International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 08 Issue: 05 | May - 2024 SJIF Rating: 8.448 ISSN: 2582-3930

Early Detection of Onion Spoilage

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Abstract - As technology advances and people become increasingly reliant on smartphones, it becomes crucial to develop technological solutions for agricultural challenges. Traditional storage methods can help prevent onion spoilage, but there are instances where spoiled onions may go unnoticed. To address this issue, implementing technology such as deep learning algorithms and sensors can be highly beneficial. While existing IoT frameworks have faced challenges in accurately predicting data due to environmental conditions, integrating image processing techniques can enhance accuracy. This paper presents a model developed using IDE, focusing on image processing to detect onion spoilage. By combining segmentation and object extraction processes, the model improves image features by removing background and irrelevant elements. With a model achieving 87% accuracy, the system then utilizes an IoT framework with sensors to monitor onion parameters and display spoilage stages on an LCD. This integrated system provides real-time spoilage information, aiding farmers and retailers in mitigating onion spoilage risks.

Keywords: *Onion, Arduino IDE, DHT11 Sensor, LED, Buzzer Internet of Things*

1. INTRODUCTION

As of 2022, India boasts a population of 1.39 billion, presenting significant challenges for both the government and farmers in ensuring food security. Despite ranking seventh globally in terms of land area and sixth in economy, India struggles to cultivate enough to feed its entire population. To address this, farmers resort to pesticides and chemical fertilizers to boost food production. However, despite increased production, an estimated 190 million Indians remain undernourished. Additionally, reports indicate that 40% of food produced in India goes to waste, amounting to approximately Rs92,000 crores annually. Constant monitoring of food is essential to mitigate such losses, as environmental factors like temperature and humidity can rapidly impact food quality. Given India's status as one of the top onion producers after China, effective storage facilities are imperative to prevent wastage. Criteria for optimal onion storage include selecting perfect bulb-size onions, timely harvesting, proper field curing, and maintaining warehouse conditions such as humidity and temperature. Key components for detecting fruit and vegetable spoilage include gas sensors, temperature sensors, pH arrays, and algorithms to analyze data patterns. In addition to an IoT-based system, a model has been trained to assess onion freshness, enhancing the productivity of onion storage systems for farmers and retailers.

2. LITERATURE REVIEW

In 2023, Keshav Abhay Shah, Madam Usha Sri, Buyya Vinod Goud, and Kiran Mannem presented a paper titled "Two-Fold Spoiled Onion Detection Using Software Computing And IOT" published by IEEE. This paper discusses a model developed using Google Collab IDE based on image processing. By combining segmentation and object extraction processes, image features are enhanced, eliminating background clutter. The model achieves an impressive 87% accuracy. Following image processing, the system integrates an IoT framework to sense onion parameters using sensors and display spoilage stages on an LCD screen.

Another study conducted in 2022 by Ankush Ramchandra Khot, Shubham Sanjay Kandale, Rushikesh Kailas Bhosale, and Poonam Arun, titled "IOT Based Food (Onion) Spoilage Detection," published in IJMRSET, focuses on developing a system to prevent onion spoilage. Utilizing IoT methods and various sensors, including temperature, humidity, and gas sensors, the system monitors and controls onion storage environments. Real-time data is accessible via a mobile application and web server, triggering exhaust fans and dehumidifiers in response to environmental changes.

Additionally, Harshitha S, Mythreyi Manjunath H.K, and Neha B. M's 2023 paper, "IOT Based Food Spoilage Detector," published in IJRASET, explores a food detection system developed using Arduino. This system utilizes a microcontroller to interpret inputs and activate sensors, aiding in early detection of food spoilage. By continuously monitoring signals from perishable items, the system displays methane pH values on an LCD panel, accompanied by buzzer and LED indicators, to prevent food spoilage.

3. PROBLEM STATEMENT:

In Indian food, onion is a prominent constituent. Though India owns the second position in producing onions, it lacks a storage system. Since the Indian government and farmers use unscientific storage facilities, it leads to the wastage of up to 500,000 tonnes of onions every year.

