PLAWATOS-An Automatic Plant Watering IOT Based System Using ESP8266

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Abstract- *Watering plants for the households becomes much tiresome to manage in their eventful schedule. Watering systems ease the saddle of getting water to plants when they need it, knowing when and how much water are the two important aspects of watering process. To make the gardeners work easily, the Smart plant watering system is created. This project uses Esp8266 Microcontroller and Wi-Fi module. It is programmed in such a way that it will sense the moisture level as well as the temperature of the plants and supply the water as required. Also it will send the data to Blynk application, where one can monitor the whole system from any part of the world. Normally, the plants need to be watered two times daily viz. morning and evening. So, the microcontroller has to be coded accordingly. People enjoy plants, their benefits and the feeling related to nurturing them. However for most people it becomes difficult to keep them healthy and alive. To accommodate this challenge a prototype has been developed, which makes a plant more self-sufficient by watering itself from a water tank. It also reports the status of current water levels in the tank and reminds the user about refilling the water tank. The system automation is designed to be assistive to the user. The aim of this prototype is to make people enjoy their green gardens without the challenges they may face to nurture them.*

Keywords- - Home Automation, IOT (Internet of Things), Plant Watering Systems

I. INTRODUCTION

IN the fast paced world human beings require everything to be automated. Our life style demands everything to be remote controlled. Apart from few things man has made his life automated. Mostly people are too lazy to water the potted plants in their gardens every day. In the world of advance electronics, life of human beings should be simpler, hence to make it simpler and convenient, we have made PLAWATOS-An Automatic Plant Watering IOT based System. A model to water plants daily that will be an assistant for millions of people in one of their day-to-day chores. This model uses sensor technology with microcontroller to make it a smart watering device. The model switches water motor on/off based on the values read from the soil moisture sensor. Finally Blynk application is used to display the soil moisture level, water level and also one can control the operation of motor/pump.

The Objectives of this Project are:

1. To design and develop an automatic plant watering system controlled by using ESP8266 microcontroller and WiFi module.
2. To implement the automatic watering system based on soil moisture sensor and temperature sensor.
3. To collect the data from sensors and upload on the Blynk application.
4. To monitor and control the system from any part of the world.
5. To make a economically affordable system.

II. LITERATURE REVIEW

1. In Sensor based Automated Irrigation System with IOT: A Technical Review by Karan Kansara, Vishal Zaveri, Shreyans Shah, Sandip Delwadkar, Kaushal Jani.[1] It mentions about a pipe with rain gun irrigation mechanism attached to the water pump, the other end of the pipe is near to the root of the plant. The flow of water is managed by solenoid valve. The opening and closing of valve is done when a signal is send through microcontroller. The water to the root of plant is done drop by drop using rain gun and when the moisture level again become normal then sensor senses it and send a signal to microcontroller and the valve is then closed. The two modules are connected using GSM. The GSM and microcontroller are connected using MAX232. The microcontroller gives the signal to mobile and it activates the buzzer. This buzzer indicates that valve needs to be opened by pressing the button in the called function.

2. In Design and Implementation of Automatic Plant Watering System by Archana P, Priya P.[2] In this paper, temperature sensors, soil moisture sensor are placed in root zone of plant and gateway unit handles the information about sensor and carry data to a web application. One algorithm was developed to measure

threshold values of temperature sensor and soil moisture sensor that was programmed into a microcontroller to control water quantity. For power, photovoltaic panel was used. Another facts like cellular-Internet interface used that allowed for data inspection and irrigation scheduling to be programmed through a web page. The automatic system was tested for 142 days and save 92 percent compared with traditional watering system. Three replicas of the automated system have been used successfully in other places for 1 year and 6 months. Because of its energy autonomy and low cost, the system has the potential to be used in water limited geographically isolated area.

