Department of Electronic & Telecommunication Engineering

University of Moratuwa

EN 1190 - Engineering Design Project

Final Project Report

Sun Seeking Dryer Robot – Team MINS

Group members:

Amarathunga D.N.	210037G
Kuruppu M.P.	210325M
Morawakgoda M.K.I.G.	210391J
Uduwaka S.S.	210663V

INDEX

1 Introduction

In today's fast-paced world, where busy schedules and unpredictable weather conditions often hinder household chores, the need for efficient and automated solutions becomes evident. Drying various materials, such as seeds, spices, clothes, and shoes, using sunlight, is often time-consuming and unreliable due to weather fluctuations. To address this challenge, our project aims to develop an automatic sun-seeking dryer that optimizes the drying process through sun tracking technology.

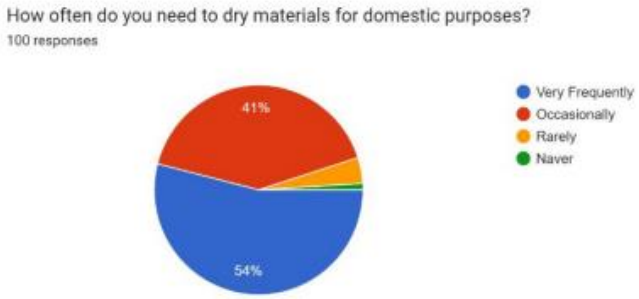
1.1 Problem description

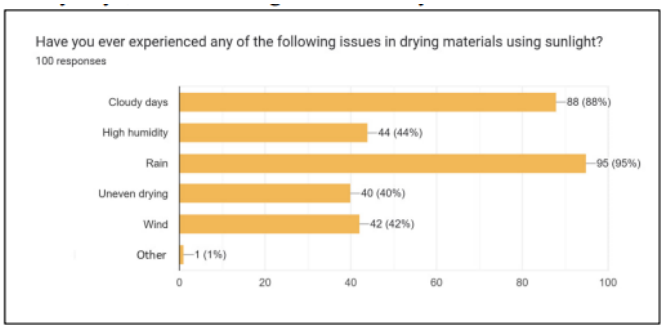
Households, especially those in rural areas with limited access to electricity, face difficulties in efficiently drying materials. Conventional sunlight-based drying methods are subject to weather conditions and require manual intervention for effective drying. Our project seeks to create an innovative solution that eliminates these challenges by automating the drying process.

1.2 Motivation

The motivation behind this project lies in enhancing the overall quality of life for individuals by providing a solution that optimizes an essential domestic task. By automating the drying process, we aim to relieve the burdens faced by households, enabling them to focus on other tasks. This project aligns with the broader societal push toward sustainable practices and resource conservation, as the sun-seeking dryer utilizes a renewable energy source.

We conducted a survey in the initial stage to gather some information about the drying process. After analyzing a sample of 100 people, we have concluded some justifications for the project.





According to the survey most of the people know the traditional methods of drying materials. It was obvious that most of the people use different drying methods to dry their clothes, shoes, and seeds in their day-to-today lives. By analyzing the survey, we could conclude that the drying methods are essential for the daily works because most of the people who responded to the survey have submitted that they are using the methods of drying for domestic purposes very frequently. The below pie chart shows how often people dry materials for domestic purposes according to the survey. Also, we decided to collect data about the issues the people are facing with the traditional methods of drying materials. According to the results, the main issues of the traditional methods are the rain, cloudy days, and the changes of humidity. Here are the results that we got. A waste of time, taking longer time than expected, bad smell, reducing the quality of the final product, not being able to dry properly, inability to attend at the right time and to the right standard, were the main issues they have been faced.

1.3 Our Solution

The team of MINS decided to take the burden on to their shoulders and decides to find a solution. The sun seeking dryer robot is the ultimate result of this. When the sun seeking dryer robot is kept in a position where the intensity of the sunlight is low it moves to a position where the intensity of sunlight is higher than the previous place.

2 Technical feasibilities

Our project of designing an automatic system that follows the sun to dry materials is technically feasible. This system can be built using a set of sensors, microcontrollers, and mechanical components such as motors, wheels etc.

