INTELLIGENT FOOD AND GRAIN STORAGE MANAGEMENT SYSTEM FOR WAREHOUSE

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ABSTRACT

Agriculture is a major sector of the Indian economy, employing 60% of the population.People primarily rely on agricultural products. All agricultural products and finished commodities are stored in the warehouse before being exported. During this timeframe, losses of 20% to 30% are possible. Some agricultural goods require adequate ventilation and temperature to maintain their quality. Variations in environmental factors in the warehouse can cause significant losses, affecting product volume and nutritional values.To prevent such losses, technology plays an important role in food storage. A successful warehouse monitors a variety of environmental characteristics, such as temperature, humidity, and fire. In this suggested system, we employ temperature and humidity sensors, LDR sensors, rain sensors, and fire sensors to measure various physical factors in the warehouse. We also use appropriate devices such as fans and ventilation to minimize losses in the warehouse.

I. Introduction

In recent times agricultural production has increased significantly, but most of the harvested food is lost or wasted during the post-harvesting period. According to research the Indian Government in 2022 has lost about 5-13% of its fruits and vegetables and 3-7% of other crops during post-harvesting period. The post harvest losses include package, storage, and transportation. These losses are categorized as weight loss due to spoilage, quality loss, nutritional loss, and commercial loss. Due to lack of quality food consumers are facing various health problems. And most of the farmers are committing suicides because of losses. Around 60% of post-harvest losses occur during the storage period due to lack of knowledge on storage conditions. Warehouses play a key role in storage facilities. However, traditional warehouse management methods lack in minimizing food losses. These methods rely on

manual monitoring which makes the process slow and leads to human error. So, here comes the concept of automated cold storage, which improves the shelf life of the food by maintaining required temperature.

The development of the intelligent food and grain storage management system provides a solution to the post-harvest losses faced by the farmers. This system offers a number of benefits that include real time monitoring and control of critical environmental parameters, multi-product storage facility, improved decision making, optimized space utilization and also reduces the warehouse accidents.

II. Existing System

The current system makes use of a Raspberry Pi Pico microcontroller and a Node MCU to process and transfer warehouse parameters to users. Sensors are used to measure various environmental characteristics such as ambient temperature and humidity, as well as weight, and are then connected to the Raspberry Pi Pico. The existing system is ineffective at detecting fire and rainfall in warehouses. Additionally, this system offers a single product storage facility. This system communicates via Wifi, which sometimes loses signals.

To address these restrictions, we offer a system with various sensors and functionality. This leads to increased efficiency and lower costs. Advanced microcontrollers and communication modules are used to deliver reliable performance at a lower cost. This allows us to monitor real-time data inside the warehouse.

III. Proposed System

As a proposed system, our approach improves on existing systems by combining the necessary sensors and functionality onto a single platform. All of the sensors are connected to the Arduino UNO, which serves as the primary interface, and we utilize the bluetooth terminal software to monitor warehouse data. The HC-05 bluetooth module is used to establish a wireless connection over a short distance. This permits real-time monitoring of a variety of environmental conditions within the warehouse.

In addition to the current system, we propose expanding the sensor capabilities to include fire detection, rain detection, and automatic ventilation management. This enhances warehouse safety and reduces product spoilage. To improve warehouse safety, we recommend integrating a fire and rain detector. The usage of a fire detector will decrease warehouse accidents, while a rain detector will detect rainfall and take appropriate action to reduce losses.

Overall, our suggested system aims to provide an enhanced solution for monitoring warehouse conditions. By integrating modern sensors and actuators, we want to improve storage conditions and data monitoring.
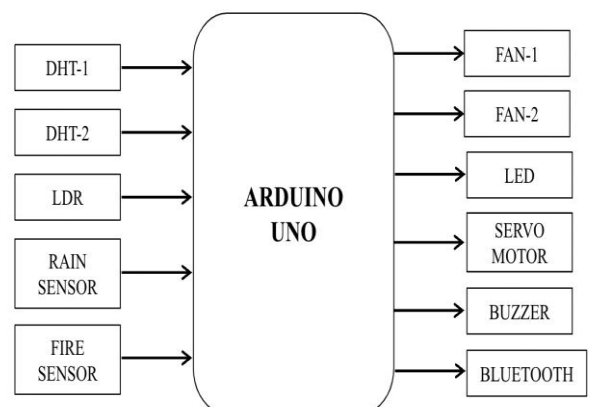

