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COGNITIVE BASED SMART AND SECURE IRRIGATION SYSTEM USING IoT

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ABSTRACT: The IoT cloud based smart Irrigation System is capable of automating the irrigation process by evaluating the moisture of soil and the weather condition (like raining).Agriculture plays a dynamic part in the development of an agricultural country. In India, about 75 percent of people depend upon agriculture and one-third of the nation's money comes from agriculture. Irrigation is necessary for agriculture and it is the process through which a controlled amount of water can be supplied through artificial means such as pipes, ditches, sprinklers, etc. The proposed system is implemented to monitor the whole field. This method is more effective than a normal field monitoring system. Water is an expensive service when it originates to most of the places in the world. This paper proposes and implements a prototype automatic irrigation system along with field protection using IoT. In this case sensors are used to determine whether it is time to water the field or not by measuring different parameters such as temperature humidity and moisture. Sensors are connected to Nodemcu. These sensors can be placed at the plant side to read moisture, humidity and temperature. DHT11 can measure the temperature and humidity of the field. A moisture sensor measures the water content of the soil. The ultrasonic sensor measures the water level in the water storage unit(well).An IP camera is used to monitor the field from the external crossover of animals and other threats to the field. It is also used in continuous monitoring to detect the diseased leaves and plants in the agricultural field. In this system, the irrigation is done by on/off mechanism of motors which relies on sensor parameters.

Keywords: NODE MCU,IoT, Arduinouno, smart irrigation

1. INTRODUCTION

As today's world is trending into modern technologies it is necessary to trend up in the agricultural field also. In India, where 60-70% conservation relies on agriculture, there is a huge need to modernize conventional agricultural practices for better productivity. Due to excess irrigation use of water in the fields the groundwater level is decreasing day by day, lack of rains, and scarcity of land water also results in a decrement in the volume of water on earth.[1][12]

Many researchers are working in the field of agriculture. Most projects signify the use of wireless sensor networks to collect data from different sensors deployed at various nodes and send it through the wireless protocol.

A smart irrigation system, contrary to a traditional irrigation method, regulates the use of supplied water. The feedback mechanism of the smart irrigation system is a moisture sensor a temperature and a humidity sensor. Thermal imaging, capacitive methods, Evapotranspiration (ET), and neutron scattering method and gypsum blocks are some of the technologies which enable moisture sensing. Capacitive sensors, however instantaneous, are costly and need to be calibrated often with the varying temperature and soil type.

The main and important factor of agriculture is to predict the climatic changes, here we are using IoT for monitoring the weather as well as atmospheric changes in the area around the field and throughout the crop field by having several systems in different fields as clients, which is getting reported every time to the server periodically, about the current atmospheric change at that every certain place. So that watering and pesticides can be served based on the conditions of the field. The IP camera used here uses digital imaging techniques to protect the field from external crossovers. Also it is used in monitoring the health of plants by continuous monitoring of plant leaves to detect any disease encountered.

2. EXISTING SYSTEM

V.R.Balajiet al **[2]** proposed a system where it derives power from sunlight through photo-voltaic cells. This system doesn't depend on electricity. The soil moisture sensor has been used and based on the values sensed PIC microcontroller is used to ON/OFF the motor pump. Weather forecasting is not included in the system.Karan kansaraet al **[3]** proposed an automated irrigation system where humidity and temperature sensors are used to sense the soil conditions and based on the values microcontroller will control the water flow. The farmer will be intimated through a GSM module. This system doesn't monitor nutrient content in soil. Archanaet al **[4]**proposed a system in which the humidity and soil

moisture sensors are placed in the root zone of the plant. Based on the sensed values the microcontroller is used to control the supply of water to the field. This system doesn't intimate the farmer about the field status. R.Subalakshmi**[5]** proposed a paper to make the irrigation system simple, the complexities involved in the irrigation system is tackled with the help of automation system using a microcontroller and a GSM module. Based on the values sensed from soil moisture, temperature and humidity sensors, a message is sent by the GSM module to the farmer when these parameters exceed the threshold value set in the program. The nutrient content in the soil is not determined by the system. C.H. Chavanet al **[6]** proposed a system on smart wireless sensor network for monitoring environmental parameters using Zigbee. The nodes in the system send data wirelessly to a central server, which collects data, stores it and allows it to be analyzed then displayed as needed and also be sent to the client mobile. Weather forecasting and the nutrient content is not determined by this system.

