Smart Indoor Agriculture System

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***Abstract*— Indoor Agricultural has been broadly applied to every aspect of agriculture and has become the most effective means & tools for enhancing agricultural productivity and for making use of full agricultural resources. The using of technology of Agriculture directly affects the degree of agricultural information and efficiency of agricultural production's decision. In this paper, on the basis of introducing the concept of smart indoor agricultural using sensors and the decision making using Arduino Uno has been discussed in detail. After that, this paper gives an implementation example of system in agricultural production [1]. Finally, the paper gives an idea of a prediction formula to find the value of the sensors which will reduce the cost of the sensor.**

***Keywords*—** Agriculture, Sensors, temperature and humidity, light, moisture, Arduino Uno, prediction formula.

I. Introduction

The methodology of Smart Indoor farming system is improving the yield of vegetables, fruits, crops etc. Environmental parameters through manual intervention control by Greenhouse or a proportional control mechanism. Production loss, energy loss, and labor cost, these methods are less effective occurs in manual intervention.

With the help of smart greenhouse should be designed, this design intelligently monitors as well as controls the climate, eliminating the need for manual intervention.

In a smart indoor agriculture in case of Control the environment farmers use different type of sensors that measure the environmental parameters according to the plant requirement. The farmer can create a cloud server for remotely accessing the system when it is connected using IoT.

The manual monitoring is totally eliminated here. The Arduino Uno enables the data processing and applies a control action inside the greenhouse. This design provides cost-effective and optimal solutions to the farmers with minimal manual intervention.

The smart indoor agriculture system uses some sensors to provide information of the light levels, pressure, humidity, and temperature. These sensors can control the actuators automatically turn on lights, control a heater, turn on a mister or turn on a fan, all controlled through the Arduino Uno.

The paper is organized as follows: Section II contains an overview of existing approaches; Section III introduces the query inversion mechanism and the algorithms to solve the issue; Section IV explains the performance of the system; finally Section V concludes the paper with limitations of the proposed approach.

II. Overview Of Existing Approaches

Write Previous work Here.

III. Proposed Method

"Smart Indoor Agriculture System" is automatic system where sensors are used for collecting data of temperature, humidity, light, moisture of soil and then there is a smart automation watering system for watering the plants, LEDs for lighting, and a 12V fan for air flow (it effects on heavy cold or dry season).

Sensors sense the data there is an automatic system to watering, lighting and airing the plants which is controlled by the code written in Arduino Uno.

The system is for indoor which is controlled by only the sensors. Here, LEDs are used for increasing the time of the day. So, it is not necessary to monitor the plants time as a result cost of the land will be decreased. The proposed technique is providing some features such as:

- The collected data provides the information about different environmental factors which in turns helps to monitor the system.
- Secondly it includes smart irrigation with smart control and intelligent decision making based on accurate real time field data.

A. *Proposed Sensor Based Agricultural Monitoring System*

In this project, several types of sensors are used to monitor the plants. Although, the system is in indoor so the climate change is not noticeable. The automation watering system, lighting system, airing system is the best part of the project which makes easier the agriculture system.

The algorithm of the indoor agriculture system is:

1. Measure the data of temperature, humidity, light, moisture, time and pH
2. Check temperature > 30 or humidity <30
3. If yes Start the FAN
4. Check moisture <45
5. If yes then RUN the water motor
6. Check RTS= Day or Night
7. If it is night then switch LEDs
8. Check current light >500lx
9. If yes then switch the LED
10. Wait 10 minutes
11. Go to step number 1

The architecture for the smart agriculture system is shown in the figure 1 which contains various services from the sensors when it is needed for the plants.

