

ABSTRACT

One of the main challenges in managing crops within a greenhouse environment is the lack of an efficient and integrated monitoring and control system. A critical issue often encountered is maintaining soil moisture within an optimal range without the need for frequent and manual inspections. Imbalanced moisture levels can directly affect the quality and productivity of crops. Therefore, an automated system is required to monitor environmental conditions in real time and provide flexible control over the irrigation process, both automatically and manually.

As a solution to this problem, this project designs and implements an IoT-based monitoring and control system for greenhouse applications using LoRa technology, Firebase, and an interactive web dashboard. The website was developed using the Flask and Bootstrap frameworks and is equipped with features such as user login, real-time gauge and historical charts, manual/automatic irrigation control, and activity log tracking for users and devices.

The system has been successfully implemented and tested. The website displays real-time data, records system activities through a log, and provides both manual and automatic irrigation modes. Based on questionnaire results from eight respondents, 50% rated website access as very easy, while the remaining 50% found it easy. Additionally, 62.5% considered the color scheme, icons, and graphics easy to understand, and 37.5% rated them as very easy to interpret. In terms of real-time data accuracy, 50% found the data accurate, 37.5% rated it as fairly accurate, and 12.5% as highly accurate. Meanwhile, 62.5% stated that the activity logs and irrigation history were helpful, and 37.5% found them very helpful.

Keywords: *LoRa, Flask, Firebase, IoT, Smart Greenhouse, Monitoring.*