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Review: IOT BASE LOW COST IRRIGATION MODEL

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Abstract: *In irrigation needs continuously monitoring the field and model be automated this can achieve by using internet of things technology. Only IOT technology has potential to make it possible a low cost irrigation model. In this paper we have reviewed on articles made by the authors of different countries with their current technologies for IOT based irrigation system. Reviewing those articles makes an alternative for a low cost irrigation model. This paper provides information about technologies is being used around the world to make a low cost irrigation system.*

Index Terms **- IOT (Internet Of Things), Blynk, Irrigation, Sensor, NodeMCU, Actuators, Cloud, Etc.**

I. INTRODUCTION

IOT is game changer concept for creating a low cost and responsible system in every field. IOT is abbreviated as Internet of Things. It is used Internet to connect and programme the things. It converts the idea into model and enhances the capability of that model. IOT makes system affordable. This model is based on IOT technology having sensors and actuators with a micro controller (NodeMCU) and Blynk cloud to visualize the data which are sensed by the sensors.

In India 70% peoples depends on agriculture for living of their life. Agriculture completely depends on irrigation which are from rain and underground water. Water is not only important things for human being but also living being on the Earth. It needs to prevent from wasting. Cent percent of water supply utility is necessary in these days to prevent water wasting this is only possible when we made a machine that uses intelligence to control water supply for their crops.

Crops also needs continuously monitoring for some parameters like Temperature, Humidity and Soil moisture to control the water supply and get wonderful productivity for their crops. Those parameters are measures from sensors and data are evaluated using algorithm then some specific results are coming out that leads to direct the actuators for On/Off the motor which is connected to the system.

This system also has visualization technique using Blynk app and Blynk web cloud. This technology is provided by the Blynk Company. It solves the problem of visualization of data into mobile phone that are hand of consumer to check the parametric value.

1. Literature Review

For designing a good quality model we are reviewed out different existing system developed by researchers. Different authors have proposed distinguished models in the field of irrigation using IOT technology and analyzing the parameters such as Temperature, Humidity, Soil moisture, Raindrop, Intensity of light and many more. By considering all these points, we designed a smart water supply monitoring system (Low cost Irrigation model) which can perform all these monitoring functions.

et.al Ravi Kishore Kodali [1] **A Low Cost Smart Irrigation System Using MQTT Protocol.** In this model they are using soil moisture sensor, DHT22 sensor, Realay module to create a model for solving problem that comes in the farm to check the water level to turn on/off the motors and also they have made the web page and mobile app. They basically solve te problems arising of unnecessary visting the farm only to turn on and off the motor pump.

et.al R.Nandhini [2] **Arduino based smart irrigation system using IOT.** This model they have used soil moisture, PH, PIR sensor, LCD to display the values which have been sensed by sensor, humidity sensor GSM module to send data as SMS and updated into website. They mainly concerned about the man power needed to work on the farm by using automated irrigation system.

et.al Ms. Swapnali B.Pawar [3] **Smart Irrigation System Using IOT And Raspberry Pi.** In this model they have created irrigation system with the help of soil moisture sensor, DHT11 sensor, Raspberry pi micro controller, relay module, transformer, webcam, LDR. They focused on water wasted due to population increases and use of water also wastage increases to reduce this in the farm field they made automation to control and monitor the farming.

et.al Prakhar Srivastava [4] **Overview of ESP8266 Wi-Fi module based smart irrigation system using IOT.** They have made smart irrigation system this system has PH, water flow sensor, soil moisture sensor, temperature sensor, servo motor, water pump and ESP8266 wifi module. They have made website for this to monitor the value. They focused on efficient use of IOT in farming to increase the productivity.

et.al Kalyan Kumar Jena [5] **A Smart Watering System Using IoT.** They have made watering system using IOT, soil moisture sensor, temperature-humidity sensor, arduino UNO board. They have focused on time saving, reducing money and man power.

et.al Anjali Dokhande [6] **A Review Paper on IoT Based Smart Irrigation System.** The paper purpose is to automate irrigation model with using soil moisture sensor, dht11, ATMEGA328P micro controller. Farmers keep updating about the sprinkler by thingspeak web. They have measured the soil moisture with different categories with efficient use of water.

et.al Divyansh Thakur [7]. **Smart Irrigation and Intrusions Detection in Agricultural Fields Using I.o.T.** They have used Arduino ATMEGA 328, Soil moisture sensor, PIR sesor and water pump they made a model to us in green house for reducing water wastage and visualize data in Arduino IDE. They have using drone to survey the farm. Their system has sensors, actuators, transmitters. They have focused on to reduce the load on human body. They are using python language for coding and data shorting in excel sheet. They have used Dropbox to check the status of field.

