Literature Review

1. A Strategic Agricultural Field Monitoring using Internet of Things enabled Wireless Sensor Network

1. Summary of Work:

The paper discusses the implementation of a novel Wireless Sensor Network (WSN) based Agricultural Management System with the integration of Internet of Things (IoT) technology. Referred to as the Intellectual Agri-Data Processing Scheme (IADPS), this approach aims to provide real-time monitoring and management of agricultural fields. The system collects data such as temperature, humidity, soil moisture, and motor pump condition using sensors placed in the agricultural field. This data is then transmitted to a server for processing and storage. Alerts are generated for farmers when the data exceeds predefined threshold levels, facilitating timely interventions to ensure crop health and productivity.

2. Authors and Affiliation:

The work is authored by Timothy Dhayakar Paul from the Department of ECE at Kumaraguru College of Technology, Coimbatore, India, and Dr. Vimalathithan Rathinasabapathy from the Department of ECE at Karpagam College of Engineering, Coimbatore, India.

3. Timeline:

The paper was presented at the 2021 International Conference on Advancements in Electrical, Electronics, Communication, Computing and Automation (ICAECA).

4. Methodology:

The methodology involves the deployment of IoT-assisted WSN using a Smart Device equipped with sensors for data collection. The data is transmitted to a server via the WSN base station for processing. The system employs algorithms to analyze the data and trigger alerts based on predefined thresholds. The proposed approach aims to enhance agricultural field monitoring and management by leveraging IoT and WSN technologies.

5. Strengths:

- The integration of IoT and WSN technologies provides a comprehensive solution for real-time agricultural field monitoring.

- The use of sensors enables accurate data collection, allowing for timely interventions to optimize crop health and productivity.

- The system's ability to send alerts to farmers promptly helps in preventing potential crop damage or losses.

- The paper provides a detailed explanation of the proposed methodology, including algorithms and system architecture.

6. Weaknesses:

- The paper lacks empirical data or case studies to demonstrate the effectiveness of the proposed system in real-world agricultural settings.

- There is limited discussion on potential challenges or limitations of implementing the proposed approach.

- The scalability and cost-effectiveness of deploying the system on a large scale are not addressed.

- The paper could benefit from a comparative analysis with existing agricultural monitoring systems to highlight the unique advantages of the proposed approach.

Conclusion:

The paper presents a promising approach for agricultural field monitoring using IoT-enabled WSN technology. While the proposed system shows potential benefits for farmers in improving crop management practices, further empirical studies and considerations of practical challenges are necessary for its successful implementation in real-world agricultural settings.

2. Smart farm and monitoring system for measuring the Environmental condition using wireless sensor network - IOT Technology in farming

1.1. Who did what

- Tharindu Madushan Bandara and Mansoor RAZA authored the paper and proposed the smart farm and monitoring system.

1.2. When was it done

- The paper was published in the 2020 5th International Conference on Innovative Technologies in Intelligent Systems and Industrial Applications.

1.3. Method that was used

- The authors utilized IoT sensors, including soil moisture sensors, temperature sensors, and water volume sensors, to collect data from the farming environment.

- Wireless sensor networks (WSNs) were employed to transmit data from sensor nodes to the central server.

- Analysis of the collected data was performed on the central server to monitor and control environmental conditions in real-time.

1.4. Strengths:

- Utilizes modern IoT technology to improve farming efficiency and resource management.

- Wireless sensor networks enable real-time data collection from sensor nodes placed in the farming environment.

- Provides a reliable and flexible solution for farmers with a simple architecture.

- Incorporates a real-time monitoring system for better control of environmental conditions.

1.5. Weaknesses:

- The paper lacks detailed information on the specific implementation and deployment of the proposed system.

- Limited discussion on potential challenges and limitations of the system.

- May require further validation and testing in real-world farming scenarios.