3. 3. In Esp8266: a breakthrough in wireless sensor networks and internet of things - Manan Mehta.[3] The paper first talks about the Esp8266 and its various variants. It then cover show it has simplified Iot and WSN projects. The Esp8266 Dimensions is a low cost, high performance system on chip Wi-Fi to serial module, part of Espress if Systems Smart Connectivity Platform that aims to provide mobile platform designers to innovate systems with embedded Wi-Fi Capabilities at the lowest cost with the greatest functionality. ESP8266-xx (01-13) each module is just a development over the previous in terms of hardware capabilities with ESP8266-01being the cheapest and the one with minimal features toESP8266-13 being the most expensive with maximum features. The various features include number of GPIO pins, presence of shield, antenna, type of package (Through-hole or Surface mount), memory and handling external analog signals.

4. Arduino Based Automatic Plant Watering System - S.V.Devika, S.K.Khamuruddeen, S.K. Khamurunnisa, Jayanth Thota, Khalesha Shaik.[4]

5. Automatic Plant Watering System -Abhishek Gupta, Shailesh Kumawat, Shubham Garg.[5]

III. HARDWARE DESIGN

This prototype firstly monitors the amount of soil moisture and temperature. A predefined range of soil moisture and temperature is set, and can be varied with soil type or crop type. In case the moisture or temperature of the soil deviates from the specified range, the watering system is turned on/off. In case of dry soil and high soil temperature, it will activate the irrigation system, pumping water for watering the plants. The circuit consists of a microcontroller ESP8266 which is the brain of the system. Both the moisture and temperature sensors are connected to the input pins of the controller and the mini submersible water pump with the output pins. If the sensors depart from the predefined range, the controller turns on the pump. Since it is an IOT project, the whole system is monitored using Blynk application. LEDs are used to indicate the status of the water in the tank and the soil moisture content.

A. Nodemcu ESP8266

NodeMCU is an open source IoT platform. It includes firmware which runs on the ESP8266 WiFi SoC from Espress if Systems, and hardware which is based on the ESP-12 module. The term ”Node MCU” by default refers to the firmware rather than the dev kits. The firmware uses the Lua scripting language. It is based on the eLua project, and built on the Espress if Non-OS SDK for ESP8266. It has the following specifications and features:

Wi-Fi Module ESP-12E module similar to ESP-12 module but with 6 extra GPIOs.
USB micro USB port for power, programming and debugging
Headers 2x 2.54mm 15-pin header with access to GPIOs, SPI, UART, ADC, and power pins
Misc Reset and Flash buttons
Power 5V via micro USB port

Dimensions 49 x 24.5 x 13mm

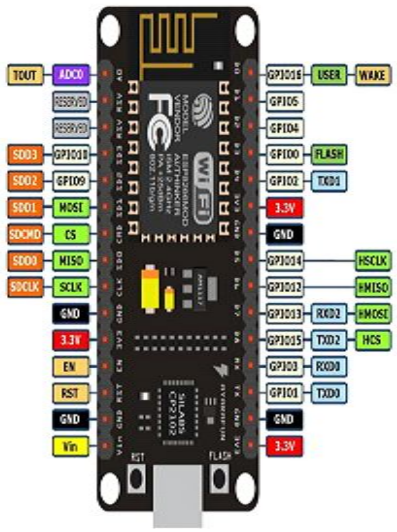


Fig. 1. Nodemcu ESp8266 Pinouts

The ESP8266 is a microcontroller built by Espress if Systems that has WiFi built in. Although the microcontroller is only produced by one company, there are a variety of board styles and a multitude of vendors selling development boards. To date, the most important variants are the ESP-1 (the original release) and the ESP-12E (the latest version as of this

writing). The main differentiation between these versions was not the microprocessor (this has remained essentially unchanged), but instead the number of ports exposed to the user. For example, the ESP-1 has a total of eight pins connected to user-reachable headers (two of which were used for power), whereas the ESP-12E has 22 pins.

