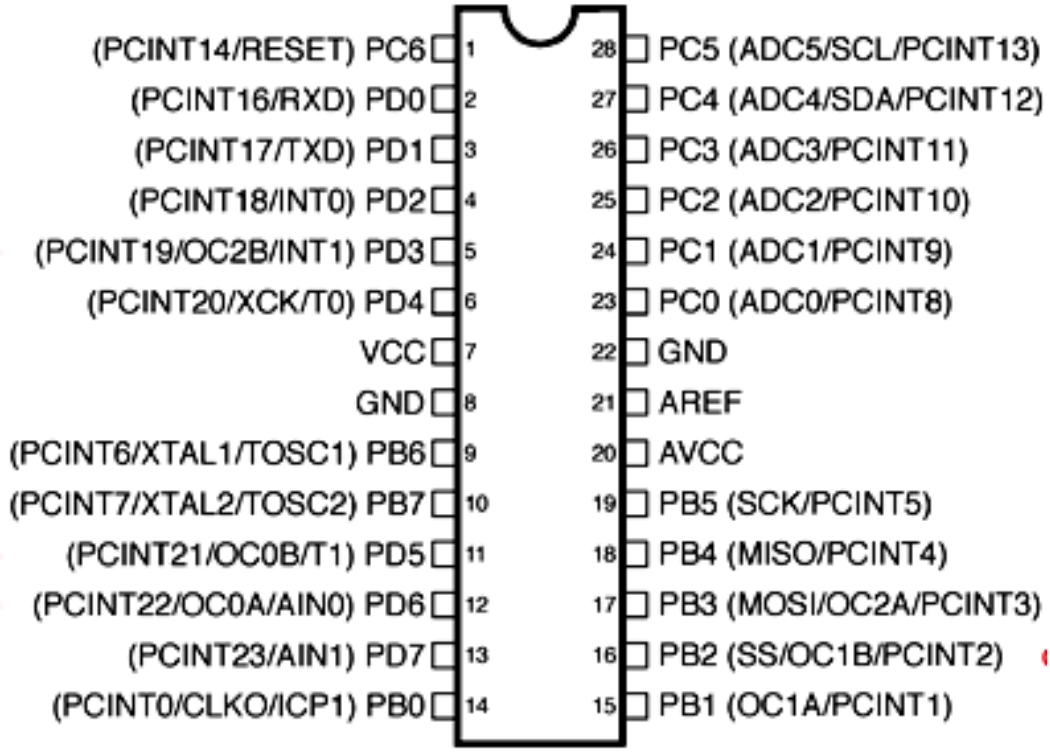

Fig 4.2 Arduino UNO Pin diagram

ATmega328P is a high performance yet low power consumption 8-bit AVR microcontroller that's able to achieve the most single clock cycle execution of 131 powerful instructions thanks to its advanced RISC architecture. It can commonly be found as a processor in Arduino boards such as Arduino Fio and Arduino Uno.

ATmega328: This is the brain of the board in which the program is stored.

Ground Pin: there are several ground pins incorporated on the board.

PWM: The board contains 6 PWM pins. PWM stands for Pulse Width Modulation, using this process we can control the speed of the servo motor, DC motor, and brightness of the LED.

Digital I/O Pins: there are 14 digital (0-13) I/O pins available on the board that can be connected with external electronic components.

Analogue Pins: there are 6 analogue pins integrated on the board. These pins can read the analogue sensor and can convert it into a digital signal.

AREF: It is an Analog Reference Pin used to set an external reference voltage.

Reset Button: This button will reset the code loaded into the board. This button is useful when the board hangs up, pressing this button will take the entire board into an initial state.

USB Interface: This interface is used to connect the board with the computer and to upload the Arduino sketches (Arduino Program is called a Sketch)

DC Power Jack: This is used to power up the board with a power supply.

Power LED: This is a power LED that lights up when the board is connected with the power source.

Micro SD Card: The UNO board supports a micro SD card that allows the board to store more information.

3.3V: This pin is used to supply 3.3V power to your projects.

5V: This pin is used to supply 5V power to your projects.

VIN: It is the input voltage applied to the UNO board.

Voltage Regulator: The voltage regulator controls the voltage that goes into the board.

SPI: The SPI stands for Serial Peripheral Interface. Four Pins 10(SS), 11(MOSI), 12(MISO), 13(SCK) are used for this communication.

TX/RX: Pins TX and RX are used for serial communication. The TX is a transmit pin used to transmit the serial data while RX is a receive pin used to receive serial data.

4.1.2 FEATURES OF ARDUINO UNO

- Microcontroller: ATmega328
- Operating Voltage: 5V
- Input Voltage (recommended): 7-12V
- Input Voltage (limits): 6-20V
- Digital I/O Pins: 14 (of which 6 provide PWM output)
- Analog Input Pins: 6
- DC Current per I/O Pin: 40 mA
- DC Current for 3.3V Pin: 50 mA
- Flash Memory: 32 KB
- SRAM: 2 KB (ATmega328)
- EEPROM: 1 KB (ATmega328)
- Clock Speed: 16 MHz

4.1.3 APPLICATIONS OF ARDUINO UNO

- Arduino Uno is used in Do-it-Yourself projects prototyping.
- In developing projects based on code-based control
- Development of Automation System
- Weighing Machines.
- Traffic Light Count Down Timer.
- Embedded systems.
- Home Automation.
- Industrial Automation.
- Medical Instrument.
- Emergency Light for Railways.

4.2 POWER SUPPLY

The power supply will give the power to the input circuit, the circuit will take the power how much it is required. The battery will provide the power to the entire circuit to work. As it is DC power it will be sent as same to each and every component of the circuit. As we can't connect the DC motors directly to the Arduino, here we are using the Motor driver Module which is named as L298N IC.

Fig 4.3: Battery

4.3 BLUETOOTH MODULE

HC-06 is a Bluetooth device used for wireless communication. It is a 6 pin module. The device can be used in 2 modes; data mode and command mode. The data mode is used for data transfer between devices whereas command mode is used for changing the settings of the Bluetooth module.

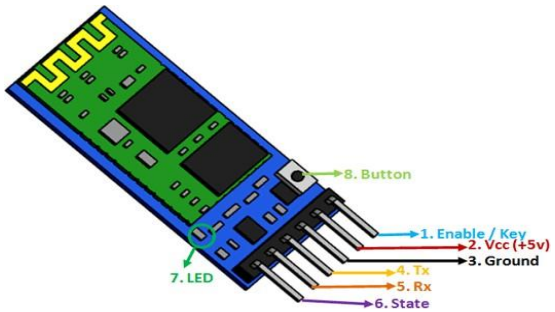

Fig 4.4: Bluetooth Module

HC-06 module has six pins as shown in the pin out. In them we only need to use four for successfully interfacing the module. Some breakout boards will only leave four output pins only because of this reason.

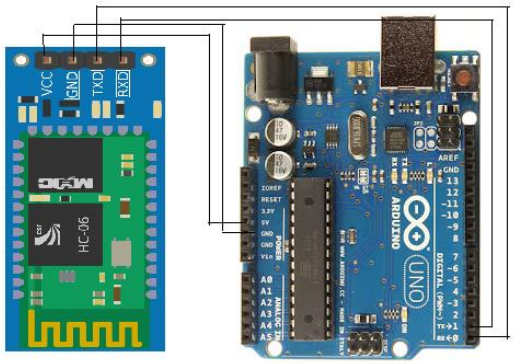

Fig 4.5 Interfacing Bluetooth with Arduino

4.3.1 PIN SPECIFICATIONS OF BLUETOOTH MODULE

Pin	Name	Function
1	Key	The pin state determines whether the module works in AT command mode or normal mode [High=AT commands receiving mode(Commands response mode), Low or NC= Bluetooth module normally working]
2	Vcc	+5V Positive supply needs to be given to this pin for powering the module
3	Gnd	Connect to ground
4	Txd	Serial data is transmitted by module through this pin (at 9600bps by default), 3.3V logic
5	Rxd	Serial data is received by module through this pin (at 9600bps by default),3.3V logic
6	State	The pin is connected to the LED on the board to represent the state of the module

The communication with this HC-06 module is done through **UART interface**. The data is sent to the module or received from the module though this interface. So we can connect the module to any microcontroller or directly to PC which has RS232 port (UART interface).

4.3.2 FEATURES OF BLUETOOTH MODULE

- HC-06 is best option when short distance wireless communication is needed. The module is used for wireless communications of less than 100 meters.
- The module is very easy to interface and to communicate.
- The module is one of the cheapest solutions for wireless communication of all types present in the market.
- The module consumes very less power to function and can be used on battery operated mobile systems.
- The module can be interfaced with almost all controllers or processors as it uses UART interface.

