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Department of Computer Engineering

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PROBLEM STATEMENT

Write the process and Design, **Smart Irrigation System (SIS)** for Farmer.
Rubrics: **(Strictly follow the steps involve in IoT system design)**

SOLUTION:

STEP-1 : PURPOSE & REQUIREMENTS

Purpose : To design a simple, easy to install methodology to monitor and indicate the level of soil moisture that is continuously controlled in order to achieve maximum plant growth and simultaneously optimize the available irrigation resources on monitoring software LabVIEW and the sensor data can be seen on Internet. An automated irrigation mechanism which turns the pumping motor ON and OFF on detecting the moisture content of the earth without the intervention of human

Behavior : System should monitor the amount of soil moisture content in soil. In case the soil moisture of the soil deviates from the specified range, the watering system is turned ON/OFF. In case of dry soil, it will activate the irrigation system, pumping water for watering the plants.

System Management Requirements: System should remotely provide monitoring and control functions.

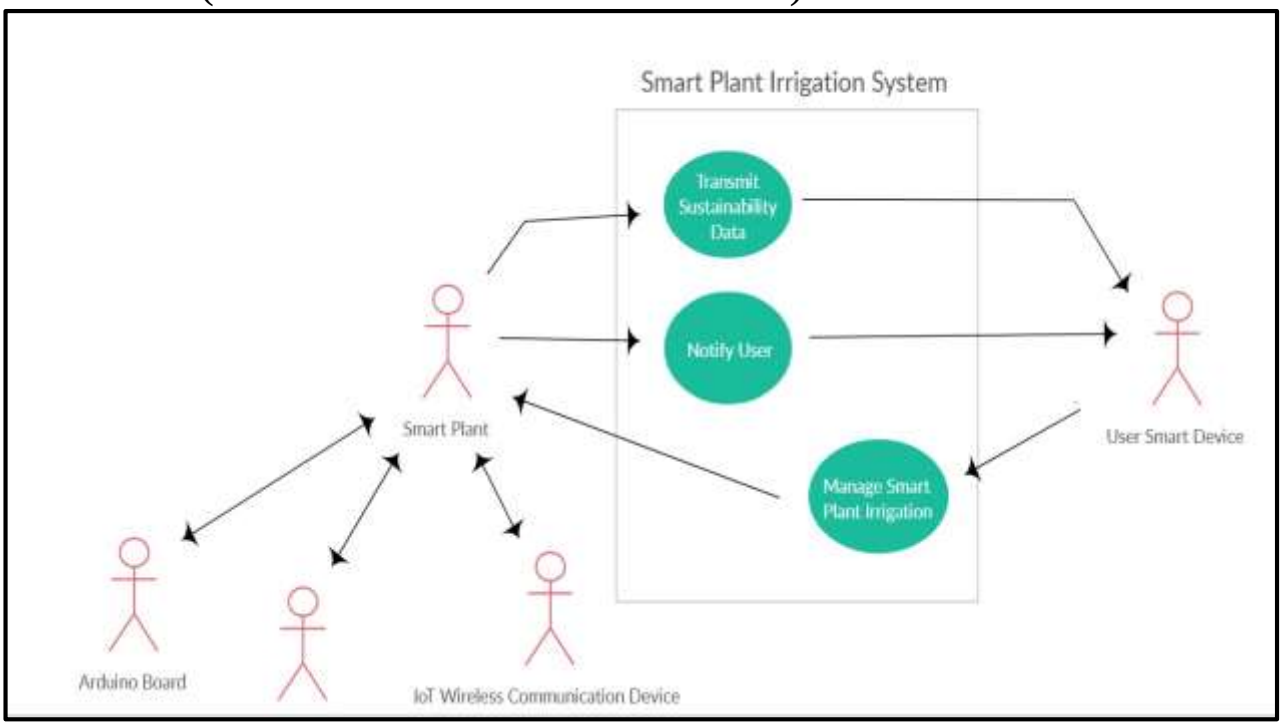
Data Analysis Requirements : System should perform local analysis of data.

