

Faculty of Engineering

Department Of Electronic Engineering

Project Proposal

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| **Name** | Francois Mavunila |
| **Student Number** | N0172507W |
| **Project Title** | Taxi safety and robbery prevention system |
| **Supervisor** | Mr. B. Dlodlo |

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# INTRODUCTION

Taxis are of use in our day to day lives, they help carry people from one place to another especially in areas which are not in the route of Kombis and Buses, but there has been a concern with the rise of taxi related robberies in the country. Both passengers and drivers fall victim of such incidents and it has been noted that usually the robbers use the same vehicle to rob different people in different places of the city and the police find it difficult to trace the robbers and in some cases the victims are found dead and dumped after some days of efforts in trying to find them. Most of these robberies happen at night where the victim cannot identify the robbers and the vehicle plate number and hence investigations become difficult and the same robbers usually victimize a number of people before they are actually caught.

The taxi safety and robbery prevention system reduces taxi related robberies by keeping track of all the authorized taxi driver’s activities as well as the activities of the passengers. The system keeps track of information such as which taxi the passenger took, the time the trip started, the driver’s details, the time the passenger and the driver separate and the destination. The passengers use their figure print as a way of information capture and both the passenger and the driver are presented with a panic button in case of any unusual activity in the taxi. With the current technology it is possible to have the system installed in all authorized taxis and they will be communicating to the server and updating the database with the relevant information in real time. Such a system would prevent the passengers from boarding a taxi that is not authorized, reduce robbery of passengers by taxi drivers and also robbery of taxi drivers by passengers as both the identity of the drivers and his/her passengers is known. Since the database will be kept and monitored by the Registrar general, investigations will be made easy in case of any robbery or misunderstanding.

# BACKGROUND

At least 3 499 people were kidnapped and robbed by pirate taxi drivers countrywide in the first half of this year, while 284 others fell prey to armed robbers. The situation is more critical in Harare where at least 1 200 cases of kidnap and robbery by pirate taxi drivers were recorded in the past four months alone, with most of the victims being offered lifts in and around the city [1]. The situation is expected to rise during rainy season as people would be desperately looking for transport and it affects mainly the big cities.

Currently the Central Vehicle Registration (CRV) is responsible for registration of vehicles in Zimbabwe and keeps track on driver’s license, vehicle registration number and some information on the medical conditions of drivers [2]. The system does not provide a way of tracking taxi information and does not provide any help when it comes to investigating taxi related robberies.

There are a number of mobility as a service providers around the world, Uber is one of the giants when it comes to taxi services and they have added a number of security measures to their system after a number of robberies were reported related to their taxis [3]. Uber added a feature that enables riders to send a text message to local authorities with one tap that automatically populates trip details such as the make, model and license plate of their driver's car and their location information at the time they send the text, along with the option to type their emergency [4]. The challenge with such a system is that the passenger has to have their mobile phone all the time, which is not the case in Zimbabwe. Most people in Zimbabwe cannot adapt to such a system because a number of them don’t have mobile phones, those who have them might not be having power at that time and also the robbers might first of all take your phone before you get time to report.

Another feature is called Verify your Ride will give passengers a four-digit PIN to verbally provide to the driver before entering a vehicle. When their driver arrives, the PIN will pop up in the app, and the rider can read it to the driver. The driver will enter the PIN into their app. If it's correct, the rider will get a confirmation on their app, and the trip can begin [4]. This system is a good way of providing the right taxi for the customer, but in a situation where the driver’s phone is stolen, someone might pretend to be the driver and kidnap the customers.

Real-time driver ID checks is a system that ask drivers to submit a selfie periodically to confirm their identity, using [Microsoft](https://www.cnet.com/tags/microsoft/) technology to compare the selfie to their profile photo [4]. The technology is much helpful in identifying the driver, but if the robbers take the driver’s mobile device first and forcefully take selfies of the driver , then such a system will be no longer be helpful.

# AIM AND OBJECTIVES

## Aim

To develop a system that keeps track of the identity of the passengers and the taxi drivers during a trip by recording and uploading the driver’s identity and every passenger’s identity, the time the driver and the passenger were together and the time the driver and the passenger went separate, to the General Registrar database.

## Objectives

* To establish the development a system to register the taxi driver’s vehicle registration number, address, Name, Id number, Driver’s License number and the finger print to a database.
* To read the passenger and drivers identity using a figure print scanner
* To send the finger print Ids to a remote server for processing and storage in the database.
* To develop a program that checks whether the driver is registered and authorized.
* To develop a system that checks that the passengers are in the taxi using weight sensor and give the number of passengers.
* To register passenger’s fingerprint upon arrival at their destination and send to the server for processing.
* To develop a web app for the authorities to monitor the activities of the taxis.
* To develop a web app that can track a taxi’s location in case of a robbery.

