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A Prototype of Smart Agriculture System Using Internet of Thing Based on Blynk Application Platform

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ABSTRACT Due to smart operation between the physical and digital worlds, peoples shows that there is huge interest in IoT systems. Today IoT devices are very user-friendly and easy to access with less power and network connectivity. This research presents the use of the Internet of Things in monitoring crops and for other agricultural purposes. The field of agriculture has always demanded high standards of resources, professionalism, and effort. Today, the majority of the world depends on agriculture for food consumption, economic growth, trade, and employment. It also comes with various sets of challenges for agriculturists. Various agriculturists, farmers, and scientists across the globe believe in formulating different plans and ideas to deal with these challenges. The smart farming system is based on the fastest growing Internet of Things (IoT) technology which will be cheaper, more productive, and cost-effective. In this research, we focus on handling various information about the crops under consideration by undertaking requisite commands from the user for better management of crops and their allied resources, hence providing a robust and useful facility for agriculturists across various domains. This research also promotes further exploration of the use of electronics and internet technology in the field of farming and agriculture.

INDEX TERMS Agriculture, Blynk app, IoT, NodeMCU, Soil Sensor

I. INTRODUCTION

With the increasing population and growing demand for food, there is a big challenge to increase productivity. Very few farmers are adopted such new techniques, but still, the count is very limited. An integrated system deals with all elements influencing profitability. The method aims to make horticulture excellent by efficiently utilizing computerization and IoT, which uses GPS-based remote-controlled robots to perform fieldwork such as weeding, splashing, dampness detecting, winged creature and creature startling, keeping carefulness, and so forth [1]. This gives 98% of the accurate data using the live agricultural stick tested on Live Agriculture Fields [2]. It uses the concept of IoT and data mining, solves the current problem of farming methodologies, and provides practical solutions [3].

The quality and quantity of crops depend on different parameters like climate, soil characteristics, available nutrients, and the quantity of irrigation. Climate change is the prime factor of threat for farmers and is very important for the adaption of new strategies and making security on productivity. IoT in agriculture increases the productivity of existing food production systems and improves food security. Other facilities such as crop monitoring, weed monitoring can also be done through using trending technologies like IoT [4]. Food demand within a limited area is a very big challenge [5]. The new era of agriculture is like the fourth revolution named Farming 4.0 [6]. Advanced IoT technologies have restructured the existing farming techniques like statistical to quantitative approaches [7]. Changes in humidity, temperature, and soil moisture have an impact on crop yield. So control, protection, and monitoring have become important to farming industries. The Indian economy mainly depends on agriculture. By taking appropriate adoption of IoT technology can improve the farm output. An emerging application of IoT is widely used fully in different sectors like manufacturing, buildings, transportation as well as farming industry.

II. PROPOSED WORK

The objective of this research is to build a model that can provide an efficient decision support system using the ESP8266 WiFi Module, which handles different activities of the farm and gives useful information about different parameters related to the crops under observation through wireless connectivity on an electronic device. These parameters include air humidity, atmospheric temperature, soil moisture, etc. The model is also required to take necessary actions like turning the water pump on or off when required or when desired through an instruction given by the user over the electronic device interface.

The model uses a GPS module to easily retrieve location information that measures the different agricultural parameters. For e.g., the quality of soil helps in determining the nutrient value in drier areas of farms, and soil acidity allows adjusting the amount of water needed for irrigation.

TABLE 1
IoT for Agriculture case study

Sr. No	Research Paper	Features	Benefits
1	IoT based smart agriculture [8]	Using Automation in IoT and GPS remote robot system.	Accurate data prediction
2	IoT in agriculture [9]	Through the help of Markov chain, it gives an idea about what a crop is suited for.	Use of IR and DM concept
3	IoT based smart agriculture stick [10]	Getting an accurate live feed of the environment temperature and soil moisture.	Know the condition of environmental parameters
4	Farming using IoT [11]	Use of sensors and by enabling automation concept.	Helpful in making decisions
5	Dynamic irrigation [12]	GSM/GPRS protocol to develop a low-cost information monitoring system for smart farming.	Efficient water management

The system contains two sensors, one is the Soil Moisture sensor, and the other is an IR sensor, apart from other components that include an ESP8266 WiFi Module, Relay, and Water Pump. The readings from the sensor are displayed in the Arduino IDE software and are notified in the form of a message in the Blynk app on Mobile. IR sensor helps to sense the presence of any unnecessary insects or wildlife in the field near to the sensor, so this will be used as smart security system [13].

