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IOT-Based Smart Greenhouse Automation

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Abstract : *The fundamental idea is to increase the yield of vegetable, fruits and crops through use of modern technologies. The proposed IOT based smart greenhouse farming system monitors factors like temperature, humidity, soil moisture, light with the help of sensors elements and alerts the users through mobile application. Sensors values demonstrated on GSM module can be used to analyze agricultural data. The authenticated mobile application development can be used to monitor the parameter from anywhere.*

Keywords : *Internet of things, Greenhouse, Temperature, Humidity, Soil moisture, GSM module.*

I. INTRODUCTION

As India is a developing economy, Make in India is such a step taken to develop Indian industrial sector by replacing man power with automated machines in all sectors but in fact most of the people in India depend on agriculture. Due to in adequate rain and less profitable crops many of them were not able to use automated machines. They were depending on many traditional ways of cultivating. In recent days many research institutions founded green houses for growing crops in controlled climatic conditions which will yield more produce with fewer inputs such as water, manures, etc. Now days due to more imports from china domestic industry has ruptured a lot and many duplicate seeds which reduced yield and harmed many people. Many institutions formed as NGO's to develop these modern methods for farming. Green houses are deployed in India at high attitude places where temperature varies from minus degrees to forty degrees where living organism's survival is difficult. Green Houses are controlled rooms where physical inspection of plants is done with timely controlling of temperatures, limiting to the quantity of pesticides and fertilizers required for cultivating with proper observation and testing's. This entire process is completed with proper coordination of men and machines. For example: Henry Ford is the first person who introduces first assembly line with the combination of automatic and manual workers. A person can do many errors but a computer cannot. In the same way green houses automation will reduce human errors which incur in traditional way of cultivating. Controls were setup in order to interact with the environment when required. As discussed earlier India is a developing economy and having less money can't afford such huge investment. Hereby, a green house monitoring and automation is a big step which is taken to make it not much expensive in large scale production.

As the world is trending into new technology and implementing. It is a necessary goal to trend up with agriculture also; IOT plays a very important role in smart agriculture. In IOT - based smart greenhouse farming, a system is built for monitoring the crop field with the help of sensors (light, humidity, temperature, soil moisture, etc.) and automating the irrigation system. The farmers can monitor the field conditions from anywhere. IOT - based smart greenhouse farming is highly efficiently when compared with the conventional approach. Greenhouse farming is a methodology that helps in enhancing the yield of vegetables, fruits, crops etc. Greenhouses control the environment parameters through manual intervention or a proportional control mechanism. As manual intervention results in production loss, energy loss, and labor cost, these methods are less effective. A smart greenhouse can be designed with the help of IOT, this design intelligently monitors as well as controls the climate, eliminating the need for manual intervention.

II. LITERATURE REVIEW

P.Dedeepya, Srinija, M.Gowtham Krishna, G.Sindhusha , T.Gnanesh proposed Smart Greenhouse Farming based on IOT, the idea is to increase the growth of different varieties of crops with good quality in a closed environment usually a Greenhouse[1]. The proposed system can monitor the changes in factors like temperature, humidity, soil moisture by integrating the sensor elements to Raspberry pi and alerts the user through mobile application. Sensor values inserted on Raspberry pi MySQL database can be used to analyze agricultural data. The authenticated mobile application developed can be used to monitor the parameters, get latest agricultural updates of schemes and news, market crop rates, weather information etc. Government Market crop prices provided will prevent farmer from being exploited by middlemen's greediness.

Aji Hanggoro, Rizki Reynaldo, Mahesa Adhitya Putra proposed Green House Monitoring and Controlling Using Android Mobile Application, the ability to control indoor humidity. Green House Monitoring and Controlling is a complete system designed to monitor and control the humidity inside a green house[2]. This software uses an Android mobile phone, connected using Wifi to a central server which connects via serial communication to a microcontroller and humidity sensor. The result shows that the condition specified in sensor's datasheet and system in reality is appropriate. The achieved test result concludes that the system is working properly.

Yung Sheng Chang, Yi Hsiung Chen, Sheng Kai Zhou proposed a smart lighting system for greenhouses based on Narrowband-IoT communication, the advance and popularity of communication technologies and the Internet, Internet of Things (IoT) becomes one of the most popular technologies in recent decade[3]. IoT are applied to various applications, such as health care, smart home and environmental monitoring in our daily life. Three short-range communication technologies, Bluetooth, WiFi and ZigBee are widely used in IoT devices but along with short transmission range, middle power consumption and weakness of interference. Hence, Low Power Wide Area Network (LPWAN) for the cellular network are proposed for wide coverage, lower power consumption and massive devices with reliable communication for IoT devices.

Ravi Kishore Kodali, Vishal Jain and Sumit Karagwal proposed IoT based Smart Greenhouse, the work is primarily about the improvement of current agricultural practices by using modern technologies for better yield[4]. This work provides a model of a smart greenhouse, which helps the farmers to carry out the work in a farm automatically without the use of much manual inspection. Greenhouse being a closed structure protects the plants from extreme weather conditions namely: wind, hailstorm, ultraviolet radiations, and insect and pest attacks. The irrigation of agriculture field is carried out using automatic drip irrigation, which operates according to the soil moisture threshold set accordingly so as optimal amount of water is applied to the plants.

