A DESIGN OF A PROGRAMMED FARMLAND WATERING SYSTEM USING ARDUINO NANO MICROCONTROLLER: IMPERATIVE TO COMPUTER LOGIC CURRICULUM

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Abstract
Farming plays a vital role in the economy and development of a most African country like Nigeraia. At present most Nigeria farmers irrigate their farmlands manually at regular intervals.This manual method consume more water, which could lead the damage of crops and consume much time and efforts from the farmer. A programmed farmland system is a designed to facilitate the automatic supply adequate water from a reservoir to the farmland once the sensor detects dryness or low level water content in the soil which represent (Logic 1)and turn off when the sensor detect the farmland is moist enough using a threshold which represent (logic 0) . One of the objectives of this work is to see how human control could be removed from irrigation and optimize the use of water in the process. The system is a low cost system of water irrigation using Arduino Nano microcontroller board to process the information, temperature and soil moisture sensors to detect the temperature and water quantity present in soil, A pumping mechanism is used to deliver the needed amount of water to the soil which depend on ON/OFF motor that will be automatically be turn on or off base on the moist level of the land This system will be designed around a Arduino Nano microcontroller that will be programmed using python language to control the microcontroller opening (Logic 1) and closing (Logic 0) the supply of water. Low cost, make the system to has the potential to be useful to farmers.

Keyword: Farmland, Arduino Nano, Soil Moisture Sensors, Microcontroller, Pumping Mechanism.

Introduction
Agricultural sector is one of largest contributor any African economy, Nigeria inclusive. As such there is need achieve maximum profit from the sector. there is need for upgrade of various techniques that are being used today. Thus by providing water or sustaining

proper amount of water level in the soil is one of the essential requirements to make a good yield of crop. Cause it will provide a great source of various types of nutrients whether micro or macro for their proper growth of the cops. As it stand now Farmers are the worst hit of shortage of water, as the Rain plays a vital role in deciding the future of these crops as well as the farmers is periodic in nature, that is it come for a maximum of four months. So there is the need to develop a system that is less expensive and use the renewable sources of energy which is environmental friendly that will improve the production of crops and increase the income of the farmers. The development of a new systems which is A PROGRAMMED FARMLAND WATERING SYSTEM USING ARDUINO NANO MICROCONTROLLER. The objective of the system is to save water and reduce or minimize labour work in the farm. Monitoring the position of sensors provide signal for taking vital action in implementing the process and get the output of soil moisture sensor & offer water according to the required of crop. This technique will be a very good choice for the small and medium farmers who suffer every year just because of failure of crops due to the shortage of raining fall. The implementation of this technology has a wide range of benefit in the nearby future and going to reach our goal of sustainable development in food production , create employment, as well as to cut off the emission of greenhouse gases to a minimum level.

Literature Review:

Watering is the artificial application of water for the success of crop production in farmland or garden. Irrigation has been a central feature of agriculture for over 5,000 (five thousand) years worldwide [9]. In the area of irrigation has reached a fast growth of mechanization. In current times, irrigation effectiveness has become imperative because of groundwater depletion [5]. As such, proper planning for irrigation is vital. To advance irrigation effectively, a smart irrigation system has need to be presented[3]. In current days, smart irrigation is the subject of popular discussion for researchers [9]. The irrigation system is the smart climate monitoring system, evaporation, soil conditions, using plant water and automatic irrigation program [9]. Intelligent irrigation systems remodel watering schedules and automatically running times to meet the specific requirements of the landscape [2]. The controllers considerably improve the efficiency of outdoor water use [13]There are several choices for smart irrigation controllers, such as climate-based soil moisture sensors (ETs) and on the site. The right solution depends on the geographical solution and the landscape environment [11] Time Based controllers also known as evapotranspiration (ET) controllers, using local meteorological data to regulate irrigation schedules [13]

[15]. recommended placing soil moisture and moisture detectors in the plant's root region. Based on the identified value, is used to regulate the field water supply by the microcontroller. This scheme does not intimidate the farmer with regard to field status To attain elevated soil output, [15]. advised to measure soil parameters such as pH, moisture, moisture and temperature. The amount of humidity on the ground automatically turns on and off the engine pump. The camp's current status is not associated with the farmer

[16].proposed a scheme using photovoltaic cells to derive the energy of sunlight. This system is not electricity-dependent. The PIC microcontroller switches the pump engine on/off depending on the soil moisture sensor's measured values. This scheme does not include weather forecasts