Conclusion:

The paper presents a comprehensive overview of a smart farming system leveraging IoT technology and wireless sensor networks. While it highlights the potential benefits of such a system for improving farming efficiency and resource management, further research and validation are needed to assess its practical implementation and address potential challenges.

3. Light Control Smart Farm Monitoring System with Reflector Control

1. Who did what

- The research was conducted by Jaekuk Choi, Dongsun Lim, Sangwon Choi, Jeonghyeon Kim, and Jonghoek Kim from the Department of Electrical Engineering at Hongik University, Sejong, Korea.

2. When was it done

- The specific timeline of the research is not mentioned in the text. However, it can be inferred that the development and experimentation took place around the time of publication.

3. Method that was used

- The researchers implemented a smart farm monitoring and control system using Arduino and DC motors. They controlled the amount of light inflow by adjusting the angle of a reflector. Environmental factors such as temperature, humidity, carbon dioxide (CO_2), and light were monitored for optimal farm conditions. The system included a server and mobile application for real-time data upload and monitoring.

4. Strengths

- The approach of using reflector control instead of artificial light for cost-effective and efficient light management in smart farms is novel.

- The system comprehensively monitors various environmental factors crucial for plant growth.

- Remote modification of temperature and humidity reference values via a mobile application enhances control flexibility.

- Accumulated data on the server enables analysis for maintaining optimal farm conditions.

5. Weaknesses

- The paper lacks detailed experimental results, including extensive data analysis or statistical validation of the system's performance.

- The scalability of the system to larger farms or different environments is not discussed.

6. Conclusion:

- The paper proposes an innovative smart farm system that effectively monitors and controls environmental factors crucial for plant growth. By controlling light intensity through reflector adjustment and utilizing real-time data monitoring, the system offers potential benefits for efficient and cost-effective smart farming practices.

4. IoT Enabled Plant Soil Moisture Monitoring Using Wireless Sensor Networks

1. Who did what

- A.M. Ezhilazhahi and P.T.V. Bhuvaneswari from the Department of Electronics Engineering, Madras Institute of Technology, conducted research on developing a remote monitoring system for soil moisture in plants using Wireless Sensor Networks (WSN) integrated with Internet of Things (IoT) technology.

2. When was it done

- The research was conducted and presented at the 2017 IEEE 3rd International Conference on Sensing, Signal Processing, and Security.

3. Method that was used

- The researchers developed a system consisting of sensing and transmitter modules, receiver module, IoT enablement using Dropbox cloud storage, and an event detection algorithm based on Exponential Weighted Moving Average (EWMA). The sensing module included a soil moisture detection probe and sensor board connected to a PIC microcontroller and Zigbee transceiver. The receiver module utilized a Raspberry Pi and Zigbee receiver.

4. Strengths:

- The research addresses the increasing demand for continuous monitoring of plant health, particularly soil moisture, in organic farming.

- Integration of WSN and IoT technologies offers remote monitoring capabilities.

- Utilization of Zigbee technology ensures efficient wireless communication.

- Adoption of the EWMA event detection algorithm enhances the network lifetime by activating nodes only when threshold conditions are met, conserving energy.

5. Weaknesses:

- The research primarily focuses on monitoring soil moisture in an open environment rather than controlled environments like greenhouses, potentially limiting its applicability in certain agricultural contexts.

- While the system's components are described, specific technical details such as sensor accuracy, power consumption, and data transmission protocols are not extensively discussed.

- Limited discussion on scalability or robustness of the proposed system beyond single-sensor deployments.

5. **Design of Novel Wireless Sensor Network Enabled IoT based Smart Health Monitoring System for Thicket of Trees**

1. Work Description:

The literature discusses the design and implementation of a novel wireless sensor network-enabled IoT-based smart health monitoring system specifically tailored for the monitoring of coconut trees. The system aims to address issues such as natural calamities, diseases like red spot disease, and the lack of proper monitoring systems, which have led to a decline in coconut farming in countries like India.

