International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 06 Issue: 04 | Apr 2019 www.irjet.net p-ISSN: 2395-0072

Smart Irrigation System And Crop Prediction

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Abstract - *Agriculture plays the major role in economics and survival of people in India. Water has been needed in each and every field. The purpose of this project is to provide embedded based system for soil monitoring and irrigation,, not only to reduce the manual monitoring of the field but also to help save water. The soil is monitored using hygrometer that is soil moisture sensor and ambient condition near soil is observed using DHT11 temperature and humidity sensor. Obtained sensor values are passed to cloud via NodeMCU, which includes firmware based on ESP8266 Wi-Fi SOC. Based on the comparison with predefined values, appropriate crop suitable for the soil is determined and informed to the farmer via android mobile application. The farmer can cultivate the suggested crop to ensure increase in production.*

1.INTRODUCTION

India's major source of income is from agriculture sector and 70% of farmers and general people depend on the agriculture. In Indian irrigation system the famers choose mostly manual methods such as drip, terraced, ditch irrigation system. In order to improve to the crop productivity there is an urgent need to change manual method to automation. Also consider the water availability throughout India it is one of the valuable resources to protect and save for future needs. Embedded based automatic irrigation system is suitable for farmers which is available at low cost and easy to install. This system should help farmer to provide the water to crop at stringent time and quantity. Automation irrigation system observes the moisture sensors and temperature variations around the crop area that's gives a precise time to turn the motor ON and OFF. So Automation avoids human errors and check soil moisture level.

The **Internet of things** (**IoT**) is the extension of Internet connectivity into physical devices and everyday objects. Embedded with electronics, Internet connectivity, and other forms of hardware (such as sensors), these devices can communicate and interact with others over the Internet, and they can be remotely monitored and controlled. .[1][2][3][4] It is a system of interrelated computing devices, mechanical and digital machines, objects, animals or people that are provided with unique identifiers (UIDs) and the ability to transfer data over a network without requiring human-to-human or human-to-computer interaction.

1.1 Objectives

The main objective of Smart Irrigation System and Crop Prediction is:

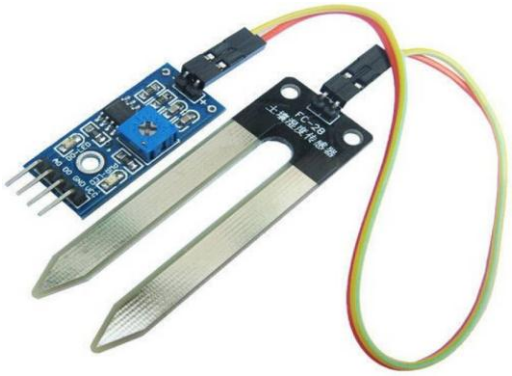
- Minimize cost and time of manual monitoring.
- Optimize the irrigation water use.
- Enable growers to take adequate irrigation actions based upon water availability and crop needs, which will minimize water usage and pumping energy.
- Suggest the crops most suitable in accordance with the surroundings:

1.2 Problem Statement

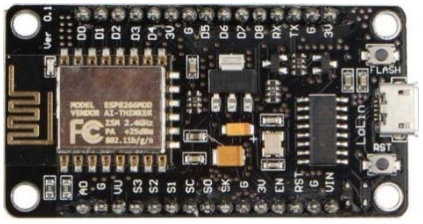
In the case of traditional irrigation system water saving is not considered. Since, the water is irrigated directly in the land, plants under go high stress from variation in soil moisture, therefore plant appearance is reduced. The absence of automatic controlling of the system result in improper water control system. The major reason for these limitations is the growth of population which is increasing at a faster rate. At present there is emerging global water crisis were managing security of water has become a serious job. This growth can be seen in countries which have shortage of water resources and are economically poor, Thus a serious problem in agricultural area. So we want to Design a Smart Irrigation support system that operate automatically by sensing moisture content of the soil and sending the values to a data store comparing it and returning appropriate information to the farmers using app.

