Irrigation Management System Using Soil Moisture Sensor and Arduino

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Abstract – This paper provides us with a method to check the moisture level of the field and control the water supply to the irrigation field using Arduino and moisture sensor. The control is to make the system on and off remotely that is without any human intervention by design and development according to the level set on the system. This project helps the farmers to irrigate the farmland in an efficient manner with automated irrigation system based on soil moisture. The system uses an automatic control by using microcontroller devices. The power supply given to the system helps to drive the motor and LED to work and is also the source of power to Arduino. In the proposed system, the water level can be updated accordingly and the irrigation status is sent to the server or local host. Java platform is used to communicate with the microcontroller. It's a strategy which aims at high efficiency of water and electricity. Intrinsically it's a method to reduce water consumption and providing uniform water to the crop leads to growing yield.

Index Terms – Arduino, LED, Soil Moisture Sensor, UNL 2003.

1. INTRODUCTION

Water is one of the most important resources of our living but due to growing pollution there is much stress on water requirements and the scarcity is growing day by day. Hence its necessary to use the water in judicial manner. Thus, the automation of water control is necessary. The amount of water given is in excess of the plant needs. The automated control is used here to avoid wastage of water and to control non uniform water for the soil which results in less yields. For we've recommended system that's Arduino based irrigation management system.

In this system when the power supply is on, the moisture sensor checks the moisture in roots of the plant. If the machine encounters low moisture level, then automatically the driver motors and the pump starts operating by which water is supplied to the field and after certain level the report is sent to user to off the power supply. And if the level exceeds fixed value soil moisture will sense and LED will start glowing. This will indicate the user to stop the power supply. And if the machine encounters low moisture level then automatically the driver motors and the pump starts operating by which water is supplied to the field. After certain time the report is sent to user to off the power supply.

2. RELATED WORKS

2.1. Related Works

The project more useful in watering plants automatically without any human interferential. Many irrigation systems exist such as,

1. Monitoring of rice crops using GPRS and wireless sensors for efficient use of water and Electricity. (ICE2T 2016)

2. Wireless Sensor Based Remote Monitoring System for Agriculture Using ZigBee and GPS. (EECCIS 2014)

3. Design of Embedded System for the Automation of Drip Irrigation. (IJIET 2013)

4. Sensor Based Automatic Irrigation Management System (ISSN 2015)

5. Smart Agriculture: An Approach Towards Better Agriculture Management. (OMICS 2014)

2.2. Drawbacks of Related Works

1. Slow response to changes in soil temperature and soil moisture.

2. The soil has to be calibrated for each different type of soil.

3. Sensors are required in abundant quantity.

4. Require regular maintaining.

3. PROPOSED MODELLING

3.1. System Architecture and Description

3.1.1. Arduino

For building electronic projects, open source software Arduino is used. It contains a physical programmable circuit board and an integrated development environment or IDE used to convert computer code to physical board. It is easier to use than most other hardware for this purpose as it can be connect using a USB. This microcontroller board is based on ATmega8 which has 14 digitalized pins (of which 6 can be used as PWM

outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button.

3.1.2. Soil moisture sensor

A soil moisture sensor measures and regularly reports the relative moisture in the soil. The sensor is composed of two metal plates with a non-conductive polymer film between them. Moisture from the soil is collected onto the film which causes small changes in the voltage differences between the two plates of the sensor, these are then converted into digital signals.

3.1.3 Water Pump

The water pump is used to artificially supply water for a task. It can be triggered ON/OFF by sending signals. This is project employs the use of a small water pump which is connected to a H-Bridge. All other processes depend on whether water is descending from a higher elevation or some pressurized plumbing system.

3.1.4 DC Motor

A current carrying conductor is placed in a magnetic field, it experiences a torque and has a tendency to move. This principle is applied on the working of Direct Current motor.

3.1.5 ULN 2003

Ideally suited for interfacing between low-level logic circuitry and multiple peripheral power loads, the Series ULN20xxA/L high-voltage, high-current Darlington arrays feature continuous load current ratings to 500 mA for each of the seven drivers.

The figure Fig 1 shown below explains the system architecture of the project. It briefly explains the connection of each device with each other. Power supply is given to Arduino and UNL 2003. The rest of the devices take the power from the Arduino and UNL 2003
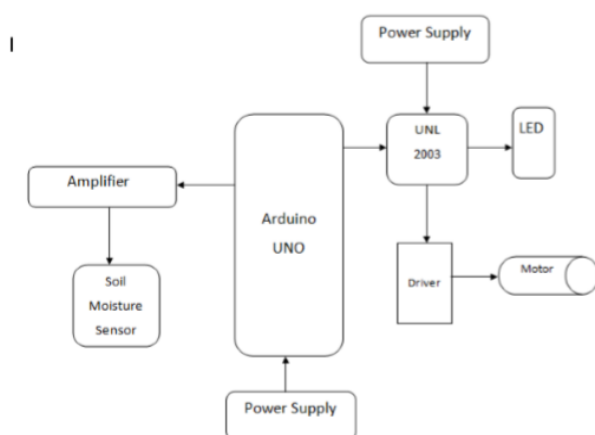

Fig 1 – System Architecture

3.2 System Implementation

3.2.1. Hardware Installation

Prototype is made by preparing components, tools, and materials. The components are completed and co-ordinated with the criteria of the project. Arrangements are done to the circuit on the PCB matrix according to the hardware setup diagram provided. It includes the following:

1. Assembling Relay Driver

2. Humidity Sensor

3. Assembling the pump

4. Stringing DC motors

Female-female and male-female cables are connected accordingly. DC motor is used for mixer circuit. Since the DC motor used only has a voltage of 12 volts, required amplifier performance should not burden the Arduino. For this, a relay module is used as an amplifier circuit DC motor. Also uses a 9 volt as power supply. It is connected to a power source using a USB power source on Arduino Uno.