Soil sensors are mostly used in agriculture, landscape irrigation, and as simple sensors for gardeners. Nowadays, robots can perform different tasks in the farming sector [12]. Automated agricultural robots have some issues in real-time performance [14]. Before implementing a sensor, its performance can be checked in the Tinkercad simulation tool[15-16].

A. SENSORS IN AGRISYSTEMS

A sensor monitors parameters like soil moisture, humidity, soil temperature, and others that play an essential role in crop production activity. Pollination and plants' leaf growth depends mainly on humidity which is easily sensed by a humidity sensor. The accurate amount of nutrients for which pH is necessary, water level, and quality are also very important in agriculture. Sensors also help in vertical farming system and become very successful [17].

B. COMMUNICATION TECHNOLOGIES

For communication with trending devices, one should use Bluetooth, WiFi, ZigBee, LoRa, or RFID. But the frequency bands, as well as the transmission ranges, are different. Considering the cost, WiFi and LoRa will be higher as compared to others. A solution to the high demand and high consumption of food and to fulfill all significant implementation of ICT which make a valuable impact on the agricultural industry [18].

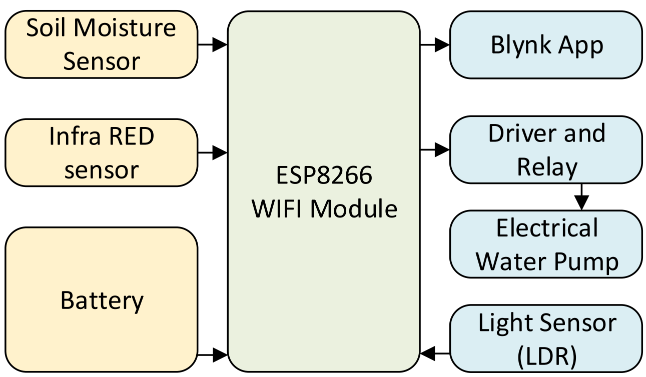

FIGURE 1. Basic block diagram of the Smart Farming System.

III. HARDWARE

A. ESP8266

The ESP8266 is a low-cost ultra-low-power WiFi chipset with a voltage rating of 3.3V. The ground of the ESP is connected to the ground pin of the Arduino. So temporary WiFi is facilitated, and any data can be displayed since ESP has its own IP Address.

The NodeMCU development kit board v0.9 consists of the ESP8266 chip along with 11 GPIO pins, 4MB flash, one pin

ADC, two pairs UART, WiFi band 2.4GHz, and supports WPA/WPA2 [19]. Figure 1 explains the basic block diagram representation of the proposed farming system.

B. IR SENSORS

Infrared sensors are valuable due to their lower mass and passive capability. They're used for surveillance on the ground and as well as in space-based platforms. IR sensor performance characteristics are omnidirectional, so they're widely used in defense and other commercial systems. It is used as the best measurement device in the farming industry [20].

C. SOIL MOISTURE SENSOR

Measurement of soil moisture content is done by inexpensive sensors that nowadays are used in gardening and Precision Agriculture. Soil moisture level detection is one of the key aspects as it controls the growth of crops.

D. RELAY

Economic activities depend a lot on agriculture, and sustainable smart farming is a way to facilitate the same, for which a relay connection is mandatory. In order to control a circuit, a relay is used as a switch, and it requires 3.75V to 6V for its operation. Apart from this, pumps and LDRs are also used.

