INTERNATIONAL JOURNAL OF RESEARCH IN COMPUTER APPLICATION & MANAGEMENT

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CONTENTS

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OBJECTIVES

HYPOTHESIS (ES)

RESEARCH METHODOLOGY

RESULTS & DISCUSSION

FINDINGS

RECOMMENDATIONS/SUGGESTIONS

CONCLUSIONS

LIMITATIONS

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IMPROVING LIFE EXPECTANCY IN NIGERIA: INFORMATION AND COMMUNICATIONS TECHNOLOGY PANACEA TO HIGH CARNAGES IN ROAD TRANSPORT SYSTEM

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ABSTRACT

Different modes of transportation have existed from time immemorial and it has benefitted the generality of the populace in no small measure. Road transportation has grown to be the commonest in Nigeria. There is a very slim possibility of a human not making use of road transport at a point in time or the other. However, road transport accident has become the most rampant source of carnages when compared to the other modes of transportation in Nigeria. WHO ranks Nigeria 149th out of 178 member states in road accident occurrences. Nigeria again records 50% less in fatality cases from road accidents when compared to countries like Mexico, Indonesia and Turkey. Road accident victim's lateness in receiving emergency medical attention is one of the major causes of untimely death to many drivers and passengers as FRSC officers don't usually get reached in good time about accident cases for prompt rescue operations. Emergency Response Model was introduced to alert the nearest FRSC mobile unit of accident cases and feed them with the location of the victims. This is made possible by the combination of an efficient Vehicle Record Database, MEMS gyroscope and wireless communication devices. ERM simulation result shows that an instant rescue team is assured at accident scenes in no time wherever an accident occurs. This offers more hope of survival for rescued victims as prompt medical attention is guaranteed. Life expectancy which has dropped to 54years in Nigeria can be increased with the adoption of ERM in Nigeria Road Transport System as carnages will definitely be reduced.

KEYWORDS

FRSC, accident, ERM, hospital, victims.

I. INTRODUCTION

There is a low life expectancy in Nigeria when compared to other developing MINT (Mexico, Indonesia, Nigeria and Turkey) countries across the world. Many reasons are responsible for this but deaths during road accidents stand out clearly.

Over the years, transportation has liberated man and has made him more mobile. This has also made him to depend greatly on vehicular movements for his day to day activities. Road transport has the greatest of the pressure of all the modes of transportation available. Road traffic accident has however become a recurring decimal and its effects are usually colossal.

Road traffic accident has thus become an issue of great international concern as it has emerged as the single greatest source of death all over the world. Road traffic accidents and deaths have reached such an alarming proportion even to the point of sheer frustration and near helplessness. According to Federal Road Safety Corps (FRSC) (2012), Nigeria continues to feature in the bottom half of World Health Organization country rankings of road traffic accidents (WHO, 2014). Table 1 shows the trend of accident occurrence in Nigeria between 2007 and 2011.

TABLE 1: ROAD TRAFFIC ACCIDENTS IN NIGERIA

Year	Number of cases	Number of killed	Number of injured	Fatality rate per 100,000 Pop	Fatality rate per 10,000 vehicles
2007	8,477	4,673	17,794	9	NA
2008	11,341	6,661	27,980	6	NA
2009	10,854	5,693	27,270	5	NA
2010	5,330	4,065	18,095	4	NA
2011	4,765	4,327	17,464	4	6
Average	8,153	5,084	21,721	5	NA

Source: FRSC Documents, 2012

The country's 149th ranking in 2009 out of 178 member states indicates the hazards associated with road transportation in a country that is largely dependent on its road network for economic and social activities.

Asian countries like China, India and Indonesia with their teeming population possess better fatality indices even up to 50% less than Nigeria's statistics. Western countries on the other hand are rated even better, recording less than 10 deaths per 100,000 population on average, with even the UK having one of the lowest with only 5.4 deaths per 100,000 population (FRSC, 2012).

It is observed that lateness in receiving emergency medical attention of accident victims is one of the great impediments to the survival of accident victims in Nigeria. This challenge of lateness in receiving emergency medical attention has led to untimely death of many drivers and passengers as FRSC officers could not be reached in good time for rescue operations on accidents cases.

The use of Vehicle Accident Emergency Alert (VAEA) system; comprising of an efficient vehicle record database, MEMS gyroscope sensors and wireless communication devices is therefore inevitable in order to address the problem.

