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Addressing Road Carnage Challenges using a Web Based Model to Compute the Driver Index

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Abstract
Road traffic accidents have been a major cause of deaths in Kenya. The effort by Kenya police to enforce traffic laws has done very little to salvage the situation. The research provides a solution by designing and implementing a model that monitors traffic crimes committed by drivers on Kenyan roads by cumulatively computing the driver road safety index (DRSI), which serves as an indicator of identifying careless drivers and, therefore, withdraw them from the road by dispossessing them of the driving license. The model is implemented using a web based prototype. The study adopted design research approach to implement the model.

Keywords: Model, Web-based application, Roads

1. INTRODUCTION

Road traffic accident also known as a motor vehicle accident or road carnage occurs when a vehicle collides with another vehicle, pedestrian, animal, road debris, or other stationary obstruction, such as a tree or utility pole and missing track. Road accidents worldwide lead to death and disability as well as financial costs to both society and the individuals involved. According to WHO report Road injuries resulted in 1.4 million deaths in 2013, up from 1.1 million deaths in 1990. About 68,000 of these occurred in children less than five years old.

In Kenya particularly Road accidents is the leading cause of death after malaria and Hiv/Aids according to (Odero, Khayesi & Heda, 2003) as cited in (Kibua & Chitere, 2004) more often than not also disrupting the economically productive population in Kenya. Indeed there is a need for enacting measures geared towards reducing mortality, morbidity, disability and increased cost of healthcare resulting from preventable road accidents.

However, transports stakeholders continue to blame the dilapidated state of Kenyan roads as the leading cause of accidents. Despite recent improvement of infrastructure in Kenya, however, fatal road accidents continue to be reported almost on a daily basis. This has resulted to a blame game between especially the operators of the Public Service Vehicles (PSV) and the Traffic department of Kenya Police, with the former blaming the poor state of Kenyan roads on accidents; while the latter blames PSV operators especially drivers on flouting the laid down regulations. PSV drivers have been blamed for careless driving,

incompetence, over speeding, drunk driving and a myriad of other vices like corruption that render them prone to causing accidents that could have been avoided in the first place (Benson, 2012).

Despite the 2003 enactment and enforcement of more stringent traffic rules by the then minister of transport the late Hon. John Michuki mainly targeting the PSV's. Passenger capacity for *Matatu* (local 14 or 33 seater mini buses) was reduced to 13; speed limit set to 80 kph and speed governors introduced, safety belts for all passengers was made mandatory as well as the vetting of drivers and conductors, who now had to meet stricter guidelines according to Kenya Law Reports of 2003. The numbers accidents continue to escalate according to WHO report.

Therefore, this study proposes a solution to reduce traffic crimes committed by drivers on Kenyan roads by cumulatively computing DRSI. The system uses a client server approach were an occurrence or complains is captured by recording it in a database. Then a law enforcement officer logins and confirms the DRSI and makes the requisite action. The proposed system will be online and, therefore, bridge the location the incident has occurred.

1.1 Statement of the research problem

The lack of a model for reducing crimes by computing driver road safety index of persons responsible for road carnage has proved difficult to reduce loss of lives' by law enforcement agencies. Therefore, it serves as a determination to instill discipline to the offender. The model will is handy for keeping records which will enable law enforcement to reduce road carnage. There is also a possibility in future to add the mobile capility for easy access and management of the system on the fly.

1.2 Objective of the study

To develop a model that would aid in reducing traffic crimes by cumulatively computing the driver road safety index (DRSI). This index identifies road unworthy drivers and withdraw them from the road.

2. LITERATURE REVIEW

2.1 The road accident challenge

Road is the most commonly used means of transport in Kenya. Road transport is categorized into private and public vehicles. It has faced a lot of challenges which include; loss of lives' through careless driving, overspending, and bribe's to law enforcement. According to WHO (2015), between 3000 and 13 000 Kenyans lose their lives in road traffic crashes every year. The majority are vulnerable road users, pedestrians, motorcyclists (known as the buda buda taxi, the common mode transport for short distances), and cyclists. In addition, nearly one-third of deaths are among passengers many of whom are killed in unsafe forms of public transportation.

The crimes involving road carnage take the form of; murder, hijacking, accidents and using vehicles to steal. It's being perpetrated by people who are mostly registered drivers and possess a certified driving license. Most of the cases appearing in occurrences books of law enforcement have no traceability because of lack of a systematic way of reporting road carnage. It is a serious fault resulting to avoidable deaths (Patton, 1990) and a good number of them are set free after bail.

However, there has been investment into ways of mitigating challenges of road carnage e.g., signalized intersection control where sensors are now used to supply real-time data for traffic adaptive signal control and mitigating recurring and nonrecurring congestion on freeways (Gillwald, et al..,2015). The many advances supported by the evolution of microprocessors and other electronics components in traffic control

system technology during the past decade have also been developed. Also relative ease with which research and widespread user knowledge can be retrieved in such technology, has also assisted agencies in selecting appropriate technologies and deployment configurations to mitigate road carnage. The Internet with its convenient access to public and private libraries that contain evaluation reports of sensor performance and traffic management strategies have also enabled the rapid sharing of test and operational experiences across the globe. This has been used in sensor applications to traffic control and management.

