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A REAL TIME FARM AUTOMATION USING IOT AND ARTIFICIAL INTELLIGENCE

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ABSTRACT- This study examines the application of Internet of Things (IoT) in agricultural. In recent years, agriculture has become one of the fastest growing sectors due to the growing population. Enhancing farm productivity and grade without continuous human intervention is a key challenge in the agriculture sector. This research suggests an Internet of Things This research suggests an Internet of Things (IoT) -based modern agriculture strategy to deal with challenging circumstances. To achieve the required accuracy, specific algorithms are applied as optimization methods to the devices, protocols, sensors, and systems used in farming monitoring. Using Arduino and Raspberry Pi as IoT based systems, this work introduces a system for collecting field data on a regular and frequent basis and reduces manual labor. As part of an efficient and cost-effective crop yielding system, the data will be gathered and processed, information transferred, decisions made, and automation and control functions provided.

Keywords: Internet of Things, Enhancing farm productivity, human intervention

INTRODUCTION

With the advancements in AI and IoT devices, smart farms are no longer a distant dream. Agriculture has undergone significant changes over the past few decades. Technology has made all of this possible. Even in hostile climates, plants can be grown today. Climate change, insects, and weeds pose fewer threats to crops today. Last but not least, it is possible to breed farm animals with high yields. The world's population is still undernourished despite these advances. The world, especially third-world nations, still suffers from food insecurity. There are a variety of reasons for this, including unpredictable rains, nutrient runoff, new strains of pests and diseases, as well as climate change.

Artificial intelligence and smart farming are being used to address these challenges that hinder food production. In this article, we will examine how artificial intelligence can revolutionize

agriculture. In smart farming, various technologies are used, such as UAV, AI, machine learning, robotics, and IoT, to improve farm productivity, reduce human labor, and improve quality. In agriculture, ICT (information and communication technology) is used to optimize and streamline the production of crops and livestock. Farms can take advantage of many technologies today, including[1] the following:

- Location systems like GPS and Geographical Information Systems (GIS) and Satellite Imagery
- Sensors for monitoring humidity, water levels, Soil Ph, Sunshine, and temperature
- Agriculture specific software that merges agronomy and cybernetic to make farm management hassle-free
- Communication via Cellular IoT solutions and Low-power wide-area networks (LPWANs)
- Data Analysis systems that provide farmers real-time data on crop and animal health

Farmers can fully control their farms with these technologies. They also support them in choosing choices that are beneficial to their animals and crops[2].

Internet of Things is essential for smart agriculture (IoT). All of these techniques are connected by the Internet of Things, which produces a farm management platform based on information. All of this can be done using their smartphones or tablets. There is no need for them to travel frequently to their farms. Farm owners can identify crop problems with smart agriculture by collecting and analyzing data. They can decide how to address the challenges based on the analyzed information. They will know what to do if there is a shortage of water or depletion of nutrients. Crop yields will be increased while production costs will be reduced through smart agriculture. It encourages resource-efficient use across the board, including human labor, fertilizer usage, and water usage

1.1.AI and Automation Are Transforming Farming

Farmer-controlled autonomous tractors are already being developed by big companies with AI. In addition to reducing labor costs, self-driving tractors will increase crop yields and farm efficiency. Farmers will be able to remotely monitor crop conditions and capture images with autonomous drones. Crop treatments, such as pesticides and fertilizers, can be applied from the air using UAVs. In large-scale farms, drones equipped with AI cameras can be used to monitor livestock. Growers will be capable of counting fruits, identify problems with crops, and even predict agricultural harvests using the cameras[4]. Harvesting, seeding, weeding, crop sorting, and other farming activities can also be automated with AI. Hands-free farming is possible on an Australian farm thanks to AI and robots. Farmers may employ effective and sophisticated AI technologies to manage all the information going in. Data's capabilities can help decrease labor costs, boost agriculture productivity, and lessen farming's effect on the environment. In order to ensure maximum efficiency and profitability, it can also help farmers evaluate their resources management strategies and farming practices.

2. IOT TECHNOLOGIES IN AGRICULTURE

Automation of irrigation techniques and the use of sensors to keep tabs on agricultural fields are the two main objectives of Internet of Things (IoT) smart agriculture solutions. Because of this, farmers and businesses that serve them may quickly and conveniently check on the condition of the fields from any location. Consider a few of the various IoT applications in agriculture [5-7]:

➢ ROBOTICS IN AGRICULTURE

Ever since industrialisation of the 1800s, automation has advanced to efficiently handle complicated tasks and increase production. Due to the global labor shortage and increasing demand, agribots, also referred as agricultural robots, are starting to get the attention of farmers. Due to a lack of workers, agricultural production in the USA alone declined by an approximate 213 crores ($3.1 billion) annually. Agrobots are now more well-known in recent developments in sensor and AI technologies that allow machines to learn from their environments. We are currently in the early phases of an ag-robotics revolutionary that will fully leverage the Internet of Things in agriculture, as the most of the techniques are still in early processes that affect the R&D mode.