This proposed system would capture details of all registered vehicles and track the location of the vehicle when the accident occurs using GPS (global positioning system). Whenever a critical accident occurs, the vehicle sensor would send an alert to the nearest FRSC office which later forwards the necessary information to the nearest mobile FRSC unit. This unit eventually locates and transports the accident victims to the nearest hospital for emergency medical care.

Despite the fact that FRSC is saddled with the responsibility of rescuing accident victims, there is still a limit to their output without an appropriate means through which they can obtain an instant notification about accident incidents.

VEAS therefore is seen to be highly critical in enhancing transportation system in Nigeria; this is because when more lives are saved from road accidents, mortality figures would be reduced on the roads, and this would in no small measure improve the road transportation traffic as passengers' confidence would be boosted.

II. SOME ICT INTERVENTIONS IN ROAD TRANSPORT

Improvement and security in road transportation are clearly unachievable outside the adoption of ICT. Unimaginable landmarks have been recorded in recent years. These encouragements have spurred further interest in researches towards a secured road transportation in Nigeria.

The following are some of the technologies/solutions that have been proffered in the past:

A. INTELLIGENT TRANSPORT SYSTEM (ITS)

Safety of traffic participants is one of the most important consequences of the intelligent transport system (ITS's) implementation, providing a regulatory and a societal impetus to the program with a national backing. The main objective of providing an ITS interface is to set up a national, multi-modal surface transportation system that features increased connectivity of transportation environment among vehicles providing the infrastructure, and portable devices to serve the public good by leveraging technology to maximize safety, mobility and environmental performance. Various technologies that are a part of ITS deployment have been studied to give the readers a comprehensive view of the intelligent transport system.

The concept of an intelligent vehicle consists of equipping the vehicle with an optimum number of sensors such as radars in order to perceive the surroundings and hence ensure an automatic guidance control of the vehicle and maintain communication with the external environment. Such a framework is more secure if communication between nearby vehicles is established and maintained. This enables, for example, the driver of a car to be aware at an early time of the emergency breaking of the preceding vehicle (in case of the presence of an obstacle in front of this vehicle) and so to avoid a collision. Thus the collision avoidance system is an information–communication technology system for early warning and collision avoidance on roads and motorways using special sensor network, which is spanned over the moving vehicles and road obstacles – transmitting automatically warning signals to the back of a column and enables distant drivers to stop in time or to do such operations automatically. V2I safety application include a broad range of capabilities from the transmission of the status of traffic signals on the road ahead in order to alert drivers of the need to apply their brakes, to driving conditions (low visibility or icy pavements), to variable speed limits (Jonathan, 2010). Intelligent Transport Services (ITS') are multi- modal and the platform can be easily set up for carriers, transit, passenger and freight rail, pedestrian and bicycle thus offering mobility enhancement and environmental improvement as other benefits.

B. NAVIGATION SYSTEM

Geographic positioning systems (GPS) in conjunction with geographic information systems (GIS) offer the possibility of decreasing the amount of time spent on search behavior by motorists. Assuming one inserts his/her origin and destination to the system, the shortest route will be proposed. Such navigation systems are already common today, either portable or fixed (in-built in the car). The use of mobile communication in route advising seems underestimated for private car use and deserves more attention (Townsend, 2004). Systems that optimize route choice have seldom the primary aim of reducing the environmental effects of driving (lowest total fuel consumption) instead of the traditional aim of shortest time or distance. In a study of real traffic driving patterns in the city of Lund, Sweden, the most fuel-economic route was extracted and compared with the original route choice (Ericsson et al., 2006). It was found that the drivers' route choice produced trips that could save 8.2% fuel by using a fuel-optimized navigation system. This corresponded with 4% fuel reduction for all journeys longer than 5 min. in Lund.

WEAKNESS: When using a navigation system, you are distracted from driving. You have to continuously glance at the screen, when you should be watching the road.

C. FUEL-INTELLIGENT VEHICLES

The demand for fuel-efficient cars has been growing in the previous year's driven by the increased and still increasing price of oil. Hybrid electric cars have already found presence in the marketplace due to the promise of saving fuel by using an electric motor in place of the internal combustion engine during particular stages of driving. All the major car manufacturers have developed or are currently developing hybrid vehicles, with the earlier models being relatively small, like the Toyota Prius and Honda Insight and Civic, and larger model being currently released, like a hybrid Ford Escape and various Lexus models. Despite fuel savings, the primary disadvantage of the hybrid technology from an adoption perspective is the initial cost for consumers that can be as much as 70% more than an equivalently powered internal combustion engine-only vehicle (Manzie et al., 2007). At the same time, fuel-intelligent cars are being developed equipped with a relatively cheap sensor network.