4.3.3 ADVANTAGES OF BLUETOOTH MODULE

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4.4 RELAY MODULE

Relay is one kind of electro-mechanical component that functions as a switch. The relay coil is energized by DC so that contact switches can be opened or closed. A single channel 5V relay module generally includes a coil, and two contacts like normally open (NO) and normally closed (NC). A 5v relay is an automatic switch that is commonly used in an automatic control circuit and to control a high-current using a low-current signal. The input voltage of the relay signal ranges from 0 to 5V.

Fig 4.6: Relay module

4.4.1 FEATURES OF RELAY MODULE

- Normal Voltage is 5V DC
- Normal Current is 70mA
- AC load current Max is 10A at 250VAC or 125V AC
- DC load current Max is 10A at 30V DC or 28V DC
- It includes 5-pins & designed with plastic material
- Operating time is 10msec
- Release time is 5msec
- Maximum switching is 300 operating per minute

4.4.2 PIN SPECIFICATIONS OF RELAY MODULE

The pin configuration of the 5V relay module is shown below. This module includes 6-pins where each pin and its functionality are discussed below.

Normally Open (NO): This pin is normally open unless we provide a signal to the relay modules signal pin. So, the common contact pin smashes its link through the NC pin to make a connection through the NO pin

Common Contact: This pin is used to connect through the load that we desire to switch by using the module.

Normally Closed (NC): This NC pin is connected through the COM pin to form a closed circuit. However, this NC connection will break once the relay is switched through providing an active high/low signal toward the signal pin from a microcontroller.

Signal Pin: The signal pin is mainly used for controlling the relay. This pin works in two cases like active low otherwise active high. So, in active low case, the relay activates once we provide an active low signal toward the signal pin, whereas, in an active high case, the relay will trigger once we provide a high signal toward the signal pin.

However, these modules generally work on an active high signal which will strengthen the relay coil to make contact with the common terminal with the normally open terminal.

5V VCC: This pin needs 5V DC to work. So 5V DC power supply is provided to this pin.

Ground: This pin connects the GND terminal of the power supply.

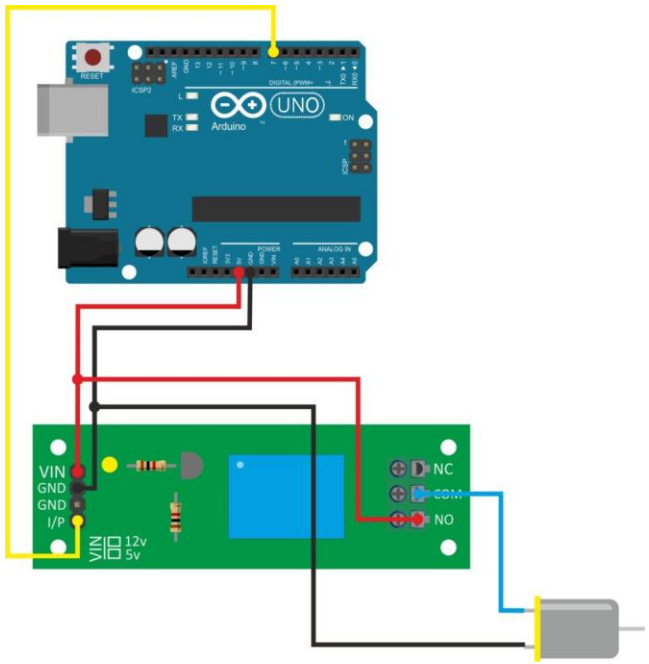

Fig 4.7: Interfacing DC motor with relay to Arduino

Arduino Uno work on 5V and the maximum current a digital pin can drive is less than 40mA. So technically we cannot drive higher power devices like home appliances directly with arduino. The relay uses the current supply for opening or closing switch contacts. Usually, this can be done through a coil to magnetize the switch contacts & drags them jointly once activated. A spring drives them separately once the coil is not strengthened.

By using this system, there are mainly two benefits, the first one is, the required current for activating the relay is less as compared to the current used by relay contacts for switching. The other benefit is, both the contacts & the coil are isolated galvanically, which means there is no electrical connection among them. A remote device can be controlled easily. It is triggered with less current but it can also trigger high power machines, easily contacts can be changed at a time, several contacts can be controlled using a single signal, Activating part can be isolated, it can switch AC or DC and at high temperatures it works very well.

4.5 DC MOTOR

A DC motor is any of a class of rotary electrical motors that converts direct current electrical energy into mechanical energy. The most common types rely on the forces produced by magnetic fields. Nearly all types of DC motors have some internal mechanism, either electromechanical or electronic, to periodically change the direction of current in part of the motor.

Fig 4.8: DC Gear Motor

To control the direction of the spin of DC motor, without interchanging the leads, you can use a circuit called an H-Bridge. An H-bridge is an electronic circuit that can drive the motor in both directions. H-bridges are used in many different applications. One of the most common application is to control motors in robots. It is called an H-bridge because it uses four transistors connected in such a way that the schematic diagram looks like an "H." We will be using the L298 H-Bridge IC here. The L298 can control the speed and direction of DC motors and stepper motors, and can control two motors simultaneously. Its current rating is 2A for each motor. At these currents, however, you will need to use heat sinks.

The above diagram shows how to connect the L298N IC to control two motors. There are three input pins for each motor, Input1 (IN1), Input2 (IN2), and Enable1 (EN1) for Motor1 and Input3, Input4, and Enable2 for Motor2.

Since we will be controlling only one motor in this example, we will connect the Arduino to IN1 (pin 5), IN2 (pin 7), and Enable1 (pin 6) of the L298 IC. Pins 5 and 7 are digital, i.e. ON or OFF inputs, while pin 6 needs a pulse-width modulated (PWM) signal to control the motor speed.

The following table shows which direction the motor will turn based on the digital values of IN1 and IN2.

IN1	IN2	Motor Behavior
		BRAKE
1		FORWARD
	1	BACKWARD
1	1	BRAKE

Pin IN1 of the IC L298 is connected to pin 8 of Arduino while IN2 is connected to pin 9. These two digital pins of Arduino control the direction of the motor. The EN A pin of IC is connected to the PWM pin 2 of Arduino. This will control the speed of the motor.

To set the values of Arduino pins 8 and 9, we have used the digitalWrite() function, and to set the value of pin 2, we have to use the analogWrite() function.

4.5.1 ADVANTAGES OF DC MOTOR

- Lack of brushes means long motor life
- High-efficiency design
- Stability of speed control
- Able to operate at high speeds
- High startup torque

4.6 L298N MOTOR DRIVER

L298N is a high voltage and high current motor drive chip which receives TTL logic signals. They are mostly used when it is needed to operate different loads like motors and solenoid etc where an H-Bridge is required. High power motor driver is required. Control unit can only provide TTL outputs. Current control and PWM operable single-chip device are needed. It has two enable inputs to enable or disable the particular device attached at its output independently. Thus, H-Bridge is basically used to control the rotating direction in DC motors.

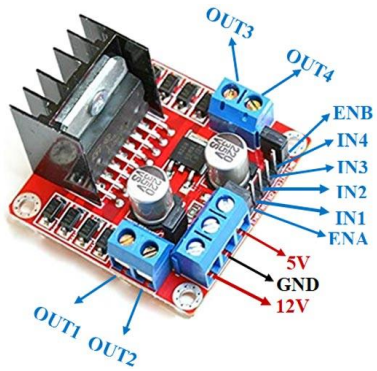

Fig 4.9: L298N motor driver

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

So first we need to define the pins and some variables needed for the program. In the setup section we need to set the pin modes and the initial rotation direction of the motor. In the loop section we start by reading the potentiometer value and then map the value that we get from it which is from 0 to 1023, to a value from 0 to 255 for the PWM signal, or that's 0 to 100% duty cycle of the PWM signal.

Then using the analogWrite() function we send the PWM signal to the Enable pin of the L298N board, which actually drives the motor. Next, we check whether we have pressed the button, and if that's true, we will change the rotation direction of the motor by setting the Input 1 and Input 2 states inversely.