Fig 1 Block diagram

IV. Working

This embedded device is intended to be installed inside the warehouse to monitor environmental conditions. It is made up of different sensors such as a temperature and humidity sensor, an LDR sensor, a rain sensor, and a fire detector that are linked to an Arduino UNO microcontroller. When powered on, the sensors begin reading data and transfer it to the microcontroller at regular intervals for processing. The Bluetooth terminal app continuously displays the sensed data. Actuators are also utilized to control parameters, such as when the temperature in either of the two rooms exceeds the threshold, the corresponding fan is turned on, and if the system detects rain, ventilation is automatically closed using a servo motor. If a fire is detected in the warehouse, the system will sound an alarm to inform the user. The Bluetooth terminal application displays the actuator data as well as the detected values at the same time.

Fig 2 Flow chart

Advantages :-

- Low cost portable device.
- Reduces the post-harvest losses faced by the farmers.
- Reduces manpower and works efficiently.
- Helps to monitor the warehouse conditions regularly and also reduces fire accidents in warehouses.
- Simple and easy to maintain.

Disadvantages :-

- Cannot view the alerts outside the bluetooth range.

Applications :-

- Used to monitor the temperature.
- Acts as a safety and alerting system.
- Used to maintain the quality of the products.
- Used to preserve food and grains for a long time.

V. Conclusion

Finally, integrating this unique device with Bluetooth technology has the potential to provide considerable benefits for monitoring warehouse environmental conditions. This technique decreases grain and food waste while increasing their shelf life. The suggested system includes a variety of capabilities, such as real-time temperature calculation within the warehouse and live data monitoring via a Bluetooth terminal application. This gadget combines hardware and software components to produce a complex system for improving food and grain storage safety within the warehouse. This system allows the user to acquire important information regarding the warehouse's temperature, rain, and fire detection, as well as programmed control actions that will be executed accordingly.
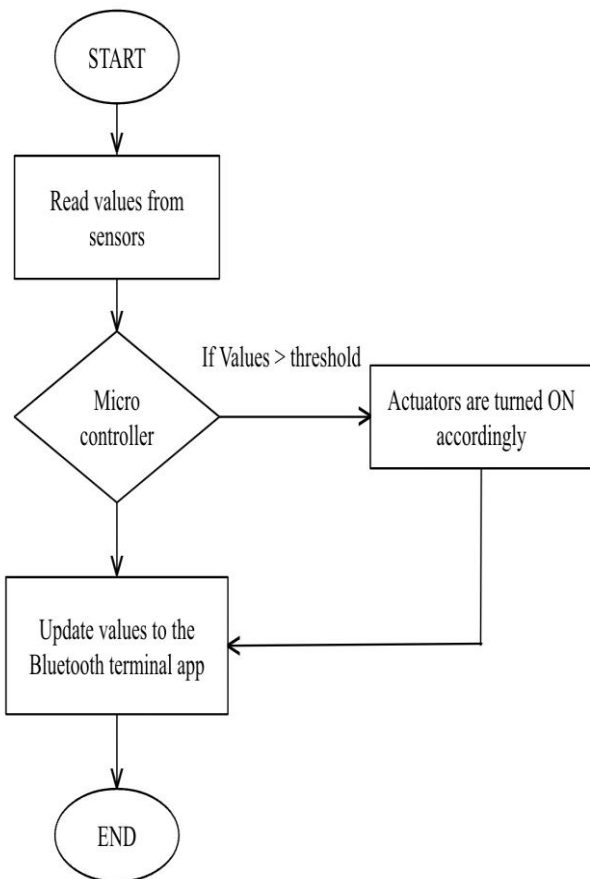
VI. Future Scope

There is interesting potential for future advancements, such as using thermoelectric coolers and heaters to maintain either cold or hot environments based on the products to be stored in huge food organisations, such as cold storage systems.

In addition, we can automate the opening of windows whenever the fire sensor alert goes out, and we can link this configuration with the GSM module to send SMS to the nearest fire station. Adding these qualities allows us to identify fires in less time, and food grains stored in the warehouse have fewer chances of spoiling.

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