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E-Agriculture Irrigation System Based on Weather Forecasting

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Abstract
The Internet of Things (IoT) is an emerging area to assist agriculture-related applications. Applications such as smart gardening, water maintenance, other equipment automatic installations based on human actions, etc., can be implemented using IoT. In this project, a wireless sensor-based networking system is proposed to address the water pumping system to crop. The first problem is to automate the process of pumping the water to crops in a garden. Atmospheric Pressure, Temperature and humidity sensor are used to monitor the temperature to initiate the water pumping system, while soil moisture sensors are used for sensing the water level and initiating the process of pumping the water to the crops in the garden. The rain sensor is used to check the rain, if rain is coming it is going to stop all the motors. The data collection is applied to collect and store the information in the server for further processing. Proposed systems are deployed and demonstrated using open-source hardware such as microcontrollers, GSM etc.

***Keywords*: Wireles sensor,microcontrollers,Gsm**

INTRODUCTION

The accelerated population growth and the continuous shortage of labor in the area of agriculture, are two of the main motivations for the growingly interest in the area of robotics and precision farming. Here, agricultural vehicles play a very important role, and a lot of research activities related to navigation, path planning and control have been increasingly taking place in the past recent years. For instance, presents a new concept with a fleet of small robots providing a solution for soil compaction in a scalable and energy-efficiently manner. In the same line of small vehicles, here we present a controller for a skid-steered robot used for corn seeding tasks.

The production of crops is associate with many factors, for example, climate change, plant diseases, and insect pests. According to recent researches, about half of the crop yield in the world is lost to pest infestations and crop diseases. Crop pests cause significant damage to crops and mainly affect the productivity of crop yield, whether in developing or developed countries. Hence, it is of great significance to identify insects in the crops at an early stage and select optimal treatments, which is an important prerequisite for reducing crop loss and pesticide use. There are too many types of insects and the number of individuals which belongs to the same species is enormous. However, traditional pest identification of insects is typically time-consuming and inefficient. Therefore, in order to improve the efficiency of agricultural production, a new effective recognition method should be proposed.

Smart farming and precision agriculture involve the integration of advanced technologies into existing farming practices in order to increase production efficiency and the quality of agricultural products. As an added benefit, they also improve the quality of life for farm workers by reducing heavy labor and tedious tasks. Replacing human labor with automation is a growing trend across multiple industries, and agriculture is no exception. Most aspects of farming are exceptionally labor-intensive, with much of that labor comprised of repetitive and standardized tasks—an ideal niche for robotics and automation.

LITERATURE SURVEY

1. Smart agriculture utilizes a variety of advanced technologies to promote sustainable agriculture and provide solutions for intelligent, automated and unmanned agriculture. Agricultural robots and related technologies are an important part of smart agriculture, while autonomous navigation is a core function of autonomous agricultural robots, which rely on information about the distance of obstacles in a scene to support decision making.

2. The current agricultural system a ground point geometric ranging model, which can be used in camera height dynamic change scenarios, and the method is validated by model derivation and hypothesis testing. The model combines ranging and camera calibration, choosing to compensate for distortion and defocus

phenomena caused by nonlinear imaging of the camera to the focal length, and completes the parameter calibration using a small amount of ground point real distance data.

3. Water is becoming scarcer. The unmonitored control and the extensive use of fossil fuel in water-table pumping for irrigation exacerbate global warming and harm the environment. Along with the rapid population growth and the concomitant increase in the demand for food, optimal usage of water-table and energy is becoming a must and indispensable for sustainable agriculture. In this context, Smart Agriculture (SA) is emerging as a promising field that leverages ICT (Information and Communication Technology) to optimize resources' usage while enhancing crops' yields. In this paper, we present an integral SA solution that leverages cost-effectiveness .

4. This paper provides a rigorous literature review to inspect the state-of-the-art development of the schemes that provide information security using blockchain technology. After identifying the core requirements in smart agriculture, a generalized blockchain-based security architecture has been proposed. A detailed cost analysis has been conducted on the studied schemes. A meticulous comparative analysis uncovered the drawbacks in existing research.

