JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

Automatic Plant Irrigation System using Arduino

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Abstract

During evolving agricultural challenges, precision water management is paramount. Our study presents an Automatic IrrigationSystem (AIS) employing Arduino technology technology. With soil moisture and temperature sensors, the AIS regulates water delivery, optimizing crop health and resource utilization. This cost-effective solution enhances agricultural efficiency, supporting sustainable practices in modern farming.

Keywords-Arudino,Dth Sensor, Ultrasonic sensor, Moisture sensor, DC Motor,12v Adapter, water pump water.

1. INTRODUCTION:

In contemporary agriculture, the efficient management of water resources is essential to ensureoptimal crop growth and sustainability. The Arduino platform, known for its versatility and ease of use, allows for the integration of various sensors and actuators to create customized irrigation systems tailored tospecific crop requirements and environmental factors.

2. EMBEDDED SYSTEM

It has hardware.It has application software

It has Real Time Operating system (RTOS) that supervises the application software and provide mechanism to let the processor run a process as per scheduling by following a plan to control the latencies. RTOS defines the way the system

works. It sets the rules during the execution of application program.A small scale embedded system may not have RTOS.

3. PROPOSED SYSTEM

The farm monitoring system is a mixture of hardware and software additives. includes embedded systems and software program is the Arduino ide.The Arduino ide displays readings fromsensors are inserted using the hardware.The special sensors used are temperature and humidity sensor and soil moisture sensor.This proposed technology is an amalgamation of different sensors, microcontroller and communication medium to help the farmers to work on their farms

4. COMPONENTS

ARDUINO UNO:

The Arduino UNO is a popular standard board that is currently on the market. Its main feature is ATmega328 chip; it doesn't contain a lot of SRAM and flash memory which limits the programs. Arduino consists of 8bit CPU, 16 MHZ clock speed, 2KB SRAM, 32kb flash

storage, and Arduino features are-: It has

6 analog input pins, removable microcontroller, and 14 digital input and output pins. It is the platform for both Software and Hardware sectors.

Figure 1: Arduino Uno

MOISTURE SENSOR:

The YL 69 moisture measuring device is being used here to measure moisture. It's just a fork-shaped PCB with tracks running on both sides of the thighs. Only insert this probing into the ground how you want to feel the moisture. That graphic of the YL 69 sensor material is displayed below.Moisture sensors typically utilize two main principles to measure soil moisture content: resistive and capacitive sensing. Resistive sensors measure the electrical resistance between two electrodes embedded in the soil. As soil moisture increases, its electrical conductivity rises, resulting in decreased resistance. Capacitive sensors, on the other hand, measure changes in the dielectric constant of the soil as moisture content changes.

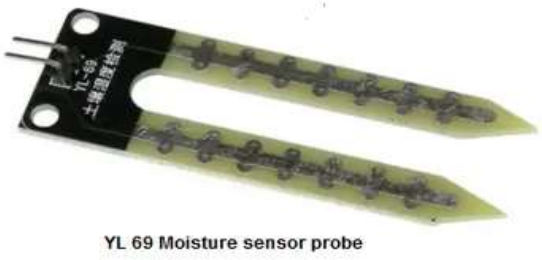

Figure 2: Moisturesensor probe

12V or 9VDC ADAPTER :

Figure 5: Dth Sensor

An internal power supply form is an AC, AC/DC or AC/DC combination adapter and is mostly found in an AC-like shell. AC to DC Converters are one of the most important in power electronics because there are lot of real applications are based on this conversions. It will delivers the DC voltage at the output side to operate any electronic device. It will be in the range of 5V,12V,24V etc.,

Figure 3: ADAPTER

WATER PUMP MOTOR:

Figure 4: Water pump motor

Water pump motors convert electrical energy into mechanical energy to drive the impeller or rotor within the pump housing. A water pump controlled by an Arduino microcontroller is a type of system that uses an Arduino to control the operation of a water pump. The Arduino can be used to turn the pump on and off, as well as to control the flow rate and direction of the water

DTH SENSOR:

The DHT11is a commonly used Temperature a commonly used Temperature and humidity sensor.the sensors comes witha dedicated NTC to measure temperature and an 8 bit microcontroller to output the valuesof the temperature and humidity as serial data.increasing the torque output. The most important parameters in regard to gear motors are speed (rpm), torque(lb-in)&effiency(%).

ULTRASONIC SENSOR:

The ultrasonic sensor is the distance measuring instrument. It uses ultrasonic waves to measure distance. This sensor emits an ultrasonic wave and receives the same wave from the target thus that target is treated as its obstacle. it measures the distance by measuring the time between transferred i.e., emission and received waves that come back from the target. It consists of an optical sensor that includes both transmitter and receiver sections but it uses a single element for emission and reception. The Waves from ultrasonic can travel from

various mediums such as glass, liquid, dust, dirt and even for transparent target

Figure 6: Ultra Sonic Sensor

DC MOTOR:

A gear motor is an all-in-one combination of a motor and gearbox. The addition of a gearbox to a motor reduces the speed while

Figure 7: DC motor

ESP8266 WIFI MODULE:

The ESP8266 is an micro controller which have the inbuilt Wifi module to connect the device to internet.Esp8266 have I analog pin and 11 data pins to connect many sensors in an single system.

