AGRIBOT FOR MULTI-PURPOSE FARMING

Submitted by

BOOPATHY S	**21E902**
KIRUTHIKA S	**21E913**
PALAPARATHI TARUN	**21E918**
SRINATH S	**21E921**

Dissertation submitted in partial fulfilment of the requirements of the degree of

BACHELOR OF ENGINEERING
ELECTRICAL AND ELECTRONICS ENGINEERING
(SANDWICH)

APRIL 2025

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

PSG COLLEGE OF TECHNOLOGY
(Autonomous Institution)

COIMBATORE – 641 004

PSG COLLEGE OF TECHNOLOGY
(Autonomous Institution)

COIMBATORE – 641 004

AGRIBOT FOR MULTI-PURPOSE FARMING

Bonafide record of work done by

BOOPATHY S	**21E902**
KIRUTHIKA S	**21E913**
PALAPARATHI TARUN	**21E918**
SRINATH S	**21E921**

Dissertation submitted in partial fulfilment of the requirements of the degree of

BACHELOR OF ENGINEERING
ELECTRICAL AND ELECTRONICS ENGINEERING
(SANDWICH)

…………………………….   ………………………

Dr. Kanthalakshmi S
Faculty guide

Dr. Kanakaraj J
Head of The Department

Certified that the candidate was examined in the viva voice examination held on

----

…………………… (Internal Examiner)

…..……………….. (External Examiner)

ACKNOWLEDGEMENT

The completion of this project would not have been possible without the guidance and support of many people. We would like to express our sincere gratitude to **Dr.K.Prakasan**, the Principal, PSG College of Technology for providing us the necessary facilities for the project work.

We express our heartfelt gratitude to **Dr.Kanakaraj J,** the Head of Department, Department of Electrical and Electronics Engineering, (sandwich) PSG College of Technology, for providing us the opportunity to carry out this project work and for her constant support and encouragement throughout the project.

We would like to thank **Dr.Kanthalakshmi S**, Professor, Programme Coordinator, Department of Electrical and Electronics Engineering, PSG College of Technology, for providing us with an opportunity to do this project and make use of the facilities.

Our sincere thanks to our tutor, **Dr.Balaji V**, Assistant Professor , Departmentof Electronics and Electronics Engineering, PSG College of Technology, for hisconstant support and guidance.

Our sincere thanks to our project guide, **Dr.Kanthalakshmi S,** Assistant Professor**,** Department of Electronics and Electronics Engineering, PSG College of Technology**,** for her constant support and guidance.

We would like to thank the Final Year project Committee Members **Dr.Kanthalakshmi S, Dr.Balaji V,** and **Dr.Maheswari C**. Assistant Professors, Department of Electrical and Electronics Engineering, PSG College of Technology, for guiding and supporting us throughout the project work.

We would like to express our sincere thanks to all teaching and non-teaching staff members in the Department of Electrical and Electronics Engineering, for their direct and indirect support

ABSTRACT

India’s agricultural sector, despite being the backbone of the economy, continues to face numerous obstacles such as labour shortages, low mechanization levels, inconsistent crop yields, and inefficient farming techniques. These issues significantly impact productivity and limit the growth potential of the sector, highlighting the urgent need for technological intervention. In response to these challenges, the Agri-Bot has been developed an autonomous, intelligent, and multifunctional agricultural robot designed to revolutionize traditional farming methods. This advanced machine is capable of executing a wide range of agricultural tasks including plowing, seeding, weeding, pesticide spraying, mowing, and harvesting, all without human intervention. What sets the Agri-Bot apart from conventional machinery is its modular design and adaptive capabilities, which allow it to operate efficiently across diverse farming environments, crop types, and soil conditions. Its core functionalities are powered by an ESP32 microcontroller, which facilitates real-time task coordination, sensor integration, and wireless communication, ensuring accurate and responsive operations. The robot is also equipped with a rear-positioned seed storage system that enables uniform seed dispersal as it navigates the field. By automating key agricultural activities, the Agri-Bot reduces dependency on manual labour, minimizes human error, and optimizes time and resource usage. Additionally, it promotes sustainable farming by improving precision, reducing chemical usage through targeted spraying, and conserving energy through intelligent navigation. A prototype of the Agri-Bot has already undergone successful testing on a real small-scale farm, demonstrating its effectiveness, reliability, and potential for scalability. As India strives to modernize its agricultural landscape, innovations like the Agri-Bot serve as crucial tools for increasing productivity, supporting farmers, and driving long-term sectoral development through smart farming solutions.

TABLE OF CONTENT

LIST OF FIGURES

CHAPTER 1
INTRODUCTION

India's agricultural heritage dates back to the ancient civilizations of the Indus Valley and extends further into regions of South India. Presently, India holds the second position globally in terms of agricultural output. The agricultural sector faces daunting challenges such as escalating input costs, a shortage of skilled labour, and inadequate monitoring of water resources and crops. To address these issues, automation techniques have been increasingly embraced in agriculture to alleviate the burden on farmers. Harvesting crops is tiring, repetitive work that also needs a gentle touch. Crop-harvesting robots are built to work in tough conditions like extreme heat. They use computer vision and machine learning to carefully pick ripe, healthy crops while avoiding damaged or unripe ones. Top companies making these robots include Harvest Croo, Abundant Robotics, and Harvest Automation. Weed control is essential in farming but often involves harmful chemicals. To avoid using herbicides, farmers are turning to weeding robots. These robots use AI to tell crops apart from weeds. They remove the weeds using special tools, reducing the need for chemicals. Leading companies in this field are Naio Technologies (France) and Nexus Robotics (Canada). Drones help farmers by giving a bird's eye view of their fields. This helps spot issues like pests, crop health problems, or weed growth quickly. It also helps them use the right number of seeds and fertilizers. Some drones can even plant seeds. These high-tech drones use computer vision and data to improve farming. Key makers of these drones include American Robotics, UAV Systems International (US), and Taranis (Israel).

FIG 1.1 EXAMPLE PICTURE (AGRI BOT)

While specialized vehicles shown in Fig 1.1 have been developed for tasks such as seeding, levelling, water spraying, and lawn mowing, integrating all these functions into a single vehicle remains a challenge. Consequently, there is a focus on developing multifunctional robots capable of performing tasks like seeding, mud levelling, lawn mowing, and water spraying autonomously. By consolidating these functions into a unified vehicle, efficiency and productivity in agricultural operations can be significantly enhanced. Moreover, data generated during these processes can be stored in a cloud-based database, facilitating convenient access and analysis from anywhere at any time.

1.1 OBJECTIVE

Agriculture is a critical sector that sustains human life and economic growth, yet farmers face numerous challenges in maintaining their fields efficiently. Traditional farming methods often require extensive manual labour, time, and resources for tasks such as mowing, spraying pesticides, plowing, and seeding. Additionally, the dependency on fuel-based machinery contributes to environmental pollution and increases operational costs.

To address these challenges, this project aims to design and develop a Agri bot for multi-purpose Farming that will assist farmers in automating essential field maintenance tasks. This smart mowing robot will integrate advanced technologies such as automated driving control, and precision agriculture techniques to enhance productivity while reducing manual effort and environmental impact.

The main objective of this project is to design a machine for agricultural tasks encompassing ploughing, sowing, lawn mowing, and water/pesticide spraying. The key objectives include:

1. Creating a cost-effective agricultural solution to reduce labor requirements.
2. Developing a lightweight and portable device.
3. Achieving high efficiency in completing tasks within shorter timeframes.
4. Harnessing solar energy for battery charging, utilizing the machine's outdoor usage to capture sunlight.

While traditional agricultural methods entail time-consuming manual efforts, modern machinery like tractors, drills, and sprayers offer efficiency but are often too expensive for middle-class farmers. In response, this machine addresses the affordability gap by integrating multiple agricultural functions into a single device, thereby minimizing costs and labor. The primary aim is to provide essential support to small and medium-scale farmers.

1.2 REPORT ORGANIZATION:

Chapter 1: Introduction

This chapter introduces the need for automation in agriculture due to rising labor costs and inefficiencies in traditional farming. It highlights existing robotic solutions like harvesting, weeding, and drone technologies. The chapter also defines the objectives of developing a multifunctional Agri Bot to support small and medium-scale farmers.

Chapter 2: System Description

This chapter explains the hardware components used in the Agri-Bot system like ESP32, DC motor, relays, pumps, batteries, solar panels, voltage regulators, and boost converters. A system block diagram is included. The info in this chapter details the specifications and working of each hardware component.

Chapter 3: Hardware Implementation

It discusses the circuit setup and hardware interfacing like motors, relays, pump, seed sowing, and grass cutting mechanisms. It also includes a regulated power supply design. The info describes how each component is connected and controlled via the ESP32.

