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Smart Architecture Foragriculture Applications Using Wireless Sensor Nodes

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Abstract

The South African Agricultural sector is facing multiple problems due to the climate change and ageing generation of the farmers. So, government has had challenges to in generating suitable income to manage their operations effectively to deliver on their mandate. Diminishing of the agricultural system day by day affecting the production capacity of ecosystem. Persistent Droughts, climate change and population growth are the sever constraints on the agriculture in many regions of the country. This emergence can be eliminated by introducing the technology to the several areas of agricultural, farming, irrigation and Cattle Monitoring to maximize the production to stable the ecosystem. To aim these various difficulties, we are proposing an IoT framework to assess and control these various parameters associated with the agriculture.

1. Introduction

In the present era were population is increasing at a rapid rate, the demand for the crop precision agronomy provides high yields with low cost of input and at the same time need the reduction of the air pollution. Integration of the technology with the Social activities brings up good social cause and establishes a relationship with each other to achieve a common goal. Internet of Things in the present scenario yielding high demand for the better cause of the social life and its integration with the agriculture and farming can bring a better balance between the demand and production. Ali, Rifaqat, et al. Wireless sensor network could be utilized for various climate parameters like temperature, Humidity, Carbon Dioxide in an agricultural field [1]. Liyan, Shanshui et. al evaluates the performance of six indices Standardized Precipitation Index, Palmer's Z-Index, Palmer's Drought Severity Index, precipitation percent normal, precipitation percentiles, Evapotranspiration which are more suitable for monitoring agricultural drought parameters in South Central United States [2].

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Sai, Zou, et al. presents the deployment methods of minimum sensor nodes using optimization methods to monitor the agricultural parameters [3]. XU, Shi-wei, et al. develop CAMES that is based on the comparative study of domestic and international agricultural Models [4]. Mohanraj, I propose a e-Agricultural Application based frame work consisting of the KM knowledge base and the various monitoring modules [5]. Zhu, Yingli et al develop the wireless sensor network for the agricultural parameters and design the hardware nodes and data flowchart [6]. Foughali, Karim et al. collected the weather information from the low power low IoT device placed in the farm lands and upload the data to cloud server [7]. Foughali et al. develop the IoT frame to monitor various parameter for agricultural monitoring [8]. Popović, Tomo, et al. discuss the case study of for designing the personal IoT platform for research in ecological monitoring system and precision agriculture. [9]. Afzal, Bilal, et al introduce the SIoT Social Internet of Things application for the various social applications. Figure 1 shows the overview of architecture.

