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Onion Health Monitoring and Alerting System

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Abstract - *Onion spoilage during storage is a major issue due to improper environmental conditions such as high humidity, temperature fluctuations, and gas emissions from decaying onions. This leads to significant financial losses for farmers and supply chain operators. To address this, we propose an Onion Health Monitoring and Alert System that uses IoT-based sensors to monitor temperature, humidity, and gas levels in real time. The system will provide automated alerts via alarms and mobile notifications to ensure timely intervention. methodology involves integrating gas sensors (MQ6), temperature and humidity sensors (DHT11/DHT22), and a Controller (Arduino Nano and ESP8266). Also GSM to alert the user. This will helps to detect spoilage trends and optimize storage conditions. Expected outcomes of project include reduced post-harvest losses, improved onion quality, and enhanced profitability for stakeholders. This solution offers a cost-effective, scalable, and sustainable approach to smart agriculture, contributing to food security and environmental sustainability.*

Key Words: Onion Health[1], Internet of Thing(IOT) [2], Climate Sensors[3], GSM[4], Arduino[5],

1.INTRODUCTION

Onions are one of the most widely cultivated and consumed vegetables globally, valued for their culinary versatility and nutritional benefits. However, they are highly susceptible to spoilage during storage due to improper environmental conditions, leading to significant post-harvest losses. As demand for high-quality produce continues to rise, effective storage solutions become essential for maintaining the health and quality of onions throughout their shelf life.

The Onion Health Monitoring and Alerting System(OHMAS) addresses these challenges by integrating advanced technology to monitor and manage storage conditions. Utilizing a network of sensors, the system tracks key environmental factors such as temperature, humidity, and air circulation, which are crucial for preserving the quality of onions. By employing real-time data analytics, the OHMAS can detect deviations from optimal conditions, allowing for timely interventions that prevent spoilage.

Smart onions health monitoring and alerting system is aimed to monitor and control onions storage and prevent it from damages occurring due to atmospheric or climatic changes. But in our project work, only monitoring operation is shown through GSM technology. The monitoring system capable of measuring methane gas and other parameters variability during transport and storage is of prime importance. This system makes use of storage units implanted with various electronic sensors which can read those parameters affecting onions storage. Design of Control circuits so as to tackle the problem of undesirable condition of onions storage is the important part of this idea. First of all, There is a greater need than ever for creative ways to maximize crop productivity and quality in the quickly changing agricultural world of today. Keeping an eye on the environment and protecting crops from any hazards are two of the many problems that farmers must overcome.

Acknowledging the importance of tackling these issues, our group presents a cutting - edge remedy: the Onion Monitoring System. Modern technology, such as the Arduino microcontroller, GSM (Global System for Mobile Communications) module, and MQ06 sensor, is integrated into the core of our system. These elements have been combined to create a thorough monitoring system that is especially suited to the particular requirements of onion farming. Giving farmers real - time insights into important environmental indicators is the main goal of the Onion Monitoring System. The device is built on Arduino NANO which is a popular prototyping board. The Arduino board is interfaced with various sensors like MQ6 to detect methane gas content. The GSM Wi- Fi Modem is interfaced with the Arduino to connect it to the internet via Wi - Fi router. The sensor data is also displayed on a mobile phone interfaced with the Arduino NANO. MQ06 sensor helps in intimating the user even about the percentage of freshness of the onions. The device detects these gases in ppm using MQ6 and compares it with the resistance of the air and makes a consolidated result of the percentage of freshness of the onions.

1.1 LITERATURE SURVEY

- Onion Post-Harvest Challenges: Numerous studies emphasize the challenges associated with onion storage, including vulnerability to moisture,

temperature fluctuations,and humidity levels. Research has highlighted the impact of these factors on onion quality and shelf life[1].

- Traditional Storage Methods: Literature also documents traditional storage practices, such as drying, curing, and ventilated storage rooms. These methods have been practiced for generations but are limited by their inability to provide real-time insights into the storage environment[2].

- IoT in Agriculture: A significant body of literature explores the applications of IoT in agriculture. IoT has been employed in monitoring soil conditions, crop growth, and pest control. However, there is limited research on its application in onion storage[3].

- Sensor Technologies: The literature reveals various sensor technologies used in agricultural applications. For onion storage, sensors measuring temperature, humidity, and moisture levels are crucial. These sensors can be integrated into IoT systems[4].

