DESIGN AND IMPLEMENTATION OF SOLAR POWERED SEED SPRAYER

A Thesis Submitted

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Design and Implementation of Solar Powered Seed Sprayer

A thesis report submitted to the Department of Mechanical Engineering for the partial fulfillment of the award of the degree of “Bachelor of Science in Mechanical Engineering”.

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DECLARATION

We hereby, declare that work presented in this project is the outcome of the investigation and research work performed by us under the supervision of **Hasan Tareq Mahin**, Lecturer, Department of Mechanical Engineering, Sonargaon University (SU). We also declare that no part of this project and thereof has been or is being submitted else where for the award of any degree.

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In my capacity as supervision of the candidate's project, I certify that the above statements are true to the best of my knowledge.

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ABSTRACT

In today's era all sectors are moving towards the rapid growth using many advanced technologies. Of all these sectors, agriculture is also one of them. In order to meet the increasing demand of food, farmers have to implement advanced techniques so that the soil texture is not affected and the overall food production is increased. Hence, in this project we aim at designing and fabricating a solar operated seed sprayer machine. Seed sowing process is usually carried out by humans using manual power. In this solar seed sprayer machine project, seed in a hopper gets sprayed by means of fan or blower directly to the land without any manual effort. Using this process the seeds are fed in the land during the time of plough. The main advantage of using this technique is that, it reduces the time of seed to land and reduces human efforts. In this solar agriculture sprayer solar panel is used as power source which is used to run the fan, and thus does not require any additional power supply. This innovative mechanical project of seed sowing equipment can save more time for sowing process and also it reduces a lot of labour cost. This solar agro sprayer project is very helpful for small scale farmers.

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LIST OF ABBREVIATIONS

AC	Alternating Current
DC	Direct Current
HC	High Capacity
IDE	Integrated Development Environment
RPM	Revolution per Minute

Chapter 1

INTRODUCTION

1.1 General

Today the environmental impact of agricultural production is very much in focus and the demands on the industry are increasing. In the present scenario, most of the countries do not have sufficient skilled manpower in the agricultural sector, and that affects the growth of developing countries. Therefore, farmers have to use upgraded technology for cultivation activity (digging, seed sowing, fertilizing, spraying, etc.). So, it's time to automate the sector to overcome this problem. In India, there are 70% of people dependent on agriculture. So, we need to study improving agricultural equipment. The innovative idea of our project is to automate the process of digging and seed sowing crops such as sunflower, baby corn, groundnut vegetables like beans, lady's finger, pumpkin, and pulses like black gram, green gram, etc. and to reduce the human effort. Since we have a lack of manpower in our country, it is very difficult to do digging and sowing operations on time, Automation saves a lot of manual work and speeds up the cultivation activity. The energy required for this robotic machine is less as compared with other machines like tractors or any agricultural instrument, also this energy is generated from solar energy which is found abundantly in nature. Pollution is also a big problem which is eliminated by using solar plates [1-3]

At present many countries have a shortage of skilled labor in the agriculture sector, which affects the growth rate of the developing countries including India which hugely depends on the agriculture sector. As the population of India is rising, the demand for food is also escalating which leads to higher crop production per hectare. So, to fix these problems farmers should use the latest technological advancements for various agricultural practices like digging, sowing, irrigation, etc., which are more efficient and less time consuming. The main work of the sowing operation is to sow seeds at the required depth with specific spacing between the two sowed seeds. This can be achieved with the help of a seed sowing machine which will dig the furrow and sow the seeds. After the seeds are placed in the furrow land, it will cover the sowed seeds

with soil and sprinkle water. The seed-sowing machine saves time and labor requirements, thus saving a lot of money along with the assurance of proper seed broadcasting [4-5].

As day-by-day labor availability becomes a great concern for the farmers and labor costs become more, this machine reduces the efforts and total cost of sowing the seeds and fertilizer placement to meet the demands of farmers who have to use new techniques in cropping to increase the yield. The requirements of small-scale sowing machines are, they should be simple in design, affordable for small-scale peasant farmers, and easy to maintain for effective handling by unskilled farmers. In this project, an attempt has been made to reduce in cost of the machine and develop a multifunctional sewing machine that can perform simultaneous operations [6].

In addition, saving in cost of operation time, labor and energy are other advantages to be derived from the use of improved machinery for such operations. A traditional method of seed sowing has many disadvantages. Our proposed **"Design and implementation of solar powered seed sprayer"** is used to sow seeds easily. In this project, an attempt has been made to provide a low-cost sowing machine that also reduces human effort

1.2 Objectives of the study

The Objectives of the Project is below:

- To **Design and implementation of solar powered seed sprayer.**
- To investigation of various types of seed sowing and spraying machine
- To development of solar powered seed sowing and seed spraying machine.
- To extend the concept of Solar PV Technology on "Solar Sprayers" as "Energy Alternate Devices".

Chapter 2

LITERATURE REVIEW

2.1 Background

A field is initially prepared with a plow to a series of linear cuts known as furrows. The field is then seeded by throwing the seeds over the field. The result is a field planted roughly in rows but having a large number of plants. Many projects are undertaken to overcome the drawbacks of the broadcasting system. Some of those projects are given below. The drawback of a manual broadcasting system is no control over the depth of seed placement. No uniformity in the distribution of seed placement. Loss of seeds & Time required for sowing is more [7].

In this era of technological revolution, we can implement new technologies in the field of agriculture for an increase in the overall production of agricultural commodities. One of the most significant components in the agricultural procedure is the seed-sowing machine. Nowadays, agricultural activities are performed by using tractors, which use fossil fuels for functioning. Harmful gases are released throughout the process, which causes a lot of damage to the environment. They work to make use of solar power which overcomes this problem and is also cost efficient. In this project, the solar power is collected by using solar panels and then the power is saved in batteries with the help of charge controllers [8].

A literature survey is a proof essay of sorts. It is a study of relevant literature materials about a topic we have been given.

2.2 Literature Review

This article [9] proposes a system model to automate the labor-intensive task of digging and seed sowing in response to Pakistan's increasing demand for food production. The proposed model utilizes solar energy and a DC Stepper Motor to automate the process of digging, sowing seeds, and leveling the soil, resulting in reduced labor costs and improved crop productivity while maintaining soil quality. The Seed Hopper is designed to discard seeds at a specific distance,

ensuring uniform spacing between seeds and rows. This system model has the potential to significantly reduce seed costs while improving the accuracy of seed count and spacing, which are often not achieved when farmers manually sprinkle seeds.

The main objective of this project [10] is to fabricate a complete functional seed sprayer machine that is fully powered by solar energy. The solar seed sprayer machine should be able to spray different types of vegetable seeds. Further analysis of the performance has been conducted through the seed amount sprayed over time and the area covered by the machine. Solar energy is used as the power supply for the machine. Wireless communication is used to remotely control the machine, and 3D printing technology is used to assist in the fabrication of required components. The solar seed sprayer machine under research is composed of four main systems: the remote driving system, solar charging system, seed storage dispenser system, and impeller spreader system. Different experiments have been conducted to assess the performance of the machine. The performance of the machine is indicated by the capability of a machine to spread different types of seeds of various sizes and shapes. The spread seed count has been also tested as well with the area covered by the machine.

