

ANDROID BASED IOT FOR AGRICULTURE AUTOMATION

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Abstract: An automated irrigation system is developed to minimize and maintain water quantity usage for farming. The system will have required sensors of our interest like temperature, moisture, humidity sensors placed in crop field at roots of plants. A micro-controller based relay is used for controlling water supply. Automation is done through IOT i.e., IOT is a shared network that can interact with objects through internet connection. This smart work helps in effective usage of resources like water, fertilizers, electricity. This system is developed for monitoring and maintaining the situation at farm field with sensors. Mobile networks i.e 3G and LTE, together with smart phones have made tremendous growth in technology. Where objects like micro controller and other are connected to internet with an IP address. This IOT has spread too many fields like home automation, smart agriculture etc., through android mobile app.

Key words : Irrigation, Automation, Micro controller, Sensors, Mobile app, Ethernet, ZigBee, Bluetooth, Internet of Things (IOT).

Introduction:

Automatic control is used in various applications like home automation, factories- boilers, switching telephone devices, ships, air craft, etc which reduces human intervention, it reduces labour, energy,

Automation can be done using two prototypes namely

- Wi- Fi, Bluetooth, Zig Bee
- Ethernet

Wi-Fi, Bluetooth, Zig Bee

Bluetooth (IEEE 802.15.1) :

Bluetooth is based on wireless radio system designed for short range and cheaper devices for replacing wired connections, i.e., mouse, keyboard, joysticks, printers etc., This is referred to WPAN – Wireless Personal Area Network. connectivity topologies in bluetooth are Piconet and Scatternet. Piconet Connection is formed by Master-Slave configuration, i.e., one master and one or more slaves devices frequency hopping channel method is used for addressing master . All devices participating in here in Piconet are made synchronous with same clock in communicating point to point under the control of master.

Wi-Fi (IEEE 802.11a/b/g)

Wireless Fidelity (Wi-Fi) is standard for (WLAN) Wireless Local Area Network. It allows surfing internet at broadband speed by connecting to access point (AP). this has many components that provide LAN. when a node in BSS moves out

of BSS it cannot connect with other members of BSS, so there is another system ESS Extended Service Set and Independent Basic Service Set (IBSS) configurations. With these configurations station can communicate without AP and this operation is referred to be ad-hoc network

ZigBee (IEEE 802.15.4)

ZigBee is a low rate WPAN i.e., LR-WPAN that connects devices that operating in close sapce. ZigBee uses mesh network, self organised, multi-hop with battery life time [8-9]. In this network two types of devices can operate namely FFD (Full Function Device), and RFD(Reduced Function Device) .FFD acts in three forms PAN coordinator, a coordinator, device.

FFD can talk with RFD and FFD, but RFD talk only with FFD. RFD are used for simple applications

After activating FFD for first time ,it acts as PAN- Coordinator. Each star network is differentiated from other, and PAN identifier can allow connections between different stars. RFD is connected in cluster tree network

Ethernet

Ethernet is physical later of Local Area Network (LAN). In last 30 years it has become the most commonly used LAN network technology as is of low cost, high speed and easy installation. It supports majority of network protocols .

Ethernet standard

Metcalf system runs at speed of 2.94 Mb/s was invented first, and in 1980 dec, Inte issued DIX Ethernet standard for 10 Mb/s. in the same year, Institute of Electrical and Electronics Engineering (IEEE) made a committee to develop open network standards. In 1985 this committee developed a standard based on DIX- IEEE 802.3,

with a technology of (CSMA/CD) Carrier Sense Multiple Access with Collision Detection, and name was continued to be Ethernet given by Metcalfe's.

Some of the Ethernet Standard are Fast ethernet, Gigabit ethernet etc., classified based on speed in Mb/s

Internet of Things (IOT):
Coming to internet of things it came to know from CISCO that 50 billions devices would be connected to internet by 2020. IOT deals with billions of objects which are connected to communicate with other. It improves quality of living in more intelligent and meaning ful manner. It also includes safety, security and entertainment. IOT plays important role in realising smart cities, smart Irrigation.

