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IOT Based Food (Onion) Spoilage Detection

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ABSTRACT: Onion is very important & valuable crop for Indian farmers, After harvesting the onion it is necessaryto store it properly because Rotten onion results in huge loss to the farmers. It is essential to develop the system thatcan helps to store the onions without rotten. By knowing this major problem we decided to develop such system. Forthat we studied different research papers. After studying more information about onion's properties we came to understand that with the help of new technologies like IOT method by using some sensors we can control the environment of onion's where they stored. By reading the papers regarding IOT and Sensors we got all information. So we develop an IOT-based device that enables real-time climate monitoring, identifies early wastage in and alerts the farmer based on the analyzed data or send signal to Ac, Fans, Dehumidifier., Which helps to reduce wastage of onion and help to store onion 6- 8 months. We developed the system and we got appropriate results according to our idea of implementation . As we used temperature , humidity, and gas sensors and in resultthey accurately detected the micro - environment change and all real- time values we got on mobile application and Web Server and as per change in values exhaust fans and Dehumidifier gets turned on until temperature and humidity levels reached to threshold i.e standard values to stores the onions values. Selection of sensors and microcontroller is done on the basis of studying and reading different research papers, by guidance of respective professionals on that fields. So that we can able to conclude our results accurately.

KEYWORDS: Temperature Sensor, Humidity sensor,LCD16*2,Oder sensor (MQ135), Node MCU (ESP8266),Lamp ,Fan, Mobile Android app .

I. INTRODUCTION

Onion is very important & valuable crop for Indian farmers. It has a wide impact on national economy and financial status of growers/consumers [2]. After harvesting the onion it is necessary to store it properly. Rotten onion results in huge loss to the farmers. Onion is grown in all three crop seasons. According to ICAR - Directorate of Onion and Garlic Research, the cultivation in India is growing day-by day[1]. Hence it has a wide impact on national economy and financial status of growers/consumers [6]. The Indian climate is becoming more erratic during various seasons causing unexpected fluctuations in temperature and humidity. This makes onions more susceptible to rotting. This leads to rotting due to growth of fungi leading to bacterial rot, sprouting, rooting. To prohibit these losses, the aimed was to design and develop an electronic device to avoid onion rotting. We visited the storage sheds in markets and study the post-harvest losses and tried to find remedy to prevent it. Knowing the storage techniques and losses, we designed and developed a need based electronic circuitry that can provide early warning and capable of sending messages to owner. This work suggests an integrated systemwhich introduces a different and convenient option for preventing or reducing onion losses. This system works on the principle which involves sensing emitted gases by onions and processing them to obtain desired output. Emitted gases are sensed by their respective sensors & then, their signals are read & processed by microcontroller. According to programmed microcontroller Audio-visual alarm and text message will be sent to the owner. To controlother parameters like temperature and humidity we use a green colored net and fan.

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1.1 INDIAN AGRICULTURE HOW BENEFICIALONIONS :

Rich in antioxidant compounds. Onions are loaded with plant chemicals including flavonoids, which have both an antioxidant and anti-inflammatory effect.

1. May support heart health.
2. May support bone health.
3. May support gut health.
4. Antibacterial.

- May Benefit Heart Health
- Onions contain antioxidants and compounds that fight inflammation, decrease triglycerides and reduce cholesterol levels — all of which may lower heart disease risk. Their potent anti-inflammatory properties may also help reduce high blood pressure and protect against blood clots. Organic sulfur compounds help reduce the level of cholesterol in your body and may also help break down blood clots, lowering your risk for heart disease and stroke. You should eat onions raw rather than cooked to get the most sulfur compounds from them. Onions contain compounds called daily l disulfide and lipid transfer protein, which can cause allergy symptoms like asthma, runny nose, nasal congestion, red eyes, itchy eyes and nose, and contact dermatitis, characterized by a red, itchy rash. Onions are a source of soluble fiber, which makes it a powerful prebiotic food. It ensures a healthy gut, which is crucial for weight loss and belly fat loss. Rich in antioxidants, onion has important actions that strengthen our immune system and prevent chronic diseases, colds, and flu. It also protects us against lung cancer. we can use onions in salads, juices, or as a syrup. It helps decongest the airways, quickly eliminating persistent coughs and phlegm.