Chapter 4: Software Implementation

This chapter focuses on software programming using Arduino IDE and Blynk App for remote control via Wi-Fi. It includes the flowchart and actual source code. The info explains the Arduino structure, setup/loop functions, Blynk setup, and widget integration.

Chapter 5: Results

This chapter shows the practical outcome and performance of the Agri-Bot in real conditions, confirming its effectiveness. Visuals of different operations are also included. The info summarizes the system's functionality and success in implementing core features like seeding and spraying.

Chapter 6: Conclusion

It wraps up the project, highlighting its value to small-scale farmers and suggesting future improvements like advanced mobility and component upgrades. The info covers the system's impact, scope for enhancements, and potential for further integration.

CHAPTER 2

SYSTEM DESCRIPTION

2.1 BLOCK DIAGRAM

Fig 2.1 shows the block diagram of the system, illustrating how different components interact to enable autonomous operation. This system enhances automation, efficiency, and remote accessibility, making it a smart and eco-friendly solution for modern farming. The Agri-Bot is an advanced agricultural system controlled via a mobile application (Blynk) using an ESP32 microcontroller. The mobile app wirelessly communicates with the ESP32 through a WiFi connection, allowing farmers to control the mower and its functions remotely. The ESP32 microcontroller processes these commands and operates different relays to control the mower's movement and various agricultural tasks.

A WiFi receiver ensures real-time communication between the mobile app and the ESP32. The mower's movement is controlled by Relay 1 (GPIO 15) for forward/reverse and Relay 2 (GPIO 2) for left/right navigation. Additionally, Relay 5 (GPIO 18) controls the seeding mechanism, Relay 6 (GPIO 19) operates the water pump for irrigation or spraying pesticides, and Relay 7 (GPIO 21) manages the grass cutter for trimming unwanted grass.

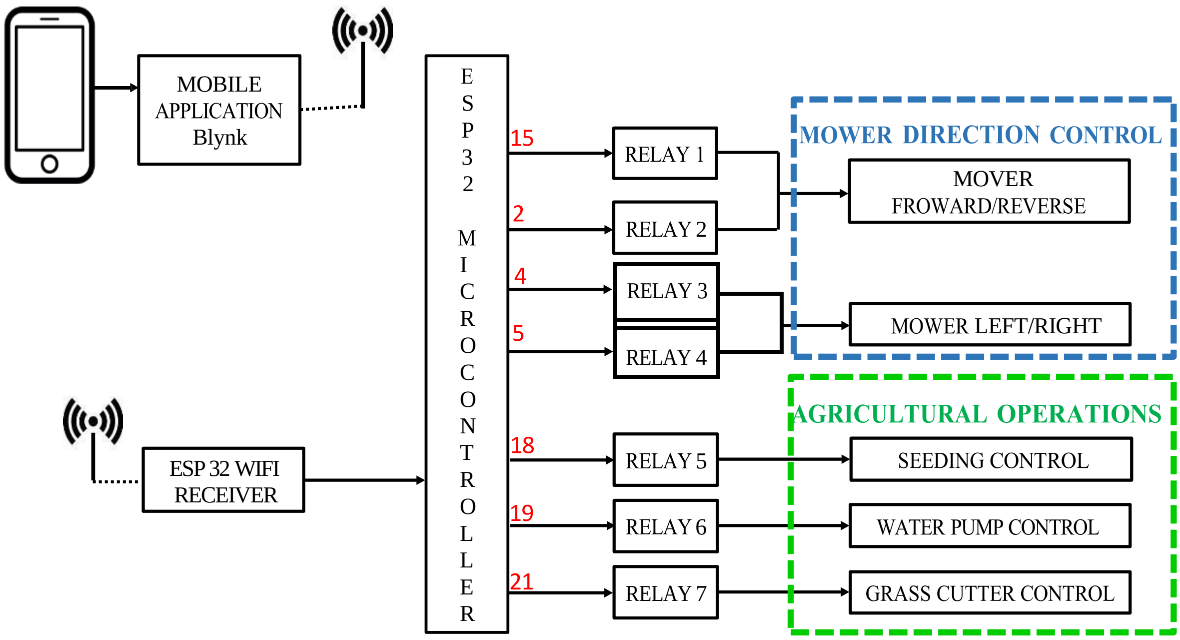

Fig 2.1 BLOCK DIAGRAM

2.2 ESP 32 MICRO-CONTROLLER

The ESP-WROOM-32 Microcontroller shown in a Fig 2.2 is a powerful and versatile Wi-Fi, Bluetooth, and BLE (Bluetooth Low Energy) MCU module designed for a wide range of applications, from low-power sensor networks to demanding tasks such as voice encoding, music streaming, and MP3 decoding. At the heart of this module is the ESP32-S chip, which features dual CPU cores that can be individually controlled or powered, with clock frequencies adjustable between 80 MHz and 240 MHz. The chip also has a low-power coprocessor that allows users to power off the main CPUs while constantly monitoring peripherals for changes or threshold crossings, optimizing energy usage.

The ESP32-S integrates a wide variety of peripherals, including capacitive touch sensors, Hall sensors, low-noise amplifiers, SD card interface, Ethernet, high-speed SDIO/SPI, UART, and I²C. Bluetooth functionality allows for phone connections or broadcasting low-energy beacons, while Wi-Fi enables a large physical range and direct internet connection via a Wi-Fi router.

The module supports data rates of up to 150 Mbps and has 22 dBm (decibel milliwatt) output power at pin PA, providing an extended range. It features 520 KB of SRAM, 4 MB of flash memory, and an on-board PCB antenna, making it highly integrated and efficient for various applications. The ESP32-WROOM-32 operates within a voltage range of 3.0V to 3.6V and consumes a typical current of 80 mA during normal operation. The processor is based on two low-power Xtensa 32-bit LX6 microprocessors, making it ideal for low-power, high-performance applications.

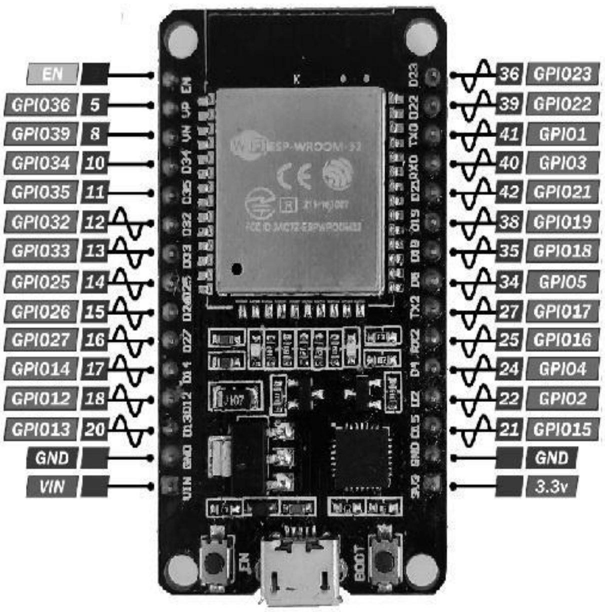

Fig 2.2 ESP-WROOM 32

2.3 12V 300 RPM DC MOTOR

DC Motor – 300RPM – 12Volt geared DC motors are typically simple DC motors with an attached gearbox, as shown in Fig. 2.3. These motors are commonly used in all-terrain robots and a variety of robotic applications. They feature a 3 mm threaded drill hole in the centre of the shaft, making it easy to connect them to wheels or other mechanical assemblies.

The shaft includes a nut and threads for easy attachment, along with internal threading to facilitate secure connections with wheels. These DC geared motors come with a robust metal gearbox designed for heavy-duty applications. They are available in a wide range of RPMs and are ideally suited for both robotics and industrial uses. The motors are user-friendly, available in standard sizes, and built for reliability and ease of integration.

Fig 2.3 12V 300 RPM DC MOTOR

2.3.1 SPECIFICATIONS OF MOTOR

- RPM = 300
- Operating Voltage = 12V DC
- Torque = 2 kg-cm
- No-load current = 60 mA (Max)
- Load current = 300 mA (Max)
- Weight = 125gm weight

2.4 12V RELAY

Relays are frequently employed as switching components in electronics. It is shown in the Fig 2.4. An essential consideration is the trigger voltage, which indicates the voltage required to initiate the relay, leading to the transition of the contact from the Common terminal to either the Normally Closed (NC) terminal or the Normally Open (NO) terminal.

The particular relay requires a 5V trigger voltage, although variants with 3V, 6V, and even 12V trigger voltages are available, allowing for selection based on the project's available voltage. Another vital factor to consider is the voltage and current rating of the load, which denotes the maximum voltage or current that the NC, NO, or common terminal of the relay can manage. For our application, it can manage up to 30V and 10A with DC. It's essential to ensure that the load being used falls within this specified range.