4.6.1 INTERFACING DC MOTORS WITH L298N TO ARDUINO

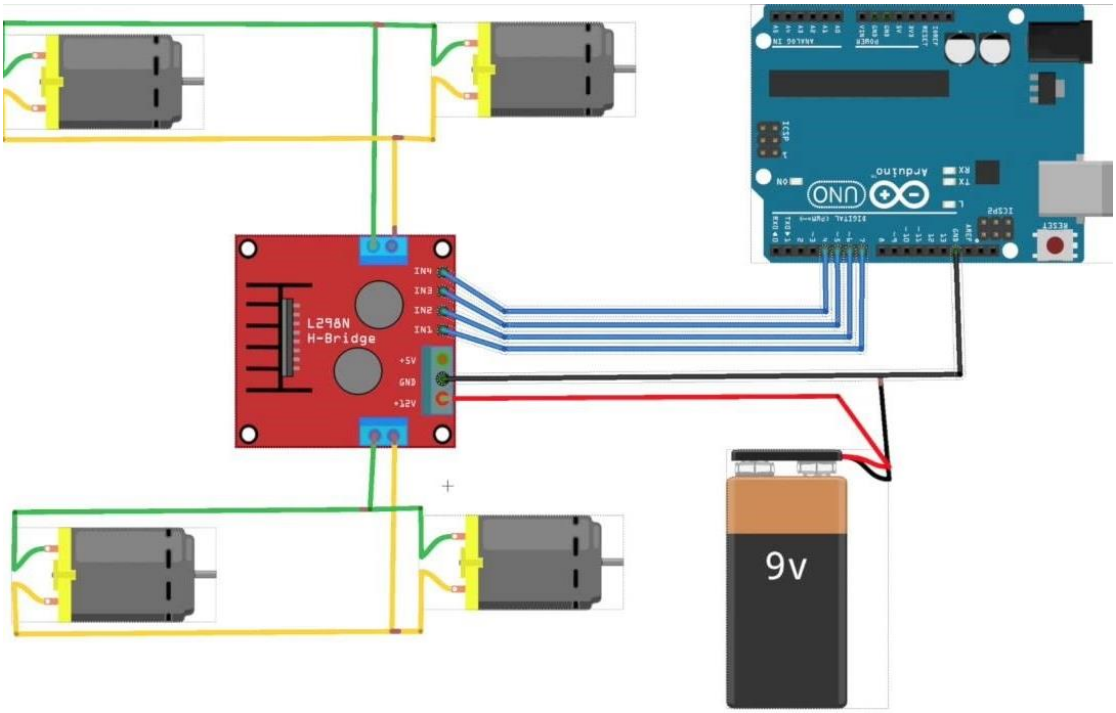

Fig 4.10: Interfacing DC motors with L298N to arduino

As mentioned above L298N contains two pairs output which are connected to a pair of DC motors.

- The positive of battery is connected to the Power Input of the L298N module and negative is connected to GND.
- The 5V pin of the driver is connected to the Vin pin of the Arduino to power the Arduino board.
- Input 1 and Input 2 pins are used to control the direction of Motor 1 is connected to pin 13, pin 12 of the Arduino respectively.
- Input 3 and Input 4 pins are used to control the direction of Motor 2 is connected to pin 11, pin 10 of the Arduino respectively.

- Enable A and Enable B are connected to the pin 9 and pin 3 of Arduino, which are used to control the speed of motors using PWM.

4.6.2 PIN DIAGRAM OF L298N

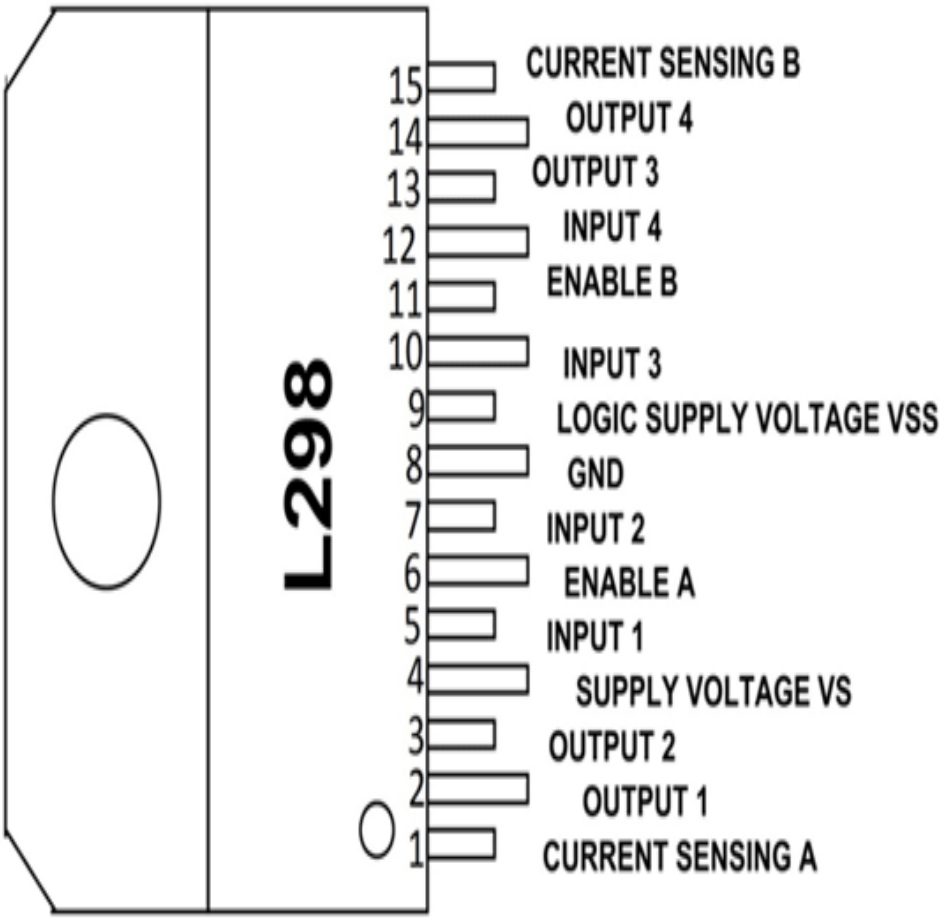

Fig 4.11: Pin diagram of L298N

4.6.3 PIN SPECIFICATIONS OF L298N

Pin Name	Description
IN1 & IN2	Motor A input pins. Used to control the spinning direction of Motor A
IN3 & IN4	Motor B input pins. Used to control the spinning direction of Motor B
ENA	Enables PWM signal for Motor A
ENB	Enables PWM signal for Motor B
OUT1 & OUT2	Output pins of Motor A
OUT3 & OUT4	Output pins of Motor B
12V	12V input from DC power Source
5V	Supplies power for the switching logic circuitry inside L298N IC
GND	Ground pin

4.6.4 PULSE WIDTH MODULATION

The speed of the motor is determined by the width of the PWM pulse sent to the "Enable" input of the L298N motor driver. The wider the pulses, the faster the motor will spin. Thus, PWM allows you to control the speed.

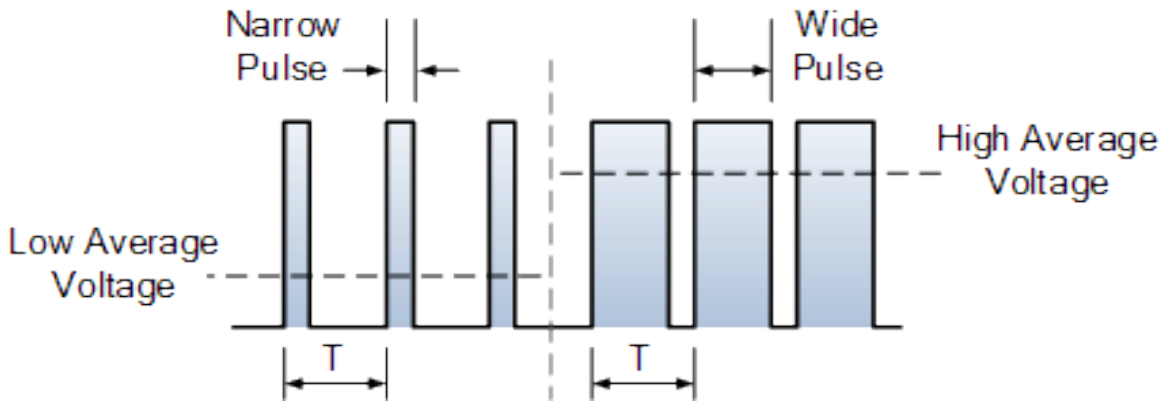

Fig 4.12: PWM

The use of pulse width modulation to control a small motor has the advantage in that the power loss in the switching transistor is small because the transistor is either fully "ON" or fully "OFF". As a result the switching transistor has a much reduced power dissipation giving it a linear type of control which results in better speed stability.

Also the amplitude of the motor voltage remains constant so the motor is always at full strength. The result is that the motor can be rotated much more slowly without it stalling. So how can we produce a *pulse width modulation* signal to control the motor.