PROPOSED IDEA

The DHT11 sensor measures environmental temperature and humidity, providing crucial data for weather analysis. The LM35 sensor monitors soil temperature, ensuring the optimal growth conditions for crops. Soil moisture level sensor gauges the soil's water content, enabling precise irrigation control. The rain sensor accurately detects rainfall, preventing unnecessary irrigation during wet weather. An LCD display presents real-time data to the farmers, empowering them with timely information. The system also incorporates a pump motor and solenoid valve, controlled by a relay module, to automate irrigation processes based on sensor readings..

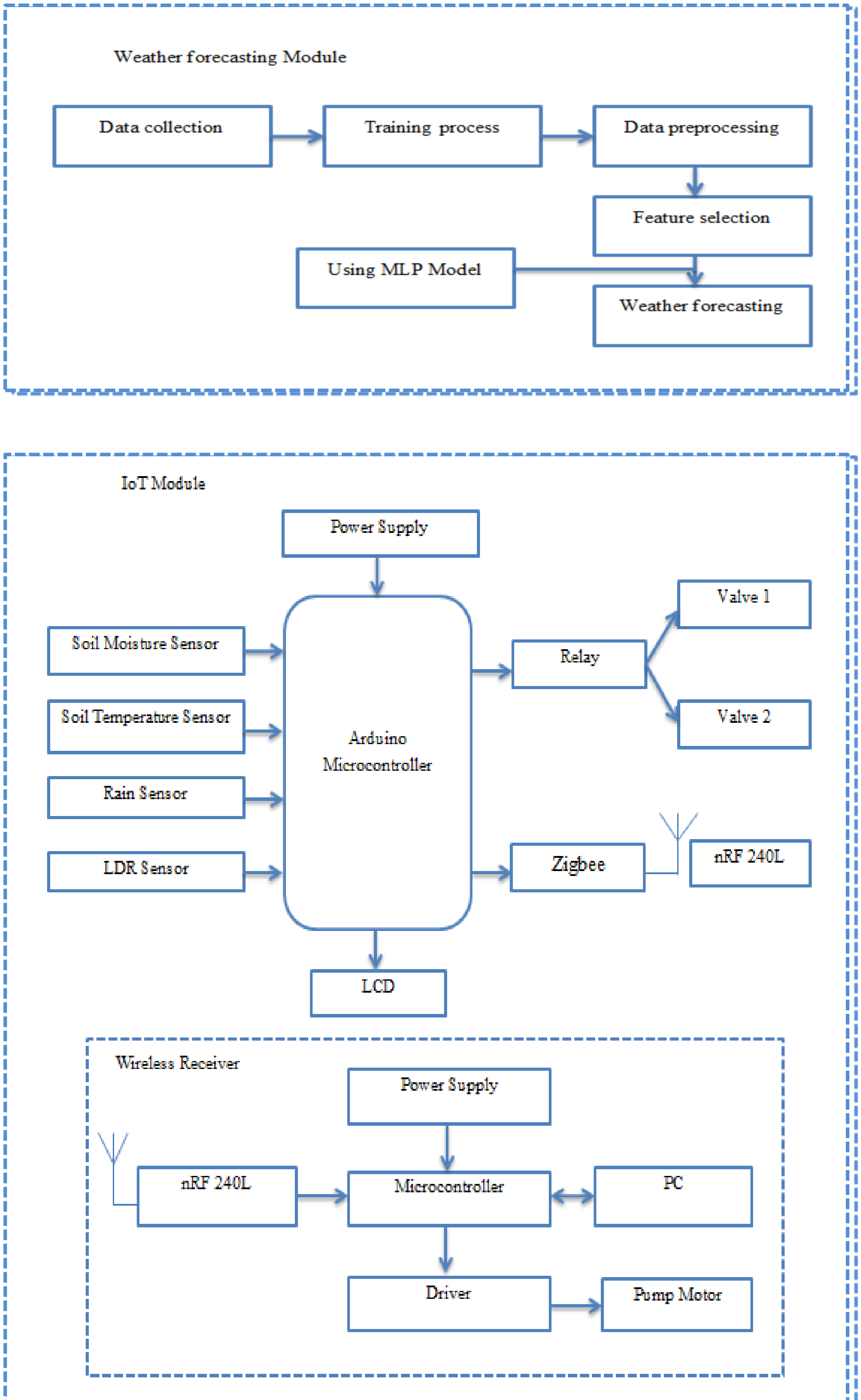


Fig. 1. Block Diagram of irrigation system using wireless sensors

An LCD display presents real-time data to the farmers, empowering them with timely information. The system also incorporates a pump motor and solenoid valve, controlled by a relay module, to automate irrigation processes based on sensor readings. Additionally, a water level sensor ensures efficient water usage by monitoring reservoir levels, while a buzzer provides alerts for specific events. The microcontroller will get information from temperature sensors, humidity sensors, soil moisture sensors, and rain sensors.

