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Python Application In A Solar System-Based Automated Irrigation Facility In The Rural Region

Durgaprasad Gangodkar Department of Computer Science & Engineering, Graphic Era Deemed to be University, Dehradun, Uttarakhand India, 248002 dgangodkar@yahoo.com

Devesh Pratap Singh Department of Computer Science & Engineering, Graphic Era Deemed to be University, Dehradun, Uttarakhand India, 248002 devesh.geu@gmail.com

Vrince Vimal Department of Computer Science & Engineering, Graphic Era Hill University, Dehradun, Uttarakhand India, 248002 vvimal@gehu.ac.in

ABSTRACT

This research aims to develop an automated irrigation facility for the farmer to save time and money. India's economy is much based on agriculture. Human effort is much needed to cultivate food in agriculture. In addition, due to the paucity of electrical power sources, there is a significant shift toward alternative energy sources. The readily available source is sunlight. Also, solar energy is used in various areas as a power source. Proper irrigation is necessary for the crop. Improper and over-irrigation may lead to crop death. As a result, to assist the farmer and provide correct irrigation to the crop. In this research, an automated irrigation system based on the Internet of Things is developed. An Arduino UNO, GSM module, temperature sensor, soil moisture sensor, and electric motor with pump are included in the proposed system. The temperature sensor measures the temperature of the farm's surroundings, while the moisture sensor measures the moisture content of the soil. This feedback is fed to an input to the Arduino UNO and communicated to the computer, and then, based on the feedback, the farmer can monitor the remote location and switch on the motor, which runs on the python program. The application of python is that it operates the motor pump for switching on and off to prevent the plant over-irrigation by the sensor input. This kind of proposed system will be helpful for the farmer to cultivate with minimum effort and save much time.

Keywords: Python program, Arduino Uno, irrigation, solar power

1. Introduction

Automobiles, electronics, industrial automation, and the power plant industry are just a few of the uses for the Internet of Things [1]. Water is the prime source of agriculture. The water is pumped underground or by the nearby river to the source. But a lot of electricity is consumed in this process to bring the water. Also, the proper amount of water is to be supplied to the crop for effective growth [2]–[4]. The periodic monitoring is very important to check the water level. If more water is provided, then the plant's life will be spoiled [5]–[7]. Similarly, if the water is less consumed, the plant's growth is affected. The optimal supply of water and stopping the power supply are much needed nowadays. To save resources, research is being conducted with the development of the internet of things to deliver a sufficient amount of water and to correctly shut down the power supply [8]. Agriculture accounts for the majority of India's GDP and the majority of its jobs and businesses. With the growth of Python technology, the Internet of Things serves various fields like as the military to monitor the presence of enemy, medicine delivery systems for patients and healthcare monitoring, remote operation of industry and automation [9]–[11]. The research on the internet of things on agriculture is very small. Also, at present, water and electricity are much needed resources to be saved for the future. In many agricultural activities, water is getting wasted because of improper shutdown of the water pumps [12], [13]. And, for irrigation, electricity is heavily used, but it is also wasted. One needs to properly monitor and shut down the entire process to save the water and electricity.

In this research the main objective is to save both electricity and the excess wastage or flow of water to the crops. The electricity is obtained from the solar power source and the power is stored by means of battery. The motor runs from the battery power source with the help of actuating command from the python program. The programme is only run when it receives input about the field, which includes the temperature and relative humidity content of the soil.. These are monitored by the sensor and it is transmitted to the local computer using the WIFI module. The previous similar kind of work is done in many research related to the motor operation during the timed interval [14], [15]. But there is no such system to check the need of water to the form and switching on the power supply. This way one can ensure that the plant gets water at the needed time.

Also, the water and electricity are saved without much demand. The flow of water can also be adjusted by changing the input power supply to the motor. This power supply is adjusted by the python programme where the motor driver gets the input from the computer and, according to the program, the driver activates the power source. In this article, Section 2 describes the various components and the programme used in the working of the entire system. The result and the feedback about the temperature and the soil quantity are described in Section 3. Finally, the overall work is summarised. This type of proposed plant irrigation system will allow the former to save a significant amount of time when irrigating the plants. It also prevents water waste and saves electricity.