In this project [11], they are developing an agricultural-based robot this robot should be useful for farmers. In this robot, automatic seed placing and pumping the water to the seed (desired location) and they are using pick and place set up to remove the dry plant and sow the seeds consecutively. They are using the sensor to find the conditions of the land. If any obstacle is noticed the robot will stop at that place and (the soil moisture sensor) is used to find the dry or wet condition in the plant if it is dry the pump motor will start and water will be supplied.

This Project [12] is with success applied for seed sowing and spraying use. Performance of the parts can be increased once it operates on a less uneven surface and potency is inflated once

the height of the crops is the same and the distance between the pair of crops is minimal. Innovative Seed sowing instrument has additional necessities in agriculture. By using this innovative seed-sowing machine, the time needed and labor price can be reduced. It is very beneficial for small-scale farmers. After comparing the various methods of seed sowing and the drawbacks of the traditional methods, it is concluded that this solar-powered seed sowing machine can:

- Maintain space between rows and control the rate of sowing.
- Control the depth of seed and losses of seeds can be reduced.
- Operate various operations simultaneously.
- Saves the requirement of labor hence labor cost, time, and overall energy consumption are reduced.

Chapter 3

METHODOLOGY

3.1 Block Diagram

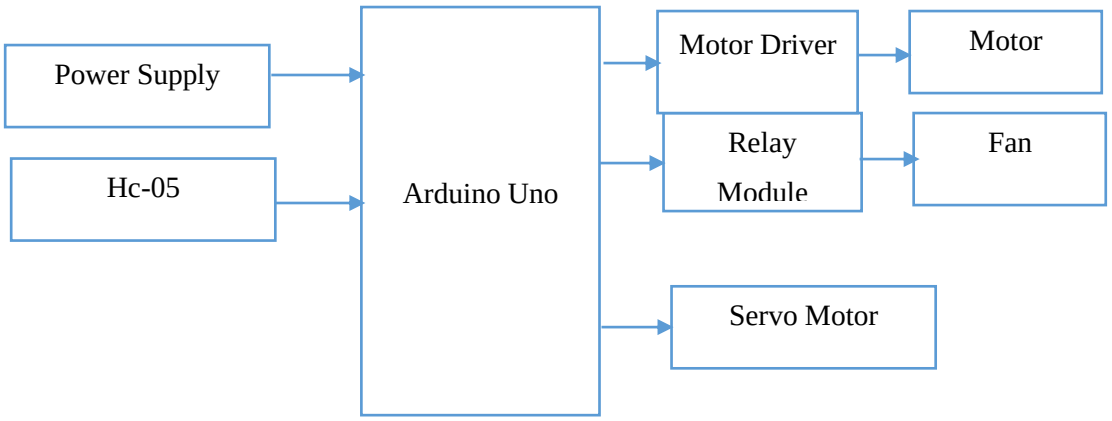


Figure 3.1: Block Diagram

In this Block diagram HC 05 is Bluetooth module. Which is used to provide short-range 2.4G wireless communication. Which Connected with mobile app and control. Arduino uno use for input date from control apps. Power supply send power all system. motor driver, relay module, servo motor is output of Arduino Uno. Motor is output from motor driver; fan is output from relay module.

3.2 Circuit Diagram

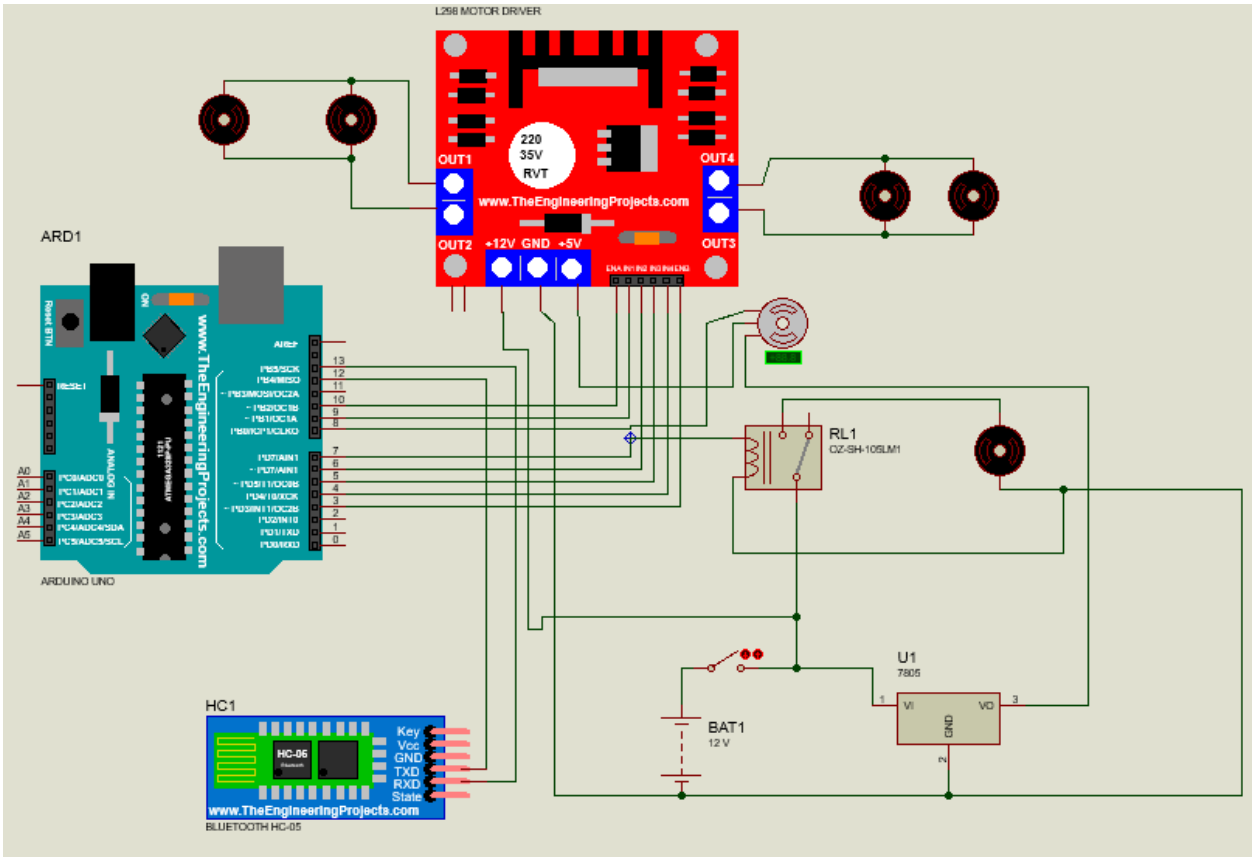


Figure 3.2: Circuit Diagram

In this circuit diagram Arduino is the main microcontroller board. Here, Motor Driver is connected with D3, D4, D5, D6, D9 and D10 pin of Arduino uno. Relay module connected with D7 pin of Arduino uno. Servo motor is connected with D8 pin of Arduino. HC-05 is connected with D12 and D13 pin of Arduino Uno. Total circuit run by 5 V DC; Motors are run by 12 V DC.

