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A System for Detecting Humidity and Soil Texture of Crop Yield

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Abstract: Crop production is likely to decrease in the future due to global warming we know that water plays an essential role in irrigation. Capturing and storing water requires adequate rainfall which lacks in the current environment. Sufficient water is required for the growing of crops in the summer season or else the yield of the crop is reduced to a greater extinct. The farmer invests most of the time in water management in the farm through continuous monitoring for better crop productivity with efficient utilizing of all the resources with adequate pricing. The system is to reduce time investment in water management and use more time in determining action towards crops by increasing the productions and measure the humidity level accordingly the motor turns off or turns on based on the requirement of water that is needed for the crops. The system does not require the involvement of humans it automatically waters itself by intimating to the owner via notification and watering level changes according to the prominent factors that affect the crop yield.

Keywords: Agriculture Monitoring, Irrigation, Temperature Sensor, Arduino Board, Raspberry Pi3.

INTRODUCTION

Agriculture plays a prominent role in the Indian economy. Water is the main source for the cultivation of crop fields. Irrigation methods are operated manually in olden days. In recent years the irrigation process is done in the automated and semi-automated process which is being replaced by the traditional agriculture mechanism.

The existing technology is a drip irrigation system, sprinkler system, ditch irrigation system that provides sufficient water to the crops only by monitoring the crop fields. This situation is modified by making use of the automated system rather than following the traditional approach.

The basic idea of the project is to help the farmers by reducing their workload on water management in the field for their crops. Advancing crop irrigation using automation by turning off the watering system and automatically informing the farmer about the change of actions in the watering system. On automating the system the invention saves a lot of time for the farmers and can concentrate more time on other works regarding the yield of the crop.

As the technology advances the manpower is saved by utilization of the Internet of Things. The main intention of the project is to automate the water management by automatically turning off the water supply to the particular crop field on reaching the required water level without monitoring. The android application running on it enables the controlling of the system and monitoring by checking the various parameters based on the information provided by the humidity sensors and temperature sensors according to the information provided by the sensors it regulates the flow of water.

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LITERATURE SURVEY

Before going into the details of our system for detecting the humidity and soil texture of crop yield. We will review some of the present systems in vogue pertaining to the agriculture.

Automated Irrigation System based on Intelligent IOT

In most of the systems the data is collected from the agricultural field in this implementation the sprinkler system controls the watering in the field. It provides the sufficient water periodically to the crops. None of the system uses intelligence which analysis the real-time data based on the previous experiences from the field. This Intelligent IOT uses Raspberry Pi3 that holds the KNN algorithm (K-nearest Neighbor) [1] machine learning. The intelligent IOT system developed by using this algorithm would make analysis on soil conditions whether the soil is wet, little dry, little wet, dry based on the soil moisture the water pumps control flow is regulated.

In addition to this, a graph is being created between the Temperatures and the soil moisture and CSV file pertaining to trained data set are stored in the cloud server. The data which is collected from different sensors like a temperature sensor and soil moisture sensor is sent to process IDE. It checks the Proper connection by restarting the system and the values are stored in a text file. After this, the ML algorithm is run it predicts the output and stored it in a file accordingly it test the soil whether the soil is wet or dry. If the soil is dry, water is pumped automatically else if the soil is wet the water is not pumped. The result is being transferred to the cloud. By accessing the website the farmer is able to view the output. Here the process of how it connects the Arduino board and raspberry pi3 is taken as a reference to our project and implement further. Figure 1 shows the complete architecture of the IOT based automated irrigation system.