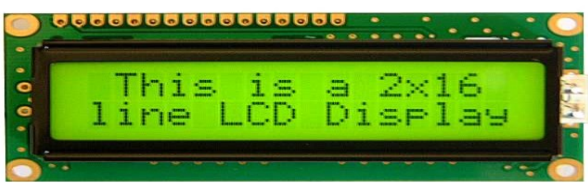
Hardware Components

- Arduino IDE
- Lcd
- Humidity sensor
- Temperature sensor

Arduino IDE

The Arduino Integrated Development Environment (IDE) is a cross-platform application (for Windows, macOS, Linux) that is written in functions from C and C++. It is used to write and upload programs to Arduino compatible boards, but also, with the help of 3rd party cores, other vendor development boards.

Lcd



LCD (Liquid Crystal Display) screen is an electronic display module and find a wide range of applications. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits .A 16x2 LCD means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. This LCD has two registers, namely, Command and Data. The command register stores the command instructions given to the LCD, The data register stores the data to be displayed on the LCD

Humidity sensor

Humidity is the presence of water in air. The amount of water vapor in air can affect human comfort as well as many manufacturing processes in industries. The presence of water vapor also influences various physical, chemical, and biological processes. Humidity measurement in industries is critical because it may affect the business cost of the product and the health and safety of the personnel. Hence, humidity sensing is very important, especially in the control systems for industrial processes and human comfort.

Temperature sensor

A temperature sensor is a device which is designed specifically to measure the hotness or coldness of an object.LM35 is a precision IC temperature sensor with its output proportional to the temperature (in °C).With LM35,the temperature can be measured more accurately than with a thermistor. It also possess low self heating and does not cause more than 0.1 °C temperature rise in still air. The operating temperature range is from -55°C to 150°C.The LM35's low output impedance,linear output, and precise inherent calibration make interfacing to readout or control circuitry especially easy.It has find its applications on power supplies,battery management,appliances,etc. The LM35 is an integrated circuit sensor that can be used to measure temperature with an electrical output proportional to the temperature (in °C).It can measure temperature more accurately than a using a thermistor.

Software requirements

- Weather forecast
- Data collection
- Sensor data collection
- Water irrigation

Weather Forecast

Weather forecasting in intelligent agriculture monitoring includes monitoring soil conditions such as moisture levels, temperature, and nutrient content. Location-specific weather data comprises factors like precipitation, humidity, and sunlight exposure. These parameters play a pivotal role in determining the health and growth of crops. By leveraging IoT devices like soil sensors, weather stations, and other smart agriculture tools, farmers can collect accurate and timely data to gain a comprehensive understanding of their farming environment. To facilitate this data-driven approach, many farmers turn to platforms like Kaggle for efficient and reliable data collection.

Data Collection

The data collected from Kaggle serves as the foundation for training the machine learning model, which plays a key role in the intelligent agriculture monitoring system. In this context, a Multilayer Perceptron (MLP) model is often employed due to its ability to handle non-linear relationships within the data.

Sensor data collection

In intelligent agriculture monitoring systems, the heart of the operation lies in efficient sensor data collection. The integration of various sensors with an Arduino microcontroller enables the system to gather crucial information about the soil and environmental conditions. This module plays a pivotal role in providing farmers with real-time insights into their crops, allowing for informed decision-making and optimized resource utilization. The key sensors involved in this module include the Soil Moisture Sensor, Soil Temperature Sensor, Rain Sensor, and LDR Sensor. Each of these sensors serves a unique purpose in monitoring different aspects of the agricultural environment.

Water irrigation

Water irrigation is a critical aspect of modern agriculture, and Module 5 addresses this key component in intelligent agriculture monitoring systems. By utilizing sensor data collected in Module 4, the system can intelligently control water irrigation, ensuring optimal moisture levels for crop growth while promoting water conservation.

Training module

The training module for intelligent agriculture monitoring often involves the use of machine learning models. One such model is the Multilayer Perceptron (MLP), a type of artificial neural network. Here are the key steps involved in training an MLP model for agriculture monitoring:

Data Preprocessing Clean and preprocess the collected data, handling missing values, normalizing numerical features, and encoding categorical variables.

