# *Smart Irrigation Using Internet Of Things*

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***Abstract - Automation in agriculture system is very important these days. This paper proposes an automated system for irrigating the fields. ESP-8266 WIFI module chip is used to connect the system to the internet. Various types of sensors are used to check the content of moisture in the soil, and the water is supplied to the soil through the motor pump. IOT is used to inform the farmers of the supply of water to the soil through an android application. Every time water is given to the soil, the farmer will get to know about that.***

***Keywords: IOT (Internet of things), smart irrigation, automation, android application, WIFI module.***

## I. INTRODUCTION

India is a country of agriculture and farmers. Around 70% of the total population rely on agriculture for their sustenance.
And as the population of the country is increasing, the total cultivation has to be increased. As the total cultivation will increase, the total amount of water usage will also increase. Currently agriculture accounts for 83 % of the total usage of the water in the country. So, some system has to be found to reduce the wastage of water and reduce the pressure on the farmers.

Irrigation is the most important part of agriculture. There are two things that are need to be kept in mind while doing agriculture, to acquire information about the soil fertility and to measure content of moisture in soil. This paper proposes not only to measure the soil content in the soil, but also to provide the required water to the soil automatically, when the moisture content is below the threshold value.

Figure1 shows the basic architecture of IOT. IOT is the big revolution for the next generation. It plays a very vital role in every field. A network which enables various physical devices, vehicles, home appliances or various electronic items embedded with software, sensors, actuators, to connect and exchange data is referred to as Internet of Things (IOT).
Remote sensing and controlling of objects in an existing infrastructure is done with the help of IOT. With the help of this, more opportunities are created for integrating the physical world directly, into the computer based systems which results in increase in the efficiency, accuracy and economic benefits.
IOT strengthens with the use of sensors and actuators, and these sensors help in connecting the physical systems remotely. It includes technologies like, smart grid, smart homes, intelligent transportation and smart cities. IOT can be referred as an architecture that consists of specialized hardware boards, Software systems, web APIs, protocols with the help of which an ideal environment is created, and smart embedded devices can be connected to the internet and can be controlled remotely.

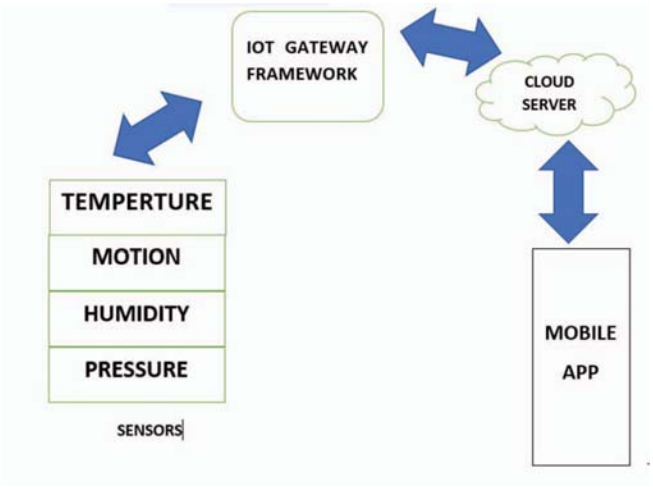


Figure 1: Basic architecture of IOT

## II. LITERATURE REVIEW

In [1] Li Da Xu et al., have mainly discussed about IOT and its current researches, its key enabling techniques. It throws light on major IOT application in the industry, and various research trend and challenges are identified.

In [2] Zhao Liqiang et al, has worked on wireless field monitoring using IOT. There is an image sensing node which takes the images of the crops and various parameters such as temperature, humidity, are used for conclusion. Low power consumption and stable running with high precision environment makes it a very good option for crop monitoring.

In [3] Keerthi.v et al, discussed about greenhouse monitoring system based on iot . A number of parameters are monitored effectively with the help of various sensors such as temperature, light, relative humidity, and soil moisture. In very 30 secs, the coordinator node collects he information from the crop and is stored on cloud. This helps the user to check the details anytime.

In [4] Joaquín Gutiérrez has developed a smart irrigation sensor. In this paper, designing and implementation of an automated irrigation is used in the crop field. In this process, digital images of the nearby soil and the root of the crop are captured, with the help of a smartphone. This helps in optically estimating the water content.

In [5] Nikesh Gondchawar et al, discussed about IOT based smart agricultural system. In this project, a GPS based robot is used. A smart irrigation with smart control and intelligent decision making and smart warehouse management system is presented in this paper.

In [6] Baltej Kaur et al, has developed a drip irrigation system. It is a completely automated system which helps in reducing the human effort by remotely controlling the drip irrigation using an android mobile application. The irrigation system is controlled based on the values from the different sensors deployed in the field to monitor the environmental conditions.