PWM, or pulse width modulation is a technique which allows us to adjust the average value of the voltage that's going to the electronic device by turning on and off the power at a fast rate. The average voltage depends on the duty cycle, or the amount of time the signal is ON versus the amount of time the signal is OFF in a single period of time.

4.6.5 CHARACTERISTICS OF L298N MOTOR DRIVER

- The operating voltage supply is up to 46 v.
- Total DC is up to 4A.
- The saturation voltage is less.
- Protection from over temperature.
- Power dissipation is 25w.
- Operating voltage ranges from +5 to +46v
- The maximum voltage supply voltage is 50v.
- Maximum input & enable voltage is +7v.
- TTL controlled inputs.
- Storage temperature ranges from -40°c – 150°c.
- Operating temperature ranges from -23°c to – 130°c.
- The maximum allowed the current flow to draw through every output is 3a.

4.6.6 APPLICATIONS

- Drive DC motors.
- Drive stepping motors
- In Robotics

4.7 SERVO MOTOR

A servomotor is a rotary actuator or linear actuator that allows for precise control of angular or linear position, velocity and acceleration. It consists of a suitable motor coupled to asensor for position feedback.

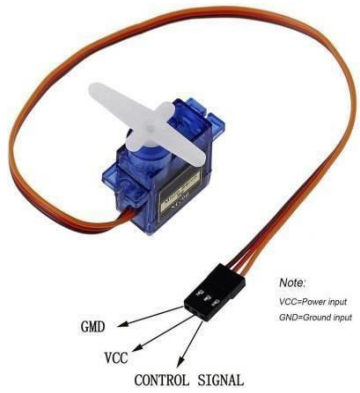

Fig 4.13: Servo Motor

Servo motors have three wires: power, ground, and signal. The power wire is typically red, and should be connected to the 5V pin on the Arduino board. The ground wire is typically black or brown and should be connected to a ground pin on the board. The signal pin is typically yellow or orange and should be connected to PWM pin on the board.

Most of the hobby Servo motors operates from 4.8V to 6.5V, the higher the voltage higher the torque we can achieve, but most commonly they are operated at +5V. Almost all hobby servo motors can rotate only from 0° to 180° due to their gear arrangement so make sure you project can live with the half circle if no, you can prefer for a 0° to 360° motor or modify the motor to make a full circle. The gears in the motors are easily subjected to wear and tear, so if your application requires stronger and long running motors you can go with metal gears or just stick with normal plastic gear. Next comes the most important parameter, which is the **torque** at which the motor operates. Again there are many choices here but the commonly available one is the 2.5kg/cm torque which comes with the Towerpro SG90 Motor.

A servo motor is an electromechanical device that produces torque and velocity based on the supplied current and voltage. A servo motor works as part of a closed loop system providing torque and velocity as commanded from a servo controller utilizing a feedback device to close

the loop. In other words, servo motors get their name from the fact that they can be relied upon to operate "exactly as commanded". Any electric motor capable of controlling parameters like position and speed is called a servo motor, regardless of how this control is achieved.

As we know there are three wires coming out of this motor. The description of the same is given on top of this page. To make this motor rotate, we have to power the motor with +5V using the Red and Brown wire and send PWM signals to the Orange colour wire. Hence we need something that could generate PWM signals to make this motor work, this something could be anything like a 555 Timer or other Microcontroller platforms like Arduino, PIC, ARM or even a microprocessor like Raspberry Pie. PWM signal produced should have a frequency of 50Hz that is the PWM period should be 20ms. Out of which the On-Time can vary from 1ms to 2ms. So when the on-time is 1ms the motor will be in 0° and when 1.5ms the motor will be 90°, similarly when it is 2ms it will be 180°. So, by varying the on-time from 1ms to 2ms the motor can be controlled from 0° to 180°

4.7.1 SERVO MOTOR WIRE CONFIGURATION

Wire Number	**Wire Colour**	**Description**
1	Brown	Ground wire connected to the ground of system
2	Red	Powers the motor typically +5V is used
3	Orange	PWM signal is given in through this wire to drive the motor

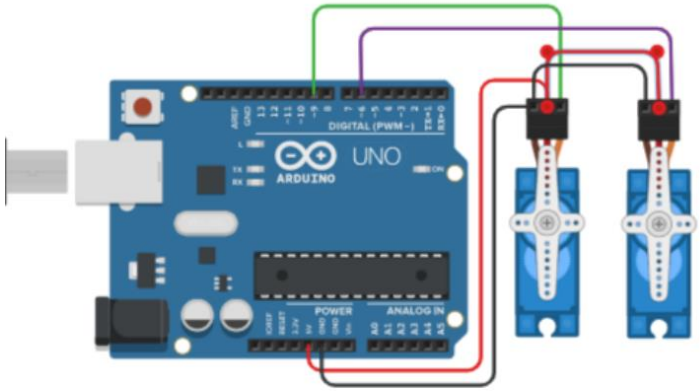

Fig 4.14: Interfacing Servo Motors to Arduino

1. The servo motor has a female connector with three pins. The darkest or even black one is usually the ground. Connect this to the Arduino GND.
2. Connect the power cable that in all standards should be red to 5V on the Arduino.
3. Connect the remaining line on the servo connector to a digital pin on the Arduino.

4.7.2 APPLICATIONS OF SERVO MOTOR

- Used as actuators in many robots like Biped Robot, Hexapod, robotic arm etc.
- Commonly used for steering system in RC toys
- Robots where position control is required without feedback
- Less weight hence used in multi DOF robots like humanoid robots
- The Servo motor is used to start, move and stop conveyor belts
- The servo motor is built into the camera to correct a lens of the camera
- The servo motor is used in solar tracking system
- The Servo motor is used in metal forming and cutting machines
- The Servo motor is used in Textiles to control spinning and weaving
- The Servo motor is used in automatic door openers to control the door in public places like supermarkets, hospitals and theatres

4.8 SUBMERSIBLE PUMP

Submersible pump is centrifugal type of pump which pumps out water from the bored hole or well. The pump is coupled with an electric motor. The shape of the pump and motor is cylindrical which makes it easy to be fitted in drilled bore in the earth.

A water pump is an electromechanical machine used to increase the pressure of water to move it from one point to another. Modern water pumps are used throughout the world to supply water for municipal, industrial, agricultural, and residential uses.

Fig 4.15: Submersible pump

4.8.1 APPLICATIONS OF SUBMERSIBLE PUMP

Because of their benefits, submersible pumps have numerous residential, commercial, and industrial uses. Some of the most common applications for submersible pumps include, but are not limited to:

- Pumping water from flooded basements
- Pumping sewage out of septic tanks
- Powering industrial and agricultural irrigation systems
- Pumping water from flooded areas at construction sites
- Pumping water from wells deep underground into above-ground holding tanks.

CHAPTER 5
SOFTWARE MODULES

5.1 ARDUINO IDE 1.8.19

The Arduino Integrated Development Environment is a cross-platform IDE designed for Arduino microcontrollers. The IDE uses a combination of the C standard library and C++. It is used to write and upload programs to Arduino compatible boards, but also, with the help of third-party cores, other vendor development boards.

In this Arduino IDE we are coding the Arduino and giving instructions to the Arduino, it works according with the code. There are different components we can connect to the Arduino like the Motors, LCD, Buzzer and etc. We need to give instructions to the Arduino to ON & OFF them and move them in different directions and many more.

The Arduino UNO board is programmed using Arduino IDE software which is an official software introduced by Arduino.cc to program the board. The Arduino program is called a sketch which you need to unload into the board. The sketch is nothing but a set of instructions that allow the board to perform certain functions as per your requirements. Each Arduino sketch comes with two main parts:

Void setup () – this sets up the things that need to be done once and they don't happen again in the running program.

Void loop () – this part comes with the instructions that get repeated again and again until the board is turned off.

