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Sustainable Future with the Development of a Secure Mini-bus Taxi Pick-up System for Children going to and coming from Schools

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Abstract: Todays children are the future of any society. Ensuring their future sustainability is very critical especially these days when their trips going to school and coming from school has become dangerous due to insecure taxis used for transport. The taxi business coupled with increased population has brought up various security issues. A particular group of taxi clients that is more susceptible is children in need of taxi to and from schools. Children's safety has been reported as a concern in South Africa, children frequently go missing leaving parents devastated. It has been reported in other studies that public transportation is not safe in South Africa especially in urban areas. Various methods have been conducted in an effort to ensure that children are safe when using taxis and taxi applications, however, the methods can tend to be inadequate as the children still go missing. In this research paper, an application is developed that will improve children's safety when using the taxi application systems. The Design Science research method has been adopted in this research and various data collection methods have been used. Furthermore, it details the business, functional and non-functional requirements. The proposed application will include the biometric technology to improve safety of children as it is known that the safety of women and children in South Africa is a huge concern. The application is implemented in the mobile app and the desktop app which allows the child and the driver to scan their fingers in departure and destination. The steps towards evaluation of the system by a group of participants are also highlighted. The the change to the use of the system leading to possible safer environment for future generation in the course of gaining education is a step in the right direction working towards a sustainable future.

Keywords: mini-bus taxis, school children, single passenger taxi, biometrics, design science systems

Introduction

This study presents the development of a Secure Mini-bus Taxi Pick-up system for children going to and coming from schools. This is vital in order to ensure a safe environment for future generation in the course of gaining education thereby working towards a sustainable future. This is a desirable state for any society as today's children are the future of any society. Ensuring their future sustainability is very critical especially these days when their trips going to school and coming from school has become dangerous due to insecure taxis used for transport. The taxi business coupled with increased population has brought up various security issues. A particular group of taxi clients that is more susceptible is children in need of taxi to and from schools. Children's safety has been reported as a concern in South Africa as children frequently go missing leaving parents devastated. How can we have a sustainable development if future generations frequently go missing? Brown (2017) explains that sustainable development (SD) is defined as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs". In this regard, we therefore need of efforts to counter the situation of future generations frequently going missing so as to avoid compromising the ability of future generations to meet their own needs. One of such efforts involves the use of Information Systems development to solve the problem of security of children security during their transportation to and from schools.

Background of the research problem

Taxis are an important constituent of the public transport system in an economy, and their importance in providing comfortable and flexible services to customers cannot be ruled out. The point-to-point demanded services could be provided to individuals or groups around the clock in lieu of an agreed fare. The importance and need of taxis complement and compete with other forms of traditional transport and create job opportunities in any economy. Irrespective of the nature of the economy of any nation, the taxi industry is quite visible, which can be a single-passenger taxi market or a shared taxi market on fixed and/or flexible routes. Single passenger taxis are more preferred in markets having less-demand and established in rural areas having a low population, where the main motive of customers is to reach business centres or areas of interest from dispersed residence. On the other hand, shared taxis are more popular in urban areas having highly dense population. The traditional global taxi market is being owned by independent owners in many developed and emerging economies. Sensing the potential, many large companies have now entered into the taxi business and are generating good profits (Makhmoor Bashir et al., 2016).

Many companies now into the taxi business coupled with increased population have brought up various security issues. One is the theft and non-payment of tax due to the cash-based income generation. Since over one hundred and fifty years ago, cash was used for almost everything: for retail purchases, bill payments, employee disbursements, large value business transactions, and interbank settlement (Humphrey et al, 2004). The way we have been paying for things has changed over the past few years. The fourth industrial revolution has brought about a lot of opportunities for seamless payment methods that bring a lot of benefits and convenience. The decline in cash as a medium of exchange has been a significant development in the evolution of money. Banking services, standing orders, direct debits, cheques, electronic transfers, debit and credit cards have all allowed people to purchase goods and services without the need for cash (Warner, 2014).

We are in the era of ubiquitous computing with a lot of wireless connected technological devices that aim to serve all several types of communication requirements. The increasing application of wireless technologies, of which mobile phones are just one example, has also provided banks with the opportunity to provide their services anytime and anywhere (Birch, 1999; Rahmati, 2004).

While various industries and even some parts of the taxi system have moved into these cashless systems, the majority of the taxi systems in developing countries are still swarming in this cash-based systems. Thus, apart from the non-payment of tax due to the cash-based income generation, one other issue is the susceptibility to crime such as robbery. These days, that has progressed into kidnapping which can be for the purpose of robbery or even for more sinister crimes like extortion or ransom payments, rape, prostitution and even terrorism. A particular group of taxi clients that is more susceptible is children in need of taxi to and from schools.

In south Africa, it has been reported that a child goes missing every 5 hours and 1.2 million children are trafficked every year in the country and only 77 percent of missing children are located, but regrettably, 23 percent are not according to Missing Children South Africa (MCSA) and (Omega 2018). Some of these cases that are reported are children missing coming back from school resulting in being picked up by a stranger or being hijacked on their way from school. There was a kidnapping case that was reported in the year 2021 of the 4 children from the same family who were under the age of 18 and were hijacked and kidnapped on their way to school. The intruders took the children and left the car and the driver (Nefdt 2021), which appears that the children are a target in South Africa for intruders who want to make money from the children's parents.

The pick up/taxi apps that are currently being utilized in South Africa are Snapp cap, Zappa cab, Uber, Bolt, DiDi, InDriver, Taxi Live and Scoop a Cab (Gitonga 2022). These taxi apps are mainly made for adults as they operate by receiving a request with a location and the driver will come and pick up the requestor and drive to the destination unsupervised. Thus, we cannot utilize them for children especially if they are unsupervised. However though, some taxi applications like Taxi Live and Scoop a Cab, are equipped with an emergency button in case of emergency (Gitonga 2022).

According to Dastbaz (2013), "Biometric technologies relate to the use of technology to identify a person based on a biological characteristic. Fingerprint recognition is one of the first and most well-known biometric technology that has been lumped together under the umbrella of digital forensics. It has been used by most companies as it is the most authentic way to uniquely identify an individual". This research focuses on implementing a taxi application that is meant for children under the age of 18, as children at this age are still considered as individuals who need guidance from their parents when making decisions. This proposed method incorporates the biometrics technology which will require the child to scan their index finger on the fingerprint scanner on their pickup and drop off locations and then

the driver to also scan their index finger to validate their identity, which will then send an update to the parent that the child has indeed been picked up and dropped at the correct destination. This will reduce anxiety for parents as they will be assured that their children are travelling safely, and they will be able to monitor them on their trip.

The main research question then is: How can we develop a Secure mini-bus taxi Pick-up System for children that uses biometrics technology on a single passenger taxi market on fixed routes to improve safe transportation of children in South Africa?

The sub research questions are: What are the current existing taxi app systems in South Africa? How safe are the current taxi app systems in South Africa? What are the requirements for developing a taxi app system? How can a taxi app system be developed and designed that uses biometrics technology to improve children's safety? How can the taxi app system be evaluated?

A further significance of this proposed system can be easily identified. The taxi industry can as well take advantage of this by introducing a cashless payment method using IoT and mobile devices as the key device featured in the approach as it already consist of a lot of readily available peripherals like security using biometric sensors, phase recognition, motion sensors and other useful built in features.

Literature Review

Introduction

The goal of this research paper is to develop a taxi application system that will be much safer for children to use in South Africa since they are unsupervised. This section will be outlining the literature review, Literature reviews are a standard element of all dissertations, regardless of subject or discipline. They serve as a foundation for all other types of study or academic activity. They are, however, frequently neglected as a type of qualitative analysis. However, the steps in constructing an argument from a body of literature are comparable to those in analyzing qualitative evidence. On this section we'll be discussing the work that was presented by other authors, similar to this research paper. This section will consist of four sub-sections which will be: Tracking devices for children in section 2.2, Safe school transportation (Anwaar Al-Lawati 2012) in section 2.3, Safe way to school in section 2.4, The current existing taxi applications (which will consist of four subsections) in section 2.5, ending with conclusion in section 2.6.

