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IOT BASED SMART IRRIGATION SYSTEM USING ARDUINO

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Abstract- Every nation has practiced agriculture, which is regarded as both a science and an art of plant cultivation. Agribusiness must also adapt to the times and keep up with new technologies in today's world. Sensors that are connected to the Internet of Things (IoT) are used to collect the data necessary to comprehend agricultural lands in smart agriculture. IoT's essential advantage is the capacity to watch out for Using remote sensor networks for farming, which gather data from numerous sensors set at different areas and send it by means of remote convention. In smart agriculture, the IoT system is powered by the Arduino. It includes a DC motor, moisture, humidity, and temperature. The humidity and moisture content are first measured by the system. The system automatically begins watering when the water level falls below a predetermined range thanks to the sensors. Temperature fluctuations affect how the sensor works. Along with the date and time, IoT also displays information about humidity and moisture level. Altering the temperature based on the crops grown is another option.
Keywords- Arduino, Internet of Things, Temperature, Humidity, Sensors, Soil Moisture, Irrigation

1.INTRODUCTION

In India, agriculture is one of the main employment opportunities. Agribusiness is essential for human survival. Population growth is inversely correlated with agricultural output growth. In essence, the amount of food that can be grown depends on the seasons and whether or not there is enough water available. It is possible to solve problems and improve agricultural outcomes with an IoT-based smart agriculture system.

Frameworks for local and global agricultural checking are designed to provide up-to-date knowledge on food production. Sensors, including those for light, humidity, temperature, and soil moisture A system is designed to track the agricultural field in IoT-based smart farming. Farmers can monitor the status of their farms from anywhere. IoT-powered smart farming is far more efficient than traditional farming. The Arduino and DHT11 Sensor are used in the suggested Internet of Things-based water supply. It will transmit data to the ThingSpeak server in order to monitor the state of land and automatically water the plants based on the moisture level of the soil [1].

Autonomous irrigation systems are now possible thanks to the development of WSN and IoT technologies, as well as recent advancements in agricultural irrigation system sensors. The system will recognise the factors that irrigation systems measure, such as water amount and quality, soil properties, weather conditions, and fertiliser application [2]. Also, it will give a rundown of the wireless technologies and nodes that are most typically used for the installation of Wireless sensor network and IoT-based smart irrigation systems.

2. LITERATURE SURVEY

In an IOT based crop Prediction and Irrigation Automation System, the process of monitoring a crop field is described. A system is built with the use of sensors, and the irrigation system is autonomous depending on a server's choice made using data collected from the sensors. The detected data is wirelessly transferred to a database on a web server [3]. When irrigation is mechanized, moisture and temperature fields are reduced to levels below their potential. The system may be monitored and controlled remotely by the user using an application that provides a web interface [1].

Smart agricultural monitoring systems employ the manual technique, which is one of the most traditional approaches in agriculture [4], to validate the parameters. The reading is independently calculated and every parameter is checked by farmers using this procedure.

The system focuses on developing equipment and tools to manage, analyse, and notify users by leveraging the benefits of a wireless sensor system [1]. With the use of automated processes and Internet of Things (IoT) technology, agriculture is intended to be transformed. Using cloud computing systems, which are used at the system's final end, it is possible to construct a whole computer system that includes detectors and tools for viewing data from crop land [5]. It provides a novel smart farming method by wirelessly connecting a smart sensor system and a smart irrigation system[6].

This system has an inexpensive installation fee. In this case, the agricultural system may be accessed and controlled via a laptop, smartphone, or computer [7].

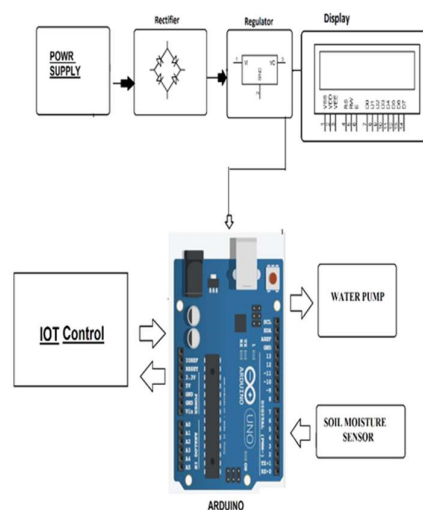Fig. 1. Depicts the block diagram of the proposed model.