	2020	2015	2010	2005	2000	1995
Production	46,962,196	46,032,893	40,750,495	39,587,473	38,696,103	37,514,029
Exports Qty	_	3,180,559	3,261,912	2,891,494	3,164,300	3,047,723
Exports - Value	_	738,489	918,543	727,672	716,953	955,326

Table:1 Yearly Production of Onion

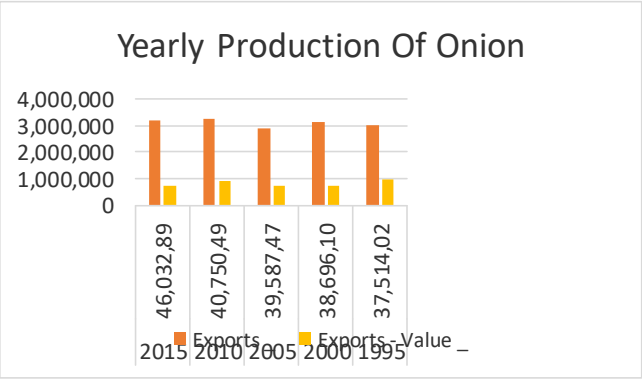

Chart :1 Yearly Production of Onions

[Refrence- Onion Post Harvest Operation INPhO Post Harvest Compendium]

1.2 METHODOLOGY

The Onion Health Monitoring and Alert System is designed to detect spoilage by continuously monitoring environmental conditions.

The system integrates an MQ6 gas sensor to detect harmful gases released from decaying onions and a DHT11 sensor to measure temperature and humidity.
These sensors are connected to an Arduino Nano, which processes the data and triggers alerts when predefined thresholds are exceeded.
For notifications, the system uses an ESP8266 Wi-Fi module for remote monitoring and a GSM module to send SMS alerts to users.

The system operates on a 12V DC power supply and is suitable for onion storage facilities. This automated, real-time monitoring approach helps reduce losses, improve storage efficiency, and enhance profitability

Hardware Components:

- Arduino Nano
- DHT11 Sensor
- GSM Module
- MQ06 Sensor
- LCD Display
- Bulb(500W)
- Fan
- Power Supply
- ESP8266

Software Requirements:

- Arduino Nano
- Proteus
- Serial Monitor

2. SYSTEM ARCHITECTURE

2.1. BLOCK DIAGRAM

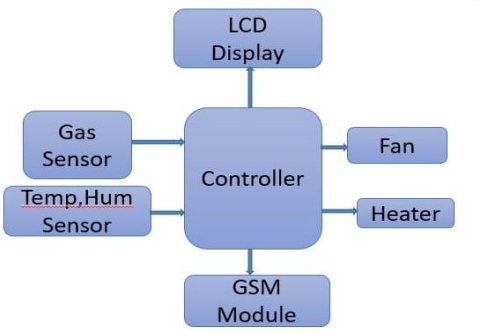

Fig:1 Block Diagram of Onion Health Monitoring and Alerting System

The above mention fig 1, shows the block diagram of Onion Health Monitoring and Alerting System, Here the controller is the heart of the system which performs all the process

2.2. Circuit Diagram:

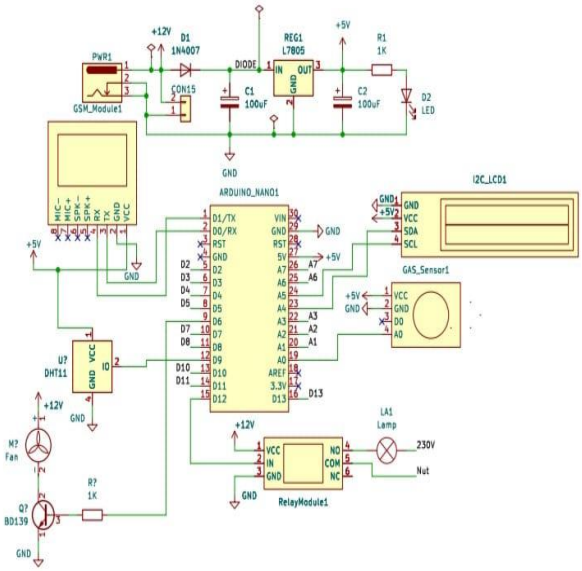

Fig:2 Circuit Diagram of Onion Health Monitoring and Alerting System

2.2.1 Working:

The Onion Health Monitoring and Alerting System continuously monitors storage conditions to prevent spoilage. The system uses a DHT11 sensor to measure temperature and humidity, while the MQ6 gas sensor detects harmful gases released by decaying onions. These sensor readings are processed by the Arduino Nano, which checks for deviations from optimal storage conditions.