3.2.2. Software installation

The open-source Arduino Software (IDE) is used to write code easily and upload it to the Arduino board. It can run on multiple platforms like Windows, Mac OS X, and Linux. Java is used to write in this environment and it is based on Processing and other open-source software. Any Arduino board can be programmed using this software. Arduino was launched at the Ivrea Interaction Design Institute with the purpose of providing an easy tool for quick prototyping, specifically for the students with or without knowledge in electronics and programming. It is an open-source prototyping platform based on easily operable hardware and software. Arduino programming language (based on Wiring), and the Arduino Software (IDE) can be used, based on Processing.

Steps for using Arduino IDE:

Step 1: A standard USB cable is taken (A plug to B plug) along with the Arduino Uno board.

Step 2: Arduino environment is downloaded. The download page is searched for the latest version of the environment. The downloaded file is unzipped after download finishe and the folder structure is preserved. The folder is double-clicked to open , viewing the files and sub-folders inside.

Step 3: The Arduino Uno, Mega, Duemilanove and Arduino Nano draws power automatically from the USB or an external power supply. The power source is selected with a jumper. Arduino board is connected to the computer using the USB cable. The LED (labelled PWR) should be lit.

Step 4: Install the drivers for the Arduino Uno with Windows7, Windows Vista, or Windows XP

Step 5: Launch the Arduino application: Double-click the Arduino application. The preferences dialog can be used to change the language if it loads in the wrong language.

Step 6: Open the LED blink. example sketch: File > Open > Temp_and_humid.ino .

Step 7: Select the board: It is needed to select the entry in the Tools > Board menu that corresponds to the respective Arduino.

Step 8: Select your serial port: The serial device of the Arduino board is selected from the Tools | Serial Port menu. This is likely to be COM3 or higher. Reconnect the board and select the required serial port.

Step 9: Uploading the program: Click the "Upload" button in the IDE. In a few seconds - RX and TX led will start flashing on the board. In case of successful upload, the message "Done uploading." will be displayed in the status bar.

3.2.3 Coding

```
Int val = 0;
Void setup()
{
pinMode(8, INPUT);
pinMode(9, OUTPUT);
digitalWrite(9, LOW);
}
Void loop()
{
 val = digitalRead(8);
 if(val==0)
 {
 digitalWrite(9, LOW);
 }
 if(val==1)
 {
digitalWrite(9, HIGH);
}
}
```

4. SYSTEM IMPLEMENTATION

The water is supplied in the field. After reaching a level set in the Arduino, the LED glows and indicates the farmer that the water supply need to be stopped. Power supply is given to the Arduino. This power generated is used by soil moisture sensor. UNL is provided by different power supply through which

driver motor and LED works. UNL and Arduino is connected and the whole system works. The work flow is shown in Fig 2:
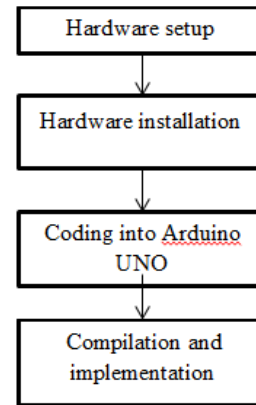

Fig 2: Work Flow Diagram

5. RESULTS AND DISCUSSION

The soil moisture sensor senses the water level in the soil and the LED glows. The flow of water is controlled by the farmer after he gets the indication by the system. The LED glows only after a certain level set in the Arduino is attained.
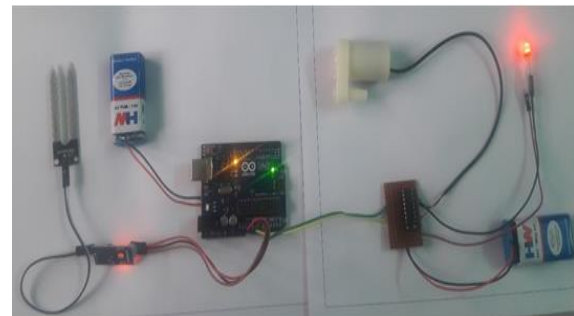

Fig 3: Model Diagram

6. CONCLUSION AND FUTURE ENHANCEMENT

In the project, the primary applications for this project are for farmers and gardeners who do not have enough time to water their crops/plants. It also includes farmers who waste a lot of water during irrigation. Minimising water usage and chemical leaching is becoming necessary as the water supplies getting scarce.

Further in the extension of this project, fertilizers required for the crops, best crops to cultivate for the particular climatic and soil conditions are updated to server at regular basis by monitoring soil PH level, Temperature level of the field area etc., By using PC host, crop is continuously monitored. Also LCD is used to display the PH, temperature and moisture level. This will improve the cultivation method and leads to better productivity.

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