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Arduino Driven Sensor Networked Smart Farming System

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Abstract: As we all know that Agriculture is one of the major sectors for countries economy, farming is the backbone of it. Now a days the farming and production of crops are getting worst day by day. So, in this paper we have come with a new solution which is totally automatic. The smart farming system include Arduino Uno, water motor, various modules and various sensors. The highlighting feature of this project includes irrigation with smart control and decision making based on accurate real-time field data. Arduino is the main operating system for this project which gives commands to the systems to act as per the received data from various sensors. This system monitors the regular status of the field like temperature, humidity, moisture level, rainfall, with the help of sensors, which are capable of providing live data of the field. It's totally automatic and can be operated by everyone. This project ensures higher quality and larger production of the crops. This system provides smart agro-business with reliable result. For the better production, every time a farmer has to monitor over his crops, either the environmental condition is suitable or not, this system solves all the problems. It is an integrated system with all the features for the better growth and production of crops.

Keywords: Arduino Uno, soil and moisture sensor, temperature and humidity sensor, Wi-Fi module.

I. INTRODUCTION

Arduino based smart farming system is developed for monitoring the status of crop fields with the help of sensors, which are capable of providing live data of the field. It's totally automatic and can be operated by everyone. This project ensures higher quality and larger production of the crops. The smart farming system is reconstructing the agri-business which enables farmers to deal with challenges in the field, for example through the broad range of strategies, such as accuracy and practical farming [19]. The Smart agriculture monitoring system is the prominent technology through which data from several agricultural fields can be collected using different sensors. The collected data are analyzed by professional operators, workers and farmers to draw the conclusions based on different climatic patterns, soil fertility, nature of crops and the amount of water that needs to be supplied to the field. Smart farming can be further advanced by automating several parameters that are essential for the plant growth. We can apply anticipating algorithms and programs on microcontrollers for the calculation of water that will be required for every agricultural area [15]. This system is to provides simple and cost-effective techniques for farmers to enable precision agriculture also guide new farmers and remotely monitoring their field, harvest crops, and control farming equipment with the help of the smart farming application. The information such as temperature, humidity, soil moisture level, the water level of the farmlands intimated to the farmers by the smart farming application and instructs the farmers to follow traditional agriculture to improve the yield, quality of crops, and also the overall production rate [11]. The main aim of this project is to solve the problem faced by old traditional method of farming. Old traditional method of farming required more man power and effort for good quality of food. But nowadays, the traditional method seems impossible because people of this generation demand comfort.so, this system is advanced and automatic with upgraded technologies. The proposed of this smart system

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developed for the agricultural plantation, which is placed at the remote location and required water provides for plantation when the humidity of the soil goes below the set-point value. But in this we did not aware about the soil moisture level so to overcome this drawback proposed system included with extra feature soil moisture value and temperature value which displayed on the LCD display attached to the system.

II. THE PROBLEM

The major problem of the traditional method of farming is as it requires more manual work and effort. Farmers cannot be able to monitor the crops for 24 hours so, because of that sometimes crops will not be able to get the sufficient supply of nutrients, which is required for healthy production. The field of agriculture is facing so many crises in producing more quality crops with fewer resource.

III. PROPOSED SOLUTION

The propose of this system is to minimize the problem faced by farmers. As it is fully automatic and requires less manual work and farmers will be updated with live data of crops in their mobile phone through Wi-Fi module.

IV. COMPONENTS

S.NO	ITEMS	QUANTITY
1.	Arduino Microcontroller	1
2.	LCD Display (16*2)	1
3.	Wi-Fi Module (ESP8266)	1
4.	Soil Sensor	1
5.	Rain Sensor	1
6.	Moisture Sensor Module (LM393 Module)	2
7.	Temperature and Humidity Sensor (DHT11)	1
8.	Light Dependent Resistor (LDR)	1
9.	LED	1
10.	DC Water Pump (9-12v)	1
11.	Single Relay Module (5v)	1
12.	Battery (9-12v)	1
13.	Potentiometer	1
14.	Buzzer	1
15.	Solar Panel	1
16.	10-k ohm Resistor	2

