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Design of Security Surveillance and Automatic Water System for Agriculture

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Abstract*:* As automation technology progresses, life becomes simpler and easier in every manner. Automatic systems outnumber manual methods in today's world. The automatic system is a developing system of daily objects, ranging from industrial machines to consumer items that can execute duties. The same automation when introduced in agriculture activities will helps farmers in getting good crop. The farmer's dependency on the seasons reduces productivity and constitutes a barrier to the achievement of the food self-sufficiency strategy. Some framers who are involved in mango, guava farming has theft of crop. To solve the problem, an agricultural instrument based on information and communication technologies is required. The goal of this work was to create a programmable microcontroller chip that could regulate irrigation autonomously and also provide security by capturing and storing the data of the persons visiting the filed. An arduino microcontroller is programmed to sensor the moisture level of plants at a specific point in time; if the moisture content is less than a predetermined threshold based on the specific plant's water requirement, the necessary amount of water is delivered until it passes the threshold. Farmers did not have to irrigate their crops by hand and can also check the saved data of on filed trespassers, this helps farmers to identify the persons in case of crop theft.

Keywords: *Arduino, Sensors, automatic irrigation, Moisture Content*

1. Introduction

Freshwater is required for food and energy production, industrial manufacturing, and human and environmental requirements. According to AQUASTAT statistics, the agriculture sector uses 69 percent of total extracted freshwater, the industrial sector uses 19 percent, and the balance is utilized by the household sector [1]. As a result, water might be seen as a vital demand in the agricultural sector for sustainable ensuring of food security.. However, the ongoing growth in demand for water by the residential and large scale industry sectors as well as increased concerns about environmental quality, have made it difficult for any country to cut agricultural water usage while meeting fresh food requirements [2]. As a result, there is a great need to strengthen science- and technology-based water-use strategies. To reduce the wastage of water, the researchers and industrialists are attempting to efficient and cost-effective automatic methods to manage water consumption. Irrigation is a man-made sprinkler used for the purpose of developing agricultural. Soil factors such as soil moisture and temperature influence the quantity of water required by the soil. Effective irrigation may impact the entire growth process, and irrigation system automation employing cont emporary technologies can give improved irrigation management. The majority of irrigation systems are administered by manual process. These traditional irrigation methods can be replaced by automated irrigation techniques in order to use water more productively and successfully.

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Traditionally, farmers have always been present on their farms to finish the irrigation operation. Nonetheless, today's farmers must balance their agricultural activities with other responsibilities. A sensor-based autonomous irrigation system may be a feasible solution for farmers in situations when the involvement of an operator in the field is not required throughout the watering operation.

The circuits designed for agriculture activity is controlled by a hardware platform which is programmable and the device is called as Arduino. The fundamental component of the Arduino interface board consists of chips with integrated circuits (IC) that may be programmed using embedded c programming language. The design of this controller is by Atmel Company. Based on the project requirements, the device can read the input, run the programmer, and provide a variety of outputs. In this article, the main focus is on the creation of automated irrigation system using the Arduino controller with different interfaces that are required. One of the main interface component used is soil moisture sensor by which the humidity present near the plant and on ground will be identified. Depending upon the value of moisture range the setup installed for automation of water supply will be activated and the water is distributed until the moisture range reaches i.e. saturation point of the water required.

2. Related Work

The author presented an Automatic Irrigation System (AIS) for various crops using a Wireless Sensor Network (WSN) to deploy sensor nodes in the agricultural field in [3]. Sensor nodes simultaneously measure soil temperature, sunshine, pH, relative humidity, and groundwater factors, as well as different types of soil and crops.

A low cost automatic irrigation system for gardens in home is designed by the author in [4] using Arduino Uno and other different type of sensors required. Solenoid valves, flow sensor and pipelines are utilized by the author. When there is drop in water level the valves that are connected to pipe line will be opened automatically and flow of water to the garden. The authors of [5] propose an Arduino-based Automatic Plant Watering System, in which they constructed the Arduino microcontroller, which is utilized to operate two practical modules. The main sensor interlinked for automatic supply of water based on the soil moisture is moisture sensor.

In [6] author proposes a smart drip irrigation solution for home automation utilizing Raspberry Pi and Arduino. The drip system is very much useful as the system delivers water slowly to the roots of the plants with the help of small tubes and every point has a valve to manage the supply of water. The system's water flow may be regulated remotely via email. The authors of [7] explored a highly precise thermostat depending on ARM9, which includes an S3C2440A microprocessor, a temperature probe, and controlling is done by Fuzzy logic technique.

The author in [8] suggested a wireless sensor networks for agriculture system by using different type of sensor that are utilized to solve the need of irrigation system without the presences of human. The process of automatic drip system is designed and proposed by author in [9] with the use of sensors and controller devices. The system included a microprocessor, a wireless module, and sensors which are suitable for agricultural sensors which includes temperature, humidity, and soil moisture sensors. An investigation on online farming using embedded devices and wireless sensor networks is performed. In [10] the author utilizes sensors like temperature, soil moisture, level of water system, a PIC type microcontroller, a water pump, and Zigbee connectivity for system. The watering of IoT plants was examined in [11] utilizing a humidity sensor, water level sensor, moisture sensor, Ethernet, a light sensor, a temperature sensor, a humidity sensor, a water level sensor, and a solenoid valve. A multi-threading design for solar-powered irrigation systems was created, and the system included a sensors like temperature, soil moisture, water level, Raspberry PI, and a solar panel water pump [12].