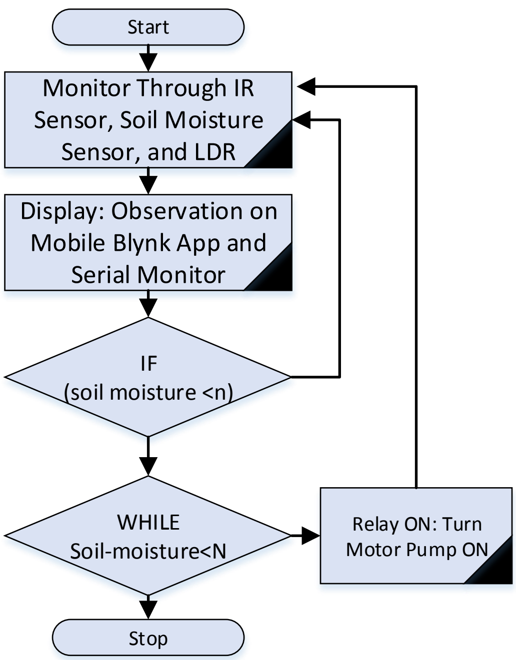

FIGURE 2. Flow chart for smart agriculture.

IV. SOFTWARES

Arduino IDE (Integrated Development Environment) for Windows is required for implementing the code written in Embedded C language. Blynk app is used for the WiFi–Server connection [21]. In general, IDE can be created by Arduino, and the sketches can be written in C or C++. Figure 2 informs the flow process which has been implemented here.

V. RESULTS

The soil sensor is inserted in the soil to sense whether the soil is wet or dry. A combination of hardware and software together makes an embedded system, and it responds in real-time. Jumper wires are required to make the appropriate connections. The hardware model representation is shown in Figure 3, which is connected with NodeMCU via relay and soil sensor.

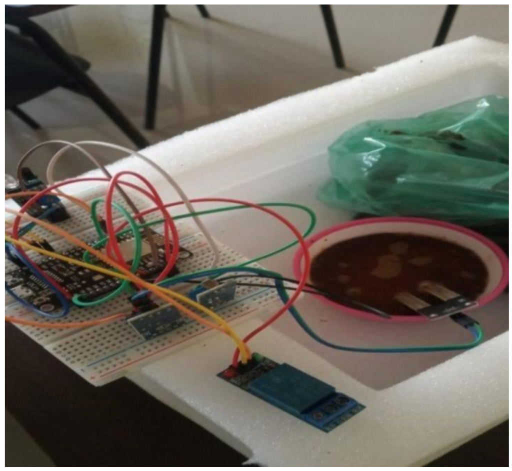

FIGURE 3. Relay connection to NodeMCU for smart farming.

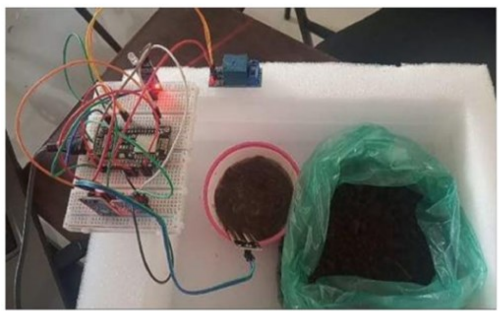

FIGURE 4. Prototype Connection for the Smart Agri System by using NodeMCU and Soilsensor.

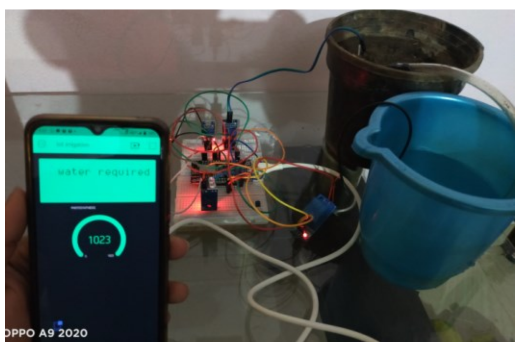

FIGURE 5. Water monitoring display on a Smartphone.

