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Implementation of Automatic Plant Water Supply and Monitoring System

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Abstract: *In daily operations related to farming or gardening watering is the most important practice and the most labour-intensive task. No matter whichever weather it is, either too hot and dry or too cloudy and wet, you want to be able to control the amount of water that reaches your plants. Modern watering systems could be effectively used to water plants when they need it. But this manual process of watering requires two important aspects to be considered: when and how much to water. In order to replace manual activities and making gardener's work easier, we have create automatic plant watering system. By adding automated plant watering system to the garden or agricultural field, you will help all of the plants reach their fullest potential as well as conserving water. Using sprinklers drip emitters, or a combination of both, we have design a system that is ideal for every plant in the yard. For implementation of automatic plant watering system, we have used combination of sprinkler systems, pipes, and nozzles. In this paper we have used ATmega328 microcontroller. It is programmed to sense moisture level of plants at particular instance of time, if the moisture content is less than specified threshold which is predefined according to particular plant's water need then desired amount of water is supplied till it reaches threshold. Generally, plants need to be watered twice a day, morning and evening. Thus, the microcontroller is programmed to water plants two times per day. System is designed in such a way that it reports its current state as well as reminds the user to add water to the tank. All this notifications are made through mobile application. We hope that through this prototype we all can enjoy having plants, without being worried about absent or forgetfulness.*

Keywords: Automatic Plant Water Supply

I. INTRODUCTION

Automatic Plant Water Irrigation System with IoT Monitoring & Control is an embedded system-based approach to implement a smart system which is able to water plants over manual or automatic control using IoT connectivity and feedback sensor system. This system can be operated in any one of the two modes that is manual control of water pump over IoT connectivity using android application or automatic control of water pump by sensing moisture level in plant's soil. It uses moisture sensors which act as a feedback device to microcontroller in order to control pump automatically without any human interaction. If the moisture level detected by sensors is below some set point/threshold the system will keep water pump ON until it reaches set point moisture level. For manual control over IoT connectivity, a Wi-Fi module is used which acts as a medium to connect our system to outside world over internet. This in-system Wi-Fi is connected to one of the available Wi-Fi or WLAN access point in order to get access to internet. To select mode of operation of system (Auto or Manual) and to control water pump manually an android application is designed which is able to connect to our system over internet for wireless control from any point/place. For watering plants, a DC/AC water pumps are used which is driven through BJTs or Relays switch. These pumps take inlet water from large water tank and sprinkles water from outlet pipeline at certain distances. Along with water pump control this system is also consists of soil moisture level monitoring and data logging over internet to one of the IoT/Cloud platform/services such as ThingSpeak, ThingsIO, AWS, etc.

II. LITERATURE REVIEW

Plant provides us with almost all the basic needs for survival but we are unable to provide plant with its basic needs like water, non-polluted oxygen and as a result plants are unable to survive. Underground plant water supply and monitoring

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system which sense the requirement of the plant and provide it with water as the soil loses its moisture AVR Atmega8 to introduce automation in watering plants. Arduino Uno and Arduino Nano respectively along with the Wi-Fi module to achieve this. However, the complexity of the circuit could be reduced by using a standalone application of Wi-Fi module this project we have discussed various types of underground automatic plant water supply and monitoring system. Let us discuss each and every technique of System. Underground automatic plant water supply and monitoring System Using Soil Moisture Sensor and Arduino. We proposed that the automic plant water supply and monitoring system system is done by soil moisture sensor and arduino. In this system, the contol is used to on and off the motor without the help of humans which is done by microcontroller. The LED is provided for working of the arduino. The moisture level of the soil will be checked and the irrigation status will be sent to the server. Automated Irrigation System Using a Wireless Sensor Network and GPRS Module proposed an automatic irrigation system was introduced to help farmers. In this a wireless network of soil moisture and temperature sensor are employed to senses the information. The gateway unit initiate the actuators and transmits the data which is between the web application and the farmer for the irrigation .The Microcontroller Based Automatic plant water supply and monitoring System to irrigate the land with the automation technique. The moisture sensor is inserted into the soil. The sensor senses the information and sends the data to the microcontroller. The controller indicates the relay to turn ON the pump if the moisture is below the threshold value and the pump will turn OFF automatically after the moisture level is sensed from the sensor. It will be displayed in the LCD of the controller. It was developed with the humidity sensor and the microcontroller. If the set-point value of the humidity sensor goes low the microcontroller turn on the motor to supply the water, after reaching the set-point value then the motor will turn OFF. The connection of the microcontroller from the android app and to the GSM is done by GSM and MAX232 respectively. The moisture level becomes low, the microcontroller initiates the mobile to activate the buzzer for the opening and closing of the valve.

