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Automated Greenhouse

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Abstract:. *The introduction of "AUTOMATED GREENHOUSE MONITORING SYSTEM" can bring a green revolution in agriculture. Introducing this system can help in increasing the cultivation in a controlled environment. Greenhouse environment, used to grow plants under controlled climatic conditions for efficient production, forms an important part of the agriculture and horticulture sectors. Appropriate environmental conditions are necessary for optimum plant growth, improved crop yields, and efficient use of water and other resources. Existing EMSs are bulky, very costly, difficult to maintain and less appreciated by the less skilled work-force. Some physical factors are interrelated, for example, temperature and humidity are related in a way when temperature raises humidity reduces therefore controlling both together is difficult. Because the temperature and humidity of greenhouse must be constantly monitored to ensure optimal conditions, wireless sensor network can be used to gather the data from point to point. The main aim of this paper is to minimize the human care needed for the plant by automating the greenhouse and monitor the in-house environment status. A single unit of the greenhouse structure prototype has been constructed and integrated with sensors.*

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Index terms: *Temperature, Humidity, Moisture, Image processing.*

I. INTRODUCTION

Gardening is one of the popular hobbies among the people in the midst of busy work culture and urban life style. Gardening seems to release the stress, healthy spending of the leisure time effectively. But the apartment living has no free space for gardening. As a result, small scale greenhouse is now the hottest trend in the century. Greenhouse is a structure that the user used to grow the plants. It is built with a specific need for the type of plant they wish to grow. So the structure varies depending on type of plant and scale of size. Although it creates a perfect environment for plants, it needs human care to control the optimum status of the house such as ventilation.Automation is process control of industrial machinery and process thereby replacing human operators [1]. It helps to monitor the situation, when they are not at home. The main aim of this paper is to minimize the human care needed for the plant by automating the greenhouse and monitor the greenhouse environment status. A single unit of the greenhouse structure prototype has been constructed and integrated with the sensors.Continuous monitoring of these environmental variables gives information to the grower to better understand, how each factor affects growth and how to manage maximal crop productiveness [2].

II. LITERATURE SURVEY

Since 1990's for greenhouse and environment monitoring various kinds of system have been developed but due to lack of awareness ,cost and implementation factors ,these systems were left behind. Introducing this system can help in increasing the cultivation in a controlled environment.Required environmental conditions like Respiration for plants[3] are necessary for optimum plant growth, improved crop yields, and efficient use of water and other resources.Low soil temperatures can inhibit water absorption in plants [4].When RH is low, transpiration increases resulting in water deficiency in plants [5].Automating the data acquisition process of the soil conditions and various climatic parameters that govern plant growth allows information to be collected with less labor requirements.Automatically controlling all the factors that affect plant growth is also a difficult task as it is expensive and some physical factors are interrelated , for example, temperature and humidity are related in a way when temperature raises humidity reduces therefore controlling both together is difficult. Because the temperature and humidity of greenhouse must be constantly monitored to ensure optimal conditions, wireless sensor network can be used to gather the data from point to point. The data from the greenhouse will be measured by the sensor and the data that are collected will be sending to the receiver. The data that has been read will be displayed on the LCD screen. By using this system, the process of monitoring is easier and it is also cheaper for installation and maintenance process.

III. PROPOSED SYSTEM

This system uses a low power, cost efficient chip, microcontroller based circuit to monitor and record the values of humidity, moisture to achieve maximum plant growth [6]. The hardware unit of the prototype of the system is represented by the block diagram below. It contains an ATMEGA-328[7] controller as the main processing unit and it gets inputs from the temperature sensor, LDR[8] and a humidity sensor . From the data obtained from the sensors the program controls the actuator components (pump, sprayer, cooler fan, light) to achieve the system requirements. It also uses a LCD display to display the data obtained from the user.

Block Diagram

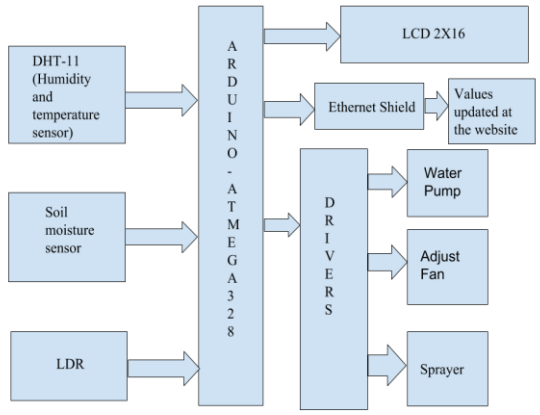

Fig.1 Block diagram of Arduino and its interconnected components.

IV. METHODOLOGY

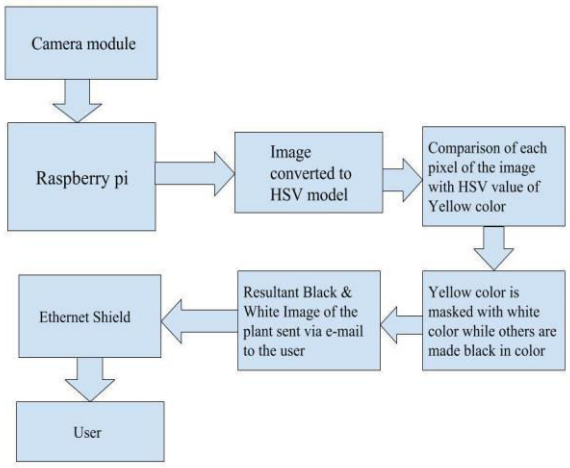

Fig.2 Block diagram of the image processing part of the project.

