

**Abstract**

Municipal solid waste management remains a major problem in urban areas, leading to serious health and environmental issues. Consequently, trash bins are placed in many places to handle the municipal solid waste, but these bins can overflow, spreading around the area, polluting the environment, and causing inconvenience to the public. Therefore, there is a need for a real-time remote monitoring system that alerts the level of garbage in the trash bins to the municipality or a waste management company. To manage the municipal solid waste efficiently, this article presents the development and validation of a self-powered, LoRaWAN Internet-of-Things (IoT)-enabled trash bin level monitoring system. The end nodes of the proposed IoT system are called trash bin level measurement unit (TBLMU) and are installed in each trash bin where the status needs to be monitored. The TBLMU measures the unfilled level and geographical location of a trash bin, processes the data, and transmits it to a LoRaWAN gateway at a frequency of 915 MHz. A LoRaWAN gateway serves as a concentrator for the TBLMUs and relays data between a TBLMU and an IoT trash bin level monitoring server. The users can view and analyze the status of every bin and its geolocation by using a smart graphical user interface. The accuracy of the developed system, wireless range between a TBLMU and a LoRaWAN gateway, average current consumption and life expectancy of the TBLMU, battery charging time, and the cost were studied and are reported here.