et.al Dr. S. Velmurugan [8]. **An IOT based Smart Irrigation System using Soil Moisture and Weather Prediction.** They have used soil moisture sensor, Uno board, and display board for their system; they have weather forecasted for prediction of soil moisture. This paper describe the measurements of parameters and along with the weather forecasting using proposed algorithm. They have worked on the problem of water wastage in the absence of knowledge of parameters details and weather.

et.al Emerson Navarro [9] **A Systematic Review of IoT Solutions for Smart Farming.** They have made a system to manage the farming using IOT. They have used Aurduino, Raspberry pi, humidity sensor, temperature sensors, drone CO_2, image sensor, AI and machine learning to create a model.

et.al R. Rajavarman [10] **Smart agricultural water irrigation monitoring and control system using IOT Blynk server.** They made framework to measure the temperature, soil dampness, stickiness and IOT Blynk server to visualize the data. They have used NodeMCU, LM35, moisture and humidity sensor, GSM modem.

et.al Omar Abu Hassan [11] **Iot Based Smart Irrigation Control And Monitoring System.** This project they have designed and developed the smart irrigation system this can be monitored and controlled through mobile phone. They have used NodeMCU microcontroller, soil moisture sensor, relay, water pump, Blynk.

et.al Laura García [12] **IoT-Based Smart Irrigation Systems: An Overview on the Recent Trends on Sensors and IoT Systems for Irrigation in Precision Agriculture.** This paper has to provide overview of IOT irrigation system for agriculture. They have measured soil moisture, weather condition for categorized water quality. They have modeled using IOT and WSN for irrigation of crops. They have also provided 4 layer architectures for management for crop irrigation.

et.al Chetan Kumar [13] **Smart Irrigation System using IOT.** They have used Arduino Raspberry pi, humidity, temperature sensor, temperature sensor, water pump, LDR, relay, GSM. They have focused to saving time in agriculture system, water management, and wastage of water.

et.al Chaowanan Jamroen [14]. **An Intelligent Irrigation Scheduling System Using Low-Cost Wireless Sensor Network Toward Sustainable and Precision Agriculture.** In this paper they have used Arduino UNO, DUE , soil moisture, DHT11, canopy temperature, LDR, solar radiation sensor, Motor driver and pump using fuzzy logic, they have developed wireless sensor network for irrigation scheduling system price of 288.98 USD($288.98*75 = 21673.5 INR).

et.al Priyanka S Talekar [15]. **Smart Irrigation Monitoring System Using Blynk App.** They have used NodeMCU micro controller, Soil moisture, Temperature, humidity sensor, pump and Blynk app for data visualization and controlling. They basically focused on neglecting the watering of the plant so they have

made a model that have been used to monitored and controlled using Blynk app connecting to the phone. That is based on mobile computing which provide real time statistics of garden.

et.al Wei-Ling Hsu [16] **Application of Internet of Things in Smart Farm Watering System.** In this model they have used Arduino control panel, Webdino control panel, soil moisture sensor, Microwave radar motion sensor module, LED matrix display, webcam, IFTTT, line reporting system, Normally closed solenoid valve, relay. They have developed intelligent watering system using IOT and ICT that monitor the field remotely from phone.

et.al T. Udhaya Kumar [17] **IoT Based Smart Farming (E-FARM)'S.** They have used soil moisture sensors, DHT11 sensor, NodeMCU, GSM module, relay module, Blynk app. They have made a model to schedule irrigation, fertilizer supply and improve the yield of efficient crop. It displays the sensor value through Blynk app in consumer's phone to control and monitor also measures temperature and humidity. Their main objectives are to reduce man power, time, increase efficiency and control cost.

2. Problem formulation

Water supply management is very much important for any kind of plantation weather it is gardening or farming. Farming is not possible in small area and it needs irrigation accordingly large area to cover. For large area it requires continuously monitoring the water supply in the farming field. For next generation farming needs a supervised irrigation but the costs of systems that in the market are very high for middle class farmers. For continuously water supply it needs a well managed automated irrigation when soil moisture value drops from the pre defined value but measuring field soil moisture level, temperature and Humidity are difficult for the farmers. If don't want to use such automation in irrigation it will affect the productivity and also consume more only to physically monitor the farming field. So the costs are the major problem of irrigation models. If farmers are doing traditional way of farming field have to monitor by themselves that causes the health issue over there. In traditional way they have to pay their labors for same thing. If irrigation is not managed well it not only affect the farmer life but also affects countries economy because in India like countries farmers and their related products are much contributed to the economy of the nation. If farmers suffer it directly related to the food shortage around the globe comes soon.