If the values exceed set thresholds, the system triggers an alert mechanism, activating a LED indicator for local warnings. Additionally, the ESP8266 Wi-Fi module and GSM module send SMS notifications for remote monitoring. To maintain proper ventilation, a 500W bulb provides heating, while a cooling fan ensures airflow, preventing excess moisture buildup.

This automated system reduces manual inspection, minimizes onion wastage, and ensures better storage efficiency for farmers and supply chain operators, making it a cost-effective and reliable solution for onion preservation.

2.3. Flow Chart

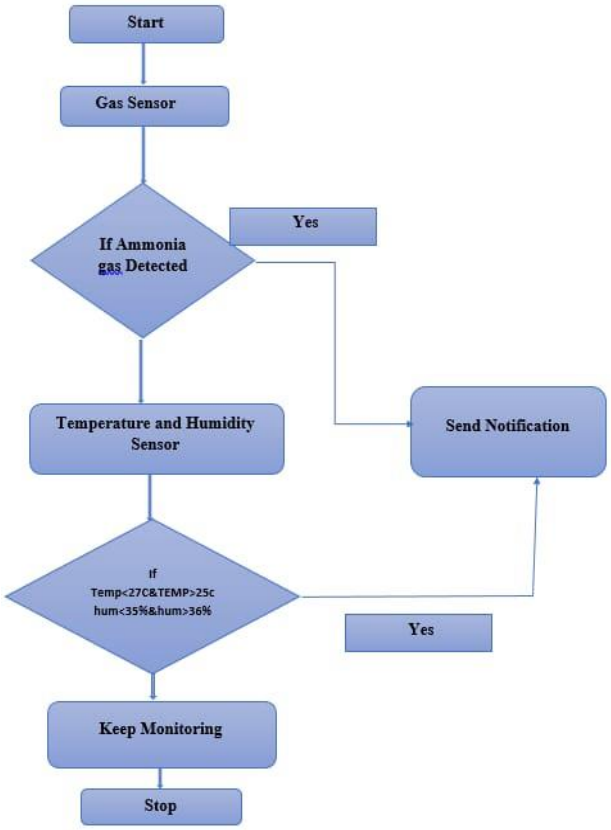

Fig: 3 Flow Chart of Onion Health Monitoring and Alerting System

3. CONCLUSIONS

The "Onion Storage Health Monitoring System" is an advanced and efficient solution designed to help farmers monitor all the essential parameters that directly impact the quality and preservation of stored onions. By utilizing this system, farmers can ensure that the storage environment remains within optimal conditions, thereby minimizing losses due to spoilage and maintaining the highest possible quality of their produce. This system continuously tracks critical factors such as temperature, humidity, and gas levels, ensuring that any deviations from the ideal range are promptly detected.

One of the standout features of this system is its ability to provide real-time notifications to farmers through both a display interface and wireless messaging (SMS), enabling them to take immediate corrective actions whenever necessary. By integrating modern sensor technology with wireless communication, this system offers a highly reliable and efficient monitoring solution that enhances the overall storage management process.

Additionally, the Onion Storage Health Monitoring System is designed to be highly cost-effective, making it an affordable

option even for small-scale farmers. Its low maintenance requirements further contribute to its practicality, as it does not demand frequent servicing or expensive upkeep. The system is also remarkably easy to install and operate, ensuring that farmers with minimal technical knowledge can set it up and use it without difficulty.

Overall, this system serves as an invaluable tool for farmers by helping them maintain maximum control over onion storage conditions, ensuring better profitability and reducing post-harvest losses. With its affordability, user-friendly design, and reliable performance, it stands out as an essential solution for efficient onion storage management.

4. FUTURE SCOPE

The Onion Health Monitoring and Alert System has vast potential for expansion and technological advancements. Future improvements include AI-driven automation, enabling smarter decision-making and predictive analysis. The integration of a camera and color sensor will allow for sprout detection, ensuring better quality control. Additionally, data storage on the cloud will facilitate remote monitoring and analysis of storage conditions over time.To enhance efficiency, a robotic arm can be incorporated to identify and remove rotten onions, reducing manual labor and minimizing wastage. The use of advanced sensors will further improve environmental monitoring, making the system more precise and reliable. Implementing real-time image processing will help detect disease symptoms early, leading to better onion storage management. These advancements will significantly enhance onion farming efficiency, reduce losses, and contribute to sustainable and smart agricultural practices.

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