



CALIFORNIA STATE SCIENCE FAIR 2012 PROJECT SUMMARY

Name(s) Anish Seshadri	Project Number J0932
Project Title Automated, Wireless Monitoring and Control System (AWMCS) for Greenhouse Management	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals The problem that is addressed in this project is that currently operation of greenhouses involves wastage of water and electricity as well as high labor costs for maintenance. The purpose of this project is to build an automated, wireless monitoring and control system (AWMCS) for greenhouse management and maintenance to reduce system, labor and installation costs, water usage, and electricity consumption.</p> <p>Methods/Materials The key evaluation criteria included automation, design of a mobile sender unit using a robot and system operation using wireless communication. The AWMCS is completely automated and wireless. No human involvement is needed for monitoring the greenhouse and for turning on/off heating, lighting and watering systems. This cuts down on labor cost and helps establish scalable greenhouses for agriculture. The AWMCS has two building blocks: the Mobile Sensor Unit and the receiver unit. The Mobile Sensor Unit is made up of sensor circuits for collecting plant soil moisture, surrounding temperature and light data. An NXT robot carries the sensor circuitry and ensures that all points of the greenhouse are maintained within acceptable levels of light, temperature and soil moisture. This data is then transmitted wirelessly to the receiver XBee and Arduino. The software runs on the Arduinos and enables the AWMCS to operate devices like water pump, heater or light bulb using relays. The prototype AWMCS is tested at many levels. Moisture, temperature and light sensor and receiver circuits are tested independently as sub-systems. Then the integrated AWMCS is tested in a greenhouse environment.</p> <p>Results I collected moisture, light and temperature data for a total of 19 hours over 2 days using the Mobile Sensor Unit and my greenhouse was operated successfully by the AWMCS as designed. Based on actual data, it is estimated that the total daily cost of maintaining a 60 sq. ft. greenhouse with 8 6-inch planters in San Jose using the AWMCS in winter is \$1.66, which translates to a monthly cost of approximately \$49.80.</p> <p>Conclusions/Discussion It can be concluded that the AWMCS provides a saving of 24 percent or \$15.54 per month in winter when compared to a conventional greenhouse of the same square footage. The results derived show that effective greenhouse management can be achieved using automation and wireless communication.</p>	
Summary Statement This project is aimed at optimizing the water use and electricity consumption for lighting and heating of a greenhouse using an automated, wireless approach in order to reduce annual cost of greenhouse maintenance and management.	
Help Received Mr. Larry Young of NASA Ames Research Center helped me by giving me very useful pointers on how to test my project at the sub-system and the system level. My mom and dad helped me solder the relays, understand the microcontroller software code and build a temporary greenhouse in my front porch..	