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COLLEGE OF SCIENCE , FACULTY OF PHYSICAL AND COMPUTATIONAL SCIENCE

SUSTAINABLE SMART FARM MONITORING AND CROP RECOMMENDATION SYSTEM

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ABSTRACT:

The global human population is projected to experience a food crisis due to low food supply and rising demand. The worldwide agriculture industry has also suffered from the negative consequences of air and water pollution as well as improper farming practices and insufficient monitoring technologies. With calls for the agricultural industry to be more sustainable with their farming practices ,it has become imperative on every industry including the Information and Communication Technology Industry to come up with smart and feasible solutions that would not only safe guard the planets fertile lands but also increase yields for the globe. Smart farming uses the Internet of Things to track, monitor, regulate, and analyse basic farm conditions in a bid to optimise human labour by maximising effort and decreasing strain on the environment.

INTRODUCTION

One of the biggest problems identified within the Ghanaian agricultural system has to deal with proper soil assessment for viability of crops. This has to deal with testing of soil conditions , assessing weather patterns and understanding what plants thrive best in certain soil types. Ghanaian farmers have stuck to unconventional forms of identifying these conditions but unfortunately with the radical change in weather patterns from effects of global warming and human activity these methods are failing.

This project looks at creating a system that not only allows a more objective way for farmers to monitor their farms and soil conditions but also an effective means of deciding what types of crops would be fit for certain soil types.

OBJECTIVES

Main objectives:

To build proper monitoring mechanisms to provide the farmer adequate data to make informed farming decisions.

Specific objectives:

Monitor farm and soil conditions such as soil moisture, atmospheric temperature and humidity and light intensity remotely.

Increase crop yield and rentention.

Improve irrigation and fertilisation practices

FUNCTIONAL REQUIREMENTS

Arduino UNO – handles the electronic processes and computing and serve as the system's main controller.

ESP8266 – the Wi-Fi module sends the sensor readings to the Firebase.

Firebase – the cloud database handles online data processing and storage.

Power source – this is required to turn on the system.

Internet connection – this is required to transmit sensor readings from Arduino Uno to Database and from Database to Application

Temperature and humidity sensor – reads the levels of temperature and humidity level in the soil.

Soil moisture sensor – reads the water level in the soil.

LDR sensor – reads the light intensity of the farm

Figure 1 **HARDWARE COMPONENTS**

Figure 2 **SOFTWARE COMPONENTS**

METHOD

- The device circuit was drawn
- The Sensors were connected to the Arduino Uno Board which serves as the micro controller for the entire system.
- The ESP8266 WIFI module is also connected to the Arduino Uno Board.
- The Sensor Components and WIFI Module were programmed using C++.
- the Arduino Uno was integrated with a Firebase real time data base
- The mobile Application was developed using flutter.

Figure 3 **CIRCUIT DIAGRAM**

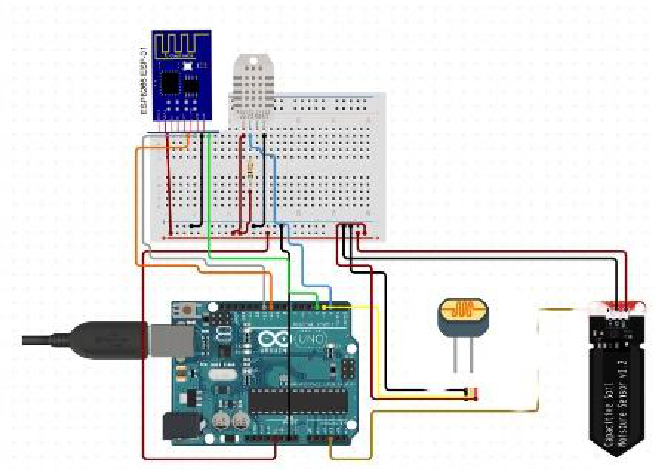
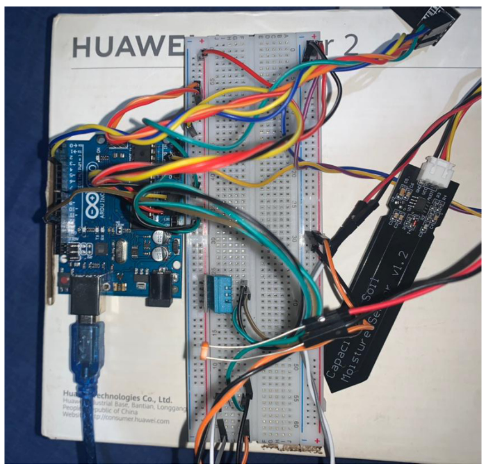


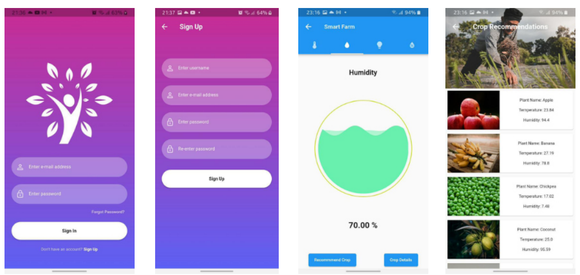
Figure 4 **ASSEMBLED DEVICE**



OPERATION

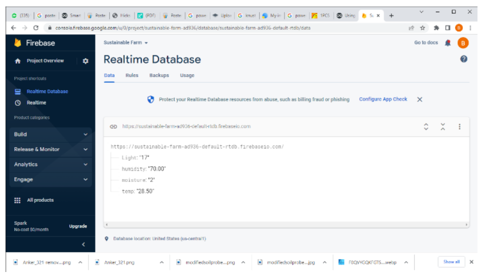
- Upon reading sensor data , the WIFI module acts as a station and transmits the sensor values to a Real-time Firebase Database.
- The Firebase database which is connected to the Mobile Application transmits the sensor readings to the application interface in a simple visual format to the user.
- The Mobile Application also uses the readings from the sensors to recommend various crops that are viable per those soil conditions to the use upon request.
- The application also provides additional plant health information to the user.

Figure 5 **RESULTS**



Snapshots from Mobile Application

Figure 6



Snapshot from Firebase Realtime Database

Future Implementation

This system in the future can be integrated with drone irrigation systems that utilise prompts from the system to automatically irrigate or fertilise farms. other implementations can be integrated with machine learning models to effectively predict weather patterns as well as a host of other crops for the farmer. One other future implementation of this project would be the usage in green houses and hydroponic farms to detect the levels of Co2 as well as fixed with motion sensors to detect intruders and large pests like birds that destroy farm crops.

Figure 6 Stock image examples of Future Implementation

Conclusion

The final System was tested with various soil samples and at various temperatures , it was able to effectively record the readings and transmit them unto the real time data base. it was also used in the to test light intensity. The System would there fore be effective in farm settings. The system also recommended some crops that would be suited for certain crops. this was tested on some maize farms and the system recommended maize as part of viable crops to be planted.

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