2. HARDWARE PLATFORM USED

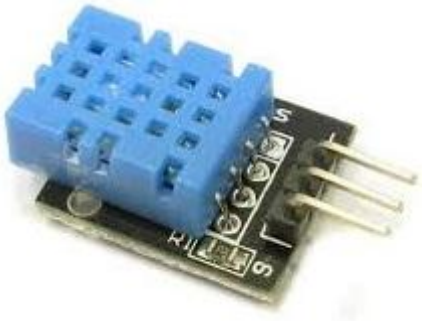
1. **Soil Moisture**: Precision soil moisture has chosen shown in which consists two probes that are inserted in to soil. When the current pass through the probes, the soil contains low moisture offer a less resistance and passes high current. That is variable resistance is the parameter to identify the level of soil moisture



2. **Microcontroller(NodeMCU):** entire automation is done using microcontroller.



3. **DHT11(Humidity & Temperature Sensor):** used to get humidity and temperature values from surrroundings.



4.Relay: A relay is an electrically operated switch. Many relays use an electromagnet to mechanically operate a switch, but other operating principles are also used, such as solid-state relays.

5. Water Pump: used to supply water to the field. Various methods of irrigation can be used to irrigate field suitable for that particular soil or field.

6. Buzzer: used to give a high pitched voice to indicate motor switched on

3. SOFTWARE AND LANGUAGES USED

3.1 C++

C++ is a general-purpose programming language that was developed by Bjarne Stroustrup as an extension of the C language, or "C with Classes". It has imperative, object-oriented and generic programming features, while also providing facilities for low-level memory manipulation. It is almost always implemented as a compiled language, and many vendors provide C++ compilers, including the Free Software Foundation, Microsoft, Intel, and IBM, so it is available on many platforms.

3.2 Arduino IDE

The Arduino integrated development environment (IDE) is a cross-platform application (for Windows, macOS, Linux) that is written in the programming language Java. It is used to write and upload programs to Arduino compatible boards, but also, with the help of 3rd party cores, other vendor development boards.[5] 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 tool chain, also included with the IDE distribution.[6]

3.3 Android App

Android software development is the process by which new applications are created for devices running the Android operating system. Google states that[3] "Android apps can be written using Kotlin, Java, and C++ languages" using the Android software development kit(SDK), while using other languages is also possible. Third party tools, development environments and language support have also continued to evolve and expand since the initial SDK was released in 2008

3.4 Firebase

Firebase is considered as web application platform. It helps developers‟ builds high-quality apps. It stores the data in JavaScript Object Notation (JSON) format which doesn't use query for inserting, updating, deleting or adding data to it. It is the backend of a system that is used as a database for storing data.

4. ALGORITHM

CROP_SUGGESTION

Step-1. Declare variables to read data from sensors like temperature, humidity and soil moisture.

Step-2. Declare variables to store crop data conditions.

Step-3. Load crop data that stores necessary crop conditions for different types of crops.

Step-4. For each crop_dataset _value

if current_sensor_reading = = crop_dataset _values.

then

{

flag++.

append crop_name to crop_suggestion_string.

}

end for.

Step-5. if flag==0

then display "no crop suggestion"

else

print crops_suggestion_string.

Step-6. Stop.

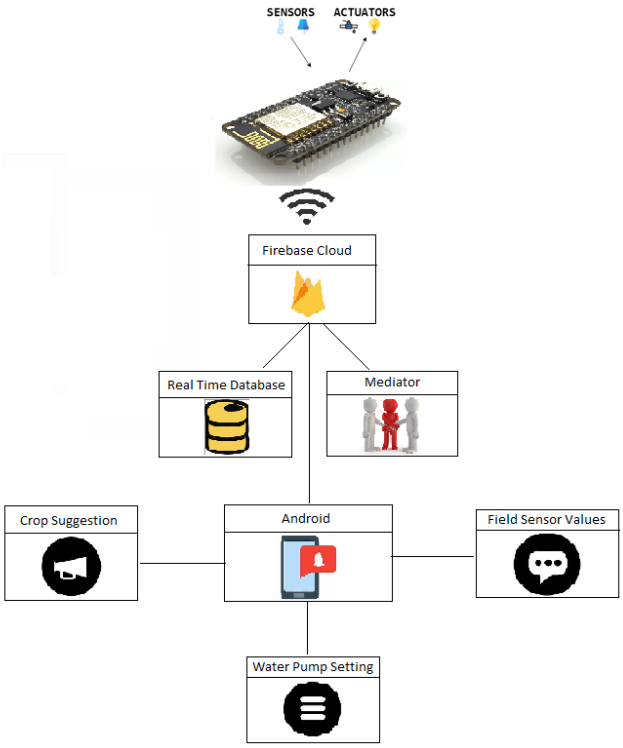
5.WORKING

The working of this project is basically divided into three parts:-

1. Sensing Layer

2. Communication Layer

3. User Interface Layer



5.1 Sensing Layer

- NodeMCU as a platform for Sensors and Actuators.
- Sensors for temperature, moisture and humidity. Data "Publishers".
- Actuators triggered automatically for managing environment.