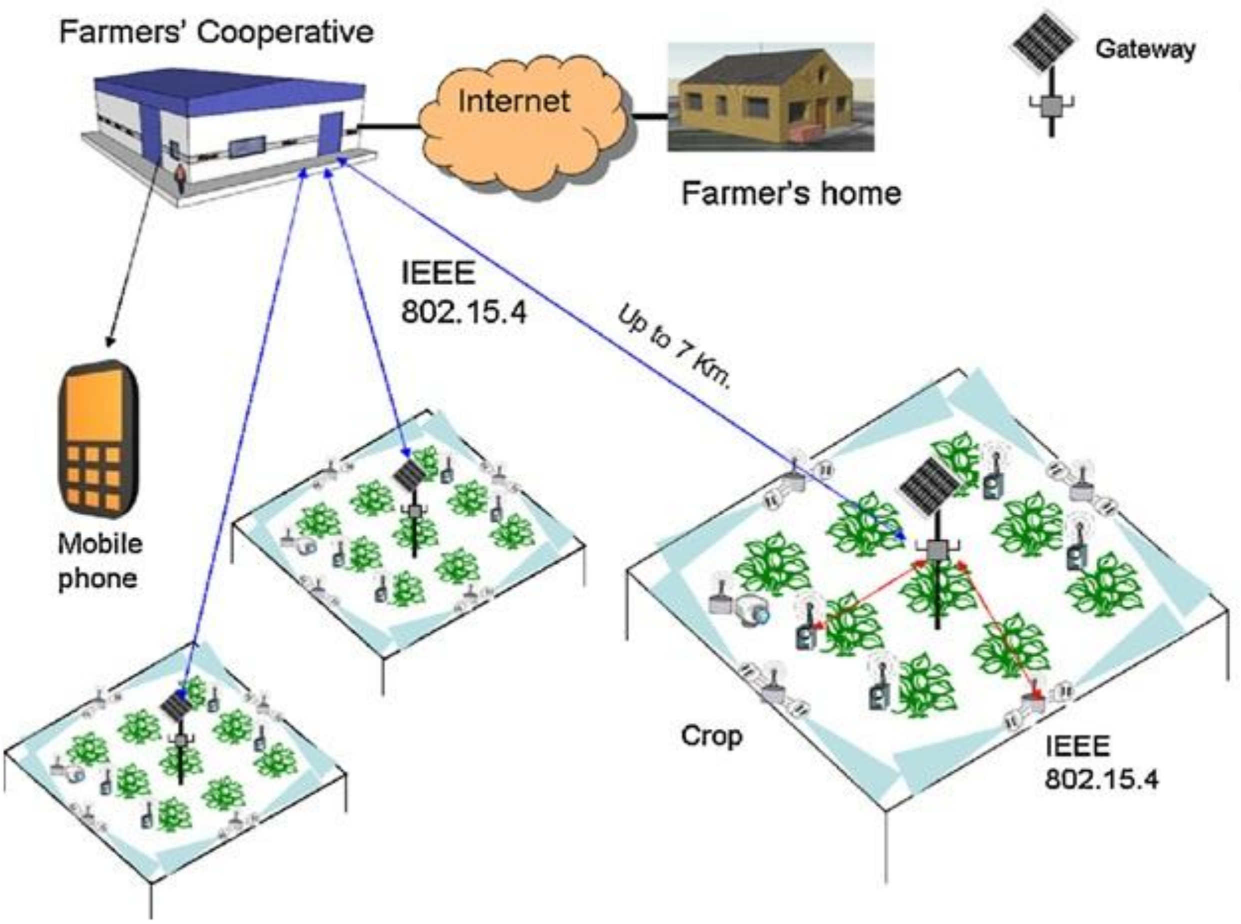

Figure1. Overview of the Architecture

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2. Methodology

The main reason behind this work is as follows:

1. To study the various conditions that are affecting the farming and create a frame work for these various conditions.
2. To identify the various sensors to be deployed within the fields.
3. To develop the optimizing algorithms so that with minimum deployment maximum area could be covered.
4. To create the WSN (Wireless Sensor Network) for the various deployed Unit.
5. Base Station to receive the data from various nodes.
6. Frame work for the data to be uploaded to the cloud

The whole frame work will be divided into Three parts:

1. Sensor Node Designing and Deployment using optimization algorithm
2. Base Station Node Designing
3. Cloud communication Unit

