

SYMPOSIUM ON INTEGRATED APPLICATIONS (B5)  
Tools and Technology in Support of Integrated Applications (1)

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A FUZZY LOGIC CONTROLLER WITH INTERNET OF THINGS (IOT) CAPABILITIES AND COTS  
COMPONENTS FOR MONITORING AND MITIGATION CLIMATE CHANGE EFFECTS ON  
SENSIBLE TROPICAL CROPS

**Abstract**

Climate change has been shown over and over to be already negatively impacting all human activities. A critic example is how agriculture and food production are affected by the excess or deficit of rainfall, changes in temperature and other associated environmental variations, which may be particularly severe in fragile tropical ecosystems. These events may constitute serious threats to food security in low and medium income economies located in these regions, such as Costa Rica. The development of the following project aims at improving expertise in the production of vegetables in protected environments within an efficient, economically viable and environmentally responsible way. Specifically, the production of food under conditions that may control or mitigate the adverse effects of climate change; such as is the case of protected environments best known as greenhouses. However, vegetable production in greenhouses represents a challenge for typical farmers because there the growing behavior of most vegetable species is markedly different than at open air, and usual culturing practices must be modified accordingly. Thus, the multidisciplinary group in charge of this project has decided to integrate Internet of Things (IoT) into their scientific research in order to convert data into information, information in knowledge and this into wisdom to manage decision making at the right time for the producers. The designed system consists of hardware with commercial off the shelf (COTS) components (sensors, 3G communication shield and actuators) and software running on the cloud (for data acquisition and processing for monitoring and decision taking). System's performance has been tested in a controlled greenhouse, where acquired data from environmental variables (temperature, humidity and light), substrate conditions (humidity and temperature) and overdrain collection (pH, conductivity and quantity in milliliters) is sent over the Internet to be processed using data fusion techniques and a fuzzy logic controller is implemented for irrigation decision-making. The concrete aim was to study the effect of temperature increase on the quantity and quality of several vegetable varieties' production, in order to estimate the consequences of this phenomenon, while allowing progress in the identification of modeling and prediction tools and strategies that might help producers to mitigate the adverse effects of climate change. The main goal in the end is to provide scientifically tested alternative food production practices under the prevailing changing environmental conditions of our planet, including new guidelines for water saving and management.