Figure 8:ESP8266 Wi fi Module

MOTOR DRIVER:

The L293D is an embedded system engine driver that can be used for the synchronized,

couple of minor currents because you have done a significant heat sink to hold the case heat down.

Figure 9:L239D Motor Driver

UNO R3 AND USB CABLE:

The Arduino Uno is a microcontroller board that serves as the brain of the irrigation system. It can interface with various sensors and actuators to monitor environmental conditions (such as soil moisture levels,

temperature, and humidity) and control the irrigation process accordingly.The USB cable is used to connect the Arduino Uno to a computer for programming and debugging purposes. It allows you to upload code to the Arduino andmonitor its operation using the Arduino IDE (Integrated Development Environment).

Fig. 6.1.4 USB cable UNO R3 board

Figure 10: UNO R3 & USB

5.BLOCK DIAGRAM

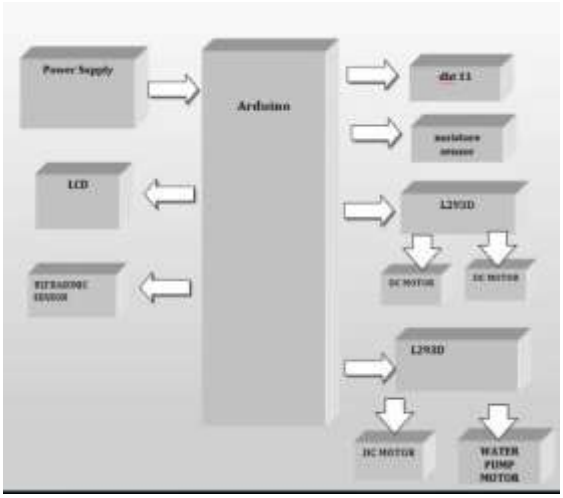

Figure 11: Block Diagram

6. WORKING PRINCIPLE

An automatic plant irrigation system using Arduino operates on the principle of monitoring soil moisture levels and providing water to plants when necessary. This system typically consists of sensors, an Arduino microcontroller, a water pump, and various other components. The soil moisture sensors are embedded into the soil near the plant roots to measure moisture content. These sensors provide data to the Arduino, which then analyzes the readings to determine if the soil requires watering. Based on predefined thresholds, the Arduino activates the water pump when the soil moisture falls below a certain level, indicating that the plants need watering. The pump delivers water to the plants for a specified duration, ensuring theyreceiveadequate hydration. To prevent over-watering or under-watering, the system may incorporate timing and frequency controls. This allows users to set watering schedules and adjust parameters such as watering duration and interval. Some advanced systems may include additional sensors to measure environmental factors like temperature, humidity, and light levels. This data can be used to further optimize watering schedules and conserve water resources. The system may feature a user interface, such as an LCD display or LED indicators, to show current soil moisture levels and system status. Users can interact with the system to customize settings and monitor plant health.

Fig 12: ***Irrigation System***

EXPERIMENTAL RESULT

To show the results of our Automatic irrigation System using Arduino.

Fig 15: ***Implemented Automatic irrigation system using arduino***

- In fig15: the Automatic irrigation system using Arduino was designed,and the hardware is built.

Fig 16: *Dh11* ***Sensor***

Fig17:Ultrasonic Sensor

When the system is powered up, there will be a display of "plant irrigation System" on LCD .

7 Ultrasonic sensor,when the bridge is located on river and river gets

- flooded the gate will be automatically closed.

Fig 18: *Moisture Sensor*

In fig 18, Moisture sensors are devices used to measure the moisture content in soil or other substrates. They are commonly employed in various applications,such as agriculture, gardening, environmental monitoring, and automated irrigation systems.

ADVANTAGES

1. Increase in productivity
2. Reduces water consumption
3. Reduce manpower
4. Much land will be irrigated
5. Easy to operate i.e. user friendly.
6. As a microcontroller is used inside so it has good sensitivity.
7. Compact in size, easily accessible, Easy to understand.

APPLICATIONS

Bridge monitoring sensors have wide- ranging applications that contribute to the safety, performance, and longevity of bridges.

fig 16 is Ultrasonic Sensor here is to measure the temperature & Humidity

FUTURE SCOPE

The future scope includes optimizing energy efficiency through solar powered solutions, integrating IOT for real time data analysis and predictive maintenance, AI driven algorithms for dynamic water management tailored to specific plants needs.

CONCLUSION:

In conclusion, the automatic plant irrigation system utilizing Arduino offers a convenient and efficient solution for maintaining optimal moisture levels in plants. Through sensor feedback and programmed logic, it enables precise watering while conserving water resources. In summary, the Arduino-based automatic plant irrigation system streamlines watering, enhances plant health, and conserves water through smart sensor-driven automation.

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