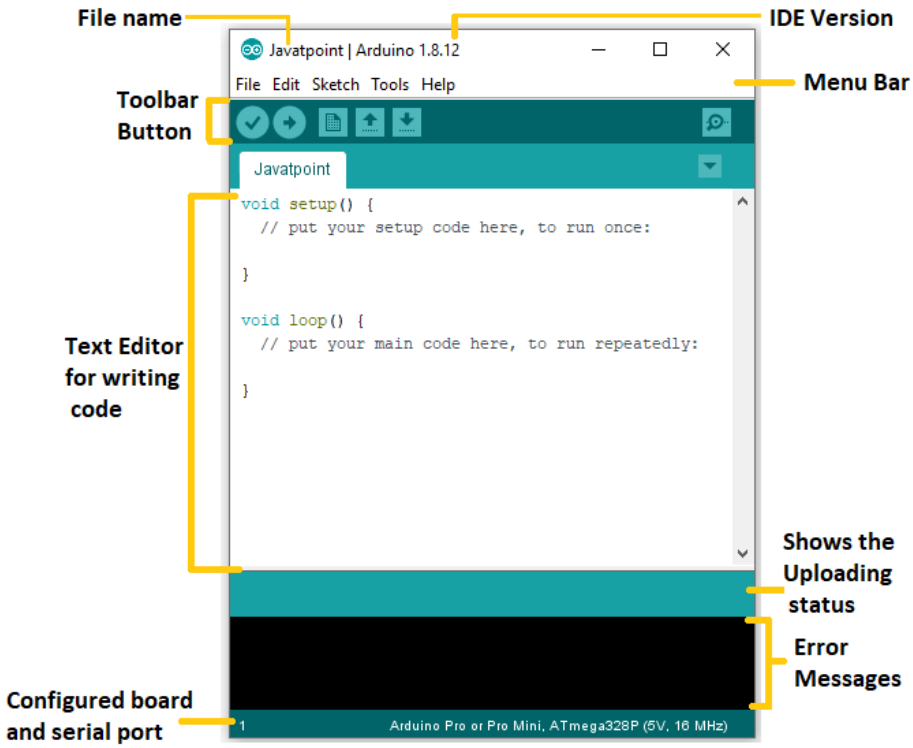

Fig 5.1: Overview of Arduino IDE

The program or code written in the Arduino IDE is often called as sketching. We need to connect the Genuino and Arduino board with the IDE to upload the sketch written in the Arduino IDE software. The sketch is saved with the extension '.ino.' The Arduino IDE will appear as:

Toolbar Button:

The icons displayed on the toolbar are New, Open, Save, Upload, and Verify. It is shown below

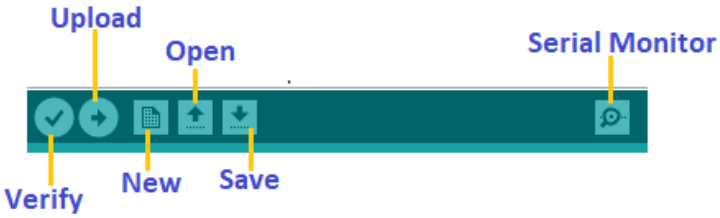

Fig 5.2: Toolbar menu

Upload: The Upload button compiles and runs our code written on the screen. It further uploads the code to the connected board. Before uploading the sketch, we need to make sure that the correct board and ports are selected. We also need a USB connection to connect the board and the computer. Once all the above measures are done, click on the Upload button present on the toolbar.

The latest Arduino boards can be reset automatically before beginning with Upload. In the older boards, we need to press the Reset button present on it. As soon as the uploading is done successfully, we can notice the blink of the Tx and Rx LED. We do not require any additional hardware to upload our sketch using the Arduino Bootloader. **A** Bootloader is defined as a small program, which is loaded in the microcontroller present on the board. The LED will blink on PIN 13.If the uploading is failed, it will display the message in the error window.

Open: The Open button is used to open the already created file. The selected file will be opened in the current window.

Save: The save button is used to save the current sketch or code.

New: It is used to create a new sketch or opens a new window.

Verify: The Verify button is used to check the compilation error of the sketch or the written code.

Serial Monitor: The serial monitor button is present on the right corner of the toolbar. It opens the serial monitor.

When we connect the serial monitor, the board will reset on the operating system Windows, Linux, and Mac OS X. If we want to process the control characters in our sketch, we need to use an external terminal program. The terminal program should be connected to the COM port, which will be assigned when we connect the board to the computer.

Menu Bar:

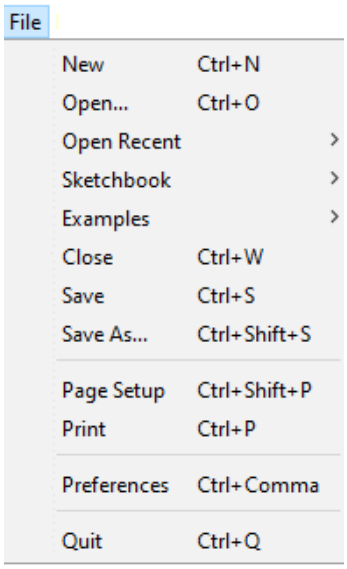

Fig 5.3: Menu bar

File: When we click on the File button on the Menu bar, a drop-down list will appear.

New: The New button opens the new window. It does not remove the sketch which is already present.

Open: It allows opening the sketch, which can be browsed from the folders and computer drivers.

Open Recent: The Open Recent button contains the list of the recent sketches.

Sketchbook: It stores the current sketches created in the Arduino IDE software. It opens the selected sketch or code in a new editor at an instance.

Sketch: When we click on the Sketch button on the Menu bar, a drop-down list appears.

Verify/Compile: It will check for the errors in the code while compiling. The memory in the console area is also reported by the IDE.

Upload: The Upload button is used to configure the code to the specified board through the port.

Tools: When we click on the Tools button on the Menu bar, a drop-down list appears.

Auto Format: The Auto Format button is used to format the written code. For example, lining the open and closed curly brackets in the code.

Archive Sketch: The copy of the current sketch or code is archived in the .zip format. The directory of the archived is same as the sketch.

Fix Encoding and Reload: This button is used to fix the inconsistency between the operating system char maps and editor char map encoding.

Manage Libraries: It shows the updated list of all the installed libraries. We can also use this option to install a new library into the Arduino IDE.

Serial Monitor: It allows the exchange of data with the connected board on the port.

5.1.1 PROGRAM COMPILING

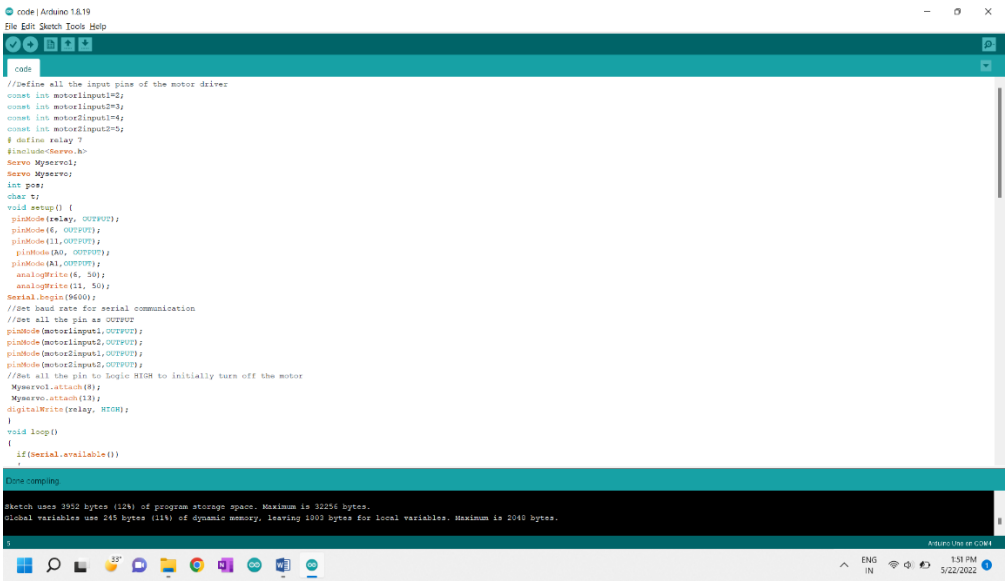

Fig 5.4: Program compiling using Arduino IDE

Firstly, we need to give instructions to the arduino through this arduino IDE software. So, that the arduino performs required tasks. We have coded, saved and compiled, the compilation was successful. Once the program is written, it has to be compiled to check for errors. During compilation the source code is converted to assembly level code.

