JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue

JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)

An International Scholarly Open Access, Peer-reviewed, Refereed Journal

SMART BUFFER STOCK SOLUTION FOR ONION

Onion Preservation System for Post Harvesting Period of Six Months

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Abstract: India is the world's second largest producer of onions. Among other fruits and vegetables, the onion is extremely important not only as a vegetable but also as a foreign exchange earner. However, because of the constant changes in the Indian climate, onions can rot or decay. As a result, onions should be stored at the temperature recommended by the National Onion Association (NOA). The onions are stored in ambient conditions at temperatures ranging from 0 to 4°C and humidity levels ranging from 60 to 70%. So the idea of preserving onion has arisen. In this project, we created an onion preservation system that preserves an onion in a specific way. Temperature and humidity sensors have been used in this system to monitor temperature and humidity, respectively. By utilizing the Peltier module, to maintain the standard temperature range, the air inside the tank is cooled and warmed. The proposed system will be smart and efficient thanks to the use of the Internet of Things (IoT), and the user will receive system notifications from anywhere.

Index Terms **- Food preservation, Onion preservation, Peltier, Thermoelectric module.**

I. INTRODUCTION

The losses in stored onions in India are higher because onion bulbs have a higher water content. A total of 41 lakh tons of onions are produced each year in India, of which 40 to 50 percent are lost to desiccation, decay, and sprouting in storage, costing more than Rs. 600 crores. As a result, their price increases by four to five times. The production, as well as, market value of this potential vegetable is increasing day by day. This states that onion desiccation, rotting, rooting, decay, and sprouting in onion storage sheds should be avoided. Onion is extremely important not only for vegetable internal but also as the highest foreign exchange earner among the fruits and vegetables. Onion farmers are trying to increase

Production year after year. However, onion price has been highly volatile and more recently the price has been sluggish. This has resulted in the Indian State Agriculture Marketing Board seeking price support.

II. EXISTING SYSTEM

In order to reduce onion degradation after harvest, a post-harvest onion storage methodology is designed and implemented.

1. The detection of onion rotting is accomplished using an Arduino, LM35 temperature sensor, humidity sensor, gas sensor and GSM module.

2. The purpose of detecting onion quality using Arduino is to measure ammonia gas, temperature, and humidity using the LM35 temperature sensor, DHT11 humidity sensor, MQ137 gas sensor, and to send SMS alerts to selected mobile phones.

III. PROPOSED SYSTEM

In terms of early detection of rotting, the proposed onion storage system performs admirably. This project offered an innovative system that will assist the user in controlling temperature between 25 and 30 degrees Celsius, resulting in positive feedback against various onion losses, as well as an inventory system for selling onions as soon as possible before they decay.

IV. BLOCK DIAGRAM OF PROPOSED SYSTEM

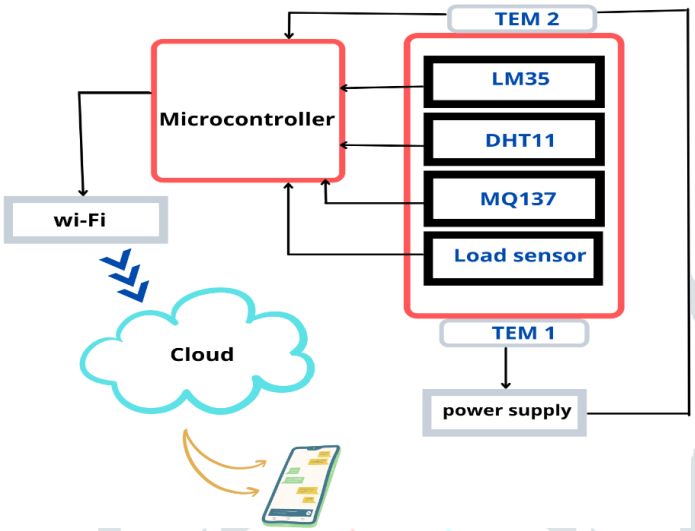


Figure (i): Block Diagram of the Proposed System

V. METHODOLOGY

In this paper, the quality and quantity of onion are maintained by using a thermoelectric cooling system and monitored using and IoT. The Wi-Fi module is used to send monitored data to the user at any remote location. Temperature controlling is the most challenging part of the system as the external environment impacts on inner tank temperature. An entire system can be divided into two parts.