Fig 2.4 12V RELAY

2.4.1 FEATURES OF 12V RELAY

- Coil Activation Voltage: 12 volts DC
- Nominal Activation Current: 70 milliamperes
- Maximum AC Load Current Handling: 10 amps @ 250/125 volts AC
- Maximum DC Load Current Handling: 10 amps @ 30/28 volts DC
- Compact 5-pin configuration with plastic casing
- Activation Time: 10 milliseconds Release Time: 5 milliseconds
- Maximum Mechanical Switching Frequency: 300 operations per minute.

2.5 12V DC PUMP

Pumps are mechanical devices used to create a pressure difference that drives fluid from a storage tank through the plumbing system to a spray nozzle. The 12V DC pump, shown in Fig. 2.5, operates exclusively on a 12V DC power supply and typically features two ports—an IN port to draw water from the tank and an OUT port to discharge it. It is commonly used for water transfer and can be fully submerged, eliminating the need for extra space. This pump has a capacity to transfer water at a rate of 10 liters per minute.

Fig 2.5 12V DC PUMP

2.5.1 SPECIFICATION OF PUMP

- Rated Voltage: 12V DC
- Operating Voltage: 9V-14V DC
- Rated current: 600mA-1500Ma
- Max Water Head: 5m
- Max Flow: 10 L/Min

2.6 CUTTER MOTOR

The Cutter Motor is a high-torque DC motor specifically designed for grass cutting applications. The 12V DC Cutter Motor is shown in the Fig 2.6. It powers the rotating blades of lawnmowers, ensuring efficient and smooth cutting of grass. With reliable performance and high speed, it provides the necessary force to tackle various grass heights and densities.

Fig 2.6 12V CUTTER MOTOR

2.6.1 SPECIFICATION OF CUTTER MOTOR

- Motor Type: 775.
- Operating Voltage: 6~20Vdc. (Nominal 12Vdc)
- No Load Speed: 12,000 RPM @ 12V.
- Rated current: 1.2A @ 12V.
- Stall Torque: 79Ncm @ 14.4V.
- Cooling Fan: Internal
- Overall Size: 98x42mm.
- Shaft: Full Round Type Ø5mm.
- Mounting Screw Size: M4.
- Weight: 350g**.**

2.7 BATTERY

A battery is a device in which chemical energy is directly converted to electrical energy. It consists of one or more voltaic cells, each of which is composed of two half cells connected in series by the conductive electrolyte. Each cell has a positive terminal, shown by a long horizontal line, and a negative terminal, shown by the shorter horizontal line. In this project, two 6V batteries with a 2.5 Ah capacity shown in the Fig 4.7 are connected in series to provide the required voltage and current for the system.

Fig 2.7 6V BATTERY

2.7.1 SPECIFICATION OF BATTERY

- Rated Voltage (V) – 6V
- Rated Power: 20-Hour Rating - 5.0 AH, 10-Hour Rating - 3.8 AH, 5-Hour Rating - 2.65 AH
- Weight - ~0.6KG
- Internal resistance: approx. 30 mΩ
- Chargeable: Yes
- Maximum charge current: 1,2 A
- Maximum discharge current: 350 A (5 s)
- Self-Discharge: These batteries can be stored for approximately 6 months at 25°C (77°F) before requiring a recharge. However, at higher temperatures, the storage time will be shorter.
- Lifespan (cycles): They can endure up to 500 cycles of charging and discharging, with each cycle involving a 50% depth of discharge.

2.8 SOLAR PANEL

The solar panel shown in Fig 2.8, consists of an array of photovoltaic cells arranged within a framework for installation. These cells utilize sunlight to produce direct current (DC) electricity. These modules commonly use crystalline silicon cells or thin-film cells. The structural layer of the module can be positioned on either the top or backside, providing structural support against mechanical loads and protecting cells from physical damage and moisture.

While most modules are rigid, there are flexible options available that incorporate thin-film cells. Cells are interconnected in series to achieve the desired voltage and then in parallel to increase amperage. The power output of the module is calculated by multiplying its voltage by amperage. In this project, the solar panel used has a module voltage of 12V, a short circuit current of 0.46A, and a rated power of 5W. The frame is made of aluminium, and the panel contains 36 cells.

Fig 2.8 12V SOLAR PANEL

2.8.1 SPECIFICATION OF SOLAR PANEL

- Module Voltage: 12V
- Short Circuit Current: 0.46A
- Rated Power: 5W
- Frame Material: Aluminum
- No. of Cells: 36
- Application: Home, Outdoor and Commercial Use
- Panel Type: Polycrystalline

2.9 REGULATOR IC’s

2.9.1 VOLTAGE REGULATOR IC 7805

The 7805 Regulator IC shown in Fig 2.9, is widely used voltage regulator integrated circuit (IC) that provides a stable output voltage of +5 volts. It ensures a consistent 5V supply required for powering to ESP 32 microcontroller. By maintaining a fixed output, the 7805 protects the microcontroller from voltage fluctuations.

Fig 2.9 7805 VOLTAGE REGULATOR

2.9.2 VOLTAGE REGULATOR IC 7812

The 7812 Regulator IC shown in Fig 2.10, is a widely used voltage regulator integrated circuit (IC) that provides a stable output voltage of +12 volts. It ensures a consistent 12V supply required for powering the system components. By maintaining a fixed output, the 7812 protects the system from voltage fluctuations. Connected at the output of the booster circuit, it provides a fixed 12V output to the battery, ensuring that the battery is efficiently charged.

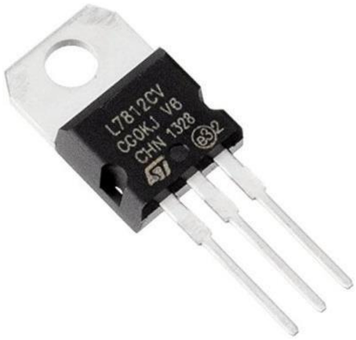

Fig 2.10 7812 VOLTAGE REGULATOR

2.10 12V BOOST CONVERTER

The 12V Boost Converter is a device that steps up the voltage from a lower voltage source to a stable 12V output. It is shown in Fig 2.11. It is connected to the output of the solar panel to boost the voltage to 12V, ensuring a consistent power supply. This converter efficiently increases the voltage while maintaining current flow to power various components. The input voltage range is from 2.5V to Vout-0.5V, and the output voltage can be set to 5V, 8V, 9V, or 12V. With a maximum output current of 1A and low power consumption, the boost converter optimizes the overall system’s efficiency and performance, making it ideal for solar- powered systems.

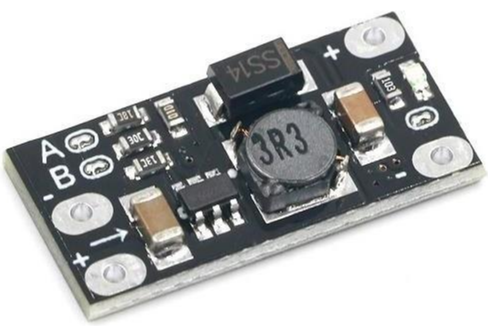

Fig 2.11 12V BOOST CONVERTER

CHAPTER 3

HARDWARE IMPLEMENTATION

3.1 INTRODUCTION

This system is designed for agricultural automation, integrating multiple functionalities such as spraying pesticides, cutting grass, and seed sowing. The pump (used for spraying pesticides), the cutter (a motor with blades for cutting grass), and the seed sowing mechanism all operate on DC power supplied by a rechargeable battery. The battery provides the necessary power to the pump, cutter, seeding motor, and other components within the system. The battery is efficiently charged using a solar panel and charger, ensuring continuous operation.

A remote controller (an Android mobile with a controlling application) is used to manage the movement of the system, along with the activation of spraying, cutting, and seeding operations. The device connects to any Android mobile with Bluetooth support, enabling real-time control. At any given time, only one user can control the device; for another user to take over, the first user must disconnect, or the device must be rebooted to reset the connection.

Following the user's instructions, the system moves across agricultural fields, spraying pesticides on plants and herbs, cutting grass in agricultural lands and sowing seeds in the soil efficiently. The integration of these three functionalities spraying, cutting, and seeding enhances agricultural productivity while reducing manual labor.

