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Aurdino based Automatic Plant Watering System with Internet of Things

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ABSTRACT: Agriculture plays a vital role in developing countries . In India, most of population depend on agricultural farming . Many issues hindering the development of agriculture in developing countries . Hence the project aims at making agriculture smart using automation and IOT technology . The highlighting feature of this project includes smart irrigation with smart control and intelligent decision making based on accurate real time field data . Secondly monitoring the operation via android application in any smartphone.In this project we are using three sensor such as soil moisture sensor,temperature and humidity sensor,level sensor. The moisture sensors measure the moisture level (water content) of the different plants. If the moisture level is found to be below the desired level the moisture sensor sends the signal to the Arduino board which triggers the Water Pump2 to turn ON and supply the water to the plant. When the desired moisture level is reached the system halts on its own and the Water Pump2 is turned OFF.The another main aspect of this project is water level sensor.It senses the water level in the tank and it send the information to the microcontroller.If the water level is low water pump1 will operate and pump water to the tank.The whole information about the agriculture field is send to android application

KEYWORDS: Arduino Node MCU, soil moisture sensor, ultrasonic sensor , Temperature and humidity sensor , ESP8266 Module.

I. INTRODUCTION

The automated irrigation system with IOT is feasible and cost effective for optimizing water resources for agricultural production. Using the automated irrigation system we can prove that the use of water can be reduced for different agricultural usage. The irrigation system provide only required amount of water to crop field. This automated irrigation system with IOT allows it to be scaled up for larger open fields. An automated irrigation system was developed to minimizes water use for agricultural crops. The system has a distributed wireless networks of soil moisture and Temperature sensor placed in the root zone of the plants and water level sensor is placed in tank for monitoring the water level in tank. In addition a gateway unit handles sensor information, triggers actuators, and transmits data to a web application. An algorithm was developed with threshold value of temperature, soil moisture and water level that was programmed into a micro-controller based on that motor is operated with the help of Arduino node mcu.

II. DETAILED STUDY

In previous system, the major drawback is “if water level is low in the tank the motor get damage ,due to excessive of heat “.For this we use a ultrasonic sensor and temperature sensor. The ultrasonic sensor is used to detect the level of water in the tank and also temperature sensor to detect the temperature of motor. When the temperature of motor reaches above threshold value the whole system is automatically turn off [1].

The moisture sensors measure the moisture level (water content) of the different plants. If the moisture level is found to be below the desired level the moisture sensor sends the signal to the Arduino board which triggers the Water Pump2 to turn ON and supply the water to the plant[2].In the previous system GSM is used but in our proposed system, we are using android application for monitoring the water level, temperature and humditiy , moisture[3].
And also we included Cloud computing and IOT in this project. cloud computing is also known as on-demand computing, is a kind of Internet-based computing, where shared resources, data and information are provided to computers and other devices on-demand. It is a model for enabling ubiquitous on-demand access to a shared pool of

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configurable computing resources Cloud Computing is the use of hardware and software to deliver a service over a network (typically the Internet). With cloud computing, users can access files and use applications from any device that can access the Internet [4]. The IOT needs standard protocols .For small devices MQTT and COAP are used. Both MQTT and COAP are open standards and are better suited to constrained environments than HTTP.MQTT gives flexibility in communication patterns and acts purely as a pipe for binary data. COAP is designed for interoperability with the web[5].