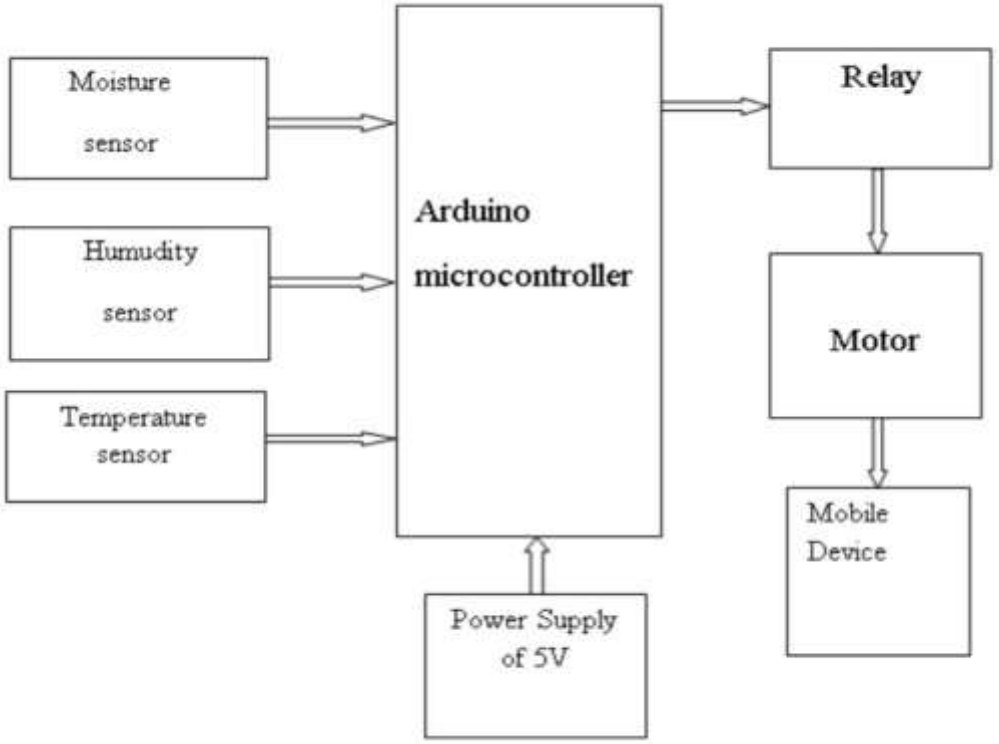
Application Deployment Requirement: Deployed locally on device, but acts remotely without manual intervention.

Security : Authentication to Use the system must be available.

STEP-2 : PROCESS MODEL SPECIFICATION

(USE-CASE DIG & BLOCK DIG)