Feature Selection Identify relevant features that contribute to accurate predictions, focusing on variables such as soil moisture, temperature, and weather conditions.

Data Splitting Divide the dataset into training and testing sets to evaluate the model's performance effectively.

Model Architecture Design the MLP model with an appropriate number of layers and neurons, considering the complexity of the agricultural monitoring task.

Activation Functions Choose activation functions for each layer to introduce non-linearity and enhance the model's ability to capture complex patterns.

Training Algorithm Implement a training algorithm, commonly gradient descent, to optimize the model's parameters and minimize the error between predicted and actual values.

Validation Use the validation set to fine-tune hyperparameters and prevent overfitting.

System testing

System testing in the context of an intelligent agriculture monitoring involves assessing the entire system's functionality, performance, and security to ensure it operates as intended before it goes live. System testing for a intelligent agriculture monitoring system involves comprehensive evaluation of the system's various components, including hardware, software, networks, databases, interfaces, and security protocols. It aims to validate that all components function harmoniously together and meet the specified requirements.

RESULT

The integration of Internet of Things (IoT) and artificial intelligence has revolutionized various industries, and agriculture is no exception. This study focuses on the implementation of intelligent agriculture monitoring using IoT, with a specific emphasis on weather forecasting through the utilization of Multilayer Perceptron (MLP) in Python and IoT processing in Arduino software. The combination of these technologies aims to enhance decision-making processes for farmers, optimize resource utilization, and ultimately improve crop yields.

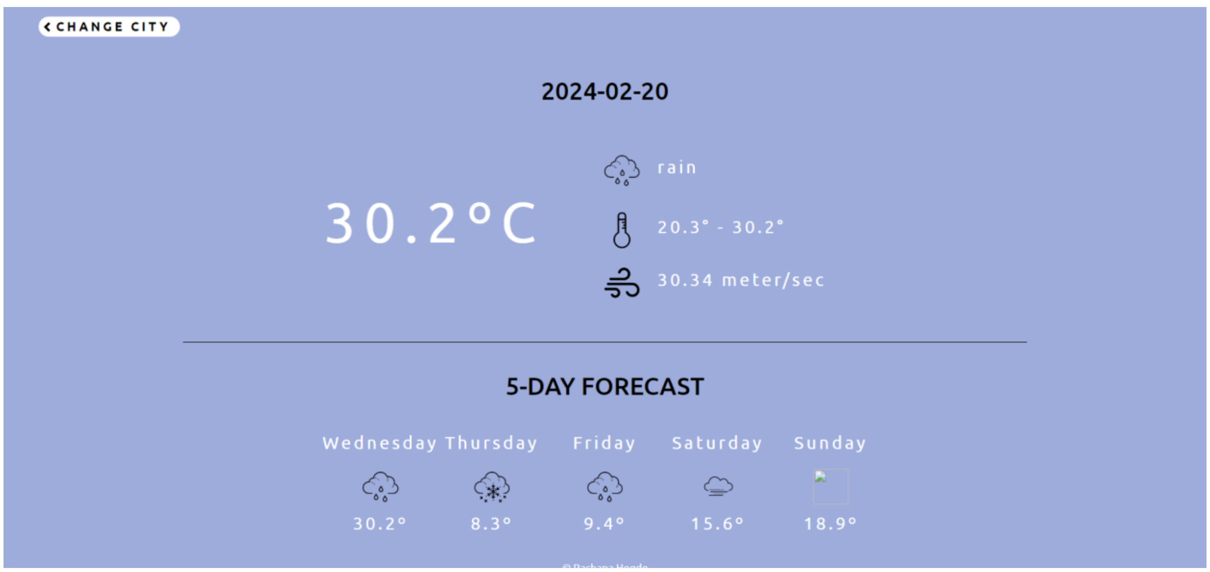
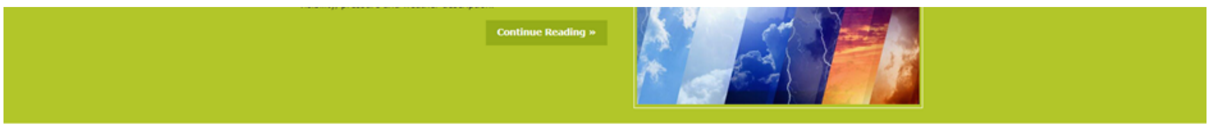


