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Onion Temperature Controlled Storage For Farmers

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ABSTRACT -

India is the second-largest producer of onions globally. Onions are harvested in three separate seasons; yet, climate change in India has hindered their storage throughout the rabi season. Therefore, it is imperative to manage post-harvest losses, oversee temperature and humidity, and anticipate spoilage for prolonged storage. The primary onion-producing states in India include Maharashtra, Karnataka, Madhya Pradesh, Bihar, Gujarat, Andhra Pradesh, Rajasthan, Telangana, and Haryana. Approximately 50 to 60% of the crop is cultivated in the rabi season, while the remaining 40 to 50% is harvested in the kharif or late kharif season. This project aims to develop and deploy an onion temperature regulating system to maintain optimal storage conditions, hence reducing spoilage and improving quality. .

KEYWORDS :-

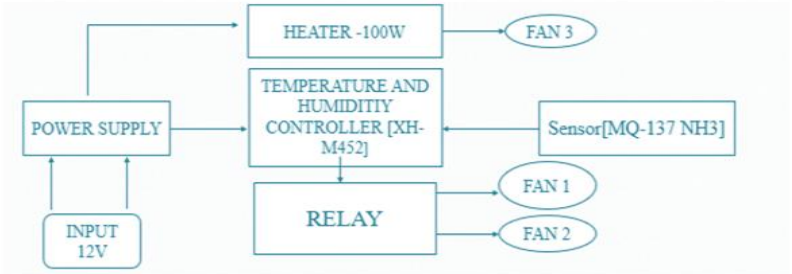
- post-harvest losses
- manage temperature and humidity.
- anticipate spoilage.

INTRODUCTION :

The Allium family, which includes garlic, shallots, and chives, also comprises the vegetable onion (Allium cepa). Onions are a prevalent culinary ingredient worldwide, noted for their unique flavor and scent. They are available in various types, including sweet onions, scallions, and red, white, and yellow onions. Onions contain substantial amounts of vitamins C and B6, along with folate and potassium. They include antioxidants, linked to many health advantages, such as a reduced risk of some malignancies and the alleviation of inflammation. Onions can be preserved using many means, including freezing, refrigeration, or by storing them for several weeks in a cold, dry, and well-ventilated space. The onion has a significant and extensive history in India, functioning as both an essential component of native cuisine and an export product. India ranks among the foremost producers and consumers of onions worldwide. Indian literature and customs date back to 5000 BCE, and the cultivation of onions has been practiced since then. Onion has been employed in traditional Indian medicine to address several diseases, including fever, cough, and colds. Onions are a common ingredient in curries, biryanis, and samosas in Indian cuisine. To enhance the flavor and texture of the dish, they are frequently sautéed or caramelized. Garam masala, an Indian spice combination employed to elevate numerous Indian meals, prominently features onions as a principal element. Onions are grown in several regions of India, with Maharashtra, Karnataka, Madhya Pradesh, Gujarat, and Rajasthan being the principal producing states. Additionally, India exports onions to nations including Bangladesh, Sri Lanka, and the United Arab Emirates. Onion prices in India vary significantly due to multiple reasons, including climatic conditions, production rates, and export regulations. Onions have been a politically difficult topic in India due to their significant impact on the cost of living for many households. .

BLOCK DIAGRAM :

Figure 1: Block Diagram



WORKING :

- **Power Supply (12V)-** Supplies power to the temperature and humidity controller, heater, fans, and sensor.
- **Temperature and Humidity Controller (XH-M452)-**Monitors temperature and humidity levels.
- **Heater (100W)-**Turns on when the temperature is lower than the set threshold
- **Fans (Fan 1, Fan 2, and Fan 3)-**Fan 3 is connected to the heater to help distribute heat.,Fan 1 and Fan 2 are controlled via a relay to regulate
- **Relay-**Acts as a switch to turn Fan 1 and Fan 2 ON/OFF based on signals from the temperature and humidity controller.
- **MQ-135 NH3 Sensor-**Detects the presence of ammonia (NH3) gas.

