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IOT based Smart Irrigation System

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Abstract: **Automation of farm activities can transform agricultural domain from being manual and static to intelligent and dynamic leading to higher production with lesser human supervision. This paper proposes an automated irrigation system which monitors and maintains the desired soil moisture content via automatic watering. Microcontroller on Arduino uno and Node MCU ESP8266 platform is used to implement the control unit. The setup uses soil moisture sensors which measure the exact moisture level in soil & also it contains Humidity and Temperature Sensor DHT11 for Online monitoring of system. This value enables the system to use appropriate quantity of water which avoids over/under irrigation. IOT is used to keep the farmers updated about the status of sprinklers. Information from the sensors is regularly updated on android application. Also, the sensors readings are transmitted to a Blynk App to display current states.**

Keywords:-IoT, Node MCU, Arduino uno, Irrigation, Cloud.

INTRODUCTION:

Agriculture is the unquestionably the largest livelihood provider in India. With rising population, there is a need for increased agricultural production. In order to support greater production in farms, the requirement of the amount of fresh water used in irrigation also rises. Currently, agriculture accounts 83% of the total water consumption in India. Unplanned use of water inadvertently results in wastage of water. This suggests that there is an urgent need to develop systems that prevent water wastage without imposing pressure on farmers. Over the past 15 years, farmers started using computers and software systems to organize their financial data and keep track of their transactions with third parties and also monitor their crops more effectively. In the Internet era, where information plays a key role in people's lives, agriculture is rapidly becoming a very data intensive industry where farmers need to collect and evaluate a huge amount of information from a diverse number of devices (eg., sensors, faming machinery etc.) in order to become more efficient in production and communicating appropriate information. With the advent of open source Arduino boards along with cheap moisture sensors, it is viable to create devices that can monitor the soil moisture content and accordingly irrigating the fields or the landscape as an when needed. The proposed system makes use of microcontroller NODE MCU [9] and arduino uno platform and IoT which enable farmers to remotely monitor the status of sprinklers installed on the farm by knowing the sensor values thereby, making the farmers' work much easier as they can concentrate on other farm activities.

LITERATURE REVIEW:

In A Remote Measurement and Control System for Greenhouse Based on GSM-SMS the proposed system introduced a GSM-SMS remote measurement and control system for greenhouse based on PC-based database system connected with base station. Base station is developed by using a microcontroller, GSM module, sensors and actuators. In practical operation, the central station receives and sends messages through GSM module. Criterion value of parameters to be measured in every base station is set by central station, and then in base stations parameters including the air temperature, the air humidity. Indu et al. (2013) mainly focuses on reviews in the field of remote monitoring and control, the technology used and their potential advantages. The paper proposes an innovative GSM/Bluetooth based remote controlled embedded system for irrigation. The system sets the irrigation time depending on the temperature and humidity reading from sensors and type of crop and can automatically irrigate the field when unattended. Information is exchanged between far end and designed system via SMS on GSM network. A Bluetooth module is also interfaced with the main microcontroller chip which eliminates the SMS charges when the user is within the limited range of few meters to the designated system. The system informs users about many conditions like status of electricity, dry running motor, increased temperature, water content in soil and smoke via SMS on GSM network or by Bluetooth. In, R.Suresh et al. (2014) mentioned about using automatic microcontroller based rain gun irrigation system in which the irrigation will take place only when there will be intense requirement of water that save a large quantity of water. These systems bring a change to management of field resource where they developed a software stack called Android is used for devices that include an operating system, middleware and key applications. The Android SDK provides the tools and APIs necessary to begin developing applications on the Android platform using the Java programming language. Mobile phones have almost become an integral part of us serving multiple needs of humans. This application makes use of the GPRS feature of mobile phone as a solution for irrigation control system. These system covered lower range of agriculture land and not economically affordable. In IoT SMS alarm system based on SIM900A, an IOT alarm system based on SIM900A module of SIMCOM Company[1] was designed for greenhouse. The system can gather environmental parameters such as air temperature and air humidity. Meanwhile, with the

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use of AT command, this system can also realize SMS[10] automatic sending and receiving, environmental parameters overrun alarm and insufficient balance alarm. Through the system setting, the alarm message can be sent to the user-specified mobile phone automatically no matter what the users' location is.