Fig.1 Block Diagram

3. REQUIRED MODULES
3.1. Arduino UNO
The Arduino Uno R3 microcontroller board, which is based on the Atmega328, is shown in Figure 2. It contains 6 analogue inputs, a 16 MHz crystal oscillator, 14 digital input/output pins, a USB port, a power connector, an ICSP header, and a reset button [6].

Fig. 2. Arduino UNO

3.2. Soil Moisture Sensor
Fig. 3. depicts a soil moisture sensor that is used to measure the humidity level in the sand. When the sensor determines a lack of water in the field, the module's output is high; otherwise, it is low [8]. Along with measuring the soil's moisture content, this sensor also informs the user to water their plants [1]. It finds extensive usage in gardening for medicinal purposes as well as irrigation in agriculture.
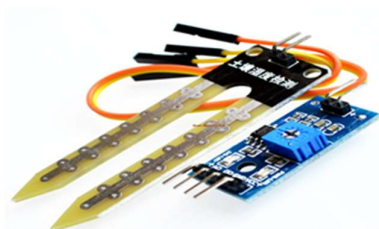

Fig. 3. Soil Moisture Sensor

3.3. Temperature and Humidity Sensor (DHT-11)
This sensor monitors the atmosphere's temperature and humidity (DHT-11). According to Fig. 4, the DHT-11 is a straightforward, inexpensive computational temperature and humidity sensor. It makes use of a capacitive humidity sensor and a thermistor to monitor the ambient air and deliver a digital signal on the data pin [8]. By measuring the resistance difference between two electrodes, the DHT-11 calculates relative humidity.

Fig. 4. DHT-11 Sensor

3.4. Relay
A switch that is electrically operated and has a relay is shown in Fig. 5. It has control signal input terminals as well as functional contact terminals. The switch may have several connections that interact in various ways to form or break circuits [7]. A relay is utilised to turn on the water pump, keeping the crop wet.

Fig. 5. Relay

3.5. Water Pump

A cheap, DC 3-6V tiny submersible pump motor is shown in Fig. 6. It requires a power supply that is between 2.5 and 6 volts to function. With a 220mA current consumption and a pumping capacity of up to 120 litres per hour. Simply attach the tube pipe to the motor port, put it in water, and turn it on [6].
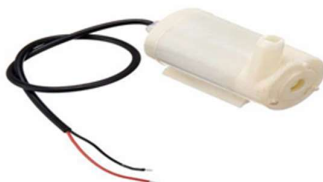

Fig. 6. Water Pump

3.6. Battery(5V)

An electric battery is a source of electricity composed of one or more electrolytic cell connected to the outside world. When a battery is supplying power, the cathode and anode are the negative and positive terminals, respectively. The charged particles that will commute to the positive electrode via an outer electric circuit will originate at the negative terminal.

Fig. 7. Battery

3.7. Resistor

Electrical resistance is implemented as a circuit element using resistors, quiet two-terminal electrical components. Electronic circuit elements called resistors are employed for a number of purposes, including lowering current flow, modifying signal power, splitting voltage levels, skewing active substances, and terminating transmission lines. Raised variable resistors may dissipate many watts of electrical power as heat and are used as test loads for motor controllers, electrical distribution systems, and generators.
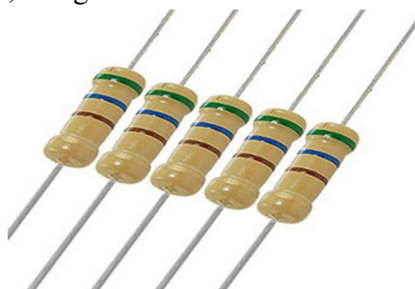

Fig. 8. Resistor

3.8. Arduino IDE

To create and find the attached to Arduino boards, open-source software known as the Arduino IDE is used. The IDE programme works with Windows, Mac OS X, and Linux among other operating systems. C and C++ are assisted languages. The term used here is Integrated Development Environment.

In the Arduino IDE, sketching is a term used to describe programming or coding. We must attach the Arduino and Genuino boards to the windows machine the IDE in order to upload the sketch formed in the Arduino IDE programme. The.ino file extension is used to store the sketch.

