

The Design and Performance Evaluation of a Wireless Sensor Network Based Irrigation System on Different Soil Types

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Abstract: In the Nigerian economy, agriculture plays a significant role, and most of its people depend on it for their livelihood. Agricultural practices in the country are still mainly based on conventional, traditional methods of farming which usually result in wastage of water resources and low production of crops to meet the country's demand. There is a need to transform farming from the traditional way to a more efficient method with optimum water utilization. Irrigation is an assistive measure to salvage the problem of inadequate water for dry season farming. Irrigation requires a lot of water and time, and it must be completed on time. Overwatering and soil underwatering are two issues that the controlled irrigation system helps to solve. This research proposed an Arduino-based smart irrigation system using a wireless sensor network to overcome the problem of overwatering, underwatering, and efficient time utilization in farming. The system is implemented using Arduino IDE, Proteus Simulation Tools, and Blynk Platform. The effect of the four-mobile network: MTN, GLO, Airtel and 9mobile on response time for Gidan- Kwano area was evaluated. Testing carried out on the system resulted in a response time of 0.75 seconds for the Glo 2G network and 0.45 seconds for the Glo 4G network. Less than 1sec in the worst-case scenario. Also, 0.72 and 6.073 seconds respectively was achieved for loamy soil average response time and average saturation time. Average response time of 0.85 seconds and 4.906 seconds for saturation time, while 0.77second and 6.366 seconds as average response time and saturation time for clay soil. This makes the system effective in terms of time response, thereby eradicating the time wasted by manual system operation to irrigation scheduling. Also, the appropriate soil moisture content is maintained, whether it rains or not. This reduces excesses and ensures healthy plant growth, increasing agricultural productivity, and cultivating crops are made possible throughout the year. The system will also help drive agricultural innovation through the use of IoT.

Keywords: IoT, ZigBee, WSN, Wi-Fi Module, Arduino, Irrigation System