2.1 Sensors

The system would require a few essential sensors, including LDRs, to monitor the sunlight intensity and ultrasonic sensors to identify barriers on the way. These sensors are readily available and affordable in the market, and the required performance targets can be met without any difficulty.

For this system we used 4 LDR to cover the four directions. Also, we used 2 ultrasonic sensors in the forward and backward directions to identify the barriers when moving.

2.2 Microcontroller

The microcontroller is the brain of the system that controls the entire operation of the automatic driving system. Microcontrollers are widely used in various industrial applications, and they can handle the necessary calculations and data processing required for this project. Moreover, the availability and affordability of microcontrollers make it a feasible option.

For this system we used ATMEGA 328 micro controller.

2.3 Mechanical components

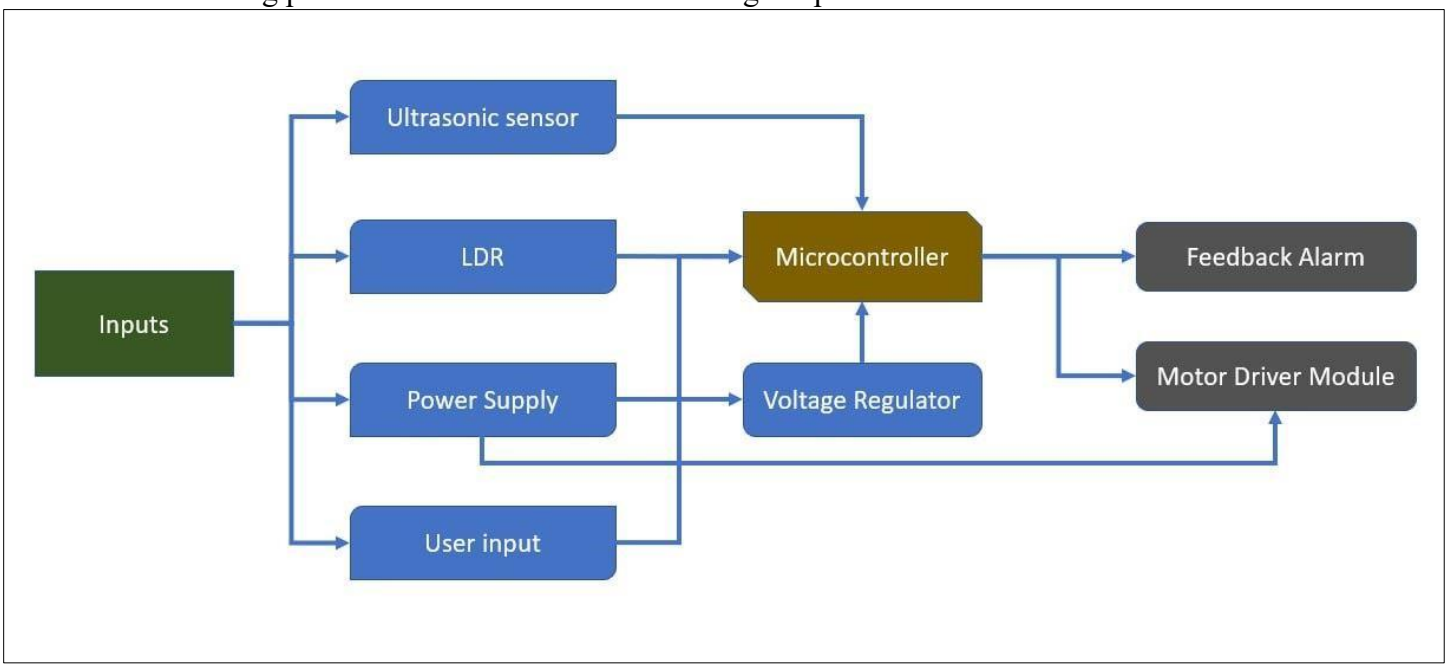
The mechanical components, including motors and wheels, are also readily available and can be used to ensure that the system moves smoothly and accurately. These components can be controlled by the microcontroller, which ensures that the system moves in the right direction and at the right speed.

In conclusion, the technical feasibility of the proposed project of designing an automatic system that follows the sun to dry materials is high, and all the necessary resources and performance targets are readily available and can be met.

3 Product Architecture

3.1 Block Diagram Abstraction of the Device

The following product architecture was used during the process.