3.2 CIRCUIT DIAGRAM

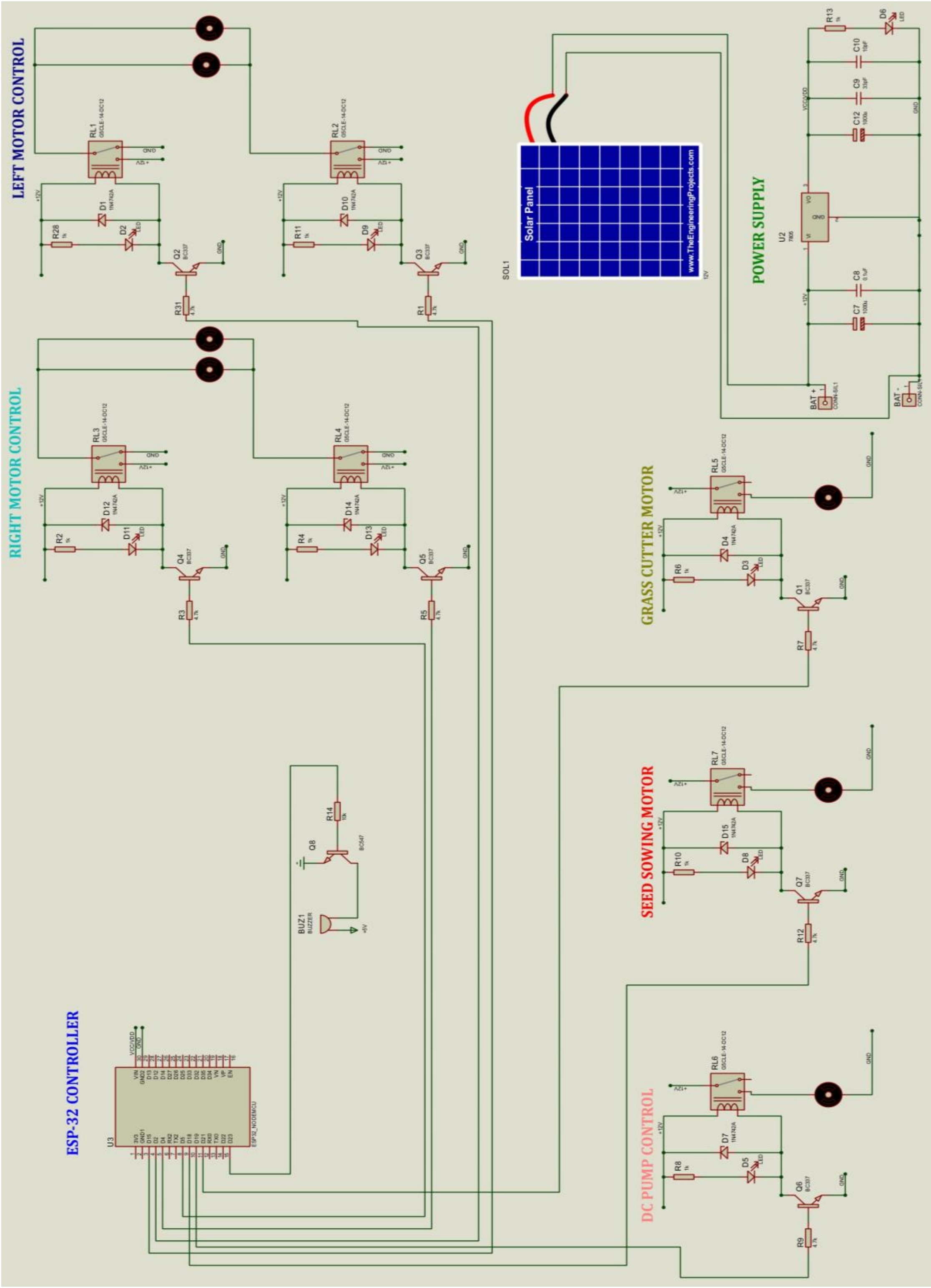

Fig 3.1 CIRCUIT DIAGRAM

The controller used in this circuit is the ESP-32. It serves as the main processing unit, controlling various motors and components. The ESP-32 receives and processes input signals and sends control signals to different sections.

3.2.1 MOTOR DRIVER INTERFACING

The motors are controlled using relays. The ESP-32 sends control signals to the transistor circuits, which, in turn, activate the relays for motor operation. The right and left motors are connected to their respective relays for movement control.

3.2.2 MOTOR INTERFACING

Two motors are used for movement, controlled by relays. The right motor is connected to RL3 and RL4, while the left motor is connected to RL1 and RL2. The relays switch the motors on or off as per the ESP-32's instructions.

3.2.3 DC PUMP CONTROL

The water pump motor is controlled using Relay RL6.

- The positive terminal of the pump motor is connected to the Normally Open (NO) pin of RL6.
- The negative terminal is connected to the battery negative terminal.
- The battery positive terminal is connected to the Common (COM) pin of RL6.
- The coil pin of RL6 is controlled by the ESP-32.

3.2.4 SEED SOWING MOTOR INTERFACING

The seed sowing motor is controlled using Relay RL7.

- The positive terminal of the motor is connected to the NO pin of RL7.
- The negative terminal is connected to the battery negative terminal.
- The battery positive terminal is connected to the COM pin of RL7.
- The relay coil pin is connected to the ESP-32 for control.

3.2.5 GRASS CUTTER MOTOR INTERFACING

The grass cutter motor is connected to Relay RL5.

- The positive terminal of the cutter motor is connected to the NO pin of RL5.
- The negative terminal is connected to the battery negative terminal.
- The battery positive terminal is connected to the COM pin of RL5.
- The relay coil pin is controlled by the ESP-32.

CHAPTER 4

SOFTWARE IMPLEMENTATION

4.1 ARDUINO IDE SOFTWARE

Arduino is a prototype platform (open-source) based on an easy-to-use hardware and software. It consists of a circuit board, which can be programmed and a ready-made software called Arduino IDE (Integrated Development Environment) Software, which is used to write and upload the computer code to the physical board. The Arduino IDE software is a cross-platform application (for Windows, macOS, Linux) that is written in the programming language Java, C and C++. It is used to write and upload programs to Arduino compatible boards. The source code for the IDE is released under the GNU General Public License, version 2. The Arduino IDE supports the languages C and C++ using special rules of code structuring. The Arduino IDE supplies a software library from the Wiring project, which provides many common input and output procedures. User-written code only requires two basic functions, for starting the sketch and the main program loop, that are compiled and linked with a program sub m () into an executable cyclic executive program with the GNU tool chain, also included with the IDE distribution. The Arduino IDE employs the program argued to convert the executable code into a text file in hexadecimal encoding that is loaded into the Arduino board by a loader program in the board's firmware.

Fig 4.1 ARDUINO IDE SOFTWARE

4.1.1 IMPORTANT TERMS IN ARDUINO IDE SOFTWARE

The important parameters present in the Arduino IDE software is shown in the fig 4.2. The explanation of each of the terms are mentioned below.

- Menu Bar: Gives the access to the tools needed for creating and saving Arduino sketches.
- Verify Button: Compiles your code and checks for errors in spelling or syntax.
- Upload Button: Sends the code to the board that's connected such as Arduino Uno in this case. Lights on the board will blink rapidly when uploading.
- New Sketch: Opens up a new window containing a blank sketch.
- Sketch Name: When the sketch is saved, the name of the sketch is displayed here.
- Open Existing Sketch: Allows to open a saved sketch or one from the stored examples.

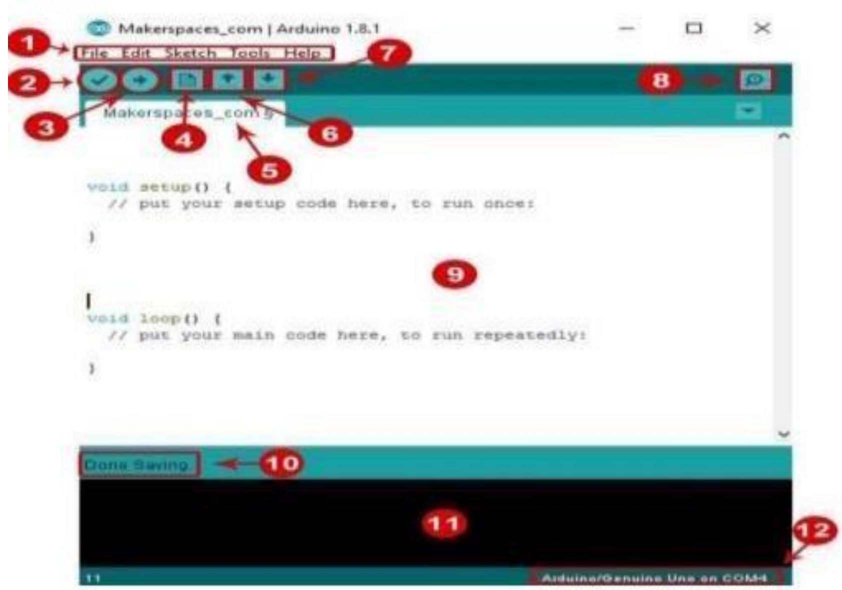

Fig 4.2 IMPORTANT TERMS IN ARDUINO IDE SOFTWARE

- Save Sketch: This saves the sketch which is currently open.
- Serial Monitor: When the board is connected, this will display the serial information of your Arduino.