3. Objective

Objective is to make a low cost IOT model to overcome the above mentioned problems and farmers can feel relax over those irrigation related issues. This product not only controls the irrigation but also it indirectly controls the hunger of the globe and economy of the nation which are agriculture dependent. From this paper we would like to explain the technology used to monitor the large area of the field, sensors data to analyze further to enhance crop productivity, automatic water supply starts when soil moisture sensed and analyzed if moisture level reduces to predefined value and also used NodeMCU for reducing the cost of system to make successful irrigation system using Internet of Thing. That's all overcome the burden of farmers.

4. Proposed system

A system or model is needed for a farmer that can control the automatic and smart water flow into the garden, farm etc whenever it's needed and should be low cost only done by the IOT technology. Internet of Things can do with help of AI and machine learning and visualize the data into different manners. I suppose to visualize the data into the Blynk cloud which is connected through Wi-Fi.

In this system has 4 parts to explain:

1. Sensors, 2. Microcontroller, 3. Actuators and 4. Visualization method

5.1 Sensors: sensors are the components which are used to sense the parameters like environment conditions ex. Temperature, Humidity, Rain, Soil moisture so it needs 3 sensors to sense 4 parameters for Temperature and Humidity it require DHT11 sensor, for Rain it require water sensor, for Soil moisture it require soil moisture sensor.

All the sensors have 3 pins to connect one is voltage pin, second is ground pin and third is Data pin that are used to send data into microcontroller.

4.1.1 DHT11 Sensor

DHT11 is abbreviated as digital humidity and temperature sensor. It provides calibrated digital output. It uses capacitive sensor element to measure relative humidity and negative temperature coefficient type thermistor is uses for temperature measurement. It has 4 pins (Supply Vcc, Ground, Data pin, No Connection{NC}) used to connect with microcontroller.

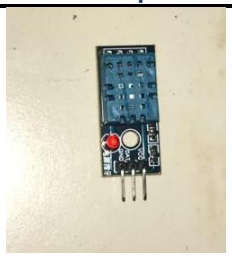

Fig 5.1 DHT11

4.1.2 Soil Moisture Sensor

It uses to measure the water content in the soil by measuring dielectric constant, electrical resistance, or interaction with neutrons.
It has four pins (A0, D0, Vcc, Ground)
A0 used for Analog data
D0 used for Digital data
Vcc used for Voltage supply
Ground used for ground.

Fig 5.1.2 Soil moisture sensor

4.1.3 LDR Sensor

It is abbreviated as Light Dependent Resistor. LDR sensed the light intensity ad changes its resistance value. This property can be Use Street light when sun goes down it senses and sends a signal to Micro Controller after calculation street light glows. This is also used to check bright of intensity of light. It is a passive component that decreases the resistance value when lights fall upon. It has two leads one is used for power and other is used for ground and data. For ground pin it connected through resistor but for data it uses only lead without resistance.

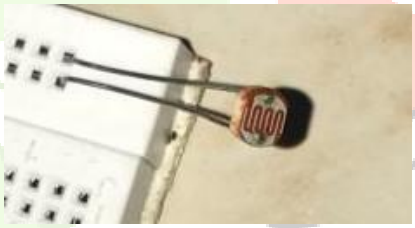

Fig 5.1.3 LDR sensor

4.1.4 Water Sensor

Water sensor is input sensor that detects the water, rain, and flood. It is widely used to sense rainfall, water level. It can measure the presence of water content in it. It has three pins (Vcc, Ground, Signal).

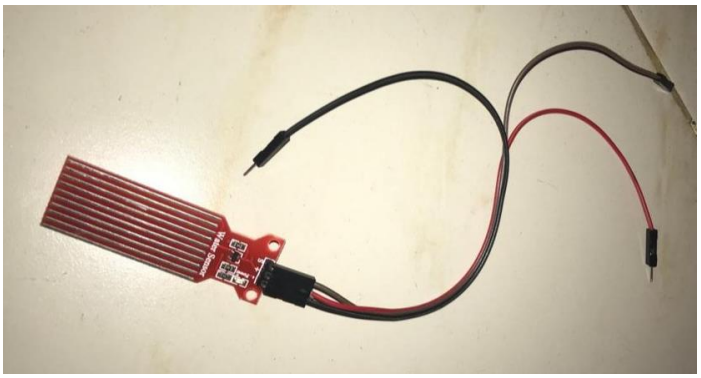

Fig 5.1.4 Water sensor

5.2 Microcontroller

Microcontroller is like mother board for the model it has number of pins, RAM, cache memory, set/ reset buttons Wi-Fi module if it is NodeMCU microcontroller.

