ANAVADYA

"FAULTLESS INNOVATION"

Final Report

Internship Project

Smart Irrigation System

By

Sanjay Babu

Shwetank M

A Vishnuvadhan

Abstract

A smart irrigation system is proposed in this report. Moisture sensors are used to read the moisture level of the soil and input to the microcontroller. Based on the crop sown in the field, this reading can be used to automatically trigger the water pump only when moisture level falls below a critical level in the soil. Using a relay control, the microcontroller controls the On and Off of the motor pumping water from the source. The microcontroller also communicates to the farmer about the live water supply status using a ESP-8266 module to the mobile device of the farmer installed with a mobile application. This app can be used to remotely monitor the irrigation process, configure the irrigation setup using the settings option and also manually override the on/Off of the motor in case of any emergency.

Problem Statement

Conventional irrigation systems with manual intervention are used by farmers in India. This system has lots of drawbacks. The irrigated water current is not well controlled, so water runs off very quickly resulting in less water being absorbed by roots and thereby more evaporation. It is labour intensive. Power consumption is high. The fertilizers are carried away due to less optimal control on the water current. This causes soil erosion and reduces underground water table level. Crop disease is a potential threat for the farmers. Identifying the crop disease at the early stage will help the farmer to ensure immediate remedial measures for protecting the crop.

Introduction

The basic idea of irrigation is to give the crops the adequate amount of water without wasting it.
In today's era of IoT and a lot of technological development, this concept of irrigation has reached its successor i.e. the Smart Irrigation using IoT as it's base.
The project deals with the same concept. Using the moisture sensors spread across the field along with the dht sensors collect the moisture levels, temperature levels and the humidity levels at the best and send that information to the API here in our case the Firebase. And to make it more convenient to the farmers we also have introduced an app specific for this purpose. All the se sir data will be sent to the app via the Firebase API.
The system will be continuously monitoring the field and whenever the moisture levels are low the water pumps will be activated using the relay switches to maintain the moisture level of the land. Here the watering the crops could vary according to the type of irrigation that is implemented in the farm.
The data that is collected on the API is further used to analyse the field type, soil quality and then can come up with further ideas that can be used to enhance the production per unit land.

Objective

The above drawbacks in conventional irrigation systems can be rectified by using IoT systems which optimize and automate the entire process. IoT has a wide range of applications and therefore using IoT for irrigation in agriculture would blend technology for the common cause and increase the productivity of the farmers with less expense and risk. Smart irrigation systems are recently gaining more popularity in other countries and farmers are adopting this to increase their productivity.

The proposed smart irrigation system has the following objectives:

- Enhanced root absorption:

Moisture sensor in the system helps to irrigate the crop on demand basis when the root soil is in deficit of water so that the root absorbs water effectively rather than manual irrigation which supplies water at random time.

- Reduced evaporation:

As the water absorption increases, the level of stagnant water will decrease resulting in reduced evaporation of the stagnant water

- Labour independent:

Smart irrigation system supplies water automatically by using sensors, microcontrollers and motor relays. So, the water supply will be turned on/off automatically without any manual intervention, hence this method is labour independent.

- <u>Reduced power consumption</u>:

The motor is turned on only when the crop soil is in deficit of water and turns off when the soil has enough water content. So, the water pump is operated optimally thereby reducing power consumption and water consumption from source.

- <u>Enhanced fertilizers absorption</u>:

Since the water is supplied only when the crop needs it utmost, the rate of fertilizer absorption will also be enhanced.

- <u>Reduced soil erosion</u>:

The increase in absorption of water will reduce the water run off so that soil and nutrients erosion can be reduced.

- <u>Enhanced underground water table level</u>:

The reduced water run off will help the soil to absorb the excess water after crop absorption. This will enhance the underground water table level.