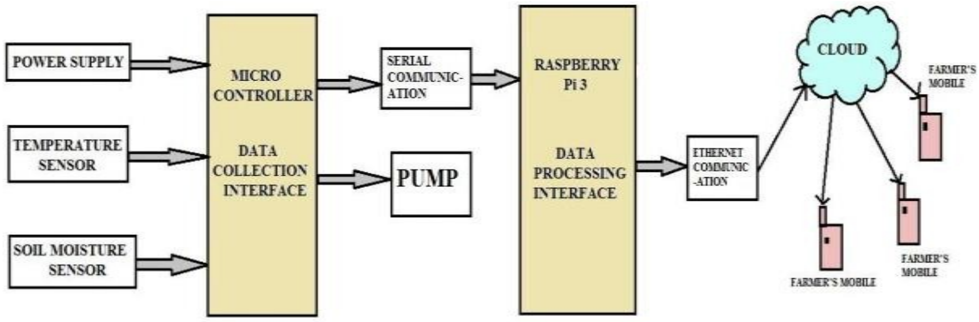

Figure 1: IOT based automated irrigation system

The Arduino here involved as a microcontroller and Raspberry Pi3 acts as a processing unit. The temperature sensor and moisture sensor deployed in sensing the temperature level and soil moisture level. The water pump involved in the system is also connected to the Arduino. The data is then serially sent to Raspberry Pi3 where ML algorithm KNN is being deployed. The predicted output that is the data set pertaining to temperature and moisture for different soil conditions like wet, little wet, dry, little dry is being predicted and transfer the output for actuating the water pump. Finally the information is stored in webpage of the cloud where farmers can have access.

Control of Wireless Sensor Network and Web-based Monitoring Using (Wireless IP Network Gateway for ZigBee)

In this paper, a case study has been made on establishing a WSN in building and home automation and with the help of IP based network used to interface using the Wingz. The Wingz has multiple IP network interfaces like HSPA, Ethernet, and WLAN on-board system of the chip. The wingz device is used because this function is suitable for an embedded hardware platform which supports both the Linux operating system and the Android operating system [2]. The two hardware elements used are WINGZ and Ubimote (End Device/Router). The major part of WINGZ is used to send the data of ZigBee which is received from ZigBee Soc to a remote server using restful web services. The major use of the Ubimote is to support the Multi-hop Zigbee network.

Web based GUI is designed for WSN (Wireless Sensor Network) which provides web based monitoring and WSN control interface. This design is implemented based on android platform which uses less power consumption. The complete design has local data logging capability using secure design memory card interfacing. The advantages in this implementation are gathering of the data by wireless sensor nodes which includes Battery Information, address Information, Description Information and Sensor Information these data is presented in Java server pages (JSP) and saves a lot of power consumption by using the android platform instead using of Linux platform. The disadvantages of this implementation are some hardware design issues in designing the multi-wireless protocol gateway, controlling of sensor network end devices and software framework enabling monitoring etc.,. The energy harvesting is not utilizing completely and should optimize the software.

Wireless Sensor Networks for Intensive Irrigated Agriculture

As intensive irrigated agriculture represents a large domain. It consists of constraints, requirements, and guidelines of a general sensor network. This paper explains the major sensor networks core components and various uses of it. The system architecture is divided into two parts which are the upper system and bottom system architecture. In the bottom level the design and implementation of gateway and sensor node including the mechanisms and communication protocols. The information is gathered by the sensor nodes there after the data is sent to the base station. The base station then provides the WAN connectivity and data logging which is shown in the framework. A base-remote link is connected to every sensor node to the internet. The sensor node base station connects to the database replicas across the internet figure 2.