NodeMCU

In NodeMCU has digital and analog pin, digital (D0-D8) pins are used for two values HIGH and LOW, analog (only one A0) is used for 1024 values. NodeMCU also have Voltage and Ground pins for power supply. Microcontroller can be controlled by programming. For programming a microcontroller needs to install Arduino IDE which have select the port and board download libraries for connected equipments then start writing a code in space providing for them. Before uploading a code into microcontroller first compile that code. Sensors start publishing their respective values into serial monitor.

Fig 5.1 Microcontroller

4.2 Actuators

Actuators are output device which is connected and programmed to the system which can perform as programmer wants. In this model actuators are nothing but a motor pump which ON/OFF if required. Motor pump require AC supply but microcontroller only has 5V and 3.3V DC supply.

4.2.1 Relay Module

Relay Module which is connected to 240V AC which connect microcontroller and motor pump. A relay module is an electrically operated switch. Relay module uses Electromagnetic principle to operate as switch. Relay module is magnetic attraction type relay if signal is HIGH it connects the power supply and motor pump as a switch and if signal is LOW it disconnects the power supply to the motor pump. Relays modules are used to control a circuit by a signal generated by NodeMCU. It has 3 pins (Vcc, Ground and Input pin). NodeMCU output is max 5v dc but the motor pump operated at 220v dc so it needs a relay that is connected to the supply and trips when it gets signal from NodeMCU to start a pump

Fig 5.2.1 Relay module

4.2.2 Water Pump

Water pump is 220v ac motor that is used to control the water flow in this project connected to the Micro Controller Unit (NodeMCU) through a Relay module.

Fig 5.2.2 Water Pump.

4.2.3 LED

LED is abbreviated as Light Emitting Diode. It is a diode which emits the light from itself when power is given to it. LED is used to being programmed with LDR to show when LDR gets a value above the threshold then LED is used to ON and if the value is less than the threshold then LED is used to OFF. LED is used as indicator to know that action performed or not. LED has two terminals long one is power supply, short one is ground through resistor.

Fig 5.2.3 LED.

5.4 Visualization method: Arduino IDE(integrated development environment) is a cross platform IDE designed for microcontrollers like Arduino, NodeMCU. It is a software that is used to run a program written to control or instruct the microcontroller and its connected sensors and actuators. It is a text editor like Notepad with have many features. The open source Arduino IDE it can make easy for writing a code, compile that code, check that code if it is correct then run the code to perform the task given to them. It contains text editor for writing code, toolbar message area, text console, serial monitors to check the performances, buttons for many functions and series of menus. It is connects to the NodeMCU with sensors and actuators through computer. Word files are called as documents whereas the Arduino files called as sketch.

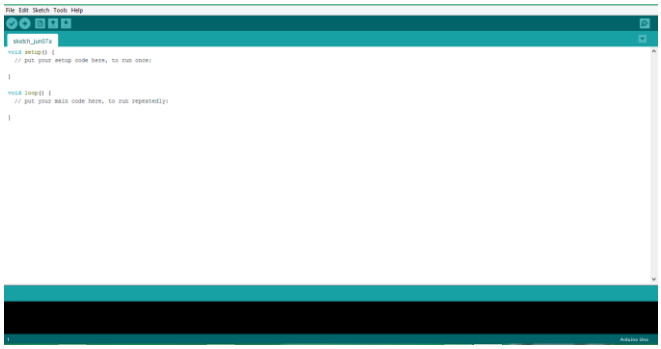

Fig 5.4 Arduino IDE

After a model is completed to operate on field it needs to visualize the data to the operator's hand. So we have to use Blynk cloud and mobile app to read the readings what sensor sensed. For Blynk to connect have to install Blynk libraries into Arduino IDE and codes for Blynk to accept values and send into the cloud and mobile app. Blynk is connected to the system by Wi-Fi, Ethernet etc. First open Blynk cloud website register their, create template, create data stream, copy the template ID, Auth token, Device name and paste into codes written for model and also SSID and PASSWORD same as mobile which have Blynk app have installed to visualize the sensor data.

Conclusion

The purpose of this paper is to review all the methods, technology, hardware, software have been used to implement a model of IOT based for irrigation. All the insights of the papers are reviewed to be used in model creation. Those papers are written in very simplified way to understood. Microcontroller needs to be programmed for system to work as the programmer wants. The programming languages that have been used is basically a LUA script which is very close to C++ for programming needs to install Adruino IDE. Those are from recent years not only from India but also from other countries this will help to understand the technologies that have been used in other countries as well. I have gained meaningful insights and data that may help to create my model based on IOT technology for irrigation. I prefer to work on NodeMCU for controlling the model as microcontroller and Blynk for data visualization in good manner. It is concluded that for model my creation a lots of components are required that are NodeMCU, breadboard, soil moisture sensor, DHT11 sensor, LDR sensor, raindrop sensor, relay module, water pump, connecting wires, Blynk cloud etc.

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