Figure 1 : Agribots

➢ DRONES IN AGRICULTURE

Drone use is prevalent in several industries, including agriculture. For imaging, mapping, and monitoring farms, drone with sensors and cameras are employed. Drones can be either aerial or

ground-based. Wheeled robots that survey the grounds are known as ground drones. Aerial drones, also known as unmanned aerial vehicles (UAVs) or unmanned aircraft systems (UAS), are flying objects. Drones have two modes of control: remote control operation or autonomous flight using flight plans synchronized with sensors and GPS in embedded electronics. The drone data can be used to gather a variety of details, such as crop health, irrigated, spraying, planting, field and soil conditions, plant counting, and production projections. Drone as a service, which involves organizing drones for agricultural inspections, or buying and storing drones nearby fields where they can be maintained and recharged, are both possibilities. To improve the usage of IoT in agricultural, drones must be transferred to nearby labs after surveys are concluded in analyzing the collected information.

➢ REMOTE SENSING IN AGRICULTURE

Data collection from multiple nodes on a farm is changing as a result of the deployment of IoT-based remote sensing in agriculture. Examples include using weather stations as sensors to gather data, which is then forwarded to analytical tools to be analyzed. Devices that can detect anomalies are called sensors. Farmers can keep an eye on their crops from the analysis dashboard and act based on their findings.

➢ HARDWARE DEVICES USED IN IOT BASED AGRICULTURE

Microcontrollers, sensors, cameras, drones, LCD screens, LED indicators, power supply modules, relays, PC/laptop/mobile, mechanical devices like water pumps, etc. are just a few examples of the various gadgets utilized in precision agriculture applications. An IoT Network is made up of all physical devices and software-supporting infrastructure. The various network elements employed in the system are explained below.

- **Microcontroller / Microprocessor:**

All embedded systems are powered by it. In many embedded devices presently, the Raspberry Pi is employed for dependable system operation.

- **Soil Moisture sensor:**

This particular probe's job is to gauge the soil's moisture content. This allows you to measure the amount of moisture in your plants' soil. Vcc, ground, an analogue signal interface, and a digital output interface make up its four terminals.

- **LCD Display:**

The specifics of the sensor data are displayed on screen using an LCD display. Typically, it comes in a (16 x 2) size, which has 2 rows and 16 columns. The user can then publish the message on the screen after the information exchange is finished.

Figure 2: 16x2 LCD display

- **Relay:**

The main function of a relay in an embedded device is current conversion. Current conversions is inevitable when a signals from a high-power circuit is transmitted to a computer or the other way around. Relay circuitry is used to carry it out.

2. PROPOSED MODEL

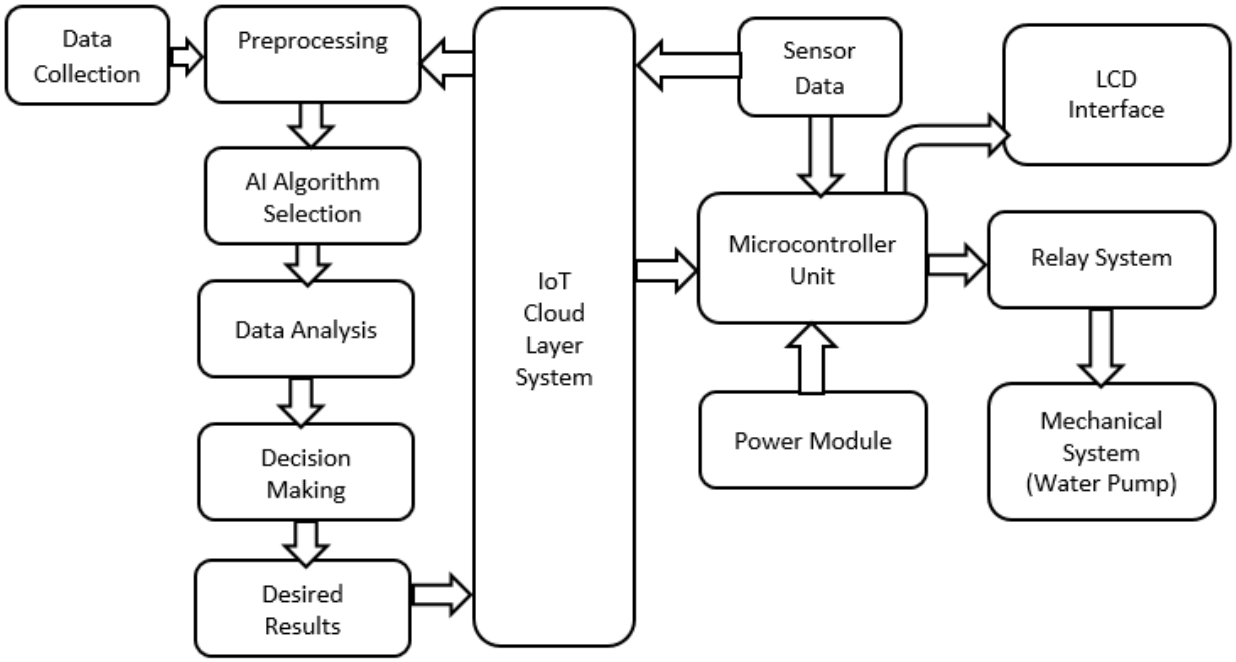

Figure 3 : Proposed Model

For collected information, input analysis will be conducted and a choice will be made for necessary data based on that assessment. The expected outcomes will be the necessary knowledge, which will be transmitted to the microcontroller or microprocessor unit through IOT layers. The Arduino Uno and Raspberry PI are popular microcontrollers. All hardware will receive electricity from the power component. After collecting the information, the microcontroller will transfer it to the mechanical components. Using a relay, a current conversion device, a receiving signal is transformed into the appropriate current signal. The output device for an irrigation purposes can be a water pump.

