# Automatic Soil Moisture Monitoring For Irrigation System

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***Abstract*— This major project on "AUTOMATIC SOIL MOISTURE MONITORING FOR IRRIGATION SYSTEM" is planned to design and implement an automated irrigation system which turns the submersible pump ON/OFF on sensing the moisture content the soil via the sensor. The submersible pump will pump the water into the field until the sensor detect that the field is wet. The main aim of this automated system is to monitor the presence of moisture in the soil in a cultivating field. Based on it, submersible pump will be automatically switched on or off through the relay. This saves water and the plants can get optimum quantity of water. The main controlling device of this automated system is a microcontroller which is programmed to receive the input signals of varying moisture condition of the soil through the sensing arrangements. This is achieved by using YL-38 which acts as an interface between the sensor and the microcontroller. The sensor will give the status of the soil with respect to the moisture content to the microcontroller, based on that the microcontroller will display the status of the soil and submersible pump on the LCD and delivers an SMS regarding the mentioned status to the registered mobile number.The concept in future can be enhanced by controlling the system through SMS.**

***Keywords—Arduino Uno, ATmega328P Microcontroller, Water level sensor YL-69 and YL-38, LCD.***

## I. INTRODUCTION

Throughout the world water plays an important role in the irrigation, some villages are far away from the rivers so the farmers belong to that places are mainly depends on the borewells, that borewell water is not available throughout the year. The storeing of water and wasteage of water is necessary.

The major drivers for the need of smart farming are the increase in demand for usage of latest technologies in agriculture, rising global demand for food, Lack of labour, and increase in greenhouse farming. Every other field across the industry has incorporated the need of latest technology which has made the process easier. The need to automate a farm comes from various drawbacks of conventional farming methods. In conventional farming, the farmer has to constantly monitor various environmental factors manually which may sometime not yield the desired result. To constantly monitor all the parameters i.e. temperature, Moisture, Humidity is very difficult to monitor. The farmer cannot take a day off from fields. If the soil moisture is found to be low the farmer has to irrigate the field manually. If there is no constant power supply it is difficult to water the crops according to their needs. These are all the few challenges which the farmer has to face while he is practising conventional farming methods.

To resolve above methods IoT based automation system is one of the best approaches. The farmer need not have to monitor the climatic conditions manually and make the decision to irrigate the crops .In this project ,the sensors are incorporated to get the data of various parameters like Soil moisture, Humidity, Temperature .The data is then sent to the controller where signal conditioning takes place and if the critical value of any of the parameters is reached it is indicated to the farmer through a mobile application which uses IoT gateway and also sending the message to the farmer through GSM module. If the soil moisture content is found to be low the farmer is not only indicated but also the motor turns on which drives the irrigation system. If there is no constant power supply to the field which stops the motor the solution that is incorporated for this problem is the usage of solar panel. The solar panel harvests the solar energy and is stored in a battery. The power backup can be done to run the motor.