2.2 Technologies used by web based models.

Road carnage detection are all efforts that are brought together in order to mitigate loss of life, property and mass killings through devising means of preventing or deterring road carnage (Jong-Wook & James, 2004). Road carnage reduction in a context of a web based model occurs in the sense that road carnage issues can be captured for future use and investigation. Typical web based application follow a model view controller pattern which has three parts Fig. 1 (Trygve, 1989).

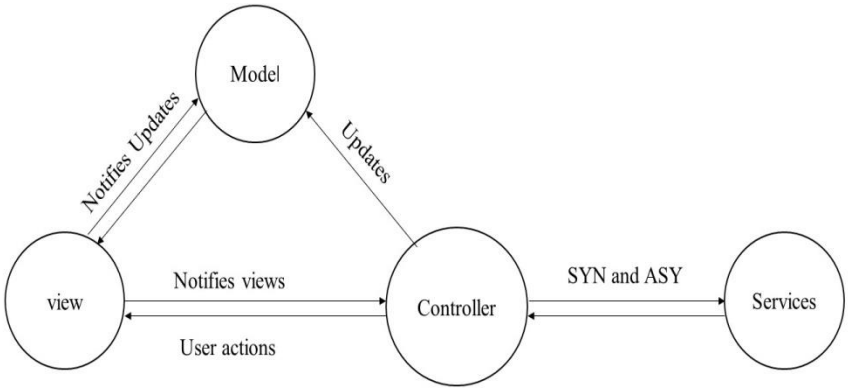

Fig. 1: Modified Basic components of MVC architectural pattern & information flow (Trygve, 1979).

The view renders the interfaces where the user interacts with and normally made up of web based tools with languages such has HTML. Therefore, the HTML page sends information to the controller. The controller responds and process events, which are the user actions and typically invokes changes to model and view. The model is the domain layer which contains the application logic layer, which adds meaning to raw data. It also contains a storage mechanism with a resource management layer underneath. The storage mechanism can be facilitated by database such as MySQL, which is a free open source software and widely available in search engine that can be used has a fast, reliable DBMS with modular engine architecture. It has been used in capturing information for further analysis in various systems like Electronic Database System, the Internet and web programming. It can be used to develop a system for evaluating impacts generated in experiments using a software or and hardware prototype (Murugesan & Venkatakrishnan, 2005).

3. Methodology – the Verification model

A model requiring a web application is thus proposed to provide an accessible and affordable road carnage management system. The model comprises of four parts; there are four main functions of the system; guest registration, enforcement registration, information search and driver index details. An overview of the system is discussed below.

3.1 User and provider registration process

The registration process is the entry point into the system and caters for the two types of system users, namely; guests and enforcement officers. Guests register by providing their name, age, national ID number,

mobile phone and gender. Enforcement officers enter details of accident scene in order to process the driver road safety index.

3.2 Information search process

The information search process, outlined above is performed using a search bar by entering car registration number and driver's license details. Upon search performance, it displays information regarding the driver index and the vehicle details associated to the driver.

3.3 Driver details entry process

The entry of driver details process allows registered users to enter details of the accident scene. Once the information is entered it can be available through a search bar for members of the public to search information at any time.

4. SYSTEM DESIGN

Based on the model proposed in the previous section, a prototype was designed. The system flowcharts are presented in Figs. 1 – 4.