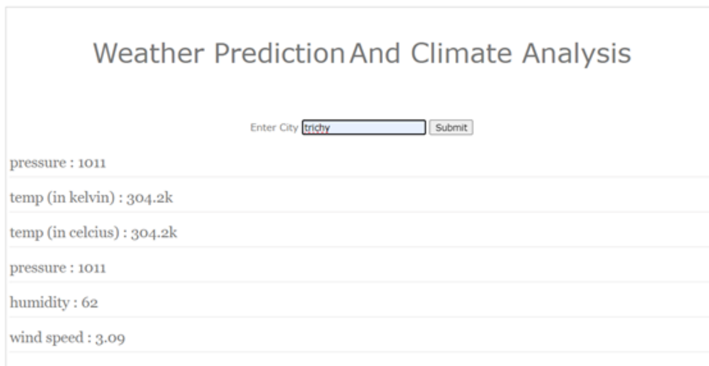
Fig.5.Throughputvs.No.of Nodes

Future advancements in agriculture involve the integration of robotic devices and drone monitoring through the Internet of Things (IoT). Robotic devices equipped with AI can perform tasks such as precision planting, harvesting, and weed control, optimizing resource utilization. Drones, equipped with advanced sensors, monitor crops for disease, nutrient levels, and overall health, providing real-time data to farmers. This integration of robotics and IoT ensures efficient and data-driven decision-making in agriculture, leading to increased yields, reduced environmental impact, and sustainable farming practices. The synergy of these technologies promises a transformative impact on the future of agriculture.

CONCLUSION

The integration of intelligent agriculture monitoring through IoT, coupled with weather forecasting using Multilayer Perceptron (MLP) in Python and IoT processing in Arduino software, represents a significant leap towards sustainable and efficient farming practices. The amalgamation of these technologies enables farmers to make informed decisions by harnessing real-time data and predictive analytics. The utilization of MLP in Python for weather forecasting empowers the system to analyze historical weather patterns and make accurate predictions, enhancing the ability to anticipate and mitigate potential risks. The incorporation of IoT in agriculture monitoring, facilitated by Arduino software, ensures seamless communication and data exchange between various agricultural devices and sensors.





REFERENCES

1. Gao, Tian, Meian Li, Lixia Xue, Jingwen Bao, Hao Lian, Tin Li, and Yanyu Shi. "Height-variable monocular vision ranging technology for smart agriculture." IEEE Access (2023).
2. Alharbi, Hatem A., and Mohammad Aldossary. "Energy-efficient edge-fog-cloud architecture for IoT-based smart agriculture environment." Ieee Access 9 (2021): 110480-110492.
3. Xue, Dingzhu, and Wei Huang. "Smart agriculture wireless sensor routing protocol and node location algorithm based on Internet of Things technology." IEEE Sensors Journal 21, no. 22 (2020): 24967-24973.
4. Bouali, Et-Taibi, Mohamed Riduan Abid, El-Mahjoub Boufounas, Tareq Abu Hamed, and Driss Benhaddou. "Renewable energy integration into cloud & IoT-based smart agriculture." IEEE Access 10 (2021): 1175-1191.
5. Vangala, Anusha, Ashok Kumar Das, Neeraj Kumar, and Mamoun Alazab. "Smart secure sensing for IoT-based agriculture: Blockchain perspective." IEEE Sensors Journal 21, no. 16 (2020): 17591-17607.
6. Ahmed, Nurzaman, Debashis De, and Iftekhar Hussain. "Internet of Things (IoT) for smart precision agriculture and farming in rural areas." IEEE Internet of Things Journal 5, no. 6 (2018): 4890-4899.
7. Viani, Federico, Michael Bertolli, Marco Salucci, and Alessandro Polo. "Low-cost wireless monitoring and decision support for water saving in agriculture." IEEE sensors journal 17, no. 13 (2017): 4299-4309.
8. Elijah, Olakunle, Tharek Abdul Rahman, Igbafe Orikumhi, Chee Yen Leow, and MHD Nour Hindia. "An overview of Internet of Things (IoT) and data analytics in agriculture: Benefits and challenges." IEEE Internet of things Journal 5, no. 5 (2018): 3758-3773.