## II. METHODOLOGY

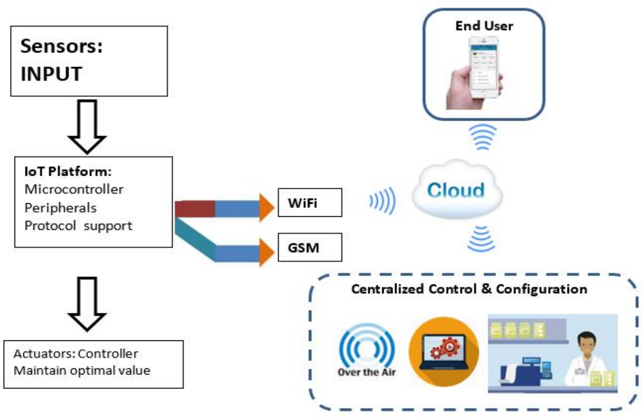


Fig 1: Block Diagram of the System

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The automatic irrigation system was designed to continuously sense the moisture level of the soil. Power supply is taken from the solar panel to battery across the voltage controller device.The system responds appropriately by watering the soil with the exact required amount of water and then shuts down the water supply when the required level of soil moisture is achieved. There ference level of soil moisture content was made to be adjustable for the dry and wet of the soil moisture the amount of irrigation, The moisture sensors were designed using probes made from corrosion-resistant material which can be stuck into soil. Voltage levels corresponding to the wet and dry states of the soil sample were computed by measuring the resistance between the moisture detector probes and matching them to output voltages of a comparator circuit. A submersible low-noise micro water pump was developed to deliver the water to the appropriate parts of the soil (the base of the plants). The volume of water required for irrigation per time was computed by considering the capacity of the water pump and the water channels. The required irrigation time was determined by considering the response time of the water pump and the water volume required per irrigation instance. A timing circuit was designed to use the required irrigation time to control the duration of each irrigation instance.the volume of water delivered to the soil,will be adjustable by the system automatically. Global system for mobile (GSM) module acts as a messenger between user and computing system,The GSM is used to send the status of the soil and light intensity to the user Nodemcu unit is used to create personal lan through which we can transfer a sensors data into the cloud. Live data can be monitored through the wifi module present in the nodemcu unit. Blynkis designed for working of the Internet of Things. It controls hardware in remote area from where the user is operating, it displays the sensor log and sensor data, it stores data, visualizes the recorded data.Itis an open source application for ios and android. BlynkServer is responsible for all the communications between the smartphone and hardware. Blynk Cloud can be used or can be run on private blynk server locally. It's an open-source, could easily handle thousands of devices and can even be launched on a Raspberry Pi. Light sensor is used to detect light intensity of environment. Light is major source for crops which is responsible for photosynthesis. Light dependent resistor is used in resistivity decreases with increases in high intensity and vice versa. The LDR is used in green house where artificial lighting is done using any of the incandescent lamps, fluorescent lamps instead of sunlight. The voltage divider circuit is designed to measure resistance due to light intensity variations. The voltage level increases with increase in light intensity.At the final the farmer is getting info of how much water is used as shown in the result.

## III. Software Details

The open-source Arduino Software (IDE) makes it easy to write code and upload it to the board. This software is the interface between hardware and user applications.A computer program that is designed to run a computer's hardware and application programs. The software that is used is Arduino IDE.

A program for Arduino hardware may be written in any programming language like C/C++ compilers that produce binary machine code for the target processor.

The Arduino integrated development environment (IDE) is a cross-platform application (for Windows, macOS, Linux) that is written in the programming language Java. It originated from the IDE for the languages Processing and Wiring. It includes a code editor with features such as text cutting and pasting, searching and replacing text, automatic indenting, brace matching, and syntax highlighting, and provides simple one-click mechanisms to compile and upload programs to an Arduino board after verifying. It also contains a message area, a text console, a toolbar with buttons for common functions and a hierarchy of operation menus. The source code for the IDE is released under the GNU General Public License, version 2. And the selection of this software is easy to use and open resource.

### BLYNK APPLICATION

Blynkis designed for working of the Internet of Things. It controls hardware in remote area from where the user is operating, it displays the sensor log and sensor data, it stores data, visualizes the recorded data.Itis an open source application for ios and android. There are three major components in the Blynkplatform: BlynkLibraries are used to enable communication with the server and to process all the incoming and out coming commands. Blynk Application allows to create various interfaces for the project using various widgets that can be selected from the user.

Blynk Server is responsible for all the communications between the smartphone and hardware. Blynk Cloud can be used or can be run on private blynk server locally. It's an open-source, could easily handle thousands of devices and can even be launched on a Raspberry Pi.