3.3 Flow Chart

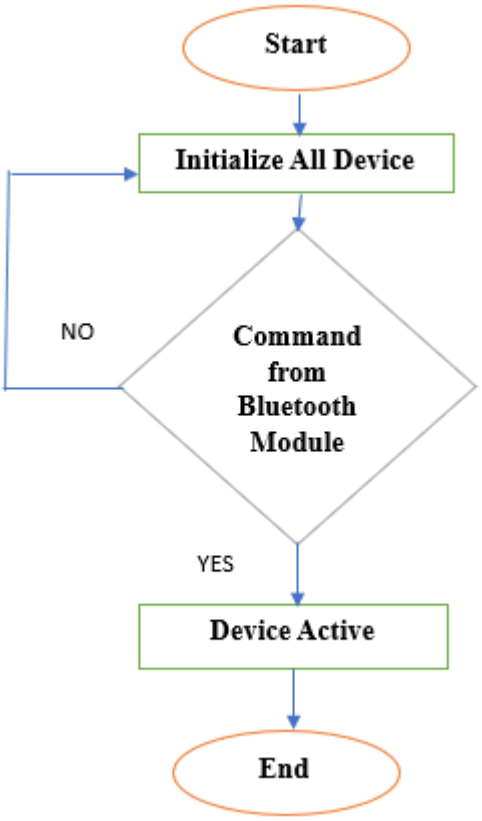


Figure 3.3: Flow Chart

First start the system. Then Connect this device the control Devices. Initialize all device.

Then send command use Bluetooth Module Which the device control this system. If Bluetooth module send data and active devices and run system then all system is ok. If Bluetooth module Command not received the back to Initialize all device and try again.

3.4 Working procedure

- **Seed Loading:**
  - Seeds are loaded into the seed hopper.
  - The hopper can hold a specific quantity of seeds.
- **Solar Power Generation:**
  - The solar panel captures sunlight and generates electricity.
  - This energy powers the entire system

❑ Seed Dispersal:

- ❖ When the system is activated (either manually or automatically), the microcontroller starts the process.
- ❖ The fan or blower creates airflow within the system.
- ❖ Seeds are released from the hopper and carried by the airflow.
- ❖ The seeds fall onto the ploughed land.

❑ Even Distribution:

- ❖ The system ensures even distribution of seeds across the field.
- ❖ Proper spacing between seeds is essential for optimal growth**.**

Chapter 4

REQUIRED COMPONENTS

❑ List of the hardware components:

- Arduino Uno
- Motor
- Motor Driver
- Wheel
- Servo motor
- HC 05
- Lithium-ion Battery
- LM2596 Buck Converter
- 2 Cell Battery Holder
- Relay module
- Cooling fan

4.1 Arduino Uno:

The Arduino Uno is an open-source microcontroller board built on the ATmega328P microcontroller. Several extension boards or shields, besides additional circuits, can be interfaced with the board's digital and analog input/output pins. A form B USB cable is essential to program the board using the Arduino IDE (Integrated Development Environment). It has 6 Digital pins and 12 Analog pins. An external 9-volt battery can be used to power it, or a USB cable can be used. It is correspondingly related to the Arduino Nano and Leonardo. It can be downloaded from the Arduino website and dispersed beneath the Creative Commons Attribution-Share Alike 2.5 license. Various outline and production files are also available.

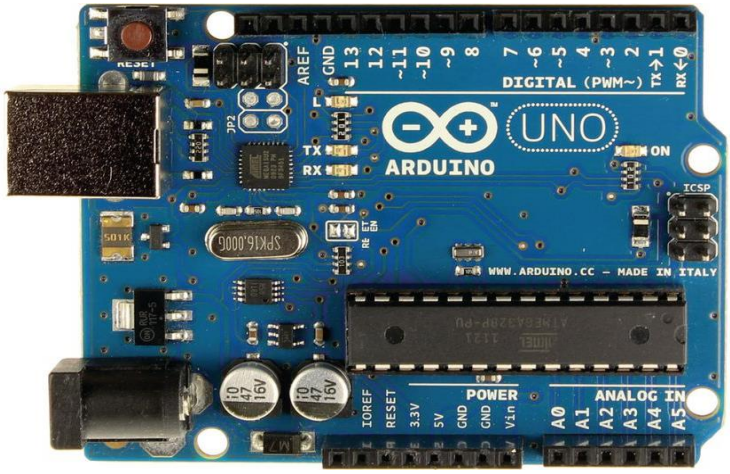


Figure 4.1 (a) : The Arduino Uno

This initial release of the Arduino Software was given the name "Uno" for its Italian meaning. Arduino Uno was the leading of a series of USB-based Arduino boards, and the Arduino IDE and Uno together were the first releases of Arduino software. A bootloader is already preprogrammed into the ATmega328, allowing programmers to upload a new code deprived of an exterior hardware systems analyst. It is the first board not to include the FTDI USB-to-serial driver chip while using the STK500 protocol as its communication protocol. The USB-to-serial converter uses the Atmega16U2 (Atmega8U2 capable of version R2) as an analog input.

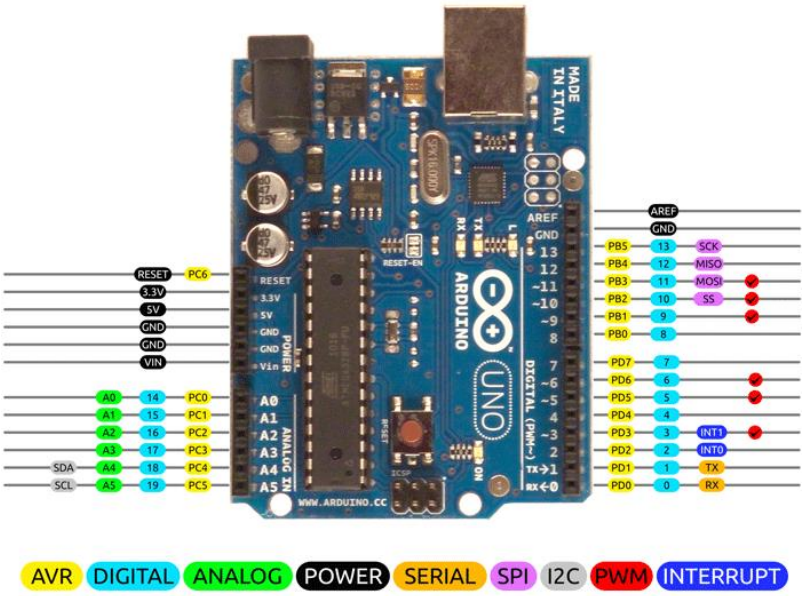


Figure 4.1 (b): The Arduino Uno pin diagram

Applications:

- Home Automation
- Robotics
- Wearable Technology
- Educational Teaching
- Data Logging
- 3D Mapping & Printing
- Smart City Projects
- Drone etc.

4.2 Motor:

Electric motors turn electricity into motion by exploiting electromagnetic induction. A simple direct current (DC) motor is illustrated below. The motor features a permanent horseshoe magnet (called the stator because it's fixed in place) and a turning coil of wire called an armature (or rotor, because it rotates).