Tracking devices for children

Commercial systems for tracking children exist, such as Bluetooth-based tracking devices designed to be worn as a bracelet or necklace by children (Al-Lawati et al. 2015). These devices can be connected to a mobile application in this type of tracking and can alert parents if their child leaves a range that they specified. The device will send a notification to the parent if the child walks outside of this range. In addition, the application uses a geographical map to send the child's location. One drawback of this type of software is that it only works in a limited range of which the parent will not be able to track their child if they go outside of the specified range(Al-Lawati et al. 2015). Which provide additional job for the parent to be always on the lookout for their children that they do not go out of the specified range. Another device was presented for tracking children with the use of a child module that sends tracking data to a database and a mobile device. The system's drawbacks include the possibility that the module will be inconvenient for youngsters and the high cost of wide-scale deployment (Al-Lawati et al. 2015).

Safe School transportation is a system designed and developed by Al-Lawati et. al (2015). This paper describes a system for monitoring children's daily bus pickup and drop-off in order to improve the overall safety of daily bus transportation to and from school. The technology is designed to automatically sense when a child gets in or exits the school bus and send an alert message when a child does not board or exit the bus, alleviating parents' anxieties about their children being lost or forgotten while riding the bus.

The system was divided into two parts: a bus system and a school system. The system detects when a youngster boards or exits the bus via the bus unit. The information is sent to the school district, which determines which students did not get in or exit the school bus and sends out a notification. A web-based database-driven application manages the system and provides important information on the children to authorized workers. After that, a prototype of the proposed system was developed and tested to ensure that it worked properly (Al-Lawati et al. 2015).

Some of the requirements of the system that they presented are as follows:

- The technology should be able to identify each child and detect when they board or exit the bus.
- A database should be included in the system to store student data.

- Reconfiguring the system should be simple.
- Communication must be dependable.

Safe way 2 school is another relevant related study. The project named “SAFEWAY2SCHOOL” was available through the “VRU (Vulnerable Road Users) application” for students (9-16 years old) and the "Parents' Application" for parents. Their two applications were created utilizing the same technology, but with different HMI (Human Machine Interface) look and feel concepts and functionalities, so that each one matches the needs and expectations of the user group to which it is directed (Kostas Kalogirou, 2012; Gitonga, 2022).

The VRU program is opened on a mobile phone and uses push message services, which is a type of internet-based communication in which the SAFEWAY2SCHOOL server initiates the request for a specified message, which might alert the child about updated information, such as schedules and route changes (Kostas Kalogirou 2012). The VRU application is a smartphone application that was created to help youngsters with their school transportation. The VRU program runs on a generic mobile phone and acts as a communication node between the child and the SAFEWAY2SCHOOL system, providing the relevant information to both the children and the system. The youngster can utilize the VRU program to find out about the state of the buses, routes, and timetables, as well as his or her own location. They also presented different types of requirements which are Functional, Non-Functional and Business requirements.

The current existing taxi applications

The below is the literature about the current existing taxi applications in South Africa:

Uber and Taxify (Bolt)

Uber has been operating in South Africa since September 2013, and has over 4000 Uber drivers, and the vast majority, 2500 are in Gauteng according to Munshi (2016). Henama and Sifolo (2017) indicates that “Since launching in South Africa in August 2013, Uber has created 2000 jobs for drivers, mainly in disadvantaged communities”. Uber operates in the South African cities of Johannesburg, Cape Town, Durban, and Port Elizabeth according to Djsbubreakfastshow (2015). Henama and Sifolo (2017) observes that it has not yet been established in the rural areas as it is more expensive compared to the taxis and the rural areas are not busy as the urban areas. Taxify was also developed and operates exactly like Uber. They also have similar fare price, it operates in urban areas as well.

However, it was reported that a woman was attacked and raped on 16 June 2016 after getting into what she thought was an Uber taxi in Fourways. A case was opened for rape, robbery and kidnapping (Henama and Sifolo 2017). Another incident took place in Johannesburg nightclub called Movida where clients were attacked after requesting a ride home. It was reported that the female client was client was assaulted and the male client was stabbed according to News24.com (Henama and Sifolo 2017).

Some Uber Vehicles have been reported to be stolen and some of them were recovered in Durban. The Suspects were arrested after it was found that one of them also committed a murder case in Westville. The cases in Sandton have also been reported of which Uber had to suspend their operation with the concern of safety (Henama and Sifolo 2017).

DiDi

According to Robin Class, DiDi app is the world’s leading mobility platform which was launched in March 2021. The app has some safety features such as facial recognition for drivers, SOS button for riders and drivers linked to the local police station. However, that does not yet still guarantee the safety of children (Chaudhry, El-Amine, and Shakshuki 2018). Didi Chixung, a Chinese ride-hailing behemoth, announced that it will be ceasing operations in South Africa. South Africa was also plagued by its third COVID wave two months after DiDi's introduction, prompting yet another shutdown as the country recorded roughly 12,000 infections per day. An incident that disrupted transportation and ride bookings (Adeyemi 2022).

InDriver

InDriver was founded in 2013 by "Asern Tomsky" who first released the app in Russia. "It has proven adaptive and successful in numerous areas", says Lerato More, a spokesperson for the South African government. According to Mavundza (2019), the InDriver app clients can negotiate fares with metered taxi drivers and the driver can either accept or reject the offer. The application takes a long time to use as you still must compare and negotiate prices with the drivers. You should have a basic understanding of what a fair cost is. The focus of this software is the opportunity

to negotiate fares with various drivers which can help one to save money. However, this application system still leaves safety for children as a concern.

Orange cabs

Orange Cabs has expanded from a three-vehicle operation to a full-fledged metered taxi service with various passenger vehicles since its debut in 2012. They provide a variety of services to customers, ranging from single-trip rides to meetings and malls to rides for groups of up to eight people. Because every ride with Orange Cabs is protected by Public Liability Insurance, you can sit back, relax, and enjoy the ride. Orange Cabs is a dependable metered taxi service that provides rides in and around Gauteng. The service is safe and dependable, and you may book your transport via their mobile app, desktop, or by just calling them. They operate daily only in Gauteng province (Johannesburg and Pretoria).

Concluding the literature review

Some states are suing ride-sharing companies because they believe that all drivers should be subjected to uniform criminal background checks, which would make the process more transparent. Furthermore, it is expected that individuals and cities should retain control over how they vet their drivers in order to protect the safety of their communities. For the sake of public safety, unified fingerprinting is required (Chaudhry, El-Amine & Shakshuki 2018). The above statement underscores the uniqueness of this study despite previous related studies. In this paper, we discuss the taxi application that will assist parents to track their children wherever they are when using these kinds of transports. Parents will not have to be anxious about the safety of their children as they will be able to see it on the app when their children get dropped off at the requested destination. Therefore, while some previous studies presented in the literature are similar to this research paper as they are all about the taxi transportation app, however, the implementation of a fingerprint scanner is what makes this research uniquely different from others and with specific focus on transporting children to wherever they want to go not for school only. The next section discusses in detail the methodology that is used in this research paper.

Literature Review

Introduction

The procedures and methods used to achieve the objectives of a study are referred to as research methodology (Chetty 2018). It's a methodical, logical approach to solving a research challenge. A technique describes how a study is approached in order to get reliable, legitimate results that meet the researcher's goals and objectives.

The design science research methodology (DSRM) is used as it emphasizes the design and building of applicable artefacts, such as systems, applications, methodologies, and others that may contribute to the efficacy of information systems in organizations (Peffers et al. 2007). Its distinguishing features provide credence as the foundation for a possible DSR genre. It accommodates the design of practically usable artefacts due to its concentration on artefact development. It is open to a wide range of procedures and may be the least concerned with rigor in the design process. It also does not need that a design be founded on formal theory, such as literature, or that artefact evaluation be part of the design process (Peffers, Tuunanen & Niehaves, 2018).