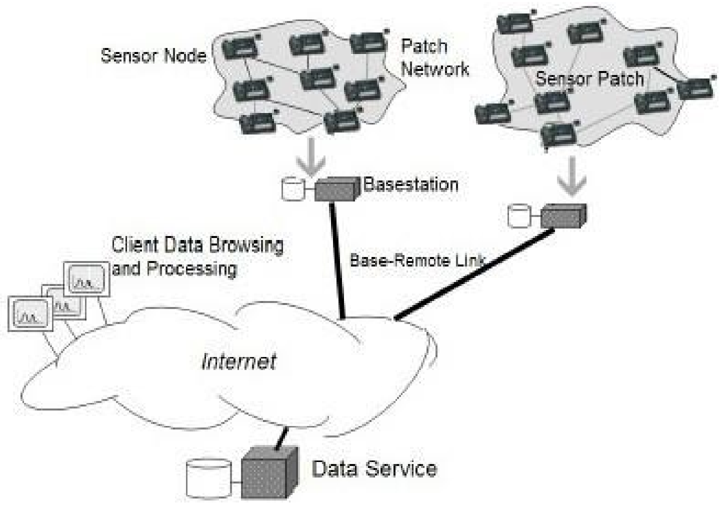

Figure 2: Architecture of Bottom System

There are five modules in the upper part they are information issuance module, WSNs data Gathering module, Business module, Decision-making module, and WSNs management module. It includes so many parts as a whole it is the data source to the entire software figure 3. A module network management is provided which tells the network status information to the database. The system which is used is based on the Mica platform.

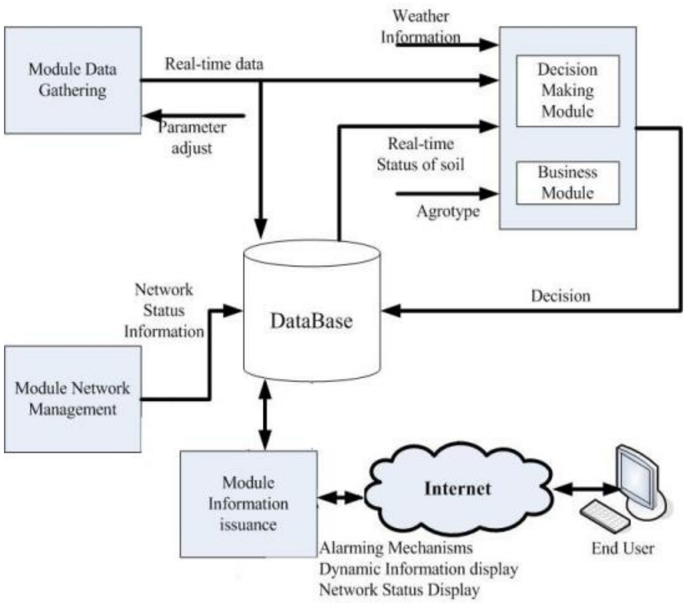

Figure 3: Architecture of Upper System

The routing level implementation is done in the paper which is a distributed way and local realization each node take itself as communication with its neighbours and centre, so as to find its father node. Similarly, each node sends information to its father and in turn the father node sends information to their father node. The application layer implementation is also done with six functions and the server collects the packets from serial port which connects to the base station and the data which is collected is saved into the database. Due to the above implementation, it reduces the average node power consumption. This paper helped in knowing the architecture of WSN and the packet transferring from each node in a detailed way.

A System for Detecting Humidity and Soil Texture of Crop Yield

Better crop growth comes from better maintenance of the crop environment. As we know that water plays a substantial part in the crop field. The implementation makes water usage very efficient and reduces the wastage of water in a minimal way. Coming in deeper analysis of the architecture of the project figure 4 there is a crop field in which all the sensors are placed in the field after the phase 1 process that is the leveling off the ground is done.

The major elements of the soil like Potassium, Nitrogen, Phosphorous, Sulphur, Magnesium, Calcium and Iron are distributed equally. The sensors which are used in the field are Soil sensor, Humidity sensor, and Temperature sensor. These sensors are placed in a highly possible effective place so that the accuracy is more while measuring the values by the sensor in an easier and convenient way. Making sure that the sensors placed does need an indication for the farmers to recognize the sensors are here and should be more careful while walking around the place. Then the humidity sensor plays a role of measuring the humidity in the field accordingly control the connections which are made to the motor. Finally, the temperature also plays a major role in indicating the temperature level in that place so that if any rise in temperature or humidity level the motor automatically turns On or Off by sending feedback to the farmer.