2. Various components used in this research

2.1 Arduino

The Arduino UNO is used for getting the feedback from the sensor and communicating the results. The UNO board is easily available on the market, and the interface with the

Arduino is achieved by the IDE software. The Arduino board used in this research, the ATMEGA 328P microcontroller, is used to incorporate with the Arduino board. The feedback from the sensor is given to the Arduino and continuously monitored from the local computer.

Figure 1 Arduino UNO

2.2 Sensor

The soil moisture content is monitored to guide the operation of the motor and to determine when water is required. Figure 2 depicts the soil moisture sensor used in this study. The threshold value is determined by the Arduino programme. If the moisture in the soil value exceeds the limit, the sensor communicates with the local computer using the Arduino Uno and IDE software. The sensor's output is an electrical voltage, and a potentiometer is used in conjunction with the sensor to transmit the sensor's voltage fluctuation.

Figure 2 Soil moisture sensor

Figure 3 shows how the GSM module is utilised to interact with the user. The module for GSM. The GSM module can communicate with the user by sending SMS messages. Table 1 lists the various specifications of the soil moisture sensor.

Figure 3 GSM module

Table 1 Specification of the moisture sensor

Type	**Specifications**
Operating range	Moisture of 0 to 99.9% at 0 to 60 ̊C
Performance accuracy	Moisture 2% and temperature 1%
Sensor method	Reflectometry
Supply voltage	10 to 15 V
Probe size	15 cm
Current	25mV

The 26-volt battery 10 A battery is used to store the power generated by the solar panel. The DC 26 V solar water pump is powered by the battery. The power supply, which is controlled by the driver switches, powers the motor. The driver activates the motor and pumps water to the field when it gets input from the Python software. Figure 4 depicts the software used to activate the power. If the soil moisture sensor reading exceeds the threshold, an instruction is sent to the local computer. The Python programme is then executed to bring the motor to a resting position.

```
import RPi.GPIO as GPIO
from time import sleep

GPIO.setmode(GPIO.BOARD)

Motor1A = 16


GPIO.setup(Motor1A,GPIO.OUT)
GPIO.setup(Motor1B,GPIO.OUT)
GPIO.setup(Motor1E,GPIO.OUT)

print "Turning motor on"
GPIO.output(Motor1A,GPIO.HIGH)
GPIO.output(Motor1B,GPIO.LOW)
GPIO.output(Motor1E,GPIO.HIGH)

sleep(2)

print "Stopping motor"
GPIO.output(Motor1E,GPIO.LOW)

GPIO.cleanup()
```

Figure 4 Python program used for motor operation

3. Working of the proposed system

Figure 5 depicts the overall operation of the system. First, the soil moisture sensor detects the soil's moisture level. If the soil's dryness value exceeds the threshold, the signal is sent to the Arduino UNO programme. Figure 6 depicts the soil moisture sensor's sample reading during the day. The signal is then sent to the GSM module, which uses it to connect with the user.