- **PROJECT OBJECTIVES :**

1. It is important that for proper onion storage/harvesting temperature in specific range (37 to 45 degree celcious). Because of change in temperature, different losses &/or diseases can occurs. To avoid these losses we tried to control thetemperature and moisture (or say, humidity 50 to 60%) as much as possible.
2. Improving storage capacity by using sensors
3. To identify smell of rotten onions by using Oder sensor.
4. To provides information about temperature detection and present humidity by using humidity or temperature sensor. and get notification on mobile App (MIT INVENTOR APP).
5. When the temperature rises above 40 degrees, switch on the fan.
6. When the temperature exceeds 70 degrees, switch on the bulb to manage humidity

II. LITERATURE SURVEY

[1] To Control the System controlling section is important inany automation system. Customer need to access every appliance through the mobile. We propose a system which proved and secure the onion from internal and external danger. Person those are outside the home/city They can just login to browser on mobile/laptop and see what is going on in their automated area. Auto controlling is important thing in our day to day life.

[2] Segmentation technique to detect a vegetable quality is avery useful method. An automated system if coupled with such technique would be very helpful in sorting the fresh and the rotten vegetables. The purpose of this research paper is to provide an approach for the segmentation of the rotten vegetables to annihilate infirmity with respect to human health. Segmentation technique such as Marker Based Segmentation, Color Based Segmentation and Edge Detection, produced promising and effective results.

.

[3] Through this paper, we have presented a low-cost cold storage management system based on IoT to overcome the difficulties of keeping track of food quality and quantity. Our proposed approach makes use of heterogeneous IoT devices, cloud services, and an Android application. [4] The proposed vision based framework utilizes histograms, gray level co-occurrence matrices, bag of features and convolutional neural networks for feature extraction. The classification process is carried out through well-known support vector machines based classifiers. After testing several experimental scenarios including binary and multi- class classification problems, it turns out to be the highest success rates are obtained consistently with the adoption of the convolutional neural networks based features.

[5] This study presents the development of a spatially resolved transmittance system for detecting internal rots in onions, particularly small and localized rots. A two- wavelength classifier was chosen by considering sensitivities to

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rots and path-length variations. Near-infrared spectroscopy transmittance measurements were carried out on rot-affected onions, to determine wavelength sensitivitiesto the presence and severity of rots.

[6] An electronic nose (Enose) relies on the use of an array of partially selective chemical gas sensors for identification of various chemical compounds, including volatile organic compounds in gas mixtures. They have been proposed as a portable low-cost technology to analyses complex odors in the food industry and for environmental monitoring..

[7] This study presents the development of a spatially resolved transmittance system for detecting internal rots in onions, particularly small and localised rots. A two- wavelength classifier was chosen by considering sensitivities to rots and path-length variations. Near-infrared spectroscopy transmittance measurements were carried out on rot-affected onions, to determine wavelength sensitivitiesto the presence and severity of rots.

[8] In this context silver based yellow col-ored colloidal nanoparticle (AgY-NPs) solution was synthesized and evaluated as a visual sensor for the organo-sulfur compound released during the spoilage of onions. The visual changes during the spoilage was monitored for ten days wherein the yellow color of the AgY colloidal solution changed to orange, pink and finally turned transparent. Diffraction (PXRD), Raman Analysis, Fourier Transform-Infrared Spectroscopy (FT-IR), Scanning Electron Microscopy (SEM) and Transmission Electron Microscopy (TEM)which clearly indicated the capacity of these AgY-NPs as a powerful detection tool for onion spoilage.

[9] When placing an onion with its neck facing upward. Binary classification based on rot scores predicted by partial least squares regression (PLSR) models revealed that the sensitivity of detecting mildly rotten bulbs was superior in a PLSR model developed using the BL1 spectra, whereas the specificity for detecting sound (non-rotten) bulbs and the sensitivity for moderately-to-severely rotten bulbs were better in a PLSR model built using the BL2 spectra. A combined BL1 & BL2 spectra model, constructed using spectra in both directions simultaneously, retained the advantages of both spectra and improved the accuracy of detecting sound and mildly rotten bulbs.

