Sri Lanka Institute of Information Technology

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Greenhouse Automation System

Proposal Document

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Background

In recent years, development of the technology has been emerged with automation in numerous ways, including Agriculture. Greenhouse Automation System helps to create an environment where we can adjust the conditions that will enhance the efficiency of the greenhouse. This system can adjust the light intensity and soil-moisture levels in real time.

This Automation system will incorporate with following technologies and tools:

Sensors – These sensors are used to indicate the primary parameters in real-time.

Automation System – Creating algorithms and using microcontrollers to manage the outputs with the given inputs.

User Interface – For displaying the measurements and to interact with the system we use mobile applications or a web application.

System Integration – Integrating the hardware components and software programs to make this automation system efficient.

This Greenhouse Automation System focused on the measuring the light-intensity and the water content of the soil to increase the productivity of the plants.

Problems and Motivation

Problems :

- Insufficient Water Supply – If the plants didn't get enough water, it will cause stunted growth and nutrient deficiency of the plants.

- Over-Watered Soil – If the plant get over-watered without proper control it will lead the plants to root rot, poor aeration and etc.

- Unnecessary heating – Plants may overheat due to the adverse effects of weather conditions.

- Lower light-intensity – This may cause the plants to reduce photosynthesis.

Motivations :

- Maintain the water usage/wastage – Water   maintenance is crucial for greenhouse. Maintaining optimal water usage and minimizing the wastage can increase the efficiency of the greenhouse.

- Cost Saving – Efficient resource management will reduce the cost associated with the resources.

- Increase the productivity/photosynthesis – With providing the necessary requirements to the plant the productivity of the plant will increase.

- Adaptability to climate changes – With this System we can maintain the requirement according to the weather conditions.

Aims & Objectives

Aim :

This Greenhouse Automation system is designed to optimize water and light management. By integrating the modern technology such as environmental sensors and microcontrollers we can increase the efficiency of this Greenhouse Automation System. This system will also increase the productivity and photosynthesis procedure of the plants.
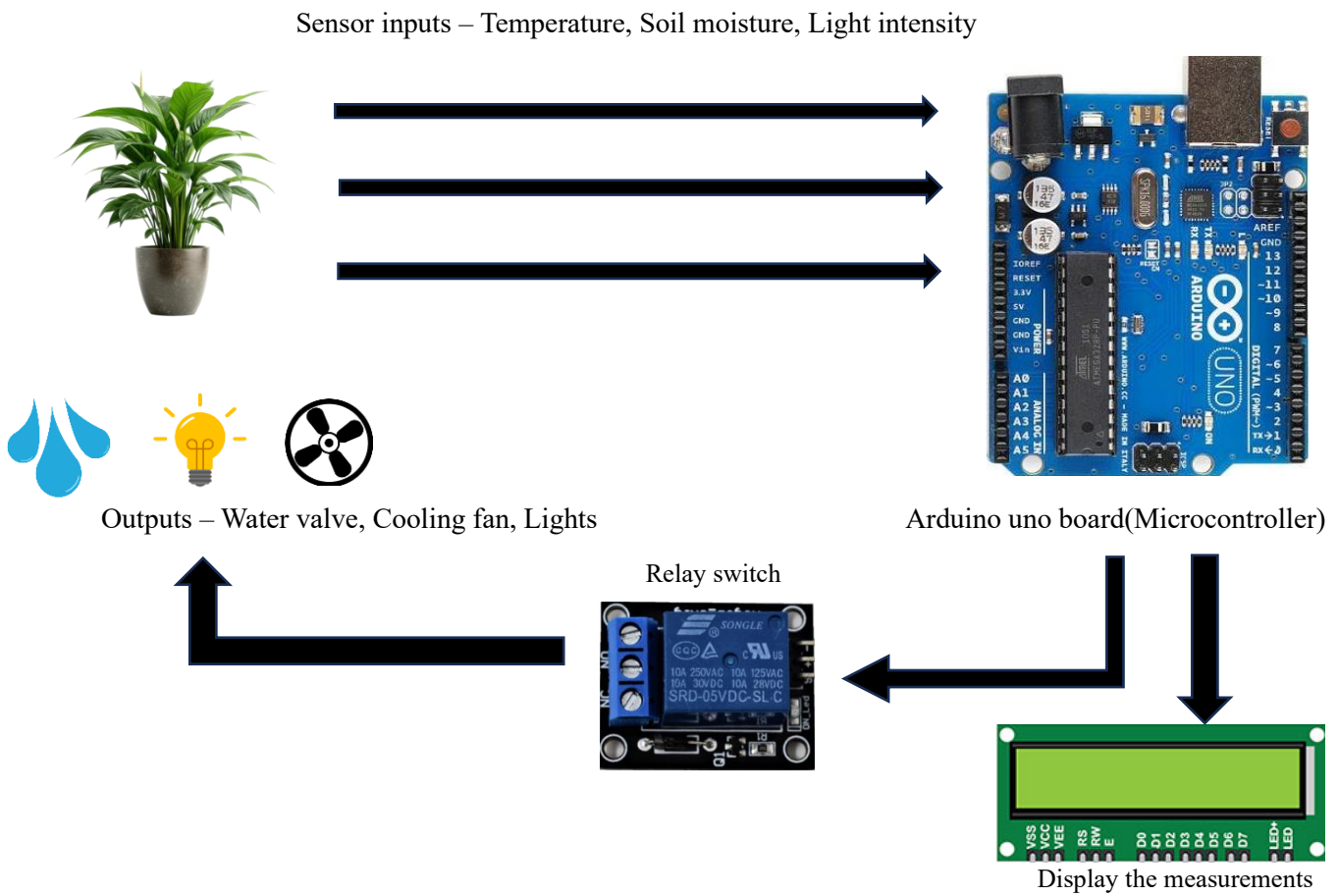
Objectives :