5.2 Communication Layer

- Firebase
  - Mediator
  - Realtime Database

5.3 User Interface Layer

- Data Visualization
  - Sensor Readings Displayed on Android App.
  - Automatic System.
  - Manual Control.
- Monitor
  - Android App Notifications

6.RESULTS

Snapshot of Firebase

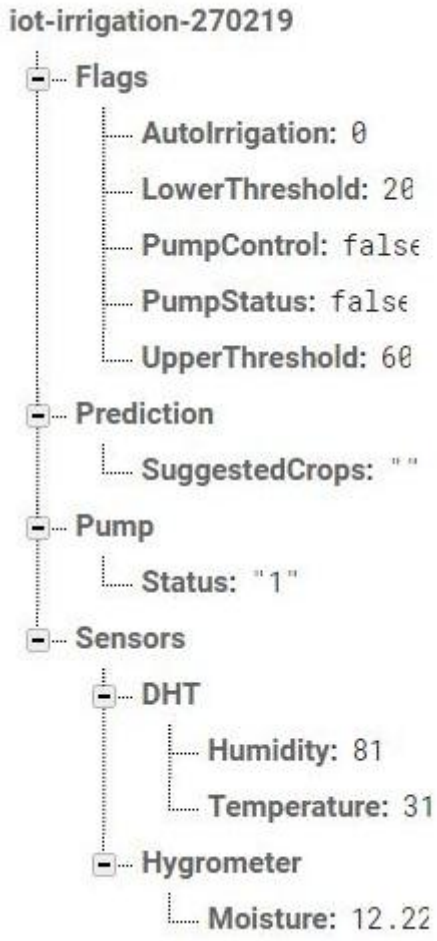


Fig -1: Firebase Database Snapshot

7. CONCLUSIONS

Agriculture plays a very important role in the economy of any country. Smart Irrigation System has been successfully developed with NodeMCU by connecting it with temperature, humidity, soil moisture sensor and gas sensor .By implementing Android interface apps in mobile, a user can manage and control the irrigation system remotely. Therefore, the intervention of human and time as well as water consumption is reduced.

8. FUTURE ENHANCEMENTS

a) Alarm System can be used to alert the Farmer/Land Owner in case of any Unusual activities on the field : this can be obtained by having sensors around to monitor the Field or by installing a live surveillance which can detect unusual movement by image processing.

b) Installation of a solar panel for providing electricity: As solar energy is a renewable source and is in abundance, this can be used to save energy.

c) Providing Different types of Irrigation according to crops: Not limiting ourselves to one type of watering method but using Drip irrigation, sprinklers etc as different crops need different type of watering system.

d) Taking weather into account: To be able to control the irrigation according to the weather such that we can predict when to water the crops and when not to according to when the next rainfall would be, this prevents over flooding.

e) Predict fertilizers required: We will be able to predict in which part of land which particular chemical is missing and hence provide farmer with detailed analysis hence, he would be able to save expenses on fertilizers.

f) Crop fire: Gas sensors like MQ2 can be interfaced with microcontroller to ensure that any type of fire is take care at earliest.

ACKNOWLEDGEMENT

We express our sincere thanks to Ms. Karuna Borhade, our project guide at SAKEC for the technical guidance, suggestions, motivation, help and facilities provided to us for the successful completion of our work and for monitoring our progress periodically and solving all our practical problems during our project work.

Also, we would like to thank our Principal, Dr. Bhavesh Patel and Prof. Uday Bhave, Head of COMPUTER Department, for their help and support.

No project is ever complete without the guidelines of these experts who have already established milestones on this path before and have become masters of it. So we would like to take this opportunity to thank all those who have helped us in implementing this project.

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