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EFFECTIVE AND EFFICIENT USE OF IOT DEVICES IN AGRICULTURE AUTOMATION

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ABSTRACT

Through this research study our main objective is to minimize the human intervention, automation agriculture process, monitoring and controlling the agriculture's conventional activities. For the better productivity of crop needs continuous caring and that a very time consuming process. Farmers have to visit physically their crop field regular basis to know about growth, requirement and diseases. Before the plantation, making the soil fertile and after the plantation growth of plants need frequent visit and treatment that process keeps engage the formers. Internet of Things (IOT) can minimize the human invention by making the automation of agriculture works such as irrigation system, monitoring the crop growths, ensuring the productivity and may others tasks. Another objective of this research paper is to make aware the farmers and researchers with respect to efficient use of IOT for better productivity of crops. IOT devices are playing essential role in the field of monitoring and supporting to take decisions. Effective use of IOT devices unfolds the agriculture challenges. For smart farming IOT integrates the many sensors such as temperature, soil moisture, and humidity; field data with smart devices using wireless communication. IOT extends its working including data analysis, prediction and display with proper time decision ability.

Keywords: Internet Of Things, Automation, Agriculture Processes, Crop Productivity, Smart Farming, Wireless Communication, Soil Moisture.

I. INTRODUCTION

Agriculture is the one of main source of income for 58% of overall population of Indi and major contributor to Indian economy. Daily needs product based companies are totally depends on agriculture for their raw materials. The price for processed food or other products almost depends on crop productivity. IOT devises can minimize the labor cost; increase the productivity in such a way that affects overall economy. There are many factors and parameter that affects the crop productivity such as soil fertility, climate, water, moisture and disease. Proper use of IOT techniques can control many parameters by continuous monitoring and taking right decision in real time. For example automatic irrigation technique reduces the water wastage as well as contributes to better productivity. Integration of IOT concept spread the real time information to right person for better decisions.

Considerable use of automatic irrigation:

- User friendly, easy to install and configure
- Resource saving
- Less energy consumption
- Farmer could know right amount of water, fertilizer etc in proper time.
- Reduce the physical frequent field visit
- Perfect prediction of moisture and avoiding human error
- Reducing labor cost

This work provides an IOT enabled technology in agriculture, which collects the essential information to solve problems in real time. Experts give the guidelines to farmers for better productivity. IOT technology communicates with daily used smart phones that help to farmer current information regarding their crop field.

II. LITERATURE REVIEW

Conventional agriculture process depends on environment and facing many issues. IOT based agriculture system can solve some issues by data analysis and prediction [1]. Here we are showing major crop and farming related problems and solution by IOT devices.

a) Proper utilization of water and management

70% of global fresh water utilized by agriculture [2] and it has been observed that some time excessive water has been used for farming due to poor water management and control [3]. Real time water level sensors provide the solution and reduce the wastage of water [4].

b) Soil fertility information

The second main trouble for Indian farmers is improper information about soil fertility and its components. It is observed that due to weather condition the soil composition changing frequently [5].

c) Plant Disease Identification and removal

Manual detection of plant disease is challenging and late identification in agriculture domain. Early automatic plant disease detection is a effective solution [6].

d) Plant grow and nutrients deficiency detection

Lack of soil fertilizer and plant diseases are the cause of improper growth of crops. Plant nutrient such as nitrogen can be detected by IOT devices [7].

III. WORKING ARCHITECTURE

Low cost, energy efficient, agriculture automation prototype physical model (figure 1) presented with key components.

a) Data acquisition from sensors

Data is transmitted to arduino form different sensors using wireless network. (Moisture sensors, water level sensors, Temperature sensors)

b) Communication medium: wireless

Data is collected from sensors and transmitted wireless medium to web server. (GSM, WIFI)

c) Data processing and Decision making

After receiving the data from sensors unit it is analyzed and send to farmers for further action.

