Light Intensity and Moisture Level Detection for Greenhouse using IOT

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Abstract – The field of Cloud computing is helping in leaps and bounds to improvise our age old business- Agriculture. Practical applications can be built from the economic consumption of cloud computing devices that can create a whole computing ecosystem, from sensors to tools that observe data from agricultural field images and from human actors on the ground and accurately feed the data into repositories along with their location as GPS coordinates . In reality, sensors are now able to detect the position of water sources in a subject that is being investigated. Issues related to farmers are always hampering the course of our evolution. One of the answer to these types of problems is to help the farmers using modernization techniques. This project proposes an approach combining the advantages of the major characteristics of emerging technologies such as Internet of Things (IoT) and Web Services in order to construct an efficient approach to handle the enormous data [1].

Keywords- Green House, Smart Agriculture, IOT, Push notifications.

1.INTRODUCTION

The field of agriculture, as well as horticulture can benefit excessively by automating various stage of the whole process. The plants in a greenhouse require extensive care around the clock. Factors like soil moisture, intensity of sunlight and humidity levels play a huge role in such environments. These factors can easily be kept in check by deploying various sensors strategically in the greenhouse or an agricultural field. The most important factors on which the yield depends are soil moisture levels, intensity of the light provided and humidity levels. Each plant or crop has its own unique requirements of moisture levels. For example rice (or paddy fields) often require very large quantity of water than other crops and plants. Similarly the requirement of intensity of each plant is different. If more sunlight is provided, the chlorophyll will deteriorate due to huge exposure, similarly in case of lack of sunlight the deterioration of chlorophyll leads to change in color of leaves from green to brown and plant eventually plant dies out. If provided with optimum levels of sunlight, the plant can thrive in that environment and the yield is improved. Therefore, deploying various sensors for continuously monitoring these factors and fulfilling the requirements can improve the process. The sensors will monitor soil moisture levels, intensity of sunlight and humidity continuously. This is the biggest advantage that the process of automation can provide in the field of both agriculture and horticulture. Since monitoring the plants would eventually require large manpower, automation can provide cost effective and efficient system for it.

2.SYSTEM MODEL

Most common problem faced by caretakers of greenhouse across the globe is the continuous monitoring of the plants of their greenhouse. From watering these plants time to time, supplying them with sufficient light and also keeping humidity and temperature to optimal levels is itself a cumbersome task. It takes a toll on the yield due to continuous human intervention required in this process. The proposed system implements IOT to overcome these problems in an automated way. Implementing this system in Greenhouses it willsolve the above problem i.e. reduction in yield of plant in Greenhouse due to human intervention by automating the process of controlling the water and sunlight requirements. This system will improve plant life within the greenhouse by providing a constantly monitored atmosphere, producing a more uniform product. As every time treating the plants manually could restrict the yield of the plant as human interventions can lead to significant errors which will not be the case if the plants are monitored automatically. This will significantly increase the yield of the plant and its growth will be much more efficient.

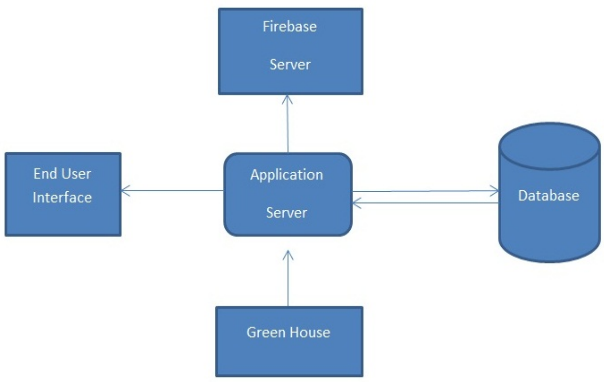

Fig.1. System Model

3. PROPOSED METHODOLOGY

A. CONSTRUCTION OF SENSORS

Several factors come into play when we consider the yield of a plant such as Sunlight , Moisture Level , NPK level etc. The factors that we considered for our approach are

Sunlight intensity and Moisture Level. These factors are calculated by various sensors deployed on the plants. For Sunlight intensity we used Light Dependent Resistor and for Moisture Level we considered Soil Moisture Sensor the one end of which is end 1-inch into the ground for moisture detection. Multiple sensor are deployed on each plant for more accurate reading of the factors. The values from the sensors are received in a defined time gap multiple times and the average of those values are calculated and fed to the Data Center for further processing through wired connections.