Table No.1

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V. BLOCK DIAGRAM

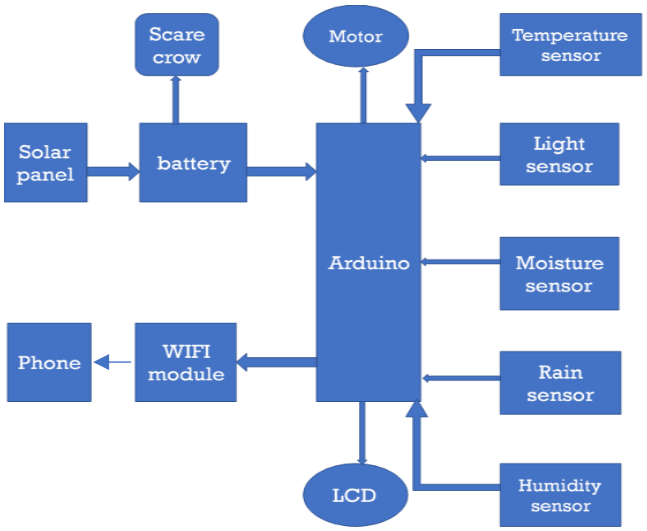

Fig no-1

VI. BLOCK DIAGRAM DISCRIPTION

First solar panel will absorb the solar energy and supply to the dual charging battery. Further the stored battery will supply the energy to Arduino which will control all the system. After that all the sensors perform their tasks and sends the live data of the crops to Arduino. Now Arduino will control all the system and operates as per the received data. If the moisture level is less 40%, than Arduino commands the water motor to turn on, which supplies water to the field. After the moisture level reached above the 40% it will turn off the motor. If there will be raining then the rain sensor will detect and alarmed the buzzer. At night the LDR will sends the information to Arduino, which commands the LED lights to turn on.
After all the live data will be displayed on the LCD board.

Arduino UNO:
The Arduino Uno is an open-source microcontroller board based on the Microchip. The board is equipped with sets of digital and analog input/output pins that may be interfaced to various expansion boards and other circuits. The board has 14 digital I/O pins, analog I/O pins, and is programmable with Arduino IDE via a B USB cable. It can be powered by the USB cable or by external 9-volt battery, though it accepts voltages between 7 and 20 volts.

Wi-Fi module (ESP8266):
The ESP8266 Wi-Fi Module is a self-contained SOC with integrated TCP/IP protocol stack that can give any microcontroller access to your Wi-Fi network. The ESP8266 is capable of either hosting an application or offloading all Wi-Fi networking functions from another application processor. Each ESP8266 module comes pre-programmed with an AT command.

Liquid crystal display (LCD):
The term LCD stands for liquid crystal display. It is one kind of electronic display module used in an extensive range of applications like various circuits & devices like mobile phones, calculators, computers, TV sets, etc. These displays are mainly preferred for multi-segment light-emitting diodes and seven segments.

Temperature and Humidity Sensor:
Humidity sensors are electronic devices that measure and report the moisture and air temperature of the surrounding environment where they are deployed e.g., in air, soil, or confined spaces. Humidity measurements indicate the concentration of water vapor presented in the air.
A temperature sensor is a device used to measure temperature. This can be air temperature, liquid temperature or the temperature of solid matter

Soil and Moisture Sensor:
The moisture sensor is a sensor connected to an irrigation system controller that measures soil moisture content in the active root zone before each scheduled irrigation event and bypasses the cycle if soil moisture is above a user-defined set

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point. It measures the volumetric water content in soil. This sensor uses capacitance to measure the water content of soil (by measuring the dielectric permittivity of the soil, which is a function of the water content). Simply insert this rugged sensor into the soil to be tested, and the volumetric water content of the soil is reported in percent.

Rain Sensor:

A rain sensor or rain switch is a switching device activated by rainfall. There are two main applications for rain sensors. The first is the water conservation device connected to an automatic irrigation system that causes the system to shut down in the event of rainfall. The second is a device used to protect the interior of an automobile from rain and to support the automatic mode of windscreen wipers.

Light sensor (LDR):

The light sensor is a passive device that converts the light energy into an electrical signal output. Light sensors are more commonly known as Photoelectric Devices or Photo Sensors because they convert light energy (photons) into electronic signal (electrons). The sensor receives the light reflected from the target.

Water Pump Motor:

Any form of prime mover or motor that is operated by the kinetic energy, pressure, or weight of water, especially a small turbine or waterwheel fitted to a pipe supplying water. A water pump is an electromechanical machine used to increase the pressure of water to move it from one point to another. Modern water pumps are used throughout the world to supply water for agriculture, industrial, residential etc

Battery:

A battery is a device that converts chemical energy contained within its active materials directly into electric energy by means of an electrochemical oxidation-reduction (redox) reaction. This type of reaction involves the transfer of electrons from one material to another via an electric circuit.

Solar Panel:

Solar panel are those devices which are used to absorb the sun's rays and convert them into electricity. A solar panel is actually a collection of solar (or photovoltaic) cells, which can be used to generate electricity through photovoltaic effect. These cells are arranged in a grid-like pattern on the surface of solar panels. It uses sunlight as a source of energy to generate direct current electricity. A collection of PV modules is called a PV panel, and a system of PV panels is called an array. Arrays of a photovoltaic system supply solar electricity to electrical equipment.