DSR has proven to be an effective tool for discovering innovative solutions to complicated problems. The nature of addressing a complicated problem, according to Genemo, Miah, and McAndrew (2016), is searching for an action or collection of activities to attain the desired aim. These authors agree on the importance of identifying, gaining, and applying knowledge to solve an issue. New data and information are extracted from results in the phenomena being examined, domain expertise, existing literatures, and specialists in domains to obtain knowledge (Genemo, Miah, and McAndrew 2016).

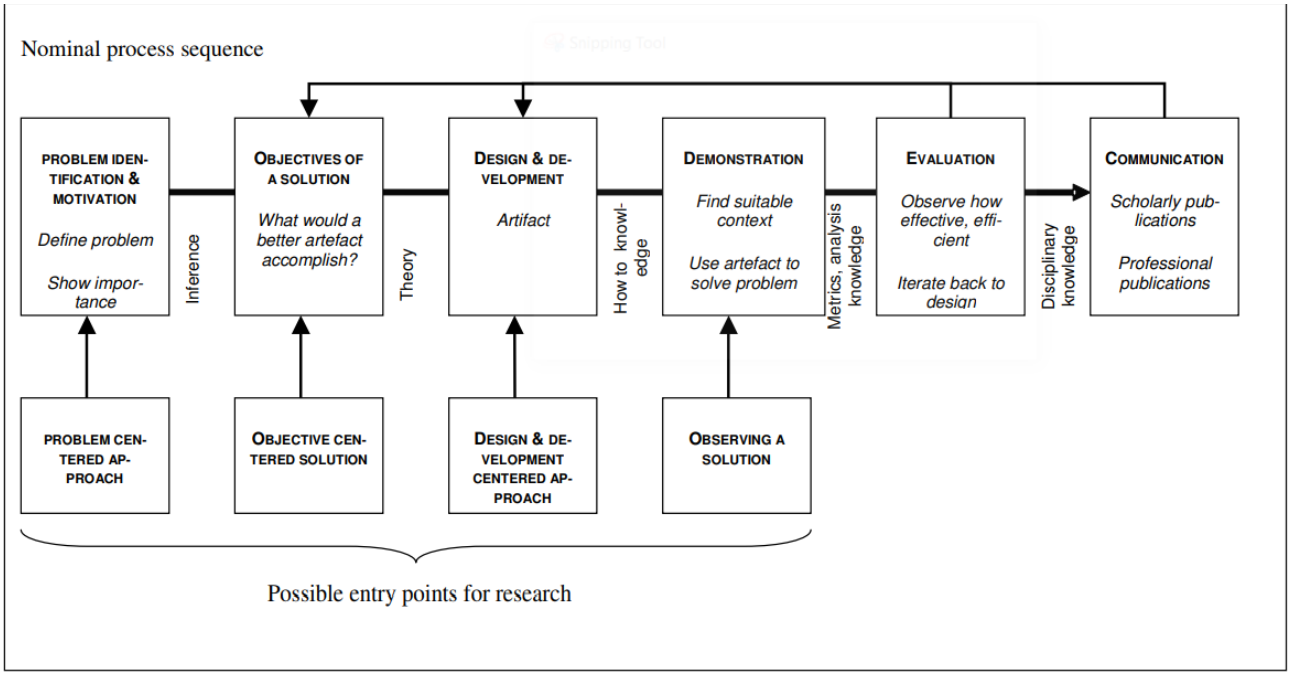
The DSR methodology has many advantages, and it is used mostly in computer science studies. The below are advantages according to Oates (2006) as well as (Engelbrecht 2016):

- The output of the research is something that is tangible.
- It is suitable for people with technical background.
- It is a suitable approach in the field of computer science.
- There are many opportunities to contribute to the body of knowledge through the building of artifacts.

The relevance of DSRM to this research paper

The Design Science research methodology is used in this paper as it is used mostly on computer science studies, which also involves the designing of an artefact. This methodology is applicable to this paper as it is also involving the design of a taxi application system that is meant for children in order to improve their safety when travelling using these kinds of systems. It further gives a structure on how the research should be carried out as it contains different steps. The processes or steps are encapsulated in detail in figure 1 below. The DSR methodology has been used in other studies related to this study by Engelbrecht (2016) and Ndame (2015). According to Peffers et al. (2007), the design science research process (DSRP) as shown below in figure 1 has six steps: Problem identification and motivation, Objectives of a solution, Design and development, Demonstration, Evaluation and Communication.

Figure 1: Design Science Research process (Peffers et al. 2007)



Design Science Research Processes (DSRP)

Problem Identification and Motivation

The researchers, as well as the research audience, are motivated to accept the research conclusions when the research motive is provided, and it also aids in understanding the researcher's grasp of the problem (Peffers et al. 2007). This step entails defining the specific research challenge and laying the groundwork for justifying the solution's worth. It beneficial to conceptually atomize the problem so that the manufactured solution accurately reflects the problem complexity. The problem and motivation of the study have been identified in the introductory and background subsections.

Objectives of a solution

A set of objectives that the solution must achieve will be drawn from the problem description. The aims can be quantitative, in which case the desired artefact would be better than the current ones, or qualitative, in which case the envisioned artefact is intended to solve a problem that has not been addressed previously. The objective of the study has also been defined in the introductory and background subsections, and in summary, is to develop a taxi application that uses biometrics technology to improve safe transportation of children in South Africa.

Design and development

The artefactual solution is developed during this action. This activity could produce four categories of artefacts: constructions, models, methods, and instantiations. The design and development of the system is discussed in detail in in forthcoming sections, and it also links to the sub research questions. The taxi app system is designed and developed with biometric technology to improve safety of children.

Demonstration

The artefact could be used in experimentation, simulation, a case study, or any other relevant activity as part of this process. Selected participants sample uses the designed tools for the evaluation phase.

Evaluation

The researcher should determine whether the designed artefact solves the identified problem in this task. A comparison must be made between the solution's objectives and the observed results from the demonstration's use of the artefact. We evaluate the taxi application by collecting feedback from end users (Requestors and drivers). This links it back to one of the sub research questions.

Communication

The problem, importance of the study, the artefact, the rigour of its design and its effectiveness should be communicated to technical and non-technical audiences. The communication will be made with the publication of this document.

Data collection methods

During the research, a variety of data collection approaches were used. For data collection in ICT research, a wide range of approaches and procedures are accessible. Quantitative or qualitative procedures could be used. On the one hand, qualitative methods include, but are not limited to, literature reviews, interviews, and observations. Experiments or questionnaires, on the other hand, are examples of quantitative approaches (Olivier, 2009). The data gathering procedures utilized in this investigation are briefly described in this section.

Questionnaires

In research, a questionnaire is a form of data collection procedure. It's an instrument that includes a series of questions for conducting research on a particular topic. It's also known as an interview in written form. The questionnaires is presented to the parents to complete in order to get their opinion on the proposed taxi app to improve children's safety.

Literature review

An extensive review of the literature on taxi applications was undertaken using published books, journals, articles, and google scholar. The purpose was to have a comprehensive understanding of safety when utilizing the taxi applications in order to assess their benefits and drawbacks. Furthermore, the literature review was undertaken to have a better understanding of the problems that taxi app users come across during their rides. In addition, the research led to an assessment of some of the attempted mitigation methods in South Africa. Finally, a literature review was carried out in order to identify some of the prerequisites for developing a taxi app for children.

Prototyping

Prototyping methodology is used in the system development phase mentioned above. This involves the use of suitable programming languages to develop the system. However, given the readership audience of this journal, we would skip the details of the prototyping text.

Concluding the methodology section

This section discusses the research methodology and the data collection methods used in this study. This gives the research a clear structure that is to be followed as all the steps or processes of the design science research methodology needs to be followed. The next chapter will discuss the design and development of a system which is the 3rd activity in the design science research process adopting the prototyping method.