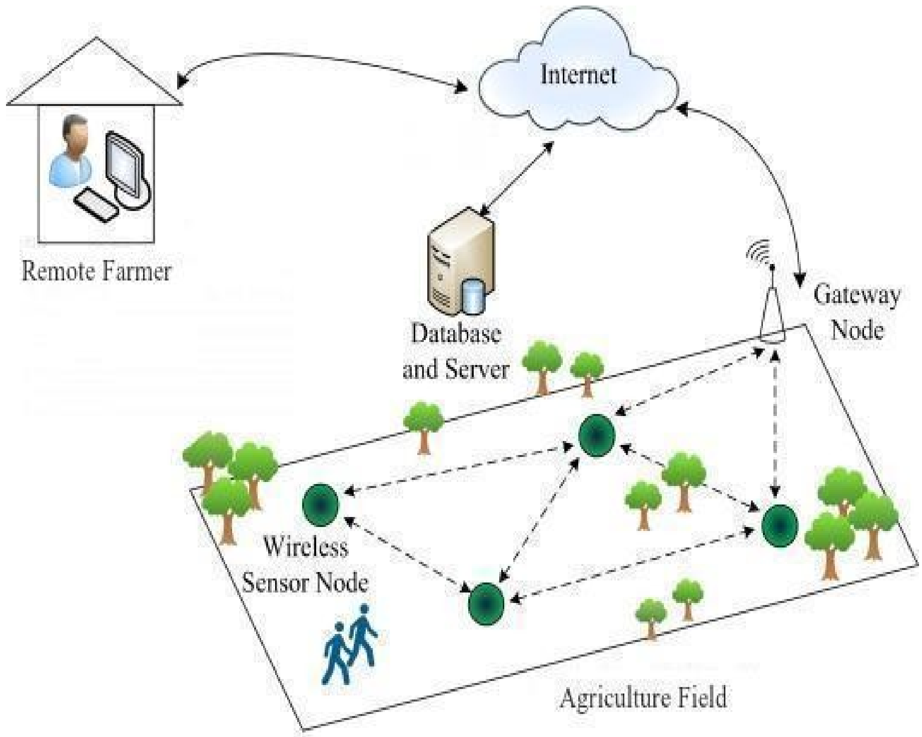

Figure 4: Architecture diagram

The farmers are provided with a digital screen where he can track the current position of the field whether the soil lacks soil elements or any changes in humidity or the temperature raises in that area. There are 2 parts in the project which is backend and frontend where a lot of work is done in the back end and the front end is just displaying the message to the farmer. In the backend we have a Database server which stores the data received from the sensors, Get link and a POST link which is connected to the front end. There is a Get link which connects to the database channel and requests the humidity level every 10seconds and compares the value with the farmers standard humidity value if the value changes that effects the field then a request is made to the motor where the water pump is turned on automatically by notifying the farmer with the feedback message.

The GET link for the project is https://farmer- server.cfapp.io. This link collects the complete data from the database using spring boot MongoDB repository and serves the data as a rest API. The data is collected in the spring boot with the help of repositories and served by rest controller web dependency. The URL is mapped by request mapping web dependency annotation. Spring boot application contains the data model of the database in the collection in the MongoDB server. The data provided by the link can be used to develop any application such as mobile apps web apps etc. The database view is shown in figure 5.