Joaquin Gutierrez **[7]** proposed a gateway unit that handles sensor information, triggers actuators, and transmits data to web application. The system is powered by photovoltaic panels and cells and has a effective duplex communication link that allows data inspection to be carried out and to be programmed in the web page.

3. PROPOSED SYSTEM

3.1 Materials and Methods

The proposed system monitors plant parameters using different sensors. NodeMcu is used as the central node. It can be programmed using an embedded C program. Collected data is uploaded to the cloud for analysis and further updates. These nodes are integrated through IoT. There are two sensors in this system. One for measuring moisture, another for temperature and humidity. All the peripherals are connected to NodeMcu. Both sensors are connected to digital pins through the GPIO interface. NodeMcu is connected through IoT. Depending upon the sensor reading and the conditions manually set by the user, the motor will turn on/off adaptively rather than continuously. These values can be monitored using our mobile application. The IP camera is used to detect the external crossover of animals that may cause a threat to the field. They are also used to continuously monitor the health of the plant by analyzing leaf health and detecting any abnormal change. If there is any change detected, then the corresponding screenshot is taken and updated to the user via Email. The ultrasonic sensor placed in the well gives us the percentage of water available for further irrigation.

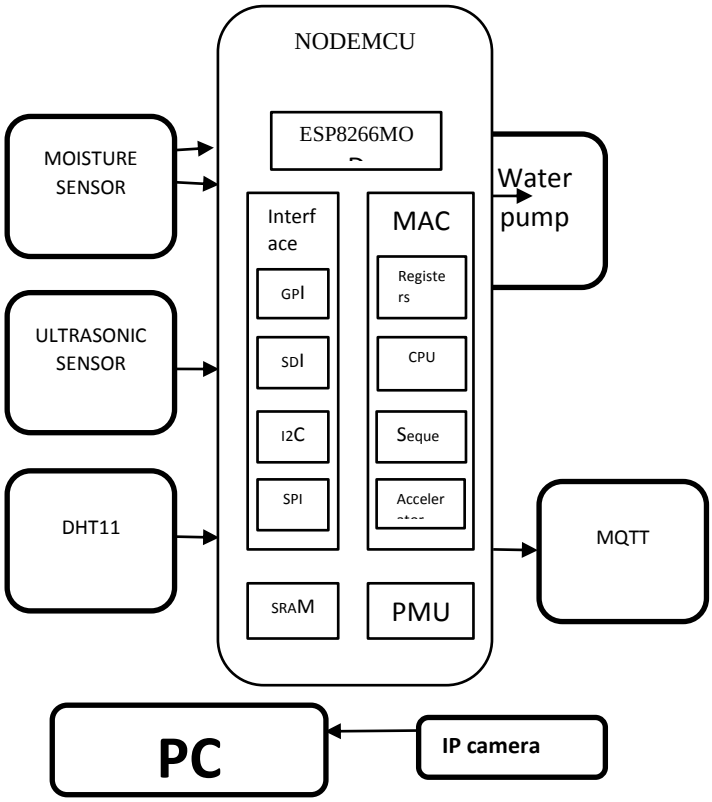

Fig 3.1 Proposed systems

3.2Arduinouno board

The Arduinouno provides Arduino integrated development environment (IDE) which is more reliable. It includes a code editor with features such as syntax highlighting, brace matching, and automatic indentation. The Arduino IDE supports the C and C++ programming languages using special rules of code organization. A typical Arduino C/C++ sketch mainly consists of two functions that are compiled and linked with a program. The Arduino IDE employs the program to convert the executable code into a suitable text file in the format of hexadecimal coding that is loaded into the Arduino board by a loader program in the board's firmware. The proposed system comprises of a water pump which will support to sprinkle water on the land subject upon the land environmental condition such as Moisture, Temperature and Humidity

