IoT-Enabled Smart Waste Management System: A Capstone Project Advancing Sustainable Waste Practices at MPSPC

June 10, 2024

Mountain Province State Polytechnic College (now MPSU) continues to advance its environmental initiatives by exploring research-driven solutions that support more responsible waste practices on campus. One of the most notable contributions is the capstone project titled "IoT-Enabled Smart Waste Management System for Mountain Province State Polytechnic College," successfully defended on May 15, 2024 and later published in a peer-reviewed journal. The project was developed after observing common challenges in campus waste handling, including overflowing bins, delayed collection schedules, inconsistent segregation, and the absence of reliable data on how much waste is generated, recycled, or sent to the landfill. These issues highlighted the need for a more modern system that could help the College monitor its waste generation more accurately.

The proposed IoT-enabled Smart Waste Management System introduces a technology-based approach using ultrasonic sensors, a microcontroller, and wireless communication modules to detect waste levels and transmit real-time information to a monitoring dashboard. With bins dedicated to biodegradable, recyclable, and residual waste, the system is designed to collect accurate data for each type of waste, helping the university understand where waste is accumulating and how much recyclable material is being recovered. Although the prototype demonstrates strong potential, the research acknowledges that full campus deployment is not immediate and would require several phases, including expanded prototyping, infrastructure planning, evaluation of network coverage, and budget allocation for multiple smart bins.

Even in its prototype phase, the project provides valuable insights by showing how technology can improve waste monitoring and support future sustainability planning. The data it can generate—such as the amount of segregated waste, the volume of recyclable materials collected, and the quantity of waste that would otherwise go to the landfill—can guide the University in strengthening segregation practices, planning targeted awareness campaigns, and improving overall waste-management strategies. These insights are important because they

help the institution better understand its waste generation patterns, which is essential for long-term environmental decision-making.

The study outlines a system architecture that includes the smart bin module, automated notification system, and a supervisor dashboard, all of which can be expanded gradually once the institution is ready to move toward phased implementation. While deployment will require careful consideration, additional testing, and institutional support, the project represents a meaningful step toward integrating modern, data-driven methods into campus operations.

Through this capstone project, MPSU demonstrates its commitment to exploring innovative and practical approaches to environmental sustainability. Although the system is not yet deployed, it lays the groundwork for a future in which waste collection, segregation, and monitoring can be guided by accurate data and smart technology, ultimately supporting the goal of creating a cleaner and more responsible campus environment.