- Code Area: This area is where to compose the code of the sketch that tells the board what to do.
- Message Area: This area tells the status on saving, code compiling, errors and more.
- Text Console: Shows the details of an error messages, size of the program that was compiled and additional info.
- Board and Serial Port: Tells that what board is being used and what serial port it's connected to system.

4.1.2 STRUCTURE OF PROGRAM

Arduino programs can be divided in three main parts: Structure, Values (variables and constants), and Functions. In this tutorial, the Arduino software program, step by step, and how to write the program without any syntax or compilation error.

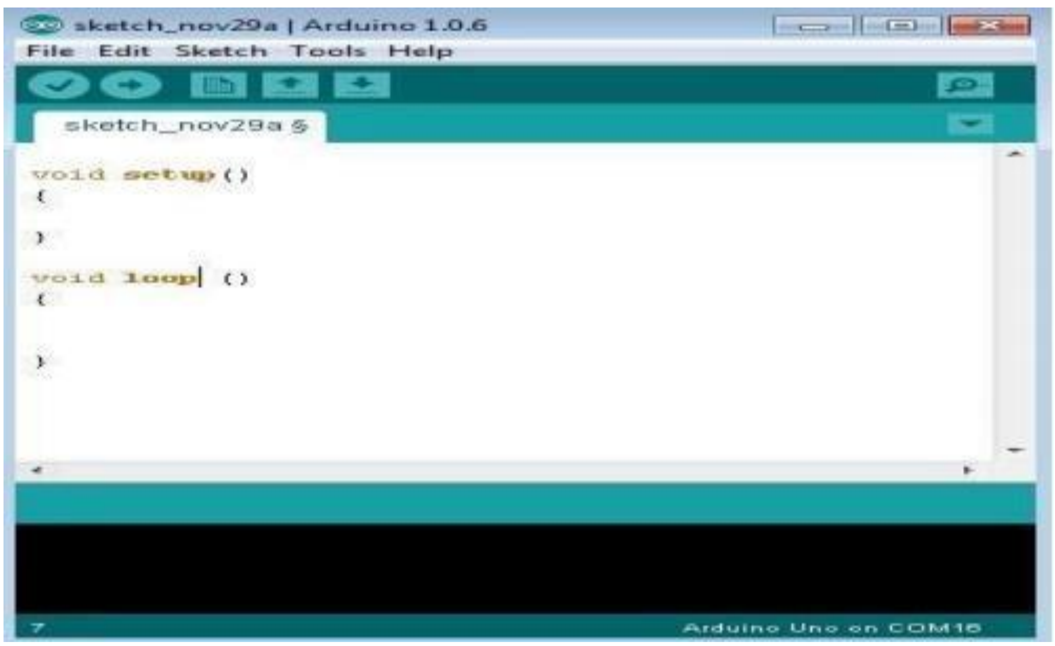

Fig 4.3 STRUCTURE OF PROGRAM

Let us start with the Structure. Software structure consist of two main functions −

- Setup () function
- Loop () function

4.1.3 SETUP () FUNCTION

The setup () function is called when a sketch starts. Use it to initialize the variables, pin modes, start using libraries, etc. The setup function will only run once, after each power up or reset of the Arduino board.

- Input
- Output
- Return

4.1.4 LOOP () FUNCTION

After creating a loop () function, which initializes and sets the initial values, the loop () function does precisely what its name suggests, and loops consecutively, allowing your program to change and respond. Use it to actively control the Arduino board.

- Input
- Output
- Return

4.2 BLYNK APPLICATION

Tailored for the Internet of Things, Blynk facilitates remote control of hardware, visualization of sensor data, data storage, and various other functionalities. The platform comprises three essential components:

- Blynk App: Empowers users to craft sophisticated project interfaces using a diverse range of widgets.
- Blynk Server: Manages communication between smartphones and hardware. Users can opt for the Blynk Cloud service or establish a private Blynk server locally. This open-source server accommodates numerous devices, with the flexibility to run on a Raspberry Pi.
- Blynk Libraries: Accessible across major hardware platforms, these libraries streamline communication with the server and processing of commands.

Key Features:

- Ensuring uniform API and UI across all compatible hardware and devices.
- Offering diverse cloud connectivity options such as Wi-Fi, Ethernet, USB (Serial), and GSM.
- Providing a range of user-friendly Widgets for enhanced functionality.
- Enabling direct pin control without the necessity for coding.
- Streamlining the integration of new features through virtual pins.
- Tracking historical data with the Super Chart widget.
- Enabling device-to-device communication via the Bridge Widget.
- Supporting communication methods like emails, tweets, and push notifications.
- Continuous addition of innovative features.
- The figure 4.4 shows the flow diagram.

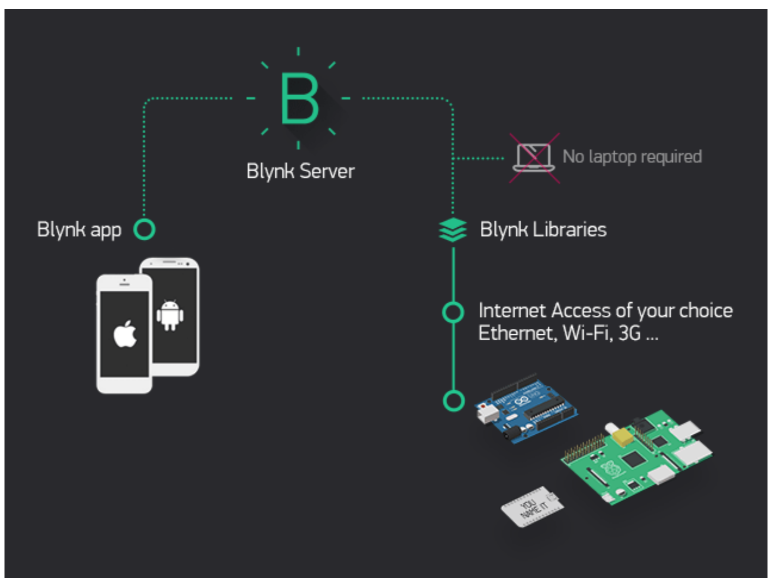

Fig 4.4 FLOW DIAGRAM

Prerequisites for Blynk:

Hardware

An Arduino, Raspberry Pi, or equivalent development board with internet connectivity features. Certain boards may require supplementary shields for internet communication, while others come pre-equipped for internet access (e.g., ESP8266, Raspberry Pi with Wi-Fi dongle, Particle Photon, or Spark Fun Blynk Board) Alternatively, boards lacking built-in internet capabilities can be linked via USB to a computer, Smartphone. The Blynk App compatible with both iOS and Android devices.

4.2.1 INTRODUCTION TO THE BLYNK APP:

1. **Establish a Blynk Account**

- Upon installing the Blynk App, create a distinct Blynk account, separate from any existing Blynk Forums accounts.
- The figure 4.5 shows the creating account.
- Using a valid email address is recommended for simplified account management.

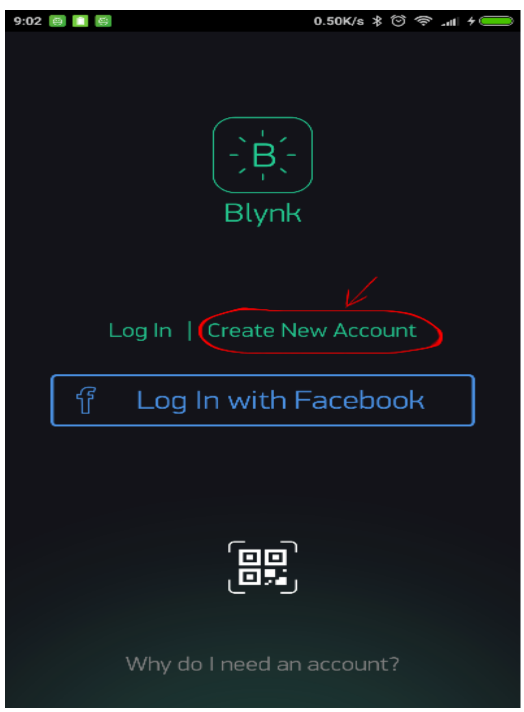

Fig 4.5 CREATING ACCOUNT

2. Start a New Project

After successfully logging in, commence by initiating a new project. The figure 4.6 shows the creating of new project.

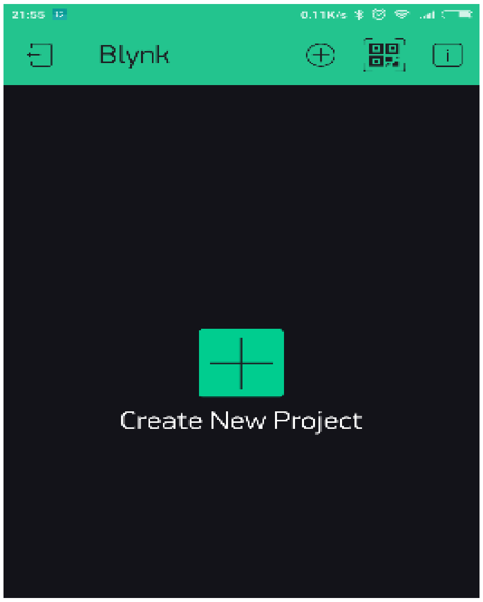

Fig 4.6 CREATING NEW PROJECT

3. Pick Your Hardware

Select the exact hardware model you plan to use. Explore the list of compatible hardware choices! Hardware is shown in the figure 4.7.