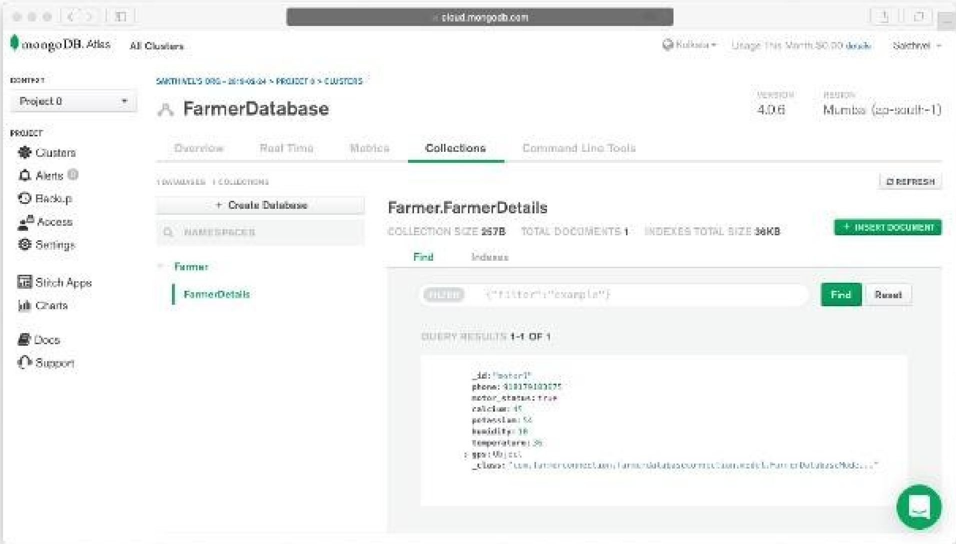

Figure 5: Farmer Database

There are two POST links which the back end is provided with the connection to the front end. The POST link plays a prominent role in backend phase they are two POST links where one is used for the sensors and the other POST link is used to update the values. The POST link for the update is https://farmer- server.cfapp.io/update and the POST link for the sensors is https://farmer-server.cfapp.io/sensor. This update link collects the data from the farmer and updates in the database and also used to serve the Arduino for the communication to the database for the actions of the Arduino. The new data thus updated is also served in the GET link so that the information displayed is up to date for the farmers. The post data contains the data to be posted in the JSON format figure 6.