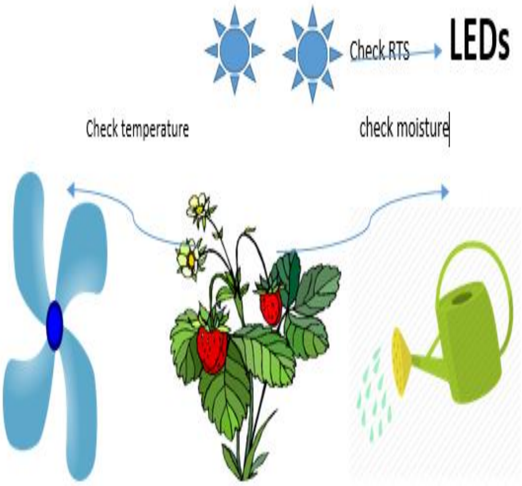

Figure 1: Architecture of the Smart Agriculture system

The flowchart is given below which is shown in the figure 7 which clearly make sense about the project.

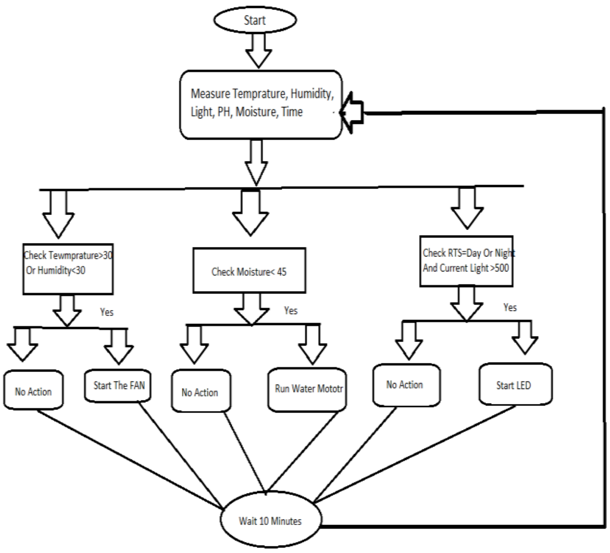

Figure 2: Flow Chart of Smart Agriculture System

After executing the program data of the sensors are record in the Arduino Uno. The Output of the program is shown in the figure 3.

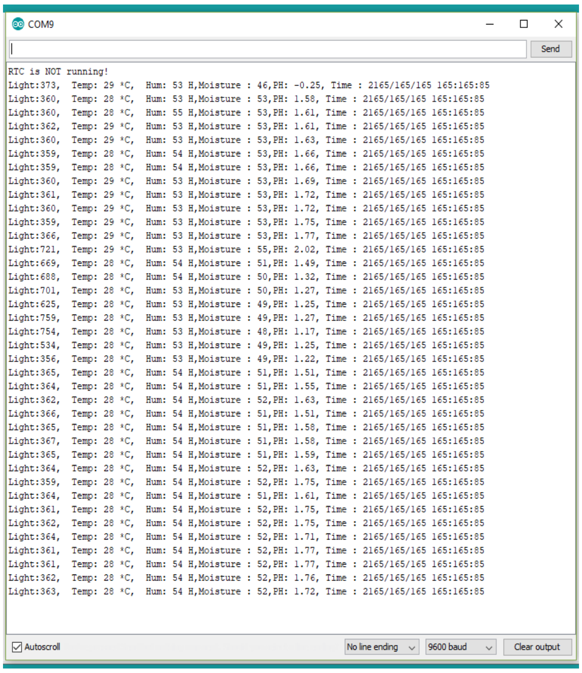

Figure 3: Data of the sensors

IV. EXPERIMENTAL RESULTS

Finally, a formula based is created based on the previous value of the sensors. Firstly, the last day's value of the sensors is measured. Then the difference between the mean of previous 7 day's actual value is found. The mean of previous 7 day's predict value, added the two value and get a predict value of tomorrow. The equation is given below on figure 4.