B. Soil Moisture Sensor

Soil moisture sensors estimates the soil volumetric water content based on the dielectric constant (soil bulk permittivity) of the soil. The dielectric constant can be thought of as the soil's ability to transmit electricity. The dielectric constant of soil increases as the water content of the soil increases. This response is due to the fact that the dielectric constant of water is much larger than the other soil components, including air. Thus, measurement of the dielectric constant gives a predictable estimation of water content. It consists of a pair of electrodes to measure the resistance of the soil. Greater the resistance, lower the moisture content of the soil.

Fig. 2. Soil Moisture Sensor

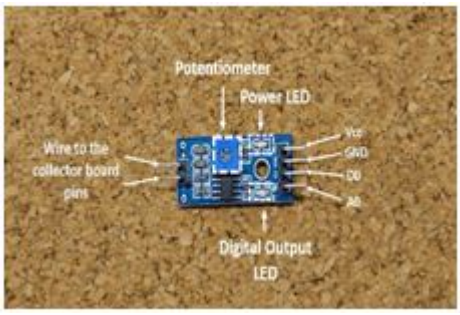


Fig. 3. Soil Moisture Sensor Pin outs

C. Temperature Sensor

The LM35 series are precision integrated-circuit temperature devices with an output voltage linearly-proportional to the Centigrade temperature. The LM35 device has an advantage over linear temperature sensors calibrated in Kelvin, as the user is not required to subtract a large constant voltage from the output to obtain convenient Centigrade scaling. The LM35 device does not require any external calibration or trimming to provide typical accuracies of C at room temperature and C over a full 55C to 150C temperature range. Lower cost is assured by trimming and calibration at the wafer level.

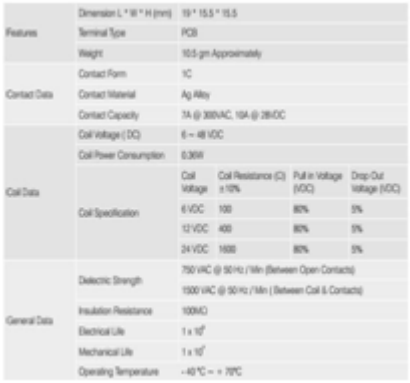
Fig. 4. LM35 Temperature Sensor

Features:

-Calibrated Directly in Celsius (Centigrade)
-Linear + 10-mV/C Scale Factor
-0.5C Ensured Accuracy (at 25C)
-Rated for Full 55C to 150C Range
-Suitable for Remote Applications
-Low-Cost Due to Wafer-Level Trimming
-Operates from 4 V to 30 V
-Less than 60-A Current Drain
-Low Self-Heating, 0.08C in Still Air
-Non-Linearity Only 1/4C Typical
-Low-Impedance Output, 0.1 for 1-mA Load

D. Relay

Relays are electromechanical devices that use an electromagnet to operate a pair of movable contacts from an open position to a closed position.The advantage of relays is that it takes a relatively small amount of power to operate the relay coil, but the relay itself can be used to control motors, heaters, lamps or AC circuits which themselves can draw a



Features	Dimension L * W * H (mm)	19 * 15.5 * 15.5			
	Terminal Type	PCB			
	Weight	10.5 gm Approximately			
Contact Data	Contact Form	1C			
	Contact Material	Ag Alloy			
	Contact Capacity	7A @ 300VAC, 10A @ 28VDC			
Coil Data	Coil Voltage (DC)	6 ~ 48 VDC			
	Coil Power Consumption	0.36W			
	Coil Specification	Coil Voltage	Coil Resistance (Ω) ±10%	Pull in Voltage (VDC)	Drop Out Voltage (VDC)
		6 VDC	100	80%	5%
		12 VDC	400	80%	5%
		24 VDC	1600	80%	5%
General Data	Dielectric Strength	750 VAC @ 50 Hz / Min (Between Open Contacts)			
		1500 VAC @ 50 Hz / Min (Between Coil & Contacts)			
	Insulation Resistance	100MΩ			
	Electrical Life	1×10^5			
	Mechanical Life	1×10^7			
	Operating Temperature	-40 °C ~ + 70°C			