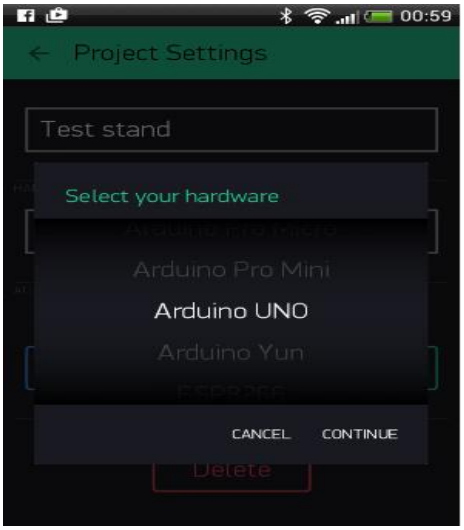

Fig 4.7 HARDWARE

4. Authentication Token

The Authentication Token acts as a unique identifier essential for connecting your hardware to your smartphone. Each new project you create will be allocated its own individual Authentication Token. After creating the project, you'll automatically receive the Authentication Token via email, or you can manually copy it. Just head to the devices section and select the device of your choice. The figure 4.8 shows the authentication token.

Fig 4.8 AUTHENTICATION TOKEN

You will encounter the token.

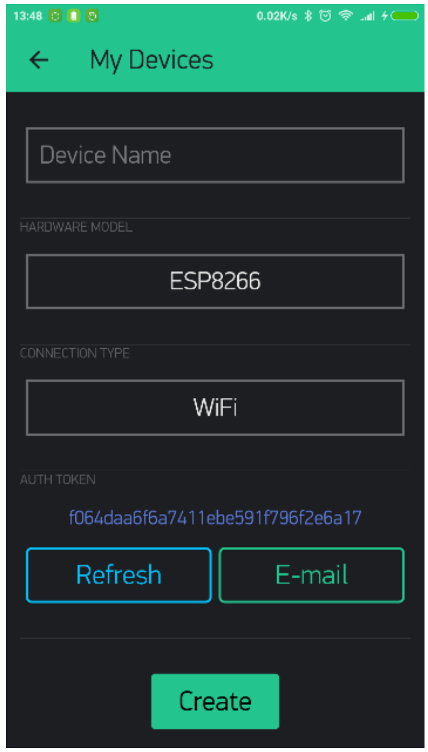

Fig 4.9 CREATING PROJECT

Reminder: To prevent unauthorized access to your hardware, refrain from sharing your Authentication Token unless you specifically intend to grant access. Emailing it is a convenient method: just press the email icon, and the token will be sent to your registered email address. The figure 4.9 and 4.10 shows the creating project.

Alternatively, tapping on the Token line will copy it to your clipboard. Finally, click the "Create" button to proceed.

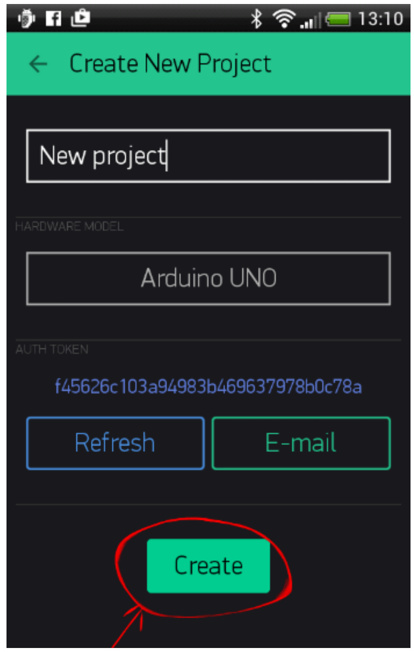

Fig 4.10 CREATING PROJECT

5. Add a Widget

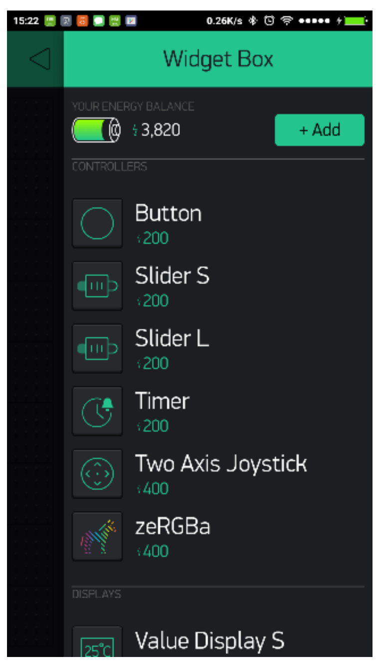

Fig 4.11 WIDGET BOX

To fill your project canvas, start by incorporating a button to manage the LED. Tap anywhere on the canvas to open the widget box, which contains an array of available widgets. Then, choose a button to include on your canvas.

To relocate a widget, tap and hold it, then drag it to the preferred location. Each widget has its own settings, which can be accessed by tapping on the widget itself. The figure 4.11 shows the widget box.

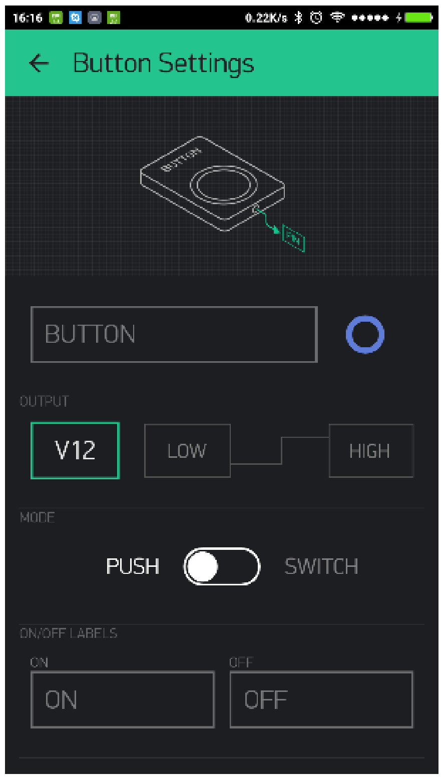

Fig 4.12 SETTINGS

Configuring the PIN is of utmost importance and shown in the figure 4.12.