2. Authors:

The work was conducted by B. Sridhar, S. Sridhar, and V. Nanchariah. B. Sridhar and S. Sridhar are professors in the Department of Electronics and Communication Engineering at LIET, Vizianagaram, India, while V. Nanchariah is an associate professor in the same department.

3. Timeline:

The research was undertaken recently, although the exact date is not specified. However, it is part of the proceedings of the Fourth International Conference on Computing Methodologies and Communication (ICCMC 2020).

4. Methodology:

The proposed system utilizes a combination of wireless sensor networks (WSN) and IoT technologies to monitor and control the health status of coconut trees remotely. It incorporates cloud-based servers and mobile devices for real-time monitoring and control. The system integrates soil moisture monitoring using WSN to achieve its objectives.

5. Strengths:

- The system offers remote monitoring and control of tree health, providing convenience to farmers.

- It utilizes IoT and WSN technologies, which are known for their efficiency in data collection and monitoring.

- The integration of cloud-based servers ensures accessibility and scalability of the system.

- Low power consumption and solar power compatibility make the system suitable for remote and rural areas.

6. Weaknesses:

- The literature lacks detailed information on the specific sensor types and their accuracy.

- It does not provide empirical data or results from field trials to validate the effectiveness of the proposed system.

- While the paper discusses technical challenges, it does not delve deeply into solutions or mitigation strategies for these challenges.

- The scalability and robustness of the system in large-scale deployment scenarios are not thoroughly addressed.

6. Development of Monitoring System for Smart Farming Using Progressive Web App

I. Introduction:

The introduction highlights Indonesia's significant role as a palm oil producer and exporter, emphasizing the need for technology integration, particularly Internet of Things (IoT), to enhance monitoring and management practices in palm oil plantations.

II. Previous Work:

The paper reviews previous research efforts in monitoring systems for agricultural sectors, particularly in oil palm plantations. It discusses the utilization of GIS-based applications and the development of APIs for real-time monitoring, noting limitations in existing systems such as lack of user-friendly interfaces.

III. Research Methodology:

The methodology section outlines user identification processes, system design including wireframes and solution architecture, and the application of Progressive Web App (PWA) for enhanced accessibility.

IV. Results and Discussion:

The section discusses the development of user interfaces tailored to different user personas, integration of APIs with UI, and the application of PWA features such as "Add to Home Screen" and push notifications. Testing methodologies including black box testing, Lighthouse, and PageSpeed Insight are also described.

V. Conclusion:

The conclusion summarizes the key findings of the research, emphasizing the usability and functionality of the developed monitoring information system. It highlights the benefits of the Progressive Web App approach and suggests areas for further refinement, particularly in API modification for better integration with user interfaces.

7. Greenhouse Monitoring with Biocompatible Humidity Sensor for Smart Farming

I. Introduction:

The study focuses on addressing the increasing demand for sustainable food production through smart farming techniques, particularly in greenhouse horticulture. The authors emphasize the need for precise environmental monitoring to optimize crop growth while minimizing environmental impact. Powdery mildew management is highlighted as a significant challenge in greenhouse farming due to its impact on crop yield and quality.

II. Materials and Methods:

A. Sensor: The study utilizes a miniaturized leaf wetness sensor integrated with an application-specific integrated circuit (ASIC) based on CMOS technology. The sensor employs interdigitated electrodes covered with biocompatible Parylene C, allowing direct attachment to plant leaves. Calibration of the sensor is conducted to ensure accurate humidity measurements.

B. Sensor Node and Experimental Setup: The sensor system is tested in a research greenhouse, with a focus on monitoring leaf microclimate properties relevant for pest management. Challenges such as sensor attachment and robustness are addressed through housing design and deployment strategies.

C. Greenhouse and Reference Sensors: The experimental setup involves monitoring a cucumber crop in a high-tech greenhouse compartment, with commercial sensors for temperature, humidity, radiation, and CO_2. State-of-the-art leaf wetness sensors (LWS) are also employed for comparison.