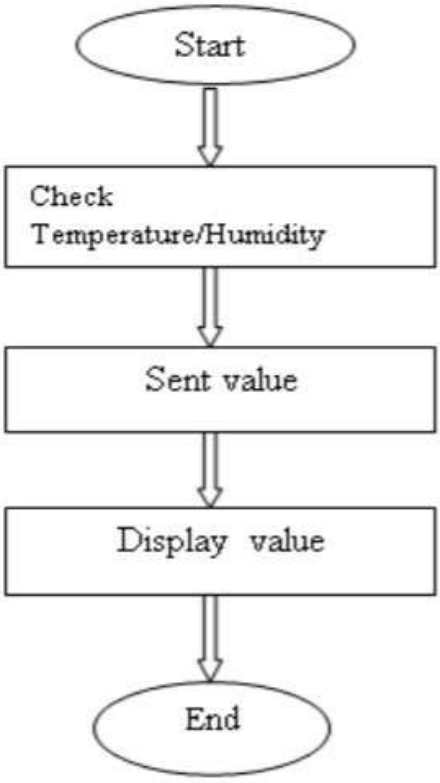




STEP-3: DOMAIN MODEL SPECIFICATION

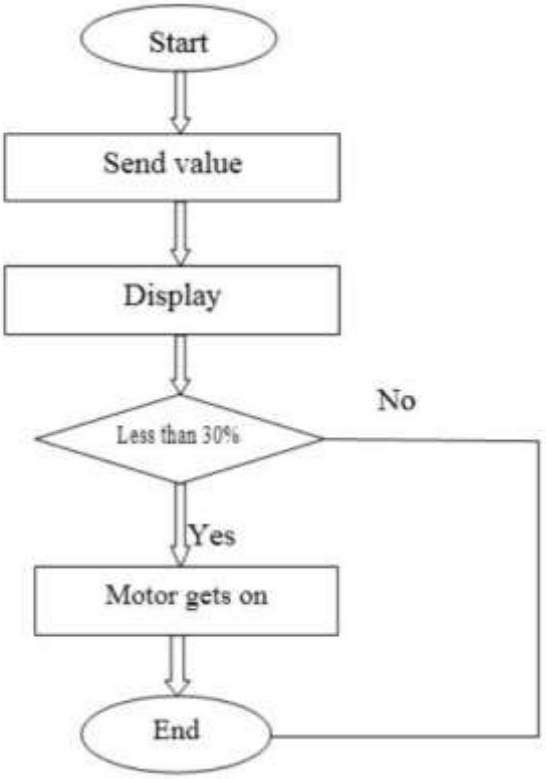
Discreet identifiable entity in physical environment For eg. Pump, motor, LCD. The loT System provides the information about the physical entity (using sensors) or performs actuation upon the Physical entity(like switching a motor on etc.)

Temperature and Humidity Sensor : Figure shows the sensed values of temperature and humidity.



The DHT11 is a basic, 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 pins needed).It is simple to use, but requires careful timing to grab data. Humidity sensors are used for measuring moisture content in the atmosphere. Then current temperature, humidity values are send to the microcontroller, those values will display in the users android app.

Soil Moisture Sensor : Figure shows the procedure of displaying soil moisture value .



Soil moisture sensors measure the water content in soil. Moisture in the soil is an important component in the atmospheric water cycle. Sensor module outputs a high level of resistance when the soil moisture is low. It has both digital and analog outputs. Digital output is simple to use, but it is not as accurate as analog output based on moisture level motor gets turn on/off automatically.

Relays are switches that open and close Motors Based on Command of Arduino In a basic relay there are three contactors: normally open (NO), normally closed (NC) and common (COM). At ON input state, the COM is connected to NC.

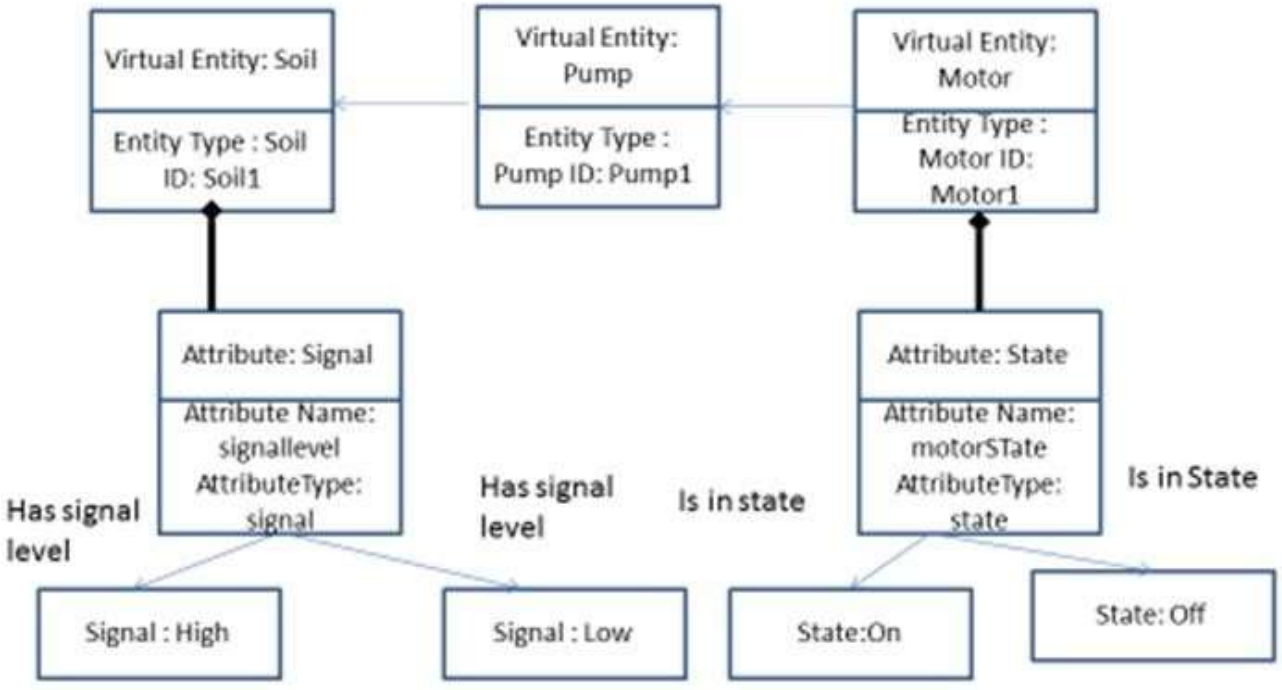
Submersible Motor Pump is for water lifting. Motor is connected with Raspberry PI_3 via Arduino.