Working Principle:

This system is designed to prevent onion spoilage by maintaining optimal Temperature, humidity, and ammonia gas levels inside the storage facility. It uses a Temperature and Humidity Controller (XHM452), an Ammonia Gas Sensor (MQ-137), a Heater, Fans, and a Relay Module to ensure proper storage conditions.

Power Supply:

- The system is powered by a 12V DC supply, which drives all components.

Temperature and Humidity Control:

- The XH-M452 Temperature and Humidity Controller continuously monitors the environment.
- If the temperature drops too low, the 100W heater is activated to maintain the required temperature.
- If the temperature exceeds a set limit, Fan 3 turns on to cool down the storage area.
- The system maintains optimal humidity to prevent excess moisture, which can lead to fungal growth and rotting.

Ammonia Gas Detection:

- The MQ-137 NH_3 sensor detects ammonia gas levels inside the storage.
- Onions release ammonia gas when they start to rot, which can accelerate spoilage in the surrounding onions.
- If ammonia levels exceed the safe threshold, the system activates ventilation.

Relay-Controlled Ventilation System:

- When ammonia gas concentration is too high, the relay module switches on Fan 1 and Fan 2.
- These fans help to remove contaminated air and replace it with fresh air, preventing the spread of decay.

LITERATURE SURVEY :

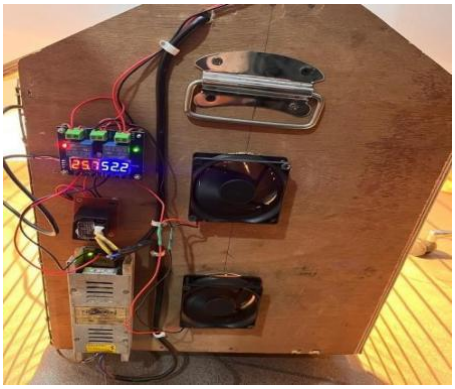
- **A study by Kumar et al**. (2018) found that onions stored at 0°C and 60-70% relative humidity had the longest storage lif**e**
- **Research by Singh et al.** (2020) developed a temperature control system for onion storage using a microcontroller and sensors.
- **A review by Sharma et al.** (2019) discussed various onion storage techniques, including temperature control, humidity control, and modified atmosphere storage

METHODOLOGY :

The research utilized a systematic approach to design, develop, and evaluate a temperature-controlled onion storage system intended to reduce post-harvest losses for small and medium-sized farmers. The project began with a comprehensive requirements evaluation that involved field trips, direct interviews with over 50 local farmers, and secondary data analysis from agricultural reports. This found that post-harvest losses in onions, primarily due to inadequate storage, ranged from 30% to 40%. The critical environmental factors identified were uncontrolled temperature, increased humidity, and the accumulation of spoilage-promoting gases such as ammonia.

Design parameters were established based on the findings. The target internal temperature was set between 25°C and 30°C, with relative humidity maintained at 65% to 70%. The technique was developed to monitor ammonia concentrations and guarantee adequate ventilation. A scalable capacity of 1–2 tons was chosen, prioritizing cost-effectiveness and the integration of solar energy for energy independence in off-grid areas.

ACTUAL SYSTEM



CONCLUSION :

A cost-efficient and accessible method for onion preservation has been developed utilizing sensors. The system is engineered to perpetually monitor the onions and alert the user upon meeting the specified criteria. The sensor system can be customized and adjusted according to the number of onions. This sensor system facilitates the preservation of onions for a duration of up to eight months. The Onion Temperature Control System Structure is an innovative solution designed to maintain ideal temperature conditions for onion storage. The system's ability to accurately monitor and control temperature fluctuations ensures that onions remain fresh and of high quality. .

Key Takeaways

1. The system's microcontroller-based design enables precise temperature control and automation.
2. The use of thermocouples and thermistors provides accurate temperature monitoring.
3. The heating and cooling systems work in tandem to maintain optimal temperature conditions.
4. The ventilation system ensures proper air circulation, preventing moisture buildup and reducing the risk of spoilage.

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