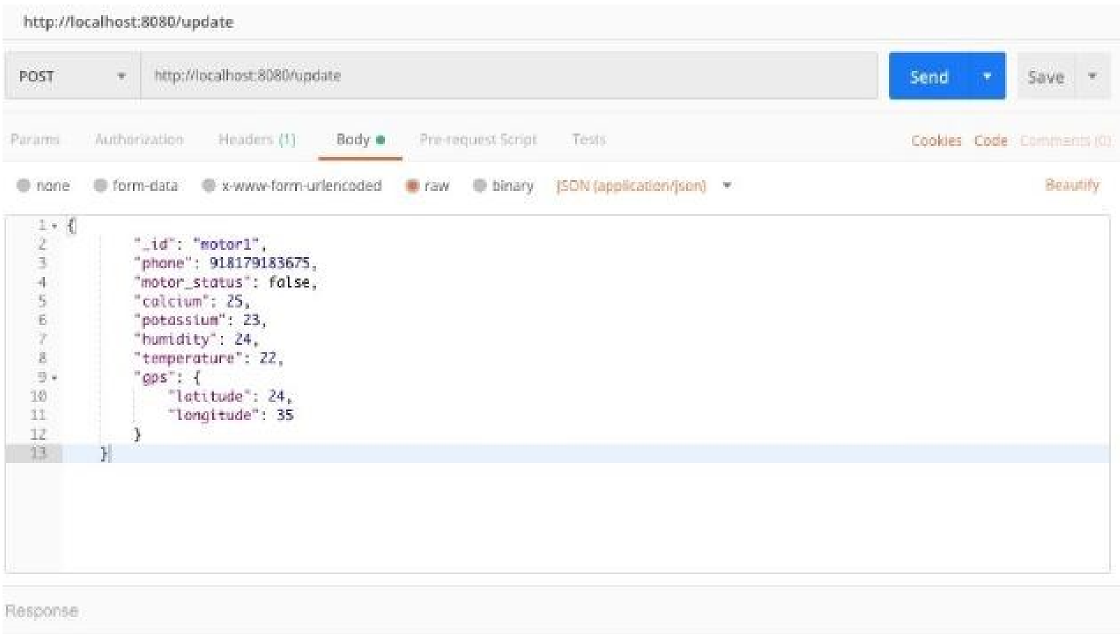

Figure 6: POST update

This sensor link in the Arduino to post the data from the Arduino the collected data to the database and the update is done in the database and the updated data is served in the GET link and the data is up-to-date in the viewing side. This makes sure that the data that is provided to the user is always up-to-date. The clearer view of the sensor link is shown in figure 7.

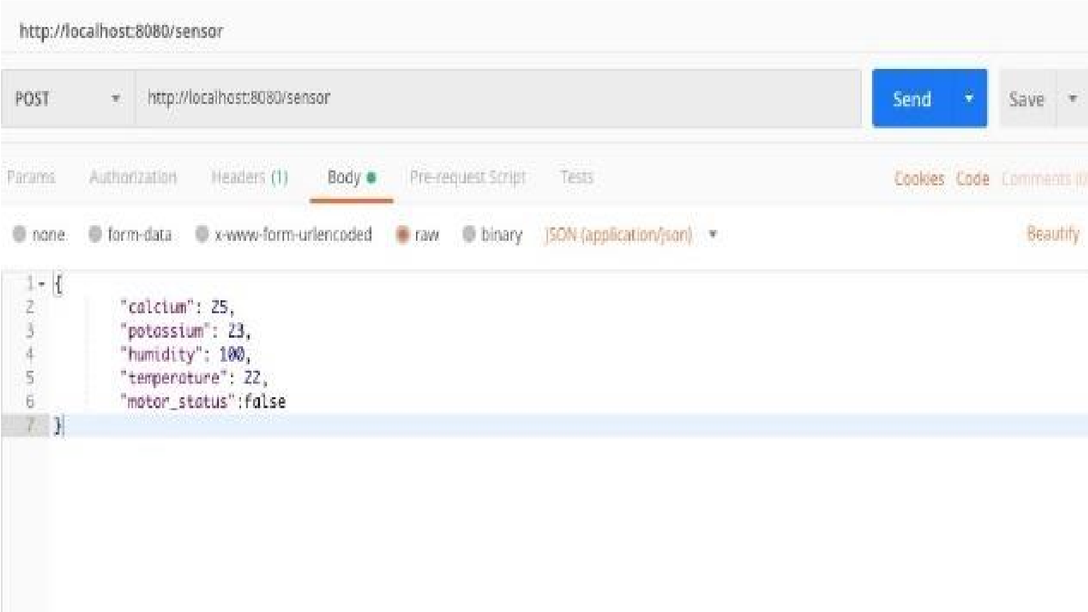

Figure 7: POST Sensor

In the front end, the sensor gathers the information to the database and collects data periodically and update the database. Any change made in humidity level the process initiates and accordingly the motor is turned on or off.

The following ER Diagram figure 8 explains the different components of the project the base station which is having ID, Location and connects to control the motor which is having Motor ID, Location and Username. The Base station then connects to the WSN (Wireless Sensor Network) which has the same components as the base station and with a value and a name in addition to it. The base station collects the information which is collected from the WSN and sends the information to the database server or the database application. The admin then checks the proper connection is maintained between the sensors and manages the database and the client farmer details using a unique farmer id for a different client.

