KSCST Synopsis Document

Project Reference Number	46S_BE_3858
Title of the project	Pedestrian Navigation based on Illumination for Smart Cities
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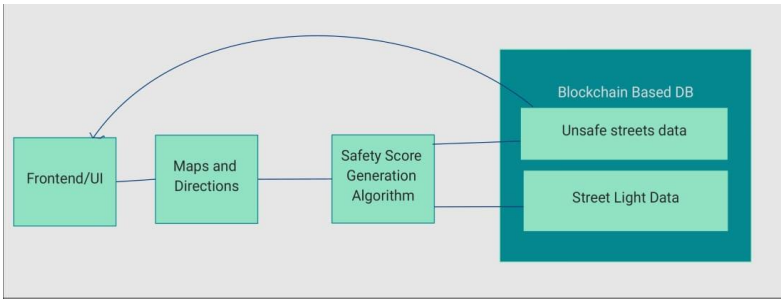
Keywords	Navigation, Blockchain, Internet of Things, Pedestrian, illumination, Safety, Night, Women's safety
Introduction / background	The IT (Information Technology) capital of India, Bengaluru, has begun work on transitioning into a smart city with projects that transform the city into a sustainable & citizen focused entity that can serve as an example for other cities in the country and the world. A smart city that is traffic free, has a highly connected public transport system with pedestrian friendly streets over motorized transportation. Pedestrian friendly cities mean less pollution, more visitors for businesses along streets with heavy footfall, better fitness as well as increased social interaction amongst people in a neighborhood. Pedestrianization comes with new problems of its own. The biggest being safety. Safety of a person walking down a street can be affected by various things. Bikes being driven on a footpath, uneven pavements and simple things like lighting or road width. The idea for this project came from the personal experiences of the team members. Whether male or

	female, the threat to anyone's safety increases when they decide to take a route that is not well illuminated. The danger can be simple where people cannot see the potholes / other obstacles in their path or it can be in the form of people who take advantage of the dark to commit crimes like knifepoint robberies and others, especially against women. There is a need to identify the safety of the paths that anyone takes to get to the destination and illumination of the path is the best metric to do so. Routing based on illumination can serve as a valuable tool to the millions of people who commute during the night.
Objectives	● Identify the shortest safe route from the given source to the destination location. ● Demonstrate a network of LDR (Light Dependent Resistor) sensors whose status is continuously monitored and stored on the Blockchain network ● Automatically detect and raise a complaint in the system about damaged street lights and broadcast streets that were identified as unsafe ● Provide a mobile application interface to the users to interact with the entire system in a convenient manner
Methodology	 Figure: Low Level System Design We designed a system that consisted of five main parts: **IOT Devices:** A sensor module is developed using a Light Dependent

	Resistor sensor with an ESP32 module. This setup transmits the current illumination status of an area. **Blockchain Based Database:** The status transmitted by the sensors is logged in the Hyperledger Fabric network as the “Street Light Data”. Once a path has been evaluated for safety, the status is stored in the “Unsafe Streets Data” and made visible to the public. **Safety Score Generation Algorithm:** The status of the street lights on a street is used to generate a safety score for the street. This safety score serves as a weight for the directions provided. **Maps and Directions:** We use the Google Directions API and other Map API to display maps and provide navigation details and directions. These directions have been optimized to show the safest and shortest path using the calculated safety score. **Frontend/UI** A react-native based frontend app is being created for easy access to the system for the users on any mobile platform (Android and IOS)
Results and Conclusions	A dataset from IUDX (India Urban Data Exchange) was collected which contained the location and power consumption of street lights in the Electronic City area. The sensor module prototype has been built. The data collected from the sensors will be logged in the Hyperledger Fabric network. The mobile application is ready with the navigation, streetlights location and profile tabs. The navigation screen allows the user to enter source and destination. The route tracing will be done based on the safety rating of the street. The streetlights location screen marks the

	location of all the streetlights using markers. The profile screen contains the basic details of the user.
What is the innovation in the project?	By investigating Illumination as a metric for path evaluation, our project questions what is considered the best path in navigation. We also show how permissioned blockchains, such as Hyperledger Fabric, can be used to store real-time data from IoT devices and how this can be used in a real-world application..
Scope for future work	● *Dataset Expansion*: Improving the accuracy and reliability by expanding the street lights dataset. This involves collecting additional data on street lights, such as their intensity, location, and maintenance records and other relevant data sources, such as crime rates, pedestrian accident records, or road conditions, to further enhance the safety classification. ● *Algorithm Optimization*: Incorporate machine learning techniques to improve the performance of the safety algorithm based on a variety of factors. ● *Real-Time Data Integration*: Incorporating real-time data into the navigation system. For example, integrating data from traffic sensors, surveillance cameras. By combining static street lights data with dynamic real-time information, the system can adapt and provide up-to-date safe navigation recommendations. ● *User-Friendly Interface*: Improving the user interface and experience of the navigation system. Considering features such as route customization, voice-guided navigation, real-time alerts for potential safety concerns, and integration with existing navigation applications like Google Maps. ● *Collaborative Mapping*: Allow pedestrians to contribute their observations and feedback on the safety of routes they have taken. Implement features that allow users to report incidents,

	hazards, or changes in street lighting conditions, enabling continuous improvement of the navigation system. ● *Integration with Smart City Infrastructure*: Explore the possibility of integrating the pedestrian navigation system with existing urban infrastructure, such as smart street lighting networks or intelligent transportation systems.