In smart irrigation example, there are three Physical entities involved : Soil (whose moisture content is to be monitored) , Motor (to be controlled) , Pump (To be controlled) In smart irrigation system there are three services - A service that sets the signal to low/ high depending upon the threshold value

- A service that sets the motor state on/off
- A controller service that runs and monitors threshold value of the moisture and switches the state of motor on/off depending upon it. When threshold value is not crossed the controller retrieves the motor status switches the motor on/off.

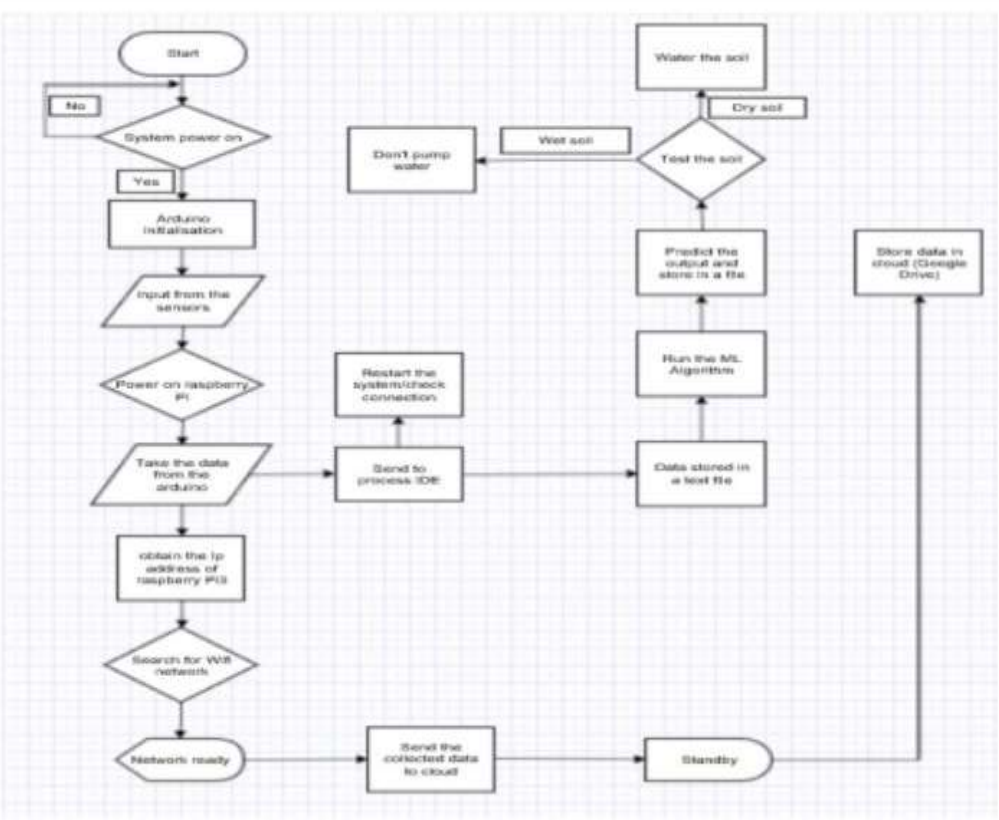
STEP-4: INFORMATION MODEL SPECIFICATION

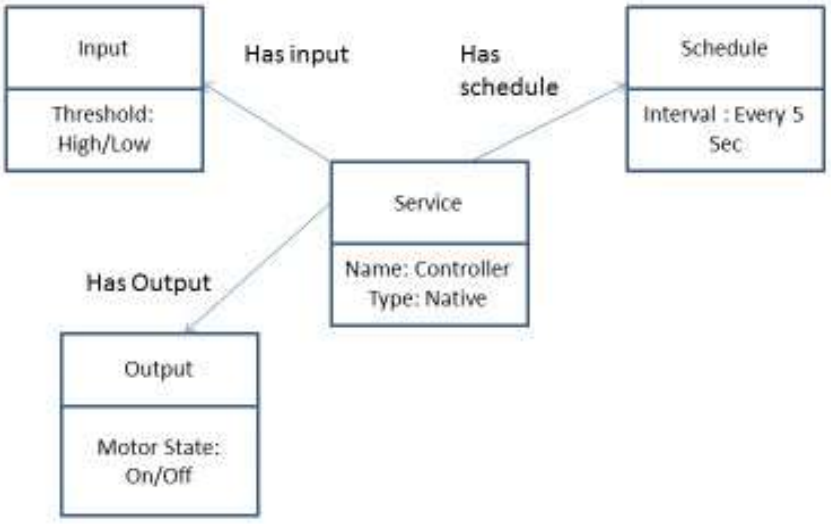
(CLASS DIG)



STEP-5: SERVICE SPECIFICATION

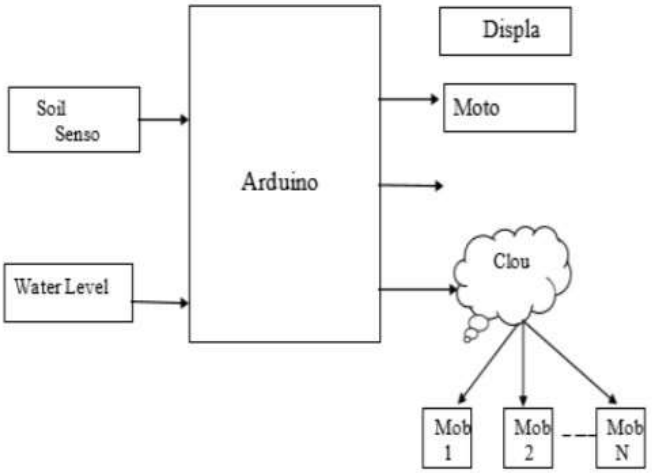
Threshold service sets signal to high or low depending upon the soil moisture value , State service sets the motor state : on or off . Controller service monitors the threshold value as well as the motor state and switches the motor on/off and updates the status in the database





STEP-6: IOT LEVEL SPECIFICATION

This module allows access to the motors anywhere and whenever. The farmers use cloud web pages to access the motors remotely and at any time. Farmers are accessing the motor via the web pages using cloud. The water level sensor is also used to estimate the water levels of crops. When the water level is reduced this machine will transfer the intimation to the condition of the farmer like ON the engine. Even the level of water is raised and then the intimation is transferred to the farmer like the motor OFF



The Arduino Uno is an open source microcontroller board, built on Arduino.cc's Microcontroller Microchip ATmega328P. The board is equipped with sets of digital and analogue input / output (I / O) pins which can be interfaced for expansion and other circuits with various boards (shields). The board is fitted with 14 digital I / O pins (six with PWM output), 6 analogue I / O pins and can be programmed using the Arduino IDE (Integrated Development Environment) cable. It can be powered by a USB cable or an external 9 Volt battery, but it tolerates voltages of 7 to 20 volts. It's similar with Arduino Nano and Leonardo, too. Distributed under a Creative Commons Attribution Share-Alike 2.5 license, the hardware reference design is available on the Arduino website. Design and development files are also available for certain versions of the hardware.