4.3 PROGRAM FLOW CHART

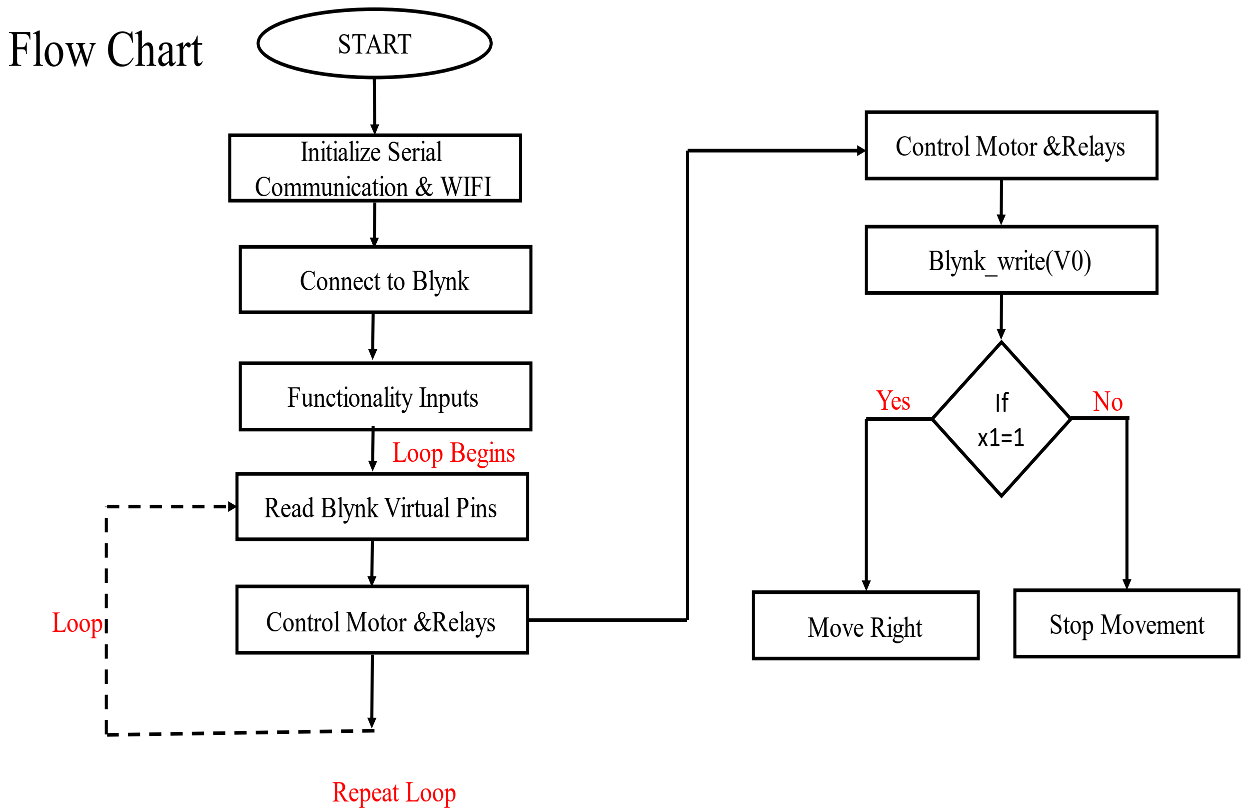

Fig 4.13 PROGRAM FLOW CHART

4.4 PROGRAM

```
#define BLYNK_TEMPLATE_ID        "TMPL3hPAtsXk-"

#define BLYNK_TEMPLATE_NAME      "Quickstart Template"

#define BLYNK_AUTH_TOKEN         "Zo8vEpr0Wpd0g-ut33uo_nR4DWzgWZ4_"

#define BLYNK_PRINT Serial

#include <WiFi.h>

#include <BlynkSimpleEsp32.h>
```

```
char auth[] = BLYNK_AUTH_TOKEN;
char ssid[] = "admin";
char pass[] = "1234567890";
int x,y,x1,x2,x3,x4,x5,x6,x7;
#define r1 15    //fwd
#define r2 2    //rev
#define r3 4  //left
#define r4 5  //right
#define r5 18 //seed
#define r6 19 //cover
#define r7 21 //grass cutter
#define buzzer 23
int start;
BLYNK_CONNECTED()
{
  Blynk.syncVirtual(V0);
  Blynk.syncVirtual(V1);
  Blynk.syncVirtual(V2);
  Blynk.syncVirtual(V3);
  Blynk.syncVirtual(V4);
  }
BLYNK_WRITE(V0)
{
```

```
x1 = param.asInt();
if(x1==1){Serial.println("right");digitalWrite(r1,LOW);digitalWrite(r2,HIGH);digitalWrite(r3,HIGH);digitalWrite(r4,LOW);} // RIGHT
if(x1==0){Serial.println("stop");digitalWrite(r1,LOW);digitalWrite(r2,LOW);digitalWrite(r3,LOW);digitalWrite(r4,LOW);} //
}
BLYNK_WRITE(V1)
{
x2 = param.asInt();
if(x2==1){Serial.println("left");digitalWrite(r1,HIGH);digitalWrite(r2,LOW);digitalWrite(r3,LOW);digitalWrite(r4,HIGH);} // left
if(x2==0){Serial.println("stop");digitalWrite(r1,LOW);digitalWrite(r2,LOW);digitalWrite(r3,LOW);digitalWrite(r4,LOW);} // RIGHT
}
BLYNK_WRITE(V2)
{
x3 = param.asInt();
if(x3==1){Serial.println("seed on");digitalWrite(r5,HIGH);} // RIGHT
if(x3==0){Serial.println("seed off");digitalWrite(r5,LOW);} // RIGHT
}
BLYNK_WRITE(V3)
{
x4 = param.asInt();
if(x4==1){Serial.println("cover on");digitalWrite(r6,HIGH);} // RIGHT
```

```
if(x4==0){Serial.println("cover off");digitalWrite(r6,LOW);} // RIGHT

}

BLYNK_WRITE(V4)

{

x5 = param.asInt();

if(x5==1){Serial.println("cutter on");digitalWrite(r7,HIGH);} // RIGHT

if(x5==0){Serial.println("cutter off");digitalWrite(r7,LOW);} // RIGHT

}

BLYNK_WRITE(V5)

{

x6 = param.asInt();

if(x6==1){Serial.println("forward");digitalWrite(r1,HIGH);digitalWrite(r2,LOW);digitalWrite(r3
,HIGH);digitalWrite(r4,LOW);} // RIGHT

if(x6==0){Serial.println("stop");digitalWrite(r1,LOW);digitalWrite(r2,LOW);digitalWrite(r3,LO
W);digitalWrite(r4,LOW);} //

}

BLYNK_WRITE(V6)

{

x7 = param.asInt();

if(x7==1){Serial.println("reverse");digitalWrite(r1,LOW);digitalWrite(r2,HIGH);digitalWrite(r3,
LOW);digitalWrite(r4,HIGH);} // RIGHT

if(x7==0){Serial.println("stop");digitalWrite(r1,LOW);digitalWrite(r2,LOW);digitalWrite(r3,LO
W);digitalWrite(r4,LOW);} //

}
```

```
void setup()
{
   Serial.begin(9600);
pinMode(r1, OUTPUT);
pinMode(r2, OUTPUT);
pinMode(r3, OUTPUT);
pinMode(r4, OUTPUT);
pinMode(r5, OUTPUT);
pinMode(r6, OUTPUT);
pinMode(r7, OUTPUT);

digitalWrite(r1,LOW);digitalWrite(r2,LOW);
digitalWrite(r3,LOW);digitalWrite(r4,LOW);
digitalWrite(r5,LOW);digitalWrite(r6,LOW);
digitalWrite(r7,LOW);
Blynk.begin(auth, ssid, pass);
digitalWrite(buzzer,HIGH);delay(1000);
digitalWrite(buzzer,LOW);
}
void loop()
{
  Blynk.run();
}
```

CHAPTER 5

RESULTS

The proposed system has demonstrated superiority over the existing system across all parameters. This section will detail and elucidate the overall outcomes of the project, encompassing the physical structure and circuit connection.

5.1 OUTCOME OF THE PROJECT

The implementation of agribot for multipurpose cultivation heralds a transformative shift in agricultural practices, yielding a myriad of significant outcomes. Firstly, the adoption of agribot leads to a substantial increase in overall productivity and efficiency in farming operations. By automating tasks such as plowing, grass cutting, spraying, and seed sowing. Agribot significantly reduce the reliance on manual labour while expediting the completion of tasks. This not only allows farmers to cover larger areas in less time but also enables them to allocate human resources to more specialized and strategic roles, thereby maximizing output.