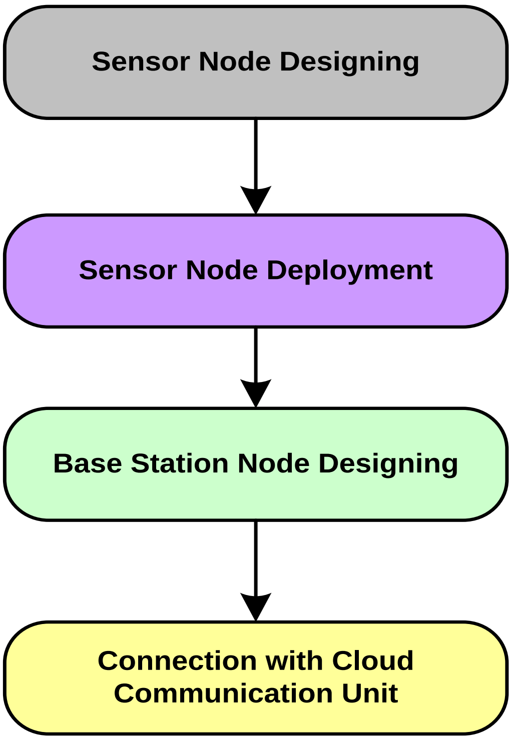

Figure 2. Flowchart of Methodology

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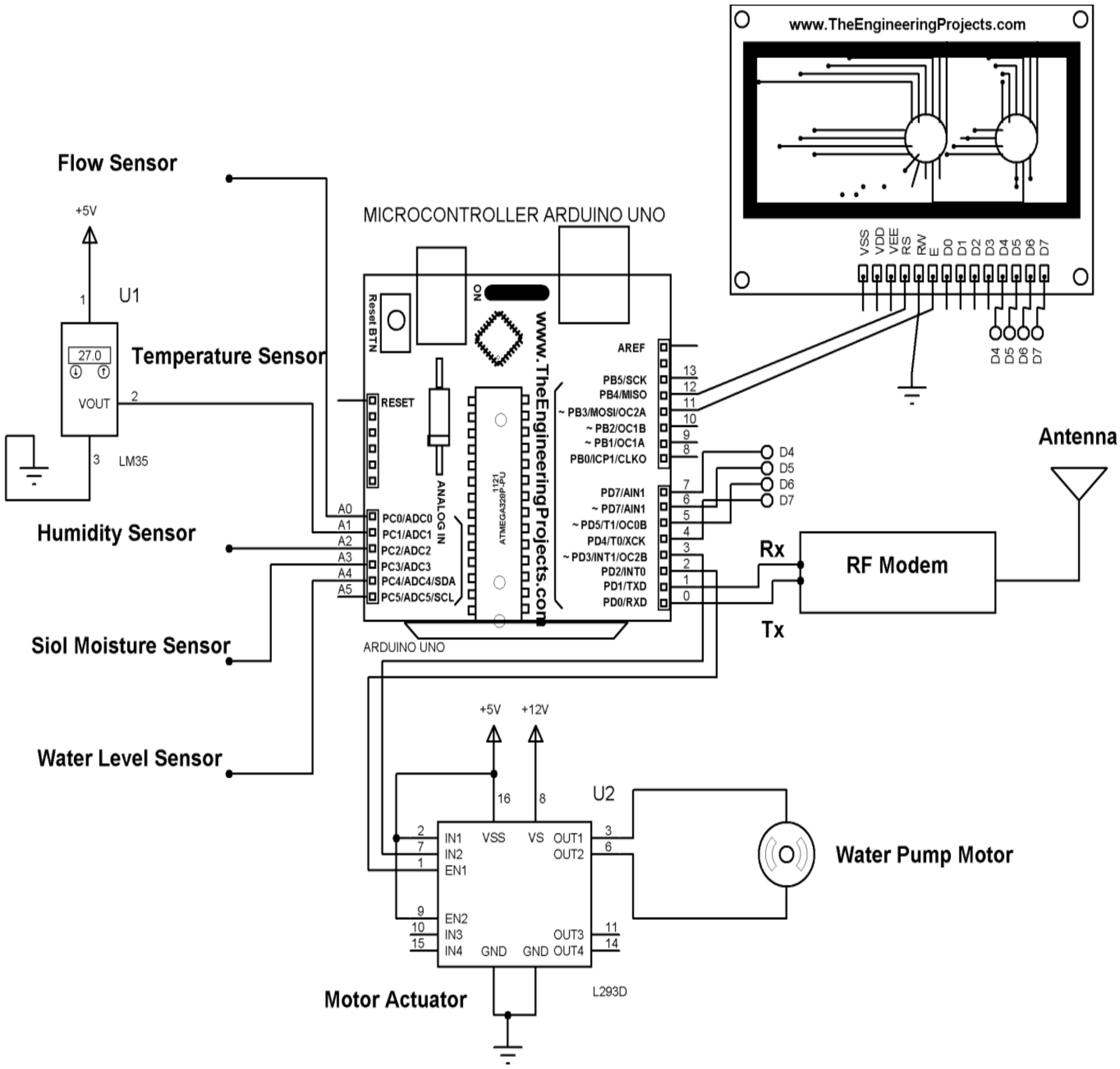

Figure 3: Architecture of Sensor Node

In the sensor nodes the selection of the various sensor is the critical task. These sensors are connected to the central processing unit. The sensor having to category i.e. analog sensors and digital sensors. The data of the analog sensors need to be converted into digital so that controller could understand the data. The digital sensors are directly connected to the digital pins of the controller. The data from these sensors would be processed and sent to the base station through the RF Modem. The Sensor Node of the Architecture is shown in figure 3.