System Analysis, Design and Development

This section outlines the design and development of the taxi application system for children. This is the 3rd step in the process of DSRM. We begin with the requirements analysis and design outline using the Unified Model Language

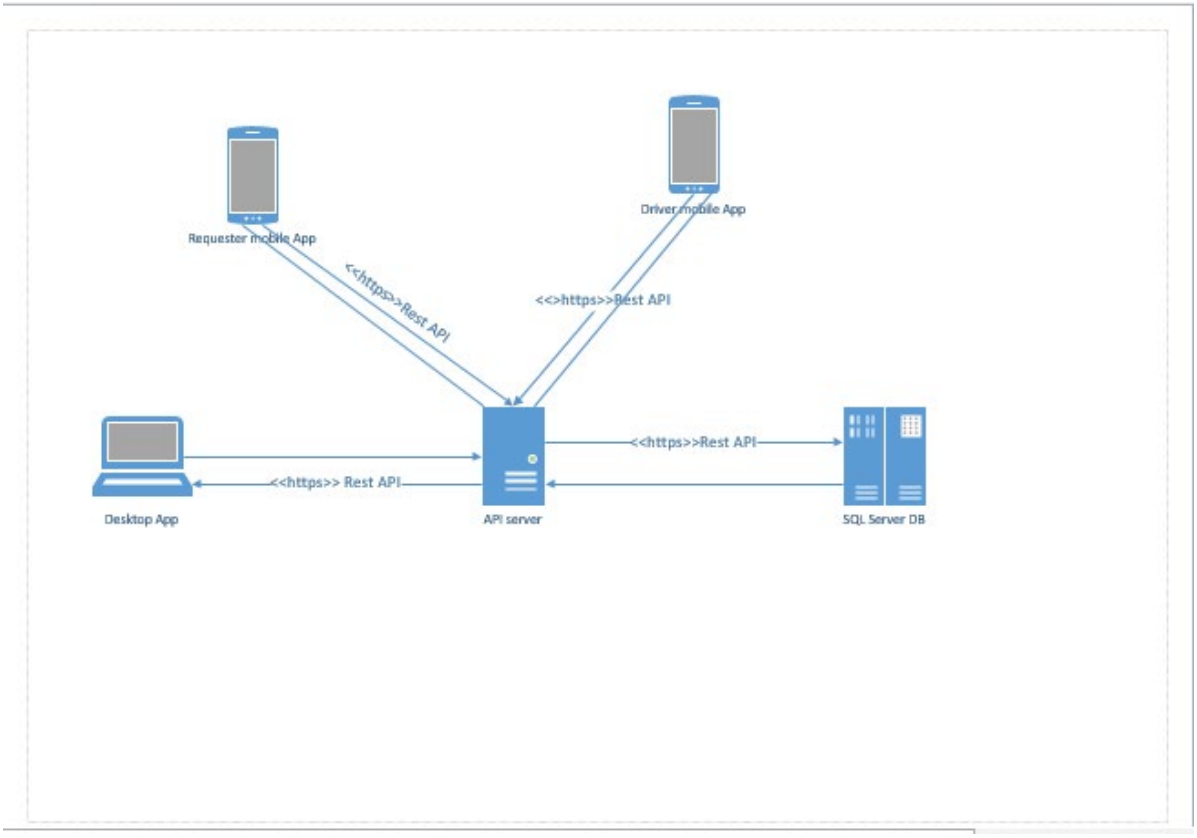
(UML) diagrams and the requirements. Requirements can be defined as the specifications of the attributes that must be stated for a system before it can be designed. The ultimate system requirement is the customer's demand, from which all other requirements and designs flow. Furthermore, requirements are assertions that indicate a system's basic demands in order for it to be valuable and useful. To aid in creating a common understanding of the desirable qualities of a system, requirements might be developed or based on interpretation of other specified criteria (Bahill & Madni 2017).

Requirements of the system

The functional requirements specify the task that the system must complete in order to meet the business requirements. As a result, the functional requirements and the tasks to be completed utilizing the system are linked (Ndame, 2015). Below are the system requirements:

- The system should be able to validate the fingerprints of driver.
- The system should be able to validate the fingerprint of rider.
- The system should be available for rides at any time.
- The system should be able to register children under the age of 19.
- The system should be able to able to identify fingerprint of registered users.
- The system should be able to calculate the trip fare

Figure 2: System Architecture



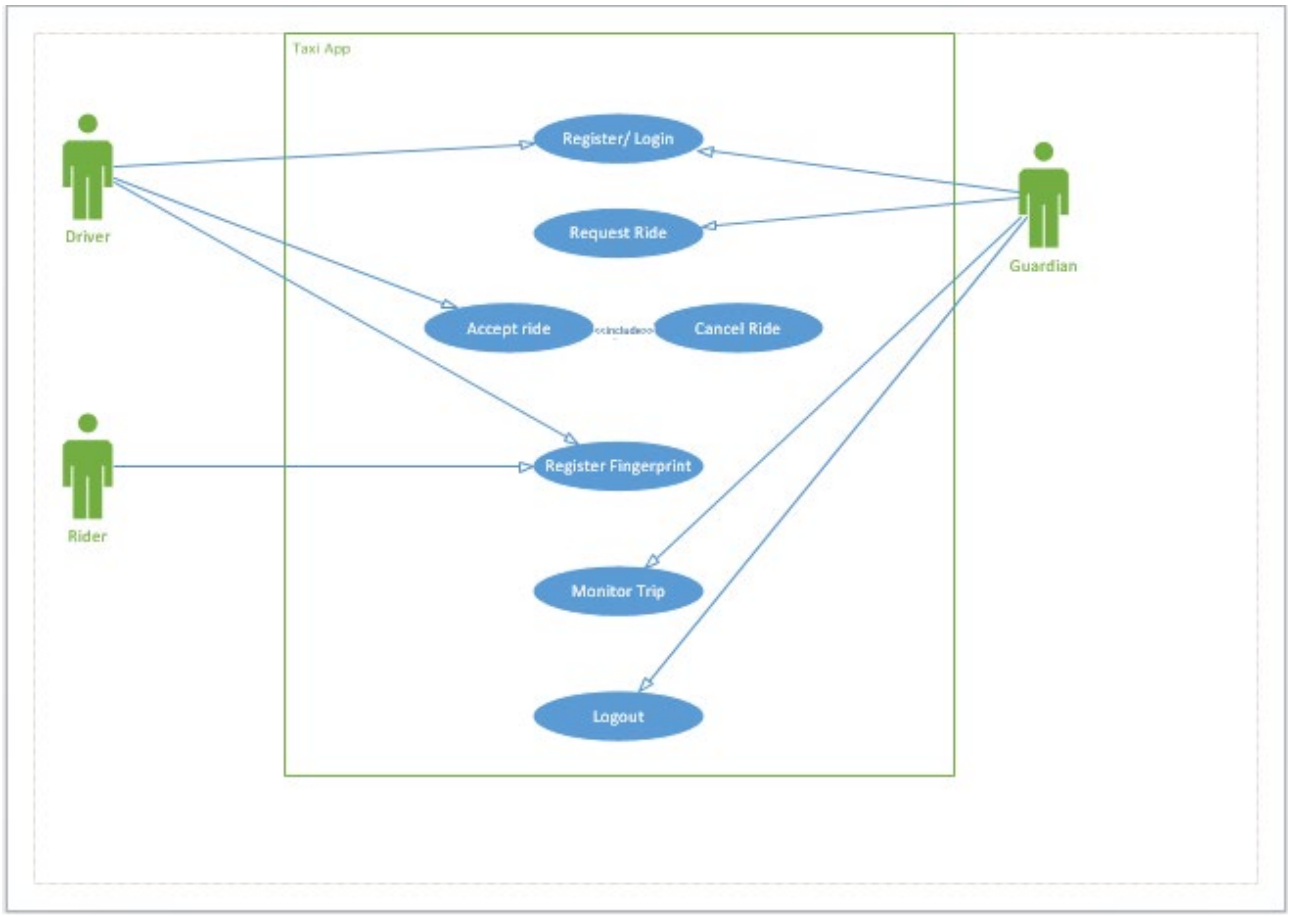
A system architecture for the study is given in figure 2 above. A network diagram is a diagram that shows how a computer or telecommunications network works. It depicts the various components that make up a network, as well as how they interact, such as routers, devices, hubs, and firewalls. The below network diagram in figure 3 shows how the system operates. The users should be able to register using mobile apps and that will go through the API server and be stored on the SQL Server database so that they can be able to login the next time they want to use the app. They can also register using the desktop app. However, in order to register their fingerprints, they will have to use the mobile app as it is more reliable.