Maintaining Temperature inside the Tank

Maintaining temperature is one of the major tasks. The thermoelectric cooling system which is based on the Peltier effect is used to decrease the temperature inside the tank. As the power supply is given to the thermoelectric cooling module, one side of the Peltier starts to become cold. The exhaust fan attached to the cooling module blows cooling air from the thermoelectric module inside the tank. The temperature decreases exponentially. As temperature lies in between 0 to 4°C, the cooling module is turned off. As soon as the temperature increases again, the cooling module is turned on. If for any reason temperature goes below the prescribed range, the heating module is turned on.

Monitoring and Logging Sensed Data on Google Cloud, and send it to the User

Parameters like temperature and humidity are monitored using LM35 and DHT11 sensors, respectively. The monitored data is logged on the Google cloud. This data can also send to the user. IoT plays an important role here. The quantity of onion is also updated to the user. So users get to know how much onion is in the store.

VI. DESIGN AND TECHNOLOGY:

Figure (i) shows the block diagram of the system. The elements of the system are discussed separately.

Thermo-Electric Cooling Module (TEM)

As the name suggests, thermal effects can be achieved using electricity. Thermo-electric modules consist of two or more p- and n-type semiconductor blocks sandwiched between two plane ceramic substrate, commonly known as “Peltier tiles”. The p- and n-type are connected in series electrically, while connected parallel thermally. When Direct Current (DC) voltage is applied to it, heat from one side is transferred from one side to another side. Hence, one side is cooled and the other becomes hot.

LM35 Temperature Sensor

For monitoring the temperature, LM35 temperature sensor is used. The main advantage of LM35 sensor is output voltage is more than the traditional thermocouple. Because of this no external signal conditioning circuitry is required and accuracy is 0.5°C. It operates from 4 to 30 volts.

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.

ATmega328P Microcontroller

In this system, ATmega328P microcontroller is used to maintain the temperature inside the onion storage tank. Basically, it is an 8-bit low power microcontroller. The main feature is inbuilt 10-bit analog to digital converter (ADC) mainly used for temperature measurement. This feature makes this microcontroller suitable for this application. It also supports Inter-Integrated Circuits (I2C).

Power Supply

The thermoelectric module requires constant DC voltage so the thermal effect can be achieved. Here, the power supply is 12V 2A. Switch 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.

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.

VEGGIE This is a smart phone application that allows users to interact easily with it. Initially, the user must create an account and answer general questions about their background, such as their role as a customer (or) farmer and the location of their warehouse. Using this information, the system is able to provide the farmer and customer with information about nearby smart buffer stocks. The app can display the availability of onions for sale based on the cloud analysis. And also an additional option is given for users to register their requirements in this application.

VII. EXPERIMENTAL RESULTS

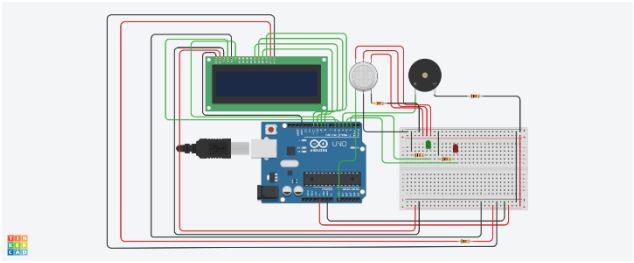
The experimental results are divided into three significant parts, which are listed below. We used Tinker cad to simulate the temperature cooling system as well as the ammonia gas detection and alerting system.

1. *SIMULATION (PART - 1)*

Temperature cooling system

In this simulation circuit, Arduino Uno, LM35, Potentiometer, Breadboard, DC motor (instead of peltier fan), and a few connecting wires are used.

