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POST HARVEST IoT BASED SYSTEM FOR CURING AND STORAGE OF ONIONS

[1] Ms.Yamini Shanmugam, [2] Swedha. D, [3] Sankamitra. SU, [4] Sowmiya. K, [5] Vijaya Dharshini. R

[1] Associate Professor, Department of ECE,Sri Krishna College of Technology, Coimbatore, India.

[2] Student, Department of ECE, Sri Krishna College of Technology, Coimbatore, India.
[3] Student, Department of ECE, Sri Krishna College of Technology, Coimbatore, India.

[4]Student, Department of ECE, Sri Krishna College of Technology, Coimbatore, India
[5]Student, Department of ECE, Sri Krishna College of Technology, Coimbatore, India

Abstract: The project aims at introducing IoT in traditional onion curing process of using air blowers. Here gas sensor is used to detect the rise in the level of ammonia gas due to decaying of onions. Early detection of rot in onions help farmers take necessary action to stop the spreading of the decaying process. Post curing the onions must be maintained in a cool dry environment. Temperature sensor and humidity sensor ensure the maintenance of proper temperature and humidity levels. Any variation in the levels of ammonia, temperature or humidity is notified to the farmer through SMS. The project is cost effective and also compatible with the existing onion curing and storage methods.

Keywords: *IoT, Sensors, SMS, Microcontroller.*

I. INTRODUCTION

India is the second largest producer of onion in the world. But 30 to 40% of the total produce is lost due to desiccation, decay and sprouting during storage. This causes fluctuation in the onion prices and also heavy loss to the farmers. Efficient curing and storage of onions is required. In traditional methods of drying or curing onion under sun light and usage of dry air blowers, the farmers were unable to maintain the temperature, humidity and also detect rotting of onions. This is rectified by incorporating IoT based monitoring technique that uses sensors to maintain the required temperature, humidity and also detect rot in onions at early stages itself.The project aims at introducing IoT in traditional onion curing process of using air blowers. Here gas sensor is used to detect the rise in the level of ammonia gas due to decaying of onions. Early detection of rot in onions help farmers take necessary action to stop the spreading of the decaying process. Post curing the onions must be maintained in a cool dry environment. Temperature sensor and humidity sensor ensure the maintenance of proper temperature and humidity levels. Any variation in the levels of ammonia, temperature or humidity is notified to the farmer through SMS. The project is cost effective and also compatible with the existing onion curing and storage methods.

II.LITERATURE SURVEY

The post-harvest onion storage methodology is designed and implemented to reduce its degradation.1 Onion harvesting detection is done using Arduino, LM35 temperature sensor, humidity sensor, gas sensor, and GSM module. The objectives of this quality of onion using Arduino is to sense the ammonia gas, temperature, and humidity with the help of the LM35 temperature sensor, gas sensor MQ 137, and send SMS alerts to mobile numbers stored inside the Arduino program, if onion quality is selected using global system for mobile communication (GSM).

This project introduces an advanced system that will help the user to control such parameters affecting positive feedback against different onion losses. Shed net is used here because it improves the thermal behavior significantly decreasing the inside temperature. The system works on the principle of sensing emitted gases by onions and attempting to control them within the desired parameter range of temperature and so humidity and also gives an online record observation facility. In this novel methodology, a system is introduced, which is an IoT based food monitoring system. In this system, sensors related to food safety, like CO2, humidity, and nitrogen sensing elements are used, and IoT plays an important role as it gives the alert to users at a remote location.