III. PROPOSED ARCHITECTURE

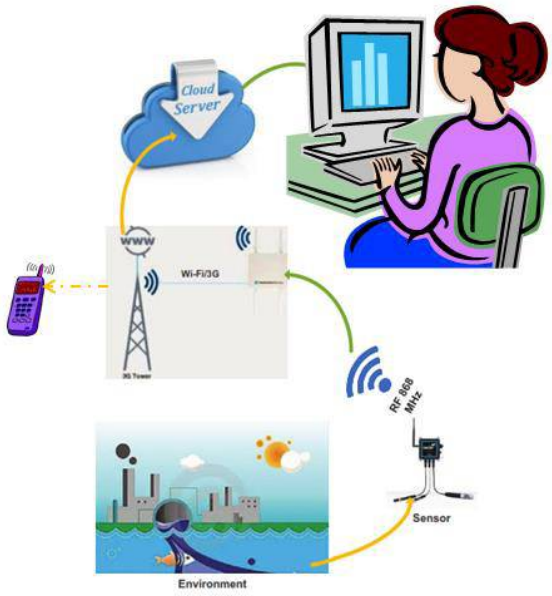

Fig: 1 Block Diagram

In this proposed architecture ,we are using microcontoller (ESP 8266) and it also has wifi router that is attached with it i.e moisture sensor, ultrasonic sensor,temperature sensor and humidity sensor at the field side connected to arduino node Mcu and output device is at the user side to view the action that performed by arduino based automatic plant watering system. Block diagram of the system is shown in the figure 1.
As shown in fig 1 sensor is connected as input to the Arduino node Mcu and it output to the field. The Arduino node Mcu is a microcontroller board based on the ESP8266. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button. And in this system we are used to control the two motor based on the sensor information via by arduino node Mcu.

A) ESP8266 Module

ESP8266 is an impressive, low cost WiFi module suitable for adding WiFi functionality to an existing microcontroller project via a UART serial connection. The module can even be reprogrammed to act as a standalone WiFi connected device .The special features of ESP8266 are 802.11 b/g/n protocol Wi-Fi Direct (P2P), soft-AP Integrated TCP/IP protocol stack

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B) ARDUINO NODE MCU

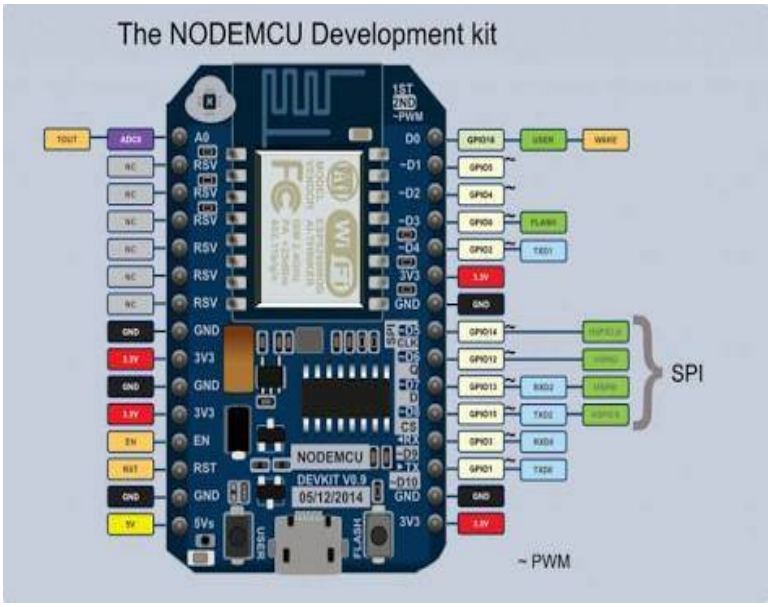
NodeMCU is an open source IOT platform. It includes firmware which runs on the ESP8266 wifi SOC from express if system and hardware which is based on the ESP-12 module. The term "Node MCU" by default refers to the firmware rather than the device kits. The firmware uses the Lua scripting language Advanced API for hardware IO, which can dramatically reduce the redundant work for configuring and manipulating hardware. Node Mcu Greatly speed up your IOT application developing process. The main advantage of node mcu are less cost, size of the board is reduced, less energy consumption.

Specifications:

The Development Kit based on ESP8266, integrates GPIO, PWM, IIC, 1-Wire and ADC all in one board.
Power your development in the fastest way combinating with NodeMCU Firmware.

