Equabin - The Smart Waste Management System

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Equabin is an intelligent IoT based waste management system. The system is built around a micro-controller integrated with multiple sensors, standard communication protocols, and a database. Each bin uses a dual-sensor approach for fill level detection, combining time of flight sensors to measure the level and volume of waste and a weight sensor to determine the weight of garbage, improving accuracy compared to single-sensor systems. Gas sensors identify dangerous emissions including methane and ammonia, thus warning about environmental and safety hazards. Environmental monitoring is enhanced using temperature, humidity, and rain sensors, allowing operations such as automatic lid closure during rainfall. The system follows a layered IoT architecture consisting of Major, Sub, and Minor bins. Major bins are Internet-enabled and act as data hubs, transmitting their own data and aggregating data received from Sub bins via ESP-NOW. Sub bins operate without Internet access and rely on Major bins for cloud communication, while Minor bins function independently with network connectivity. LTE & GPS technologies also allow real-time location tracking and stable data transmission even in those areas where WiFi connection is not available. All data, including fill levels, weight, gas concentration, and location, is stored in a database for real-time monitoring and analysis. The mobile app provides administrators and waste collectors live notifications of optimized routes via a dashboard. The web app allows users to find the whereabouts of bins nearby. Equabin offers a scalable and efficient solution for smart waste management through an array of sensors and data-driven decision-making.

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