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IoT in Agriculture

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Abstract -Agriculture is the most important enterprise in the world. Agriculture is a production plant where the free gifts of nature such as land, water, air, soil energy, etc. are used as inputs and then converted into a single primary unit that is crop plants and their yield which are indispensable for human beings Irrigation intakes 70% of the world's fresh water supply and often due to errors in various management systems or carelessness, this investment gets wasted. With freshwater becoming scarce, proper planning must be done at the earliest for water management. Our proposed methodology for Smart Irrigation System solves this purpose to a much impact-able extent by collecting data from the sensors that can be used in irrigation, it provides an end-to-end user interface.

Keywords: ***IoT; Irrigation; Sensors;***

INTRODUCTION

Irrigation and agriculture provide 80% of the food supplement to the world population. It is a vast ground level industry that needs more focus and attention than it is currently receiving. With an increased amount of water scarcity in the world, it is time that we plan for a regularized water intake of water in irrigation which currently uses 70% of the world's freshwater quantity. The proposed system provides a fully automated platform for irrigation that would make water proportions exact by elimination of human and machinery error. The main features that the model facilitates are i.) It provides an automated system as well as a manual backup, ii.) Levels all the specifications according to the needs of the land, iii.) Conserves energy, water as well as manpower.

The system uses several sensors extracting values of water levels, chemical levels, temperature, and several other features which in turn controls the water supply as per need. Techniques in Machine Learning algorithms helped to process predictions for water levels and several other notations. The system is not only functioning, but can be used by the farmers through their smartphones. The connection range in between their phones and the system is wide. All the sensors in the model are extremely cheap, thus making the whole idea economically-stable. High range sensors are specifically not used due to the presence of radiations which might harm the crops as bio-hazard cannot be compromised with the staple food industry.

This paper proposes several new features that were not considered previously.

COMPONENTS

Several small components have been used in the system to get the desired results. The real time application of all these components is vast to be discussed simultaneously. Thus, in the following section we focus only on the roles played by these components in our system.

Solar Panel

The component for main power supply is Solar panel. This transmits the solar energy into electrical energy for the system. With the help of this renewable source of energy, we have not only eliminated the factor of constant electrical power supply, but have also helped in lowering the economical effect of the system. The power is formed and stored in a cell attached to the system and then is used according to the need of the other components.

Fig1. Solar Panel

Arduino UNO Microcontroller

The whole system requires to be functional under one single controlling unit. Arduino UNO does the job in this case. The microcontroller takes the input of the sensors and gives output to the water motor when to start or not according to it. It also further sends the report of the sensors to the users via the LoRa module and further accepts order from the user according to it.

Fig 2: Arduino UNO Microcontroller

LoRa

The name is the simple abbreviation of Long Range. Manufactured by Semtech, this medium of connection is far advanced than Bluetooth module or Node MCU. With higher range of connection, this device transmits signal as far as 50 km. It would enhance the point of contact of the microcontroller with the user far and wide.

Fig3: LoRa Module

Sensors

The main integral components for the system can be considered to be the sensors. They are the only medium through which live data gets transmitted from the field for further processing. Thus, the following sensors are being used for the required data.

Soil Moisture Sensor

The sensor is implanted in the soil with its two nodes acting as conductors inside the soil. Current is passed through these two heads and the resistance caused in between conduction due to presence of moisture helps in estimating the moisture level of the soil. Moisture level and resistance value is directly proportional in nature.

Fig 4: Soil Moisture Sensor

Raindrop Sensor

This sensor will be used to detect occurrence of rainfall. Set-up in an uplifted place, to avoid any intervention from any other water sprinkles, this sensor gives the detailed report of when and how much is rain occurring. Like all other sensors, this too gives its input to the Arduino microcontroller which then further gives its further instructions as per required.

Fig 5:Raindrop Sensor

Temperature and Humidity Sensor

This module is used to detect temperature and humidity simultaneously. This sensor, also known by its serial name, DHT11 is being used to receive better level of datasets for the user. All these reports from the sensor can be used by the user to tally and get a better perspective of his land

Fig 6:Temperature and Humidity Sensor

pH Sensor

This module is being used to review the acidity level of the soil. It simply gets connected with the microcontroller and gives the pH level. The acidity level would be followed by the user to track down how much amount of fertilizers or any other chemicals is preferable for usage to the land.

Fig 7: pH Sensor

Relay Module

This is considered to be a simple switching device that controls the flow of instruction or rather electrical charge from one component to another. In this case, the relay module restricts the water pump motor as when to start or when to stop according to the instruction given by the Arduino. Based on the principle of electromagnetic attraction, this device works as an automated switch in between the pump motor and the microcontroller.

Fig 8:Relay Module

METHODOLOGY

Firstly, sensors and microcontroller sense data to survey the ground on a real time basis. The data received from there is then transmitted to the user.