User requirements

These are the quality attribute requirements that specify the characteristics of the features that are required for the system to be successful, efficient, and appealing to users (Ndame 2015). Below are the user requirements for the application:

- User/guardian should be able to request a ride at anytime
- User/rider should be able to register and register their fingerprint.
- User/guardian should be able to login.
- User/guardian should be able to cancel the trip.
- Driver should be able to accept and end the trip.
- User/guardian should be able to monitor the trip.

Figure 3: Use Case Diagram



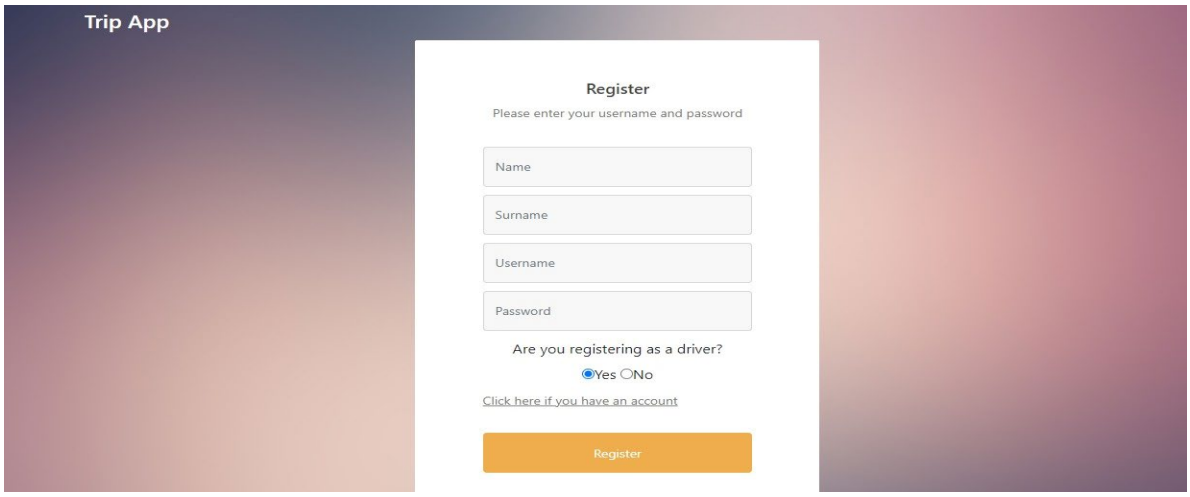
Use cases are an important aspect of UML since they help to tell a coherent story about how a system behaves. They're used to keep track of system needs. They can also be used for communication among multiple players in a software project, such as system developers, prospective users, and, in most cases, system acceptance criteria. Even for persons who are unfamiliar with information technology, use cases appear to be quite simple to comprehend. Use cases help you comprehend the system even if they don't go into too much depth about the implementation (McLeod, 2019). A use case has been used in figure 3 to show the requirements of the users of the system.

System Output Results

This section demonstrates how the system works. It involves the use of the artefact in experimentation. The application system has two applications, the mobile app and the desktop app. The desktop app will serve the purpose of registering both the driver and the parent/guardian, while the mobile app serves the purpose of requesting the trips and fingerprint registration. The below figures 4 – 9 demonstrate how the system functions. The driver and the parent will login to

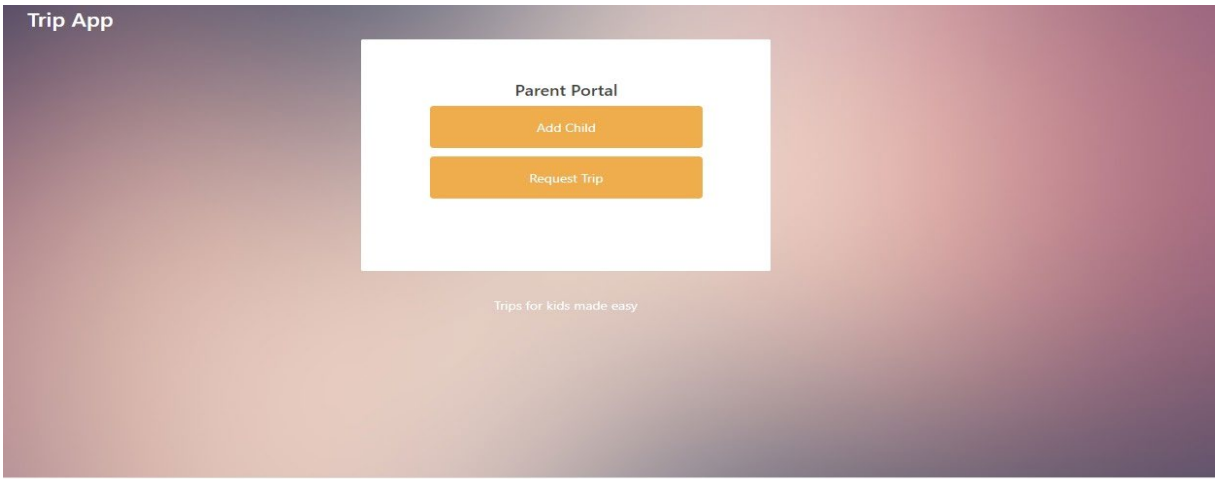
request using their details and if they are not yet registered, they will have to click on the link which will redirect them to the registration page.

Figure 4: Registration Interface



The registration interface is where the user can register their details as a driver or a rider. This gives an option to click further links or if the user is already registered that will redirect to the login screen.

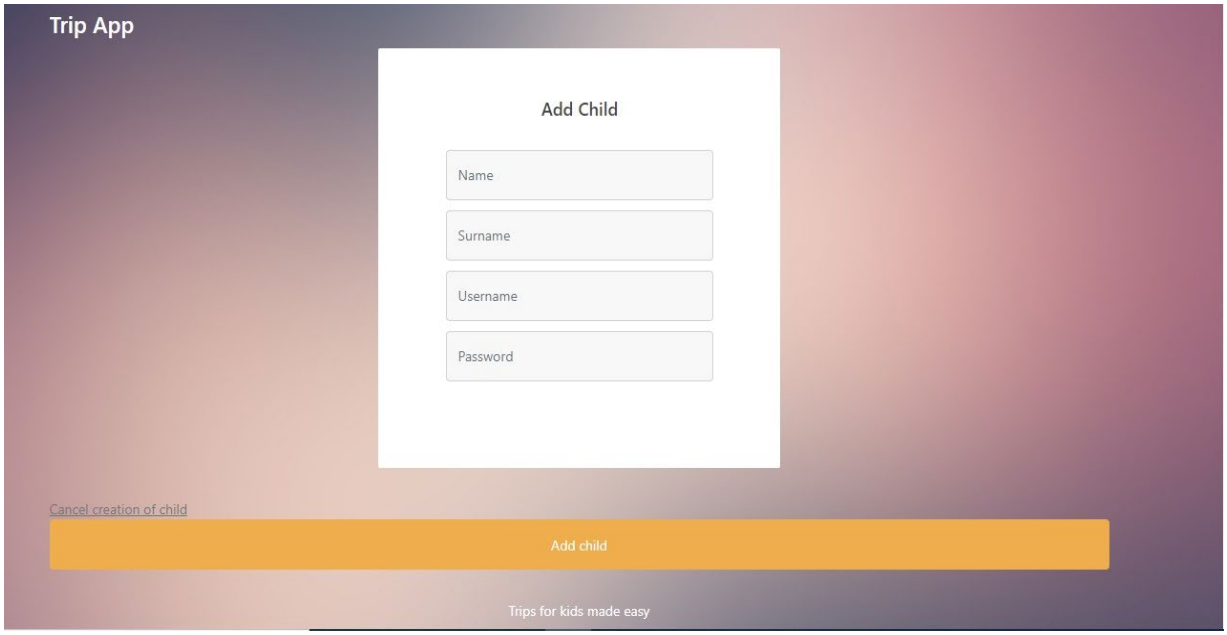
Figure 5: The parent portal



The parent portal in figure 6 is where the parents have an option to add their children and request a trip which will redirect them to registration and request trip page.

