IOT Based Smart Farming Monitoring System for Bolting Reduction in Onion Farms

Pushpak Gavali, Akshay Gend, Darshana Birari, Ruchita Garad

MET Institute of Engineering, Nashik

Abstract*: Internet of Things (IoT), a well-known branch of computer science has introduced smart farming to each and every farmer's neighborhood while offering constructive green agriculture. IoT depicts a self-configuring chain of components. The efficient implementation helps agriculture, a self-discipline as nicely as reducing human work and increasing crop cultivations. In onion farming, bolting is an insidious phenomenon that occurs in onion plants due to fluctuations in environmental factors such as temperature, humidity, and light intensity. Due to bolting, the flowering stem of an onion plant is produced before the crop is harvested, resulting in a poor-quality harvest and yield. Therefore, from a farmer's perspective, it is highly desirable to monitor and control the environmental factors to avoid bolting. In this paper, we propose and design a new prototype, namely, a smart farming monitoring system (SFMS) for bolting reduction, which is based on the generic three-layered IoT architecture. By using IoT (Internet of things) technology and careful remote monitoring, a more favorable environment can be provided to reduce and avoid onion bolting. To analyze the efficacy and performance of the proposed SFMS, a real test-bed implementation was carried out. The SFMS prototype was installed both in the open and in a greenhouse environment to monitor onion crops. Based on the data received via sensors, the percentage of onion bolting was recorded as 16.7% in the open environment while 3% in the closed environment. In the closed environment, optimal temperature, humidity, and light intensity were provided to the onion crops using the SFMS. For this reason, the percentage of onion bolting was reduced from 16.7% to 3%, consequently yielding better onion production. Moreover, the SFMS is a low-cost, easy-to-install solution that is developed with locally available hardware and resources, and we believe that this new solution can transform conventional onion farming into a more productive and convenient smart farming in the region.

***Keywords*: IOT, Machine Learning, Sensors (DHT11, BMP180, LDR, NodeMCU)**

INTRODUCTION

We are developing IoT-based smart farming monitoring system (SFMS) for bolting reduction in onion farms. With the advancement of mobile and communication technologies, with the concepts of the Internet of things and with the power of cloud computing, it is possible to develop low-cost solutions and applications in smart farming. Our proposed SFMS system's architecture is made up of sensors that collect data such as temperature, air humidity, and light intensity data. The raw data are transmitted through a gateway to a cloud platform for analysis. The farmer is then informed through e-mail or Short Messaging Service (SMS) or Mobile App to take any preventive measures accordingly. Perception, network, and application layers are the three generic architecture layers of IoT. Real-world events are collected using various sensors, etc. at the perception layer, also known as the "sensing layer." The network layer routes data over the Internet using Wi-Fi/Bluetooth, gateways, routing and switching operations, etc. The application layer directly interacts with the end-user. Each of these layers performs specific functions and tasks with their identified service. IoT-based smart farming/agriculture is highly effective compared to traditional approaches. IoT-based smart farming is a network typically designed with sensors (light, humidity, temperature, soil moisture, etc.) to monitor the crop field and automate farming activities. The farmers are able to track the conditions in the field from anywhere. The standard IoT technology architecture has three (03) layers, i.e., perception layer, transportation layer, and application layer, as indicated in Figure 1. The perception layer is the bottom layer of IoT, consisting of RFID tags, wireless sensor network (WSN) technology, and GPS technology, which collects information/data from objects/things. The transportation layer or network layer is responsible for

communicating over the IOT Based Smart Farming Morning System for Bolting Reduction in Onion Farms or other network devices and servers. Finally, the application layer acts as an interface to provide different end-user services, such as data storage, data visualization, and analysis.

LITURATURE SURVEY

In 2021, Internet of Things enabled Onion Growth Monitoring System using Cloud, Internet of Things enabled Onion Growth Monitoring System using Cloud", Many real-time applications recognize the various advances that have been made in many areas through the use of new technologies. This research work presents a remote internet of things (IoT) based onion growth monitoring method using Wireless Sensor Networks and Think speak Cloud. The proposed research work enhances the traditional approach to onion farming in rural areas with the help of internet of things and wireless sensor networks. This research work proposes the development and implementation of a thermal based Internet of Things system within the onion farms for the purpose of controlling devices such as fan and heater according to the optimal range of onion production and good onion growth. The proposed model is implemented and validated using the simulator. The results show that the proposed method is faster and that this proposed model provides a shorter simulation time with greater efficiency.