Figure 4.2: DC Gear motor

Motor Specifications:

- Standard 130 Type DC motor
- Operating Voltage: 4.5V to 9V
- Recommended/Rated Voltage: 6V
- Current at No load: 70mA (max)
- No-load Speed: 9000 rpm
- Loaded current: 250mA (approx.)
- Rated Load: 10g*cm
- Motor Size: 27.5mm x 20mm x 15mm

Pin Description:

Table 4.1: DC Gear Motor Pin Out

	Pin Name	Description
1	Terminal 1	A normal DC motor would have only two terminals. Since these terminals are connected only through a coil they have no polarity. Revering the connection will only reverse the direction of the motor
2	Terminal 2	

Use of the DC motor:

As the name suggests the Hobby DC motor is highly used by hobbyists who start exploring electronics. Hence this motor is very simple and easy to use. You can use any normal 9V battery or even a 5V supply since this motor has an operating range from 4.5V to 9V. To make it rotate just connect the positive (+) side of the battery to one terminal and the Negative (-) sign of the battery to the other end and you should see the motor rotating. If you want to reverse the speed of the motor simply interchange the terminals and the direction will also be reversed. To control the speed of the motor you have to vary the voltage supplied to the Motor the easiest way to do this is by using a Potentiometer. There are also many other ways to achieve this. Also, remember that the motor can consume up to 250mA during loaded conditions so make sure your supply can source it. If you are controlling it through any Digital IC or any Microcontroller you should use a motor driver IC like L293D or ULN2003

Applications:

- Toy cars
- Windmill projects
- Basic Electronics projects
- As Robot wheels

4.3 Motor Driver:

Interfacing the motors with the control circuits, motor drivers act as interfaces. Controller circuits work on signals with low currents, whereas motors require a high amount of current. It is the function of motor drivers to take low-current control signals and turn them into higher-current signals that can drive a motor.

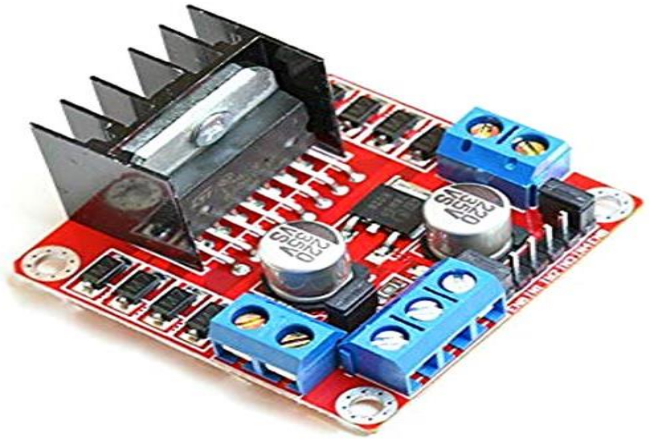


Figure **4.3** : L298N motor driver module

This driver module supports DC and stepper motors. It is a high-power motor driver module. It consists of a motor controller IC L298 and a regulator 78M05. It can control up to four DC motors or two DC motors with directional and speed control.

Specifications and features

- Driver Model: L298N 2A
- Driver Chip: Double H Bridge L298N
- Motor Supply Voltage (Maximum): 46V
- Motor Supply Current (Maximum): 2A
- Logic Voltage: 5V
- Driver Voltage: 5-35V
- Driver Current: 2A
- Logical Current: 0-36mA
- Maximum Power (W): 25W
- Sensors for measuring the current at each motor
- Performance-enhancing heat sink
- Power-On LED indicator

4.4 Wheel:

A circular frame or disk that rotates on an axis, typically in or around vehicles or machines. A potter's wheel, roulette wheel, or spinning wheel is any equipment, device, or instrument that is fashioned like this or has a circular frame, disk, or revolving drum as an essential element.



Figure 4.4: Wheel

Description:

- Wheels for land rovers & explorer robots with a large diameter.
- Suitable for gear motors with 6mm mounting holes.
- The semi-pneumatic rubber side allows squishing. Exploration robots are dampened by it.
- It is recommended for 3 to 10 kg robots (4 or 6-wheel usage recommended).
- Diameter: 130mm
- Thickness: 59mm
- Weight: 173 gr (each wheel with mounting hub)

4.5 Solar Panel:

Through the photovoltaic effect, light energy (photons) is transformed into electricity in photovoltaic modules. The majority of modules employ thin-film or crystalline silicon wafer-based cells. A load-bearing structural element may be located at the front or back of a module. Moisture and mechanical degradation should be the two main threats to membranes. Semi-flexible modules based on thin-film cells are also available. The cells are linked in series to produce voltage, and the equivalent is an increase in current. The voltage and current of the module are multiplied to get the module wattage. It is not always the case that solar panel

manufacturers base their specs on the actual conditions at the installation location. The output interface of solar panels is a PV junction box located at the rear of the panel.

The majority of photovoltaic modules are linked to the rest of the system using MC4 connections to guard against weather damage. Additionally, USB power interfaces are included.

The PV system or solar panels are connected in series or parallel to provide the required output of voltage or current. Depending on their capacity, the conductors that remove the current from the modules might be made of silver, copper, or other non-magnetic conductive transition metals. When a module is partially shaded, bypass diodes can be added internally or externally to increase the output of the lit areas. Mirrors or lenses in solar PV modules with concentrators direct sunlight onto smaller solar cells. It is an economical method of employing expensive per-unit cells (like gallium arsenide). In addition to the metal frame, the solar panel is supported better by troughs, reflector shapes, and brackets.



Figure 4.5 : Solar panel

Features:

- 12V off-grid solar panel.
- 0~+5W guaranteed positive power output.
- IP 65 or IP 67 rated.
- Built with an aluminum frame and sturdy tempered glass;
- Designed to survive harsh climatic conditions;
- Offers exceptional low-light performance on overcast days, early in the morning, and late at night.

4.6 Servo Motor:

Servo motors are rotating actuators or motors that provide precise control of position, acceleration, and velocity. Normal motors cannot do this. There is no such thing as a servo motor; they are a combination of specific components, including both DC and AC motors that are designed to operate in closed-loop systems. Automated assembly lines, robotics, and CNC machining applications have all used them.

Position feedback controls the rotational speed and position of a closed-loop servo mechanism. Inputs such as analog or digital signals represent the position commands for the shaft. Encoders act as sensors, providing information about speed and position. The position is generally reported from encoders. If there is a discrepancy between the final position reported to the controller and the initial position, the motor will be moved to get to the correct position.

Simple servo motors use DC motors with a potentiometer for position sensing, as well as big-bang controls, so the motor runs at maximum speed until it reaches the designated position or stops. Despite it can be quite inaccurate, this kind of servo motor is commonly employed in radio-controlled devices such as model aircraft and toy cars.



Figure 4.6 : The servo motor

Specifications:

- Weight: 9 g
- Size: 22 x 11.5 x 27 mm
- Operating Speed (4.8V no load): 0.12sec/60 degrees
- Stall Torque (4.8V): 17.5oz/in (1.2 kg/cm)
- Temperature Range: -30 to +60 Degrees C
- Dead Band Width: 7usec
- Operating Voltage:3.0-7.2 Volts

4.7 HC-05 Bluetooth Module:

A Bluetooth module (Bluetooth module) is a chip that integrates Bluetooth functionality, which is used to provide short-range 2.4G wireless communication. Bluetooth modules are semi-finished products as far as the end-user is concerned. A common Bluetooth module, the HC-05 is capable of adding two-way (full-duplex) wireless capability.