Through the research, it is found that around 20 fungal and bacterial species cause onion spoilage. It is known that onions take time to show visual symptoms of spoilage and due to this, for farmers growing this crop, it is either a jackpot or a complete loss. An effective technology should be introduced to reduce postharvest losses. In this project, an idea is proposed in which the warehouse pictures of onions are taken on a conveyor belt and segmented into single onions. process continues with sensing the onion parameters and displaying the stage of spoilage on led

To identify the debase onions from the warehouse, it should be protected from getting degrade. So, our system provide alert in the form of siren and LED which is sensed through the sensor.

4. AIM & OBJECTIVES

1. To enhance system, maintain quality and quantity of onion and solve all financial issue of farmers.
2. Also, to improve economic conditions of farmers and to stop them from suicide in our state.
3. Instead of importing onion from outside countries we will maintain the quantity of onion and increase productivity.
4. Objective of propose warehouse is to provide smart solution to reduce the post harvest storage losses of onion.
5. To reduce the manual efforts of the farmers and stakeholders also maintain the quality and quantity of stored onion.
6. The proposed system provides all information regarding temperature, humidity condition of onion, location of degrade onion. Provide alert notification to the user in case of climate change.
7. The objective behind implementing this system is reducing the time and loss of farmers and vendor.

5. PROPOSED SYSTEM

Early Detection of Onion Spoilage Systems introduction:

Our system employs advanced sensor technology to detect subtle changes in onion quality, indicating potential spoilage. The DHT11 sensor, renowned for its affordability and reliability, measures temperature and humidity within a range of 0 to 50 degrees Celsius with an accuracy of ±2 degrees Celsius, and 20 to 80%, respectively. This low-cost sensor offers excellent performance, making it ideal for our application. Moreover, our system integrates Internet of Things (IoT) capabilities, enabling seamless connectivity and remote monitoring of onion storage conditions. IoT facilitates data transfer over networks without human-to-human or human-to-computer interaction, allowing stakeholders to receive timely alerts and notifications about potential spoilage events.

We utilize the Arduino Integrated Development Environment (IDE), which provides a user-friendly platform for writing and uploading code to Arduino hardware. The IDE includes essential features such as a text editor, message area, and toolbar for common functions, facilitating efficient programming and communication with Arduino boards via a Type B USB cable. Additionally, our system is designed for scalability and adaptability, catering to various production and distribution environments. Whether deployed in small-scale farms or large-scale warehouses, the system can be customized to meet specific needs and requirements, ensuring optimal performance and effectiveness across different settings.

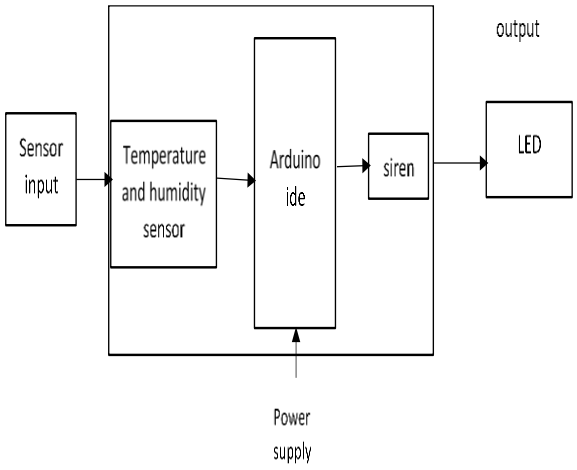

Fig. Early Detection of Onion Spoilage System

The major components of the Early Detection of Onion Spoilage systems are:

1) This system is basically use for getting information related to onion which will be stored warehouse.
2) Farmer can easily find out infected onion and also easily get the information like temperature, humidity. Finally, all financial issues of farmer can solve easily.
3) Our System is design to protect onion from degrading or wasting. It is stated that with the use of this system the farmers and vendors will have the less ratio of infected onion.
4) In low cost this system protects huge amount of onion.
5) This system is very useful in future of farmers.
6) It is also decreasing human efforts as it works automatically. This system solve financial issue of farmers.

