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IOT based Prevention of Faster Ripening of Fruit using Ethylene Absorbant

Sahil Ahamed J, Mohamed Asak T.S, Mohamed Fardeen A, Dawfeeq Rahman, S

Dr. Selva Murugan. C

PG Student, Department of Food Technology, Dhaanish Ahmed Institute of Technology, Coimbatore, India

Associate Professor, Department of Dept. of Food Technology, Dhaanish Ahmed Institute of Technology, Coimbatore, India

ABSTRACT: The rapid ripening of fruits poses a significant challenge in the agricultural industry, leading to post-harvest losses and reduced product quality. This project proposes an innovative solution leveraging Internet of Things (IoT) technology to detect and mitigate the effects of ethylene gas, a key accelerator of fruit ripening. The system utilizes Arduino-based sensors to monitor ethylene gas emissions from fruits and employs a dynamic control mechanism to prevent faster ripening. Upon detecting elevated levels of ethylene gas, the system activates an exhaust fan to efficiently expel the gas, creating an environment conducive to slowing down the ripening process. Additionally, an ethylene absorbent pump is triggered to release an ethylene absorbent, further impeding the ripening process and extending the shelf life of the fruits. The real-time data on ethylene gas levels and system status are seamlessly transmitted to the ThingSpeak cloud server, providing users with a centralized platform for monitoring and analysis. This cloud integration enhances the system's scalability, allowing for remote management and intervention, contributing to efficient and proactive fruit preservation. By integrating IoT technology with ethylene gas detection and control mechanisms, this project offers a sustainable and automated solution to prevent faster ripening of fruits. The proposed system not only addresses post- harvest losses but also promotes a more efficient and eco-friendly approach to fruit preservation in the agricultural sector

KEYWORDS: GSM Modem, Ethylene Sensor, LCD Display, Gas Exhaust, Pottasium Permanganate (KMnO4), Arduino Sensor.

I. INTRODUCTION

In contemporary agriculture, post-harvest losses due to the rapid ripening of fruits remain a critical concern, impacting both farmers and consumers alike. Ethylene gas, a natural plant hormone, plays a pivotal role in the ripening process and is often a key contributor to the accelerated decay of fruits. Addressing this challenge, our project introduces an innovative. Internet of Things (IoT)-based solution aimed at detecting and mitigating the effects of ethylene gas to prevent the faster ripening of fruits. By employing Arduino-based sensors, our system monitors the ethylene gas emissions from fruits, providing real-time data that serves as the foundation for an intelligent control mechanism. When elevated levels of ethylene are detected, the system activates an exhaust fan to expel the gas, creating an environment conducive to slowing down the ripening process. Additionally, an ethylene absorbent pump is deployed to release an ethylene absorbent, further impeding the ripening process and extending the shelf life of the fruits. The integration of IoT technology not only allows for precise and timely ethylene gas detection but also facilitates remote monitoring and control through the Thing Speak cloud server. This cloud-based platform provides a centralized hub for tracking ethylene gas levels, system status, and overall performance, empowering users with actionable insights for efficient fruit preservation. This project represents a convergence of technology and agriculture, offering a sustainable and automated solution to the age-old challenge of post- harvest losses due to fruit ripening. By harnessing the power of IoT, our system not only addresses the immediate concern of fruit preservation but also aligns with broader goals. of resource efficiency and environmental sustainability in the agriculture.[1-3]

INTRODUCTION TO INTERNET OF THINGS: The Internet of Things (IOT) encompasses the utilization of various control systems to manage diverse processes and machinery, aiming to reduce reliance on human labor. IOT

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refers to a network of physical objects, or "things," embedded with sensors, software, and other technologies. These objects are interconnected, enabling the exchange of data with other devices and systems via the Internet. In our context, IOT is employed to enable staff to interact with the stretcher and to facilitate communication through mobile applications, software technologies, signal detectors, and sensors. Additionally, IOT allows for the determination of the appropriate ward or room for patient transfer. It enables the display of information on LCD screens and triggers audible alerts, such as a buzzer, when obstacles are detected or during the stretcher's sterilization process. Essentially, IOT enhances the functionality and connectivity of the stretcher system, streamlining operations and improving overall efficiency.[4-6]

