A Ubiquitous Approach to Toll Collection on the Addis-Adama / Hawassa Expressway

The Addis-Adama / Hawassa highway is a vital transportation corridor in Ethiopia, connecting major cities and facilitating economic growth. However, the existing manual toll collection system has resulted in congestion and inefficiencies at toll plazas, negatively impacting the overall travel experience. To address these issues, I propose the implementation of a pervasive toll collection system that combines technology and user convenience.

Objective:
The primary objective of this project is to enhance the efficiency of toll collection, reduce congestion at toll plazas, and provide a seamless experience for daily customers and frequent travelers. This will be achieved through the adoption of electronic toll collection technologies, user registration, and the seamless integration of popular payment systems like **Telebirr**, **Chapa**, and **Arifpay**.

Key Components:
Seamless Toll Collection: Creating a toll collection system that seamlessly integrates into daily travel, making toll payment an effortless and inconspicuous part of a driver's routine.

Context-Aware Booth Allocation: Utilizing real-time data on user arrival times to dynamically allocate the number of booths dedicated to pervasive users, reducing congestion and enhancing efficiency during peak hours while aligning with the principles of context awareness.

Privacy and Security: Prioritizing robust security and privacy measures to safeguard user data and ensure trust in the system's reliability.

User-Centric Design: Focusing on ensuring toll collection is an efficient and intuitive process, aligning with the principles of pervasive computing for a seamless and human-centered user experience that serves their needs effectively.

Benefits:
- Reduced congestion at toll plazas.
- Enhanced User Experience for Daily (Frequent) Customers: Providing daily commuters with a user-friendly and streamlined toll experience, where frequent users are identified seamlessly, eliminating the need for manual ticket acceptance at the entrance and return at the exit. This approach simplifies the process and fosters a hassle-free commute for regular travelers.
- Payment Handling in the Background: Implementing a system where payment processes are seamlessly managed in the background, in line with the concept of ubiquity where the computer takes care of tasks without direct user interaction.
- Modernization of transportation infrastructure.

Conclusion:
The implementation of a pervasive toll collection system on the Addis Ababa - Adama / Hawassa expressway presents a visionary and research-driven solution to address existing inefficiencies in toll collection. As a master's thesis project, it offers the opportunity to explore, analyze, and contribute to the field of pervasive computing within the context of transportation infrastructure. This concept note outlines the foundational elements of the research project and provides a clear direction for its academic exploration and practical implementation.

I seek input, further discussion, guidance, and academic support on this research project, thank you