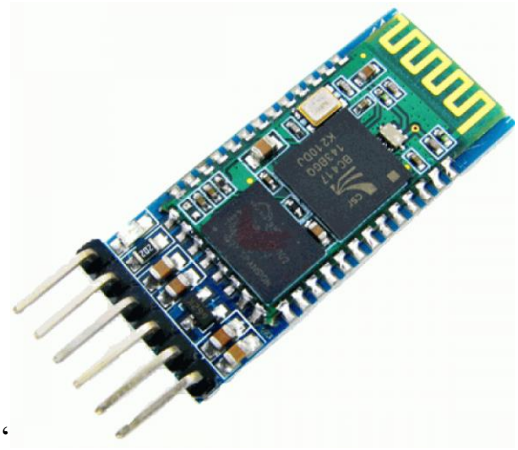


Figure 4.7: HC-05 Bluetooth module

Table 4.2: HC-02 pinout configuration

	Pin Name	Description
1	Enable / Key	Data Mode is toggled using this pin (set low) and AT Command Mode is toggled using this pin (set high). By default, it defaults to Data Mode.
2	Vcc	Powers the module. Connect to +5V Supply voltage
3	Ground	Ground pin of module, connect to system ground.
4	TX – Transmitter	Transmits Serial Data. This pin will receive everything that's received via Bluetooth as serial data.
5	RX – Receiver	Receive Serial Data. Bluetooth will transmit all serial data given to this pin.
6	State	It can be used as feedback to check if Bluetooth is working properly since it's connected to the onboard LED.
7	LED	Point out the status of Module Blink once in 2 sec: Module has entered Command Mode

		Repeated Blinking: Waiting for connection in Data Mode Blink twice in 1 sec: Connection successful in Data Mode
8	Button	Controls the Key/Enable pin and toggles between Data and Command Mode.

4.8 LM2596 Buck Converter:

To obtain the desired output, the voltage of the input is stepped down using a buck converter. Buck converters are primarily utilized for powering audio amplifiers, quad copper, battery chargers, USB on-the-go, point-of-load converters for PCs and laptops, and solar chargers. The voltage rating of this LM2596 DC-DC Buck Converter is 4.5-40V to 3-35V. The step-down power module is adjusted using potentiometers.



Figure 4.8 : LM2596 Voltage Regulator

Structures:

- Tuning process: Main, set the input voltage (usually between 4.5-50V), then use a multimeter to observe the output voltage also regulate the potentiometer (typically clockwise turn boost, counterclockwise turn buck),
- A positive input is IN+ and a negative input is IN-
- A positive output is OUT+, a negative output is OUT-

- Motionless power ingestion is simply 6mA.
- Linking: Fusing, plus the pin can be straight joined after the PCB.
- Short circuit fortification: current preventive, thermal security, self-recovery.
- Buck switching regulator (BUCK) that is not isolated.
- Short circuit protection: Current preventive, self-rescue
- It is possible to adjust potentiometers in either clockwise or anti-clockwise directions.
- Non-synchronous rectify.

4.9 Lithium-ion Battery:

Lithium-ion (Li-ion) batteries are used in many products such as electronics, toys, wireless headphones, handheld power tools, small and large appliances, electric vehicles, and electrical energy storage systems. A LIB is an electrochemical device that stores/delivers electrical energy through a reversible intercalation reaction in which Li+ ions are shuttled between two dissimilar electrode materials separated by the Li+ ion conducting electrolyte solution.

Lithium is the lightest of all metals, has the greatest electrochemical potential, and provides the largest specific energy per weight. Rechargeable batteries with lithium metal on the anode (negative electrodes) could provide extraordinarily high energy densities, however, cycling produced unwanted dendrites on the anode that could penetrate the separator and cause an electrical short. The cell temperature would rise quickly and approach the melting point of lithium, causing thermal runaway, also known as “venting with flame.”



Figure 4.9: Li-ion battery

4.10 2 Cell Battery Holder:

An 18650-battery holder price in BD is one or more compartments or chambers for holding a battery. For dry cells, the holder must also make electrical contact with the battery terminals. For wet cells, cables are often connected to the battery terminals, as is found in automobiles or emergency lighting equipment. Where the battery is expected to last over the life of the product, no holder is necessary, and a tab welded to the battery terminals can be directly soldered to a printed circuit board.

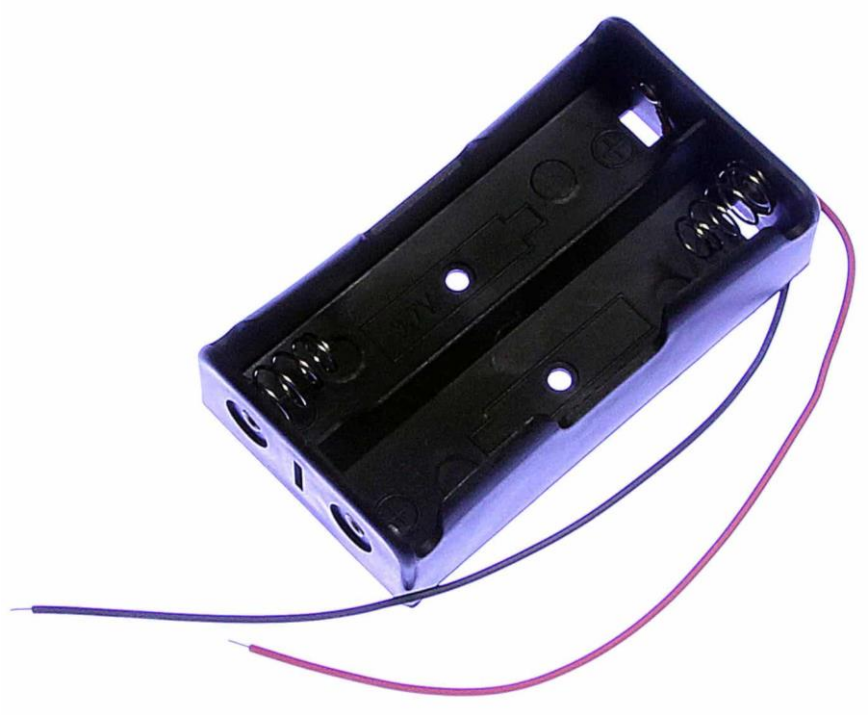


Figure: 4.10: cell battery holder

Feature:

- 2 Cell 18650 Battery Holder
- Material: Plastic + Copper
- Color: Black
- Size: approx. 77x 40 x 21mm (Not counting the wire length)
- Net weight: 15g

4.11 Relay Module:

A relay is an electrically operated expedient. An input circuit or input contactor may be referred to as a control system or controlled system for the device. It is habitually utilized in the spontaneous control circuit. The device uses a low-current signal to control a high-current circuit. Relays are automatic switches that are commonly used to control high currents with low current signals in automatic control circuits. An input voltage of 0 to 5V is needed for the relay signal. Using the Single Channel Relay Module, you can control high voltage, and high current loads such as motors, solenoids, lamps, and AC loads. Microcontrollers such as Arduino, PIC, etc. can be interfaced with it.



Figure 4.11: Relay module

Structures:

The structures of the 1-Channel Relay module are, for instance, trails:

- Safety is good. A lower current can control a higher one in power systems and high-voltage systems.
- Providing a single-channel output for high-voltage systems.
- The extensive variety of controllable voltage.
- A high load current can be controlled, up to 240V, 10A.
- This switch is normally open (NO) and normally closed (NC).

4.12 Cooling fan:

A cooling fan is an essential component when using a thermoelectric Peltier device for cooling applications. Thermoelectric Peltier devices operate on the principle of the Peltier effect, which enables the transfer of heat from one side of the device to the other when an electric current is applied. However, this process generates heat on the opposite side, requiring efficient heat dissipation.

A cooling fan serves the purpose of enhancing heat dissipation by facilitating airflow across the hot side of the Peltier device. The fan helps to remove the excess Heat generated by the Peltier module and prevent overheating, ensuring optimal performance and longevity of the device. By directing a stream of air over the hot side, the fan aids in dissipating heat into the surrounding environment.