D. Leaf Wetness Algorithm: The study develops an algorithm to determine leaf wetness duration based on dew point depression (DPD) calculated from sensor data. Different DPD thresholds are evaluated to optimize wetness detection accuracy.

III. Results:

The study reports challenges encountered during sensor deployment, including reliability issues and sensor breakages. Data analysis reveals variations in relative humidity and DPD within the greenhouse, affecting wetness detection accuracy. Correlation between mildew observations and wetness events is explored, highlighting the complexity of powdery mildew management.

IV. Discussion and Outlook:

The discussion emphasizes the importance of accurate leaf wetness measurement for optimizing crop climate and pest management. Challenges such as sensor reliability and calibration are acknowledged, suggesting areas for future research and improvement. The study concludes by highlighting the potential of miniaturized sensors for cost-efficient and biocompatible leaf wetness monitoring in smart farming applications.

Conclusion:

The literature review summarizes a study on greenhouse monitoring using biocompatible humidity sensors for smart farming. The research addresses the need for precise environmental monitoring in greenhouse horticulture to optimize crop growth and mitigate pest-related risks. Challenges, results, and future outlook are discussed, emphasizing the potential of miniaturized sensors for sustainable agricultural practices.

8. Design of a smart system for monitoring and management of pastures and meadows: The Relational Database Approach

Authors:

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Summary:

Mladenova, Valova, and Valov present a study focusing on the development of a smart system for monitoring and managing pastures and meadows, emphasizing the utilization of a relational database approach. The article highlights the increasing interest in leveraging information and communication technologies (ICT) and hardware advancements in agriculture, particularly in the context of smart farming. The authors discuss the significance of solutions based on sensors, communication networks, and actuators, with a specific focus on Internet of Things (IoT) technologies for remote monitoring and management of farms.

Who did what

- The study was conducted by Tsvetelina Mladenova, Irena Valova, and Nikolay Valov from the University of Ruse, Bulgaria.

When was it done

- The study was presented at the 2022 8th International Conference on Energy Efficiency and Agricultural Engineering (EE&AE) in Ruse, Bulgaria.

Method that was used

- The study proposes a system comprising both hardware and software components for monitoring and managing smart farms. The hardware aspect involves the deployment of measuring stations equipped with various sensors, microcontrollers, batteries, and communication modules. The software part includes modules for data collection, processing, normalization, relational database management, user interface, and machine learning model training.

Strengths:

- The study addresses the growing interest and importance of ICT in agriculture, specifically in the context of smart farming solutions.

- The proposed system integrates hardware and software components for comprehensive farm monitoring and management.

- Utilization of a relational database approach ensures efficient data storage, processing, and analysis.

- Detailed descriptions of hardware components and software functionalities provide clarity on system implementation.

Weaknesses:

- The study primarily focuses on the technical aspects of the proposed system, with limited discussion on potential socio-economic impacts or scalability issues.

- While the software functionalities are described in detail, practical implementation challenges and potential barriers to adoption are not extensively discussed.

- Further empirical validation or field testing of the proposed system's performance and scalability could enhance the study's credibility.

Conclusion:

The study underscores the significance of integrating advanced technologies for efficient farm management and monitoring. By leveraging IoT, ICT, and relational database approaches, the proposed system aims to provide real-time data insights and predictive capabilities for improved decision-making in agriculture. Future developments may include expanding sensor capabilities, experimenting with machine learning algorithms, and extending the system to incorporate animal monitoring functionalities.

9. Cloud-based Low-Power Long-Range IoT Network for Soil Moisture Monitoring in Agriculture

Authors:

- Subhra Shankha Bhattacherjee, Shreeshan S., Gattu Priyanka, Akshay Ramesh Jadhav, P. Rajalakshmi (Indian Institute of Technology, Hyderabad, India)

- Jana Kholova (Crop Physiology, ICRISAT, Hyderabad, India)

1. Work Description:

The paper presents a proposal for a low-power, long-range IoT network designed for soil moisture monitoring in agriculture. The authors focus on addressing the challenges associated with deploying IoT networks in agricultural settings, emphasizing the importance of long-range communication, low power consumption, and cost efficiency.

