

AI ROBOT POWERS THE NEXT GENERATION OF URBAN SANITATION IN THIRUVANANTHAPURAM

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Under Swachh Bharat Mission–Urban 2.0, Thiruvananthapuram Municipal Corporation has deployed an AI-powered G-SPIDER robot for safe, precise, and human-free canal cleaning in high-risk areas.



In a major step to phase out manual scavenging and ensure the safety of sanitation workers in waste removal in high-risk and inaccessible areas, the Thiruvananthapuram Municipal Corporation has deployed G-Spider, an AI-powered robotic canal-cleaning system at the Amayizhanchan canal near the railway station premises at Thampanoor.

The Amayizhanchan Canal, particularly the covered stretch beneath Thampanoor Railway Station, poses significant operational challenges owing to restricted vertical clearance, continuous water flow, confined working conditions, and the absence of safe human entry points. As a result, routine cleaning and maintenance of this stretch became extremely difficult through conventional methods.

To address these constraints, an AI-powered robotic canal-cleaning system was commissioned by Shri M. B. Rajesh, Minister for Local Self-Governments. The initiative represents a collaborative effort between the Thiruvananthapuram Municipal Corporation and Technopark-based Genrobotic Innovations, developers of the robotic scavenger 'Bandicoot'.

The introduction of this advanced robotic system would effectively remove the need for workers to enter dangerous and unhygienic environments, as mentioned by officials. They termed the initiative a groundbreaking move that enhances operational efficiency while significantly strengthening safety standards in waste management.



The G-SPIDER Automated Canal Cleaning Robot, created by Genrobotic Innovations, is engineered to operate in complex, high-risk canal environments without any human entry. Built on a Cable-Driven Parallel Robotics (CDPR) architecture and powered by AI-enabled vision and sensor intelligence, it enables precise detection, assessment, and removal of accumulated waste.



Using advanced machine vision, the system autonomously identifies and adapts to different waste types, flow conditions, and structural challenges in real time. Its five-degrees-of-freedom robotic mechanism, equipped with a biomimetic claw-type grabber, ensures accurate positioning and secure handling of mixed and irregular debris. The extracted waste is directly transferred into designated collection vehicles, enabling a fully hands-free, end-to-end canal cleaning process—from detection to safe disposal.

Deployed by the Thiruvananthapuram Municipal Corporation, the G-SPIDER AI-powered robotic system marks a transformative step in urban sanitation. By automating canal cleaning, the robot significantly enhances worker safety by minimizing direct exposure to toxic gases, contaminated water, and hazardous waste. Designed to function efficiently even during high water levels and continuous flow conditions, G-SPIDER ensures uninterrupted and consistent maintenance of urban waterways. It is capable of safely extracting mixed and hazardous waste—including plastics, sharp debris, and other harmful materials—thereby improving overall sanitation standards. Through scheduled and systematic cleaning, the robotic intervention also strengthens drainage efficiency, playing a crucial role in preventing urban flooding and promoting a cleaner, safer city environment.

The deployment of the G-SPIDER Automated Canal Cleaning Robot marks a decisive shift towards safe, mechanised, and technology-driven canal maintenance. By eliminating the need for workers to enter hazardous environments, the initiative safeguards the lives of sanitation workers, enhances operational efficiency, and strengthens sustainable urban infrastructure systems. Serving as a scalable and replicable model, G-SPIDER sets a strong precedent for adoption in other high-risk canals and drainage networks across the State.

Aligned with the vision of the Swachh Bharat Mission, such technology-driven interventions reflect how states are increasingly embracing innovation to modernise urban sanitation systems while prioritising the dignity, safety, and well-being of sanitation workers.

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