INTRODUCTION TO PROTEUS DESIGN SUITE: The Proteus Design Suite, developed by Lab center Electronics Ltd, is a pivotal software tool in the realm of electronic design automation. It caters primarily to engineers and technicians involved in the creation of schematics and electronic prints for manufacturing printed circuit boards (PCBs). Available in multiple languages, including English, French, Spanish, and Chinese, Proteus enjoys widespread adoption worldwide. At its core, the suite comprises various modules, with the flagship product being a Windows application designed specifically for schematic capture, simulation, and PCB layout design. Its adaptable configurations cater to diverse design needs and microcontroller simulation requirements. Noteworthy features include an auto router and basic mixed-mode SPICE simulation capabilities, which are indispensable for efficiently designing PCBs.One of the standout features of the Proteus Design Suite is its schematic capture functionality. This component serves a dual purpose as both a simulation tool and the initial stage in the design process for PCB layouts. By providing users with comprehensive functionality, it enables the creation and visualization of electronic circuits, offering a crucial step in the development process before the circuits are physically realized on PCBs.[7-8]

INTRODUCTION TO ARDUINO UNO:
Arduino Integrated Development Environment (IDE) serves as a comprehensive platform for programming and interfacing with Arduino microcontroller boards. The Arduino Uno, a prominent board within the Arduino ecosystem, is based on the ATmega328 microcontroller and features 14 digital input/output pins, 6 analog inputs, and various components including a 16 MHz ceramic resonator, USB connection, power jack, ICSP header, and reset button. Unlike its predecessors, the Uno utilizes the Atmega16U2 as a USB-to-serial converter instead of the FTDI USB-to-serial driver chip. Subsequent revisions of the Uno, such as Revision 2 and Revision 3, introduced enhancements like additional pinouts, improved reset circuits, and compatibility features for future board iterations. These advancements ensure compatibility with various shields and peripherals, while the robust features of the Uno make it a versatile choice for a wide range of projects.[9-10]

INTRODUCTION TO LCD DISPLAY: LCD stands for liquid crystal display. They come in many sizes 8x1 , 8x2 , 10x2 , 16x1 , 16x2 16x4 , 20x2 , 20x4 ,24x2 , 30x2 , 32x2 , 40x2 etc . Many multinational companies like Philips. Hitachi Panasonic make their own special kind of LCD'S to be used in their products. All the LCD'S performs the same functions (display characters numbers special characters ASCII. characters etc).Their programming is also same and they all have same 14 pins (0-13) or 16 pins (0 to 15). Alphanumeric displays are used in a wide range of applications, including palmtop computers, word processors, photocopiers, point of sale terminals, medical instruments, cellular phones, etc [11-14]

INTRODUCTION TO SIMCOM GSM: This GSM Modem can work with any GSM network operator SIM card just like a mobile phone with its own unique phone number. Advantage of using this modem will be that its RS232 port can be used to communicate and develop embedded applications. Applications like SMS Control, data transfer, remote control and logging can be developed easily using this. The modem can either be connected to PC serial port directly or to any microcontroller through MAX232. It can be used to send/receive SMS and make/receive voice calls. It can also be used in GPRS mode to connect to internet and run many applications for data logging and control. In GPRS mode you can also connect to any remote FTP server and upload files for data logging.

II. EXISTING SYSTEM

The literature on IoT-based prevention of faster ripening of fruits using ethylene absorbent systems encompasses various aspects related to fruit ripening, ethylene sensing, IoT technology, and the integration of ethylene absorbents

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into the supply chain. Here's an overview of key findings from existing studies: Fruit Ripening and Ethylene Production: Literature often begins with an exploration of the physiological process of fruit ripening and the role of ethylene, a natural plant hormone, in this process. Ethylene is known to accelerate ripening and senescence in fruits, making it a crucial target for control in post-harvest management. IoT Technology in Agriculture: Many studies discuss the application of IoT technology in agriculture and specifically in post-harvest management. IoT devices such as sensors and actuators are utilized for real-time monitoring and control of environmental parameters such as temperature, humidity, and ethylene concentration. Ethylene Sensing Technologies: Research highlights various ethylene sensing technologies, including electrochemical sensors, optical sensors, and gas chromatography, employed to detect ethylene levels accurately in storage and transportation environments.[15-18]

III. PROPOSED METHADOLOGY

Our proposed system leverages state-of-the-art Internet of Things (IoT) technology to create an intelligent and dynamic solution for the prevention of faster fruit ripening. By addressing the drawbacks of traditional preservation methods, the proposed system offers several distinct advantages

Precise Ethylene Gas Detection:
The use of Arduino-based sensors in our system enables precise and real-time monitoring of ethylene gas emissions from fruits. This high level of accuracy allows for targeted interventions, ensuring optimal control over the ripening process.