5.1.2 SELECTING BOARD

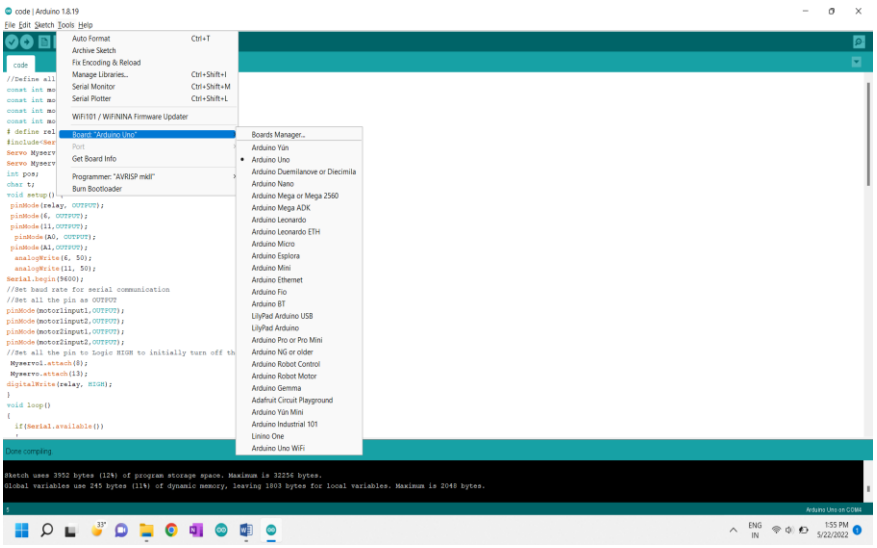

Fig 5.5: Selecting the board from Tools menu

Then after successful compilation of the code we need to choose the Board. In order to select the board, go to Tools in the menu bar and select the board from the given options. For our requirement we have selected the Arduino UNO Board

5.1.3 SELECTING PORT

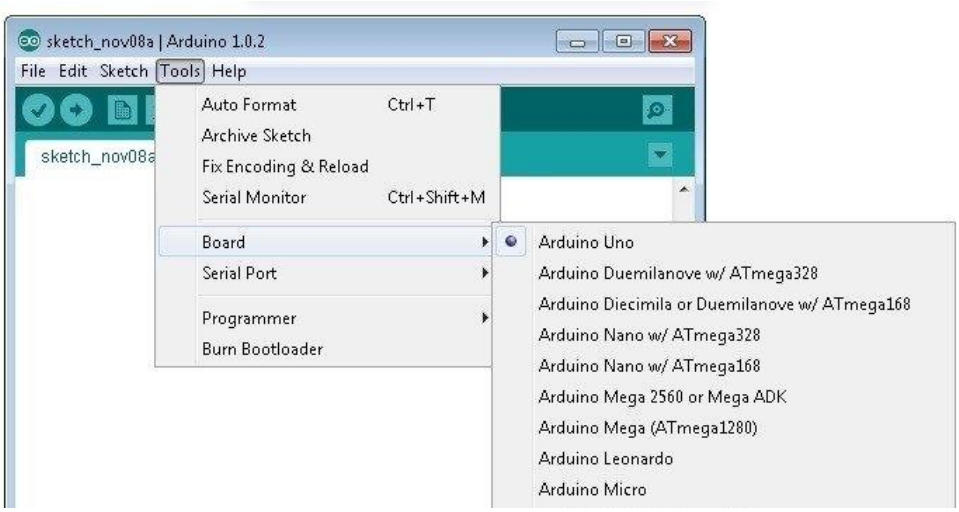

Fig 5.6: Selecting the port from Tools menu

From the Tools menu, select the port to which the Arduino board is connected. These details can be modified at the port settings of the system.

5.1.4 UPLOADING PROGRAM

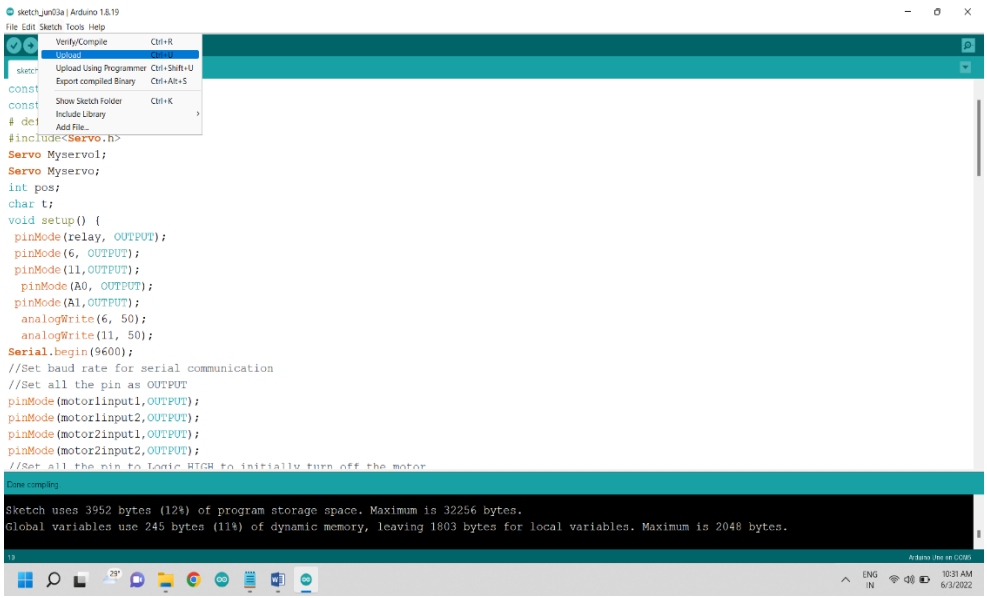

Fig 5.7: Uploading program to the Arduino

Once the board and ports are selected, in case of no errors, the program can be uploaded to the Arduino by clicking the upload icon on the menu bar of the IDE.

The Help section includes several documents that are easy to access, which comes along with the Arduino IDE. It consists of the number of options such as Getting Started, Environment, Troubleshooting, Reference, etc. We can also consider the image shown above, which includes all the options under the Help section.

Some documents like Getting started, Reference, etc., can be accessed without the internet connection as well. It will directly link us to the official website of Arduino.

5.2 COMMANDS USED

Serial.print()

It prints data to the serial port as ahuman-readable ASCII text. This command can take many forms. Numbers are printed using an ASCII character for each digit.

Floats are similarly printed as ASCII digits, defaulting to two decimal places. Bytes are sent as a single character. Characters and strings are sent as is. For example-

Serial.print(78) gives "78"

Serial.print(1.23456) gives "1.23"

- Syntax: `Serial.print(val)`

Serial.begin

Sets the data rate in bits per second (baud) for serial data transmission. For communicating with the computer, use one of these rates: 300, 600, 1200, 2400, 4800, 9600, 14400, 19200, 28800, 38400, 57600, or 115200.

- Syntax: `Serial.begin(speed)`

Pin mode

Configures the specified pin to behave either as an input or an output. See the description of (digital pins) for details on the functionality of the pins. As of Arduino 1.0.1, it is possible to enable the internal pull up resistors with the mode INPUT_PULLUP. Additionally, the INPUT mode explicitly disables the internal pull ups.

- Syntax: `pinMode(pin, mode)`

Serial.available()

Get the number of bytes (characters) available for reading from the serial port. This is data that's already arrived and stored in the serial receive buffer (which holds 64 bytes).

- Syntax: `Serial.available()`

delay()

Pauses the program for the amount of time (in milliseconds) specified as parameter. There are 1000 milliseconds in a second.

- Syntax: `delay(ms)`

Digital read()

Reads the value from a specified digital pin,either HIGH or LOW.

- Syntax: `digitalRead(pin)`

Print()

Prints data to the serial port as readable ASCII text followed by a carriage return character and a newline character .This command takes the same form as Serial.print().

Analogwrite()

Writes an analog value (PWM wave) to a pin. Can be used to light a LED at varying brightnesses or drive a motor at various speeds.

- Syntax: `analogWrite(pin, value)`

Servo- write()

Writes a value to the servo, controlling the shaft accordingly.

- Syntax: `servo.write(angle)`

digitalWrite()

The digitalWrite() function is used to write a HIGH or a LOW value to a digital pin. If the pin has been configured as an OUTPUT with pinMode(), its voltage will be set to the corresponding value: 5V (or 3.3V on 3.3V boards) for HIGH, 0V (ground) for LOW.