3.2 Functionality of the Blocks

- **Power Supply Management**

  The power supply management for this device utilizes two 3.7V rechargeable batteries, which are regulated down to 5V using a voltage regulator.

- **User Input**

  An on/off switch is manually controlled by the user to switch the entire system on and off.

- **LDR**

  The device is equipped with four LDRs that are used to detect and measure the intensity of sunlight in all four directions. This information is used to make decisions about the device's operation and to adjust its movements and functions, as necessary.

- **Ultrasonic Sensor**

  Two ultrasonic sensors are also incorporated into the device to measure the distance to obstacles and prevent collisions while the device is in use.

- **Microcontroller**

  The microcontroller is responsible for processing all these inputs and controlling the device's overall operation.

- **Feedback Alarm**

  If all sides are dark, a feedback alarm is triggered to inform the user of this situation. For this purpose we used a buzzer.

- **Motor Driver Module**

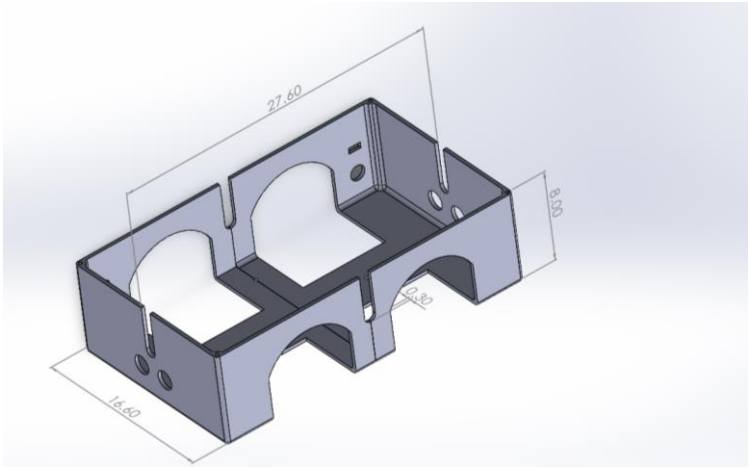
  The device is equipped with a motor driver module that allows system to rotate its wheels and move throughout its environment.

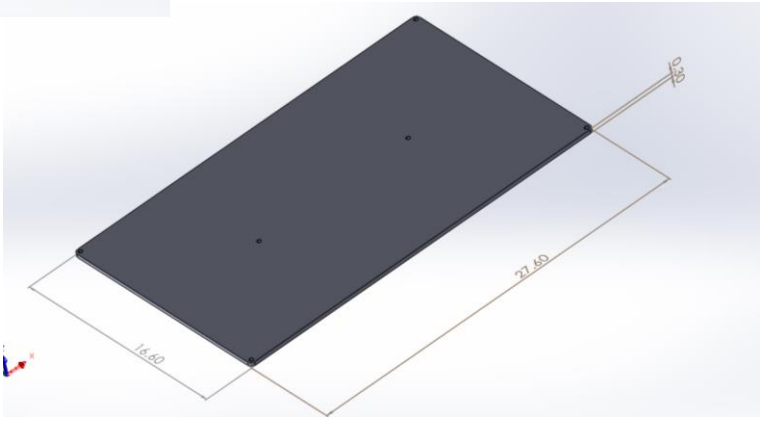
4 Product enclosure

4.1 Solid work design

The enclosure was designed by using ‘Solid Works’. It is made by the material ‘PLA’

The enclosure contains 2 major parts. They are the top and the bottom part. The bottom part was design in such a way that it contains holes for four wheels, two ultrasonic sensors, four tubes for the LDR, switch, charging port.