Dynamic Control Mechanism:
Unlike passive control mechanisms in traditional systems, our proposed system incorporates dynamic control mechanisms. When elevated ethylene levels are detected, the system autonomously activates an exhaust fan and an ethylene absorbent pump, creating an adaptive and responsive environment for effective fruit preservation.

Efficient Gas Expulsion:
The integration of an exhaust fan ensures the efficient expulsion of ethylene gas from the storage environment. This active ventilation system creates conditions that significantly slow down the ripening process, leading to extended shelf life and reduced post-harvest losses

Passive Control Mechanisms:
Many existing preservation systems employ passive control mechanisms, relying on fixed parameters or manual adjustments. This lack of adaptability hinders the ability to respond dynamically to changing conditions, leading to suboptimal fruit preservation outcomes.

Inefficiency in Gas Expulsion: Traditional methods often do not address the efficient expulsion of ethylene gas. Inadequate ventilation systems may fail to create an environment conducive to slowing down the ripening process, resulting in increased post- harvest losses.

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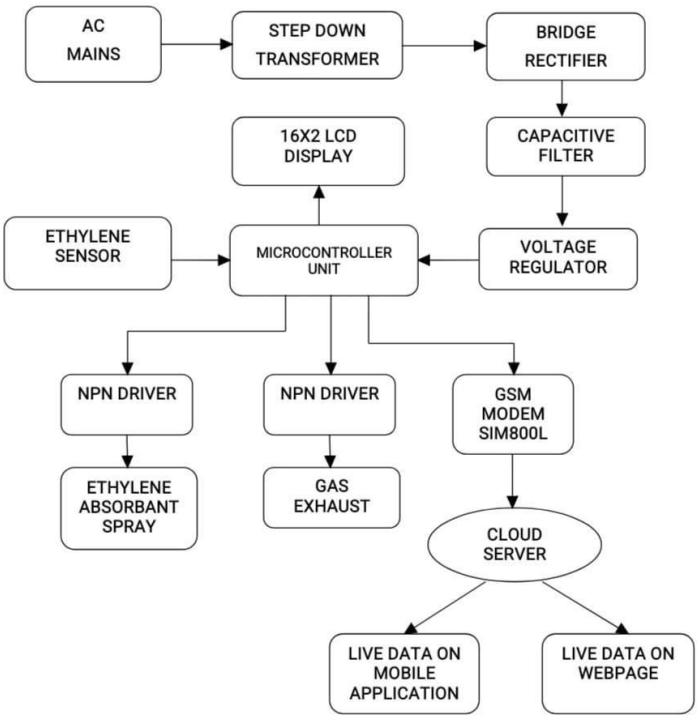
Block diagram



IV. EXPLANATION

IoT-based prevention of faster ripening of fruits using an ethylene absorbent system involves deploying sensors to monitor ethylene levels emitted by fruits during storage and transportation. These sensors communicate data to a central IoT platform, which analyzes the information in real-time. When ethylene levels rise beyond a certain threshold indicating accelerated ripening, the system activates ethylene absorbents strategically placed within the storage or transportation environment. These absorbents help mitigate ethylene concentrations, slowing down theripening process and extending the shelf life of the fruits. Through continuous monitoring and intervention, this IoT-based system optimizes fruit quality and reduces spoilage, ultimately enhancing efficiency and reducing losses in the supply chain.

InputDevices:
Start Button: The start button serves as an input trigger for the system to initiate the process through mobile application.
Sensors:GSMModem,EthyleneSensor,LCDDisplay,GasExhaust,PottasiumPermanganate(KMnO4), ArduinoSensor
ControlUnit: Arduino: ActsasthemaincontrolunitthatreceivesinputsfromtheIOTsensorsand coordinates the operation of the system, including ethylene gas movement.
16x2LCDDisplay: Providesreal-timeinformationaboutthesystem'sstatus,includinggasmovements, container conditions.
Buzzer: Generatesaudiblealertstonotifytheethylenegaswhichabsorbedbysensonafterthebuzzerthe exhaust fan starts its work.