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Components Used

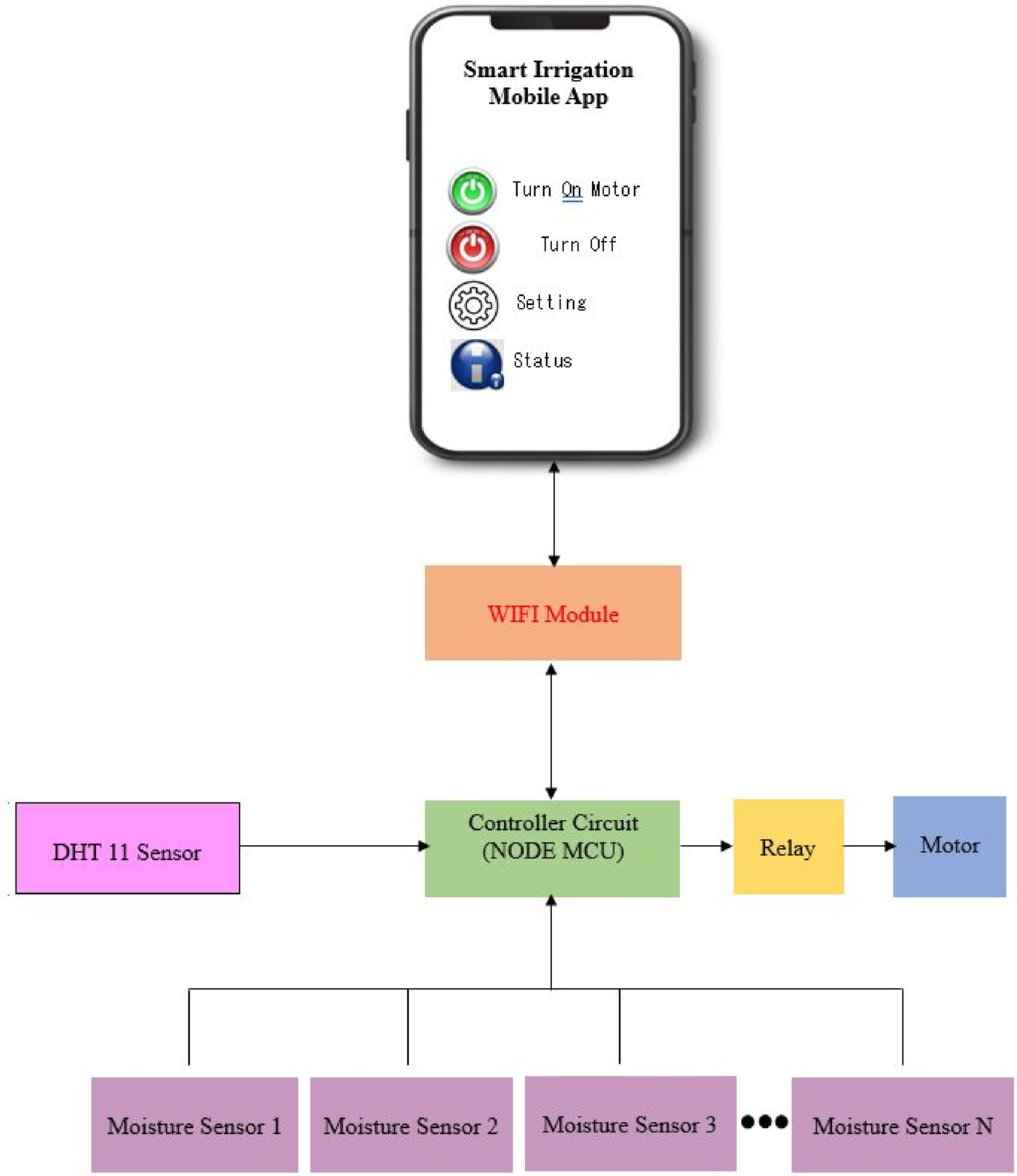
Hardware

- Node MCU Esp8266
- Dht 11 sensor
- Soil Moisture sensor
- Jumper cables
- Breadboard
- Relay module
- Motor DC (Imitation of real pump)