Blynk application has following features:

- Similar user interface and application program interface for all supported hardware & devices
- It can be connected to the cloud using :
  - GSM
  - USB (Serial)
  - WiFi
  - Bluetooth and BLE
  - Ethernet

  It has widgets which can be easily accessible
- There is direct pin manipulation
- The history data can be accessed and monitored by the user using widgets

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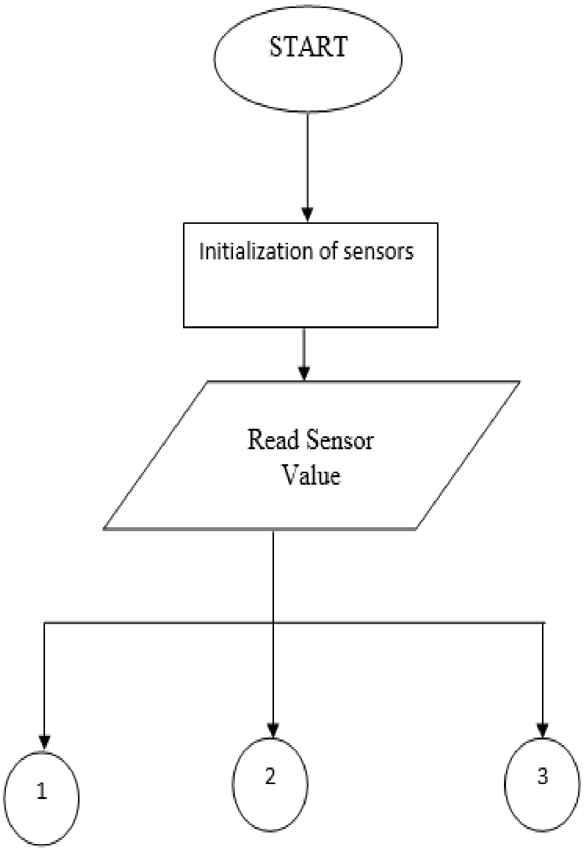
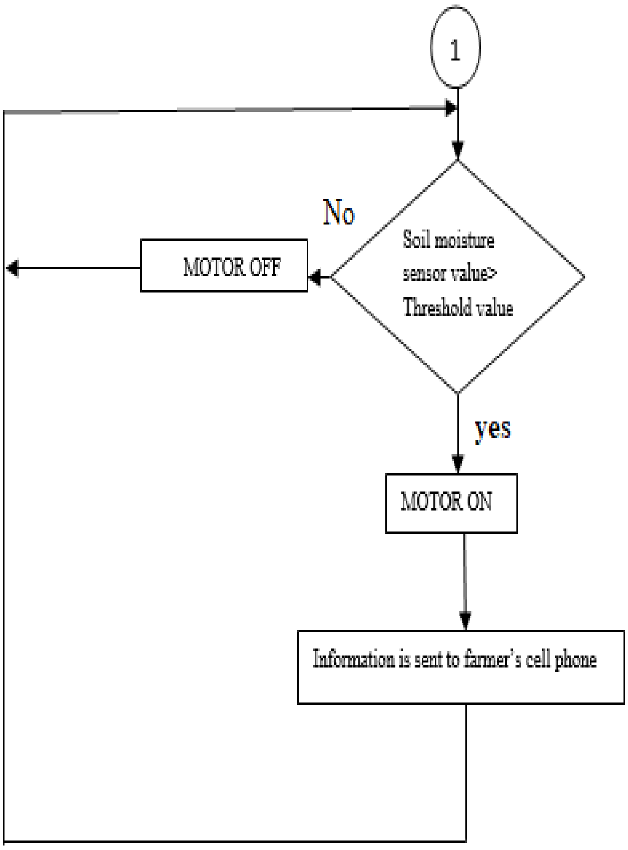
- Device-to-Device communication using Bridge Widget
- Push notification is sent to the device when there is a cross of threshold value of any sensor.