Arduino programming along with motor operation control is a very good decision support system, which not only helps in reducing the waste of water but is also beneficial for determining the hour when the crop needs water. The suggested actions can be implemented in any weather conditions to make smart precision agriculture; for e.g., when the farming area is required to be irrigated, each information will come to the Smartphone, as shown in FIGURES 4 & FIGURE 5, or if an animal attempts to enter the farming area or agriculture field it can be monitored through any mobile Smartphone as is shown in FIGURE 6. One can monitor the output of the smart sensor from anywhere by using the internet. The Blynk app does a splendid job in finding, monitoring, and displaying real-time data only within a fraction of time. From the above prototype system, we are assured of Blynk's effective operation and application, and hence the research model is suitable to be implemented in big farming for smart cultivation for improving productivity.

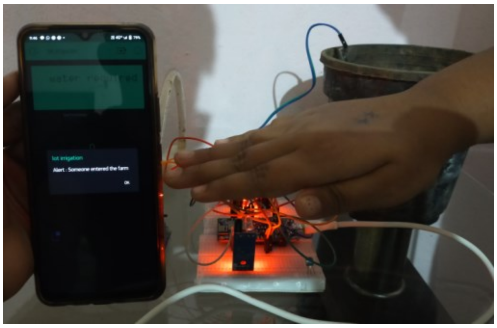

FIGURE 6. Someone entered the farm" alert message displayed

TABLE 2 shows the cost and model which is used in the proto-type research. These results will vary in terms of land area or size, occupancy, location, and environment. As our experiment was conducted for a week to check the accuracy and continuously monitored where data's are automatically reflected in the computer.

TABLE 2
Hardware Cost for Prototype Model

Sr. No	Hardware	Model No	Cost (Indian Ruppe)
1	Soil moisture sensor	REES52	100-200
2	IR Sensor	.	40-50
3	Nodemcu Esp8266	Serial Wireless Module Ch340 Wifi Development Board	400-600
4	5V Relay	1 Channel .	70
5	Micro Submersible Pump Mini water pump	Micro DC 3-6V	50-100
6	LDR		40-60
7	Solderless Breadboard	GL-12 840 Points	100-150

First of all, farmers need to follow a smart irrigation process like reading the soil moisture measurement estimation like which time the irrigation require to their farming field. Because there may be the generation of two choices like a plant needs water or the soil is dry, so it requires water. So the design should be developed with farmer ideas and predictions about the plant/crop production. Based on that, the system developer can satisfy the farmer by implementing the actual system. This approach provides a good farming service for a smart agriculture system. For this, researchers, scientists and engineers, and manufacturing agencies develop IOT based architecture and enhance crop data management.

Latest development technologies are very real future prospects and recommendations for advanced agriculture. Advanced agriculture consists of three different approaches like monitoring soil, crop, and types of machinery. A second approach like sensor information like temperature, stem, fruit size. Furthermore, the last approach such as fertilizer, pesticides, irrigation, etc. Now Smartphone and IoT technology can change by bridging the rural-urban gap and reducing the limitation on delivering systems.

VI. CONCLUSION

In this research, we conclude that an agri-environmental monitoring system is possible through a small prototype design model. Even if the model has a lot of advantages, but many big challenges can be listed. First on the list stays the concerns on hardware cost, software cost, and energy optimization. Secondly, the storage of data and reliability. Thirdly, data accessibility and connectivity and fast real-time deployment. No doubt the sensor can give the sensing location and agriculture parameters, but at what position one needs to place and how many sensors are required for a particular land area, details like these should be thoroughly specified. To achieve better efficiency, these are some of the open challenges in modern smart concepts in the agriculture domain. Even after these advancements, there is still a need for awareness in village people about modern agricultural technologies. Modern agriculture practices not only help to improve the farm output but also contribute to the overall welfare of farmers.

Data transmission in poor internet connection can create harsh environment, but in terms of functionality, it enables a diverse range for communication for physical devices. This work opens up new ideas like implementation on a large area, and field installation with power management and skillful, efficient farmer choice farming by deploying farmer required data for using the best algorithm for the good implementation results better productivity. It also helps in best management like water management, crop monitoring also improves time efficiency and minimizes the human efforts.

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