III.PROPOSED WORK

1. Mechanization in Onion Harvesting and its Performance

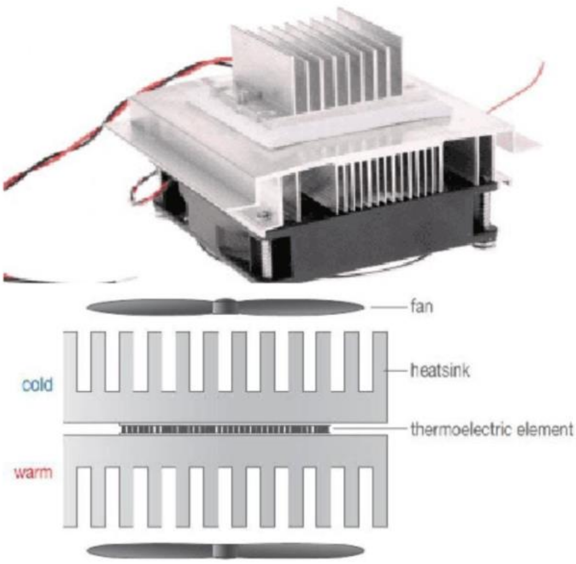
Onion harvesting is a complex operation involving digging of the onion bulbs and cutting of matured leaves from the onion bulbs which is repetitious and tiring, and involves a lot of bending postures. This complex harvesting process often leads to delays which ultimately results in a financial loss to the farmer. In India, mechanization in onion (Allium cepa L.) harvesting is very low as compared to other tuber crops such as potato. Many attempts have been made to mechanize onion harvesting using potato diggers and other root crop harvesters. As the biometric properties of onion bulbs are entirely different from the crops for which these harvesters are intended the results have not been satisfactory, i.e., the cleaning efficiency is low and the damage percentage is high. Moreover, these harvesters only uproot the onion bulbs, but the matured leaves from the onion bulbs are required to be cut, which requires human intervention and time. This paper reviews the existing harvesting techniques followed both mechanical and traditional for onion crop. It also highlighted the research gap in mechanizing onion harvesting. The conceptual design of an onion harvester from Indian perspective for simultaneous topping and digging of onion bulbs has been given.

Mechanization of onion harvesting system

2. Internet of Things-Based Onion Preservation System

India ranks second in onion production in the world. Onion is extremely important not only as a vegetable but also as a foreign exchange earner amongst other fruits and vegetables. But due to the continuous change in the Indian climate onions can rot or decay. Therefore, onions should be preserved by maintaining the temperature given by the National Onion Association (NOA). Under the ambient condition, the onions are stored at temperature 0 to 4ºC with humidity 60 to 70%. So the idea has come up to preserve onion.

In this project, we have designed an onion preservation system, which preserves an onion in a prescribed manner. In this system temperature, humidity sensors have been used to monitor temperature and humidity, respectively. Using the Peltier module, the air inside the tank is cooled and warmed to maintain the standard temperature range. By using the Internet of Things (IoT), making the proposed system smart and efficient, the user will get notification of the system anywhere in the world. Also, users will get recent onion market trends.



Onion storage system using IoT

IV.HARDWARE USEDMICROCONTROLLER:

The PIC microcontroller ESP32 is one of the most popular microcontrollers in the industry. It is user convenient and easier to handle. The coding or programming of this controller is also easy. The program that is coded can be easily erased due to the flash memory technology. The microcontroller has wide range of applications used in many huge industries. It is used in security, remote sensors, home appliances and industrial automations. An EEPROM is also featured which is used to store the information permanently like transmitter codes andreceives frequencies and some other related data.

POWER SUPPLY

The thermoelectric module requires constant DC voltage so the thermal effect can be achieved. Here, the power supply is designed for 12V 2A. 100Switch mode power supply (SMPS) is a good option as a power supply because less heat is generated through it. But, SMPS is complicated to design and implement. As compared to the linear power supply, SMPS is much better because switch mode stores less heat in the components, hence, the life of components is more as compared to linear.

6 ESP32 Wi-Fi Module

It is an integrated system-on-chip (SoC) used to connect the device to the world. It is a wireless trans receiver. It also supports WPA/WPA2 security mode. Even we can connect sensors directly to it. It supports Bluetooth 4.2. It gives wireless connectivity to the devices so it can connect and communicate with other systems. It operates at a voltage range of 2.2 to 3.6V. Figure 7 shows the ESP32 Wi-Fi model which can be easily mounted on the top of the microcontroller.

ESP32 Wi-Fi Module

DHT11 HUMIDITY SENSOR

DHT11 is a humidity sensor having a range of 20 to 95%, and it also measure temperature with a range of 0 to 50°C. shows the Pin details of the DHT11 sensor**.**

