

Development Of Solar Powered Cold Storage For Agricultural Purposes

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Abstract

In this paper, the design and development of a solar powered cold storage for agricultural purposes being presented. The final year project work undertaken by us involves a ground-breaking advancement in cold storage technology that combines portability and flexibility with solar energy's efficiency. The need for dependable and long-lasting cold storage solutions is growing in the modern world, particularly in isolated and off-grid locations. Traditional cold storage systems are immobile and frequently rely on non-renewable energy sources. Effective cooling mechanisms, real-time monitoring, and control via IoT integration, and a user-friendly interface are some of this revolutionary solution's standout characteristics. The Solar Hybrid Cold Storage system might have a significant influence on sectors including agriculture, healthcare, and disaster assistance where dependable cold storage is essential for protecting perishable goods, medications, and emergency supplies. The fusion of solar power with portability opens new avenues for cold storage accessibility in places with poor infrastructure, while simultaneously lowering operational costs and carbon footprints. The Solar Hybrid Cold Storage with Portability is the subject of this abstract, which encourages deeper investigation into its technological, financial, and environmental elements while highlighting its potential to fundamentally alter how we think about cold storage in a mobile and sustainable way. The work carried out is the seventh semester main-project by the students of Electronics & Communication Engineering under the guidance of the faculties supervision (guide).

Introduction

The idea of "Solar Hybrid Cold Storage with Portability" presents itself as a spectacular invention at the intersection of renewable energy, refrigeration technology, and mobility in a world where sustainable energy solutions and the preservation of perishable goods are becoming more and more important. This ground-breaking method addresses the urgent demand for effective, environmentally responsible cold storage systems that can function in a variety of occasionally difficult conditions. Traditional cold storage methods can rely on expensive, environmentally risky diesel generators or grid electricity. They generally only work in fixed places, which limits their utility in remote or dynamic environments. On the other side, the Solar Hybrid Cold Storage with portability proposal aims to transform how we store and move perishable goods.

Objectives of the project work

The major objective of the project is to provide solar-powered containerized small cold storage systems that can transport perishable fruits and vegetables in container vans with refrigerators in order to enhance the agricultural value chain. Some specific goals include using solar power for small-scale cold storage in off-grid locations to preserve fruits and vegetables, demonstrating the solution's scalability in various regions of the nation to improve the agriculture value chain overall,

establishing the containerized solution as a provisional possibility for use as a refrigerated van, and demonstrating the technical functionality of the suggested solution.

Proposed block diagram

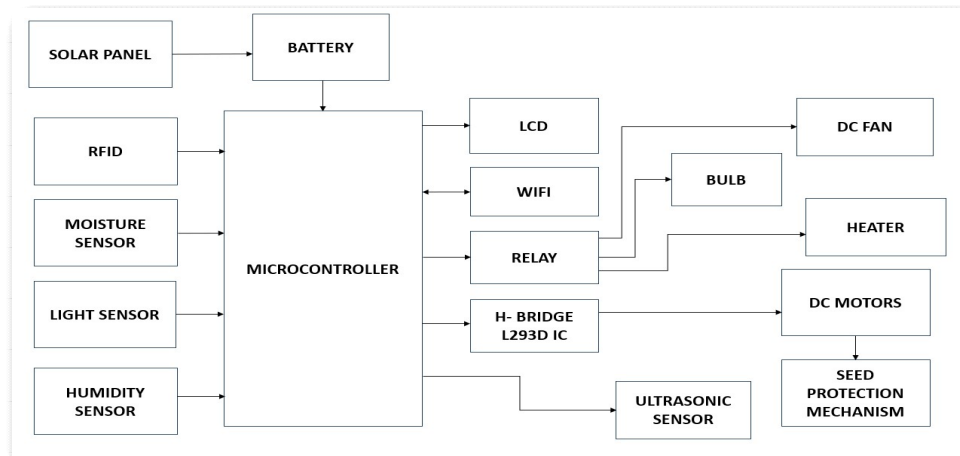


Fig. 1 : Proposed block-diagram of the project work

Aim of the project work

The project's goal is to offer a flexible and sustainable solution for the effective preservation and transportation of perishable items, coinciding with several important goals including extended shelf life, sustainability, portability, community empowerment, and decreased food waste.

Proposed methodology

Conversion of solar energy into electrical energy via solar panel, thermoelectric cooling via Peltier effect, Temperature reading and displaying of same with ESP32 and IOT.

Working of the main project module

The system works that ensures temperature control, optimizes the use of solar energy, and offers dependability through battery backup, all with the goal of extending the shelf life of perishable agricultural products while minimizing energy costs and environmental impact.

Tools used (hardware / software)

C++ on the Arduino, Arduino IDE, Temperature Sensors, ESP 32 board, solar panel 200W, thermoelectric cooler module, Arduino nano, LED module, charge controller, MCB.

Applications & Advantages

Operating expenses and environmental effect are reduced using solar electricity. Small-scale farmers have a cost-effective option they may use to follow environmentally friendly practices, which lowers carbon emissions, reduces post-harvest losses, maintains product quality, and provides trustworthy storage alternatives that increase the degree of food security, conserves food stockpiles for crises, protects pharmaceuticals and vaccines in remote locations, minimizes losses while extending the shelf life of crops, maintains food quality during transit, and offers temporary cold storage for outdoor markets.

Expected Outcome

Increase farm revenue, get access to new markets, cut down on food waste, lengthen the shelf life, and take more environmental responsibility.

Conclusions

The project, "Development of Solar-Powered Cold Storage for Agricultural Purposes," represents a significant leap in addressing the challenges of agricultural storage in off-grid or energy-deficient regions. By harnessing solar power, the project offers a sustainable and cost-effective solution for preserving perishable produce. The solar-powered cold storage system demonstrated its capability to maintain a controlled environment suitable for various agricultural products. It significantly reduces post-harvest losses, enhances food security, and increases the income of farmers by extending the shelf life of their produce. Furthermore, the system aligns with environmental sustainability goals, relying on clean energy sources and reducing the carbon footprint associated with traditional refrigeration methods. Its modular design and adaptability make it a valuable asset for small-scale and large-scale farming operations. In conclusion, the "Development of Solar-Powered Cold Storage for Agricultural Purposes" has the potential to revolutionize agricultural practices, particularly in regions with limited access to reliable electricity. The project offers a sustainable, eco-friendly, and economically viable solution that can benefit farmers, communities, and the environment, contributing to food security and economic development.

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