III. IMPLEMENTATION

Underground Automatic Plant Water supply system Irrigation with IoT Monitoring System consists of various electronic/electrical components and devices such as 8-bit AVR microcontroller ATmega8, ESP8266 WiFi module, Soil moisture sensor modules, Darlington-pair BJT transistors, DC water pumps, LEDs, Buzzer, 12v/1.5Amp SMPS,5v voltage regulator, 3.3v voltage regulator, resistors, capacitors, diode, etc. These components and devices are connected to each other as per designed circuit and Printed Circuit Board (PCB). In the system an 8-bit ATmega8 microcontroller is used which is preprogrammed in order to process and control all inputs and output devices. For indication purpose few LEDs, and buzzer is used which is controlled via few of the GPIO (General Purpose Input & Output) pins of microcontroller which are programmed and configured as output pins in order to source current out.To drive DC water pumps, few Darlington-pair BJTs (Bipolar Junction Transistors) are used as a switch for high side switching (high-voltage switching), these BJTs are also controlled via few of the GPIOs of microcontroller those are also configured to source current out.Along with simple i/o devices this system also consists modules such as soil moisture sensor module, & Wi-Fi module.The soil moisture sensor module consists of on-board opamp as a comparator whose job is to compare differential input values and give digital output in form of high or low. This sensor module is able to give both analog as well as digital signals. In order to sense plant's soil moisture level these sensors are connected through analog input pins of microcontroller which uses internal Analog to Digital Converter (ADC) of microcontroller to convert the sensor moisture level equivalent analog signal into 10-bit ADC range for further processing. For wireless IoT connectivity a ESP8266 nodeMCU based Wi-Fi module is used which consist of TCP/IP hardware stack for internet connectivity and communication over internet protocols such as HTTP, FTP, MQTT, etc. which connects any control device to outside world (internet). This ESP8266 WiFi module is interfaced with microcontroller through UART (Universal Asynchronous Receiver & Transmitter) serial protocol for asynchronous full duplex TTL serial communication which is operated at fix baud-rate of 115200 bits/s. In order to control this WiFi module microcontroller sends and receives AT commands over serial bus to change/modify settings and exchange data packets. Which connects any control device to outside world (internet)? This ESP8266 Wi-Fi module is interfaced with microcontroller through UART (Universal Asynchronous Receiver & Transmitter) serial protocol for asynchronous full duplex TTL serial communication which is operated at fix baud-rate of 115200 bits/s. In order to control this Wi-Fi module microcontroller sends and receives AT commands over serial bus to change/modify settings and exchange data packets. The microcontroller is programmed to control the complete flow of system such as initialization, control, and monitoring of i/o devices and also to initialize and keep track of internal peripherals for timing-counting operation, Analog

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to Digital Conversion, interrupt control and buffering, serial communication, etc.To power the complete system a 12v/1.5A SMPS (Switch Mode Power Supply). In order to provide power to all low power devices such as microcontroller, sensors, etc. a 5v linear voltage regulator is used and for extreme low power device such as Wi-Fi module a 3.3v linear LDO voltage regulator is used. For fill the Water tank the water level controller circuit is built around IC 555 to monitor the water level in the overhead tank and on/off status of the motor through the inverter and driver circuits