2. *SIMULATION (PART-2)*

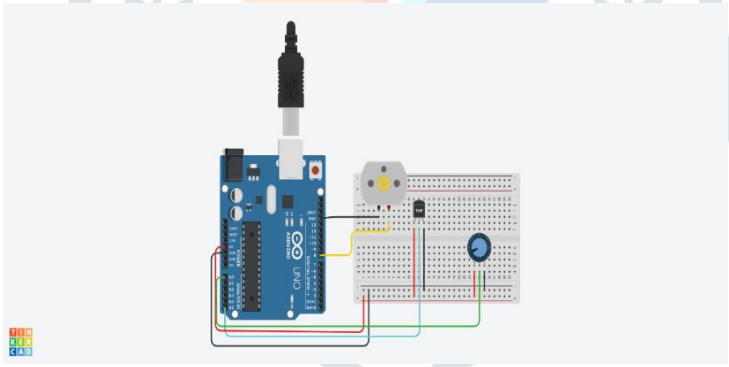


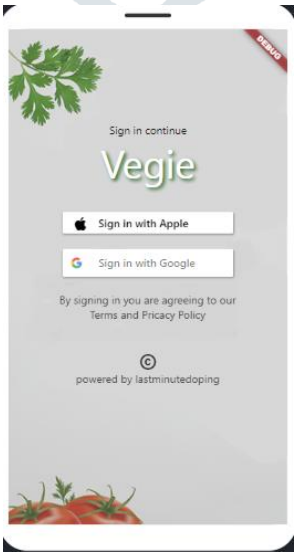
Ammonia gas Detection and alerting system

In this simulation circuit, Arduino Uno, MQX Sensor, Resistors, Breadboard, LCD(16*32) & Buzzer (instead of GSM), and a few connecting wires are used.

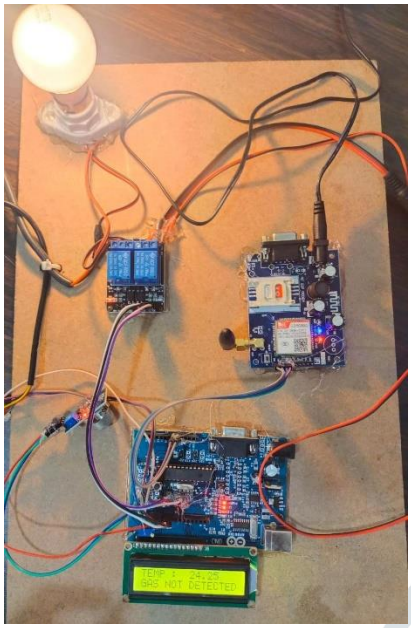
3. *APPLICATION PROTOTYPING (PART – 3)*

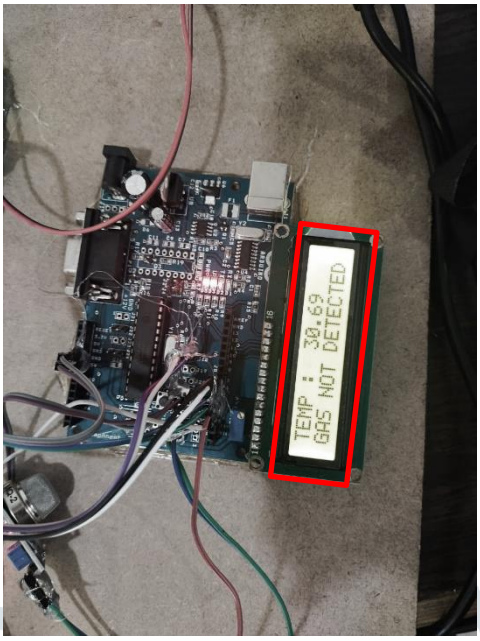
Veggie, a platform-independent mobile application that can run on both iOS and Android, is being developed with flutter. The figure below depicts the user interface of our mobile application.





VIII. RESULTS AND OUTPUT:





IX. 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 using our application, users will get updates regarding system conditions and also current rates of onion and sell them accordingly.

XI. ACKNOWLEDGMENT

At the outset, we would like to express our sincere gratitude to our beloved Chairman Dr. B. BABU MANOHARAN, M.A., M.B.A., Ph.D., for his constant guidance and support.

We would like to express our thanks to our respected Managing Director, Mrs. B. JESSIE PRIYA, M.Com, and our Director Mr. B. SHASHI SEKAR, M.Sc., for their kind encouragement and blessings.

We express our sincere gratitude and whole-hearted thanks to our Principal Dr. P. RAVICHANDRAN, M.Tech., Ph.D., For his encouragement to make this project a successful one.

We wish to express our sincere thanks and gratitude to our Head of the Department Dr. C. GNANA KOUSALYA, M.E., Ph.D., of Electronics and Communication Engineering for leading us towards the completion of this project.

We also wish to express our sincere thanks to our Project guide Dr. C. GNANA KOUSALYA, M.E., Ph.D., Head of the Department, Department of Electronics and Communication Engineering for her guidance and assistance in solving the various intricacies involved in the project.

Finally, we thank our parents and friends who helped us in the successful completion of this project.

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