4. OPERATION

The smart agriculture system is able to monitor crops which is tested under various conditions. Under all climatic conditions, the soil is tested with a soil moisture sensor, and the results are correctly construed. Under various weather conditions, measurements of the humidity output are begun taking and updated.

Two soil moisture sensors allow us to measure the soil's moisture content and transmit that data to the Arduino. In that spot, install the soil moisture sensors. The Arduino receives the signal from the sensor, but since plants need water when the soil is dehydrated, this tells us that the planet is dry [9]. When the Arduino sends a signal to the relay module, the water pump turns on immediately. The duration can be changed by modifying the code. The entire amount of water coming from the water pump stays in one place, crops might be damaged. A servo motor can be used to spin the pipe in a loop from one position to another, solving this problem.

5. ADVANTAGES

• It is affordable to purchase and simple to maintain.

• The needed components are readily accessible.

• Utilizing the internet to check the status on a laptop or smartphone provides benefits. Even without a farmer present, the information is current.

• The data that is gathered is constantly revised, keeping the farmer updated of the crop's status[1] .

• Additional sensors can be used to obtain crop information that are more precise and effective.

6. RESULTS AND ANALYSIS

The primary goal of this project is to apply cutting-edge technology to critical industries such as agriculture. Through the use of IoT technologies, this solution simplifies agricultural monitoring. The benefits of saving labourers and water are especially important in today's agricultural climate. So, agriculture on agricultural lands with sensor networks is smart. Cloud technique is used to deliver IoT data to customers. As a result, any changes in the crop are readily apparent, allowing for early investigation. [7]. Fig. 9. depicts the components of the kit for the proposed model.
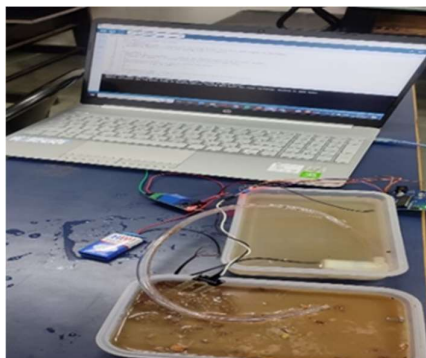

Fig. 9. IoT based automatic irrigation monitoring system

Table. 1. Irrigation for Different Crops

Crop	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5	Total Water Required (Litres/Acre)
Rice	(1-30) Days 5%	(31-60) Days 20%	(61-90) Days 40%	(91-120) Days 30%	(121-150) Days 5%	87,50,000
Sugar Cane	20%	25%	40%	10%	5%	60,00,000
Wheat	5%	20%	40%	20%	5%	26,37,000
Potato	5%	20%	40%	20%	15%	45,00,000
Corn	5%	20%	40%	20%	15%	27,30,000

The proposed method for supplying water to the crop divides the crop's total duration into five distinct stages. As a result, the proposed method provides the crop with the necessary amount of water based on the stage of the crop. Table 1 depicts it. We gathered data for various crops such as rice, sugar cane, wheat, potato, and corn in the table and divided each crop's duration into five stages. Because different crops require different amounts of water at different stages, we cannot irrigate the entire crop with the same threshold value. As a result, the table displays the percentage of total water at five stages per one acre of land. Depending on the crop and water requirements, the motor will automatically turn on and off. The below table shows the water requirements per acre of crop at various stages.

7. CONCLUSION
Smart farming will benefit from IoT. By predicting moisture and soil moisture levels, the innovation can monitor and control the irrigation system.

In several aspects of farming, IoT significantly improves time effectively, flood control, crop scouting, soil conservation, and weedkiller and insecticide control. Furthermore, this technology helps to reduce the amount of human labour required, streamlines farming techniques, and promotes precision agriculture. In spite of the advantages this system offers, the farmer market can be expanded at the touch of a finger and little effort thanks to smart farming [10].

8. FUTURE SCOPE
The project has the potential to add new features and enhance the usefulness of the system in a number of ways, including:

• Set up a web camera in the system to take pictures of the crops, and the data can then be saved in a database[4].

• For less literate users, the system could be grew with a speech-based option.

• The incorporation of the Global Positioning System, or GPS, allows for the supply of the farmers precise location as well as more accurate weather data for croplands and gardens.
• To make things simpler for farmers who only speak their regional language, regional language features can be included.

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