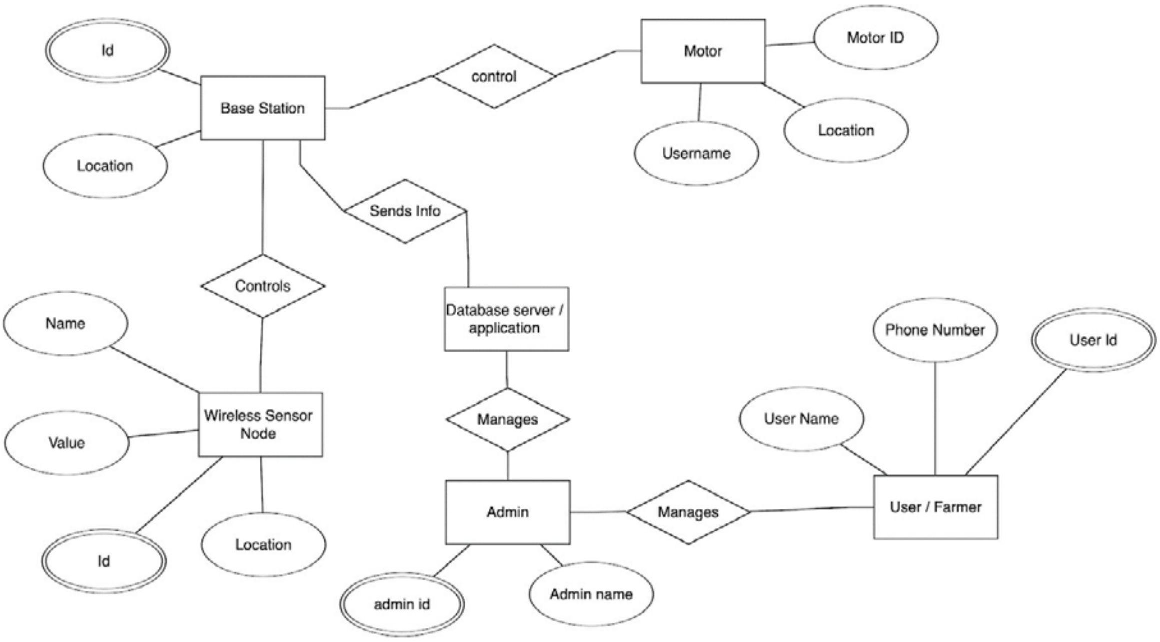

Figure 8: ER Diagram

IMPLEMENTATION RESULTS

Figure 9 clearly shows the notification which is sent to the farmers. The text notification contains the information of the elements like humidity, temperature, and the motor status whether it is turned on or off, Potassium content and calcium content. Thus the automation of the water pump is done easily without the farmer on site clearly this invention helps in saving of water, low-cost invention and time-saving.

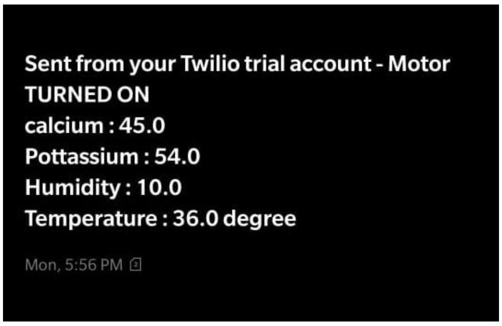

Figure 9: Text Notification to the Farmer

CONCLUSION AND FUTURE WORK

Monitoring of agriculture is necessary for better crop growth. By automating the process it saves a lot of time to farmers and invests more time on other works of crop growth. Because of this invention, the time saving and water wastage is reduced a lot and farmers can easily monitor the work from their living places. Some additional measures to be taken for crops which is the crop should be checked before whether the crop is infected with any disease or not controlled measures to be taken before itself. IOT makes the work easier for humans making to concentrate more on other works the same scenario happened in this implementation. This has resulted in complete automation in the irrigation system where the Arduino collects the sensor information and updates the database and in turn, the notification is sent to the farmers.

The soil contents majorly concentrated here are potassium and calcium if the accurate results are needed then all the other contents in the soil also measured for the future work. In future, the IOT intelligent based irrigation system can be extended by adding more sensors that are able to detect the infected disease in the crop growth for proper results.

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