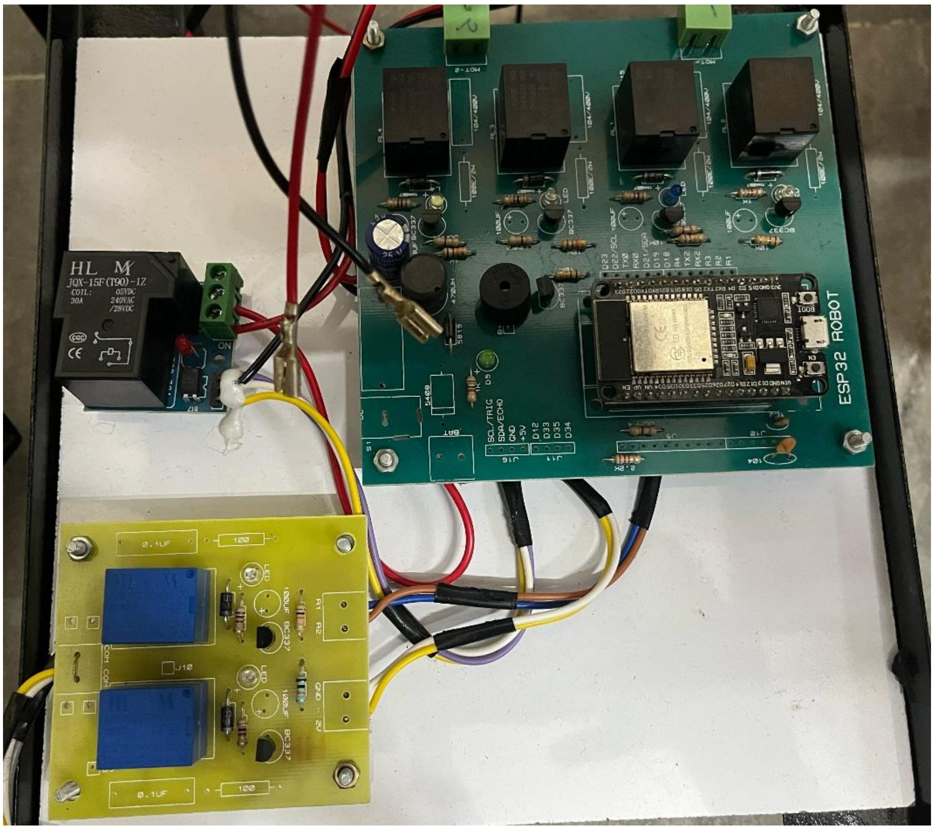

Fig 5.1 CIRCUIT CONNECTION OF THE PROPOSED SYSTEM

Fig 5.2 SEED SOWING OPERATION

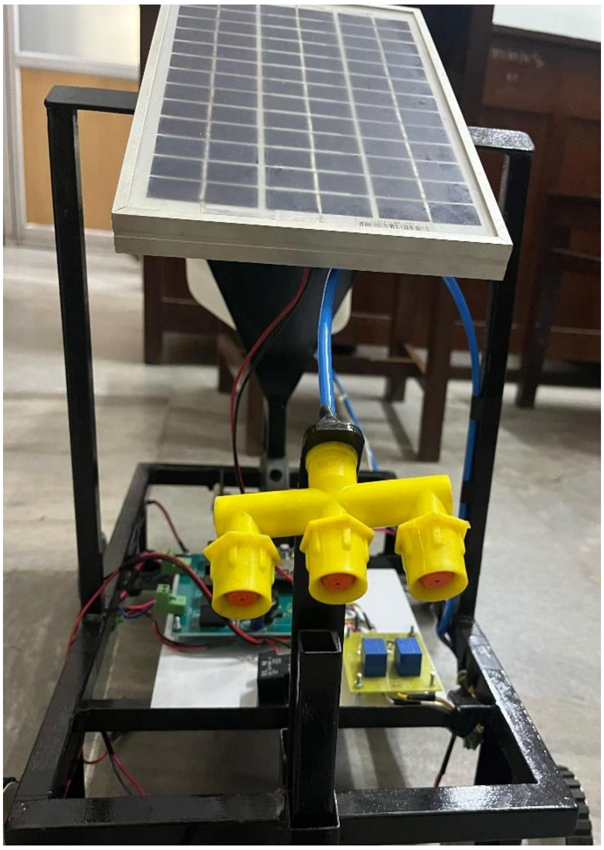

Fig 5.3 SPRAYING OPERATION

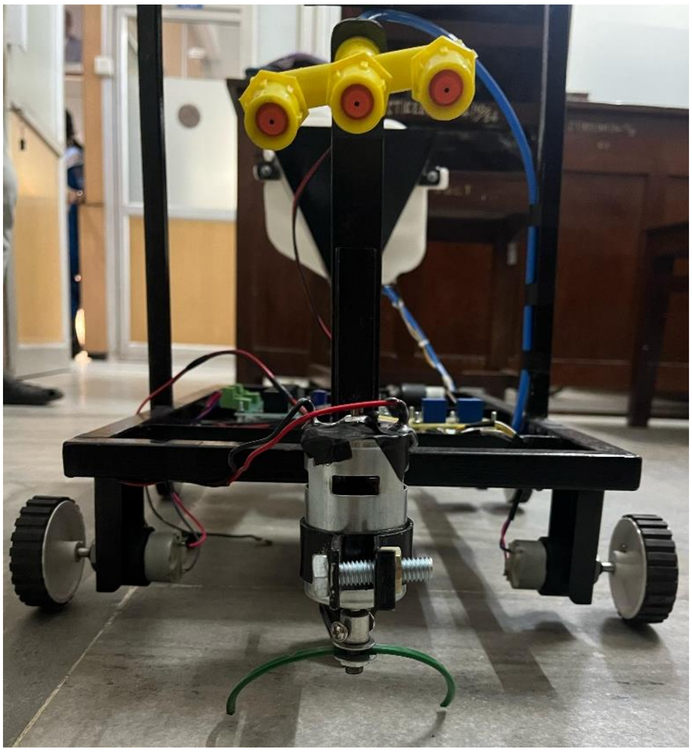

Fig 5.4 GRASS CUTTER OPERATION

Fig 5.5 OVERALL HARDWARE SYSTEM

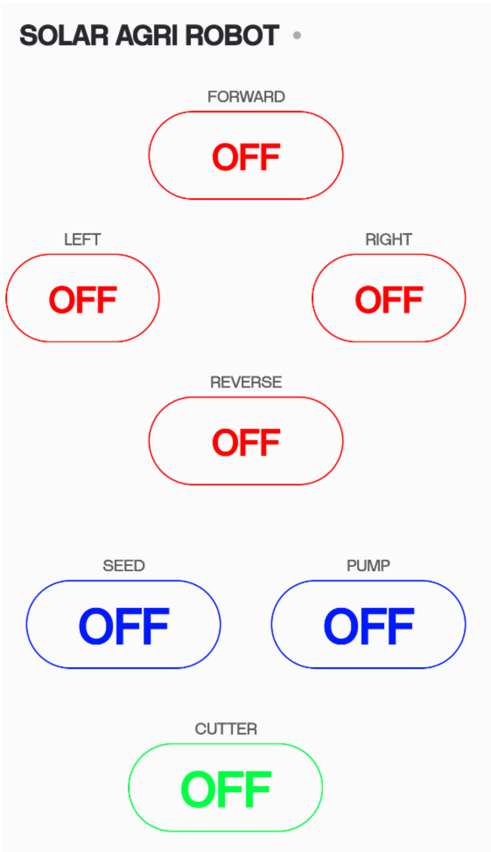

Fig 5.6 BLYNK APP INTERFACE

CHAPTER 6

CONCLUSION

The multipurpose agri robot developed can significantly impact the farming sector. A versatile agricultural machine proves invaluable for performing multiple tasks with a single unit. Practically, this all-in-one agricultural machine can handle seed sowing, water/pesticide spraying, grass cutting, and plowing. Each component is strategically arranged to allow for seamless transitions between farming stages, optimizing efficiency. This project has effectively amalgamated diverse concepts from mechanical engineering and agriculture to enhance productivity while cutting down on labor and expenses. The concept of multifunctional devices is pioneering, potentially patentable, and has been successfully implemented in practical scenarios. Further enhancements could include integrating additional functionalities such as grading and lawn mowing into the vehicle, utilizing the engine to power equipment, and adapting tires to suit various terrains. Implementing a separate placement mechanism for the plow tip enables easy replacement in case of breakage. Additionally, incorporating a steering mechanism would facilitate maneuverability.

6.1 FUTURE SCOPE

By further refining and enhancing the durability and performance of our machinery, we aim to create a truly lifelong multi-purpose agricultural solution. With the integration of hydraulics, gearboxes, and other adjustments, these units could potentially be transformed into tractor units, expanding their versatility and utility.

REFERANCES

1. Kim, S. Kim, C. Ju, and H. Son, "Unmanned aerial vehicles in agriculture: A review of perspective of platform, control, and applications," 2019 IEEE Access, vol. 7, pp. 105 100–105 115.
2. D. Ramesh and H.P.Girishkumar," Development of Agricultural Seeding Equipment", International Journal of Informative & Futuristic Research, 2014, volume-1 Issue-10, J, Pp-133 138.
3. J. Haule and K. Michael, "Deployment of wireless sensor networks (WSN) in automated irrigation management and scheduling systems," in Proc. 2nd Pan African Int. Conf. Sci., Comput. Telecommun. (PACT), Arusha, Tanzania, 2014, volume-1 ISBN: 978-1-4799-6899-2.
4. Swapnil L. Kolhe et.al. (Feb2019), "MULTIPURPOSE SPRAY PUMP MACHINE" (Publisher).
5. M. H. Hameed, S. H. Ali, and A. H. Ali, "Implementation of automatic lawn mower system for smart lawn maintenance," in Proc. Int. Conf. Electr., Commun. Comput. Eng. (ICECCE), Istanbul, Turkey, 2023, pp. 1–6.
6. R. Kumar, P. S. Kumar, and B. Singh, "Design and development of smart lawn mower," in Proc. IEEE Int. Conf. Comput. Power Commun. Technol. (GUCON), Greater Noida, India, 2021, pp. 1–5. doi: 10.1109/GUCON50781.2021.9591825.
7. H. Zhuang, W. Zhang, and Y. Liu, "Study of autonomous robotic lawn mower using multi-sensor fusion based simultaneous localization and mapping," in Proc. IEEE Int. Conf. Ind. Technol. (ICIT), Shanghai, China, 2022, pp. 1–6. doi: 10.1109/ICIT48603.2022.9910445.
8. A. R. Rahman, M. A. M. Said, and S. A. Hassan, "Development of a light weight autonomous lawn mower and performance analysis using fuzzy logic technique," in Proc. IEEE Symp. Ind. Electron. Appl. (ISIEA), Kuala Lumpur, Malaysia, 2022, pp. 1–5. doi: 10.1109/ISIEA52957.2022.9856342.