The figure depicts the suggested irrigation model. First, numerous sensors are used to measure and record the soil's value, which is then stored in embedded systems. The minimum amount of humidity will then be confirmed. The watering application will keep if it is discovered that the calculated value are below the minimum necessary. However, the water reserve's level is checked before to cultivation. Again, if it narrowly misses the target value, a notification will be issued to the farmer's mobile app and a requested for the filling will be performed. The crop will then be irrigated after the irrigation system has been turned on [8].

3. ALGORITHMS/METHODS FOR SMART CROP FARMING

The technique is essentially a method for step-by-step issue solving. The Smart Farming system receives intelligence from the algorithms. An algorithm for making decisions needs several factors. Algorithms for classification, prediction, surveillance, recognizing, categorizing, and assessment. Artificial Neural Networks (ANN) can create, assess, and analyze everyday farming activities to evaluate the condition of smart farming. Precision agricultural research was used to gather experimental results. We need a significant amount of information to train ANN systems, and doing so effectively takes time[9]. The precise agriculture industry has several chances to complete agricultural activities more quickly thanks to multiagent systems. A group of tools make up statistics. For the reduction of data analysis, we employ statistical techniques such as Bayesian statistics. Systems for controlling agriculture are created and simulated using fuzzy logic. For the purpose of detecting variations in humidity, temperature, and brightness, a fuzzy system has been developed. A classification method for cloud-based agriculture data processing and crop predictive modeling is created using the cutting-edge decision tree algorithm C5.0. For classification and regression analysis, Support Vector Machine (SVM) are related learning methods. It can be used to build a forecasting model for the daily temperature. To handle data with multiple characteristics and carry out a given purpose, algorithms are used[10]. Practically speaking, it will take some time to fully automate farms. Remote farming is being automated, observed, and managed using a variety of algorithms and techniques.

4. YIELD MANAGEMENT USING AI

Artificial intelligence (AI), cloud machine learning, satellite imagery, and technical indicators are examples of cutting-edge technologies that are making smart farming an actuality. As a result of the confluence of all these innovations, farmers may now improve their average productivity and better control their prices. Microsoft provides advisory services to farmers in Andhra Pradesh using the Cortana Intelligence Suite, which also includes Power BI and Machine Learning. The pilot project used an AI sowing app to provide farmers with guidance on a variety of topics, including the best time to sow, how to prepare the field, how to fertilize in accordance with soil tests, how to use composted manure from the farmyard, how to treat the seeds, and how deep to sow them. This led to a 30% increase in the typical crop yield per hectare. Technology can also be used to pinpoint the ideal sowing window, historical weather data, real-time Moisture Adequacy Data (MAI) from daily rainfall, and soil moisture in order to boost predictability and provide farmers with guidance on the best sowing time. United Phosphorus Limited and Microsoft are working together to create a Pest Risk Prediction API that can assist accurately predict pest attacks. In order to forecast the likelihood of a pest assault in advanced, this API

uses artificial intelligence (AI) and machine learning. Dependent on the weather and crop growth period, pest infestations are classified as High, Medium, or Low[11–12].

5. SCOPE OF AL IN AGRICULTURE

Artificial intelligence (AI) and machine learning (ML) are being fast applied into the agriculture sector in terms of crop supplies and field farming practices. The most significant technology advancement in farm activities will likely be cognitive computation, which has the ability to grasp, learn, and respond to a wide range of circumstances (based on learning) to maximize efficiency. All farmer will be able to stay up with technical advances and implement the same in their everyday farming to advantage from this service if some of these technologies are made available to them as a services like a chatbot or other conversational platforms. In order to assist 175 farmers in Andhra Pradesh, India, Microsoft is currently offering consultancy services for sowing, land, fertilizer, and other agricultural products. The average yield per hectare has indeed increased by 30% as a consequence of this approach in comparison to last year.

6. CONCLUSION

The destiny of the agricultural sector is AI and smart farming. They will enhance farming by assisting in the early detection of crop pests and illnesses while raising the caliber of the harvest. Accurate crop yield forecasts based on AI will help countries achieve food security. As you can see, the agriculture industry stands to gain significantly from artificial intelligence. It enables more interaction, greater effectiveness, and cheaper production. Although automation is the method of the future for agriculture, it cannot function independently. AI is not without its challenges, though, including a lack of diverse datasets and a high learning curve. Additional problems include worries about safety and privacy, as well as a lack of computer literacy. Even so, AI has the potential to enhance agricultural production by helping to clear agricultural industry bottlenecks.

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