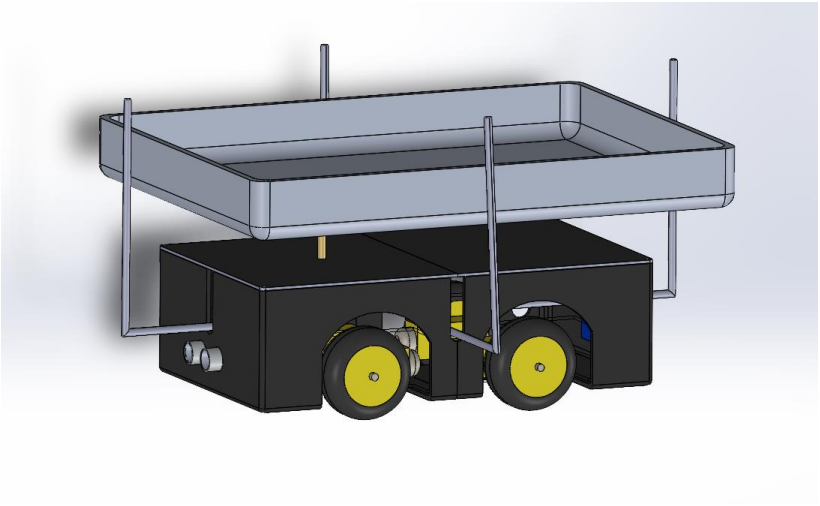




The tray to hold materials such as grains was made by a light metal to enhance the tendency for absorbing sunlight to make the drying process more rapid than the normal way. The reason for not selecting iron as the material for designing the tray is the tendency of iron to corrode when imposing sunlight, wind, and humidity climatic parameters and it will cause to reduce the quality of the drying material.

Also, we had to keep a distance between the metal tray and the top part in order to avoid unwanted heating of the circuit.

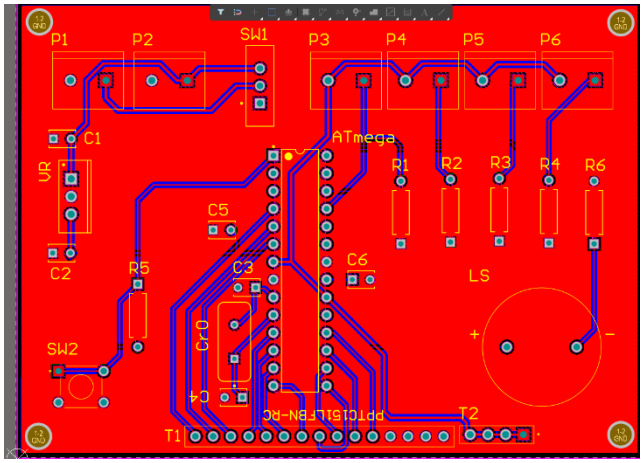
The following diagram shows how the final design looks like.

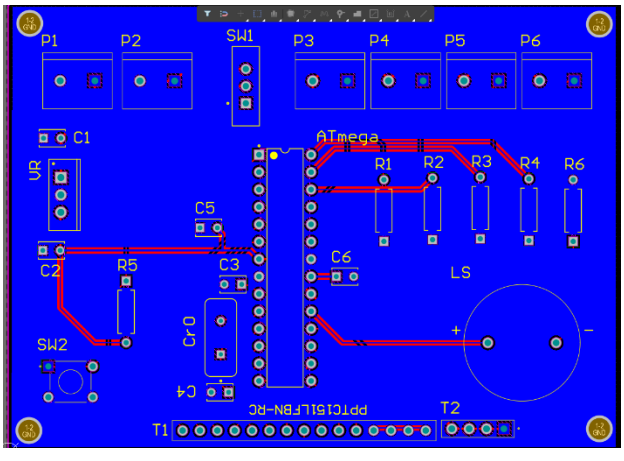


5 Circuit Diagram

5.1 Altium Schematic Diagram

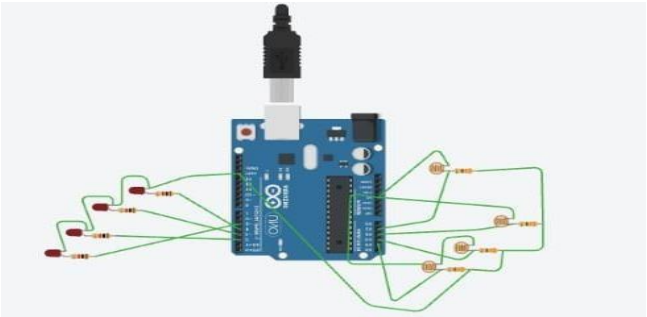
The following schematic diagram has been created using Altium.