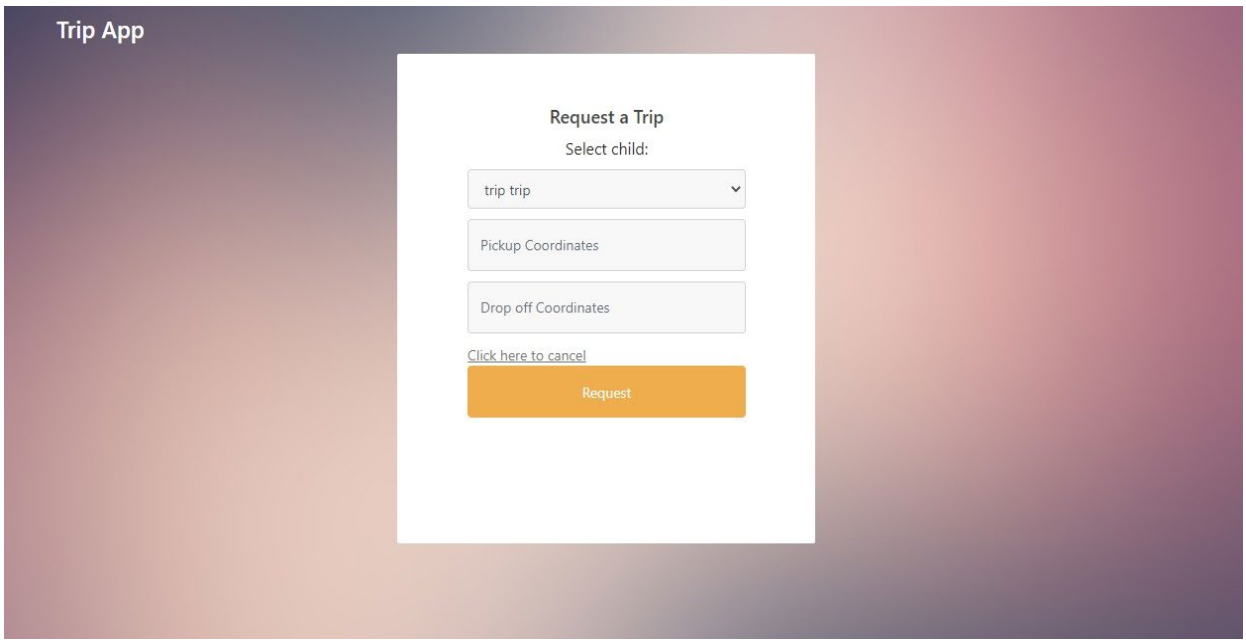
Next page

Figure 6: Child registration



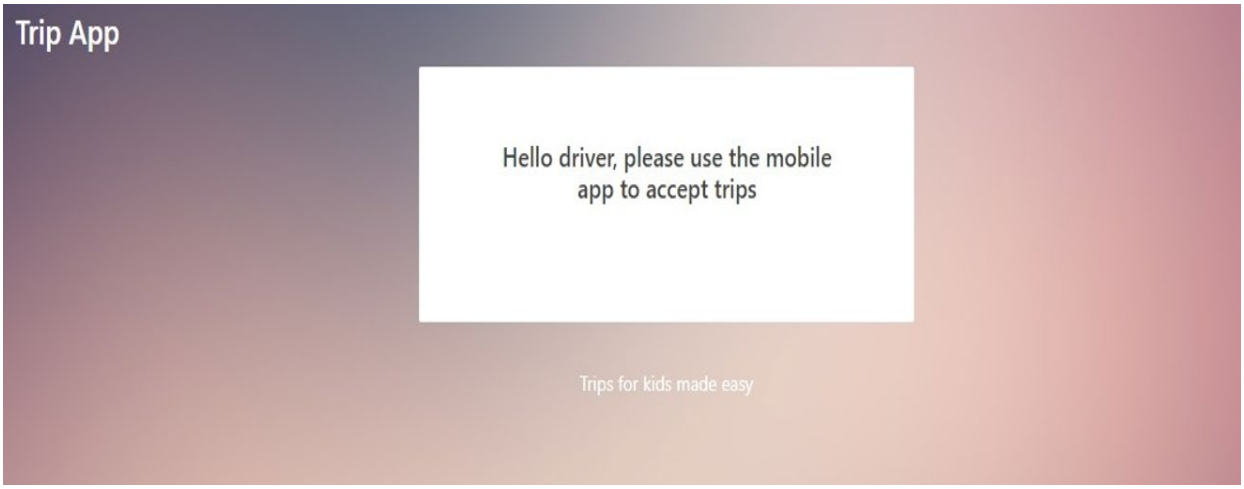
The child registration in figure 7 is the interface in which the parent/ guardian will have to add the details of their child in order for the system to identify the child when they request another trip.

Figure 7: Requesting Trip



In the trip request interface in figure 8, the parent request a trip putting in the pickup coordinates and drop off coordinates, which will go to the nearest driver as a notification for the forthcoming ride.

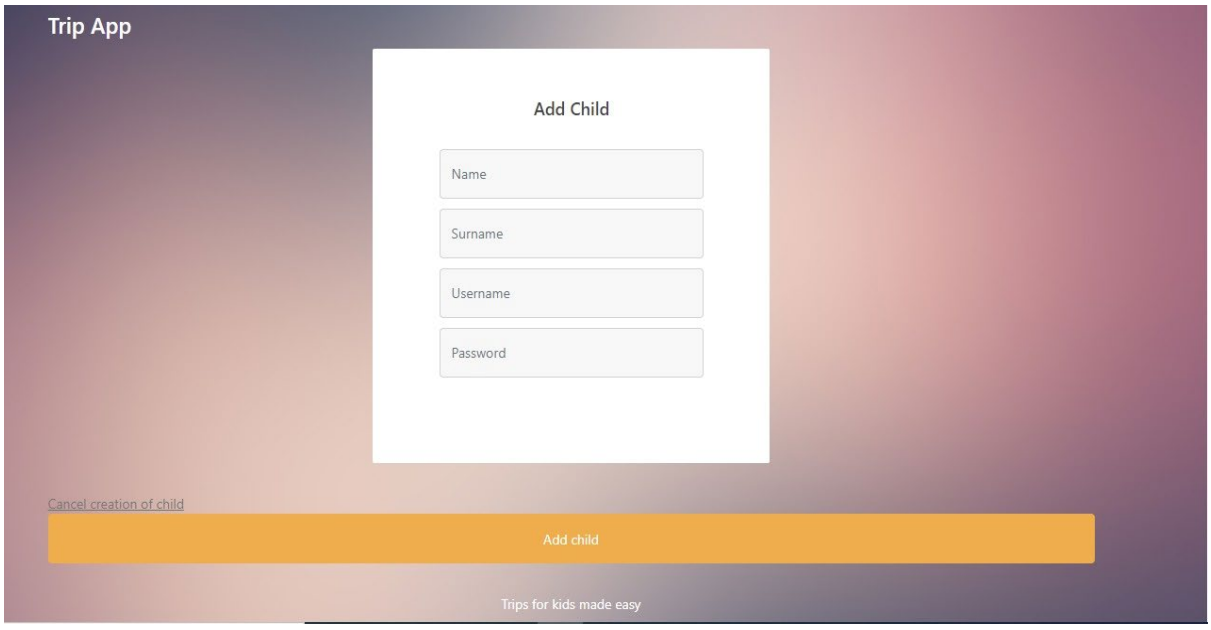
Figure 8: Notification



The notification page in figure 9 enables the option that can be turned on to alert the driver of the incoming trip. Push technology is used in the app's notification feature. The nearest driver will then accept or decline the trip and it will be redirected to the next available driver if it has been declined by the first driver.