BLOCK DIAGRAM

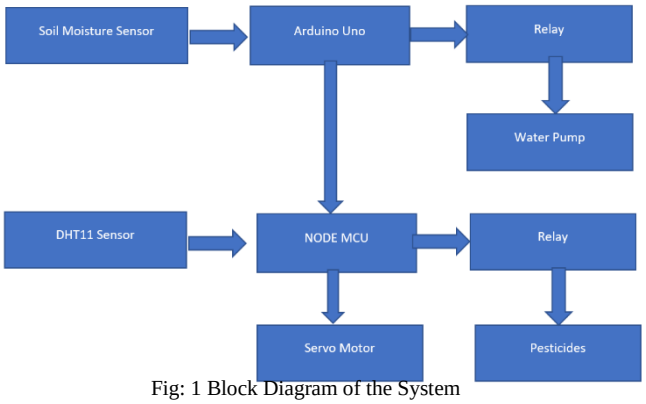


Fig: 1 Block Diagram of the System

FLOW DIAGRAM

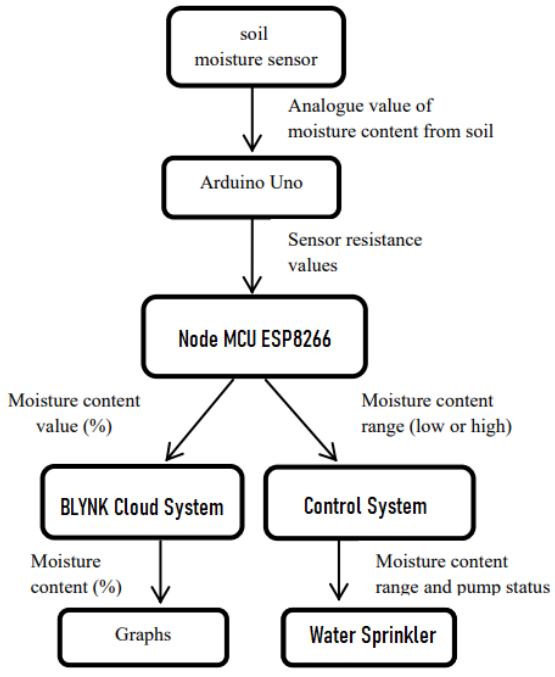


Figure : Flow chart of the system

WORKING

It is clear from the above block diagram, that the soil moisture sensor will sense the moisture level and send the analog signal to the Arduino Uno which will make a decision based on the logical condition define. If moisture level will low then microcontroller will send the signal to the relay to switch the water pump so that it will maintain the moisture level of the soil.

On the other hand DHT11 [2] Sensor will sense the Temperature and Humidity level of the environment and send the signal to the Node MCU for Sending data into cloud for monitoring and Control. In the application end there will be a display unit in which all the data will be displayed and also it consisting of button for pesticide sprinkling control system, in which user will make it on remotely based on Internet of Things.

CIRCUIT DIAGRAM

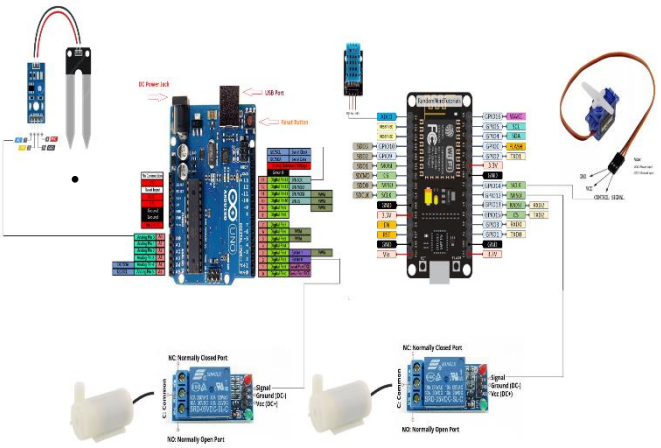
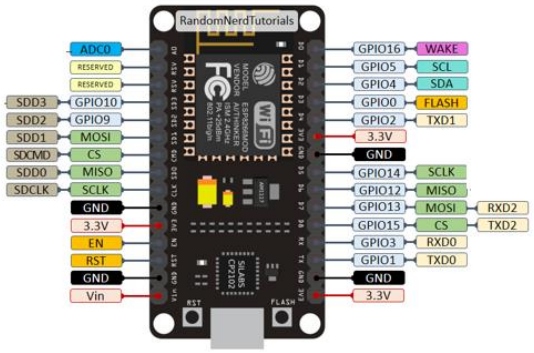


Fig:2 Circuit Diagram

COMPONENTS DESCRIPTION

1. NODE MCU ESP8266:



NodeMCU is an open-source Lua based firmware and development board specially targeted for IoT based Applications. It includes firmware that runs on the ESP8266 Wi-Fi SoC.