The system starts initially by obtaining power from the solar cell. The solar panel receives the solar energy which is then further used in the system. The solar energy is converted into electrical energy and stored in a voltage unit as well which helps the system in functioning at the time of sunlight deficiency as well.

After receiving power, the first action is performed by sensors as it senses the different factors from the land and reports it to the microcontroller. The electrical energy powers on all the sensors that are placed in the field for readings. These sensors sends their own sets of data which are received by the Arduino UNO microcontroller.

Arduino then functions according to its program. For example, if it is programmed to release water after the decrease of soil moisture to a certain level, it will do so. It would dictate the motor to start or stop according to the moisture content increasing or decreasing than the optimal level. The Arduino and the motor is linked with the relay module that acts as a switch between two of these components.

Arduino then also further sends these data via the LoRa module to the user as well. LoRa as discussed earlier has ahuge range and thus does not face any problem in connecting with the network of the user, thus sending the required data.

RESULTS AND DISCUSSION

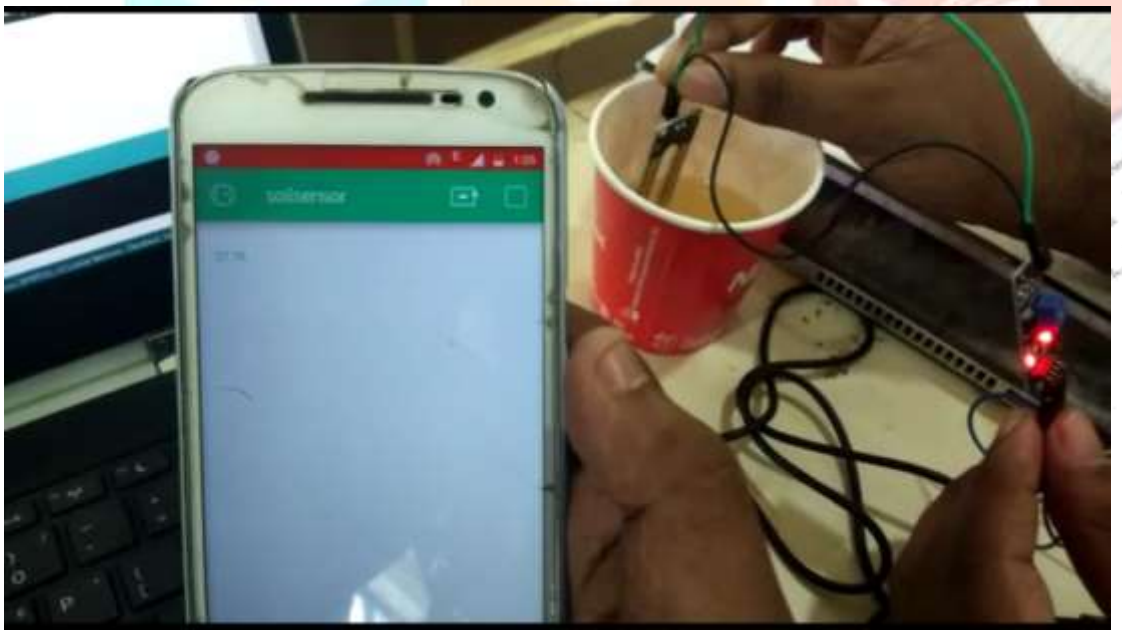
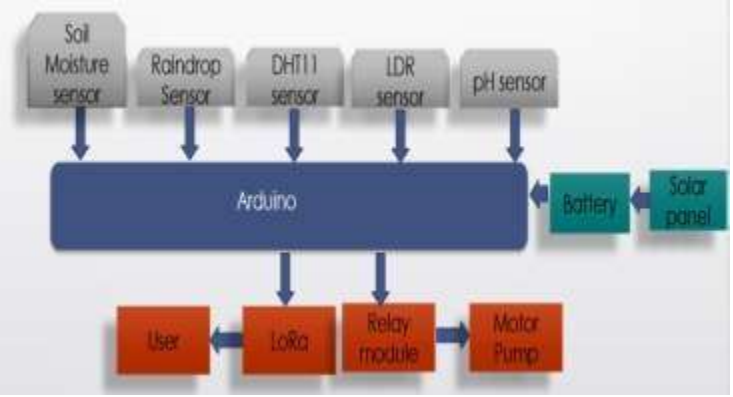


Fig 9: Soil moisture content displayed on blynk app using adafruit library programing with Arduino

User can get these live reports about his land from far away if his device stays connected with the LoRa Module in a web server named Adafruit that displays these values or use blynk app on his phone. On simple modifications made in this, one can connect the Google assistance of the smartphone with the system as well. Making the system to be manually function-able via commands given through Google Assistance. Further we sensors to sense data and applyinf them together is a bit tedious without proper funding.

Fig10:Schematic of the Iot module



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