Fuel consumption in urban environments is up to 50% higher than on highways, whereas one of the largest contributors to fuel use in urban areas is the stop-start behavior of traffic flow. This phenomenon provides possibilities to address this area using ICT. Through the use of ICT, vehicles can communicate with the road infrastructure and other vehicles to obtain essential information to adjust driving behavior. In recent simulation studies, using different times of preview information, it appeared that fuel savings could be achieved between 15 to 25% with 60 seconds preview and up to 33% with 180 seconds preview relative to an 'unintelligent' baseline car. The development of a combined hybrid and ICTs equipped intelligent vehicle seems still under way with the optimal use of feed forward information as an ongoing research problem (Manzie et al., 2007).

WEAKNESS: The initial cost for consumers can be as much as 70% more than an equivalently powered internal combustion engine only vehicle.

D. VIDEO SURVEILLANCE RESPONSE

Several cities maintain a continuous monitoring of key network locations to determine if traffic is moving or encountering congestion. Such monitoring can be done with strategically located sensors or television cameras. If flow interruptions are apparent they are usually caused by a disabled vehicle according to traffic vision. Once these events are perceived, a repair/assistance vehicle is dispatched to the location. Upon arrival at the problem site, the objective is to remove the obstacle to flow and offer assistance (tire replacement, and so forth) or transport to the motorist.

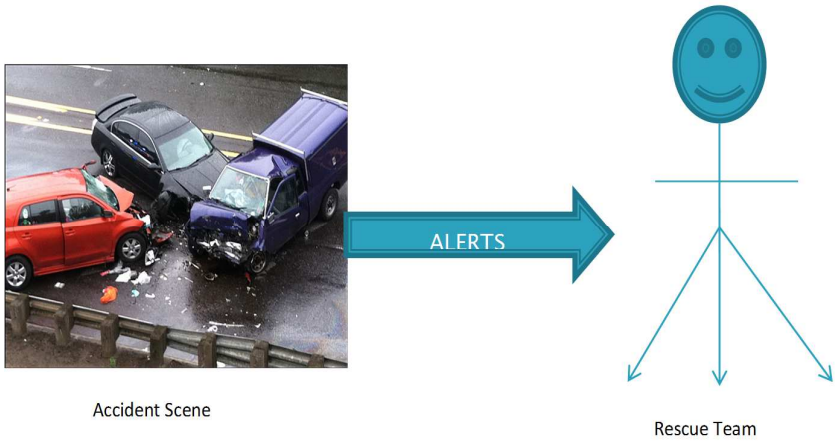
E. ADVANCED TRAVELER INFORMATION SYSTEMS

Personal information systems may take different forms and may be in-vehicle for car drivers and portable for passengers using public transport (Black, 2006). Based on real-time information, the best route and connections (in public transport) are given. In advanced modes, opening times of facilities (shops, services, etc.) and the length of stays are used as an input, enabling an overall space-time optimization of activity chains. In the case of interruption (accident, congestion, etc.) new travel solutions are produced. Adoption of such traveler assistants - that are currently in an experimental stage - may be hampered by high costs but also by limited needs of travelers to plan their activity and traffic chains.

III. EXISTING MODEL

In the immediate past, cars use sensors that have the capacity to inform the rescue team about accident occurrences. The model however does have in its plan how rescue operations can be done seamlessly. All the model does is just to notify that an accident has taken place. Fig. 1 depicts how alert is sent to inform the rescue team of an accident that has taken place when there was a collision of 3 vehicles at a particular location.

FIG. 1: DESCRIPTION OF ACCIDENT SENSOR MODEL



IV. PROPOSED MODEL: VEHICLE ACCIDENT EMERGENCY ALERT (VAEA) MODEL

It is observed that many seriously injured individuals from car accidents could have survived such incidents if they had been transported for an emergency medical attention in good time. The use of Information Communication and Technology tools in enhancing transportation systems in Nigeria using VAEA system is to ensure victims of road accidents have faster access to medical attention. The concept of a vehicle accident emergency alert involves equipping the vehicle with MEMS gyroscope sensor incorporated with GPS tracker, alert system, database system and communication systems.