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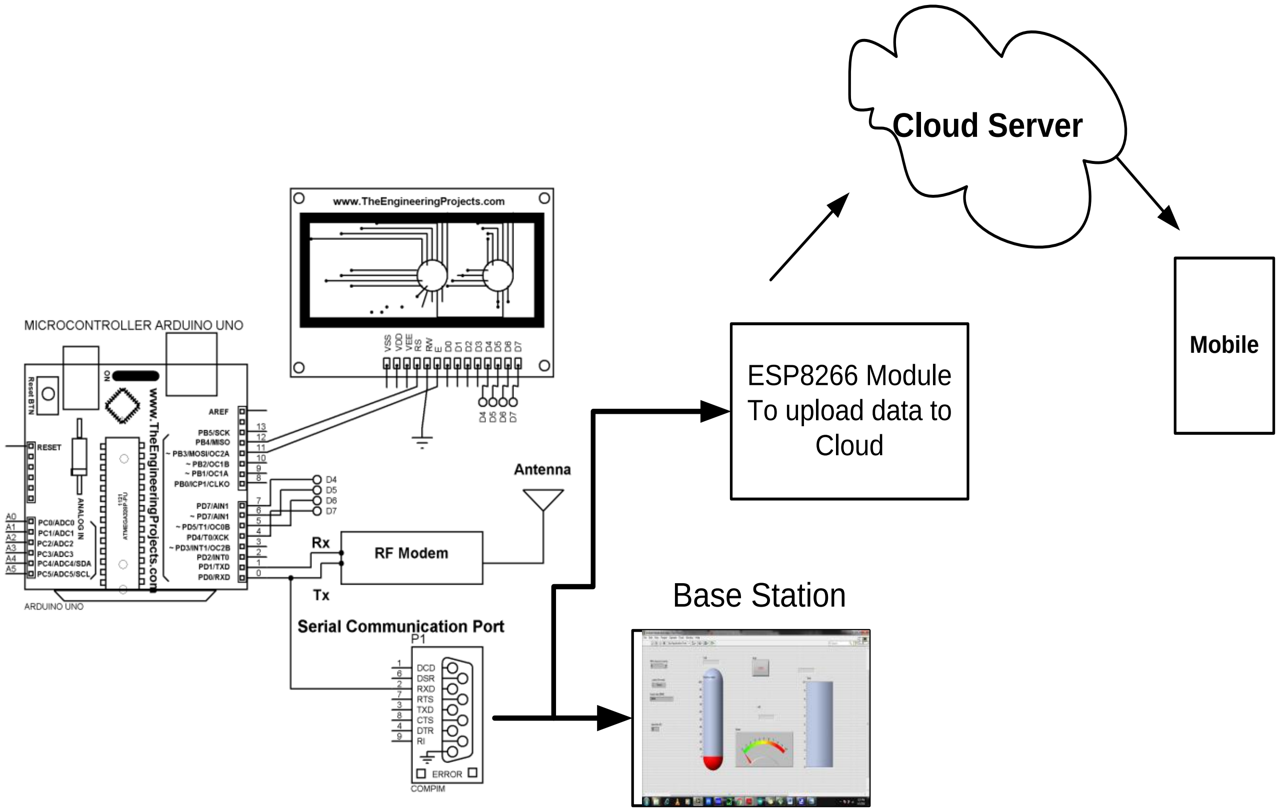

Figure 4. Architecture of Base Station and Cloud Server

In the receiving side the data sent by the various units is received and displayed over the display unit and over the computer through the serial modem. The various parameters are obtained over the LabView and are analyzed. For the cloud communication this data is feed to ESP8266 Module which aces the router through a Serial IP and upload the data to the cloud platform and this data can be accessed through the mobile phone and over computer where internet facility is available. Figure 4 shows the Base Station and Cloud Server Architecture. Figure 5 shows the sensor values on the cloud. All the sensors deployed in the field are connected with ThingSpeak cloud and the values given by every sensor deployed in the field is shown in the Figure 5. This arrangement will help the farmers to visualize the field remotely. Moreover, by setting the threshold values the system will automatically start the motor to water the field. Further the android application also helps the farmers to monitor the field remotely from anywhere.

