UNIVERSITY of RWANDA

ACEIoT

Design and Application of a Low-Cost, Low- Power, LoRa-GSM, IoT Enabled System for Monitoring of Groundwater Resources with Energy Harvesting Integration

Omar Haji Kombo
University of Rwanda
PhD Student ,ACEIOT

Abstract:

The rapid expansion of Internet of Things (IoT) devices and applications has accelerated research in various areas of human development. However, the cost of commercial instrumentation impedes the momentum of technological growth in developing regions. In this study, a low-cost, low-power, wireless sensor network for groundwater monitoring (LWNGM)was developed to provide near real-time groundwater level data to support prudent decision making in groundwater resource management in Zanzibar, Tanzania. The system is based on the ATmega328P microcontroller platform and incorporates MS5803-14BA and MB280 sensors. The I2C communication channels between the sensors and the microcontroller were extended using 25-meter PVC cables. The electronics were potted and protected in a waterproof aluminum cylinder. The Arduino UNO wakes up in six-hour intervals for measurements and data-logging to the SD card, and at twelve-hour intervals for relaying data (in batches) to the LoRa gateway, before it goes back into a deep-sleep mode for the rest of the time (duty cycle < 1%). The average power consumption for the end node was 104.081mW. The power autonomy of all nodes is provided by a 3.7V, 5000mAh rechargeable LiPo battery, and a 9V, 600mAh rechargeable Li-ion battery, respectively, which are supported by 6V and, 3W solar chargers. The data processing and storage components, as well as the data visualization dashboard, were created using free and open-source software. The LWNGM was reasonably
priced, ranging between $350 and $400. Practical evaluation determined that, the system is reliable and transferable, particularly in areas with a limited budget for hydrologic management.

Seminar date:	Time:	Venue:
24th June 2022	10:00-11:00 am	Virtual