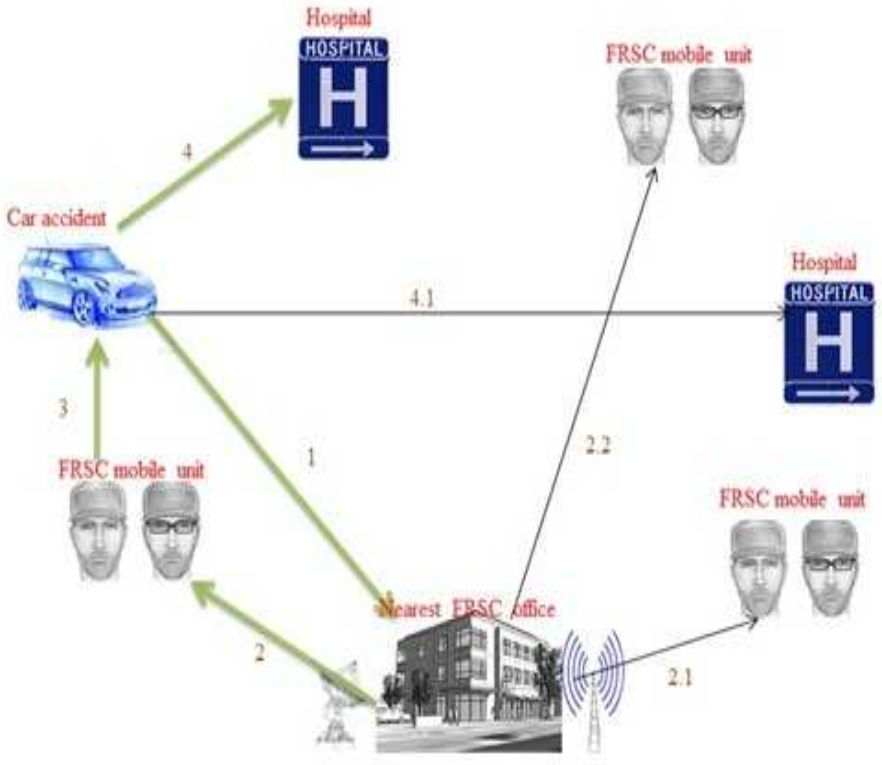
The sensor would be located beside the airbag. Once the air bags are deployed, the sensor gets dislodged from its initial position; the vibration forces a digital signal to be sent to the nearest FRSC office that an accident has occurred. With the signal transmission, the FRSC office would obtain the location of the accident with the use of GPS tracker and the vehicle details on their database management system. After getting the full details of the vehicle, the FRSC office will communicate to the nearest FRSC mobile unit to the accident scene for rescue operation and immediate transmission to the nearest hospital for medical care.

The FRSC has the database of vehicles and tracking technology to get the location. The signal is transmitted to them because of the antenna at the FRSC post which makes it possible to receive the necessary signal from the sensor. This information stored in the database is provided to the FRSC by the agencies involved in vehicle registration and plate number issuance. It is therefore hoped that this solution would improve the live saving possibility of road accident victims that have hitherto died cheap and unnecessary death. Figure 2 shows a graphical flow of the implementation of the proposed model

i. Steps in Vehicle Accident Emergency Alert

a. As soon as the airbag is deployed, the sensor is capable of detecting this and would communicate with the nearest FRSC office.
b. Once the FRSC office receives the alert signal via the antenna. They will locate the accident scene with the GPS tracker and get the vehicle details from their database. With this, the FRSC office will contact the nearest FRSC mobile unit and will communicate with them about the accident and give them the necessary details.
c. The work of the FRSC mobile unit is to locate the accident scene which would be communicated from the nearest FRSC office.
d. The next activity entails the immediate transmission of the accident victims to the nearest hospital for medical care.