Pin Category	Name	Description
Power	Micro-USB, 3.3V, GND, Vin	**Micro-USB:** NodeMCU can be powered through the USB port **3.3V:** Regulated 3.3V can be supplied to this pin to power the board **GND:** Ground pins **Vin:** External Power Supply
Control Pins	EN, RST	The pin and the button resets the microcontroller
Analog Pin	A0	Used to measure analog voltage in the range of 0-3.3V
GPIO Pins	GPIO1 to GPIO16	NodeMCU has 16 general purpose input-output pins on its board
SPI Pins	SD1, CMD, SD0, CLK	NodeMCU has four pins available for SPI communication.
UART Pins	TXD0, RXD0, TXD2, RXD2	NodeMCU has two UART interfaces, UART0 (RXD0 & TXD0) and UART1 (RXD1 & TXD1). UART1 is used to upload the firmware/program.
I2C Pins		NodeMCU has I2C functionality support but due to the internal functionality of these pins, you have to find which pin is I2C.

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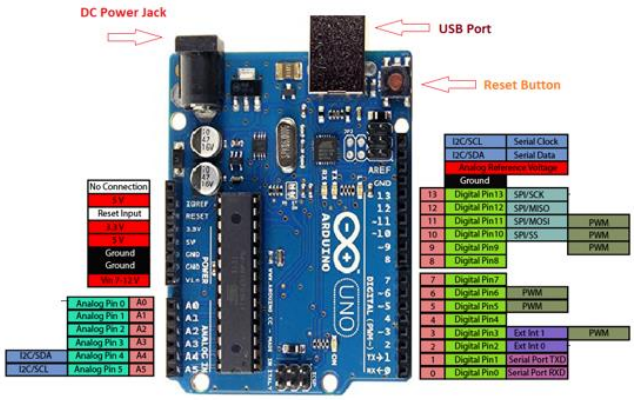
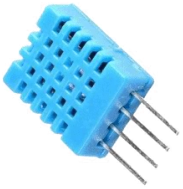
2. ARDUINO UNO:



Arduino UNO is a microcontroller board based on the ATmega328P [3]. 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. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.

The Arduino Uno is an open-source microcontroller board based on the Microchip ATmega328P microcontroller and developed by Arduino.cc and initially released in 2010.[2][3] The board is equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits.[1] The board has 14 digital I/O pins (six capable of PWM output), 6 analog I/O pins, and is programmable with the Arduino IDE (Integrated Development Environment), via a type B USB cable.[4] It can be powered by the USB cable or by an external 9-volt battery, though it accepts voltages between 7 and 20 volts. It is similar to the Arduino Nano and Leonardo. The hardware reference design is distributed under a Creative Commons Attribution Share-Alike 2.5 license and is available on the Arduino website. Layout and production files for some versions of the hardware are also available.
The word "uno" means "one" in Italian and was chosen to mark the initial release of Arduino Software. The Uno board is the first in a series of USB-based Arduino boards; it and version 1.0 of the Arduino IDE were the reference versions of Arduino, which have now evolved to newer releases. The ATmega328 on the board comes pre programmed with a bootloader that allows uploading new code to it without the use of an external hardware programmer.
While the Uno communicates using the original STK500 protocol [12] , it differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it uses the Atmega16U2 (Atmega8U2 up to version R2) programmed as USB to Serial Converter.

3. DHT 11 Sensor



The DHT11 is a basic, ultra low-cost digital temperature and humidity sensor. It uses a capacitive humidity sensor and a thermistor to measure the surrounding air and spits out a digital signal on the data pin (no analog input pins needed). It's fairly simple to use but requires careful timing to grab data. The only real downside of this sensor is you can only get new data from it once every 2 seconds, so when using our library, sensor readings can be up to 2 seconds old.

Technical Details

- •Low cost
- •3 to 5V power and I/O
- •2.5mA max current use during conversion (while requesting data)
- •Good for 20-80% humidity readings with 5% accuracy
- •Good for 0-50°C temperature readings ±2°C accuracy
- •No more than 1 Hz sampling rate (once every second)
- •Body size 15.5mm x 12mm x 5.5mm
- •4 pins with 0.1" spacing

4. MOISTURE SENSOR

The fork-shaped probe with two exposed conductors, acts as a variable resistor (just like a potentiometer) whose resistance varies according to the water content in the soil.