The various sensor inputs are taken into Arduino and depending on those inputs the relay switch performs the required action. For example, if soil moisture is observed to be less than the threshold value which is set then motor is switched on and required amount of water is provided. The respective real-time values of humidity, temperature sensor[9] and other parameters are displayed on LCD and web page. The next section of the project deals with image processing for health detection of plants. Raspberry Pi 2 is used for this purpose. Initial setup procedure of Raspberry Pi 2 will be done including the installation of its OS. Images of the plant will be taken using a camera module. The photograph hence taken is provided as an input for the Open Cv[10] which is also installed in the Raspberry Pi 2.Coding is done in python programming language. This image is processed inside the Raspberry Pi 2 , converted into HSV(Hue, Saturation, Value) and. only yellow color will be detected from the whole image. Detected yellow part gets masked with white color while everything else will appear black. Hence the output is a black and white image out of which white represents the damaged area. This image will be sent to the user via email, using an Arduino Ethernet Shield interfaced with Raspberry Pi 2.Hence constant monitoring of plants and proper care can be done at ease.

V. RESULTS

Fig.3 Screenshot of status of output devices displayed on webpage.

Fig.4 Screenshot of the sensor values displayed on web page

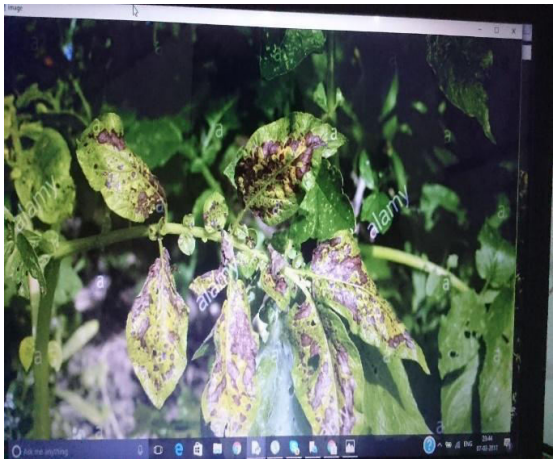

Fig.5 Image captured of the infected leaves Camera Module

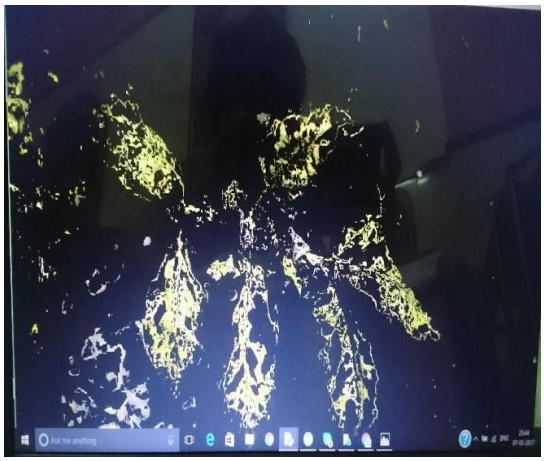

Fig.6 Processed image in which yellow pixels are detected (assuming: yellow color as damaged part of the leaf)

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 arduino and control action taken by the arduino to compare with preset values. AGMS eliminates risk of greenhouse not being maintained at specific environmental conditions due to human error and labour cost can be reduced and it is eco-friendly. Pests are eliminated by this system and also the quality of yield can be increased. This 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 arduino. The microcontroller constantly monitors the digitized parameters of the various sensors and verifies them with the predefined threshold values and checks if any corrective action is to be taken for the condition at that instant of time. In case such a situation arises, it activates the actuators to perform a controlled operation. An array of actuators can be used in the system such as relays, contactors, and changeover switches etc. They are used to turn on AC devices such as motors, coolers, pumps, sprayers. The values of the parameters are updated to a web page created on html code. It gets refreshed after every 5 seconds. All the parameter values are displayed on the web page. The status of the output devices are also updated to the same webpage as if it is ON or OFF.

VI. CONCLUSION

A step-by-step approach in designing the microcontroller based system for measurement and control of the four essential parameters for plant growth, i.e. temperature, humidity, soil moisture, and light intensity, has been followed also image processing is used to detect the health of the plants for proper and healthier growth. The results obtained from the measurement have shown that the system performance is quite reliable and accurate. The system has successfully overcome quite a few shortcomings of the existing systems by reducing the power consumption, maintenance and complexity, at the same time providing a flexible and precise form of maintaining the environment. The continuously decreasing costs of hardware and software, the wider acceptance of electronic systems in agriculture, and an emerging agricultural control system industry in several areas of agricultural production, will result in reliable control systems that will address several aspects of quality and quantity of production. Also, integration of all these technologies is not a daunting task and can be successfully carried out.

VII. FUTURE SCOPE

The circuit can be improved in many ways and can be used in wide applications. It can be placed and operated in any of the environmental conditions. Non-conventional energy sources such as solar panels, wind mills are used to supply power to the automatic greenhouse equipment. AGMS has a bright scope of future in agriculture field and it will create a revolution in it. In our project we have made a prototype taking only one sensor for humidity, temperature etc. into consideration. We can use this system for many sensors as a future use of this project. And in the future by using limited number of sensors we can maintain the greenhouse at specific environmental conditions. Also we can use a 360 degree camera module to click pictures of leaves from various angles so

that we can detect health of a plant and distinguish between healthy and infected plant and detect the exact disease which a plant can have by this proposed project in the future.

VII. REFERENCES

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