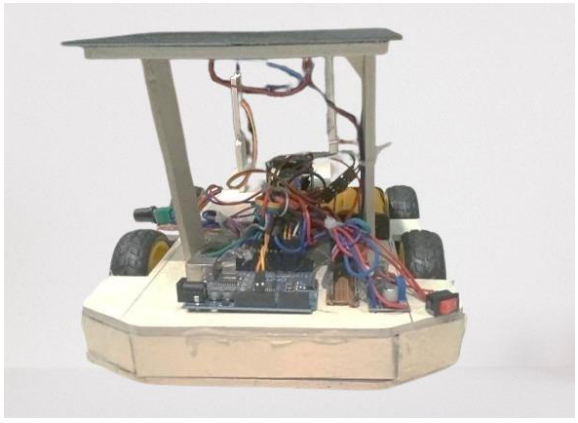


Figure: 4.12 Cooling Fan

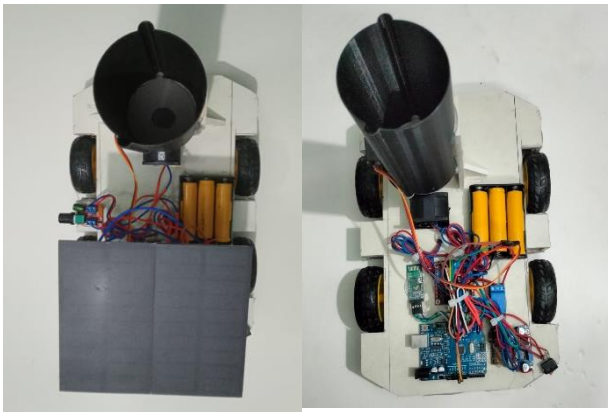
Choosing an appropriate cooling fan is crucial to match the cooling requirements of the Peltier device. Factors such as airflow rate, static pressure, and noise level should be considered when selecting a fan. Additionally, the fan should be mounted securely to ensure effective heat transfer and proper airflow.

4.13 Final Views of the Project:

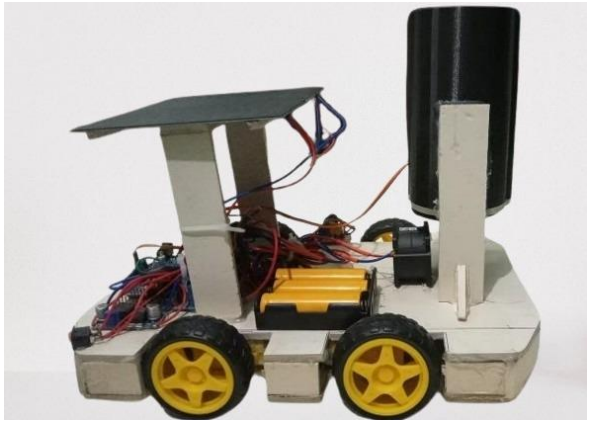
- To implement a solar-powered seed project and derive thesis results using a high-speed fan like a blower with an RPM of 1000, transporting seeds through a canal at a rate of 500 gm per minute, with transportation RPM set at 170.
- When we command from mobile app “Bluetooth RC Car” then HC-05 received the command and data send to Arduino then Arduino Send data to Servo motor for open the seed tank and relay module for turn on the high-speed fan to sprinkle seeds.
- Here, Battery charging through solar panel. Solar panels are mono crystal solar panel. Solar panel rating 12 V 1 A. Battery Rating 12 V 3 A.



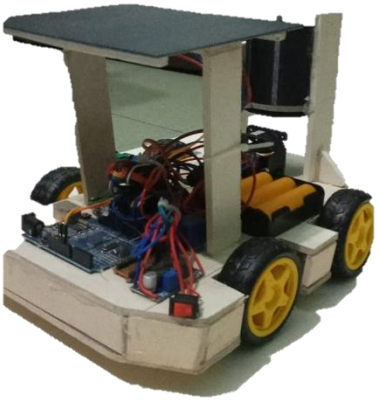
(a) Front view



(b) Top view



(c) Side View



(d) Isometric View

Figure: 4.13 Final Views the Project

Chapter 5

RESULTS AND DISCUSSION

5.1 Calculation

To calculate the area covered by the seed sprayer car while sprinkling seeds, we need to determine the area covered per minute based on the speed and width of the sprinkler.

First, let's convert the speed of the car from km/h to feet per minute:

1.936 km/h * (3280.84 feet/km) / 60 minutes ≈ 106.63 feet/minute

Now, let's calculate the area covered per minute:

Area covered per minute = Width * Length * Speed

= 1.5 feet * 1 foot * 106.63 feet/minute

≈ 159.945 square feet/minute

Now, if the rotation speed of the seed fan is maximum, it can sprinkle 500 grams of seeds in 1 minute. If the seed size is larger than 4 mm, then it sprinkles 350 grams.

If we assume that the sprinkling is uniform across the area covered, we can use these weights to determine the seeding density per square foot:

For maximum rotation speed:

Seed density = 500 grams / 159.945 square feet ≈ 3.13 grams/square foot

For seed size larger than 4 mm:

Seed density = 350 grams / 159.945 square feet ≈ 2.19 grams/square foot

These densities represent the amount of seeds deposited on each square foot of the area covered by the seed sprayer car.

Wheel’s RPM is 320 and the wheel radius is 58mm

Car Speed: 1.936 km/h

- When the rotation speed of the speed fan is maximum, it is able to sprinkle 500 grams of seeds in 1 minute. However, if the size of the seed is larger than 4 mm, then my machine can sprinkle 350 grams.