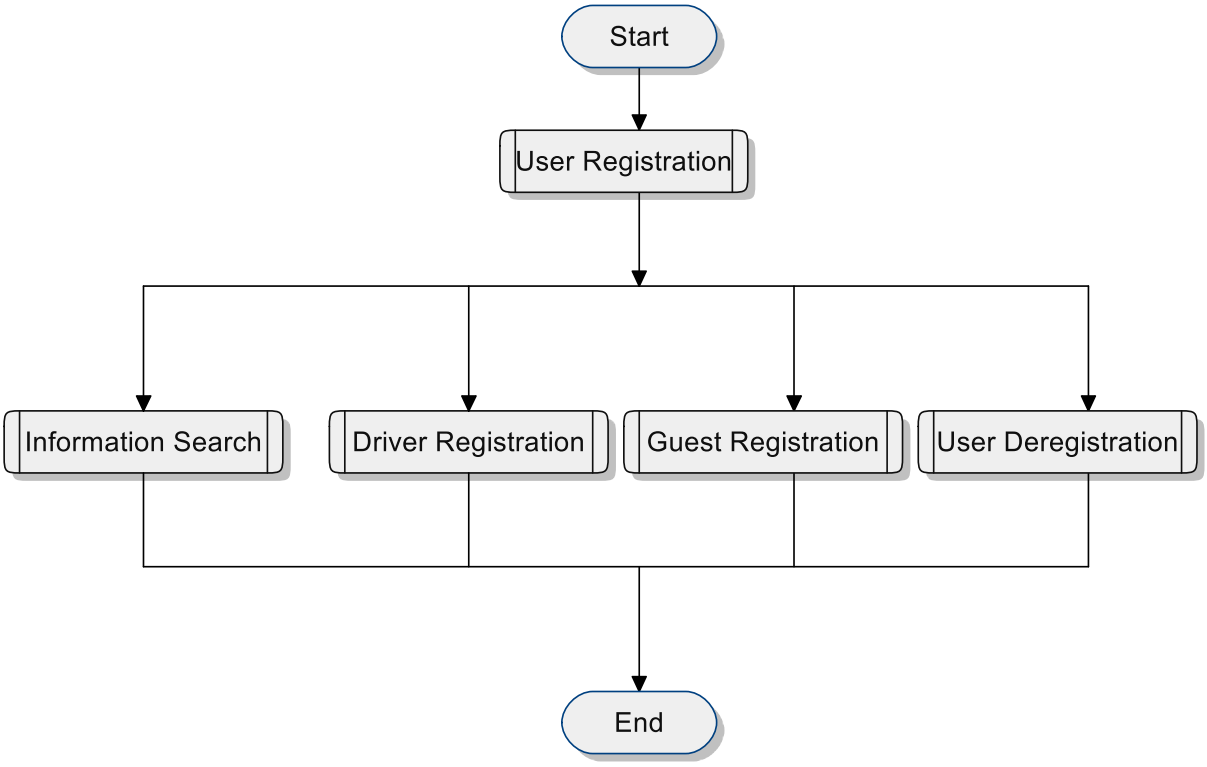

Fig. 1: Flow chart of WBRM prototype

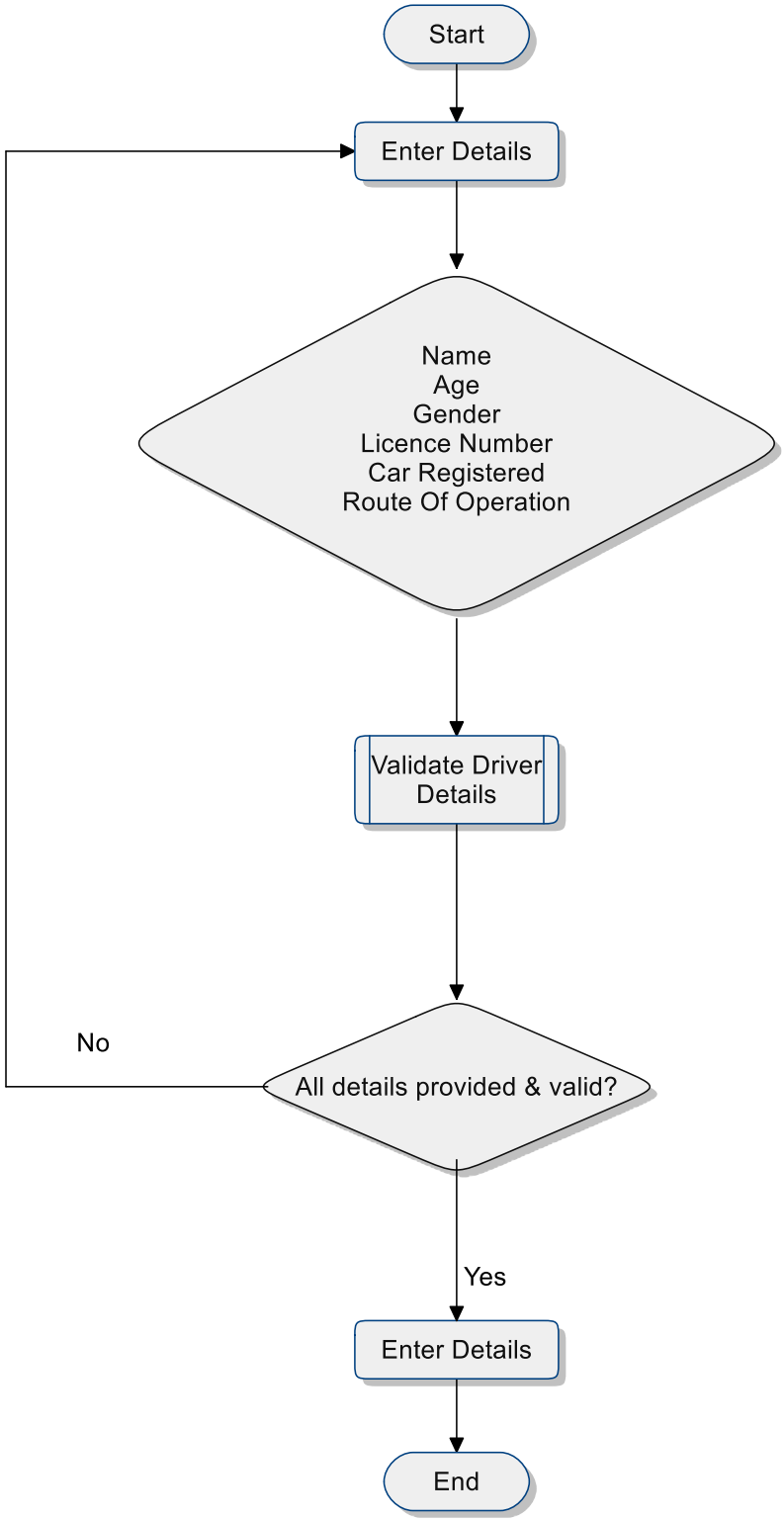

Fig. 2: Driver registration process

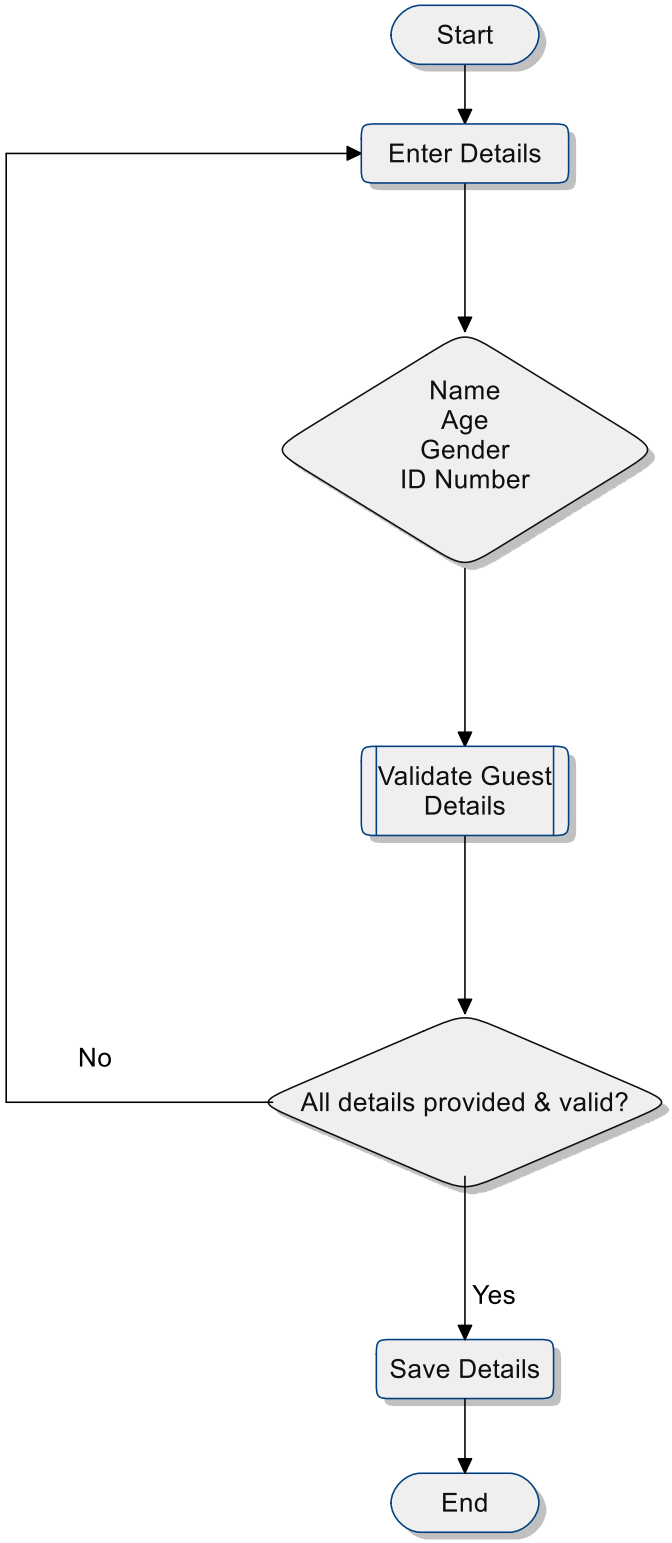

Fig. 3: Guest registration process

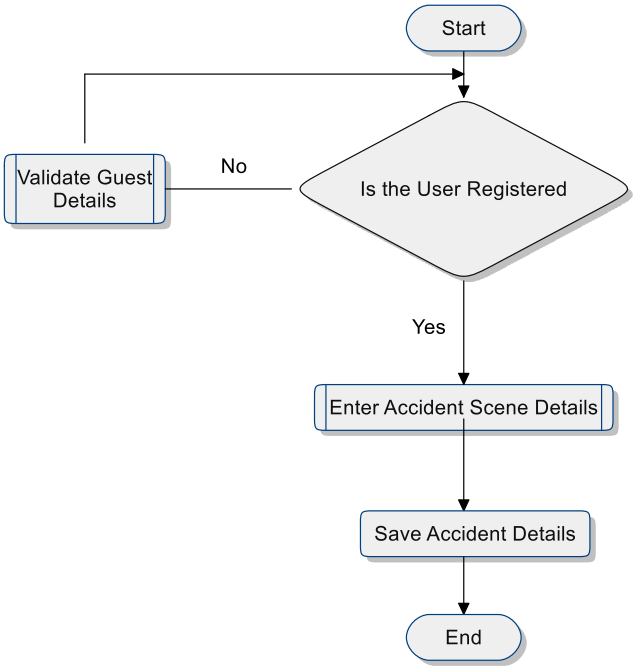

Fig. 4: Accident entry process

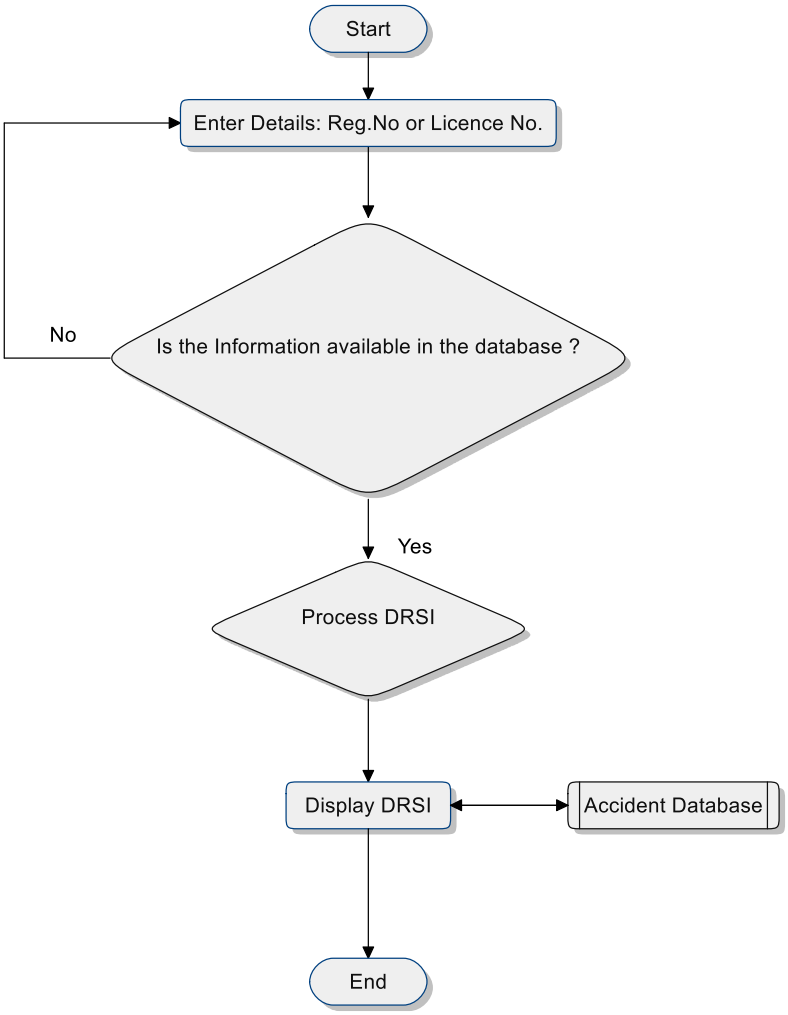

Fig. 5: Information search process

