Identifying the Needs for Reduction of Sensor Count in Green House Monitoring

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Abstract: The greenhouse effect is a process in which the atmospheric gases trap the solar radiations. This result into increasing temperature of earth more than what it could have been without atmosphere, thus making it comfortable to live. This effect is utilized to create a healthy environment to grow crops. A Green House is a structure made up of translucent material wherein climate is regulated for growing plants. This structure range from small shades to large industry sized construction. Green houses are particularly used for growing vegetables and flowers. These green houses need monitoring mechanism for knowledge of various parameters like temperature, humidity, light intensity, soil moisture contents, plant growth and atmosphere controlling or actuating elements like heaters, light sources, sprinklers, ventilators. Sensors and actuators used for measurement and control of these parameters have a limited range in terms of area covered. Hence numbers of sensors are deployed in monitoring of a typical green house. As number of sensors increases, not only the cost but also complexity of system increases. Although wireless sensor networks are proving point, but still 'sensor count', cannot be reduced. The objective of system presented in this paper is to reduce number of sensors required for green house monitoring and thus reduce system cost and complexity, System design, installation and monitoring.

Keywords: Green house, GSM, temperature, humidity, light intensity, soil moisture and line tracking.

I. INTRODUCTION

Greenhouses are a great way to make plants available all year round, however their effectiveness depends on the weather conditions which vary constantly. Although we are able to predict the weather to a high degree, the predictions are not always 100% accurate and so planning ahead would not help all of the time. Some of the problems that can occur are frost, condensation and overheating which can lead to the plants becoming damaged. Automated systems that are used to control environments e.g. a fish tank that needs to maintain a specific water temperature, are able to cope with sudden, unpredicted changes. Being able to cope with the changing weather would reduce the number of damaged plants. Monitoring and control is an important aspect of all of the greenhouse's present around the world. To monitor the greenhouse environment parameters effectively, it is necessary to design a measurement and control system. The present research work is generally directed to a system for monitoring a variety of environmental and/or other conditions within a defined remotely located region. Using a variety of sensors we are able to determine the conditions present at a given time and take action if a parameter/condition present exceeds or falls below a pre-determined range. Also using wireless technology we can encompass a wide area of operation which would not have been available if we used a traditional wire based system.

II. REVIEW OF CURRENT GREEN HOUSE MONITORING SYSTEMS

Many researchers observed that, the greenhouse technology is well accepted in agriculture engineering. The integration of wireless sensor network in green house is the recent concept which leads to precision agriculture. Greenhouse projects are being deployed across India where the temperature ranges forms sub-zero to 40°C which in turn makes any kind of plantation almost impossible and in arid regions where conditions for plant growth are hostile. Climate monitoring is important aspect of green house monitoring as it directly affects productivity of the crops. Huge losses are incurred by plant diseases destroying the crop. The green house facility is intended to provide a regulated environment required for plant growth. This control is to be brought over temperature, humidity, light intensity, CO2 level and soil moisture [1].

The data acquisition system is use to collect and analyze experimental data, having the ability to clearly present real time results. Using sensors and probes the system able to responds the parameters which are beyond the normal range available from most traditional equipment. The system is used for measuring the temperature, humidity and detection of carbon monoxide. We have design a weather data acquisition system, which is of less cost, portable, and consumes low power. It is an efficient system, which works in real time mode and measures the parameter like temperature, humidity and detects the presence of carbon monoxide gas. These data can be seen on monitor using Terminal software [4].

Automated greenhouse monitoring system consists of various sensors, namely soil moisture, temperature and light. These sensors sense various parameters temperature, soil moisture and light intensity and are then sent to the controller and control action taken by comparing with preset values. Thus agricultural greenhouse monitoring system eliminates risk of greenhouse not being maintained at specific environmental conditions due to human error and labor cost can be reduced and it is eco-friendly [9]. Wireless sensor network technology, although under development, seems to be promising mainly because it allows real time data acquisition. However, for such agricultural application to be developed, some technological challenges should be resolved. A greenhouse is a controlled environment and does not require a lot of climatic parameters to be controlled. The use of this technology in large scale seems to be something for the near future. In this application, the great number of climatic parameters can be monitored using the sensors available. As a greenhouse is a relatively small and controlled environment, and energy is a

limited resource, the possibility of replacing batteries or even resorting to a steady energy source adaptation is a constructive aspect [8].

