

ABSTRACT

DEVELOPMENT OF PIPELINE ROBOTS TO CLEAN CLOGGED SEWAGENS FOR PALM OIL FACTORIES

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Palm oil factories often face significant operational inefficiencies due to the clogging of waste drainage channels caused by oil residues, fibers, and debris. These clogs not only reduce the flow efficiency of waste disposal systems but also require frequent maintenance interventions that lead to production downtime. Current manual methods are laborintensive, unsafe, and time-consuming, often involving exposure to hazardous environments. Addressing these challenges, this project proposes the design and development of an autonomous robotic system capable of detecting and eliminating clogs within the confined spaces of industrial drainage pipelines. The proposed robot integrates mechanical scrapers and a high-pressure water jet system controlled by a microcontroller unit (ESP32) that allows it to clean effectively while navigating the internal pipeline network. The robot is designed with a compact acrylic body, tankstyle traction wheels, and a smart obstacle detection system using infrared sensors. It can operate autonomously within the waste drainage pipelines of palm oil factories, significantly reducing human labor and safety risks. The integration of IoT functionalities also allows real-time monitoring and remote operation, ensuring efficient oversight of the cleaning process. Initial testing in simulated pipeline conditions demonstrates the robot's effectiveness in clearing standard blockages within a short time frame, with a high success rate. This development represents a significant step toward sustainable industrial waste management and improved operational efficiency in the palm oil industry.

Keywords: Autonomous Cleaning Robot, Waste Drainage Pipeline, Palm Oil Industry, ESP32 Microcontroller, Internet of Things (IoT)