Integrated Robotic System To Clean Flood Tunnels, Divert Flood Water & Generate Electricity

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Flooding is a significant issue in urban environments, causing widespread damage and disruption. Existing solutions lack integration, often addressing isolated aspects, such as detection or diversion. Our study investigates the development of HydroGuard, a multidisciplinary system combining robotics, floodwater management, and renewable energy generation. The purpose is to create a holistic, sustainable solution that mitigates flooding while supporting environmental resilience. Our methodology consists of 2 components - first being HydroBOT which operates in storm drains to remove sediment, detect structural defects, and measure water flow while generating hydroelectricity through a turbine. The second component is HydroBOT which transmits real-time data to HydroHUB, integrating with water-level readings from retention ponds to assess flood risks and initiate automated water diversion. Laboratory experiments tested HydroBOT's ability to clean drains and detect defects, while HydroHUB’s diversion system was evaluated using simulated flood scenarios. Our results demonstrated that Hydro BOT efficiently removed blockages and identified structural issues in storm drains, while the turbine generated renewable energy. HydroHUB redirects floodwater to non-flooded areas, increasing retention capacity and delaying flooding onset. HydroGuard provides a practical and adaptable solution to urban flooding, overcoming the limitations of existing systems. Our solution supports the goals of creating sustainable cities and communities, as outlined in United Nations SDG 11 by reducing flood-related damages and improving urban resilience. This innovative system demonstrates significant potential as an integrated approach to managing urban water challenges and mitigating flood risks.

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