(a)

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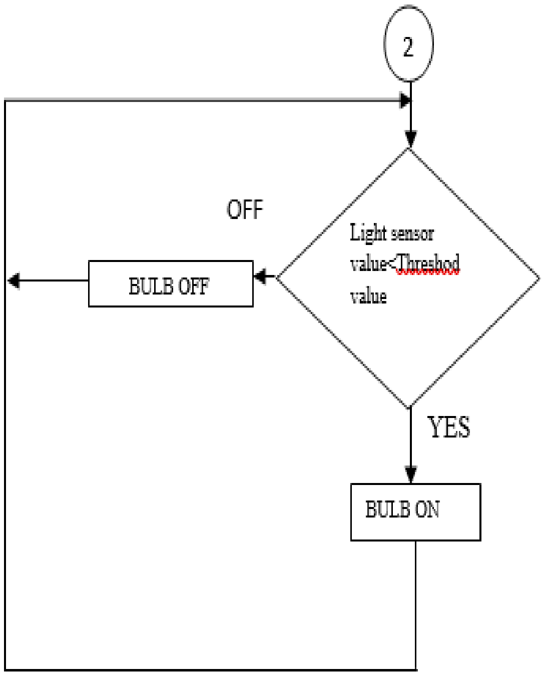


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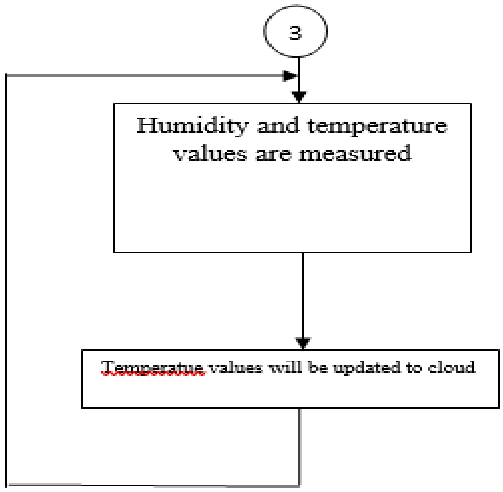


(d)

Fig 2: Flow Chart of the system

The Arduino IDE supports the languages C and C++ using special rules of code structuring. The Arduino IDE supplies a software library from the Wiring paper, which provides many common input and output procedures. User-written code only requires two basic functions, for starting the sketch and the main program loop, that are compiled and linked with a program stub main() into an executable cyclic executive program with the GNU toolchain, also included with the IDE distribution. The Arduino IDE employs the program avrdude to convert the executable code into a text file in hexadecimal encoding that is loaded into the Arduino board by a loader program in the board's firmware.

A program written with the Arduino IDE is called a sketch. Sketches are saved on the development computer as text files with the file extension .ino. Arduino Software (IDE) pre-1.0 saved sketches with the extension .pde.

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A minimal Arduino C/C++ program consist of only two functions:

• setup(): This function is called once when a sketch starts after power-up or reset. It is used to initialize variables, input and output pin modes, and other libraries needed in the sketch.

• loop(): After setup() has been called, function loop() is executed repeatedly in the main program. It controls the board until the board is powered off or is reset.

## IV. RESULTS

We succeeded in transferring the sensor data to the cloud. We have used an open source blynk app which is customised to our needs.The Fig 3 shows the page of blynk app which our sensor data has been transferred.