ESP8266 : The chip first came to Western makers' attention in August 2014 with the ESP-01 module, developed by a thirdparty manufacturer Ai-Thinker. This small module allows microcontrollers to connect to a Wi-Fi network and use Hayes-style commands to create simple TCP / IP connections. However, there was almost no Englishlanguage documentation on the chip at first and the commands it recognized. The very low price, and the very few external components Many hackers were drawn to the module, which meant that it would eventually be very inexpensive in volume Exploring the board, the chip and the applications on it and translating the Chinese documents. The ESP8285 is an ESP8266 with 1 MiB of built-in flash which enables single-chip devices to connect to Wi-Fi.

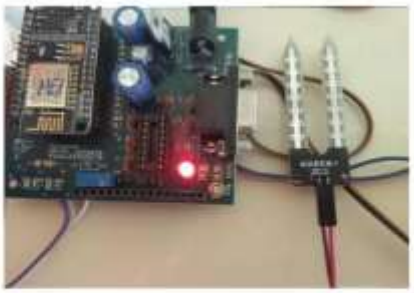
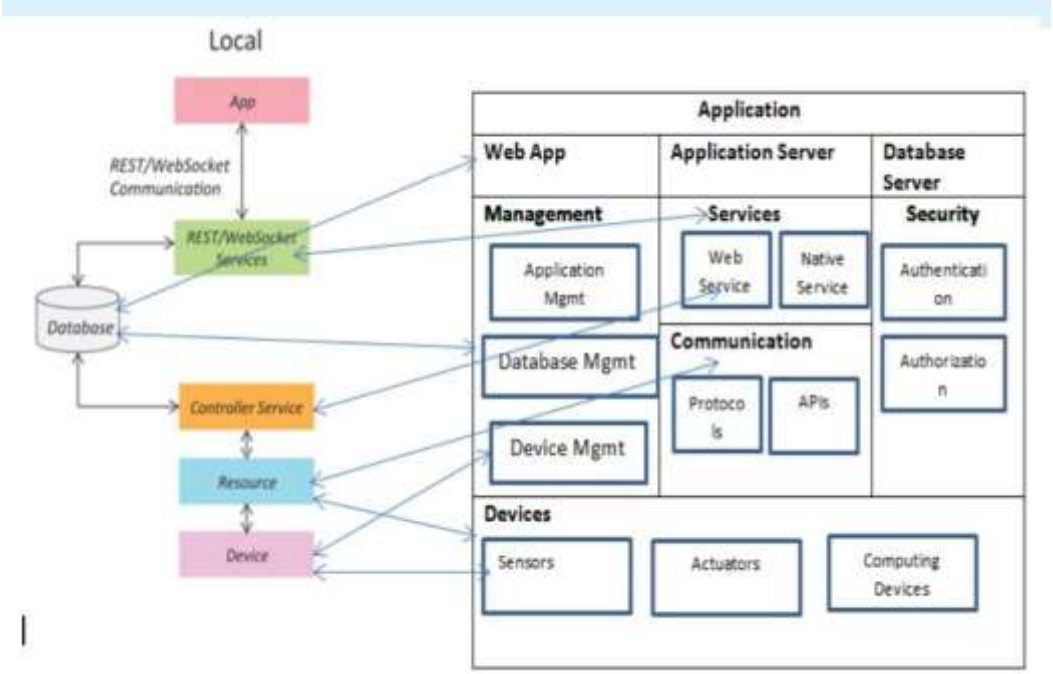