- Syntax: **`digitalWrite(pin, value)`**

CHAPTER 6
RESULTS

1. Firstly, the frontend part of our BOT is as shown below which contains the Grass cutting, Seeding and the sprayer.

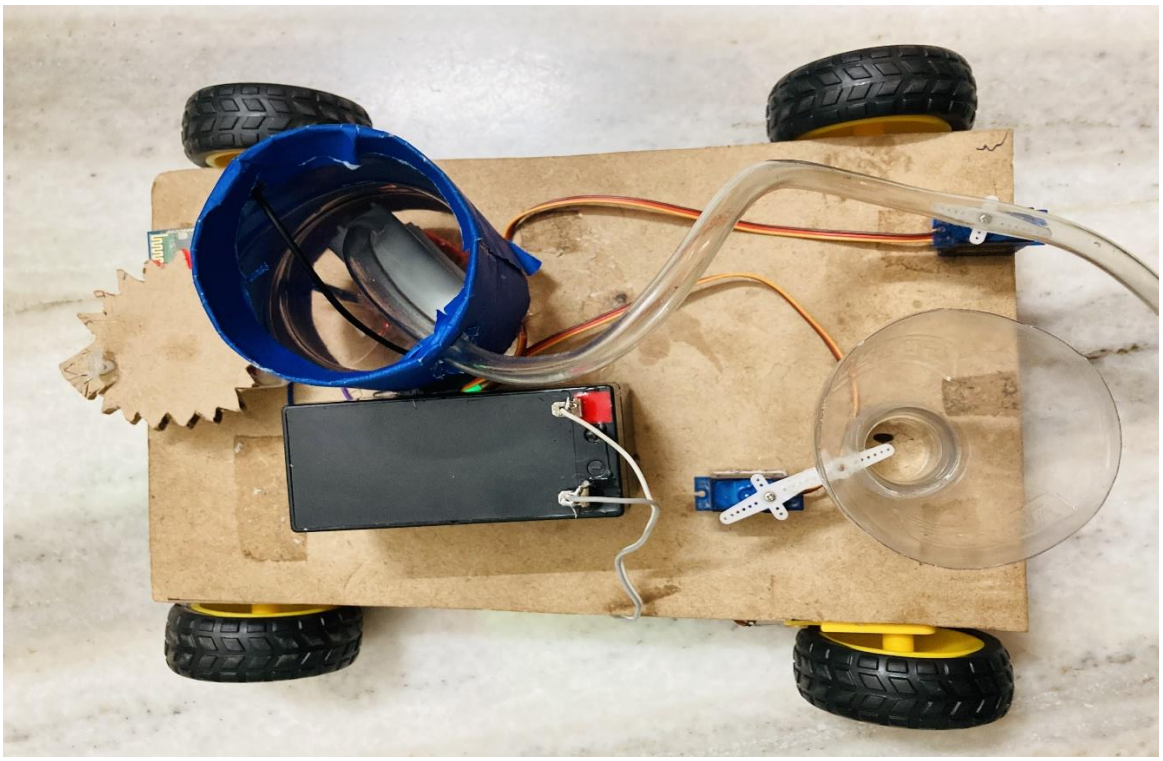

Fig 6.1: Frontend section of the BOT

Battery is also placed in the frontend part it's a 12v battery, which is sufficient for the BOT to perform all the tasks like movement of the BOT, pesticide spraying, cutting and seeding.

2. Next comes the backend thing, to make the BOT look simple and good we made the connections and inverted it so that all the wires and connections can't be visible.

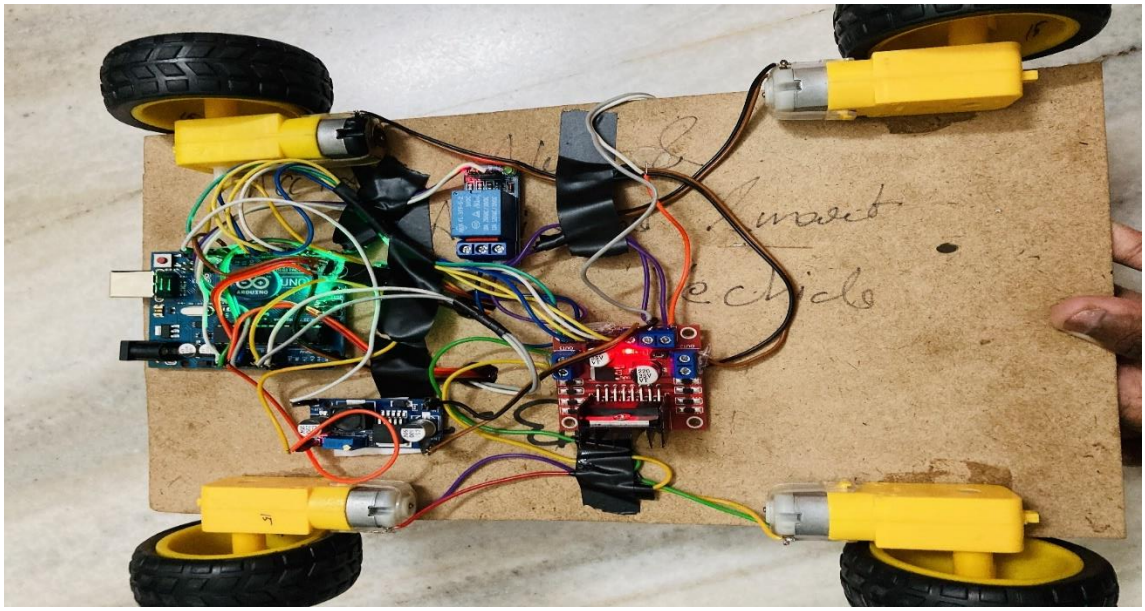

Fig 6.2: Backend section of the BOT

3. The Grass cutting is controlled using a DC Motor which is connected via a relay and operated using an application with the help of a Bluetooth module.

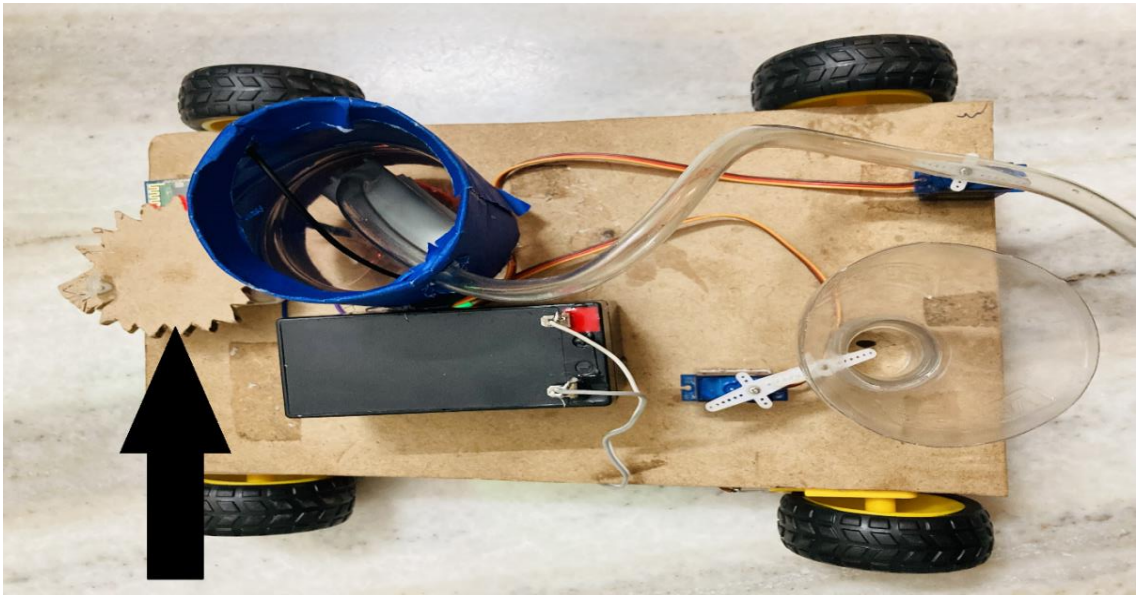

Fig 6.3: Grass Cutting

4. Pesticide spraying is done using a submersible pump which is inserted in the tank which makes pesticide reach the nozzle then the servo motor moves left and right so that the pesticide sprinkles to left and right.