Fig 4.4: Temperature Sensor

TEMPERATURE SENSOR

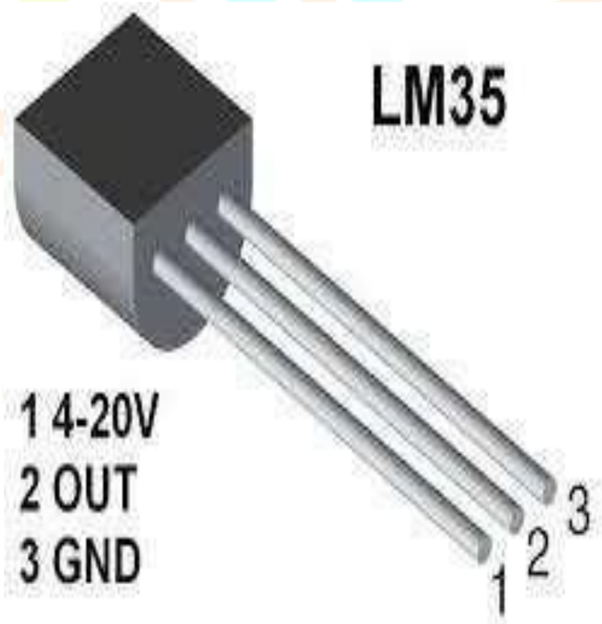
The LM 35 sensor is highly used because its output voltage is linear with the Celsius scaling of temperature. It does not provide any external trimming. It has a wide operating range. The maximum output is 5V. The output will increase 10mV for every one degree rise in temperature. The range isfrom -55 degrees to +150 degrees. There are three terminals as Vcc, Ground and the analog sensor. It consumes minimum amount of electricity. Thus, it is energy efficient.It is very efficient in horticulture. It is user friendly to use.

GAS SENSOR

Gas sensors (also known as gas detectors) are electronic devices that detect and identify different types of gasses. They are commonly used to detect toxic or explosive gasses and measure gas concentration. Gas sensors are employed in factories and manufacturing facilities to identify gas leaks, and to detect smoke and carbon monoxide in homes. Gas sensors vary widely in size (portable and fixed), range, and sensing ability. They are often part of a larger embedded system, such as hazmat and security systems, and they are normally connected to an audible alarm or interface.

The MQ-137 is an Ammonia (NH_3) gas sensor from Winsen. The sensing element is SnO_2, which has lower conductivity in clean air. When NH_3 (Ammonia) gas exists, the sensor's conductivity gets higher along with the gas concentration rising. A simple circuit makes measuring this change in conductivity and turning it into data straight-forward, but does require some calibration.

GAS SENSOR



I. SOFTWARE USEDPROTEUS 8 SIMULATOR

Proteus 8 is one of the best simulation software for various circuit designs of microcontroller. It has almost all microcontrollers and electronic components readily available in it and hence it is widely used simulator.

It can be used to test programs and embedded designs for electronics before actual hardware testing. The simulation ofprogramming of microcontroller can also be done in Proteus.
Simulation avoids the risk of damaging hardware due to wrong design.

EXPERIMENTATION & RESULTS

The hardware is interfaced with all the sensors in the board. The hardware components include the microcontroller, buzzer, relay, ADC converter, GSM module and all the sensors interfaced. The board is inserted with a SIM card which is used to communicate with the owner and the recorded values.

The output shown below denotes the temperature, soil moisture condition and the intruder detection. The second result is the output from the Android Application that is developed in the mobile phone. It determines the temperature, humidity, moisture and the intruder detection.

Fig 6.1: Android application monitoring

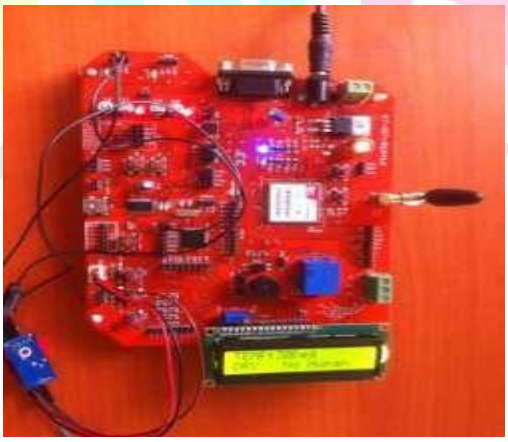


Fig 6.2: Output of Temperature, Moisture, PIR detection

II. FUTURE WORK & CONCLUSION

To preserve the onion, a thermoelectric cooling system has been introduced. This system can control the temperature inside the cell required for the onion preservation by using Peltier tiles. According to the quantity of onion, this system can be easily modified and implemented. By taking Google's assistance, users will get updates regarding system conditions and current rates of onion.
For fresh onions (sample), the output readings seem to be controlled (within the range) according to Indian environment. We started rotting process and performed the same procedure and we observed that the values of parameters are getting increased rapidly. In India considering erratic environment monitoring temperature and various parameters are important. In addition to that rain is also a considerable parameter. By using this system, one can monitor all the desired parameters and provide maximum controlled onion quality. This system will provide notification to owner (farmer) by mean of audio , display and wireless message(SMS).It is low cost, low maintenance and easy to install, anyone can afford it. We can have real time data which can be used for future research/purposes.

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