5.2 Performance Test:

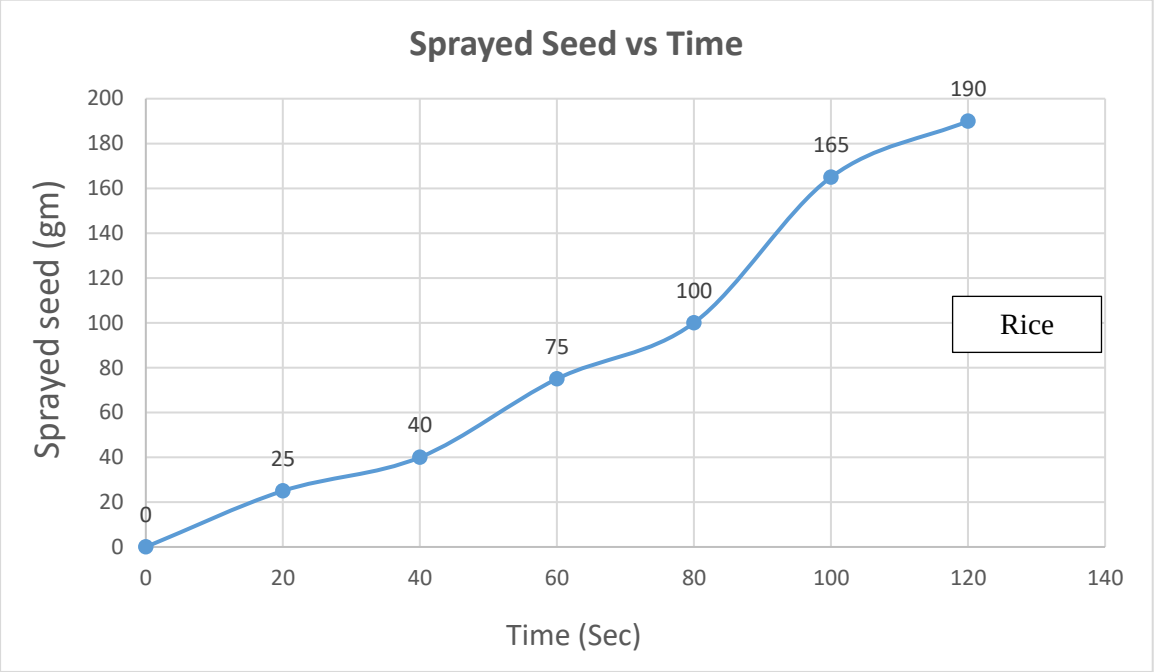


Figure: 5.1 Performance Test using Rice

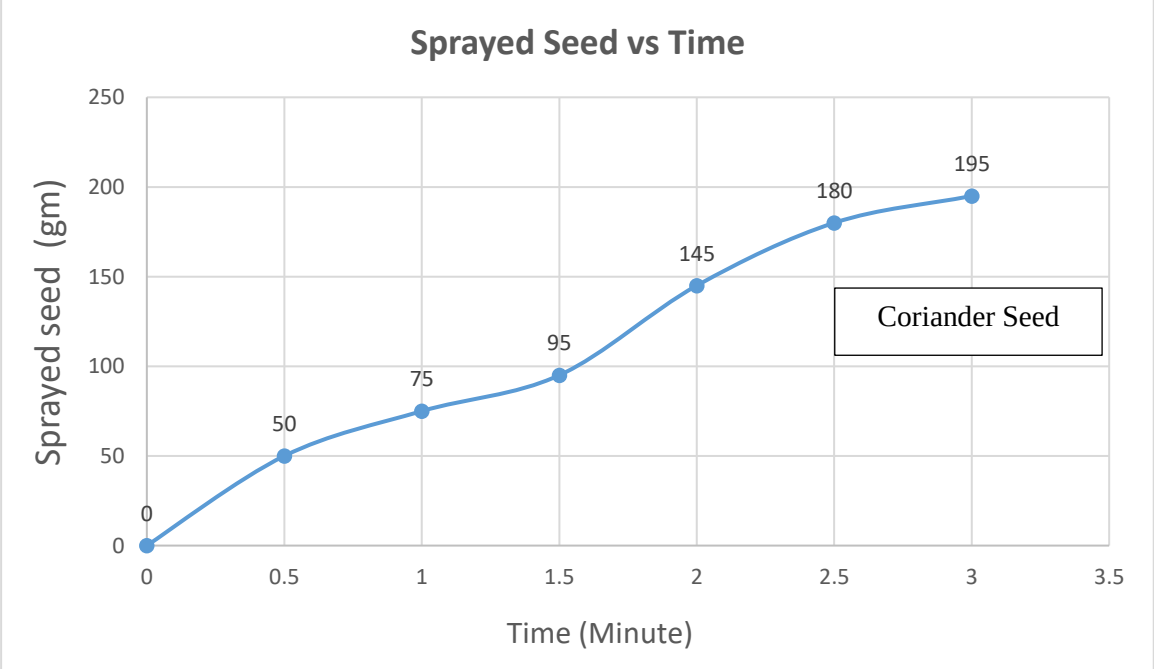


Figure: 5.2 Performance Test using Coriander Seed

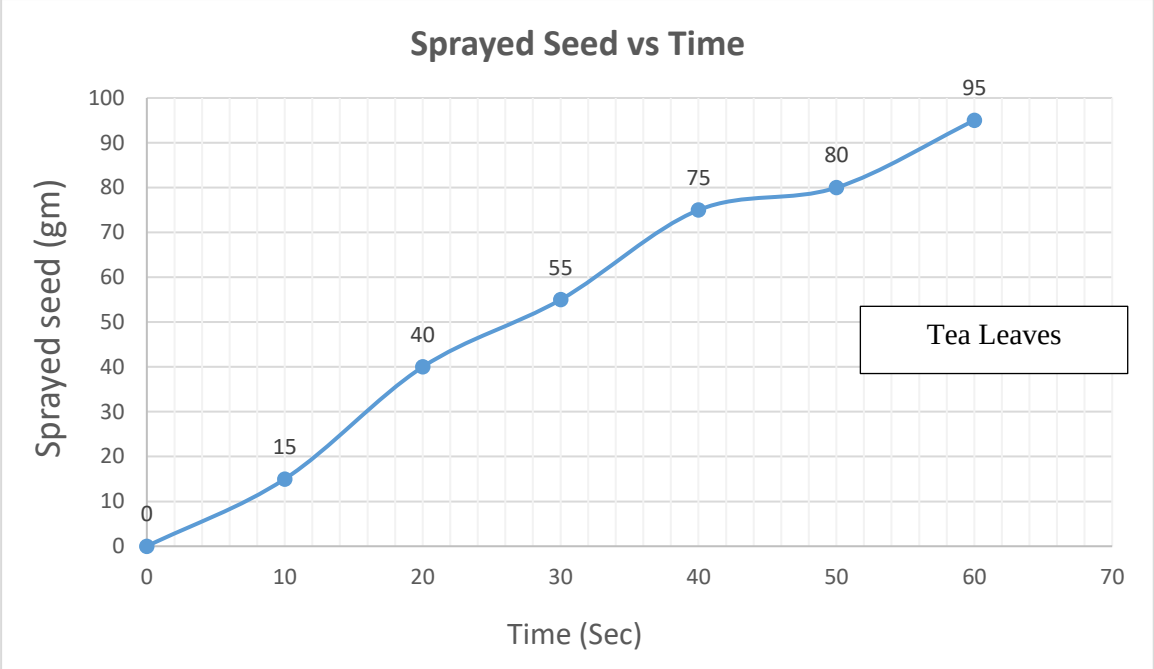


Figure: 5.3 Performance Test using Tea Leaves

Performance Test using Rice:

We have used Total 200gm of Rice in storage tank. Then run the system, rice spray 20 sec 25 gm, 40sec 40gm, 60sec 75gm, 80sec 100gm, 100sec 165gm & when 120 sec rice spray total 190 gm (Approximately).

Performance Test using Coriander Seed:

We have used Total 200gm Coriander seed in storage tank. Then run the system, Coriander seed spray 0.30min 50 gm 1min 75gm, 1.30min 95gm, 2min 145gm, 2.30 min 180gm & when 3min Coriander seed spray total 195 gm (Approximately).

Performance Test using Tea Leaves:

We have used Total 100gm Tea leaves in storage tank. Then run the system, tea leaves spray 10 sec 15 gm, 20 sec 40gm, 30sec 55 gm, 50 sec 80gm & when 60 sec Tea Leaves spray total 95 gm (Approximately).

Chapter 6

APPLICATIONS, FUTURE SCOPE & MODIFICATION

6.1 Applications

The **Design and Implementation of Solar Powered Seed Sprayer** project has practical applications in agriculture. Let's explore how this innovative system can benefit farmers and enhance crop production:

1. Efficient Seed Sowing:

- The solar power seed sprayer automates the seed sowing process.
- Farmers can cover large areas efficiently without manual effort.
- By reducing the time needed for seed placement, overall productivity increases.

2. Precision Agriculture:

- Even seed distribution is crucial for optimal crop growth.
- The system ensures consistent spacing between seeds, leading to uniform plant growth.
- Precision seed sowing improves yield and reduces wastage.