In [7] Indu Gautam and S.R.N Reddyet al , has worked on a GSM/Bluetooth technology which has been implemented in an embedded system which can be controlled remotely. By collecting data from the sensors like temperature and humidity, the system sets the irrigation time and irrigate the crop field automatically.

| Component | Quantity |
|---|---|
| ESP8266 WIFI CHIP | 1 |
| LED INDICATOR | 1 |
| DC MOTOR | 1 |
| SOIL MOISTURE SENSOR | 3 |
| ARDUINO UNO | 1 |

Table 1: Components Required

## III. PROPOSED METHADOLOGY

In this paper, a conceptual model for smart irrigation has been proposed. Table 1 tells about the components required in this model.

The basic proposed system consists of irrigating the field automatically with the help of soil sensors. Figure 2 depicts the flow chart for the proposed system.

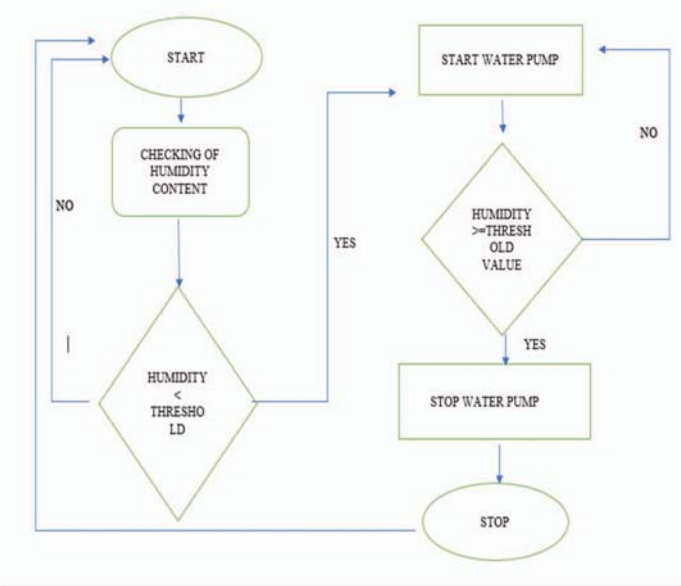


Figure 2: Flow chart for the proposed system

So, the process will be done in steps:

- Initially, the content of moisture in the soil is checked with the soil sensor which has been placed in the agricultural field.
- If the humidity content is not less than the threshold value, then the system will go back to the initial state.
- If the humidity value is lower than the threshold value, then the water motor is started and water is given to the soil.
- If the humidity value is more than or equal to the threshold value, then the water pump is stopped, and if its not then, the system will go back to the previous stage.

This basic model can be a little modified with some changes.
The modified model will have 3 soil moisture sensors instead of only one. These three sensors will be interconnected and will be put into the soil at three different levels. When the top sensor detects the moisture, water will not be given to the soil. If the top sensor won't detect the moisture but the second sensor detects moisture, then the system will be off. If both the top and the middle sensor will not detect moisture, the system will go on, and water will be given to the soil, even if the last sensor detects some moisture.

Whenever the soil will be given water by the motor pump, a notification will be sent to the android application with the help of the WIFI module chip ESP8266, which helps the user to know about the status of the irrigation.

In this project, an Arduino uno board is used on which all the components, like the WIFI module, the dc motor pump, led indicator will be attached and the required commands will be coded and will be sent to the ESP 8266 wifi module.

Another advanced system of automated irrigation can also be used. In this proposed system, various other parameters such as soil temperature, soil moisture, relative humidity, air temperature are also considered for irrigation of the field.
In this system, two sensor nodes are placed in the soil. The placement of the sensor nodes in the soil is very important, as on this only, the irrigation of the soil is dependent.

For the sensor nodes to work best, they should be placed where they are easily accessible and are away from the edges. Also, damaged plants or crops will require less water than healthy plants. So, the sensor nodes should not be placed near damaged plants. There can be various types of soil in a field, having different water holding capacities. Some soil may have great water holding capacity, but some have very low capacity.
The sensor nodes should be placed in low holding capacity soils, so that these soils never have water stress, and the field is irrigated frequently, but in smaller amounts.

Another important thing that is very important for irrigation is the deepness of the sensor nodes. Ideally, the sensor should be placed where all the active roots of the plant or the crop are. Majorly, all the active roots are near the surface of the soil, where there can be depletion of water too due to evaporation and transpiration of plants. So, this soil sees the most dryness and wetness cycles. From this soil, the sensors can help the user to know when to irrigate the soil. And, the sensors located deep in soil helps with the knowledge of water depletion and lets the user know how much to irrigate.