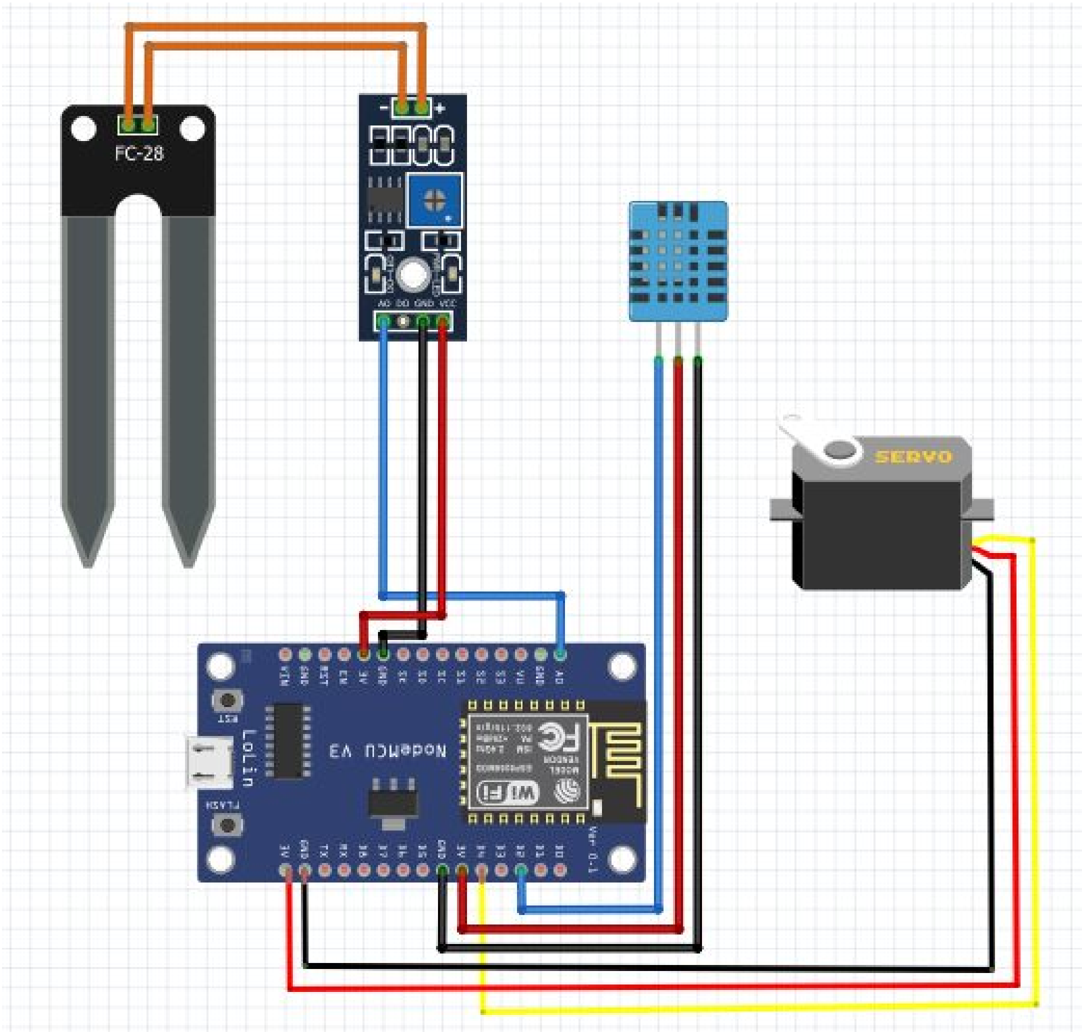
Software

- Arduino IDE
- Visual Studio Code
- Android Studio
- Expo Mobile App

Block Diagram



Circuit Diagram



Methodology

In this project we have used a DHT11 sensor for measuring humidity and temperature of the environment and a soil moisture sensor for measuring the moisture content in the field soil where the sensor is going to be placed. These sensors are connected directly to the NodeMCU through cables. The power supply is drawn from the board itself. DHT11 is a digital sensor and soil moisture sensor is an analog sensor.