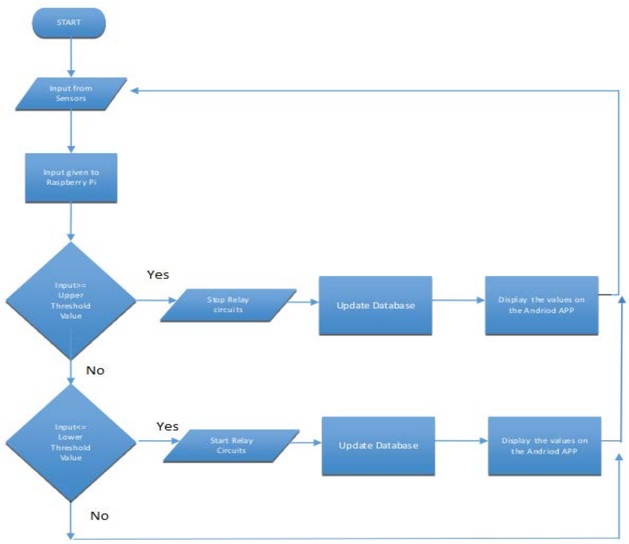

Fig.2. System Flow

The Data Center is composed of Rapberry Pi which collects the data from all the sensors and calculate their average value and compare them with the corresponding set standards and accordingly controls the Motor Pump and Florescent Lamp

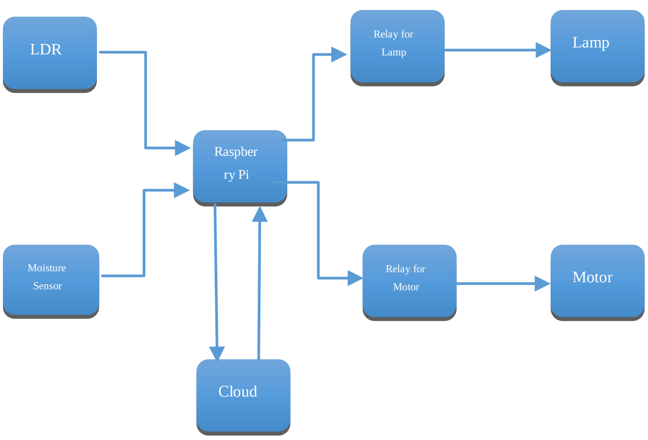

Fig.3. System Hardware Implementation

circuits through relay modules. If average values of the factors calculated is below the set standards then corresponding circuits will be enabled and the average values will be measured again and as soon as these values cross the threshold he circuits will be disabled by the Raspberry Pi for example when the average moisture level is low then the set standards the Raspberry Pi will enable the motor circuitry to allow the water flow in plants , now the moisture level of the soil increases and average is calculated by the Data Center again, when these value cross the threshold Motor circuitry is disabled and water flow is stopped. Then the values are entered into the Database through Internet connection and a notification is generated on the user application.

B. SERVER IMPLEMENTATION

```php
<?php
require "../db_connect.php";
$message=$_REQUEST['message'];
$title=$_REQUEST['title'];
$path_to_fcm='https://fcm.googleapis.com/fcm/send';
$server_key="AAAAdB8IBqQ:APA91bE1Qg99fBntOkb6rhVqBgBR7boNqaA2xEBdUrriLI-_7lW5ipOQkyLZ5Dyki844o2m4KWbo5
    n826xWWdOfxckVki-xM-ti53RjDjITsFJM5CaIBM9C7uh85bcGtaq-YR84eulv";
$sql="select fcm_token from fcm_info";
$result=$con->query($sql);
$row=mysqli_fetch_row($result);
$key=$row[0];

$headers=array(
    'Authorization:key=' .$server_key,
    'Content-Type:application/json'
    );

$fields=array(
    'to'=>$key,
    'notification'=>array('title'=>$title,'body'=>$message)
    );

$payload=json_encode($fields);

$curl_session=curl_init();
curl_setopt($curl_session, CURLOPT_URL, $path_to_fcm);
curl_setopt($curl_session, CURLOPT_POST, true);
curl_setopt($curl_session, CURLOPT_HTTPHEADER, $headers);
curl_setopt($curl_session, CURLOPT_RETURNTRANSFER, true);
curl_setopt($curl_session, CURLOPT_SSL_VERIFYPEER, false);
curl_setopt($curl_session, CURLOPT_IPRESOLVE, CURL_IPRESOLVE_V4);
curl_setopt($curl_session, CURLOPT_POSTFIELDS, $payload);

$result=curl_exec($curl_session);

curl_close($curl_session);
mysqli_close($con);
?>
```

Fig.4. Code Snippet for push notification initialization

The server acts as the connecting bridge between the farm land and the farmer. It allows the farmer to access the farm details remotely. The Farmer and the Farm land are mapped using the Mobile number and the mac address of Rasberry pi , installed in the field.The Server exposes a push notification Service that allows the farmer to be notified in almost the real time about the relevant information regarding his farm. Firebase Cloud and Messaging service is extended to achieve this real time notification. The server is implemented in PHP using MVC design patterns. Mysql is used for data storage at the backend.