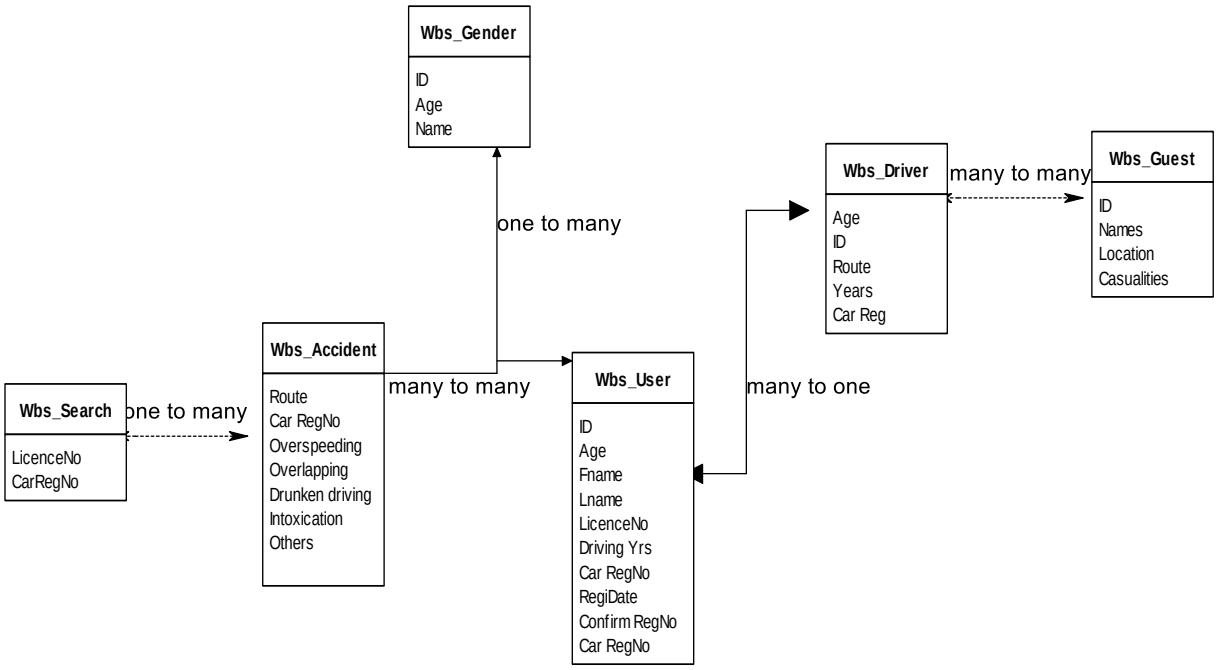

Fig. 6: Database schema

5. PROOF OF CONCEPT

A prototype was developed to implement the Web based model for monitoring road carnage. The program was developed using Android and the PHP with MySQL as the database for data storage and retrieval. The system is capable of displaying the drivers' details as shown.