Sensors:

The data pin of DHT11 is connected to D2 pin and Soil moisture to A0 pin of NodeMCU. The code uploaded via Arduino IDE gets the required values from the sensor and gives the values in the required units. Temperature is obtained in Celsius, humidity and soil moisture is converted to percentage in the program.

Firebase:

The values from the sensors are sent to Google Firebase and then those values are retrieved from there and used to display and control the motor in the mobile app. The Firebase host ID and authorization key is obtained from the database created for the project along with the hotspot details to which the NodeMCU is needed to be connected to send and receive the values from Firebase.

Motor:

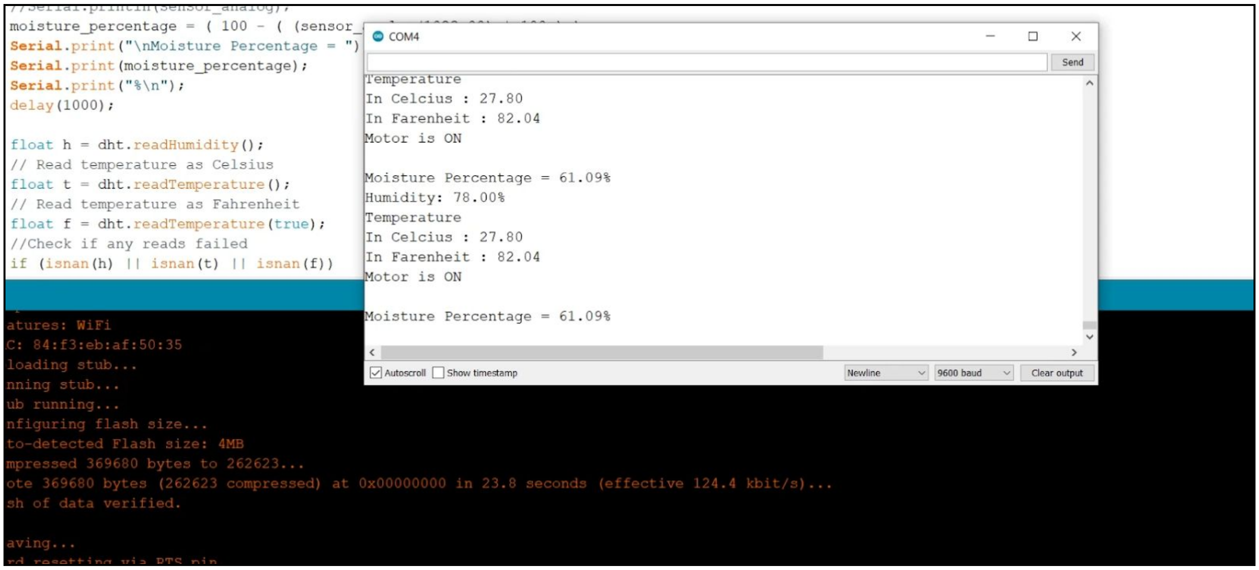
The motor here is the main representation of the original water pump that we are intending to control from the data received from the soil sensor from the fields. If the sensor value is less than 60% we switch ON the motor or else turn it OFF automatically in the program. Also to control it from the app, we switch it on in the app and that is sent to Firebase where the motor status is set to TRUE and which is in turn read in the NodeMCU continuously. When the status is TRUE motor is switched ON that is when we switch it ON in the app and if it is FALSE motor is switched OFF that is when we switch it OFF in the app.

App:

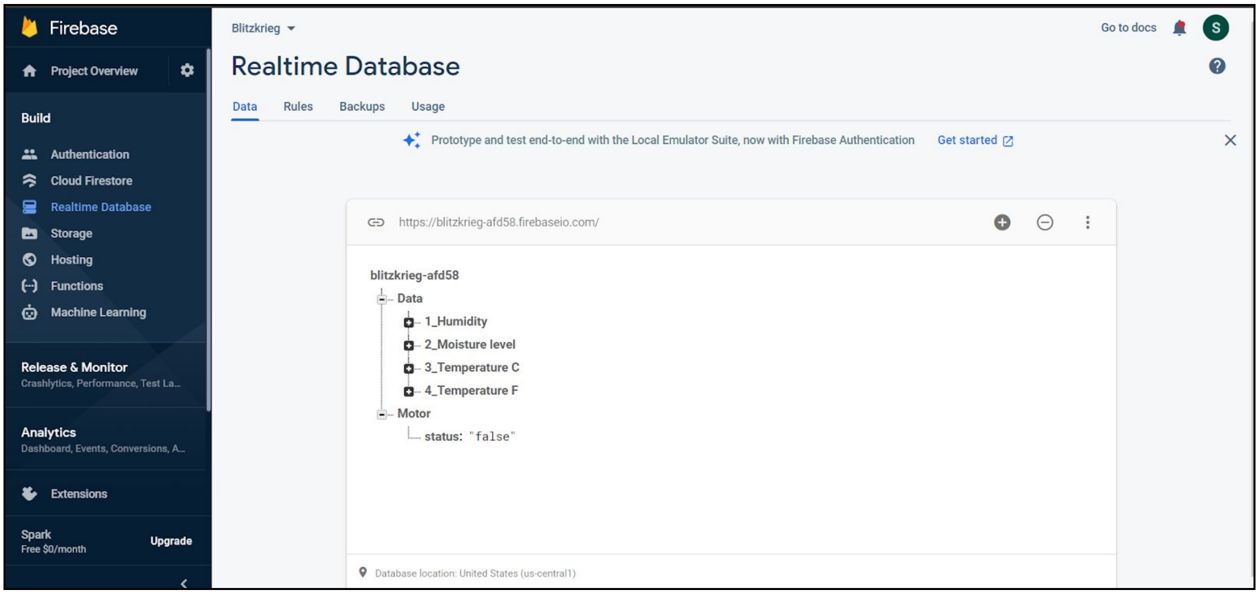
We Designed and Developed React Native based Mobile App supporting both Android and iOS. App eases the work of farmers by controlling the motor and notifying the moisture level of soil for each second. It plays a major key role in our project with a well structured UI allowing farmers to access it easily without much trouble. App Displays current stats and past 10 status of moisture level, temperature, humidity recorded on various sensors and fields over the farmland. It also allows farmers to easily switch ON and OFF the motor with remote access. Farmers can keep track of moisture level on various fields and control the motor instantly. Our App utilizes real time data from firebase and keeps updating instantly on changes in sensor data.