- USB-TTL included, plug& play
- 10 GPIO, every GPIO can be PWM, I2C, 1-wire
- FCC CERTIFIED WI-FI module
- PCB antenna

Input / Output Configurations:



Power Supply:

- 1 x Analog input (1.0V max)
- 9 x GPIO (3.3V logic), which can also be used for I2C or SPI 2 x UART pins
- 2 x 3-6V power inputs, reset, enable, LDO-disable, 3.3V output

One breakout at the end has an "FTDI" pin out so you can plug in an FTDI or console cable to upload software and read/write debugging information via the UART. When you're done with your coding, remove the cable, and this little module can be embedded into your project box.

Output Point Wiring:

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- GPIO #0, which does not have an internal pull up, and is also connected to both a mini tactile switch and red LED. This pin is used by the ESP8266 to determine when to boot into the boot loader. If the pin is held low during power-up it will start boot loading! That said, you can always use it as an output, and blink the red LED
- GPIO #2, is also used to detect boot-mode. It also is connected to the blue LED that is near the WiFi antenna. It has a pull up resistor connected to it, and you can use it as any output (like #0) and blink the blue LED
- GPIO #15, is also used to detect boot-mode. It has a pull down resistor connected to it, make sure this pin isn't pulled high on startup. You can always just use it as an output
- GPIO #16, can be used to wake up out of deep-sleep mode, you'll need to connect it to the RESET pin.

C) SENSORS

MOISTURE SENSOR:

The soil moisture sensor uses capacitance to measure the water content of soil (by measuring the dielectric permittivity of the soil, which is a function of the water content). Simply insert this rugged sensor into the soil to be tested, and the volumetric water content of the soil is reported in percent.

Fig.4 soil moisture sensor

Specifications:

- Operating voltage: 3.3V~5 Dual output mode (analog output more accurate).
- A fixed bolt hole for easy installation with power indicator (red) and digital switching output indicator (green).
- It consists of LM393 comparator chip.
- Digital Output: digital output interface (0 and 1).

Temperature and humidity sensor:

Temperature and humidity sensor is calibrated with digital signal output. This sensor includes a resistive-type humidity measurement component and an NTC temperature measurement component. The calibration coefficients are stored as programmes in the OTP memory, which are used by the sensor's internal signal detecting process. The single-wire serial interface makes system integration quick and easy. Its small size, low power consumption and up-to-20 meter signal transmission making it the best choice for various applications, including those most demanding ones. The component is 4-pin single row pin package. It is convenient to connect and special packages can be provided according to users' request.

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Fig 5: Temperature and humidity sensor

Specification:

- fast response,
- anti-interference ability
- cost-effectiveness
- 8-bit microcontroller
- a high performance

ULTRASONIC SENSOR:

The HC-SR04 ultrasonic sensor uses sonar to determine distance to an object. It offers excellent non-contact range detection with high accuracy and stable readings. From 2cm to 400 cm or 1 to 13 feet. The operation is not affected by sunlight or black material like Sharp rangefinders are (although acoustically soft materials like cloth can be difficult to detect). It comes with a complete package of ultrasonic transmitter and receiver module

Fig 6: ultrasonic sensor

D) PUMP: A pump is a device that moves fluids (liquids or gases), or sometimes slurries, by mechanical action. Pumps can be classified into three major groups according to the method they use to move the fluid: direct lift, displacement, and gravity pumps. Pumps operate by some mechanism (typically reciprocating),and it consume energy to perform mechanical work by moving the fluid. Pumps operate via many energy including manual operation electricity, engines, or wind power, come in many sizes, from microscopic for use in medical applications to large industrial pumps.