III. SYSTEM ARCHITECTURE

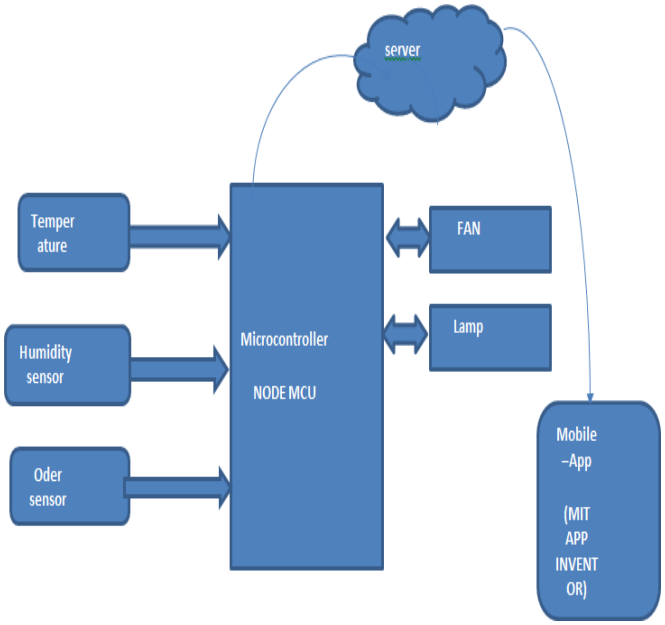

Fig 3.1 System Architecture.

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A) HARDWARE IMPLEMENTATION

1. Ardunio Nano

Fig3.3 .NODE MCU

Node MCU is an open-source LUA based firmwaredeveloped for the ESP8266 Wi-Fi chip. By exploring functionality with the ESP8266 chip, Node MCU firmware comes with the ESP8266 Development board/kit i.e. Node MCU Development board Both the firmware andprototyping board designs are open source.
The prototyping hardware typically used is a circuit board functioning as a dual in-line package (DIP) which integrates a USB controller with a smaller surface-mounted board containing the MCU and antenna. The choice of the DIP format allows for easy prototyping on breadboards. The design was initially based on the ESP-12 module of the ESP8266, which is a Wi-Fi SoC integrated with a Tensilica Xtensa LX106 core, widely used in IoT applications.

2. DHT 11(Temperature and humidity sensor):

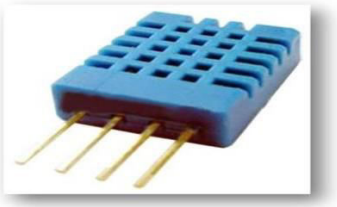

Fig 3.4 DHT 11 sensor

DHT 11 working of DHT 11 sensor which used to detects rotten onions temperature which have connected to Onions collected box which has provides information about rotten onions increases temperature value which fed to the microcontroller we have disused their specifications in details:

- The DHT11 is a basic, ultra low-cost digital temperature and humidity sensor. It uses a capacitive humidity sensor and a thermistor to measure the surrounding air, and spits out a digital signal on the data pin (no analog input pins needed).
- To measure the surrounding temperature gives the data on Ardunio IOT App .

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3. Oder sensor (MQ135):

Fig3.5 MQ135 Oder sensor

Oder sensor we have used detect the present smell in rotten onions presents in boxes and which has internally connectedwith microcontroller which has send to analog value and this value will be shows on LCD display. MQ135 Air Quality Sensor Module for ammonia, sulfide, benzene vapor high sensitivity of the smoke and other harmful monitor is also very good. This sensor can be used to measure a variety of harmful gases and also low-cost sensors for our design application.

4. FAN

Fig 3.6 Moisture control Fan

One of the best use of fan to control surrounding temperature of storage of onions boxes the system we have design to connect humidity sensor where senses present humidity, or temperature when temperature is reach greater than >40° to turn on Fan. we have already to fixed programed related temperature value.

5. LAMP

Fig 3.7 Lamp

The purpose of use lamp which to control humidity of surroundings onions to when humidity increases >70° to turn on lamp this setting we have already to done in programme.

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6. DC motor:

Fig 3.8 DC motor

DC Motor – 30RPM – 12Volts geared motors are generally a simple DC motor with a gearbox attached to it. This can be used in all-terrain robots and variety of robotic applications. These motors have a 3 mm threaded drill hole in the middle of the shaft thus making it simple to connect it to the wheels or any other mechanical assembly. A 30 Rpm dc motor is used which has high torque based to rotate continuously to detect rotting onion detection to check while rotating take every angle of onions to detect perfectly detection.

7. *ULN 2003*

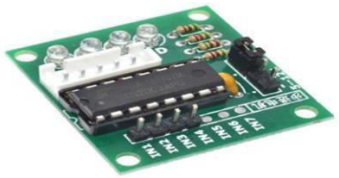

Fig 3.9 ULN 2003

It's easy to use Ardunio or other development platform to drive the stepper motor by this diver board. The step motoris to a machine to convert pulse to angular displacement. So if you give stepper driver a certain pulse signal, it will drive motor to a certain angle. we can control the angle the stepper moved by the number of the pulse. And you also can control the speed of the stepper rotate by the frequency of the pulse.