2. Authors:

The work is conducted by researchers from the Department of Electrical Engineering at the Indian Institute of Technology, Hyderabad, India, and a researcher from Crop Physiology at the International Crop Research Institute for Semi-Arid Tropics (ICRISAT), Hyderabad, India.

3. Timing:

The study was conducted and the paper written before the date of publication.

4. Methodology:

The proposed IoT network utilizes LoRa (Long Range) communication technology operating at 868 MHz ISM band for transmitting data. The authors have designed soil moisture sensors and LoRa nodes in-house. These sensors measure various field parameters including ambient temperature, humidity, soil moisture, and soil temperature. The nodes are powered by rechargeable Li-Ion batteries and solar panels, enhancing their longevity. The network architecture incorporates Raspberry Pi as a gateway device, connecting to servers hosted by OVH, a cloud computing company.

5. Strengths:

- The paper addresses the critical need for efficient soil moisture monitoring in agriculture, emphasizing the benefits of IoT technology in addressing this need.

- The use of LoRa technology enables long-range communication, making it suitable for large agricultural fields.

- The in-house design of sensor nodes and LoRa communication devices demonstrates technical expertise and customization according to specific requirements.

- The deployment of the network at ICRISAT's LeasyScan platform validates its practical applicability in real-world agricultural settings.

6. Weaknesses:

- While the study focuses on soil moisture monitoring, it does not extensively discuss other relevant field parameters such as nutrient content, which could also impact crop yield.

- The paper lacks detailed discussion on the data analysis techniques employed, such as statistical analysis to address outliers in the collected data.

- Limited information is provided regarding the scalability of the proposed network and its compatibility with diverse agricultural landscapes.

Conclusion:

The study presents a promising solution for soil moisture monitoring in agriculture through the deployment of a low-power, long-range IoT network. By leveraging LoRa technology and in-house designed sensor nodes, the proposed network offers cost-effective and scalable monitoring capabilities. However, further research is needed to address certain limitations and optimize the network for broader agricultural applications.

10. Smart Farm Monitoring Using Raspberry Pi and Arduino

1. Who did what?

- Siwakorn Jindarat and Pongpisitt Wuttidittachotti from the Faculty of Information Technology at King Mongkut's University of Technology North Bangkok conducted a study on implementing an Intelligent System for chicken farming management using Raspberry Pi and Arduino Uno.

2. When was it done?

- The study was conducted recently, though an exact date is not provided in the text.

3. Method that was used?

- The researchers employed an embedded system consisting of Raspberry Pi and Arduino Uno to monitor various parameters in a chicken farm, such as temperature, humidity, and air quality. They also integrated a Smart Phone application for remote monitoring and control.

4. Strengths:

- The system effectively monitored weather conditions and controlled the filter fan switch in the chicken farm.

- It provided convenience to farmers, allowing them to monitor and control the farm remotely using a smartphone application.

- The study suggests that the system led to cost reduction, asset saving, and improved productivity in chicken farming.

5. Weaknesses:

- The study lacks specific details about the experimental setup and methodology.

- The text does not provide information on the scale of the chicken farm used for testing the system, which may impact the generalizability of the results.

- It is unclear whether the system underwent rigorous testing under various conditions to assess its reliability and robustness.

Conclusion:

The study by Jindarat and Wuttidittachotti presents a promising approach to modernizing chicken farming through the use of intelligent systems integrating Raspberry Pi, Arduino Uno, and Smart Phone applications. While the system shows potential benefits such as remote monitoring and cost reduction, further research is needed to validate its effectiveness under diverse farm conditions and to address any limitations identified.

11.