[12]. recommended a microcontroller and GSM automation scheme that would solve all manual problems. The GSM sends a signal to the farmer based on soil moisture, temperature and humidity sensor sensor sensing values. This scheme does not determine the nutrient content of the soil

[9].advocated a network of smart wireless sensors using Zigbee to monitor environmental parameters. These nodes send the information wirelessly to a main server collecting, storing and analysing the information, then viewing it as required and even sending it to the mobile client

[2]. Advocated an IOT-based automatic irrigation system using wireless sensor networks to evaluate soil parameters using separate sensors. This system offers a remote monitoring and control of the system by a web user interface. In this scheme, climate surveillance is not carried out

[4].recommended a document in which six field stations spread throughout the camp were specifically tracked on the site by field circumstances. To intimidate the farmer, GPS and wireless communication were used. The farmer cannot access data about the present state of the field without the Internet

Methodology

The soil rate of humidity is continuously controlled by the system. The system effectively reacts by watering the soil with the accurate amount of water required and then closes the water supply when it reaches the necessary level of soil moisture. The soil wetness content reference level was produced modifiable based on [3]. The system operator can adjust the amount of irrigation (light, nominal and high). The system's block diagram and flow chart diagram is shown in the figure

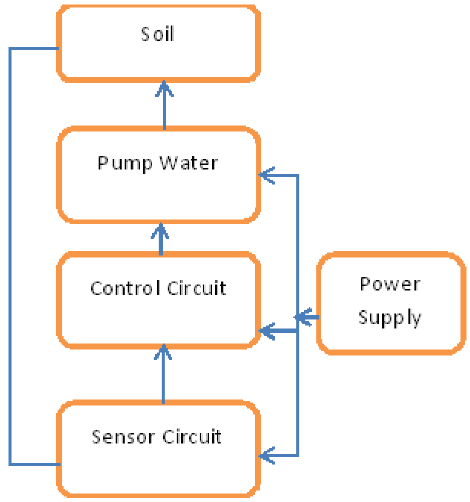

Fig.1:Block Diagram

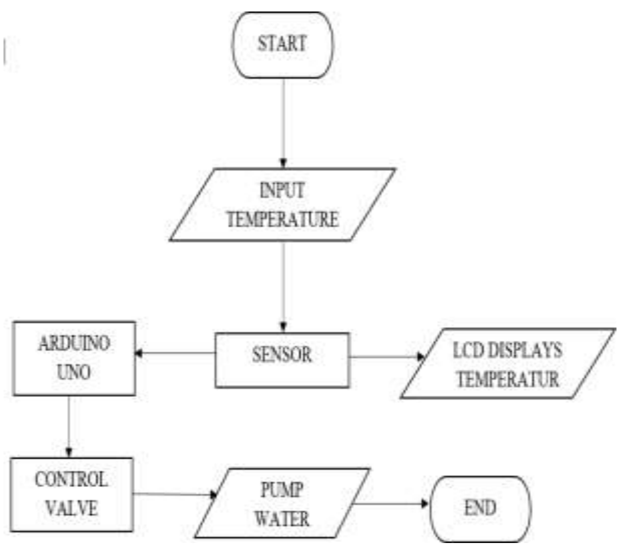

Fig. 1: Flowchart Diagram

The hardware requirements for the design and implementation are:

- **i.** Solderless Breadboard
- **ii.** Arduino Uno
- **iii.** 5v 2Amp Power Adapter
- **iv.** Male and Female jumper Wires
- **v.** Soil Moisture Sensor
- **vi.** Water Control Valve
- **vii.** LCD Display

Solderless Breadboard

This is a board that will contain the flow of current throughout the circuit, Fig 2 below show the image of the breadboard.

Breadboard, Half-Size, White, 2.2" x 3.4"

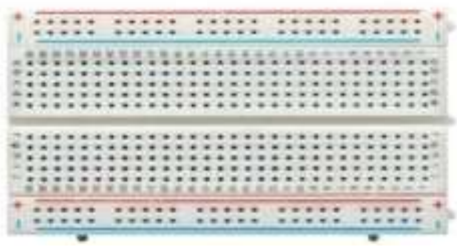

Figure 2: Solderless Breadboard

Arduino Nano

This is where the programs will be burned into, it is an Arduino Nano product that allows us to write a high-level programming language for electronics instead of using the microcontroller which enables Assembly languages only. Fig 3 below is the image for Arduino Uno.