• In 2022, Rathnakar Achary; Rohan R; Riya K; Pavan V, Effect of Temperature and Relative Humidity on Onion farms and its Monitoring by using IoT Based Smart Farming System", Onion cultivation in many parts of India and Karnataka State have affected by a rapid change in the climatic conditions. The objective of this research paper is to analyze the effect of volatile atmospheric conditions such as temperature and relative humidity (RH) in open and greenhouse farming on onion cultivation and provide an early alert to maintain a favorable environment for better yielding of onion by using a smart farming system. The smart farming system developed by using IoT, is built for monitoring the onion crop with the help of different types of sensors. The data gathered by these sensors are analyzed to assess the favorable and adverse effect of the climatic parameters on the onion crop and making decisions for the cultivation of crops or maintain favorable environmental conditions in a greenhouse to minimize the loss due to crop failure. IOT Based Smart Farming Morning System for Bolting Reduction in Onion Farms also provides an early information to the farmers about the variations in environmental factors and their effect on the crop in different stages of its growth. For an onion crop the variations of these parameters cause the bolting. This unfavorably conditions effect on the quality of the onion produced. The smart framing system proposed is suitable for monitoring the changes in the environmental factors, and to analyze the effect of these parameters both in a greenhouse and open environment. The result obtained by experiments of this research specifies that the percentage bolting is more in an open environment than a greenhouse. The greenhouse will produce a better yielding due to controlled parameters.

• In 2021, M. Saravana Mohan; D. Abhishek; J. Hemchander, "IOT Based Onion Farming Solar Powered Hydroponics Monitoring System", Traditional method of farming has become outdated nowadays. It is a time-consuming process. Scientists are working hard to identify new methods to grow plants and to increase the yield. Hydroponics when compared with the traditional method of farming is considered to produce more yield. Due to the increase in population, importance must be given to higher productivity without compromising the nutrient value. Onions are considered as the most consumed and essential crop in India. Growing onions in hydroponics will produce a higher yield with higher nutrient value. The growth of onions in hydroponics can be monitored by using an IoT system. The system can be automated with sensors and microcontrollers to imply machine-to-machine communication and to control the hydroponics system automatically. The system is intelligent enough to provide the hydroponic system's control action based on several parameters. By using the solar supply to control water flow, the cost of electricity in this IoT-based system in hydroponics can be reduced and it is eco- friendly too. The system will automatically discharge the solution whenever the plant needs it. The user can monitor periodically.

• In 2022, Pulung Nurtantio Andono; Filmada Ocky Saputara End-to-End Circular Economy in Onion Farming with the Application of Artificial Intelligence and Internet of Things" The agricultural sector in Indonesia plays an essential role in economic development and food security in Indonesia, with an average contribution of 13.5 to Gross Domestic Product (GDP). One of the strategic agricultural commodities in daily

needs is onions. Agriculture in Indonesia has not been able to produce onions that allow the fulfillment of fluctuations in people's consumption needs. Onion production is sometimes abundant, so it is wasted and makes prices fall. On the other hand, there are times when the availability of onions in the community is deficient, so the price becomes very high. It is possible to solve this by building a system that can integrate all the nodes involved in supply chain management (SCM) and customer relationship management (CRM). Furthermore, this will create a balance between supply and demand, and revive the various micro, small and medium enterprises (MSME) involved in the value chain. The demand is quite significant, forcing Indonesia to still require imports of several agricultural commodities the community needs in their daily lives. However, this is one of the factors related to competitiveness with local farmers' yields and unstable onion prices.
MET's Institute of Engineering 2022-2023 4
IOT Based Smart Farming Morning System for Bolting Reduction in Onion Farms
This is an early study about on how to model the optimization end-to-end value chain of onions. Optimizing the agricultural cycle in Indonesia, such as optimizing agricultural land, harvest cycles, supply and demand for crops, storage and delivery of crops, and determining commodity prices can improve food security in Indonesia.
• In 2017, Richard A. Speir; Mark A. Haidekker proposed the framework Onions are of major importance to the agriculture sector with an estimated world-wide pro- duction of 78.5 million metric tons. Out of these, approximately 3.7 million tons are ascribed to the United States with an aggregated farm gate value of USD 1.15 billion [1]. Onions are susceptible to bacterial and fungal infections, most critically during the short harvest period from April to May. To allow for a year-round supply, onions are stored in controlled atmosphere facilities. Infected onions, even if no decay or damage is visible, put the entire harvest in the storage facility at risk. Early detection of bacterial and fungal infections is therefore highly desirable. In this pilot study, we used a low-cost, custom-built x-ray computed tomography (CT) scanner to obtain cross-sectional images of yellow sweet Granex onions that were inoculated with pathogens. CT images were analyzed for features that could potentially be used to detect signs of pathogen-related decay in the early stages of infection. The long-term vision is to use CT scanners in an onion packinghouse to perform automated postharvest quality assessment.