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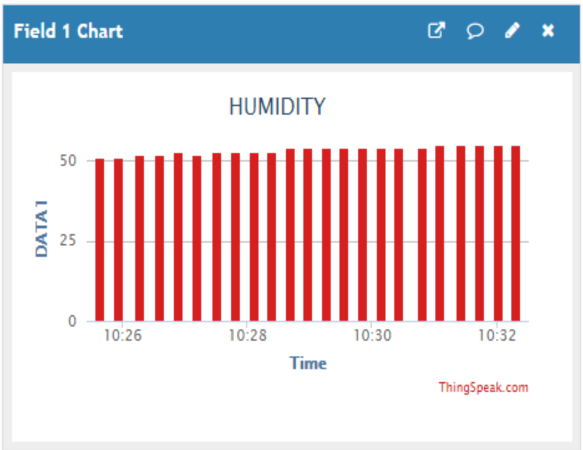
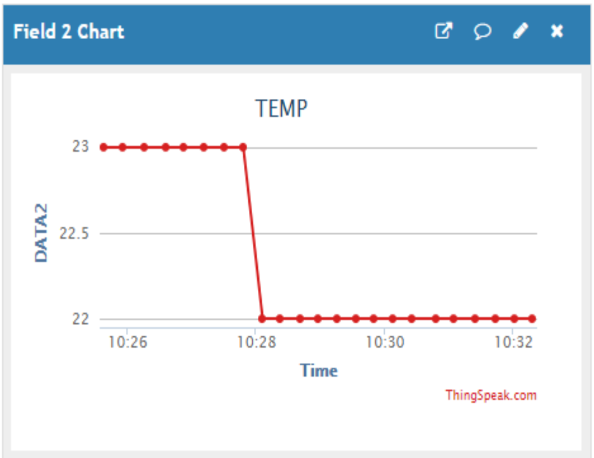


a).



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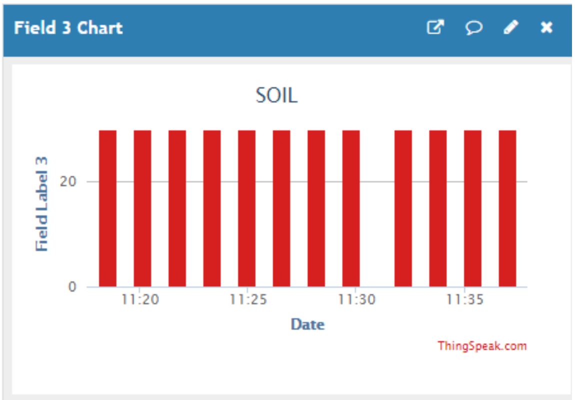
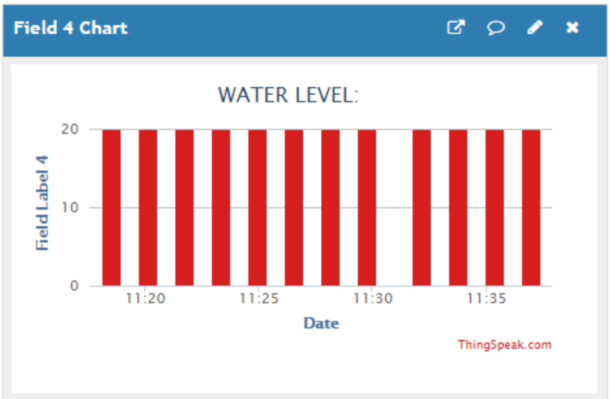


c).



d).

Figure 5. Sensor Values on Cloud a). Humidity Sensor graph b). Temperature Sensor Graph c). Soil Moisture Sensor Graph d). Water level Sensor Graph

3. Conclusion and Future Scope

The Proposed work suggests the algorithm for the deployment of the various sensor nodes along the farmer field so with minimum use of resources the output could be increased. The research to be developed by creating Wireless Sensor Network and the overall all development is associated with the Internet of Things. The real data acquisition would be done over the LabVIEW and the data to be uploaded to the cloud server. The range of the proposed system can be further extended using long range.

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