3. Time-Saving:

- Traditional manual seed sowing is time-consuming.
- With the solar power seed sprayer, farmers can sow seeds quickly, especially during peak planting seasons.

4. Reduced Labor Dependency:

- Manual seed sowing requires significant human effort.
- By automating the process, farmers can allocate labor to other essential tasks.

5. Environmental Impact:

- The system operates sustainably, reducing the carbon footprint.

6. Cost-Effective:

- Once installed, the solar power seed sprayer has minimal operational costs.
- It utilizes renewable energy, saving on fuel or electricity expenses.

6.2 Future Scope & Modification Pathways

1. Integration with Smart Farming Systems:

- The solar power seed sprayer can be integrated into larger smart farming systems.
- Combine it with soil sensors, weather stations, and crop monitoring tools.
- Implement real-time data analysis to optimize seed sowing based on soil conditions, moisture levels, and weather forecasts.

2. Adaptive Seed Dispersion Algorithms:

- Develop advanced algorithms for seed dispersion.
- Consider factors such as seed type, planting depth, and spacing.
- Optimize seed distribution patterns for different crops.

3. Variable Rate Technology (VRT):

- Implement VRT to adjust seed sowing rates based on field variability.
- Improve resource efficiency and yield.

4. Energy Storage Solutions:

- Enhance the solar power system with energy storage (e.g., batteries).
- Store excess energy during sunny days for use during cloudy periods.
- Ensure uninterrupted operation even in low sunlight conditions.

5. Remote Monitoring and Control:

- Enable remote monitoring and control of the seed sprayer.
- Farmers can adjust settings, monitor performance, and receive alerts via mobile apps or web interfaces.

6. Seed Coating and Treatment Integration:

- Explore options for integrating seed coating or treatment mechanisms.
- Apply fertilizers, pesticides, or growth enhancers during seed sowing.
- Enhance seed health and germination.

7. Scaling Up for Large-Scale Farming:

- While the current system may be suitable for small to medium-sized farms, consider scalability.
- Design robust, high-capacity versions for large-scale agriculture.

8. Research on Seed Germination Enhancement:

- Collaborate with agronomists and researchers to improve seed germination rates.
- Investigate innovative seed priming techniques or bio stimulants.

9. Climate-Resilient Seed Spraying:

- Develop adaptations for extreme weather conditions (e.g., high winds, heavy rain).
- Ensure reliable operation under adverse circumstances.

Chapter 7

CONCLUSION

7.1 Conclusion

The project aimed at harnessing solar energy for agricultural mechanization has successfully culminated in the Design and implementation of solar powered seed sprayer The objectives were meticulously addressed as follows:

- **Design and Construction:**

  A robust and efficient solar-powered seed sprayer was designed, integrating cutting-edge Solar PV Technology to ensure seamless operation. The design was focused on simplicity, durability, and ease of use in agricultural settings.

- **Development:**

  The development phase saw the creation of a solar-powered seed machine capable of both sowing and spraying. This dual functionality underscores the machine's versatility and potential to streamline the seeding process.

- **Testing:**

  Rigorous testing was conducted in actual agricultural farms, which validated the effectiveness of the solar-powered seed sowing and spraying machines. The tests confirmed that the machines performed optimally under various conditions, marking a significant advancement in agricultural technology.

- **Extension of Solar PV Technology:**

  The project extended the application of Solar PV Technology to "Solar Sprayers," positioning them as a viable "Energy Alternate Device." This initiative not only promotes sustainable farming practices but also paves the way for further innovations in solar-powered agricultural equipment.

In essence, this project has not only achieved its set objectives but has also set a precedent for the future of eco-friendly and energy-efficient agricultural machinery. The successful implementation of this solar-powered seed sprayer stands as a testament to the potential of renewable energy in revolutionizing the agricultural industry.

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Appendix

```
#include <Servo.h>

Servo myservo1;

#define motor1     3
#define motor2     4
#define motor3     9
#define motor4     10

#define RELAY1                  7
#define servopin1               8

int adc = 250;

void setup() {
  Serial.begin(9600);
  Serial1.begin(9600);
  pinMode(motor1_E, OUTPUT);
  pinMode(motor2_E, OUTPUT);
  pinMode(motor1, OUTPUT);
  pinMode(motor2, OUTPUT);
  pinMode(motor3, OUTPUT);
  pinMode(motor4, OUTPUT);

  pinMode(RELAY1, OUTPUT);
  digitalWrite(RELAY1, HIGH);
  myservo1.attach(servopin1);
  myservo1.write(0);
  delay(200);
  myservo1.detach();
}

void loop() {
  if (Serial1.available() > 0) {
    char command = Serial1.read();
    switch (command) {
      case 'F':
        forward();
        break;
      case 'B':
        back();
        break;
      case 'L':
        left();
        break;
      case 'R':
```

```
  right();
  break;
case 'S':
  Stop();
  break;
case 'G':
  Fleft();
  break;
case 'I':
  Fright();
  break;
case 'H':
  Bleft();
  break;
case 'J':
  Bright();
  break;
case '0':
  adc = 0;
  break;
case '1':
  adc = 80;
  break;
case '2':
  adc = 85;
  break;
case '3':
  adc = 95;
  break;
case '4':
  adc = 100;
  break;
case '5':
  adc = 125;
  break;
case '6':
  adc = 150;
  break;
case '7':
  adc = 175;
  break;
case '8':
  adc = 200;
  break;
case '9':
  adc = 225;
  break;
case 'q':
  adc = 255;
  break;
```

```
      case 'X':
        digitalWrite(RELAY1, LOW);
        myservo1.attach(servopin1);
        myservo1.write(180);
        delay(200);
        myservo1.detach();
        break;
      case 'x':
        digitalWrite(RELAY1, HIGH);
        myservo1.attach(servopin1);
        myservo1.write(0);
        delay(200);
        myservo1.detach();
        break;
    }
  }
}

void forward()
{
  digitalWrite(motor1, 1);
  digitalWrite(motor2, 0);
  digitalWrite(motor3, 1);
  digitalWrite(motor4, 0);
}

void back()
{
  digitalWrite(motor1, 0);
  digitalWrite(motor2, 1);
  digitalWrite(motor3, 0);
  digitalWrite(motor4, 1);
}

void left()
{
  digitalWrite(motor1, 0);
  digitalWrite(motor2, 1);
  digitalWrite(motor3, 1);
  digitalWrite(motor4, 0);
}

void right()
{
  digitalWrite(motor1, 1);
  digitalWrite(motor2, 0);
  digitalWrite(motor3, 0);
  digitalWrite(motor4, 1);
}
```

```
void Stop()
{
  digitalWrite(motor1, 1);
  digitalWrite(motor2, 1);
  digitalWrite(motor3, 1);
  digitalWrite(motor4, 1);
}

void Fleft()
{
  digitalWrite(motor1, 1);
  digitalWrite(motor2, 0);
  digitalWrite(motor3, 1);
  digitalWrite(motor4, 0);
}

void Fright()
{
  digitalWrite(motor1, 1);
  digitalWrite(motor2, 0);
  digitalWrite(motor3, 1);
  digitalWrite(motor4, 0);
}

void Bleft()
{
  digitalWrite(motor1, 0);
  digitalWrite(motor2, 1);
  digitalWrite(motor3, 0);
  digitalWrite(motor4, 1);
}

void Bright()
{
  digitalWrite(motor1, 0);
  digitalWrite(motor2, 1);
  digitalWrite(motor3, 0);
  digitalWrite(motor4, 1);
}
```