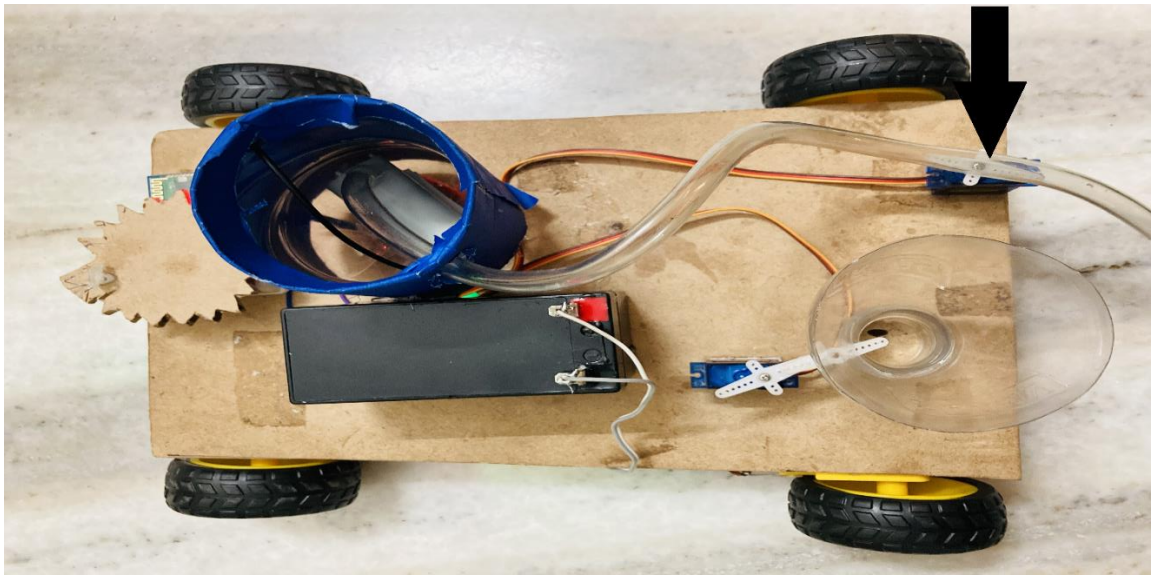

Fig 6.4: Pesticide spraying

5. Seeding is done with a servo motor, when we click on seeding button in the application then the servo motor starts moving, seeds are dropped (sowed) with some distance

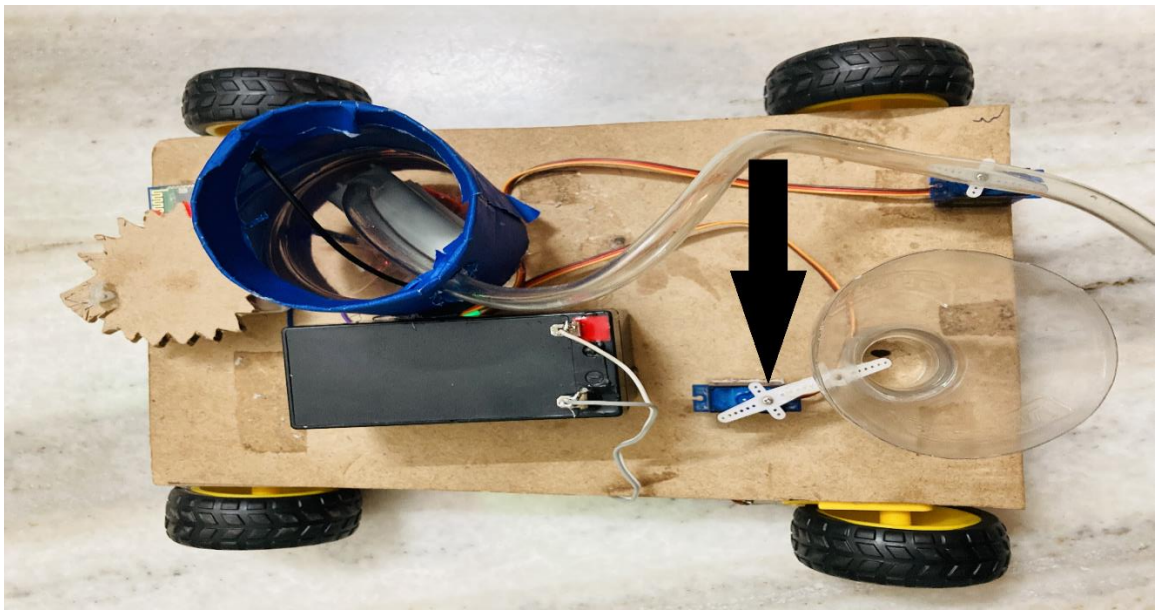

Fig 6.5: Seed Sowing

CHAPTER 7
ADVANTAGES AND APPLICATIONS

7.1 ADVANTAGES

- It is not effected by wind as compared to Drone
- Maintenance is less than a Drone
- Skilled operator is not required
- Inexpensive

7.2 APPLICATIONS

- Fertilizing and Irrigation
- Crop Weeding and Spraying
- Nursery Planting
- Crop Monitoring and analysis

CHAPTER 8
FUTURE SCOPE AND CONCLUSION

8.1 FUTURE SCOPE

Further analysis can be focused on a raspberry pi microcontroller which is very effective and efficient in used instead of the ongoing Arduino and Node MCU. Camera can be used at thefront of the BOT for better visual during the operation. Without using any manual things this can be operated using IOT with advanced features.

8.2 CONCLUSION

According to the requirements the farmer's health issues were neglected while spraying pesticides on the crops, hence our project has brought into consideration keeping in mind safety of the farm laborers. Literature review gave ideas regarding important aspects of the design of the components. The design finalized may require some changes further according to the design testing. Thus an alternative to the most primitive method of spraying pesticides and fertilizers which will reduce the after effects caused in the process of spraying.

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[3] Merlin Ruby.K.M, Anne Jenefer.F, Vidhya.D. "*Study of Arduino Controlled Robotic System*" Department of Electronics and Communication Engineering, Panimalar Engineering College, Chennai India 2017.

[4] Kalpana Murugan; B.Jaya Shankar; A.Sumath; C.Venkat sudharshan; G. Vigandhar Reddy "*Smart automated pesticide spraying Drone*" 2020.

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APPENDIX
PROJECT CODE

```
//Define all the input pins of the motor driver
const int motor1input1=2;
const int motor1input2=3;
const int motor2input1=4;
const int motor2input2=5;
# define relay 7
#include<Servo.h>
Servo Myservo1;
Servo Myservo;
int pos;
char t;
void setup()
 {
 pinMode(relay, OUTPUT);
 pinMode(6, OUTPUT);
 pinMode(11,OUTPUT);
  pinMode(A0, OUTPUT);
 pinMode(A1,OUTPUT);
  analogWrite(6, 150);
  analogWrite(11, 150);
Serial.begin(9600);
//Set baud rate for serial communication
//Set all the pin as OUTPUT
pinMode(motor1input1,OUTPUT);
pinMode(motor1input2,OUTPUT);
pinMode(motor2input1,OUTPUT);
pinMode(motor2input2,OUTPUT);
//Set all the pin to Logic HIGH to initially turn off the motor
 Myservo1.attach(8);
 Myservo.attach(13);
```

```
digitalWrite(relay, HIGH);
}
void loop()
{
  if(Serial.available())
  {
    t = Serial.read();
    Serial.print(t);
    }
if(t == 'P'){pest();
}
if(t == 'D'){seed();
}
if(t == 'Z'){stop2();
}
if(t == 'F'){forward();
}
if(t == 'B'){backward();
}
if(t == 'L'){left();
}
if(t == 'R'){right();
}
if(t == 'S'){stop1();
}
if(t == 'C'){relay1();
}
 }
 void relay1()
 {
  digitalWrite(relay, LOW);
  }
void stop1()
{
```

```
 digitalWrite(motor1input1,HIGH);
  digitalWrite(motor1input2,HIGH);
  digitalWrite(motor2input1,HIGH);
  digitalWrite(motor2input2,HIGH);
}
  void forward()
{
  digitalWrite(2,HIGH);
  digitalWrite(4,LOW);
  digitalWrite(3,LOW);
  digitalWrite(5,HIGH);
  Serial.println("In Forward");
  }
 void backward(){
  digitalWrite(motor1input1,LOW);
  digitalWrite(motor2input1,HIGH);
  digitalWrite(motor1input2,HIGH);
  digitalWrite(motor2input2,LOW);
}
void left()
{
  digitalWrite(motor1input1,LOW);
  digitalWrite(motor2input1,HIGH);
  digitalWrite(motor1input2,LOW);
  digitalWrite(motor2input2,LOW);
}
void right()
{
digitalWrite(motor1input1,HIGH);
  digitalWrite(motor2input1,LOW);
  digitalWrite(motor1input2,LOW);
  digitalWrite(motor2input2,LOW);
}
void seed()
```

```
{
  for(pos=30;pos<=90;pos++)
{
Myservo1.write(pos);
delay(15);
}
  delay(500);
  for(pos=90;pos>=30;pos--)
{
Myservo1.write(pos);
delay(15);
}
}
void pest()
{
 digitalWrite(A1, HIGH);
 digitalWrite(A0, LOW);
  for(pos=80;pos<=160;pos++)
{
Myservo.write(pos);
delay(15);
}
  delay(1000);
for(pos=160;pos>=80;pos--)
{
Myservo.write(pos);
delay(15);
}}
void stop2()
{
  Myservo1.write(30);
  Myservo.write(80);
  digitalWrite(relay, HIGH);
 digitalWrite(A1, LOW);
```

```
digitalWrite(A0, LOW);
}
```