Create a prototype of Greenhouse Automated system that can control soil water content and light intensity.

Sub objectives:

- Automated cooling fan that can reduce the heat.

- Automated water valve that open when water level is dropped.

- Automated lighting system that can control the light intensity.

System diagram

Sensor inputs – Temperature, Soil moisture, Light intensity

Outputs – Water valve, Cooling fan, Lights

Arduino uno board(Microcontroller)

Relay switch

Display the measurements

Methodology

Components :

- Sensors –   Soil moisture sensor for measure the water content. Temperature sensor for measure the temperature. Light sensor for measure the light-intensity.
- Microcontroller – Program the algorithms for the system.
- Output Devices – Give the necessary environments for the plant. (According to the inputs and the processor)
- User-interface – To detect the system procedures.

System procedure :

- Measure the environmental requirements for the plant with used sensors. (Temperature, Light-intensity, Soil-moisture)
- Give the inputs directly to the microprocessor and run the programmed algorithms.
- According to the algorithms give the specific relay switch a signal for the specific requirement.
- Output devices will turned on if the relay switch get the signal.
- The User-Interface will display the measurements and the warning signals in real-time

System design :

- Analyze current greenhouse operations
- Identify specific issues with water and light management.
- Define technical requirements for sensors, control systems and lighting.
- Develop system architecture and integration plan.

Technology Selection :

- Environmental Sensors – Soil moisture sensor, Light Sensors, Temperature Sensor
- Select lights and other light supplemental lighting.

System Integration :

- Data management – connect sensors and controls to a microcontroller.
- Implementing the protocols – Develop the algorithms for automated adjustment. (C++ , Java)

Implementation :

- Install – Setup sensors and lighting systems.
- Testing – Test the system for checking errors.

Monitoring and store data :

- Performance – Monitoring the system performance and plant health.
- Store Data – Storing the data for future development.

Evaluation

Real-Time Monitoring

We can monitor the environmental statuses using this Greenhouse Automation System. Also the user can see the monitored measurements from the UI.

Low-Cost Implementation

This System will only take affordable implementation. With the future interest within this System, its more advantageable to use this system as a solution for the Greenhouses.

Increase the productivity

With this Automation Greenhouse System we can increase the productivity of the plants. With the lack of human touch and fully automated system, it will provide the necessary requirements when the plants need.

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