Related works :

The functional Components in the system are sensors and motor pump. Arduino with Arduino IDE software. Moisture sensor is used to moisture level of soil, motor is used to supply water. Ranges of sensor is set according requirement of plants with these setting micro controller works, all sensor are connected to input pins of controller, pump motor is connected to output pin, so that when soil moisture falls below threshold value system triggers motor automatically till threshold level is reached and reported to user using mobile application

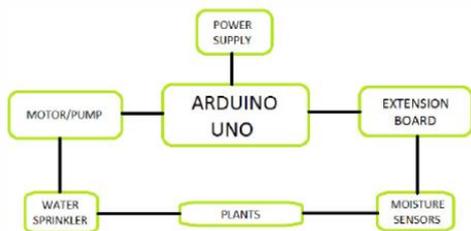


Fig:Block diagram of existing work

Aspects of the system

Measuring Mositure content

Soil moistures placed in field performs this action . they are connected to arduino board and sensors sends sensed data signal to board.

On Receiving logical high data signal arduino checks with threshold and notify whether to turn on motor or not. Arduino is used in combination with relay network to control motor pumps and motor is driven by external 9 volt battery.

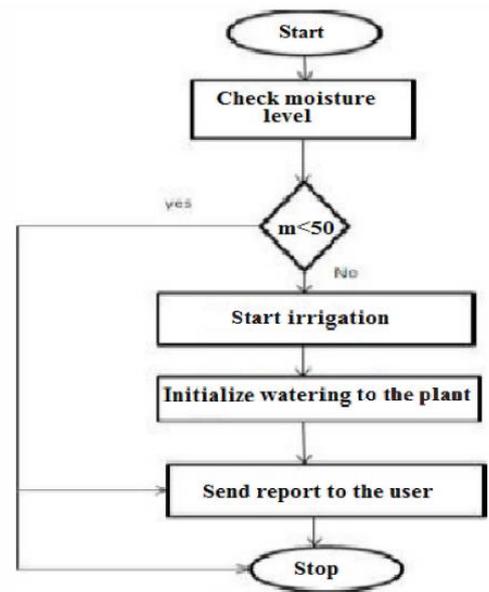


Fig:Flow chart of the system

Components used for Implementation of the system

Arduino Board (UNO)

Arduino is micro-controller based on Atmega328, having 14 digital In/Out pins of which 6 are for PWM output, 6 are for analog input. Operates at 16 MHz, with a USB, Power jack, rst button



Fig:Arduino board

Moisture Sensor

Soil Moisture Sensor detects the moisture content of soil, it consists of a plurality of soil moisture sensors.

Technology used is Frequency domain Sensor i.e., capacitive sensor, moisture meter characteristic of the use of water in the neutron moderator



Fig:Temperature Sensor Water Pump

It performs specific task of artificial watering to plants, Here it is controlled by microcontroller electronically, it can be on 1 triggered by sending signal and can be turned off as needed. Here we used H-bridge connected small pump.



Fig:Water Pump

Relay Module

Relay is an electrical switch. It uses solenoid mechanism that is operated mechanically

Relay system provides provision for operating motor by microcontroller because, microcontoller cannot directly control motor, because power supplied by cotroller is not suufficient to drive motor

Arduino IDE Tool

Arduino IDE tool (software) is a open source environment where we can write a code and upload it on to UNO board . it runs on windows Mac os and Linux Os

Proposed Work :

Proposed work have many advantages over the existing

- Used Raspberry Pi , which can handle many tasks , whereas arduino can perform single task at once.
- Here, we use an ANDROID application for not only monitoring the readings from sensors, but also we can give threshold limit for automating motor based on moisture level in soil
- The proposed architecture is given in the figure