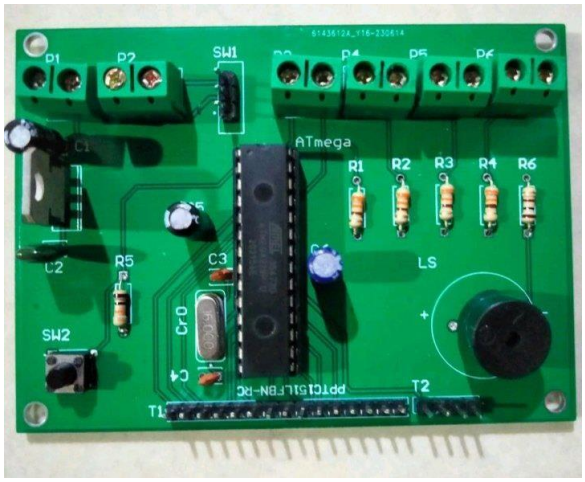


5.2 ATmega Circuit Stimulation

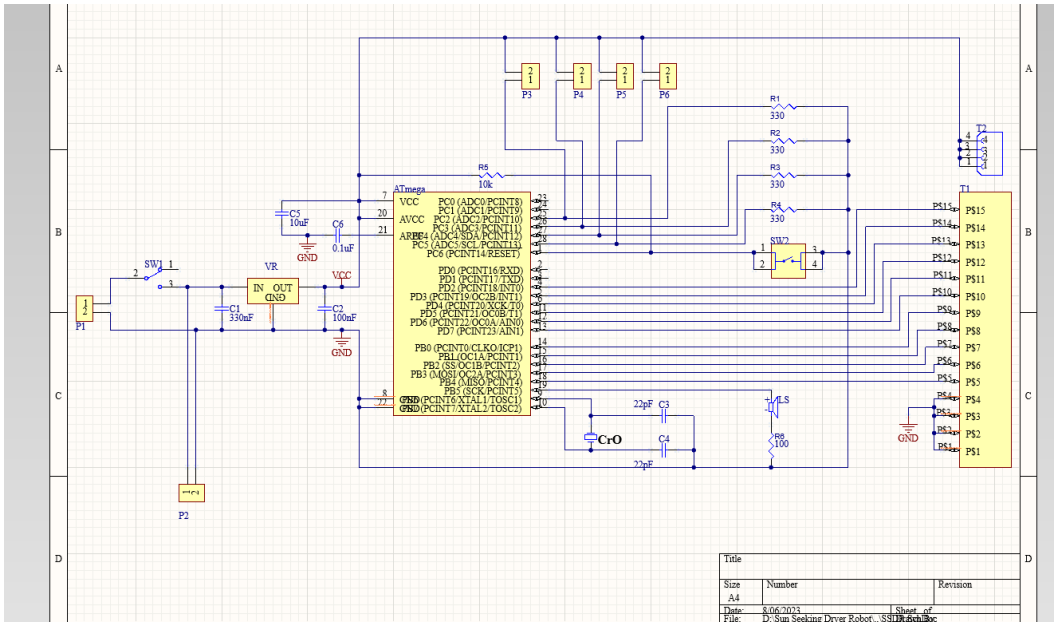
The ATmega circuit has been stimulated using virtual tools. It is unclear what specific tools were used or what the results of the stimulation were, but it can be assumed that progress has been made on this aspect of the project.



After Soldering the components



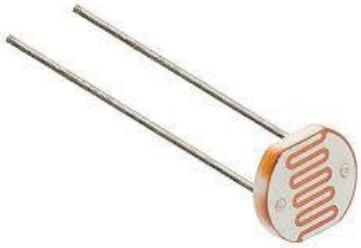
5.3 Final Circuit Diagram



6 How it works.

6.1 Logical part of LDRs

The output values of the LDR varies from 0-1023. Hence if all the values are below 450 then it makes a sound by the buzzer. If all the values are above 650 then it is stable and it remains at a stationary position. If the value is between the values 450-650, then it takes the difference between two consecutive LDRs and if there is a difference then it moves opposite to the dark side (where the intensity of the sun light is low.) Also, priority is given to the forward and back word directions.



6.1 Logical part of Ultra-sonic Sensors

If there is an obstacle in the moving direction with a distance less than 40 cm then it stops and moves to the direction where the intensity of the sun light is higher among the remaining directions

7 Business Model

7.1 Marketing and Sales

- **Identify target audience.**
  The target audience for the sun seeking dryer robot could be busy individuals, families, and small business owners who need to dry materials such as seeds, spices, clothes, shoes and so on.