# JUSTIFICATION

Zimbabwe has seen a rise in the number of taxi-based robberies in the past years and in some cases the passengers have been robbed by drivers and while in other cases robbers are the passengers and drivers are robbed of their cars and even killed in some cases. The Taxi safety and robbery prevention system is well suited for reducing the occurrence of such incidences. If the robbers, whether the driver or the passengers, are aware that their identity at that particular time is known to the police they would not possibly take the risk of a robbery and in case they try to, the system would be designed to have a panic button that will send an alert message to the police and start real time tracking of the vehicle’s location.

The system is well suited for developing countries like Zimbabwe as most people do not adapt well to the use of mobility as a service providers, some do not have mobile devices and the system doesn’t need the use of a mobile device.

The system has an advantage when it comes to police investigations in case of a robbery as there is enough information in the database for the investigation. The system also has an advantage in that it will be managed by the authorities and not by the different taxi association groups or mobility service providers which might cause a threat to the user’s information.

Apart from the driver and passenger’s safety, the authorities may use such a system to monitor violation of laws such as vehicle overloading and also the information gathered can be used for statistics purposes in the transport sector.

# METHODOLOGY

## System design

### System Users

The system will have 3 types of users:

* The drivers
* The Passengers
* The authorities (The registrar and police officers)

### System design plan (overview)

DRIVER REGISTRATION SYSTEM

TAXI-RIDE AUTHENTICATION SYSTEM 1

GENERAL REGISTRAR SERVER AND DATABASE

COMMUNICATION SYSTEM

TAXI-RIDE AUTHENTICATION SYSTEM 2

TAXI-RIDE AUTHENTICATION SYSTEM N

REGISTRAR GRAPHIC USER INTERFACE

(WEB APP)

ROBBERY

ALERT SYSTEM

*Fig1-overvveiw of the system design*

Figure 1 above shows the overview of the whole system, the system will be divided into several subsystems that will be communicating through the internet (IoT). The design of the subsystems will be as follows.

### The taxi-ride authentication system

This subsystem will consist of finger print sensors as input devices to be used when capturing driver and passenger information, the weight sensors to check the presence of passengers in the car, a raspberry pi board for processing information.

### Driver registration system

This subsystem will be implemented using a finger print scanner, an esp32 microcontroller board with internet connectivity. The system will be connected to the web app for registration and the information sent to the database.

### General registrar server and database

This will be the main part of the system, it will be implemented using node.js, express for backend and a mongo dB for the database. The front end of the administration site will be implemented using react.js. The system will be responsible for processing all the information, searching the database and running authentication and location algorithms.

### Registrar graphic user interface (web app)

This will be the web application that the authorities will use anytime they want to monitor or search the database for particular information. The GUI will consist of a login system and a dashboard with different analytics visuals. The system will be designed using React.js.

### Robbery alert system

This system will be responsible for raising an alert through the web app.

### Communication system

Wi-Fi will be used as the main means of communication.

## Implementation and Testing

The design will be implemented using laboratory prototyping equipment, and the testing is expected to be done in the laboratory.

# TIMELINE AND BUDGET

This section outlines the time constraint and an approximation of the budget required to successfully build the proposed system.

Table 1-estimated timeline for the project

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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| Activity | 2021 | | | | | | | | 2022 | | | | | | | | | | | | | | | | | | | | | | | |
|  | Nov | | | | Dec | | | | January | | | | Feb | | | | March | | | | April | | | | May | | | | June | | | |
| Research |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Driver Registration |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Taxi-ride authentication |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Server and data base |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Registrar GUI |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Robbery alert system |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Integration |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| testing |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

The budget for the project depends on the hardware components required and the table below shows an estimate of the budget in United States dollars.

Table 2-budget estimate for the project

|  |  |  |
| --- | --- | --- |
| **Component** | **Quantity** | **Price** |
| Raspberry Pi 3 B | 1 | $60 |
| Esp32 board | 1 | $10 |
| Finger print scanner | 2 | $20 |
| Pressure sensor | 2 | $20 |
| LCD | 1 | $5 |
| **Total Cost** |  | **$115** |

# REFERENCES

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| --- | --- |
| [1] | AllAfrica, "allafrica.com," All Africa, [Online]. Available: https://allafrica.com/stories/201311050080.html. [Accessed 10 November 2021]. |
| [2] | "transcom.gov.zw," transcom.gov.zw, [Online]. Available: http://www.transcom.gov.zw/?page\_id=374. [Accessed 10 November 2021]. |
| [3] | "uber.com," uber, [Online]. Available: https://www.uber.com/br/en/ride/safety/rider-safety-features/. [Accessed 10 november 2021]. |
| [4] | C. Net, "cnet.com," C Net, [Online]. Available: https://www.cnet.com/tech/mobile/how-ubers-new-safety-features-want-to-fight-murders-kidnappings-and-other-horrible-things/. [Accessed 10 11 2021]. |