VII. CIRCUIT DIAGRAM

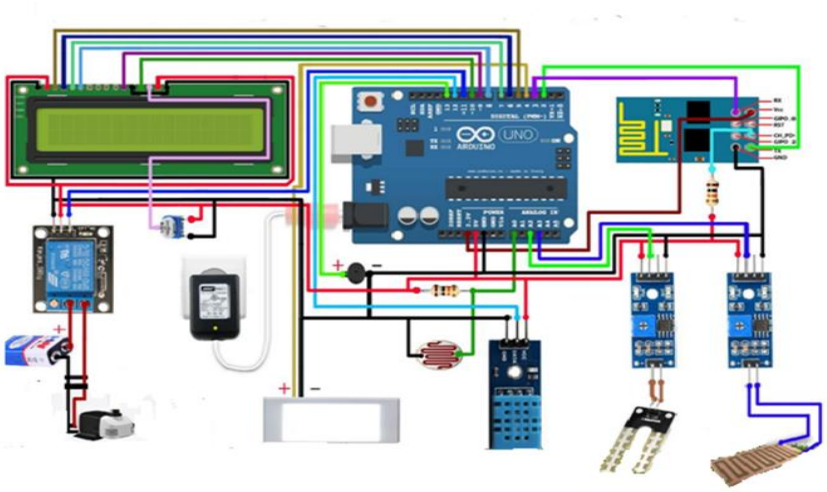

Fig No-2

VIII. CIRCUIT DIAGRAM EXPLANATION

Step 1: First we prepare all the input devices which are all the sensors used in the project.
We connect soil and rain sensors to the moisture sensor module:
The other sensors used are LDR and Temperature and Humidity Sensor which will connect directly to the Arduino Uno micro-controller.

Step 2: Now we will prepare the output devices used in the project.

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The water pump used for irrigation cannot be powered by the Arduino so a 5V relay module is used with it. And glow LED is also used as output device for this project.

Step 3: Connect the Arduino microcontroller with the Wi-Fi module to send data over a local network to the phone. To interface this module with the Arduino:

- Connect the Vcc of ESP8266 to the Arduino 3.3V because it will get damaged at 5V. it works on 3.3V.
- Connect GND of ESP8266 to the GND of Arduino.
- Connect Rx of ESP8266 to the Digital Pin 3 of the Arduino Uno.
- Connect Tx of ESP8266 to the Digital Pin 2 of the Arduino Uno.
- Connect the CH_PD of the ESP8266 to a 10K-ohm resistor and the other end of the resistor to the 5V of the Arduino.

Now the ESP8266 Wi-Fi module is ready to interface with the Arduino.

Step 4: Finally, the LCD display and Vcc GND of all the devices are connected with the 5V and GND of the Arduino. And the required power supplies are connected to the Arduino and the water pump.

IX. APPLICATIONS

1.Agriculture livestock watering, crop irrigation, home gardens.
2.For roof gardening irrigation system.
3.Soil moisture tracking.
4.Remotely tracking of the status of crops**.**
5.Can be used in smart greenhouse system.
6.Monitor climate conditions.

XI. ADVANTAGES

1.It is energy efficient.
2.It decreases water wastage.
3.Eco friendly.
4.It reduces manual labour.
5.It allows farmers to maximize yields using minimum resources such as water, fertilizers, seeds etc.
6.It is cost effective method.
7.It delivers high quality crop production.

XII. DISADVANTAGES

1.High initial cost
2.Bulky solar panel are required for the large power production.
3.Less human labour opportunities.
4.The smart farming-based equipment's require farmers to understand and learn the use of technology. This is major challenges in adopting smart agriculture farming at large scale across the countries.

XIII. IMPLEMENTATION

Arduino UNO is used to control the system as per the data provided by sensors, and sensors senses the moisture level, temperature, humidity, rain, light and send information to the Arduino. LCD (liquid crystal display) displays the live data received from sensors.

XIV. RESULT

Whenever the moisture level is less than 40% the motor will turn on and supply the water to field and if the moisture level is greater than 40% the motor will automatically turn off.
If there is raining in the field the rain sensor detects the rain and buzzer will alarmed and displays the message on the LCD.
At night the light sensor detects the darkness and turn on the lights at the field.
Details of the crops (moisture level, temperature and humidity, rain, lights etc) will display on LCD Board.

XV. CONCLUSION

As we know that agriculture plays a major role in our society. This project mainly focusses on smart farming system. In future, while the people demand the comfort life, it is expected that this project will decrease the manual labor as it is fully automatic.

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This system is also considered as cost effective.

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