- **Create a brand name.**
  Create a brand name that is catchy, easy to remember, and represents the product's features and benefits. So, we choose our brand name as ‘Selfodryer’

- **Social media presence**
  Create a social media presence to generate interest and attract potential customers. Also, it will showcase the features and benefits of the product. Also, we can publish some posts that show how the sun seeking dryer robot works, how it can save time and energy, and how it can improve the drying process.

- **Offer product discounts.**
  Offer discounts to early adopters (customers) to encourage them to try the product and share their experiences with others.

- **Attending trade shows and exhibitions.**
  Attend trade shows and exhibitions related to home appliances, gardening, and household products to showcase the sun seeking dryer robot to potential customers and distributors.

- **Provide excellent customer service.**
  Provide excellent customer service to ensure that customers are satisfied with the product and their experience with the company. This will lead to positive reviews and word-of-mouth marketing. Also, we are planning to conduct a survey among the customers once a year.

Overall, the marketing plan will be focused on highlighting the benefits of the sun seeking dryer robot, such as saving time and energy, improving the drying process, and providing a convenient solution for busy individuals and families. We will also be emphasizing the product's innovative and eco-friendly features, which will appeal to environmentally conscious customers.

7.2 After-Sale Service

After-sale service is a critical aspect of any product, therefore we had to focus on the after sales service of the sun-seeking dryer robot. It ensures that customers are satisfied with their purchase, and any issues or concerns are addressed in a more efficient way, which enhances customer loyalty. And it will have a good effect for the customers to repeat the business. Here are some considerations for after-sale service for the sun-seeking dryer robot.

- **Clear Warranty**
  We are planning to offer a clear and concise warranty of six months. That outlines the terms and conditions, including what they cover. This will help customers understand their rights and what to expect in case of any issues.

- **User Manual**:
  Provide an understandable user manual that includes detailed instructions for setting up, using, and maintaining the sun-seeking dryer robot. We are planning to include troubleshooting tips and contact information for customer support.

- **Customer Support**:
  Offer reliable and quick customer support through multiple channels, such as email, Facebook and Instagram.

- **Replacement Parts**
  Replacement parts are readily available and affordable for customers in case any part of the sun-seeking dryer robot needs to be repaired or replaced.

- **Feedback Mechanism**:
  We have set up a feedback mechanism for customers to report any issues or suggestions for improving the product. (Customer survey, Online feedback form). Also, we have planned to enable a QR code system where the customers can submit the problems and issues whenever they need.

By implementing these after-sale service considerations, customers will have a positive experience with the sun-seeking dryer robot, and our brand **'Selfodryer'** will be able to establish a strong reputation for quality and customer support.

8 Project Budget

8.1 Cost of Modules and Components

Component	Unit price (LKR)	Quantity	Amount (LKR)
Wheel with DC gear motor	280	4	1120
ATMEGA 328P microcontroller	1800	1	1800
Ultrasonic sensors (Sona sensers)	280	2	560
16 MHz oscillator	40	1	40
Motor driver	500	1	500
BMS	500	1	500
IC holder	8	1	8
3.7V 4000MA battery	450	2	900
Battery holder - 2 cell	120	1	120
220 Ω resistor	3	4	12
330 Ω resistor	3	4	12
1kΩ resistor	3	4	12
LDR	15	4	60
0.1 µF capacitor	2	1	2
22 pF capacitor	5	2	10
0.33 µF capacitor	5	1	5
ON/OFF slide switch	50	1	50

7806 voltage regulators	60	1	60
Tray	930	1	930
		Total(LKR)	6701

8.2 Product Price

Price of components	Rs.6701
PCB printing	Rs.580
3D printing	Rs.3240
Other expenses	Rs.150
Total Expense	Rs.10671
Profit	Rs.4328
Total Product Price	Rs.14999/=

9 Task Allocation

Member	Tasks Allocated
Kuruppu M. P.	Coding, Circuit design, Assembling the components
Uduwaka S.S.	Coding, Circuit design, Assembling the components
Amarathunga D. N.	PCB design, Assembling the components
Morawakgoda M. K. I. G.	Enclosure design, Assembling the components