So, in this system, two sensor nodes are located according to the soil, and programming is done such that the soil parameters are sent to the node which acts as the coordinator node every minute using wireless communication protocol. There is a transceiver and database in the coordinate node, which is responsible for collecting the data from the sensor continuously, and storing it in the MYSQL database.
The data cannot be simultaneously transmitted by two sensor nodes because there is a collision detection mechanism. The data is read from the database then, and is matched with the threshold values. The moisture present in the soil is captured after combinations of various other parameters present such as temperature, humidity etc.

If the moisture value will be less than the threshold value, then the buzzer will go on and LED light will start blinking. And as soon as the water will be flown to the soil, a notification will be sent to the famer through an android application. All the data of the soil captured from various sensors will be stored on the cloud server and the user can view them anytime from anywhere.

Another very important concept of irrigation is *Evapotranspiration.* It is the sum of the evaporation and transpiration from the crops or the plants. Control is evapotranspiration is huge requirement because it helps in saving approx. 47% of the amount of water used in irrigation of the fields.
In this concept, the evapotranspiration controllers schedule the irrigation according to the weather data such as wind speed, air

| S.no | Crop | Water Requirement (mm) |
|---|---|---|
| 1. | Wheat | 450-650 |
| 2. | Rice | 900-2500 |
| 3. | Cotton | 700-1300 |
| 4. | Maize | 500-800 |
| 5. | Ragi | 400-450 |
| 6. | Sugarcane | 1500-2500 |

Table 2: Threshold values of various crops [11]

temperature, solar radiation and relative humidity. Other various parameters that are required are root depth, soil type, irrigation efficiency.

The controller can use the weather data from the weather station remotely or use the long term climatic data or use the on-site weather measurements.

Thus, optimum irrigation can be obtained through simple water balance concept with the help of ET water scheduling.

Table 2 shows the water requirements of various crops in India. These values represented in millimeter tells about the total water requirement of the crop in its whole production.

These values can be used as the threshold values while irrigating the fields. The value of the moisture sensor is set according to these values so that the water requirements are met properly.

## *SENSORS*

*A. Soil Moisture Sensor : Figure 3 depicts a soil mositure sensor. It has a detection probe and a sesnor board. It has three output modes i.e. serial, analog, and digital. The amount of water present in the soil, i.e. the moisture content will be detected by the sensor. Low water content gives high output value,otherwise a neutral value is returned. There are two probes in the moisture sensor which are used to first pass the current in the soil, and then read the resistance between the two probes in order to get the moisture content. Greater the water content, easier will be the conduction of electricity and lower will be the resistance, whereas dry soil with less water content will conduct the electricity poorly, and therefore more resistance.*

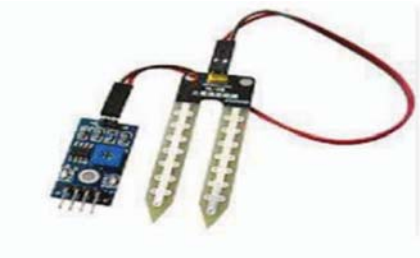

Figure 3: Soil Moisture Sensor

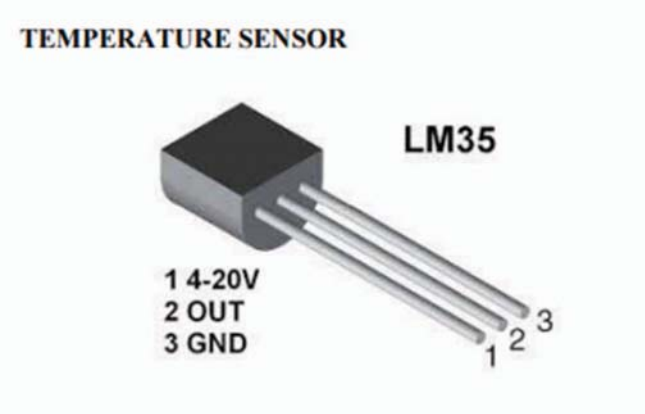


Figure 4: Temperature Sensor

*B.* Temperature sensor : Figure 4 shows the temperature sensor. This sensor is mostly preferred because of its output voltage and is linear with Celsius scaling temperature. It has a maximum output of 5V and a wide operating range. There are three terminals in this sensor. It is a user friendly sensor as it consumes minimum amount of electricity and is energy efficient.

## IV. CONCLUSION

With the technologies of IOT, agriculture can be made more efficient and more accurate. Water is the most important thing a person needs and is very important for agriculture.

Water wastage due to poor irrigation system, or in efficient methods will cost us a lot in the future.

The proposed system automates the whole process of irrigation, which is a huge time-consuming process. Thus saving, time money and water wastage too. From this project it can be concluded that there can be huge development in agriculture with the help of IOT platform.

Thus, it can be said that this system is a potential solution of the problems faced by the farmers in manual execution of the irrigation process and thus utilizing the water resources to their best.

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