AIM & OBJECTIVES

- To reduce the problem of time consuming.
- To make a centralized system to detect the condition of onion robusting It will be enjoyable method without affecting their day-to-day life.
- To make a system for normal user who are lack of qualified personnel and adequate infrastructure in rural India

SYSTEM ARCHITECTURE

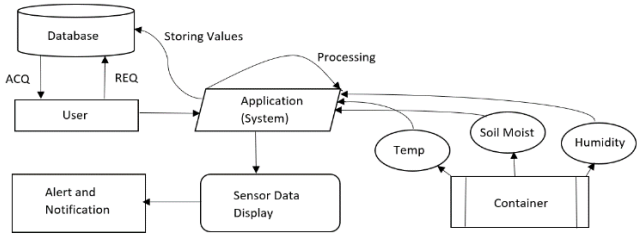

Fig -1: System Architecture Diagram

FUNCTIONAL&NON-FUNCTIONAL REQUIREMENTS

Functional requirements:

- Sensor should able to give proper values as per grade
- System should give user a notification of onion crop
- System should process the data comes from sensors.

Nonfunctional Requirements:

- User needs to login to the system
- User able to see the details of crops on mobile application
- IOT devices sends the data to cloud and later it fetched in application

Functional requirements

- Registration
- User Login
- Creation of database: Users Mandatory Information

Design Constraints:

1. Database
2. Operating System
3. Web-Based Non-functional Requirements

Security:

1. User Identification
2. Login ID
3. Modification

Performance Requirement:

1. Response Time
2. Capacity
3. User Interface
4. Maintainability
5. Availability

SYSTEM REQUIREMENTS

SOFTWARE REQUIREMENT:

• Arduino IDE or above
• Python 4.4 or above
• Dataset
• **HARDWARE REQUIREMENT**:
• Processor dual core or high
• Ram 4 GB or high
• Hard Disk 250GB or high
• Soil Moisture sensor
• Water Pump
• Node MCU • DHT 11
• LDR

CONCLUSION

Hence, we are overcoming the drawback of existing system, and providing a smart system that will not only monitor but also control onion bolting with security and send notification to user whenever necessary.

REFERENCES

[1] D. Miorandi, S. Sicari, F. D. Pellegrini, and I. Chlamtac, “Internet of things: vision, applications and research challenges,” Ad hoc networks, vol. 10, no. 7, pp. 1497–1516, 2012.
[2] K. Ammit, “Collection of screw tag sensor data for the Microsoft azure cloud service,” 2020, https://www.google.com/searchenpk26tbs=simg:caqspwijbkpfqx4slrgamwilelc.

[3] Z. Haq, M. Ishaq, A. Farooq, K. Saddozai, N. Yaqoob, and A. Shah, “Effect of farmers’ characteristics on onion yield,” Sarhad Journal of Agriculture, vol. 25, no. 4, pp. 523–528, 2009
[4] S. Balachandar and R. Chinnaiyan, ”Centralized Reliability and Se- curity Management of Data in Internet of Things (IoT) with Rule Builder”, International Conference on Computer Networks and Communication Technologies, vol. 15, 2019.
[5] R. Divya and R. Chinnaiyan, ”Reliable AI-Based Smart Sensors for Managing Irrigation Resources in Agriculture—A Review”, International Conference on Computer Networks and Communication Technologies, vol. 15, 2019.
[6] M Saramago and R Chinmaya, “Cloud and fog computing models for internet of things”, International Journal for Research in Applied Science and Engineering Technology, December 2017
IOT Based Smart Farming Morning System for Bolting Reduction in Onion Farms
[8] M. Saramago and Chinmaya, ”Cloud and fog computing models for internet of things”, International Journal for Research in Applied Science and Engineering Technology, 2017.