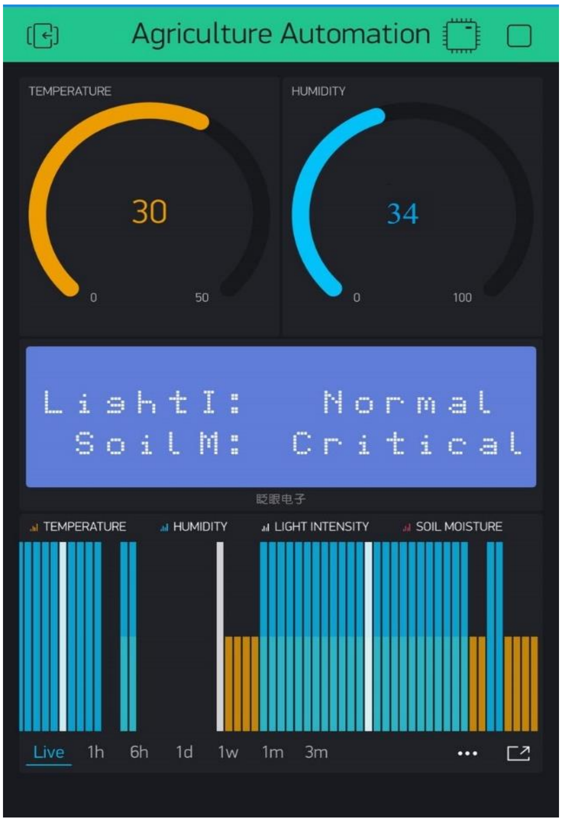


Fig 3:Application view of the sensor data

We successfully interfaced GSM unit and managed to get the text message to the user.The fig 4 shows the message displaying that the soil is wet. The fig 5 shows the message displaying that the soil is dry

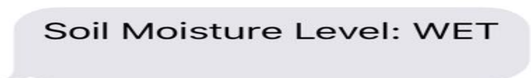


Fig 4: Message sent to mobile through GSM when soil moisture level is HIGH


Fig 5: Message sent to mobile through GSM when soil moisture level is LOW

Tests

We measured the intermediate voltage and current at the node of soil moisture sensor.We got the intermediate values as shown in the table

| Condition | Voltage(V) | Current(mA) |
|---|---|---|
| Wet | 1.75V | 0.45mA |
| Dry | 4.75V | 0.45mA |

The graph of Temperature v\s Time is plotted for various readings measured is shown in Fig 4.1.2.

Fig 6: Temperature v\s Time graph


Fig 6: shows Light intensity v\s Time graph plotted for On/Off condition of LDR.

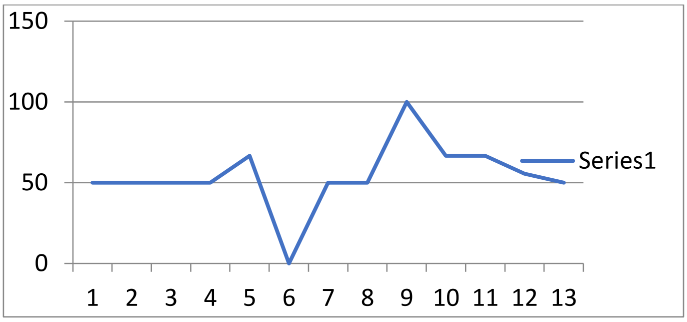


Fig 6: Light Intensity v\s Time graph

## V. CONCLUSION & FUTURE SCOPE

The system which is developed measures the different environmental factors i.e., Temperature, humidity, light intensity and soil moisture. The system uses wireless modules for the data transfer and also to the communication purpose.The measured readings are transferred to cloud through IoT module which can be monitor from any part of the world.The system also includes the irrigation system from which the water is automatically controlled or irrigated to the plants depending on the soil moisture sensor. The wetness of the soil is high the motor will be off when the

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wetness of the soil is less the motor will be on and the plants get water. Light dependent resistor is used to automatically switch on the lights when the intensity of the light decreases in the agricultural fields, Solar panel is used to energise the battery and to supply the power to the agricultural land. By using the system wastage of water can be minimised, labour work can be reduced and the economy of the farmer can be saved and yield of the crops can be increased. The system can be easily used in the agricultural lands

*Benefits to the Society:*

- Saves Water and Power.
- Reduce labour.
- Provides an effective solution to regular real world water problems.
- Low power consumption.

*Future scope of work:*

For future developments it can be enhanced by developing this system for large acres of land. The sensors and microcontroller are successfully interfaced and wireless communication is achieved between various nodes Also the system can be integrated to check the quality of the soil and the growth of crop in each soil. Implementation in this field can definitely help to improve the yield of the crops and overall production. And further we can also, monitor the water level with the flow level and we can display as abovesaid in web.Further the project can be extended by adding other sensors like wind speed, wind direction, pH, water level, atmospheric pressure, and monitor the data received and the data can be sent to the cloud to access the data when the farmer needs an expert advice. Further the data from the field can captured through image processing and can be monitored. The project further can be improved by optimising the program where the farmer can easily change the threshold value according to the plant requirement and the crop cycle.

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