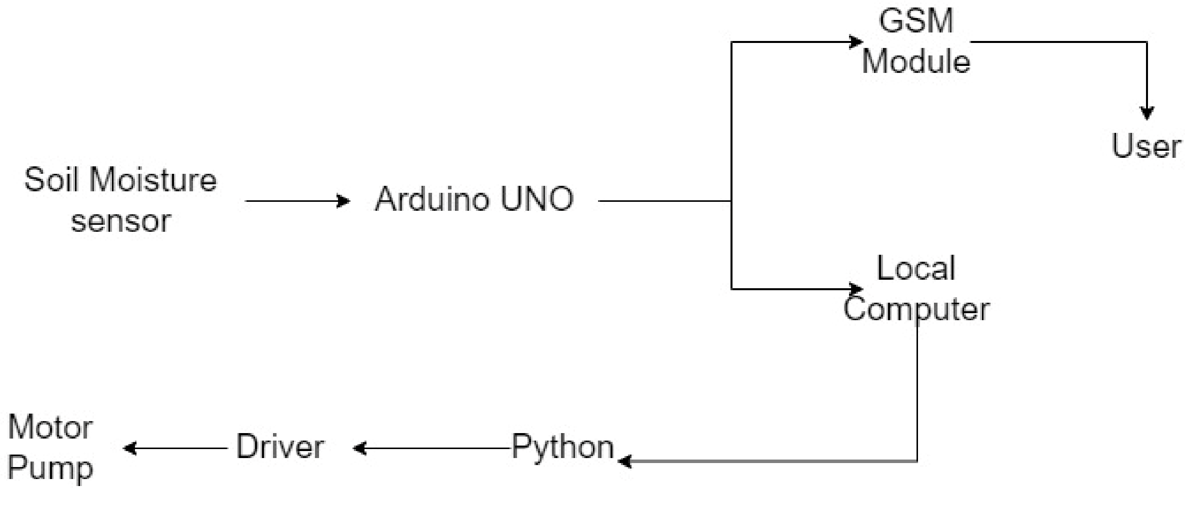

Figure 5 Block diagram of the proposed irrigation system

On the other hand, the same signal is then passed to the local computer. The computer sends the programming signal to the driver for actuating the power supply to the motor for supplying the water for irrigation. If the moisture content reaches the pre-set value, then the signal is communicated to the local computer and the pump is stopped to supply the water. The proposed system is being tested in the local farming area. The system is operated with a satisfactory response. This kind of proposed system may help farmers' irrigation and also save the power supply.

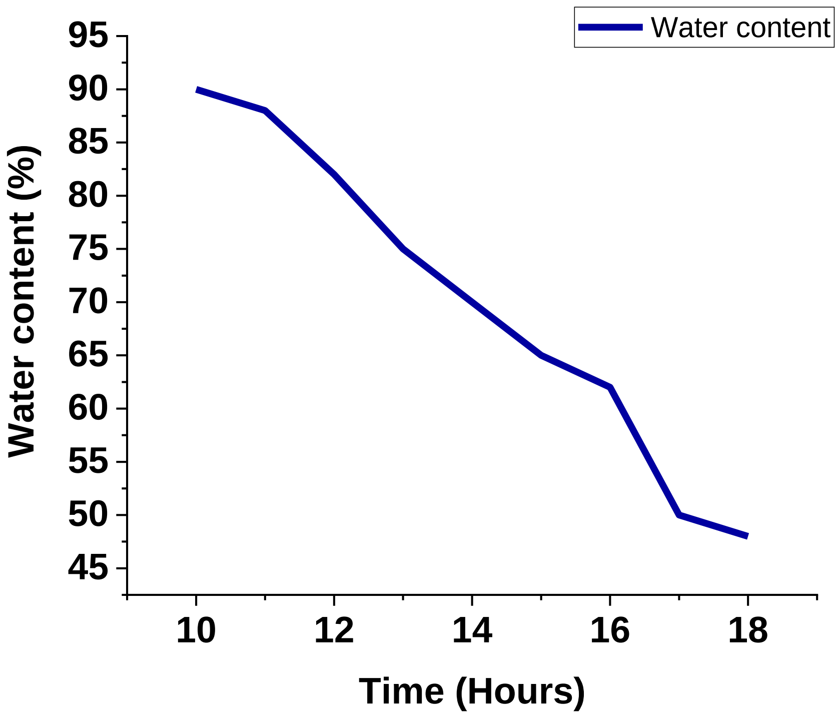

Figure 6 Sample data obtained from the soil moisture sensor

CONCLUSION

The focus of this research is to save water and power required for irrigation. The current setup is powered by Arduino and a Python software. The moisture sensor detects the presence of water in the soil and transmits the data to the local computer through the Arduino and GSM module. Using a Python application, the local computer activates the solar pump using the driver signal. When the moisture level in the water hits the threshold, the motor shuts down. The major advantage of this technique is that it reduces the amount of labour required for irrigation. Furthermore, the suggested method protects the plant from overwatering by providing a suitable quantity of water only when it is needed.

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