7) It will explore the key indicators of onion spoilage, such as changes in color, texture, Odor, microbial growth, and biochemical composition.
8) The project will aim to identify reliable and cost-effective methods for detecting early signs of onion spoilage, suitable for both laboratory and industrial application.
9) It will consider factors influencing onion spoilage, including storage conditions, handling practices, and microbial contamination. The project scope will encompass research activities, experimentation, data analysis, and the development of practical recommendations for onion producers, processors, and quality control personnel.
10) This method can help identify spoilage before it becomes visually evident, allowing for timely intervention to prevent further deterioration and potential health risks.

6.. WORKING

A Smart Contact Management System operates by integrating advanced technologies to automate and optimize the handling of contact information. The system begins by collecting contact data from various sources, such as emails, social media profiles, and CRM platforms. Through intelligent algorithms and machine learning, it processes this data to identify key information such as names, email addresses, phone numbers, and company affiliations. Next, the system employs data validation techniques to ensure accuracy and consistency, eliminating duplicates and correcting errors. It then organizes the information into a centralized database, accessible to authorized users through a user-friendly interface. Security measures play a crucial role in the system's operation, with encryption protocols and access controls implemented to safeguard sensitive contact details. Regular updates and patches further enhance security and protect against emerging threats.

The system facilitates seamless collaboration among team members by enabling real-time synchronization of contact data across devices and platforms. Integration with communication tools and productivity software enhances workflow efficiency and coordination. Overall, the Smart Contact Management System revolutionizes the way organizations manage and utilize contact information, saving time, reducing errors, and enhancing security while fostering collaboration and productivity.