V. WORKING METHADOLOGY

The Internet of Things (IOT) encompasses the utilization of various control systems to manage diverse processesand machinery, aiming to reduce reliance on human labor. IOT refers to a network of physical objects, or "things," embedded with sensors, software, and other technologies. These objects are interconnected, enabling the exchange of data with other devices and systems via the Internet. In our context, IOT is employed to enable staff to interact with to facilitate communication through mobile applications, software technologies, signal detectors, and sensors.

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Additionally, IOT allows for the determination of the appropriate container which stores the fruits.. It enables the display of information on LCD screens and triggers audible alerts, such as a buzzer, when obstacles are detected or during the eylene gas flow.

Facilitating connectivity is the NodMCU, enabling the gas flow with the Internet of Things (IoT) ecosystem. Through this connection, data flows between the container system and the IoT platform, providing a foundation for remote monitoringand control. In food and beverage cold chain a dedicated mobile application interfaced with the IOT platform to oversee fruits quality remotely. From adjusting movement parameters to initiating UV disinfection cycles,themobileapp empowersstaff with real-time in sightsand control, quality efficiency and elevating fruits standards. With its seamless integration of advanced technologies.

VI. FUTURE SCOPE

The future scope for IOT based preventionof faster ripening of fruits by using ethylene absorbent is promising, with potential advancements aimed at further enhancing fruits quality and emergency response capabilities. Below are some key areas of development: ¬ Integration with Food Chain Systems: Future iterations of the IOT-based stretcher could be seamlessly integrated with food industry and cold chain management systems, allowing for automatic transmission of keeping the quality of fruits. ¬ Enhanced Sanitization Features: Continued advancements in sanitization technology may lead to the integration of more sophisticated disinfection mechanisms into the containers, such as UV-C light sterilization or antimicrobial coatings. These enhancements can further reduce the risk of infection transmission and ensure a hygienic environment for fruits and vegetables. ¬ Smart Notification and Alert Systems: Future IoT-based stretchers may incorporate advanced notification and alert systems that automatically notify the designated contacts in the event of critical incidents or changes in condition. This ensures a coordinated response and timely intervention, improving fruits outcomes. ¬ Artificial Intelligence and Predictive Analytics: Integration of artificial intelligence algorithms and predictive analytics enables the sensor to analyze fruits data, identify trends, and predict potential health complications. By leveraging machine learning techniques, quality control providers can proactively address fruits and vegetables quality and prevent adverse events before they occur. . ¬ Collaboration with Emergency Services: Strengthening collaboration with emergency services and first responders facilitates seamless communication and coordination during hazard emergencies. Integration with emergency response systems enables rapid deployment of resources and ensures efficient quality of fruits. ¬ Overall, the future of IOT based prevention of faster ripening of fruit using ethylene absorbent systems looks promising. As technology advances, there will likely be improvements in sensor accuracy, data analysis algorithms, and connectivity, allowing for more precise monitoring and control of fruit ripening processes. Additionally, integrating machine learning algorithms could optimize ethylene absorption efficiency, leading to better preservation and extended shelf life of fruits. This technology could also be scaled for use in various stages of the supply chain, from farm to table, enhancing food quality and reducing food waste.

VII.OUTCOME

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VIII.CONCLUSION

Our IoT-based system for preventing faster fruit ripening by monitoring and controlling ethylene gas emissions presentsa transformative solution to longstanding challenges in post-harvest preservation. Through Arduino-based sensors, the system enables precise detection of ethylene levels, triggering an exhaust fan and an ethylene absorbent pump for active and responsive control. The integration with the ThingSpeak cloud server allows remote monitoring, reducing manual intervention and operational costs. By promoting environmental sustainability, extending fruit shelf life, and improving overall quality, our system represents a significant advancement in agricultural technology, promising economic benefits for farmers and stakeholders while contributing to a more efficient and eco-friendly approach to fruit deteriorate preservation

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