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BETELUNT HARVESTED CROP PROTECTION FROM HEAVY RAINFALL

Aishwarya K R[1], Bhavana T G[2], Shivapriya K S[3], Nanditha C[4], Mrs.Keerthi M[5]

UG student Department of ISE, GSSSIETW, Mysuru, VTU, Belagavi, India[1-4]

Assistant Professor, Department of ISE, GSSSIETW, Mysuru, VTU, Belagavi, India[5]

Abstract: The protection of betel nut trees is of paramount importance in agricultural practices, especially in regions where betel nut cultivation is a significant source of livelihood. However, ensuring the safety and well-being of these trees amidst environmental challenges such as heavy rainfall, sudden changes in light intensity, and fire outbreaks poses a considerable challenge to farmers. Traditional methods of protection often involve manual monitoring, which is labor intensive and may not guarantee timely intervention. To address these challenges, this project proposes an innovative Betel Nut Protection System that integrates various sensors, Arduino-based automation, and GSM technology to enhance the responsiveness and effectiveness of betel nut tree protection. The system aims to provide real-time detection of environmental factors and trigger appropriate responses, such as closing protective curtains and sending SMS alerts to farmers, even when they are off-site. By leveraging advanced technology, the proposed system seeks to revolutionize betel nut cultivation practices, ensuring the sustainability and productivity of this vital agricultural sector.

1. INTRODUCTION

The betel nut or areca nut crop is grown for local consumption and exports. Most betel nut growing countries are India, Sri Lanka, Thailand and Bangladesh. The areca nut is the fruit of the of areca palm, which grows in much of the tropical areas. They are widely cultivated in Karnataka, Kerala and Assam; all three states together account for more than 85 percent of its production. Other Indian states including Meghalaya, Tamil Nadu, and West Bengal, the crop is grown in a very small area. Therefore, this cultivation plays a significant role in agricultural economies worldwide, providing livelihoods to millions of farmers and contributing substantially to agricultural output. However, these harvested crops are susceptible to various environmental factors and threats, including heavy rainfall, fire outbreak and many more. These climatical challenges can pose serious risks to the cultivated and harvested crops, lending to yield losses for the farmers.Traditionally, the protection of betel nut harvested crop has relied on manual monitoring and intervention by farmers and paid labours. However, this approach is often labor – intensive, time – consuming, and may not provide adequate protection, especially during off – site periods. Farmers face difficulties in continuously monitoring environmental conditions and responding promptly to potential threats, leading to increased vulnerability and risks for betel nut harvested crop cultivation. There is, therefore, a pressing need for an automated system that can effectively detect environmental changes and trigger appropriate responses to mitigate risks to betel nut harvested crop.

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2. PROBLEM STATEMENT

Betelnut, a significant cash crop in many regions, faces vulnerability to rainfall-induced damage during its harvesting and post-harvest stages. Rainfall can lead to a series of detrimental effects on betelnut crops, including spoilage, quality degradation, and economic losses for farmers. While rainfall is essential for crop growth, excessive or untimely rain can result in significant damage to the harvested betelnut, affecting both quantity and quality. The problem lies in the lack of effective methods or infrastructure to protect harvested betelnut crops from rainfall damage. Traditional practices such as covering betelnut bunches with leaves or plastic sheets are often insufficient, especially during heavy or prolonged rainfall. Moreover, the high humidity levels accompanying rainfall can exacerbate issues like fungal growth and rotting, further deteriorating the quality of betelnut produce.

3. PROPOSED SYSTEM

The proposed system retains the features of rain sensors, LDR sensors, fire sensors, and Arduino- based automation. Additionally, a GSM module is integrated to send SMS alerts when any detection event occurs. Upon rainfall detection, the system triggers protective curtain closure and simultaneously sends an SMS alert. This added feature enhances the responsiveness of the betel nut protection system, allowing farmers to receive immediate notifications even when offsite.

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4. LITERATURE SURVEY

I. This paper presents an in-depth analysis of various Arduino modules integrated with weather sensors. It discusses the implementation of predictive algorithms that anticipate heavy rainfall. Arduino microcontrollers activate protective mechanisms, providing an effective and automated crop protection solution.[1]

II. Focusing on real-time applications, this paper proposes a low-cost Arduino based solution. Rainfall data is collected and processed in real-time. The Arduino system triggers a series of protective actions, such as closing automated barriers, ensuring crops are shielded from heavy rainfall and associated flooding. [2]

III. This research explores the integration of wireless sensor networks with Arduino microcontrollers. The system analyzes weather conditions, including rainfall intensity. When heavy rainfall is anticipated, the Arduino controlled network activates a protective shield, safeguarding the crops from potential damage. [3]

IV. This paper introduces an innovative approach using Arduinobased sensors and actuators for real- time monitoring of soil moisture levels. The system triggers protective measures, such as deploying covers, when heavy rainfall is detected, ensuring crop safety. [4]

V. The main objective of this proposed project is to help farmers protect their crops from animal and fire. Most of the farmers in India use electrical fence to guard the crops [5]

VI. If the crop needs a certain amount of water in such case farmer needs to permit the rain over the crop and once it having sufficient amount of the water content then he can protect the crop by covering it with the roof. [6]

VII. DC motors spin continuously in one direction when current is applied until the current ceases. Polarity is irrelevant for DC motors, allowing wire swapping for direction reversal. Utilizing a transistor in the circuit after the motor enables Arduino control over the motor's power, facilitating direction and speed manipulation. [7]