3.3 Sensor

The ultrasonic sensor is used in the system to detect and find the water level in well. By using a wide variety of ultrasonic transducers and several different frequency ranges, an ultrasonic sensor can be designed to solve many application problems. Temperature and humidity sensor is used to monitor the humidity variation of the environment where the crops are cultivated. DHT11 humidity and temperature sensor are available as

sensors and modules. The main difference between this sensor and module is the pull-up resistor and a power-on LED. DHT11 is a low-cost digital sensor for sensing temperature and humidity efficiently. This sensor could be easily interfaced with any microcontroller platforms like Arduinouno. The moisture sensor detects the wetness or dryness of the soil. Based on the dryness value of the soil the controller controls the pump. This sensor reminds the user to water their plants and also monitors the moisture content of the soil. It has been widely used in agriculture, land irrigation, and botanical gardening.

3.4 WebCams

To monitor the crop field from a remote area we have interfaced with the camera to the system. The camera is used to detect leaf disease and find the animals. Unauthorized access of webcams can present important secrecy issues. Webcams can be used as security cameras. Software is made available to allow PC-connected cameras to watch for movement and sound, recording both movement and sound when they are detected. These recordings can be saved to the computer, e-mailed, or uploaded to the Internet making the system a more secure one. In one well-publicized case, a computer e-mailed images.

3.4 ESP8266 Wifi module

The ESP8266 is a very user-friendly and low-cost device to provide internet connectivity to our project. The module can work both as an Access point(can create hotspot) and a station (can create Wi-Fi), hence it can easily fetch data and upload it to the internet making the Internet of Things as easy as possible. Another exciting feature of this module is that it can be programmed using Arduino IDE which is user-friendly

4. EXPERIMENTAL RESULTS

SENSORS	READINGS	
	Practical	Threshold
Moisture	1024 g/m^3	<600 g/m^3
Temperature	29 ^{0}c	>35 ^{0}c
Humidity	45 g/m^3	>65 g/m^3
Ultrasonic	3 cm	Pump on for >30cm Pump off for <5cm

Conditions of working:

a. When the moisture is <600, the motor will turn ON
b. When the temperature is >35^{0}C, the motor will turn ON
c. When humidity is <65 g/m^3, the motor will turn ON
d. When an external crossover is detected, screenshot is taken and an Email along with the screenshot is sent to the user as showed in Figure a)
e. If an abnormal change is detected in the plant leaf, the system analyzes the leaf for its symptoms, and a corresponding Email along with the screenshot is sent to the user.
f. The percentage of water in the well monitored by the Ultrasonic sensor is updated to the user for future analysis and management of water.
g. All these sensor readings are uploaded to the cloud and can be checked by the user on his mobile with the help of the mobile application.

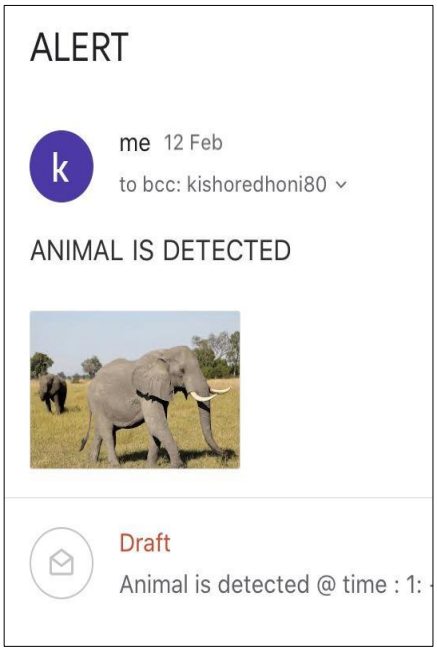

Figure a) Protection Alert

Figure b) Animal encountered

5. CONCLUSION

Importance of controlled irrigations led to the idea of this project. It is very important to have such a system that will irrigate water according to analysis made on soil. The system here implemented has been tested and proved to be very helpful in determining the amount of water to different parts of the farm. This system is more

secure with the help of a surveillance system. The irrigation system helps the farmer by making his work smarter. Overall this system is feasible and cost-effective and a more efficient system among automated irrigation systems. This makes the life easier and simpler.

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