Integrating IoT with greenhouse environments for monitoring and analysis

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The increasing demand for quality crop production has significantly risen in utilization of high quality greenhouses. Specific environmental conditions are required to cultivate crops in greenhouses. Monitoring environment parameters such as humidity, soil moisture, and light play a significant role in research that attempt in optimizing efficiency in greenhouse crop production. Automated monitoring of above parameters plays a vital role in researches which are carried out under the greenhouse conditions in Sri Lanka. Currently researchers visit greenhouse and use complex instruments to monitor these conditions. In this study, it is expected to enhance the system automated way with creating an advance dynamic network of Internet of Things (IoT). This study is designed and developed a sensor based android mobile application that facilitates transition data to IoT web server over Wi-Fi connection while enabling view information efficiently through the mobile application. Main users of this application (e.g. researchers) can collect real time data that monitor greenhouse conditions, receive notifications, input plant performance details, study and control parameters using graphs. Proposed approach focuses on development and integration of four main modules: Wi-Fi sensor device, IoT Server, Firebase database and mobile application. The device is designed by integrating DHT11 (Humidity and Temperature sensor), LDR (Light intensity sensor) and Arduino Soil moisture sensor. Collected data can be analyzed with respect to controlled factors and the time. It provides three graphs in order to show basic measures of plant growth performance including shoot length, shoot diameter and number of leaves. Therefore, on the basis of these graphs, researchers are able to analyze plant growth during the specified time period. Further, this analysis can be used for future predictions and decision making for large collection of data. Developed Android application was tested on the selected mobile platforms using questionnaires. We received feedback from participants to the system and their outcomes were: the accuracy of measured values for tested parameters and ability to maintain plant log for treatment were high; the usability and readability of the system was in an acceptable level.

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