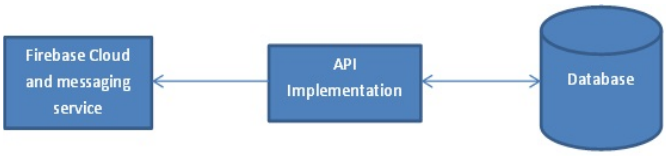

Fig.5. Server Implementation

C. STRUCTURE OF THE APP

The app is an end user (farmers in our case) interface that acts a console that provides farmer a real time view of the acivities at his farm. It will have an OTP based Mobile number verified registration for each farmer and thereby unique login. The farmer can have a look at the parameter values at anytime with just one click, which is the main beauty of the solution. In case of emergencies such as moisture level below the threshold value, a push notification is generated to the farmer notifying him the current status.

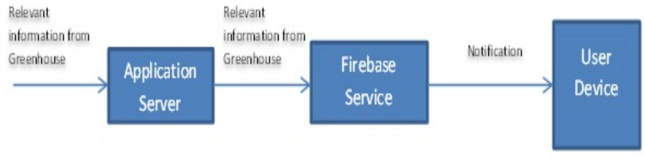

Fig.6. Push Notification Flow

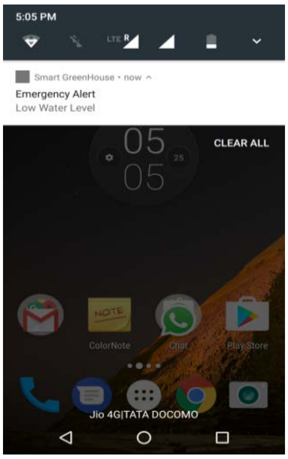

Fig.7. Notification in User App

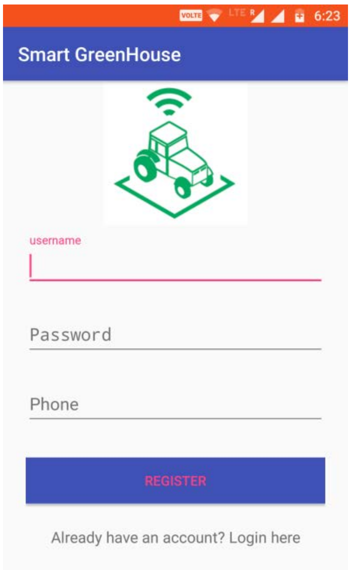

Fig.8. User Registration

The corresponding action can be taken based on the mode selected by the farmer. In case of automatic mode, the water will be released as soon as the moisture level goes down to a certain value, but manual mode selection allows the farmer to take the necessary actions. That means the appallows the farmer to control the flow of water or light intensity or any other parameter with just one click. This surely makes farming an easy cup of tea.

4. ADVANTAGES

Wastage of water can be solved easily in areas with scarcity of water availability. Less maintenance and manpower is required as the whole system is automated leading to less chances of error, better crop health and thus better yield.

Monitoring of system on farmer's end becomes easy by providing android application for the said purpose. There will also be a 10-12 time better yield,marginor error. Future work can include data collection and smart application

5. LIMITATIONS

The system we implemented is based on wired communication between the sensors and Raspberry Pi which not only limits the area that can be monitored but also the number of plants by one Raspberry Pi can co-ordinate simultaneously.

Security has always been the prime concern of the devices connected over the internet. Our system does not ensure any validation that whether the data received by the database is legitimate or system does not ensure any avoidance of man in the middle attack.

6. FUTURE SCOPES

Large no. of farmers in our india are not literate enough to provide their farms a healthy environment for proper growth. We keep a view to enable the farmers to have an easy access to all this information through our farmer console. We have different soil textures in different regions of our state, which is the real time challenge that is yet to be overcome. There is also a need to make the designs for our application more user friendly by supporting different languages from different regions so farmers from anywhere, whether literate or illiterate can make most out of it.

As stated earlier our system deploys a wired connection which can be replaced by a wireless connection between the sensors and Raspberry Pi. A small device can be fitted to a number of plants and that device can exchange the various sensor data with a single Raspberry Pi thus eliminating the problem of area that can be monitored and the number of plants.

To ensure that the values send by the data center to the database are legitimate we can use SHA-1 algorithm which as of February 2017first ever SHA-1 collision was recorded. To ensure the avoidance of man in the middle attack we can use ABE Encryption that is without the proper privileges and access structure even the man in the middle will not be able to obtain the data.

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