d) Web application and mobile Application

User friendly access the desired information

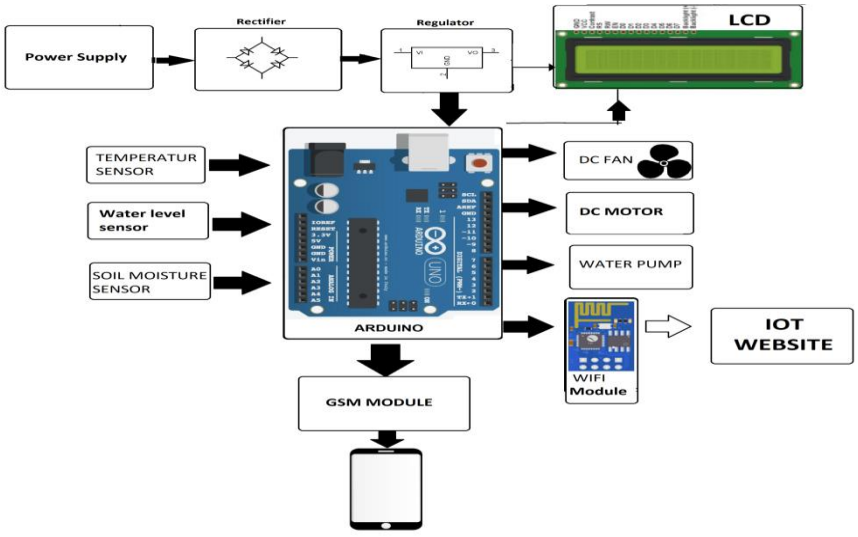

Figure1: The Key Components, Component level working architecture proposed model

For the prototype model hardware required

A complete automation agriculture block diagram (figure 2) with all its hardware components is presented. Arduino, GSM Modem, Wifi Modem, Temperature Sensor, Humidity Sensor, Water Sensor, Mini Exhaust, Fan, Water Pump, Crystal Oscillator, Resistors, Capacitors, Transistors, Cables Connectors, Diodes, Breadboards, LED Transformer/Adapter, Push Buttons, Switch, IC, IC Sockets. Agriculture is the pure science and experience that grow the plants and nurture. Here proposed components are capable to develop and integrate the smart automatic agriculture system prototype. Here wireless sensors are used for data collections and send the

information. The main component that connects other IOT devices is Arduino. This working model send the messages regarding moisture, humidity, temperature, water level to web server and phone applications.

Major challenges to implement

a) Proper physical establishment of sensors so that it could collect the information for whole field (identifying the place)
b) Ensuring the power backup for sensors
c) Sensors efficiency, quality and deviation from actual after some time.
d) Establishment of wireless connectivity
e) Portability, communication, integration and compatibility issues
f) Real time communication

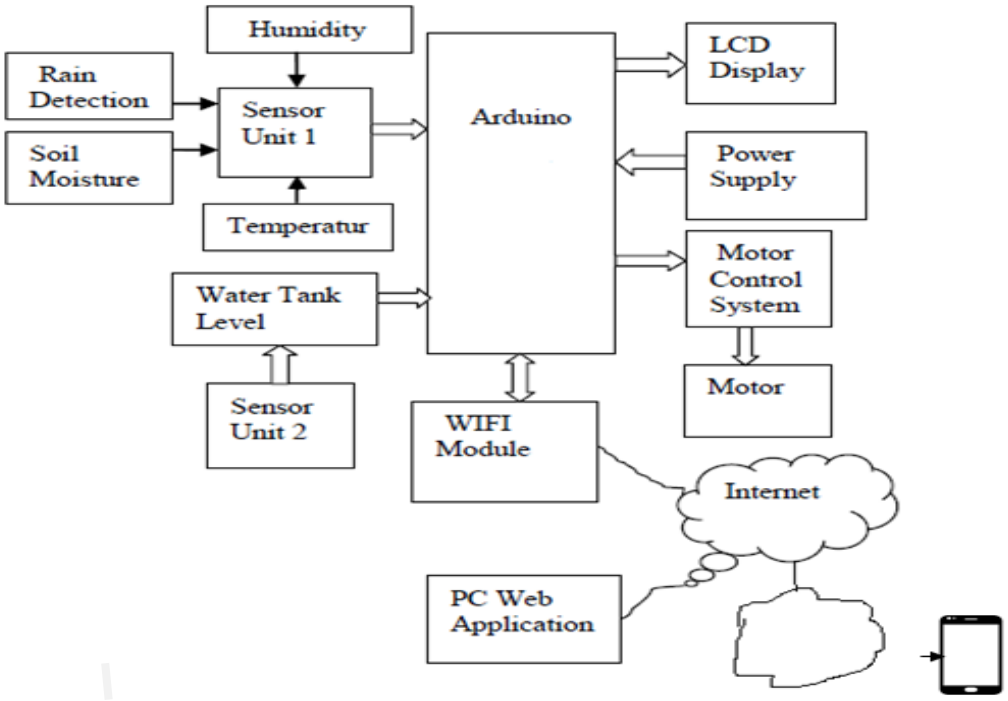

Figure 2: Block Diagram complete proposed model

Data Visualization module connected with three sub components monitoring, controlling and tracking-tracing. Where controlling units are connected with fertilization control, pest control, green house illumination control and field location tracing.