Fig. 6. Features of relay

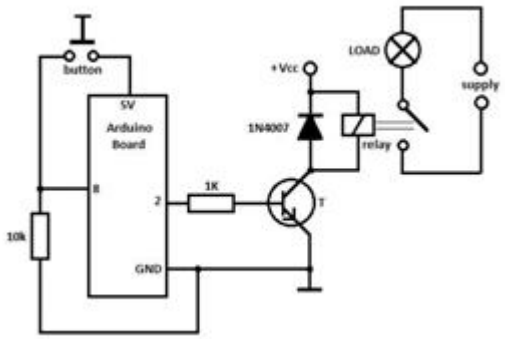


Fig. 7. Relay switch circuit

lot more electrical power.

Fig. 5. 6V Relay

A typical relay switch circuit has the coil driven by a NPN transistor switch, TR1 as shown depending on the input voltage level. When the Base voltage of the transistor is zero (or negative), the transistor is cut-off and acts as an open switch. In this condition no Collector current flows and the relay coil is de-energised because being current devices, if no current flows into the Base, then no current will flow through the relay coil.

If a large enough positive current is now driven into the Base to saturate the NPN transistor, the current flowing from Base to Emitter (B to E) controls the larger relay coil current flowing through the transistor from the Collector to Emitter.

E. Water pump

The water pump is used to artificially supply water for a par-ticular task. It can be electronically controlled by interfacing it to a microcontroller. It can be triggered ON/OFF by sending signals as required. The process of artificially supplying water is known as pumping. There are many varieties of water pumps used. we have used a Generic Micro DC 3-6V Micro Submersible Pump Mini water pump. The specifications of the motor are :

Operating : 3v to 6v
DC Power consumption: 0.4W to 1.5W
Rate of flow: 80 - 120L/hr
Lift : 1.1m MAX Type :submersible
Dimension: 45 x 24 x 30 (LxHxB)mm

Fig. 8. Mini submersible water Pump

F. Water level indicator

Water-level indicator is used to indicate the level of water in tank or ,by using this we can avoid the overflow of water ,and at any time we can know the level of water in tank, it has a simple circuit . Here in our project we have used it to just indicate the level of the water with the help of leds.

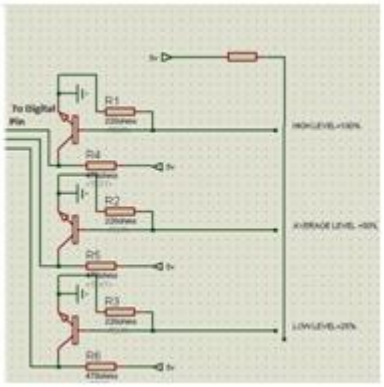


Fig. 9. Water level indicator circuit

G. Blynk Applcation

Blynk is an amazing Drag and Drop IoT application builder for development boards like Arduino, ESP8266, Raspberry, Spark Fun and many other platforms. This wonderful appli-cation that can be installed in both Android and IOS, gives us the possibility to build a digital dashboard by dragging multiple interfaced widgets that can directly communicate with the development board. Installing the application is easy and free for entry projects, the number of widgets that can be used is limited by level of energy which is

used by every control activated. To get more energy you need to pay but the good part is that price is very low.

The working principle is like a chat program. Both the development board and the Blynk app connects to a central Blynk server (cloud) and using an authorization token opens a communication channel which allow them to talk each other trough a push / socket system. That means that the communication channel is bidirectional and asynchronous, exactly what we need for an interactive project.