Prototype

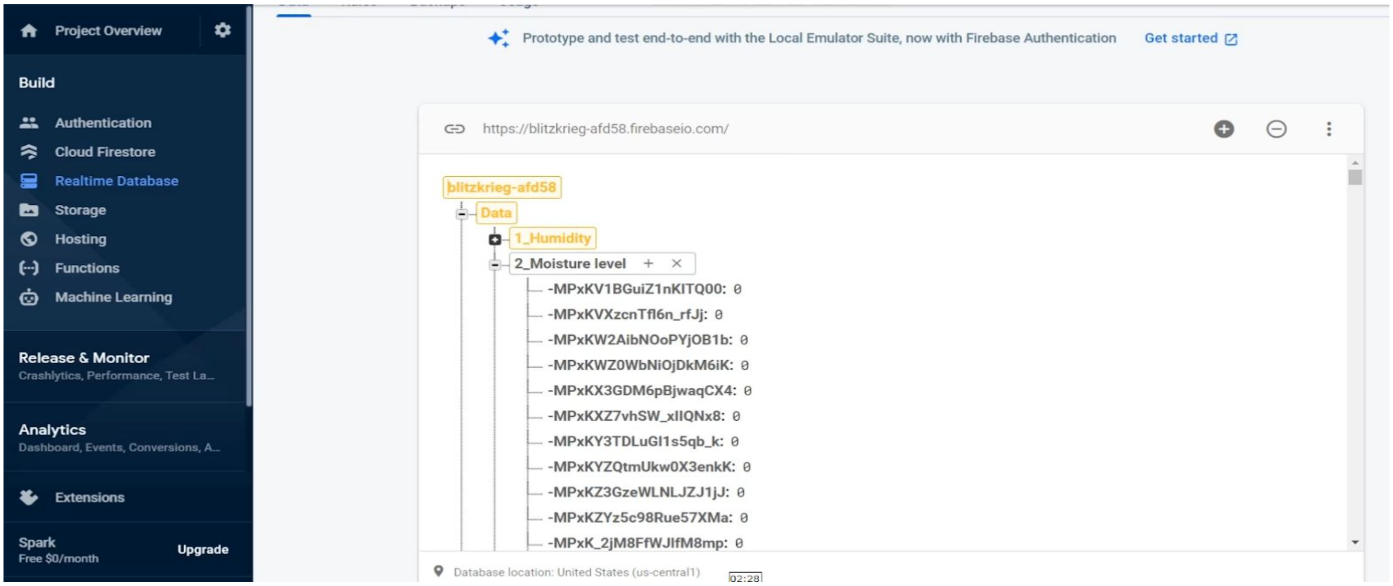
Result



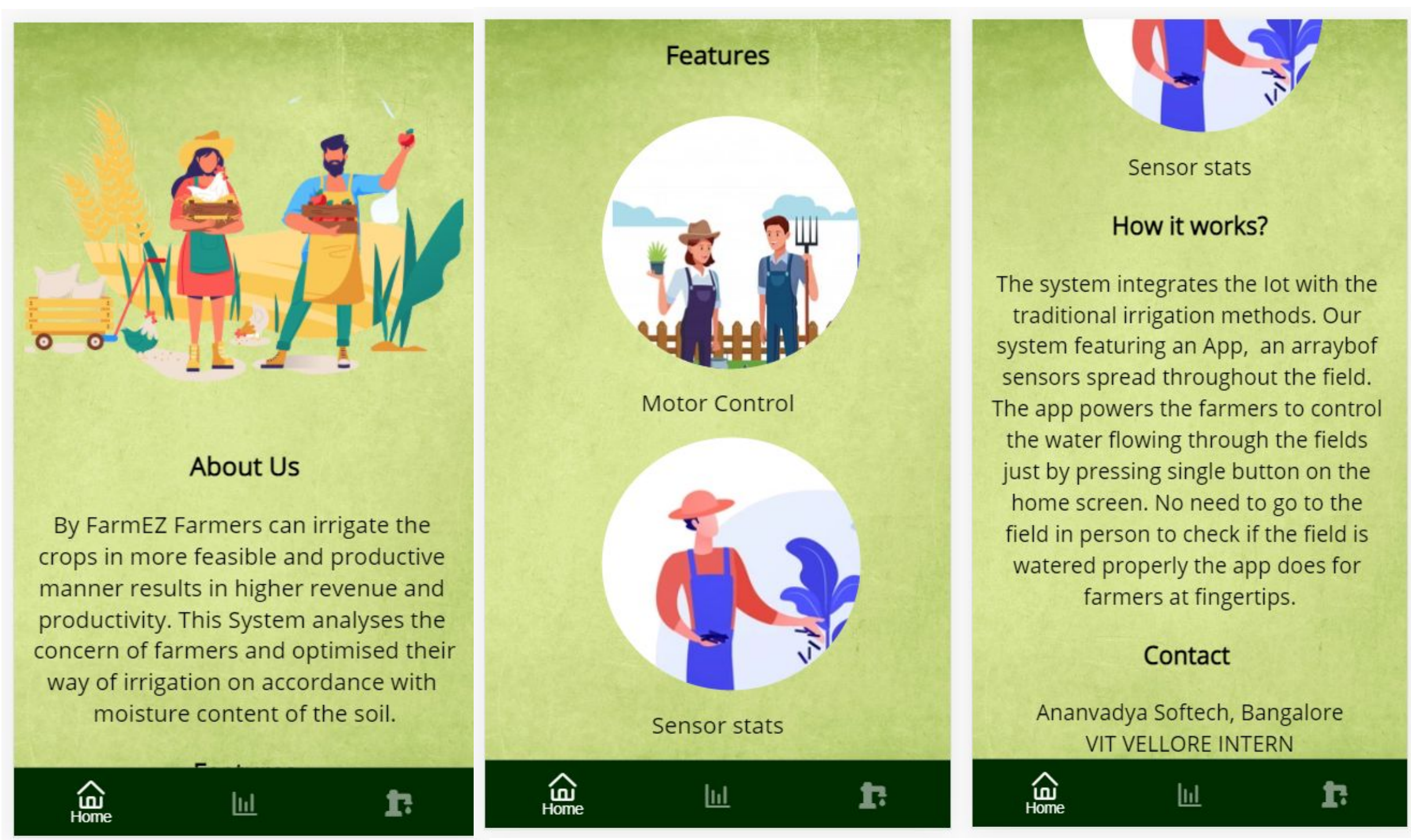
Arduino IDE Serial Monitor



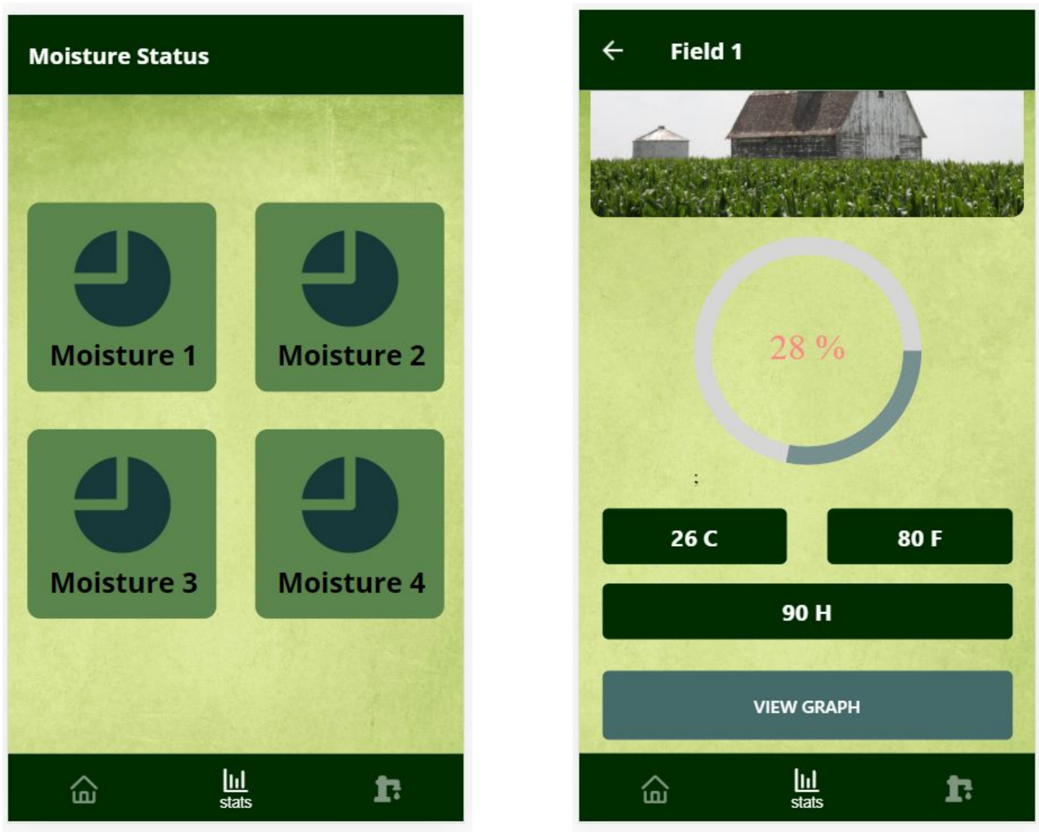
Firebase: figure 1



Firebase: figure 2

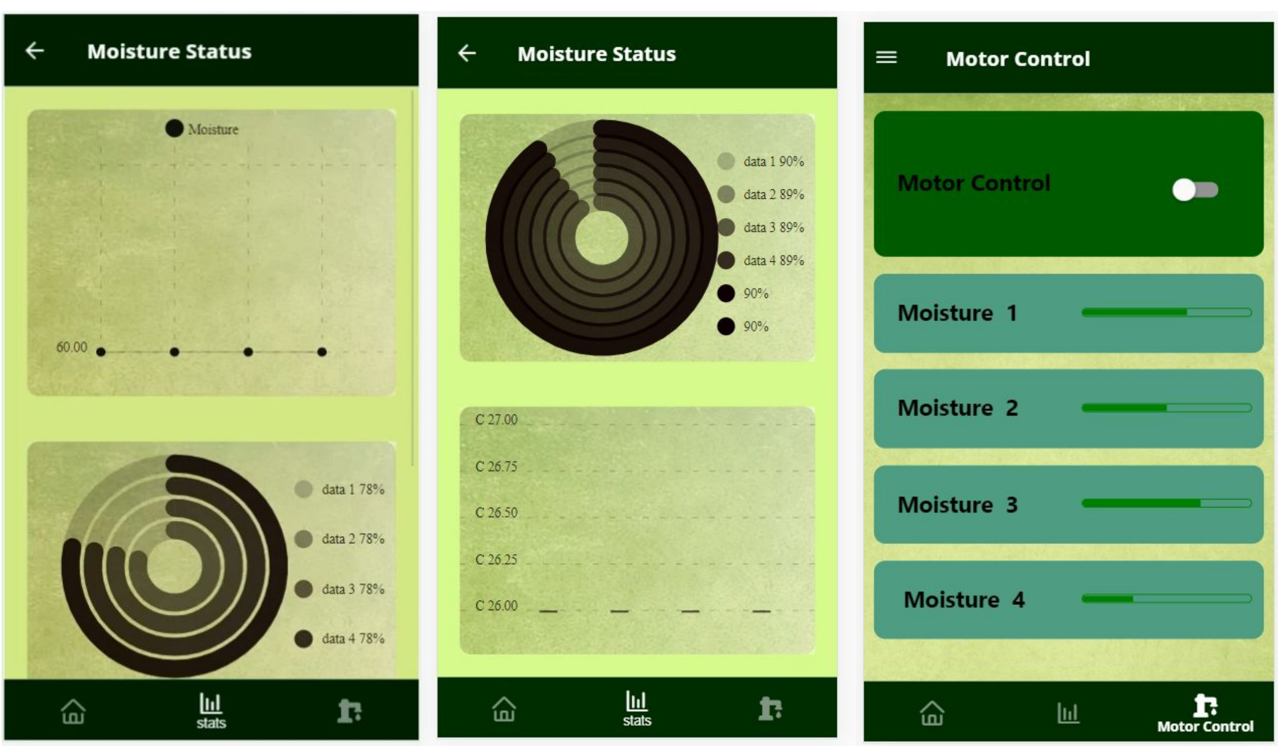


App- Homepage



Sensor values display

Page to control the motor by tracking the moisture values of various sensor fields over the farmland.



Project summary and Conclusion

The project was designed to ease the farmers, to make the load of watering the field time- to - tie and making the best use of the technology available. Using the IoT at its best to solve the current problem.

Using the NODE MCU (ESp8266) which serves as the medium to connect the system to the network using the WIFI module built in it.

The Arduino Uno serves as the base for all the sensors attached to it and the central processing. Various sensors attached to the arduino send the sensor values to the firebase api , in our case it is the soil sensor information, temperature values and the humidity sensor values.

From this project we conclude these things:

- All the sensors attached to the Arduino UNO work fine; sending right sensor values.
- The NODE MCU sends those values to the firebase API and then the personalised app made to ensure that the information collected is used right to get the real-time information of the atmosphere in the field.
- VIsualisation of the sensoray data in the android app made it easy to realise the patterns to water plants efficiently with the least amount of water.
- The water pump controlled using the arduino app made specifically for the system.
- No need to visit the field every time to check whether the field is dry. The system sends the soil sensor value.
- When the soil sensor value goes less than the certain threshold turns on the pump and waters the field to a certain soil sensor value.

Thank You!