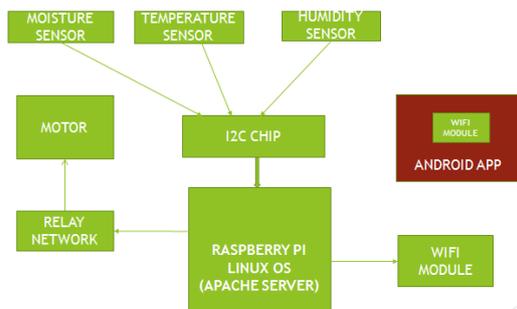


Fig:Block diagram of Proposed Work Components used for Implementing the System

Raspberry Pi

It is single board device developed by UK-Raspberry Pi foundation, for promoting teachings on basics of computer science and original model became more popular than anticipated mainly used in robotics and can be connected to keyboard, mouse ect.,

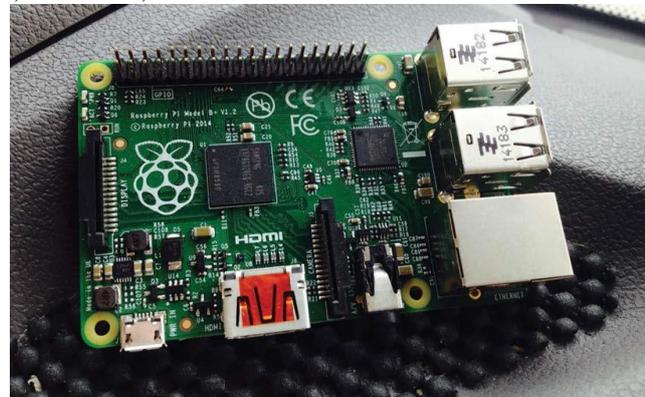


Fig:Raspberry Pi

USB ports

As raspberry Pi can perform similar actions that of computer, It have a provision to interface with keyboard, mouse by using USB port, raspberry has 4USB ports. Since the ports don't provide much power we have to find a device that comes with an external power supply



Fig:USB port

Ethernet port

The most traditional way for connecting internet to device by using ethernet cable, raspberry pi have ethernet port for connecting internet to Pi board, and easier method to setup than wi-fi and provide faster internet than alternate ways,



Fig:Ethernet Port

GPIO header

GPIO stands for General Purpose Input Output port, used for set up of connection for various functions, mainly to connect Raspberry Pi to an Electronic circuit using programming

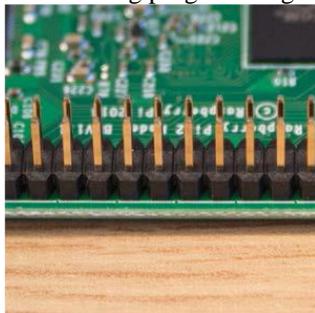


Fig:GPIO pins

MicroSD card slot

A micro SD card is used hard drive for Pi, SD card will have Operating System loaded into it. .A computer doesn't have provision for connecting SD card directly to it.



Fig:Micro SD card Slot

Power

Power supply to Raspberry Pi is given through Power that is similar to Smart Phone charger pin, Power supply can be given from a Charger ie. Mobile charger, or can be given from PC

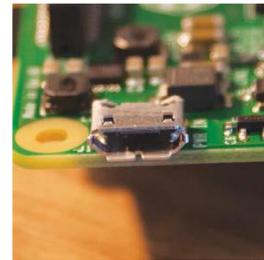


Fig:3.8:Power Pin

HDMI port

HDMI port is used fro connectng Raspberry Pi with TV and Monitor to see on required Screen

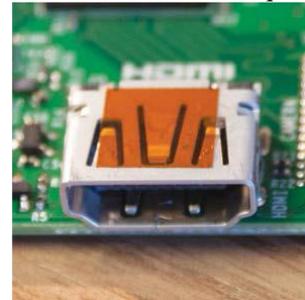


Fig:HDMI Port

Operating system (LINUX OS)

Embedded sytem, a combination of hardware and software.Hardware is RASPBERRY PI- It is a micro computer that performs all tasks done by computer like storage , communicating etc,

- Software is LINUX OS- OS is defined as code that runs hardware kernel bit set. It is an interface between user and the architecture.
- LINUX OS is open source operating system and is freely distributed cross-platform

Temperature and Humidity sensor

Temperaature and humidity sensor used is DHT11. It has a complex feature with a calibrated digital signal as output. This sensoe has digital acquisition technique and sensing technology which makes it highly reliable and long term stable.