III. RESULT AND DISCUSSION

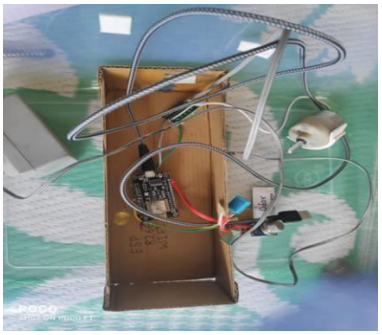

Fig 4.1 Hardware module

In above figure it will be shows of hardware module of advance rotting onion detection which consists of Node MCU

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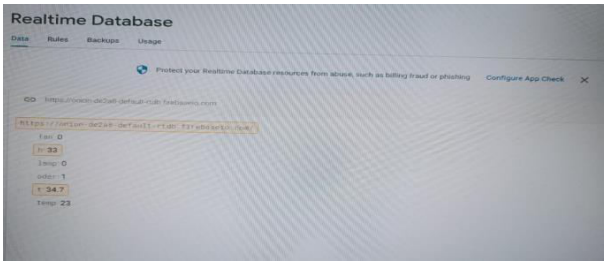
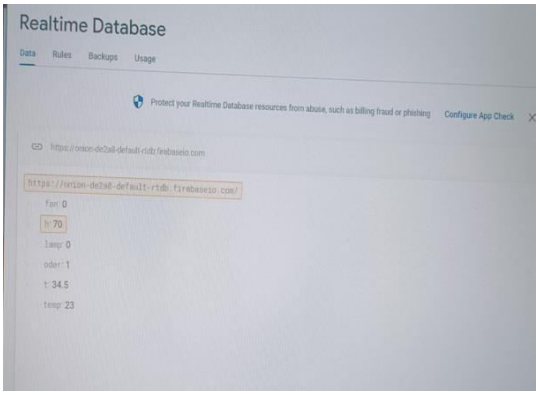
,DC motor ,DHT 11 sensor ,ULN 2003 ,connecting wires ,above module which has Wi-Fi based Node MCU based the real time database which has send to server and server through h to get all notifications of the real time temperature ,humidity our developed android mobile app.

1. Result page -1



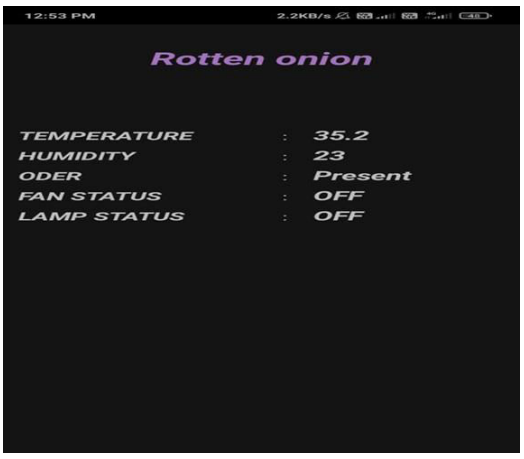
In result page -1 which have discussed to monitor real time data where we have send to firebase server to take action to control temperature and humidity at storage of onions such as to lamp on when necessary and turn on fan .above page which has shown value of humidity -33 and temperature level at -23° and Oder sensor will be detected -1. in this condition Fan is Off and lamp is Off .

2. Result page -2



In this result page humidity at level of 70° and temperatureis 34.5 °fan is turn OFF and lamp is turn OFF .

3. Result page -3



Above result page which has display our design MIT inventor App shows all real time data such as temperature and

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humidity, and status of fan is turn on or not and lamp is turn off or on. When humidity is beyond 70° to turn on lamp and temperature is >40° to turn on fan.

IV. CONCLUSION

The newly developed advanced rotten onion sniffer device will be beneficial in extending the life of onions when they are being harvested. We can keep onions for 8 to 10 months with the help of this technique. If rotting occurs as a result of water contact, the temperature control system will take prompt action and notify the owner.to get all the notificationwe have design our android mobile app.

V. FUTURE SCOPE

In future we have design machine learning based rottenonion detection.

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12. March 2019; Received in revised form 13 June 2019; Accepted 13 June 2019 Corresponding author. E-mail address: skuroki@dragon.kobe-u.ac.jp (S. Kuroki). 1 These two authors contributed equally to this paper. Postharvest Biology and Technology 156 (2019) 1109350925-5214/ © 2019 Elsevier B.V. All rights reserved.

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