**ECHO GHAT - GHAT ROAD SAFETY PROJECT**

**A PROJECT REPORT**

***Submitted by***

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**BONAFIDE CERTIFICATE**

Certified that this project report titled “**ECHO GHAT - GHAT ROAD SAFETY PROJECT**” is the bonafide work of **Nishanth R (950021104035)**, **Vivekanandan S (950021104301), Sharon Joseph A S (950021104302), Rakesh Sudhanson P (950021104311)** who carried out the project work under my supervision.

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**ABSTRACT**

The **EchoGhat** Road Safety Project addresses the **critical safety challenges** encountered in mountainous ghat roads where conventional cellular networks are unreliable or nonexistent. This innovative system utilizes **LoRa (Long Range) wireless technology** integrated with **ESP32 microcontrollers** to establish vehicle-to-vehicle communication networks that function independently of existing infrastructure. The solution enables **real-time exchange of location data**, speed information, and heading details while providing **timely alerts** about approaching vehicles and hazardous road conditions, particularly at blind spots and hairpin bends that characterize ghat roads.

The implemented system comprises three integrated components: **custom ESP32-LoRa hardware gateways** that create local WiFi access points, a **Next.js web application** with offline mapping capabilities, and a **Capacitor-based Android mobile application**. Extensive field testing in mountainous terrain demonstrated reliable communication at distances **exceeding 2 kilometers**, with advanced features including **movement-based heading calculation**, **sophisticated speed algorithms**, and **voice-based safety alerts** proving highly effective in mountain driving scenarios. The EchoGhat system represents a significant advancement in road safety technology for remote areas, providing a **resilient solution** that operates without dependence on conventional network infrastructure.

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