Fig 3: Arduino Nano

5V 2AMP POWER ADAPTER

This is an adapter that collects electricity from the source and regulates it then passes current into the Relay. Fig 4 below is the diagram for the Adapter.

Fig 4: 5v 2amp Power Adapter

Male And Female Jumper Wires

The wires are used for carrying current from one device to the other in the circuit. Fig 5 below is the image for Jumper Wires.

Fig 5: Male And Female Jumper Wire

Soil Moisture Sensor

This is a sensor that will be placed inside the soil to report the temperature of the soil. Fig 6 below shows the image for the sensor.

Fig 6: Soil Moisture Sensor

Water Control Valve

This device will turn on and off the flow of water immediately the Arduino sends it command. Fig 7 below shows the image of the valve.

Fig 7: Water Control Valve

LCD Display

This is a display device that it purpose is to display the temperature of the soil that has been read by the sensor. The image is shown in fig 8 below.

Fig 8: LCD Display

Software Development

The project will be programmed using the Python programming language. Python has a library for Arduino programming which will make it a good choice to be used.

System Description

Here are the step-by-step instructions for a system using soil moisture sensor, LCD display, and solenoid valve:

a. Connect the soil moisture sensor to an Arduino Nano board.
b. Connect the LCD display to the board using appropriate pins.
c. Connect the solenoid valve to the board using a relay module.
d. Upload the code to the board that reads the soil moisture level using the sensor and displays it on the LCD.
e. Set a moisture threshold level for the soil in the code.
f. If the moisture level is below the threshold, trigger the solenoid valve to turn on the irrigation system.
g. While moisture level is below threshold allow the solenoid value to remain on otherwise turn off solenoid valve.

The sensor sends every signal of the moist level sensed to the Arduino Nano which in turn display on LCD and which in turn checks if the moist level is above the threshold which is 700 (quantifying the dryness of the soil) it sends signal to the relay which then allow the current flow to the valve and valve then allows the water to flow through it.
Overall, the system will automatically water the plants when the soil is dry and stop when it is sufficiently moist. The LCD display can provide real-time feedback to the user and the system can operate independently without the need for manual intervention.

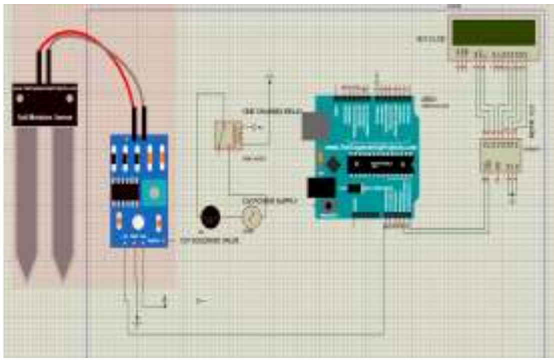

Fig 9: Structure Of The System

Benefits of the Systems

The systems offer several benefits over traditional irrigation methods. Firstly, they optimize water use by monitoring soil moisture levels, weather data, and crop water demand, thereby reducing water waste and over-extraction. Secondly, they improve crop yield and quality by ensuring that plants receive the right amount of water at the right time, which enhances plant growth and development. Thirdly, systems enable farmers to make data-driven decisions, reducing the risk of crop failure and improving resource management. Finally, they provide real-time information on the status of irrigation systems, enabling farmers to detect and resolve issues quickly.

Summary

In summary, the adoption of smart irrigation systems can play a significant role in addressing the challenges of water scarcity and climate change in the agricultural sector. With continued research and development, smart irrigation systems have the potential to revolutionize the way we manage water in agriculture, making it a more sustainable and efficient industry.

Conclusion

In conclusion, the use of smart irrigation systems has been identified as a promising solution for water conservation in agriculture. By integrating various sensors and controllers, smart irrigation systems can help farmers optimize their water usage and reduce their overall water consumption. The Arduino Uno, breadboard, one channel relay, solenoid valve, jumper wires, soil moisture sensor, 16 by 2 liquid crystal display, and I2C module are some of the essential components that make up a smart irrigation system. By working together, these components can help farmers monitor and control their irrigation systems with greater accuracy and precision.

While the implementation of a programmed farmland s systems may require an initial investment, the long-term benefits of reduced water usage, improved crop yields, and increased efficiency can result in significant cost savings for farmers. Moreover, the use of smart irrigation systems can contribute to sustainable agriculture practices, which can help protect and conserve our natural resources.

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