This has a resistive type humidity measuring component connected to a micro controller offering excellent, quality, fast response, anti-interference ability and cost effectiveness

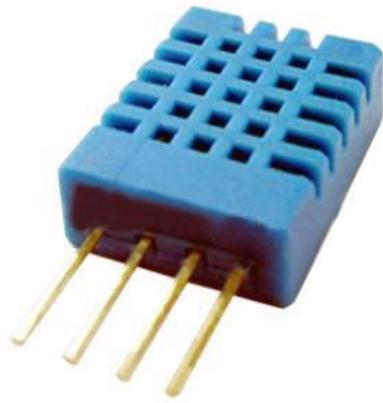


Fig:Temperature and Humidity Sensor

Apache Web Server

- Apache web server is the most commonly used web server.
- It stores data acquired from farm field and accepts reques from client and sends resposes to those requests..

This gives a URL, IP address to communicate, i.e., by installing this we get an IP address to hardware RASPBERRY PI, so that we can get update either through web page or android app.

Android Application

Android app is created by Java, in eclipse software, so that we can continues monitoring, if necessary we can update the threshold values of moisture directly by sending signals to microcontroller through Wi-Fi module.

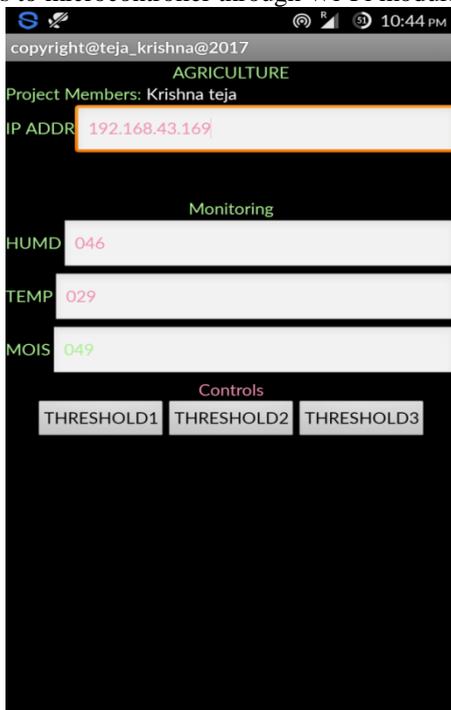


Fig:Screenshot of Mobile Application

I²C Chip

- Inter Integrated Circuit often shortened as I2C, IIC, I²C .
- It was developed as a Communication Protocol to interact between different IC's, Sensors, Chips to Central Processing Unit (CPU) i.e. Computer.
- Here we are using RASPBERRY PI as CPU.
- It converts sensor Analog signals to Digital signals.
- It is interaction between Low speed peripheral like sensors, keyboard with High speed peripherals like processors.



Fig:I²C CHIP

I²C chip is usually referred as PCF8591, it is a data acquisition device with four analog inputs and one digital output. Three address pins A0,A1,A2 are used for programming, and allowing connections upto eight devices, without additional hardware. C bus through which address, control, data are transferred to and from the devices connected

Result :

Circuit and Performance Analysis

Connected circuit of the proposed system is shown in the fig 4.1 , here we install apache server in Raspberry pi for getting an IP address for the board, and linux os for running this embedded platform. Rasberry Pi receives all the sensed data from sensors through ADC (I²C CHIP) where sensed analog datas converted into digital for processing.

Using putty software we are going to writing coding algorithm into Raspberry Pi through ethernet port that ,when moisture level fall below threshold switch on motor, and when threshold buttons in the app are tapped ,change the threshold limit.