Fig 3. Sense Alert Notification

Fig 4. Microcontroller Microchip Atmega328p

STEP-7: Functional View Specification

(fig.Deployment level to function group mapping**)**



Step-8 : Operational View Specification

Application

- Web App : PhP WebApp
- Application Server : Google App engine
- Database Server : MySQL

Services

- Native : Controller Service
- Web : REST

Communication

- Communication APIs : REST SPIs
- Communication Protocol :
    - ✦ Link Layer: 802.11
    - ✦ N/w : IPV6
    - ✦ Transport : TCP
    - ✦ Application : HTTP

Management

- Device Management: Arduino device management
- Application Management : PHP App Management
- Database Management: MySQL Db Mgmt

Security

- Login Management

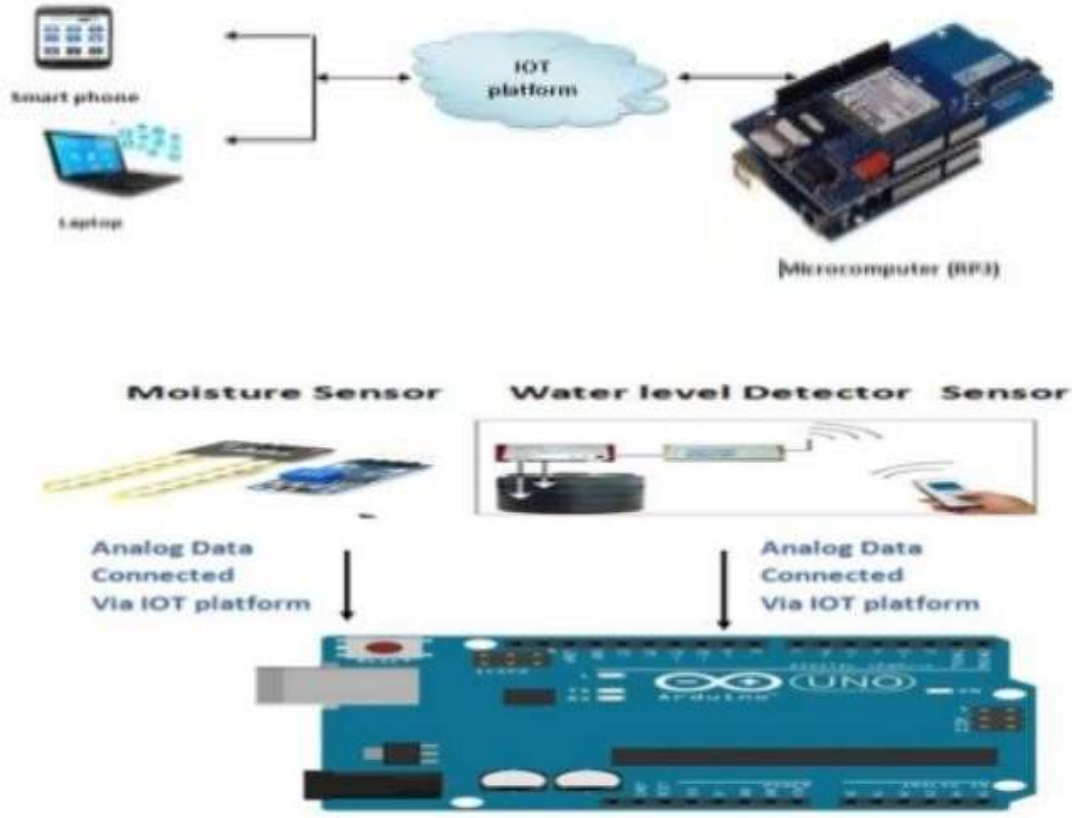
Step- 9 : Device and Component Integration

Step 1: Login :(Enter Username/Password) and Give Command (ON/OFF) to your application

Step 2:

- IOT base platform: Collect and send all Analog data to GSM Shield
- GSM Shield connected in RP3 (Raspberry Pi 3)(Microcomputer)
- Now command(ON/OFF) command pass to RP3

