

ABSTRAK

Toni Nur Fajariantoro. 2026. Rancang Bangun Tongkat Navigasi Sensorik Berbasis *Internet of Things (IoT)* Dengan Sistem Pelacakan Lokasi Melalui Telegram Untuk Penyandang Tuna Netra. Skripsi. Program Studi Teknik Informatika, FT, Universitas PGRI Madiun. Pembimbing (I) Moch Yusuf Asyhari, S.Tr.Kom., M.Kom.(II) Alim Citra Aria Bima, S.Pd., M.Kom.

Penyandang tunanetra masih menghadapi berbagai kendala dalam melakukan mobilitas secara mandiri, terutama dalam mendeteksi hambatan di lingkungan sekitar dan memperoleh bantuan saat berada dalam kondisi darurat. Tongkat konvensional memiliki keterbatasan karena hanya mampu mendeteksi objek melalui sentuhan secara langsung tanpa dilengkapi fitur pelacakan lokasi maupun notifikasi darurat. Penelitian ini bertujuan untuk merancang dan membangun tongkat navigasi sensorik berbasis *Internet of Things (IoT)* yang mampu mendeteksi hambatan, memberikan informasi suara, serta mengirimkan lokasi pengguna secara *real-time* kepada keluarga atau pendamping melalui Telegram. Metode pengembangan sistem yang digunakan adalah V-Model, yang meliputi tahapan analisis kebutuhan, perancangan, implementasi, dan pengujian menggunakan Black Box Testing. Sistem dibangun menggunakan mikrokontroler ESP32, sensor ultrasonik HC-SR04, modul GPS Neo-6M, DFPlayer Mini, speaker, tombol SOS, serta Telegram Bot sebagai media notifikasi. Hasil penelitian menunjukkan bahwa sistem berhasil mendeteksi hambatan di bagian depan, kiri, dan kanan pengguna, memberikan peringatan suara sesuai arah hambatan, serta mengirimkan koordinat lokasi ketika tombol SOS ditekan secara *real-time*. Berdasarkan hasil Black Box Testing, sistem memperoleh tingkat keberhasilan sebesar 92,31% (12 dari 13 skenario pengujian berhasil) dengan kategori Sangat Layak, sehingga sistem dinilai mampu membantu meningkatkan keamanan, mobilitas, dan kemandirian penyandang tunanetra dalam beraktivitas.

Kata kunci: *Internet of Things (IoT)*, Tongkat Navigasi Sensorik, ESP32, Sensor Ultrasonik HC-SR04, GPS Neo-6M, Telegram Bot, Penyandang Tunanetra.

ABSTRACT

Toni Nur Fajariantoro. 2026. Design and Development of an Internet of Things (IoT)-Based Smart Navigation Cane with Telegram-Based Location Tracking System for Visually Impaired People. Undergraduate Thesis. Informatics Engineering Study Program, Faculty of Engineering, Universitas PGRI Madiun. Supervisor (I) Moch Yusuf Asyhari, S.Tr.Kom., M.Kom. Supervisor (II) Alim Citra Aria Bima, S.Pd., M.Kom.

Visually impaired individuals continue to face various challenges in performing independent mobility, particularly in detecting surrounding obstacles and obtaining assistance during emergency situations. Conventional white canes are limited because they can only detect objects through direct physical contact and do not provide location tracking or emergency notification features. This study aims to design and develop an Internet of Things (IoT)-based smart navigation cane capable of detecting obstacles, providing voice notifications, and transmitting the user's real-time location to family members or caregivers through Telegram. The system development employed the V-Model methodology, which consists of requirements analysis, system design, implementation, and testing using the Black Box Testing method. The system was developed using an ESP32 microcontroller, HC-SR04 ultrasonic sensors, a Neo-6M GPS module, DFPlayer Mini, a speaker, an emergency (SOS) button, and a Telegram Bot as the notification platform. The results indicate that the proposed system successfully detects obstacles located in front of, to the left of, and to the right of the user, provides voice alerts according to the obstacle direction, and transmits the user's location coordinates in real time when the SOS button is pressed. Based on the Black Box Testing results, the system achieved a 92.31% success rate (12 out of 13 test scenarios passed), which falls into the Highly Feasible category. Therefore, the developed system is considered effective in improving the safety, mobility, and independence of visually impaired individuals in their daily activities.

Keywords: *Internet of Things (IoT), Smart Navigation Cane, ESP32, HC-SR04 Ultrasonic Sensor, Neo-6M GPS, Telegram Bot, Visually Impaired People.*