5. SYSTEM REQUIREMENTS

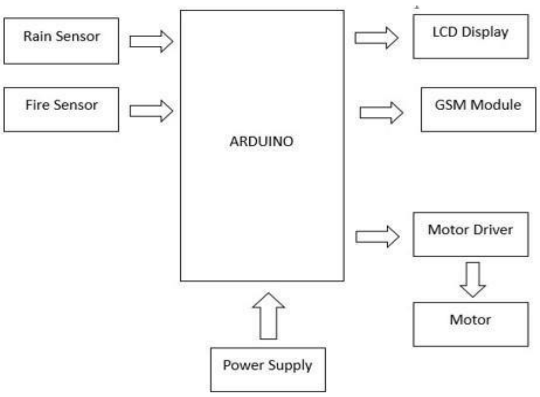
HARDWARE REQUIREMENTS

ARDUIN MICROCONTROLLER BOARD
RAIN SENSORS
FIRE SENSORS
GSM MODULE
DC MOTOR
FOAM BOARD
CONNECTING WIRE
POWER SUPPLY

SOFTWARE REQUIREMENTS

ARDUINO IDE
SENSOR LIBRARIES
GSM LIBRARY
PROGRAMMING LANGUAGE: C++
SMS PROTOCOL
SENSOR MONITOR

6. SYSTEM ARCHITECTURE



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7. METHODOLOGY

The methodology employed in the development and implementation of the Betel Nut Protection System encompasses several key stages, including system design, sensor integration, Arduino programming, hardware assembly, testing, and deployment. Each stage is crucial for ensuring the effectiveness, reliability, and scalability of the system. The following sections outline the methodology in detail:

1. System Design:

The first step in developing the Betel Nut Protection System is to define its overall architecture and functionality. This involves identifying the core components of the system, including sensors, actuators, microcontroller, and communication modules. The design phase also entails specifying the interactions and interfaces between these components to ensure seamless integration and operation.

During the system design phase, careful consideration is given to the selection of sensors based on their suitability for detecting environmental factors such as rainfall, light intensity, and fire. Additionally, the design incorporates the GSM module for communication and the DC motor for actuation of protective curtains. The overall system architecture is conceptualized to facilitate real-time monitoring, detection, and response to potential threats to betel nut trees.

2. Sensor Integration:

Once the system design is finalized, the next step is to integrate the selected sensors into the system. This involves connecting the sensors to the Arduino microcontroller and configuring them to communicate effectively. Each sensor is calibrated and tested to ensure accurate detection and measurement of environmental parameters.

For example, rain sensors are integrated to detect rainfall by measuring the presence of water droplets. LDR sensors are utilized to monitor light intensity, while fire sensors are employed to detect the presence of flames or high temperatures. The integration of these sensors enables the system to continuously monitor environmental conditions and respond promptly to changes.

3. Arduino Programming:

The Arduino microcontroller serves as the brain of the Betel Nut Protection System, responsible for processing sensor data, controlling actuators, and executing predefined logic and algorithms. Arduino programming is carried out to develop the firmware that governs the operation of the system.

The programming logic includes algorithms for real-time data acquisition from sensors, decision-making based on predefined thresholds and criteria, and actuation of the DC motor to close protective curtains when necessary.

Additionally, the firmware incorporates error handling mechanisms and communication protocols for interfacing with the GSM module to send SMS alerts.

4. Hardware Assembly:

With the sensor integration and Arduino programming completed, the next step is to assemble the hardware components of the Betel Nut Protection System. This involves connecting the sensors, actuators, microcontroller, and communication module according to the system design specifications.

The hardware assembly process includes mounting the sensors in strategic locations within the betel nut cultivation area, connecting them to the Arduino microcontroller using appropriate wiring, and integrating the DC motor for actuation of protective curtains. Care is taken to ensure proper grounding, insulation, and protection against environmental elements to prevent damage to the components.

8. CONCLUSION

Our project focused on developing an IOT – based system to protect betelnut harvested crops from heavy rainfall, integrating various technologies such as rain sensors, fire sensors, GSM modules, and motors. The goal was to automate the process of safeguarding agricultural produce from adverse weather conditions, reducing the burden on farmers and enhancing the overall efficiency of farm or field operations.

The system successfully demonstrated the ability to detect environmental changes, specifically heavy rainfall, and respond appropriately by deploying protective measures. Through the use of rain sensors, the system could automatically activate motors to cover crops with protective shields, effectively minimizing water damage. Additionally, the integration of fire sensors ensured a dual protection mechanism, enabling the system to alert nearby individuals and the farmer via SMS in the event of a fire, thus preventing potential losses from fire outbreaks. The use of an LCD display allowed for real – time monitoring, giving farmers immediate feedback on system status and environmental conditions.

Moreover, the implementation of the GSM module played a critical role in communication. It not only informed farmers about the system's actions but also alerted them to potential issues, allowing for timely interventions. This technological synergy between different components showcased the potential of IOT in transforming traditional farming practices by making them more resilient to climatic challenges.

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9. FUTURE ENHANCEMENT

1. Integration with Advanced Weather Forecasting: Future enhancements could include integrating more sophisticated weather prediction models that utilize real – time data analytics. This would allow the system to anticipate adverse weather conditions well in advance, preparing the mechanisms even before the actual occurrence of heavy rainfall or other detrimental weather events.
2. Expansion to Other Environmental Threats: While the current system focuses on rainfall and fire, it can be expanded to monitor other environmental factors such as high winds, hail, or extreme temperatures. This would make it a protection to crops from a variety of natural threats. Solar Power Integration: To ensure sustainability and continuous operation especially in remote areas, integrating solar panels as a power and reduce the dependence on conventional power supplies, which are often unreliable in rural settings

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