Wireless sensor networks are used to gather the climate data from various points with Bluetooth or ZIGBEE technology. The wireless sensor network avoids complex wiring and messing. The collected from various sensor nodes is sent to a controlling center for necessary actions like heating, cooling ventilation or irrigation. Temperature, humidity and water, radiation and CO2 concentration are the major features that are monitored in greenhouses. WSNs should be applied in greenhouse control systems, providing a distributed and real time sensing, obtaining parameters values differences inside the greenhouse. In early stage of WSN, farmers were reluctant to deploy it, because of high cost. Technological development has reduced the cost. In addition to MEMS technology for hardware, some other technologies like, satellite sensing, Remote Sensing, Global Positioning System and Geographical Information System are also contributing in overall progress [5]. Green house environment monitoring technology has continuously improved, and good greenhouse environment can improve crop quality, short the growth cycle and increase production, which have very important theoretical significance and value for study. Android based embedded system can closely monitor and control the climate parameters: humidity, temperature, soil moisture, light of a greenhouse on a regular basis [6].

Environmental parameters in greenhouse can be monitored and controlled manually as well as remotely. The hardware and software modules of the application system are is cussed in detail. This embedded application is implemented and tested for its correct functionality. The monitoring system has the following features, such as simple structure, high reliability, good extensibility and flexible on configuration [7].

The IOT based systems monitor and manage growing conditions of their greenhouse. The use sensor nodes, internet connection, and the cloud will deliver real-time updates about plants and help people grow plants more efficiently and will provide a solution for automating greenhouse activities and irrigation activities. Implementation of such a system in the field can definitely help to improve the yield of the crops and overall production, and with its quality to cost ratio, it will be affordable to the majority of the agricultural community and also to agro-based industries [2].

Several agriculture projects even in urban areas are on a rise in recent times, in unique forms. The technological progress makes the agricultural sector grow high made by using the Cloud IOT. The IOT will dramatically bring about a change in the way we live our daily lives. This cloud computing can be used anytime and anywhere. It can be accessed if the computer relates to the Internet. This monitoring system uses different parameters inside the greenhouse using sensors, Arduino, and cloud to provide the updates [3].

III. PROBLEM IDENTIFICATION

The literature survey shown that the green house monitoring and control requires complex structure of large no. of sensor connected with wired or wireless network. A threatening factor in implementation of such an automated greenhouse is the cost incurred in installation of sensors and their networking.

Here, it is proposed to build a robot capable of moving across the green house. This robot will carry all the sensors involved in monitoring different parameters in green house. While developing such monitoring robot, the green house structure is required to be modified for accommodating the ease of operation of this robot. A simple line follower robot can serve the purpose. RFID tags can be placed at various points from where the collection is intended.

IV. GREEN HOUSE MONITORING ROBOT

A green house monitoring robot is proposed to serve the purpose. This robot is divide into two parts viz. wheeling system and sensing system. The wheeling system is aided to IR sensors to move through entire green house on a predetermined track as line following robot. Sensing points are also predetermined. At each sensing point, the sensing unit monitors temperature, humidity and soil moisture contents and sends it to the user by GSM. Thus it enables monitoring the parameters at various nodes using single sensor and thereby reducing the sensor count.

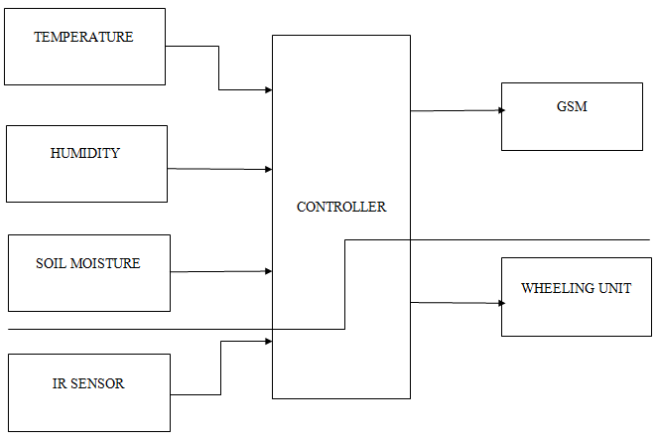

Figure 1: Block diagram of proposed robot for green house monitoring

V. CONCLUSION

In conventional green house automation, numerous sensors are required for monitoring parameters at various points. The proposed project work focuses on reducing sensor count in a typical green house monitoring. A robot mounted with sensors for monitoring temperature, humidity and soil moisture moves across the green house on pre designed path and monitors these parameters at all the specified points. Thus a single sensor becomes sufficient for monitoring 'n' points across green house. This will greatly reduce the cost of greenhouse monitoring system installation.

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Biography

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