Based on data from soil health card, proper amount of nitrogen, phosphorus, potassium and other minerals can be applied by using drip fertigation techniques. Proper water management tanks are constructed and they are filled with water after measuring the current water level using an ultrasonic sensor. Plants are also provided the requisite wavelength light during the night using growing lights. Temperature and air humidity are controlled by humidity and temperature sensors and a fogger is used to control the same. A tube well is controlled using GSM module (missed call or sms). Bee-hive boxes are deployed for pollination and boxes are monitored using ultrasonic sensors to measure honey and send mails to the buyers when they are filled. Further, the readings collected from storage containers are uploaded to cloud service (Google drive) and can be forwarded to an e-commerce company.

Plant growth directly governs with climatic parameters like sunlight, soil, humidity etc. Their proportion must be controlled and automated according to plant requirement. At any time, automation is very costly affair but will have good results. So in order to do this some research centers namely GK, VK designed and linked one parameter with another parameter. As technology is growing faster and faster more education is required for laborers. As there were many advantages some of the disadvantages were also there such as high repairs, complexity in designing the structure etc. Many farmers in India under below poverty line are unable to meet their daily expenses and cannot afford such modern system. Keeping this in view some researchers are designing control systems and implement them in future which will help Indian farmers and country's economy.

III. THE PROPOSED APPROACH

Design of hardware for greenhouse monitoring is used to control the environment condition of given house to get good condition. The parameters are humidity and temperature in the green house. The monitoring of greenhouse component consists of sensor for the temperature, water level and soil moisture, ARDUINO UNO, GSM modem, wifi modem, water pump, DC motor, DC fan, LCD, regulator, rectifier power supply. The output for the sensor become and input ARDUINO UNO and sent it to.

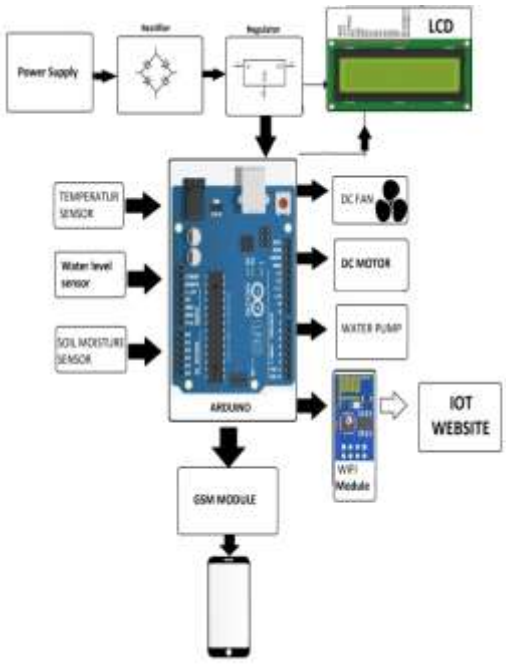

Fig. Block Diagram

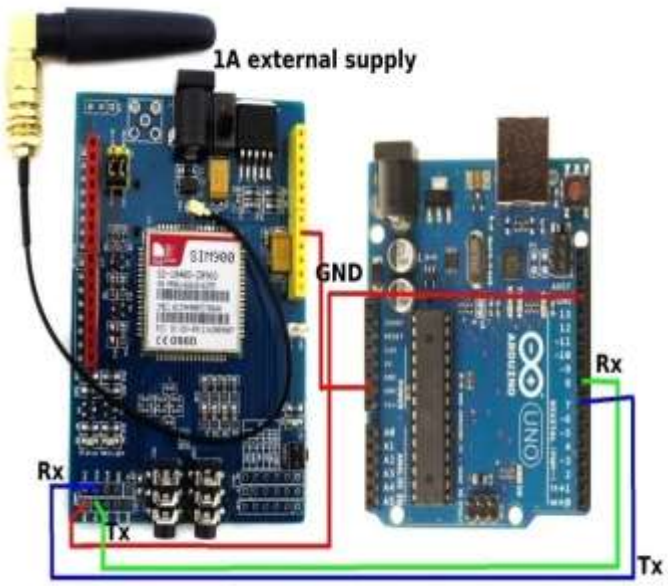

Fig. Interfacing with GSM Module

The task of GSM module is to transfer the data to application software at Android Smartphone. The task of this IOT website is to control the components such as LCD display. It will read the sensor periodically and update the values of sensor on the LCD display.

The Soil Moisture Sensor is used to measure the volumetric water content of soil. This makes it ideal for performing experiments in courses such as soil science, agricultural science, environmental science, horticulture, botany, and biology. Soil Moisture Sensor probes enable precise low cost monitoring of soil water content. Because our probe measures the dielectric constant of the soil using transmission line techniques, it is insensitive to water salinity, and will not corrode over time as does conductivity based probes. Our probes are small, rugged, and low power.

Fig. Soil Moisture Sensor

IV. CONCLUSION

The sensors can be successfully interfaced with microcontroller and wireless communication can be achieved. This project provides solution to the field activities and irrigation problems. Implementation of such a system in the field can definitely help to improve the yield of the crops and aids to manage the water resources effectively reducing the wastage.

Our project can be improvised by using a sensor to note the soil ph value such that usage of unnecessary fertilizers can be reduced. A water meter can be installed to estimate the amount of water used for irrigation and thus giving cost estimation. Further it also reduces the investment of farmers.

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