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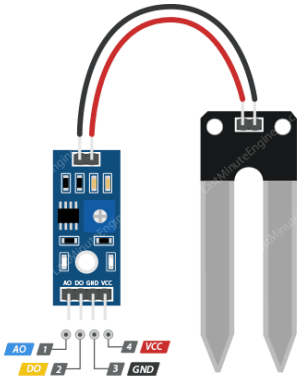
This resistance is inversely proportional to the soil moisture:

- The more water in the soil means better conductivity and will result in a lower resistance.
- The less water in the soil means poor conductivity and will result in a higher resistance[4].

The sensor produces an output voltage according to the resistance, which by measuring we can determine the moisture level.

The sensor also contains an electronic module that connects the probe to the Arduino.
The module produces an output voltage according to the resistance of the probe and is made available at an Analog Output (AO) pin.
The same signal is fed to a LM393 [5] High Precision Comparator to digitize it and is made available at an Digital Output (DO) pin.



5. DC – WATER PUMP:

Micro DC 3-6V Micro Submersible Pump Mini water pump is a low cost, small size Submersible Pump Motor which can be operated from a 3 ~ 6V power supply. It can take up to 120 litre per hour with very low current consumption of 220mA. Just connect tube pipe to the motor outlet, submerge it in water and power it. Make sure that the water level is always higher than the motor. Dry run[7] may damage the motor due to heating and it will also produce noise.

RESULTS:

MODEL:

APPLICATION:

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CONCLUSION:

As per the comprehensive analysis and design of project we found that IoT [8] based smart irrigation system plays an important role for a smart farming. The regular update of data and its notification make it more intelligent level of farming system. This system will increase the productivity of the crop and also save the time of the farmer for remote operation and control.

REFERENCES:

[1] Dr. Narayan G. Hegde, "Water Scarcity and Security in India", BAIF Development ReseachFoundation, Pune.

[2]Marvin T. Batte, "Changing computer use in agriculture: evidence from Ohio", Computers and Electronics in Agriculture, Elsevier science publishers, vol. 47, 1–13, 2005

[3] Csótó, Magyar, "Information flow in agriculture – through new channels for improved effectiveness", Journal of Agricultural Informatics 1 (2), 25–34, 2010

[4] Jin Shen, Song Jingling, Han Qiuyan and Yang Yan, "A Remote Measurement and Control System for Greenhouse Based on GSM-SMS", Electronic Measurement andInstruments, 2007. ICEMI '07. 8th International Conference

[5] Indu Gautam and S.R.N Reddy, "Innovative GSM based Remote Controlled Embedded System for Irrigation", International Journal of Computer Applications Vol. 47 – No.13, June 2012

[6] R.Suresh, S.Gopinath, K.Govindaraju, T.Devika, N.SuthanthiraVanitha, "GSM based Automated IrrigationControl using Raingun Irrigation System", InternationalJournal of Advanced Research in Computer and Communication Engineering Vol. 3, Issue 2, February 2014.

[7] Karan Kansara, Vishal Zaveri, Shreyans Shah, Sandip Delwadkar, and Kaushal Jani "Sensor based Automated Irrigation System with IOT: A Technical Review",(IJCSIT) International Journal of Computer Science and Information Technologies, Vol. 6 (6) , 2015, 5331-5333

[8] Sumeet. S. Bedekar, Monoj. A. Mechkul, and Sonali. R. Deshpande "IoT based Automated Irrigation System", IJSRD - International Journal for Scientific Research& Development| Vol. 3, Issue 04, 2015 | ISSN (online): 2321-0613

[9] K.S.S. Prasad, Nitesh Kumar, Nitish Kumar Sinha and Palash Kumar Saha "Water-Saving Irrigation System Based on Automatic Control by Using GSM Technology", Middle-East Journal of Scientific Research 12 (12): 1824-1827, 2012ISSN 1990-9233 c IDOSI Publications, 2012DOI: 10.5829/idosi.mejsr.2012.12.12.1258

[12] Alexandros Kaloxylos, Robert Eigenmann, Frederick Teye, ZoiPolitopoulou, SjaakWolfert, Claudia Shrank, Markus Dillinger, IoannaLampropoulou, Eleni Antoniou, LiisaPesonen, Huether Nicole, Floerchinger

[10] Remote Sensing and Control of an Irrigation System Using a Distributed Wireless Sensor Network by Yunseop (James) Kim, Member, IEEE, Robert G. Evans, and William M. Iversen, IEEE Transaction on Instrumentation and Measurement, VOL.57

[11] Blynk Application :https://blynk.io/

[12] Alexandros Kaloxylos, Robert Eigenmann, Frederick Teye, ZoiPolitopoulou, SjaakWolfert, Claudia Shrank, Markus Dillinger, IoannaLampropoulou, Eleni Antoniou, LiisaPesonen, Huether Nicole, Floerchinger