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Fig.7 pump

IV. FLOW CHART OF THE PROCESS

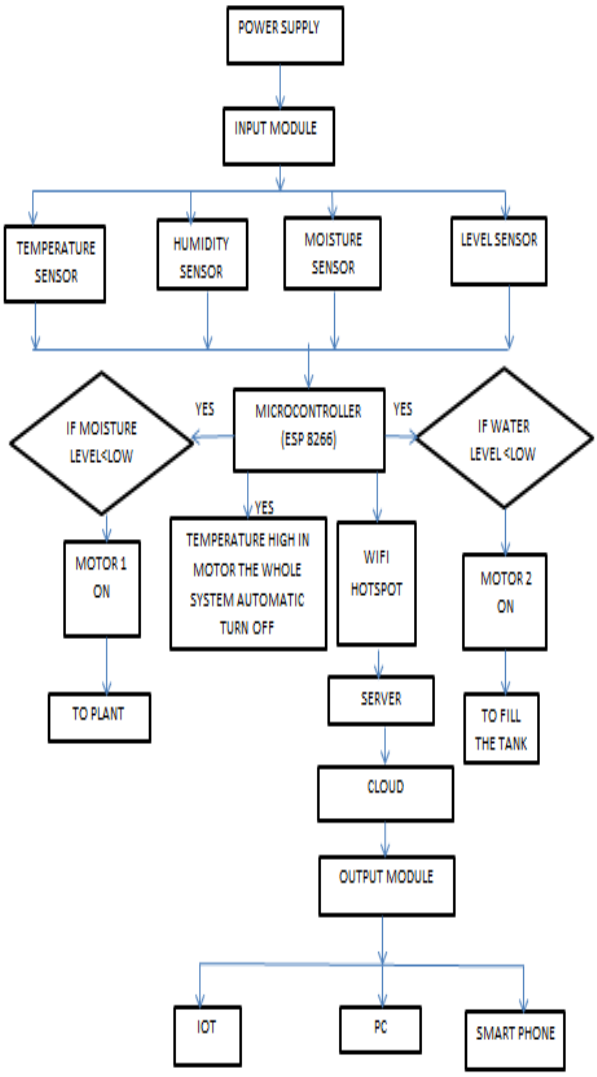

Fig :7 Flow Chart

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Steps of the Process:

1) When power supply is ON, the input module of three sensors starts to activate.
2) When sensors get ON, the Arduino module will activate.
3) If Moisture level is low, the motor 1 is operated and it water the plant
4) If Water level is low in tank, motor 2 is turn on and temperature sensor sense the motor temperature and it turn off the whole system.
5) All the information is send via by wifi hotspot through server and it store in cloud
6) User can See the information from their smart phone

V. SIMULATION AND HARDWARE

From the programming side first we have to configure the Arduino node mcu in communication mode for communication purpose and that is common part for all Arduino node mcu for communication. After the compilation program is in the online simulation mode. Online simulation is used to check that how program is running step by step.

VI. LITREATURE SURVEY

A.N.Prasad [1] Smart Water Quality Monitoring System, water that made available for drinking in town and city articulated supplies . The availability of good quality water is paramount in preventing outbreaks of water-borne diseases as well as improving the quality of life. This paper presents a smart water quality monitoring system using IoT and remote sensing technology.

DIKSHA TARWARE [2] Microcontroller based automatic plant watering system ,When the desired moisture level is reached, the system halts on its own and the Water Pump is turned OFF. Thus, the functionality of the entire system has been tested thoroughly and it is said to function successfully.

.H.T.Ingale [3] Automated Irrigation System, This project based on “Microcontroller based drip irrigation system”. By using sensors we will make them aware about changing conditions of humidity level according to weather so according to changing conditions of humidity they will be able to schedule the proper timing for water supply.

Dr. R.S.Kawitkar[4] Smart Agriculture. Controlling of all these operations will be through any remote smart device and the operations will be performed by interfacing sensors, Wi-Fi or ZigBee modules, camera and actuators with microcontroller and raspberry pi.

Jayanth Thota [5] Arduino based automatic plant watering system, If the moisture level is found to be below the desired level , the moisture sensor sends the signal to the Arduino board which triggers the Water Pump.

VII. CONCLUSION

Thus our project creates an awareness about the automation in agricultural field. Here the manual intervention can be reduced by irrigating the plants automatically and the whole information about the agricultural field can be viewed in android application.

Future scope

1. The project scope involves ARM-controller with a video capturing and sending it to user as MMS about the total crop position or to know the total crop condition.

2. We can connect to the nearer weather station to know the up-coming weather changes.

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