5.1 User registration

The user registration is shown in Fig. 7.

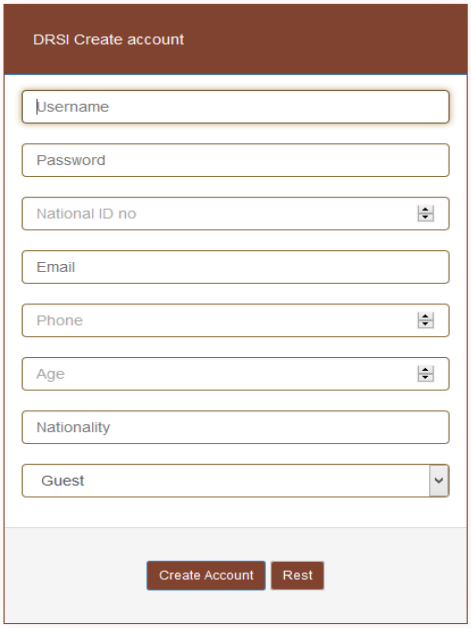

Fig. 7: Web interface for user registration

Once the user details have been entered and saved, and authentication process is captured; the users can then be able to login as shown below in Fig. 8.

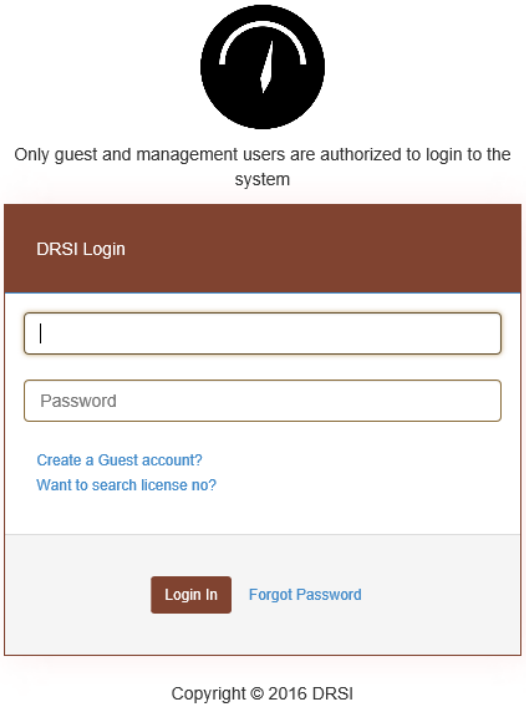

Fig. 8: User login interface

5.2 Online Driver Road Safety Index Processing

Once the users are logged in they can be able to enter in crime scene details as shown in Fig. 9 and Fig. 10, respectively. Registered enforcement officers and the guests who are the members of the public in an accident scene can enter the accident details using a form shown below in Fig. 9 and Fig. 10, respectively.

