Problem Statement Number: **PS1472**

Problem Statement: **“Student Innovation”**

Organization Name: **AICTE, MIC-Student Innovation**

Domain Bucket: **Renewable/ Sustainable Energy**

Category: **Hardware**

Team Name: **Solar Synergies**

Team Leader Name (Registration Number and Email ID): **Devyani Yogesh Deshmukh (2020BME007, 2020bme007@sggs.ac.in)**

Smart India Hackathon 2023
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Idea/Solution/Prototype

- In the process of drying, heat is necessary to evaporate moisture from the material.
- A flow of air helps in carrying away the evaporated moisture.
- When the air is passed through cabinet, the air gets heated by solar energy collected through Sunlight.
- In winter or rainy season, when dryer runs on electricity, blower works , to supply air inside the dryer
- In this case, Entrant air, in cabinet through contact with **Wheatstone Bridge circuit** (Electric Heater) increases air temperature by 3 to 4 times than atmosphere.

Sample	Atmospheric Temp. [°C]	Inlet Temp. [°C]	System Temp. [°C]	Drying Time (In Hr. or Min.)
Potato	34.8°	40.3°	53.2°	55 mins.
Rock Candy (Raw Sugar)	36.5°	48°	55.6°	2 hrs. and 45 mins.

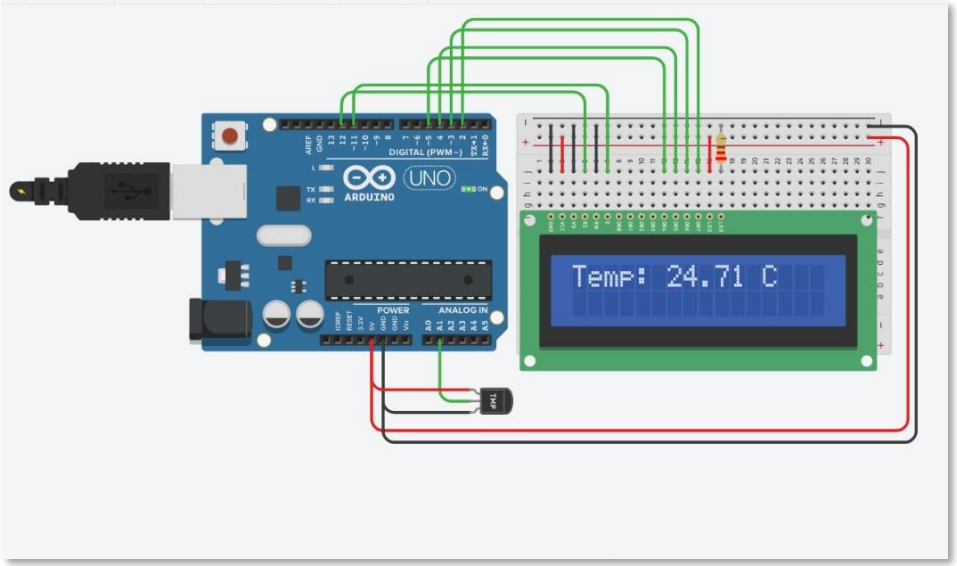
CAD Model

Features

- Our product is :
  - User-friendly,
  - Portable,
  - Light weight,
  - Durable
  - Simple design with no moving parts
- Uses renewable energy source - Solar Energy for drying
- Have option of Electric Drying in case of No Sun Light
- Has sensing & data sharing system to provide real-time information to the user like,
  - Current humidity
  - Current Temperature
  - Time elapsed to complete drying
- This solution has minimal maintenance

Schema

Temperature Display Module



Working of system

- The dryer is a passive system in the sense that it has no moving parts.
- It is energized by the sun rays entering through the collector glazing.
- The trapping of the rays is enhanced by the inside surfaces of the collector that were painted black and the trapped energy heats the air inside the collector.
- If the vents are open, the hot air rises and escapes through the upper vent in the drying chamber while cooler air at ambient temperature enters through the lower vent in the collector.
- An LCD display will display the current humidity inside the chamber.
- A digital grain moisture meter can be used to determine the moisture of the content which is to be put in the drier.

Technology Stack: Software/Hardware

- *Software:*
  - Arduino IDE
  - IOT
- *Hardware:*
  - MS Sheet
  - Square Pipes
  - Round Pipes
  - Glass
  - Prob-Type Thermometer
  - Exhaust Fans
  - Wheatstone Bridge Circuit Setup
  - Arduino Nano
  - Humidity Sensor
  - LCD Display
  - Digital Grain Moisture Meter

Existing systems, if any, and why my solution is better

- Although the dryer was used to dry Potato, it can be used to dry other crops
- There is ease in monitoring when compared to the natural sun drying technique.
- The capital cost involved is much lower to that of a mechanical dryer.
- Solar dryer was designed and constructed using locally sourced materials.

Limitations :

- Long Drying time compared to electrical dryers
- Different efficiencies on different weather conditions

Future Scope

- Possible to adapt larger size & capacity as per customer requirement
- Possible to improve efficiency by using multiple **(heater) Wheatstone bridge circuits** with hybrid working for specific req.
- Smart Program to switch off circuit when the moisture and temperature displayed by the psychrometer, and sensor is fulfilled
- Possible to integrate automated drying by means of conveyor belts

References

- Ajayi, C., Sunil, K.S., and Deepak, D. 2009. **"Design of Solar Dryer with Turbo ventilator and Fireplace"**. International Solar Food Processing Conference 2009.
- Brenidorfer B, Kennedy L, Bateman C O (1995). **Solar dryer; their role in post-harvest processing**, Commonwealth Secretariat Marlborough house, London,Swly 5hx.
- A.A. El-Sebaii; S.M. Shalaby (2012): **Solar drying of agricultural products: A review**, Renewable and Sustainable Energy Reviews 16, 37– 43.
- Fadhel; S. Kooli; A. Farhat; A. Bellghith (2005): **Study of the solar drying of grapes by three different processes**, Desalination 185, 535–541.

Mentors

- **Faculty mentors:**
  - Gajanan R. Trikutkar, Professor or Practice, SGGSIE&T, Vishnupuri, Nanded-431606

Team

1. **Devyani Yogesh Deshmukh (2020BME007) (TL)**

   Fabrication and CAD modelling

2. **Hemant Rajgopal Khandekar (2021BME507)**

   Hardware and prototyping

3. **Vedant Nitin Dahake (2020BME036)**

   Arduino and Rendering

4. **Saeel Rupesh Gote (2020BEC055)**

   Arduino and IOT

5. **Prasad Ashokrao Balkhande (2020BME062)**

   CAD Modelling and prototyping

6. **Shreyash Santosh Iname (2021BME508)**

   Hardware