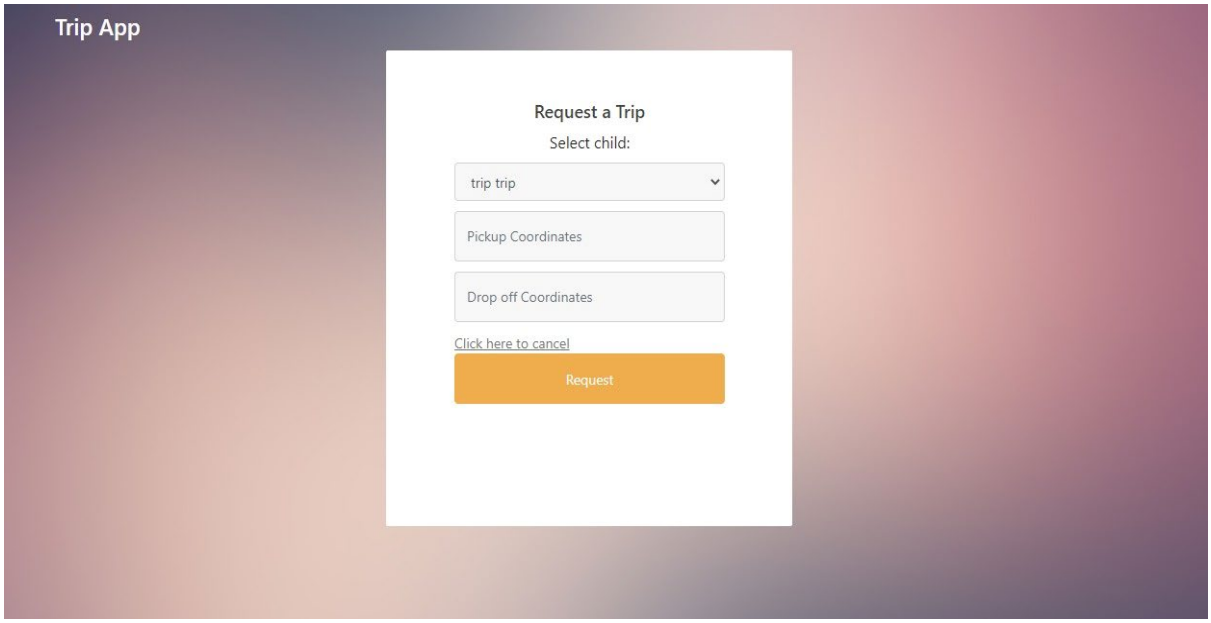
In registering the children in figure 10 below, Click on “Add Child” first to register the child, it will take you to child registration screen and users would have to enter the child’s name, surname, username and password. Thereafter, on can click “Request Trip” if you have already added the child, registering the child to the system.

Figure 10: Adding and registering a child



After entering the Name, Surname, Username and Password for the child and click on “Add child”, one can cancel the registration process if one realise that one have already added the child previously. This is done by clicking on the link “Cancel creation of the child”. Thereafter, with the child registered, one can return to the page for requesting a trip in figure 11 below.

Figure 11: Requesting Trip after adding a child



In this situation, follow the following steps: Click on the drop down to select the child you have added, enter your pickup coordinates, Enter your drop off coordinates and click on "Request" to successfully request a trip. You can click on the link (Click here to cancel) if you do not wish to proceed with requesting a trip. Thereafter, a driver accepts a the trip and receives notification of incoming trip.

Figure 12: Driver accepts a Trip and receives notification of incoming trip

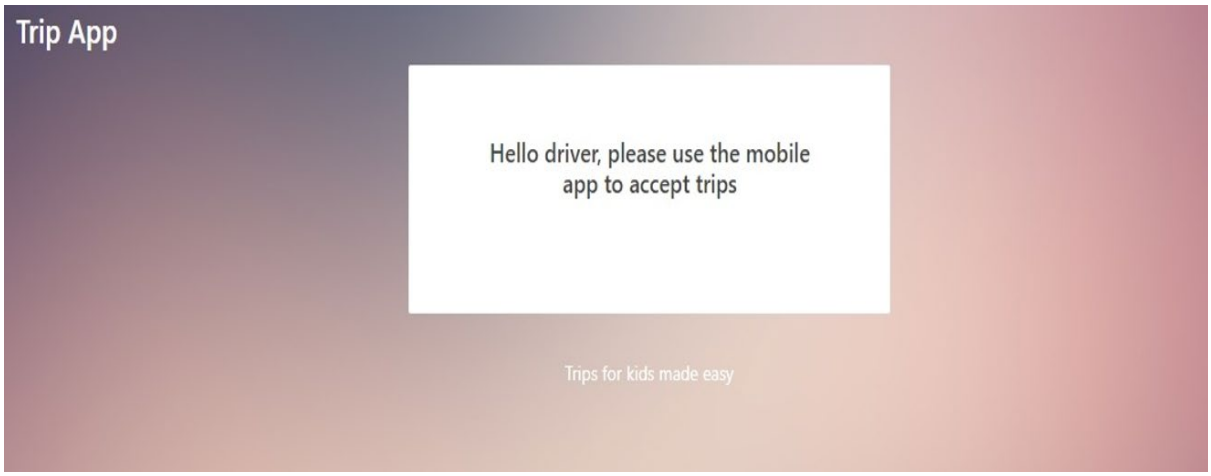
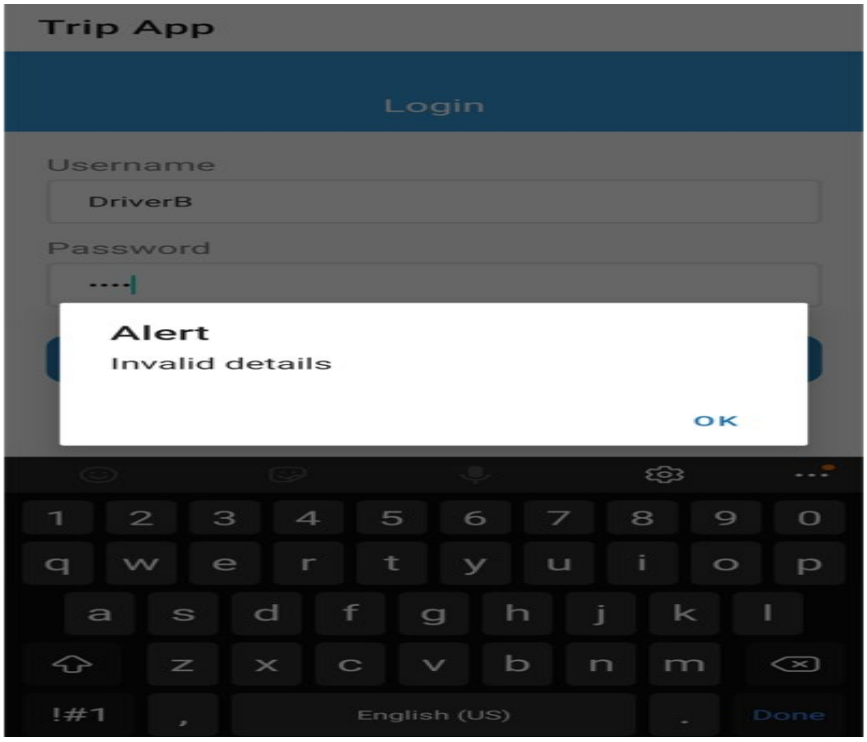


Figure 13: The mobile App



In beginning the trip, the driver logs in on the mobile app in figure 12. An error will be displayed if incorrect details are entered. Thereafter, the driver and child enter fingerprint in order to verify identity and click on the "Start Trip" button in figure 13 below and also click on or select the "Authenticate" radio button.