3. Design Implementation

The design implemented is to monitor the level of soil moisture continuously. When the level of moisture is lower, the system responds to the sensor and supply water from the overhead tank to the agriculture field. When the moisture is maintained to required level the supply of water will be stopped automatically. The block diagram of our suggested automated irrigation system is shown in Figure 1. The controllers used in the suggested model are listed in figure 1. All the components are interfaced with arduino as per the requirement for irrigation development. The battery used in the implemented design is 5V to 9V which is DC, an AC converter, or a solar panel, whereas the water pump requires a separate 12V battery.

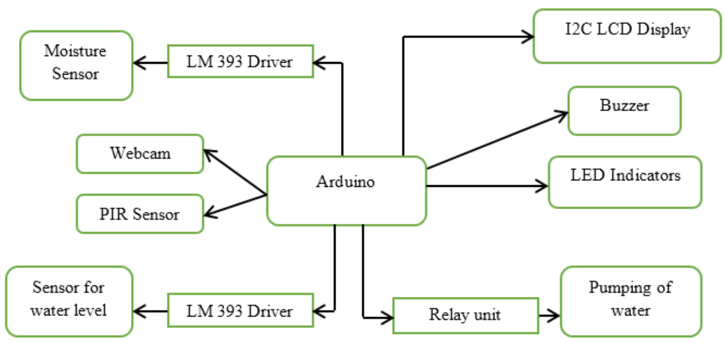

Fig.1. Proposed System model

The experimental setup for performing the proposed approach is shown in figure2. The connections are made as per fig1 for executing the proposed framework.

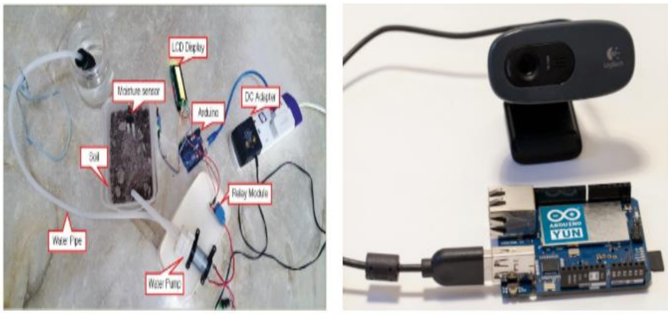

Fig.2. Experimental Setup

The value received by the Arduino from the moisture sensor is displayed on the LCD display in Figure 2. Simultaneously, the obtained data is delivered to the relay module, which determines the on and off system of the water pump. If the criterion for turning on the water pump is satisfied, the water pipe connected to the pump will begin to pull water from the water source and push it to the other side of the water pipe to finish the watering operation for the soil. While interfacing the soil moisture to controller pin A0 is used to validate the threshold levels before converting to digital. The value of sensor from the soil moisture sensor is read by the code section in Fig 3. The analogue result is then converted to a digital result, which is then used to either switch on the water pump or displaying on the panel board of LCD. In the code fragment's last sentence, the higher bound 400 is set to 100% while the lower bound 900 is set to 0%.

```
void readSensor()
{
sensorvalue=analogRead(A0);
sensorvalue=constrain(sensorvalue,400,900);
soil=map(sensorvalue,400,900,99,0);
}
```

Fig. 3. Reading of sensor using embedded C language

The code developed to interface the moisture sensor to microcontroller to find the percentage of wet or dry condition of the soil. The code is shown in fig 4. Based on the value displayed LCD the water pump will be turned open or closed. The threshold level is programed so that below 35% soil moisture level is indicated to pump the water automatically. When the moisture level of soil reaches 60%, the water pump is turned off. This process will be continued and very much helpful for the farmers.

```
void loop()
{
readSensor();
lcd.setCursor(0,0);
lcd.print("Moisture = ");
lcd.print(soil);
lcd.print("%");
if (soil <= 38)
{
lcd.setCursor(0,1);
lcd.print("Pump : ON ");
digitalWrite(WATERPIN,LOW);
while(soil <= 47)
{
readSensor();
delay(100);
}
lcd.setCursor(0,1);
lcd.print("Pump : OFF");
digitalWrite(WATERPIN,HIGH);
}
}
```

Fig.4. Pumping of water and display in LCD

One of the primary activities in this the suggested work is the measure of moisture is soil. To monitor soil moisture, the sensor used copper plates as electrodes. Electrical voltage is converted into digital data for measuring the soil moisture. Table 1 shows the outcome.

Table1. Percentage of moisture w.r.t volume of water

Volume of water (cc)	Percentage of Moisture
1	31
2	34
3	38
4	41
5	49
6	54
7	60
8	62
9	67
10	69

After checking the soil level and performing the operation of water management, the webcam gets activated and records the data. In this study, PIR sensors are employed for thermal sensing applications such as security and motion detection. They're often employed in security alarms, motion detection alarms, and automated lighting purposes. The webcam and PIR sensor is linked. The data recorded is saved in external memory device. Once the PIR sensor is activated the camera records the data of surroundings to maximum extent. The data stored in external device can be viewed anytime. The only limitation is space availability of to store data once the device is full the data cannot be saved. So the data need to be checked at least every week and free-up the data.

4. Conclusion

The primary focus of this study is to describe a development in irrigation system by making automation of distributing the water to crop without the involvement of of human and also provide protection of crop from theft. The implemented automated irrigation system has shown to be a feasible and cost-effective method of utilizing water resources for agricultural output. It was discovered that the suggested approach regulates the moisture content of cultivated land soil. The motor will automatically start pumping water if the soil is dry and will stop when the soil's moisture level is maintained as necessary. Aside from the automatic irrigation system, the suggested system includes a monitoring feature that allows users to monitor the values of soil moisture level on the provided LCD display**.** Furthermore, this water precaution may be extended by assigning auto lift gates to drain the access water during rainstorms and other natural disasters and also the data recorded by webcam can be sent via mail or watsapp to the concern owner of the crop using GPS modules and IOT.

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