Xn = Xn-1 + (Xmean of the previous 7 day's actual value – Xmean of the previous 7 day's predict value)

Figure 4: The prediction formul

After using the above formula the values recorded in a excel sheet and then plotted a graph. The graph is shown in figure 5

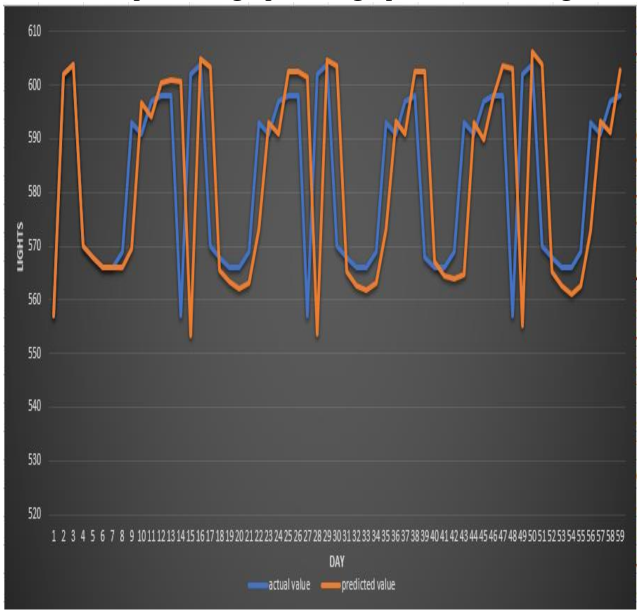

Figure 5: Actual value Vs predict value

On the above graph the blue series is the actual value of the sensor and the orange series is the predict value. It shows the difference between actual and predict value graphically.

After that, the difference between actual value and predict value is found.

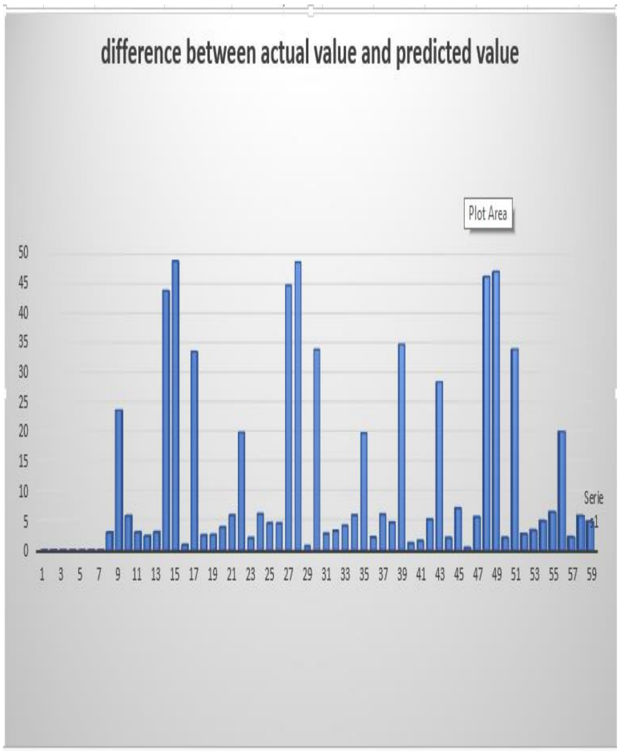

Figure 6: Difference between actual value and predicted value

This is the actual visualization of the difference on the graph and X axis stands for the day and Y axis stands for the value which is the actual difference.

V. Conclusion

Smart Farm is a small farm for indoor use that is targeted for homes, offices and smaller public places. The farm can also be used in schools and universities for educational purposes.

The farm comes with automated watering and lighting which makes the growing of plants effortless. It also senses the pH of the soil and provides Water vapor by a 9V fan if there is high temperature in environment.

This method is very efficient and effective because there is no need to monitoring the plants. The plants are automatic controlled by the sensors. This is so easy to adopt the system. Farmers do not need to panic for the irrigation system. They do not need for herbicides and do not need to spend on pesticides or on insecticides; everything is produced in a controlled environment so there are less chances of attack of pests and insects.

This is so efficient because they do not need any soil in this farming system. Instead of soil the system uses Coco-peat which is very popular now. There is no need for highly toxic chemicals and other expensive till age equipment

Future Work

Finding the predict value formula it can be used an intelligent idea for the future. By uploading the code into Arduino Uno of the prediction formula, then there is no need to use sensors. Only the Arduino Uno and the actuators like LEDs, Fan, motor are needed. So it can be reduce the cost to cultivate in the way of smart. So it is going to be in the focus of the authors' future research.

Appendix

Appendixes, if needed, appear before the acknowledgment.

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