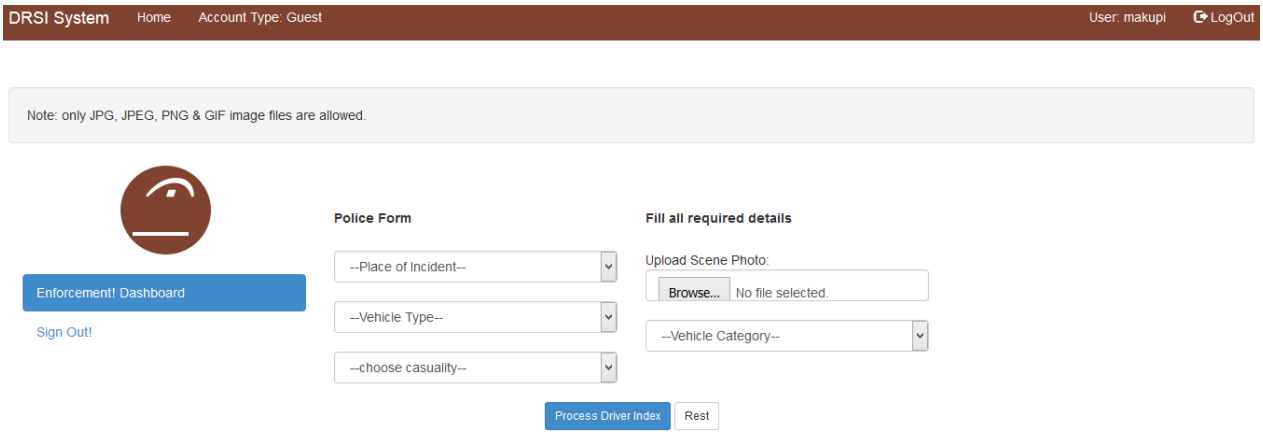

Fig. 9: Crime entry process by Guests

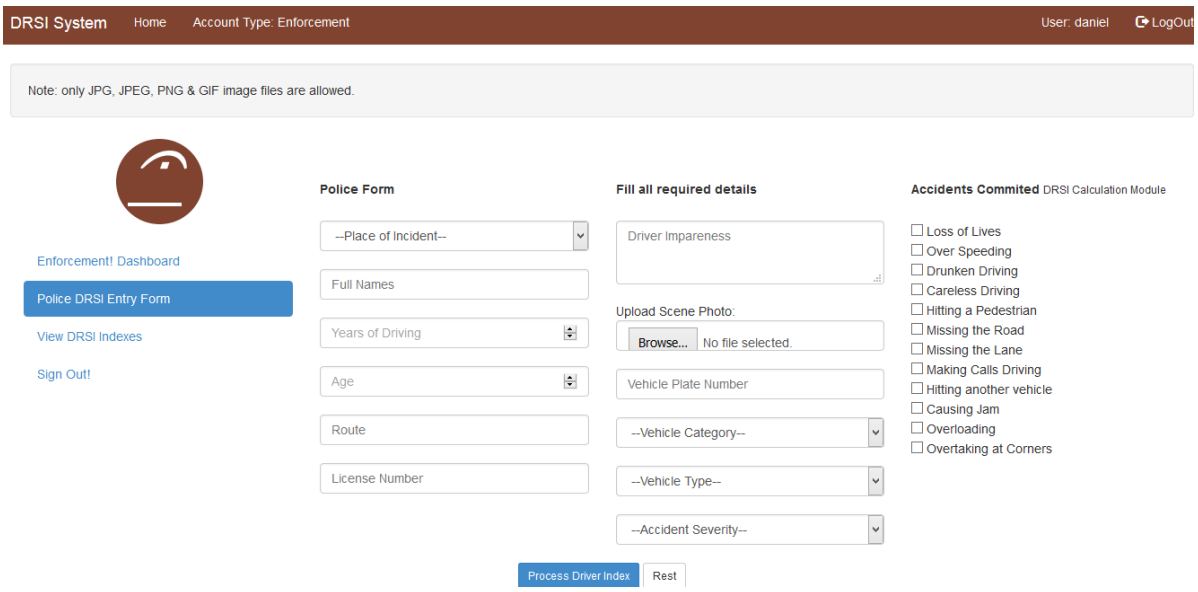

Fig. 10: Crime entry process by law enforcement officers

Once users are registered they could then search for information on the system as illustrated in Fig. 11.

Fig. 11: Information search process

The driver road safety index is displayed upon successful information search as shown in Fig. 12.

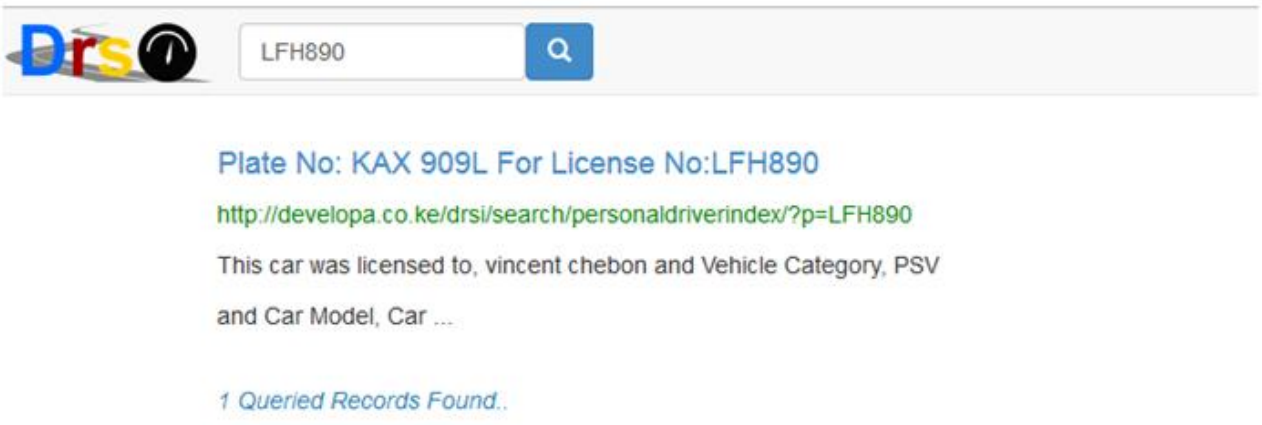

Fig. 12: Information display

The identified drivers' details associated with the car registration and the license number is displayed as shown in Fig. 13 below.