Step 3:



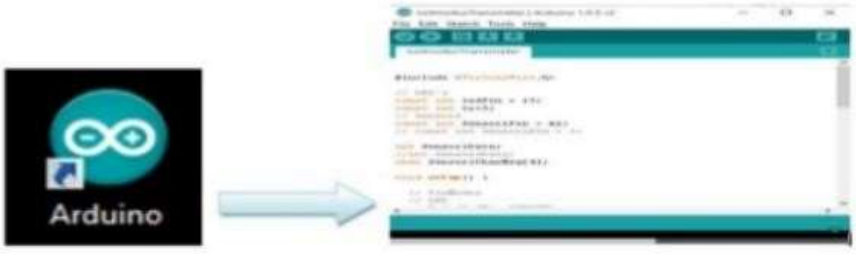
Step 4: Microcomputer (Raspberry Pi 3)

RP3 is just like main controller of this system: Convert all analog data into digital form.

Step 5: Arduino software:

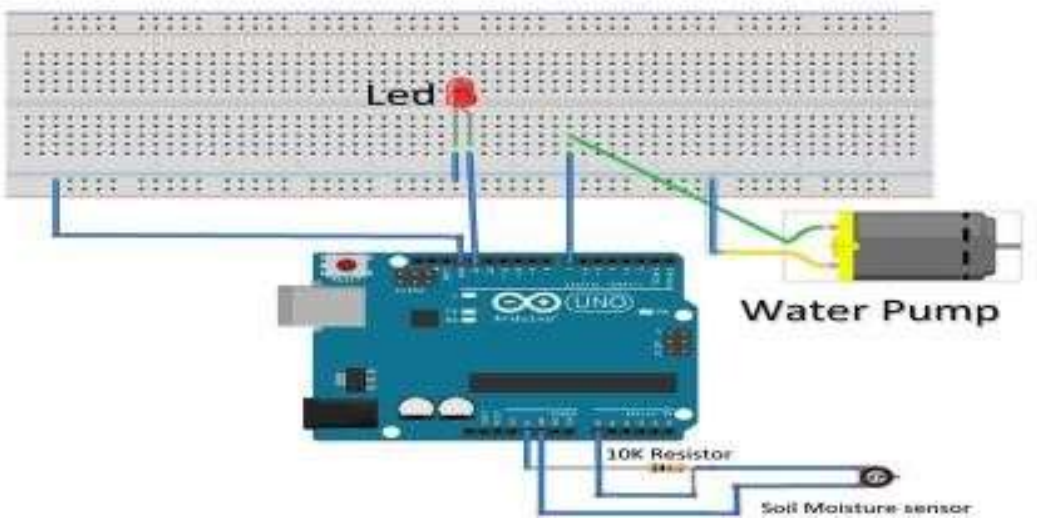
Check Conditions:

1. If soil moisture content is greater than a fixed value, then there is no need of irrigation.
2. If the soil moisture content is less than a fixed value, then start irrigation.
3. If the water reaches the prescribed point of water level, then sensor gives data to system to stop the irrigation. Command sends to Relay Module.



Step 6:

1. Raspberry Pi 3 Connected -Arduino give command ON/OFF to relay Relays are switches that open and close Motors Based on Command of Arduino.
2. Relays are used where a safe low-voltage circuit controls a highvoltage circuit so motor is safely ON/OFF.



Step 7:

1. Now this GSM Shield connected with microcomputer (RP3) access digital data from RP3.
2. The Arduino GSM Shield SIM connect to the internet send/receive SMS messages from Smartphone and tablet or computer.

Step 8:

Farmer is getting SMS:

1. Motor: ON or OFF
2. Current moisture content (Ex. 50%)
3. Current water level (Ex: 90 DEPTH Feet)

Step-10: Application development

Conclusion: We can conclude that system proposed based on the information received from the sensors and estimates the amount of water

required. The proposed systems based on these values which are needed to measure the quantity of water for irrigation.