On reaching the destination, the driver/ child clicks on complete trip. The summary map of the trip is then displayed as shown in figure 14 below when destination is reached. The system also sends necessary information to the parents/guardian of the child to confirm safe arrival.

Figure 14: Clicking the Start Trip" button and also selecting the "Authenticate" radio button

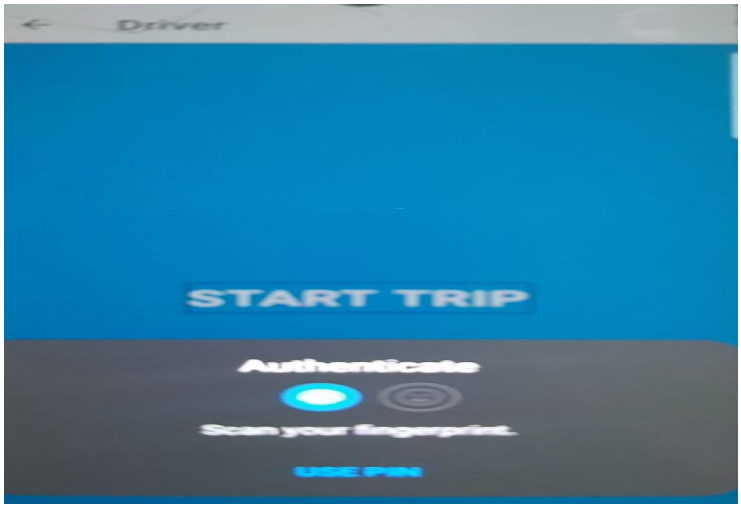
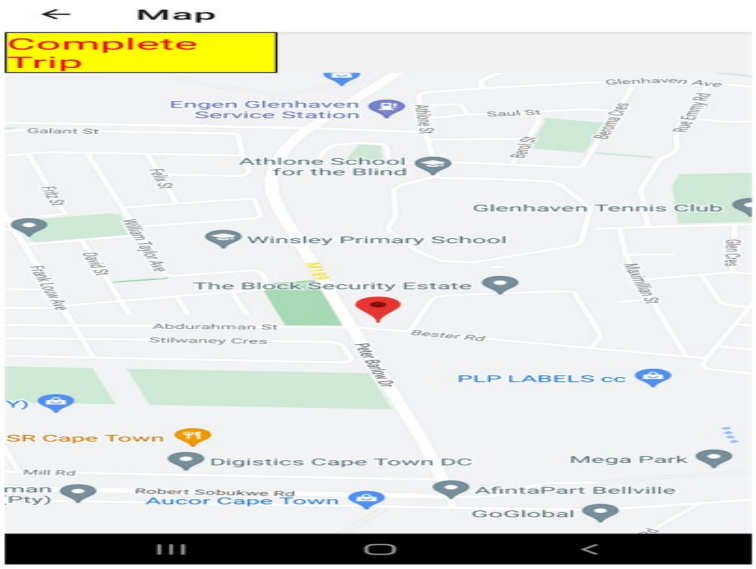


Figure 15: Summary map of the trip displayed when destination is reached



System Evaluation

According to Mochueneng and Dehinbo (2022), evaluation is distinct from testing by the programmer as it is important to assert that the system meets the need of the users. However, due to space limitations, such is not presented here as that is a study on its own. We however recommend that interested people can use quantitative methods (survey) to obtain as much data and information as possible for the evaluation of the system in this study.

The evaluation can be done in order to ensure that the system was functional and helpful to the children and their parents. The responses through the written questionnaires can be collected using simple random sampling method. The respondents can be given the system to use with the questionnaires (sample in figure 15 below). The respondents can then answer the questionnaires which questions were asked regarding the system and their opinions on the effectiveness and ease of use of the system as well as possibly the impact of the use of the system on sustainable development of the society.

The results can then be presented using charts like in the figure 16 below. No names would be disclosed, and the privacy of the respondents should well be respected when conducting this survey.

Next page

Figure 15: Sample Questionnaire usable for evaluating the system

1. Did you find the system useful in your context?

☐ Strongly agree ☐ Agree ☐ Neither Agree/disagree ☐ Disagree ☐ Strongly disagree

2. Does the system appear safer for children?

☐ Strongly agree ☐ Agree ☐ Neither Agree/disagree ☐ Disagree ☐ Strongly disagree

3. Was requesting a ride easy?

☐ Strongly agree ☐ Agree ☐ Neither Agree/disagree ☐ Disagree ☐ Strongly disagree

4. Does the system need more safety features?

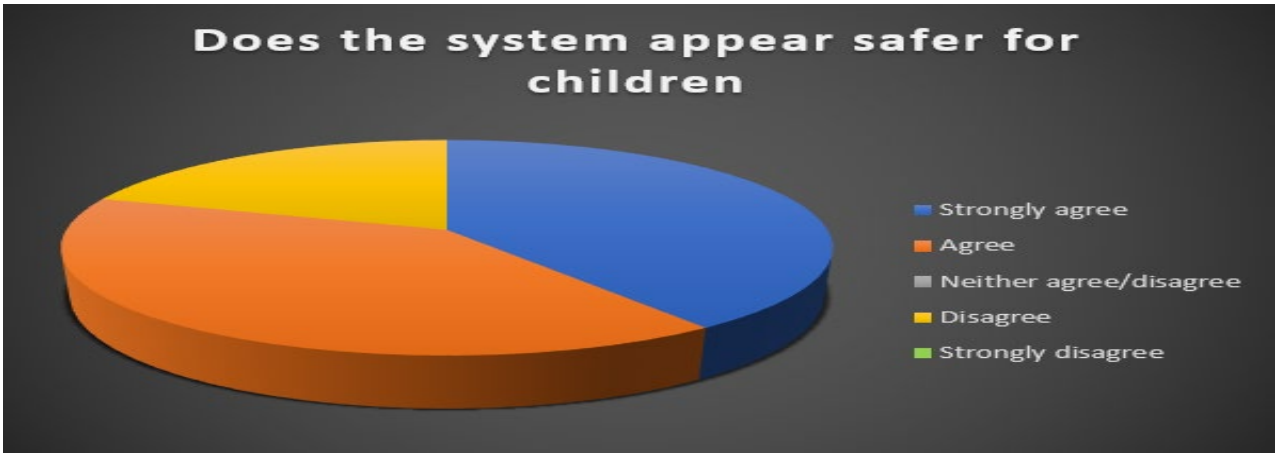
☐ Strongly agree ☐ Agree ☐ Neither Agree/disagree ☐ Disagree ☐ Strongly disagree

5. Would you recommend someone to use it?

☐ Strongly agree ☐ Agree ☐ Neither Agree/disagree ☐ Disagree ☐ Strongly disagree

Comments

Figure 9: Possible pictorial summary of the responses from the respondents



Conclusions

The purpose of this research paper is to improve the safety of children when using the taxi to and from school by developing a taxi application that will include the biometrics technology as safety for children and women is a concern in South Africa. Studies relating to this one has been discussed in the literature review. And it has been revealed that the existing methodologies for these related taxi applications are insufficient as there are still reports of children being kidnapped using the current related taxi applications. The suitable methodology is identified as the Design Science Research Methodology. The steps of the methodology are presented including outlining the steps for the requirements analysis, design to develop an artefact. The steps towards evaluation of the system by a group of participants are also

highlighted. Given that today's children are the future of any society, the change to the use of the system leading to possible safer environment for future generation in the course of gaining education is a step in the right direction towards a sustainable development now and in the future.

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