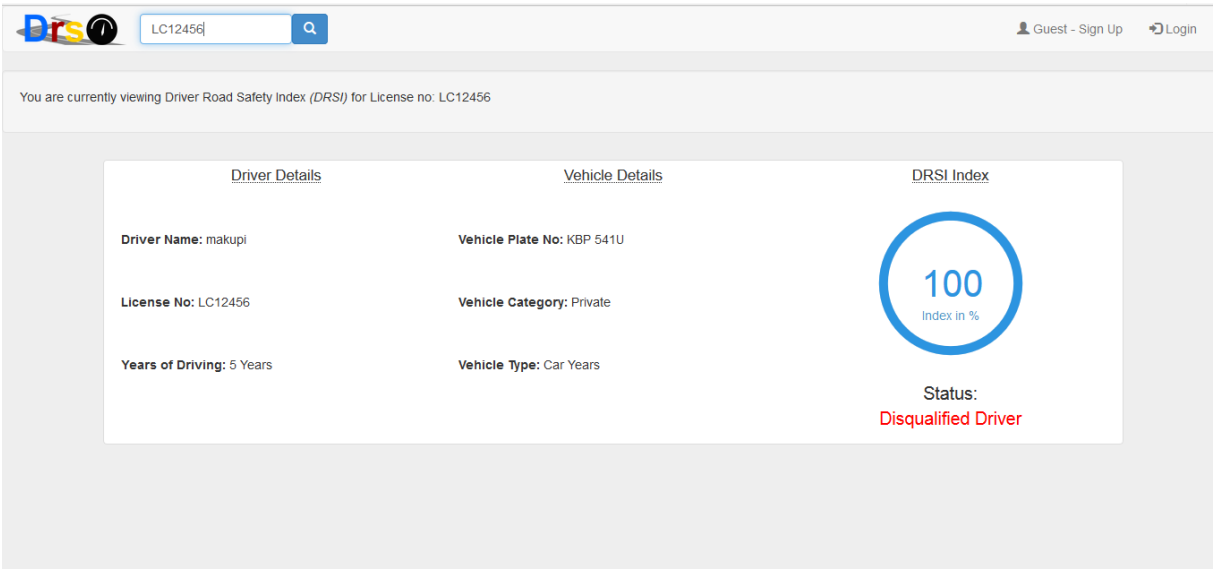

Fig. 13: DRSI index rating

The crime is processed depending on the number of crimes committed and also the intensity of the crime. The index can be accessed by searching vehicle number plate and the driver license number.

7. DISCUSSION

The proposed system presents a number of advantages towards reducing road carnage, these are:

- *User detail capture*: These details are captured once, used many times and can be shared other incidental utilizations.
- *User detail availability*: The members of the public and also the law enforcement officers can get details of drivers and therefore control driving by making available the driver rating that they would ordinarily not have access to due to their inability to capture and maintain them as well as the nature of accidents for emergency.
- *Easy to use system*: The utilization the Web based model for driver interaction with the system makes it very easy to use.
- *Affordable operation*: The use of the Web based model is relatively low cost because when multiple users and enforcement officers connect to a common system.
- *Report generation:* The use of this system can make it possible to produce summary reports of accident statistics. This information is often not availably and accurate in the present setup that relies on manual records.

7.1 Challenges

The main challenge facing the utilization of such a system from the law enforcement perspective is that it will require a PC and Internet access to operate the system for receipting and viewing of reports.

7.2 Assumptions

- The government of Kenya through the law enforcement agencies cooperates on road carnage issues that have been reported.
- How government and the law enforcement will reduce road carnage to prevent loss of life through accidents.
- Availability of funding to purchase the required equipments and tools
- Hosting services providers will cooperate in providing models in existence that allow high performance web based prototypes to operate, therefore, laying a basis for coming up with a secure platform for reducing road carnage.

8. CONCLUSIONS

There is great potential in a system that can provide a practical, effective and affordable solution to the challenges of reducing road carnage. The proposed use of a web solution is a viable approach given the fact that a majority of users and law enforcement officers are already familiar with these technologies

9. AREAS FOR FURTHER STUDY

The proposed system has potential spinoffs due to it being enhanced to be utilized in processing of insurance claims, crime investigations and statistics for health planning.

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