IV. SOFTWARE USED

Sr. No.	Software	Version	Purpose
1.	Arduino IDE	1.8.15	For microcontroller AVR ATmega328P programming. [Embedded C++]
2.	Proteus ISIS	8.0	For circuit designing.
3.	Proteus ARES	8.0	For PCB designing.
4.	Android Studio	2020.3.1 (Arctic Fox)	To build IoT based Android Application.
5.	Pulse View	0.4.2	For digital signal analysis (embedded interface devices).
6.	Serial Monitor	N/A	For debugging.
7.	Prog ISP	1.72	For uploading compiled binaries (ihex file) to microcontroller AVR ATmega328P

V. HARDWARE USED

Sr. No.	Part	Quantity
1.	Microcontroller AVR ATmega328P	1
2.	28-Pin IC Base	1
3.	LM7805 5v Voltage Regulator IC	1
4.	LM1117 3.3v Voltage Regulator IC	1
5.	ESP8266 ESP-01 WiFi Module	1
6.	Analog Soil Moisture Sensor Module	2
7.	12v 1.5Amp DC SMPS	1
8.	DC Water Pump	2
9.	Medium Size Copper Clad PCB	1
10.	Bug Strip	1
11.	Any Colour LED	3
12.	P55NF06 N-Channel MOSFET	2
13.	16MHz Crystal	1
14.	1N4007 Silicon Diode	2
15.	100uF Electrolytic Capacitors	3
16.	0.1uF Ceramic Capacitors	4
17.	22pF Ceramic Capacitors	2
18.	10 Ohm Resistors	2
19.	1 KOhm Resistors	2
20.	1.8 KOhm Resistor	1
21.	10 KOhm Resistors	4
22.	100 KOhm Resistors	2

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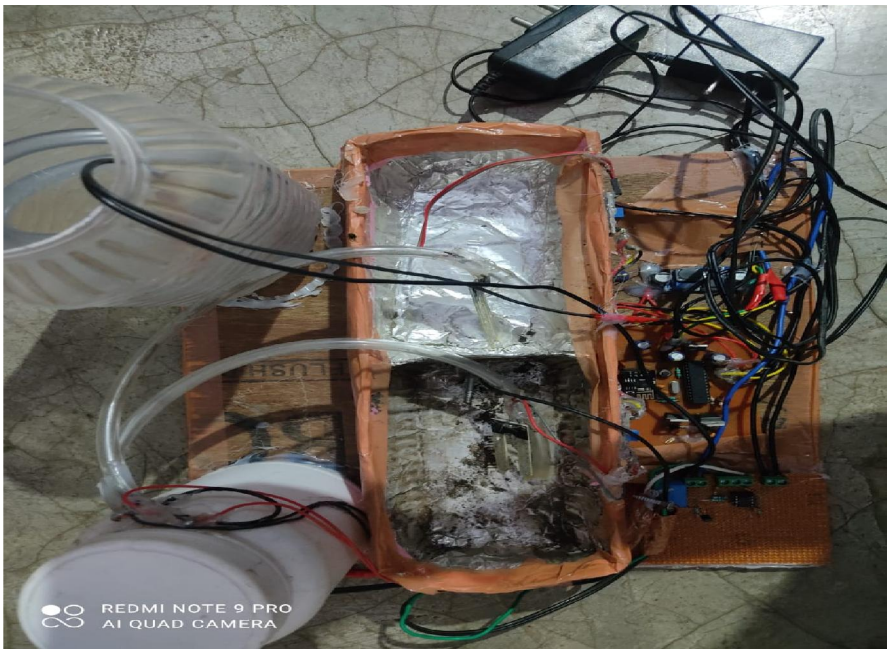
VI. HARDWARE



VII. CONCLUSION

Automatic system using a microcontroller, moisture sensor and other electronic tools were been developed. It was observed that the proposed methodology controls the moisture content of the soil of cultivated land. The motor automatically start pumping water if the soil is dry and need water and stops when the moisture content of the soil is maintained as required and to control water pump manually an android application is designed which is able to connect to our system over internet for wireless control from any point/place.

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