IV. ISSUES AND CHALLENGES

The most challenges are, make aware about IOT devices to farmers, let them know about benefit of smart farming, make belief on new technology and physical establishment of IOT devices and its security issues at different level [8],[9],[10]. Make literate to farmers, regarding the IOT devices that is "how to maintain" for the uninterrupted services [11,][12]. Consistency and Compatibility are the frequent level challenges during modification or change made [13],[14],[15].

V. DISCUSSION

IOT enabled smart agriculture data analysis, monitoring and visualization is easy and understandable. Information collected from different sensors can be visualized on We have used a web based and mobile app-based system integrated with IOT enabled farming system known as data visualization. Figure 3 and figure 4 are the data visualization graph, information collected from three different sensors established in the crop field.

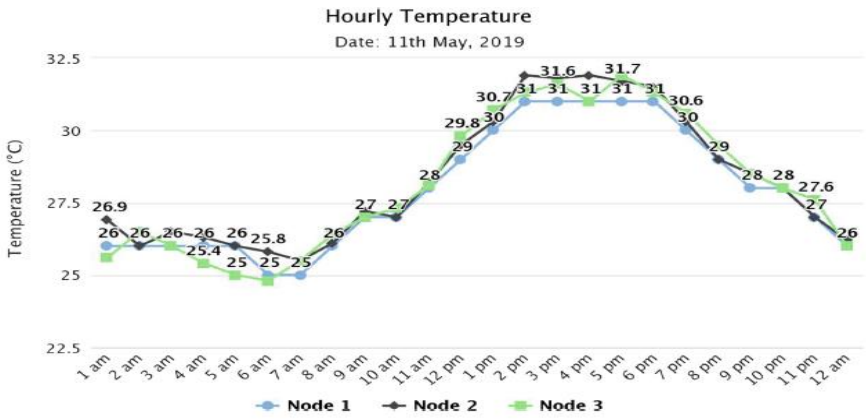

Figure 3: Temperature visualization using graph

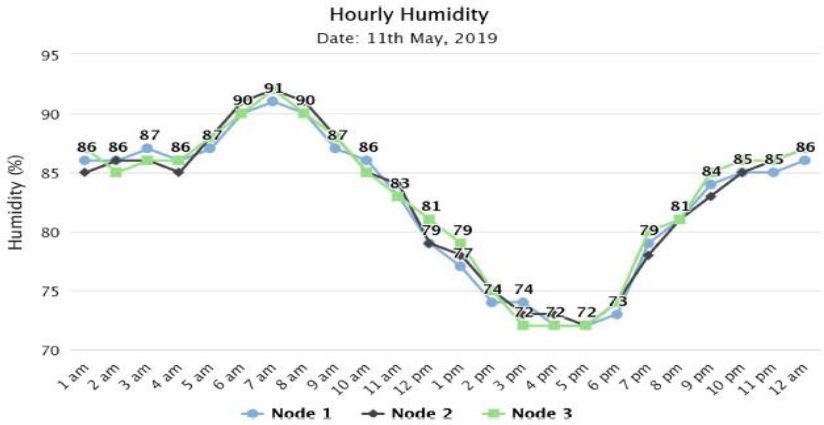

Figure 4: Humidity visualization using graph

VI. CONCLUSIONS

IOT enabled agriculture concept has enhanced the agriculture process and provided solution for time consuming process. Now it is working as bridge to fulfill the gap between demand and supply of crop, maximizing the production and quality. Prior information and timely proper action cause the less damage to the crop. This paper included most recent available technology with minimum cost. The establishment and integration of IOT devices presented through block diagram. This automation process reduces the frequent visit of crop field along with provide the complete monitoring and control information. Real time information makes the agriculture decision better and efficient consequently more quality productivity.

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