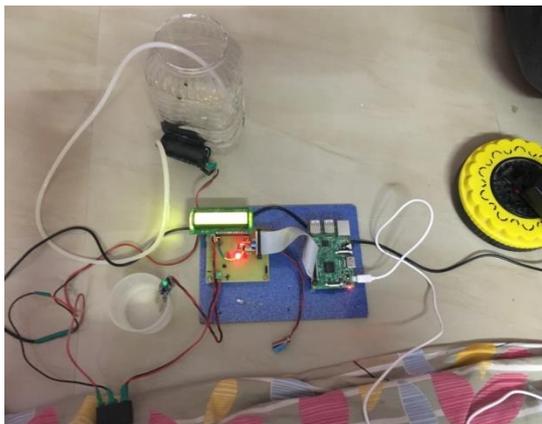


Fig:Working Model

LCD is used here for displaying the sensed values, and for every certain period of time, value from sensors are updated into mobile application, whenever there is need to change the threshold value, according climate and stage of crop we can tap a threshold limit button, corresponding to those situations.

Android application is developed in eclipse software where we have a layout for structure of application page, number of columns, numbers of button for tap, ON/OFF buttons, etc. Which can be accessed through coding with the help of address allocated to a particular button or column.

All the IOT components like Raspberry Pi, Mobile application are connected to Wi-Fi module and IP address of Raspberry is entered into mobile application so that we can access data present Raspberry's server, when we tap threshold button Raspberry Pi gets a request for changing threshold limit.

RESULTS

Result of the proposed system will be displayed on LCD and Mobile Application and practically will be shown by motor .

Result on LCD screen



Fig:LCD Output

Result on Mobile Application

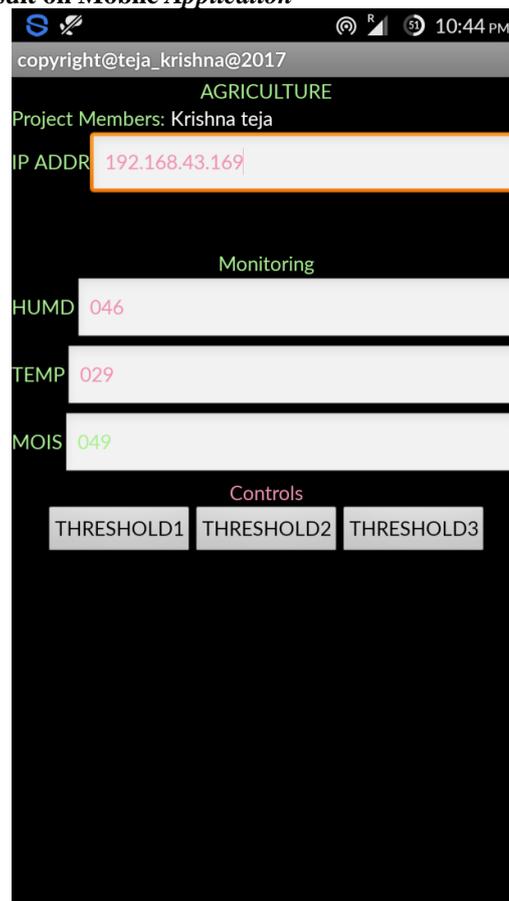


Fig:Mobile Application Output

Result shown by Motor

Motor is turned on automatically when moisture level is less than threshold through relay, and turned off when moisture level cross the threshold.

Conclusion

A survey on agriculture automation models has been done we came to a final conclusion after encounter limitation of existing. Agriculture is base for all the industries for raw material and cultivation requires different water levels at different periods, so for minimizing and maintaining water level we have implemented this system. Automation in agriculture reduces labour, and difficulties, as most important in irrigation i.e., supplying water is done automatically by microcontroller based IOT as, IOT made life interesting and easy.

Farming involves sophisticated activities, so emerged technology replaced complex systems, and software tools and have made provision to act through internet.

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