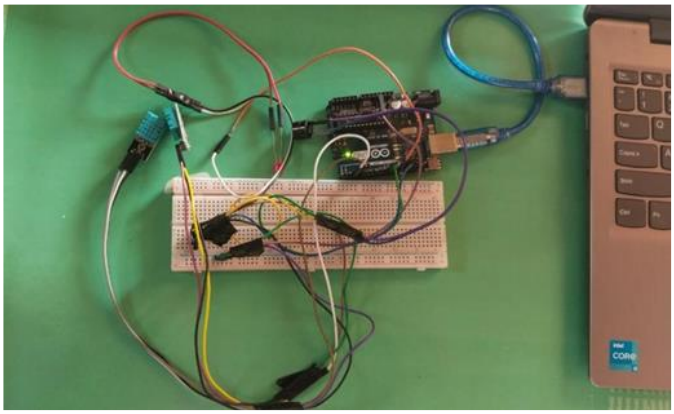

Fig1. Early Detection of Onion Spoilage System

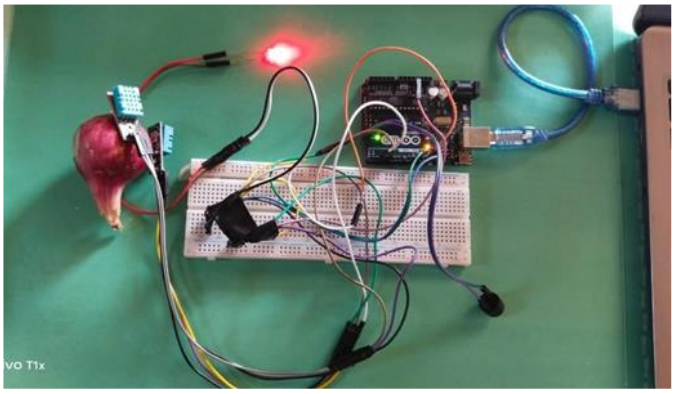

Fig2. LCD Printing Humidity

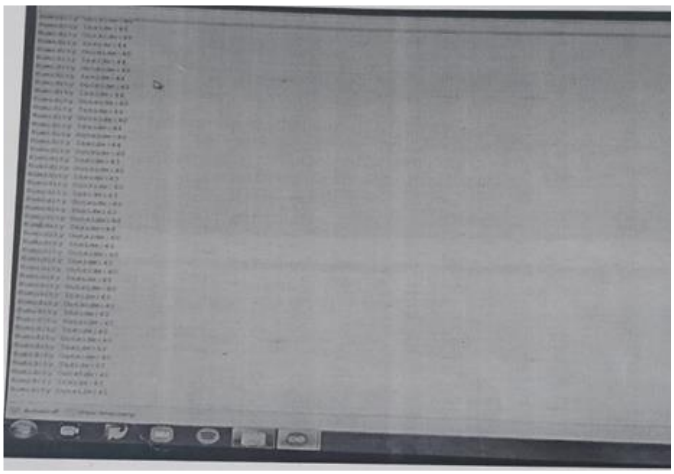

Fig3. Before Detection

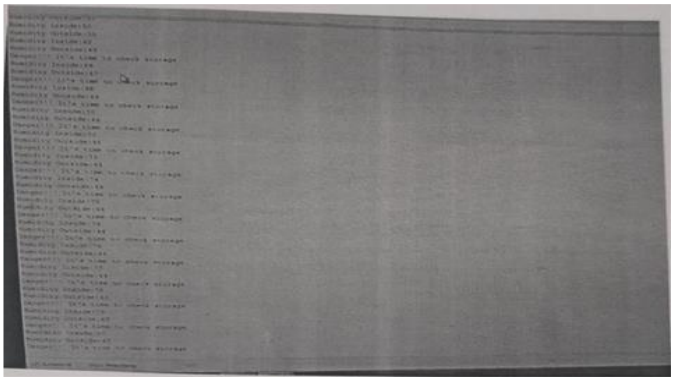

Fig4. After Detection

7. ADVANTAGES & APPLICATIONS

7.1. Advantages: -

1. Improved Quality control: By continuously monitoring temperature, humidity, and other environmental factors, the system helps maintain optimal conditions for onion storage, reducing the risk of spoilage due to unfavorable conditions.

2. Timely spoilage Detection: The system detects signs of spoilage at an early stage, allowing facility personnel to take corrective actions promptly before spoilage spreads and affects a larger batch of onions.

3. Reduced Food Waste: Early detection of spoilage enables the removal of spoiled onions from storage before they contaminate other onions. This helps reduce food waste and preserves the quality of the remaining onion stock.

4. Cost saving: By minimizing food waste and spoilage-related losses, the system helps save costs associated with discarded onions and potential revenue losses for onion producers and storage facilities.

5. Real-Time Alerts and Notifications: The system generates real-time alerts and notifications when spoilage conditions are detected, enabling immediate action by facility personnel to mitigate potential losses.

6. Enhanced Shelf Life: Maintaining optimal storage conditions based on real-time monitoring data extends the shelf life of onions, ensuring that they remain fresh and marketable for a longer duration.

7.2. Applications: -

In the food processing industry, onion spoilage detection systems are integrated into processing lines to ensure the quality and safety of onion-based products.

8. CONCLUSION

The custom build DTH-11 sensor is commonly used for Temperature and Humidity sensor. With the help of such sensor the farmers can get information of the onion which is stored at warehouse. The main contribution of this is too avoiding the huge amount of onion from infections. As the onions are well stored then the loss of the farmers and vendor will be avoided and he can earn money. Farmers have benefitted with storage losses reducing from 25-30 percent as in traditional storage to 5 percent in case of scientific storage. Consumers have benefitted from less volatility in the prices of onion due to even arrival in the market. Onion storage has also facilitated promotion of onion export from India. There is a need in the onion industry for a sensitive and inexpensive Temperature and Humidity (DTH-11) sensing device that can differentiate between healthy and diseased onions.

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