Fig. 10. Blynk Application

IV. WORKING

Our system works on the following principle: the soil mois-ture sensor will continuously monitor the moisture content of the soil and thus shall send the data to esp8266 module which will then transfer it to the blynk application. If the moisture content is below the desired level, then the Esp8266s microcontroller will switch ON the relay and thus the water pump will supply water to the plants. Again the soil moisture sensor will sense the moisture content and if it is not up to the desired level, the microcontroller will start the water pump. Also we have connected a temperature sensor LM35, that will detect the temperature of the surroundings and if the temperature is too high, the motor will start, supplying water to the plants. The whole system can be monitored from any part of the world using Blynk Application. The blynk application can control the relay, and also it can notify the user if desired i.e. If soil moisture content is less than the desired value then the system will send a notification on the phone asking the user whether he/she shall water the plant by himself/herself,and then again the it will sense the moisture level after some time and if the value matches with the desired value then it will direct the microcontroller to not turn the relay on.

V. RESULTS

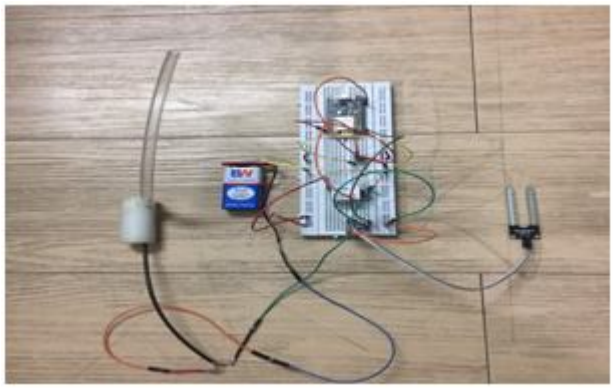


Fig. 11. Relay , soil moisture, temperature sensor circuit

Fig. 12. water level indicator circuit

Fig. 13. Blynk application- soil moisture graph plot

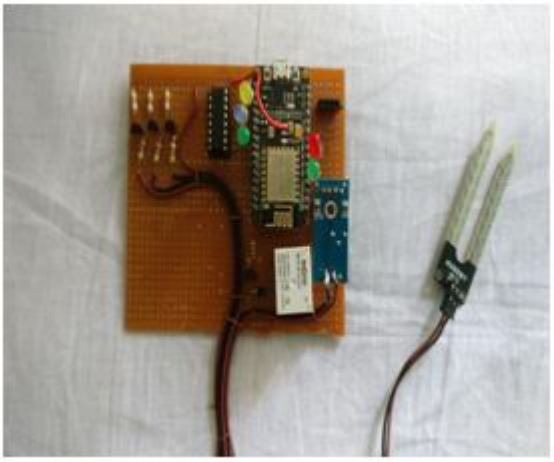


Fig. 14. PLAWATOS MODEL

We tested our system on a garden plant , and we observed the following :

The water requirement of the plant is 900 to 1200 mL/day.

The soil moisture varied from 360 to 960.

The temperature of the soil surrounding varied from 28 to 35 degree Celsius.

VI. FUTURE SCOPE

- The system can be made more efficient by making use of solar panel for power supply which saves the use of electricity.
- More parameters of plants can be measured using varieties of sensors
- It is possible to connect more than one ESPs together using internet in client-server fashion which then can be used to cover more area or even field
- The idea can be further extended in home automation.

VII. CONCLUSION

- Use of Node MCU ESP8266 eliminates the need of arduino as it contains microcontroller of itself
- The product saves the usage of water to some extent and helps in proper watering of plants automatically.
- Use of IOT helps in controlling the product from anywhere in the world.
- The system is being controlled automatically which helps in advancement towards the digital world.

VIII. ACKNOWLEDGMENT

The authors would like to thank Vishwakarma Institute of Technology, Pune for providing such a good platform for applying our technical knowledge. We would like to thank Dr.R.Jalnekar for inspiring and encouraging us by introducing such project activities. Also it wouldn't have been possible for us to focus on this activity without help of our Head of Department Prof.Dr.V.Gaikwad, his continuous motivation has made us work consistently. At last we would like to thank our guide Prof.Dr.S.V.Kurundkar for guiding us throughout this project and making us to think out of the box.

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