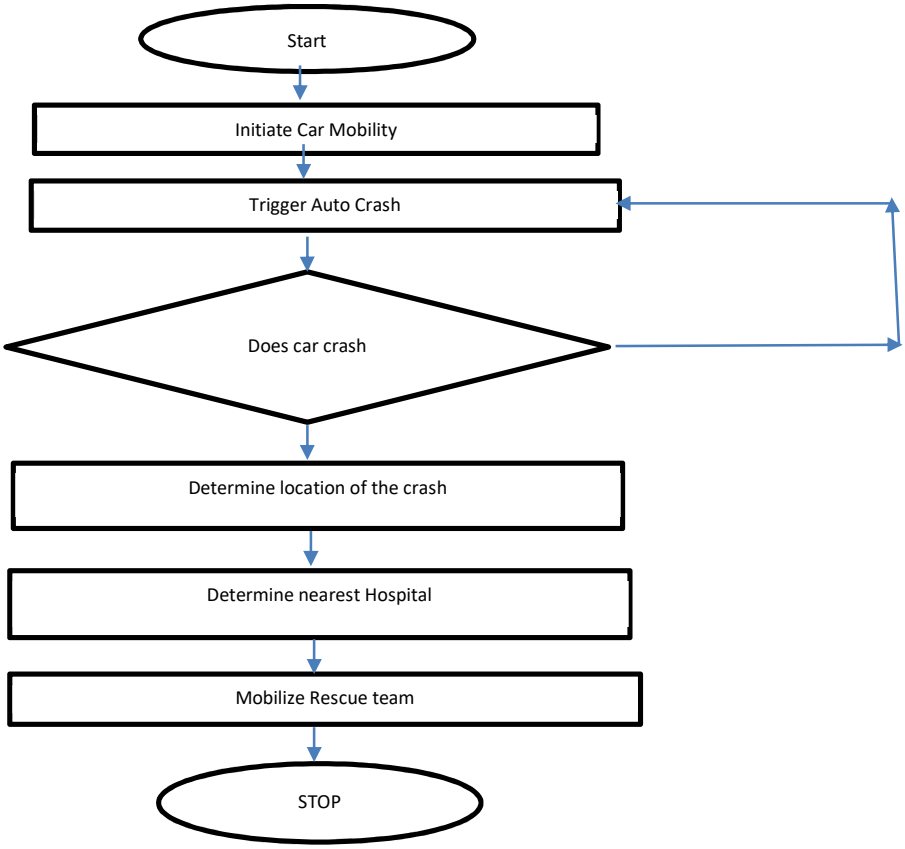
FIG. 2: LAYOUT OF VEHICLE ACCIDENT EMERGENCY ALERT MODEL



ii. Description of some of the devices/ facilities used in VAEA model:

Figure 3 captures all the devices and facilities being described in this section.

FIGURE 3: FLOW DIAGRAM OF VAEA MODEL



a. **MEMS Gyroscope Sensors:** A sensor is a device that detects and responds to some type of input from the physical environment. The specific input is the displacement of the sensors by the airbag. The output is generally a signal that is converted to human-readable display at the sensor location or transmitted electronically over a network for reading or further processing to the FRSC office.

b. **Antenna:** This will enable the nearest FRSC office to receive digital alert signal sent by the sensor system via wireless communication and transmission.

c. **Database:** This holds information stored in a computer system for easy storage and retrieval. This is needed by the FRSC office to store the full details of information about the vehicle.

d. **GPS tracker:** This is a technology that is used to monitor the location of vehicle and it is useful to the FRSC office to access the location of the vehicle that has accident after they would have received alert signal from. It is also installed in the vehicle for easier location and installed in the mobile FRSC unit.

e. **Federal Road Safety Commission (FRSC) office:**

The FRSC would be incorporated with IT technology such as antenna, database management system and GPS tracker.

f. **Mobile Federal Road Safety Commission (FRSC) officers:** These are the officers that have their post on roads either rural or urban roads and will be notified of accident nearest to them via wireless communication for immediate transmission to the nearest medical hospital for medical care

g. **Medical centre:** The nearest FRSC officers will transport the accident victims to the nearest emergency medical centre for medical care.

FIGURE 4: FLOWCHART OF VAEA MODEL

V. OUTPUT OF THE SIMULATION SCENARIO OF ACCIDENT OCCURRENCE WITH VAEA

Vehicles are at liberty of movement from one place to another. In the course of these movements however, accidents do occur. In the simulation depicted with Flowchart in Figure 4 and shown in the scenario presented in Figure 5. There were movements of vehicles in road1, road2 and road3 free of collision or accidents. The movement of vehicles at high speed or low level of concentration while driving may lead to occurrence of accident which may be fatal accident in some cases. This accident can be triggered in the simulation presented by pressing the "trigger botton".

When an accident occurs, it is assumed that the accident victim will be in an unconscious state, and as such would need external intervention. In many cases, it is due to delay of the rescue team to locate the accident scene that leads to untimely death of most accident victims.

In the simulation scenario, an alert is sent to the nearest FRSC office where they communicate with the nearest Rescue Team. In Figure 6, the nearest Rescue Team is seen moving towards the direction of the accident scene upon receiving the distress alert. The rescue team that is alerted to visit the scene depends on the closest team to the accident scene. In the simulation presented in Figure 6, there are two rescue teams, but the team commissioned for the assignment was that which had a smaller proximity. In the simulation scenario shown in Figure 6, the rescue team locates the accident scene to rescue the accident victims.

To reduce the death rate of accident victims, there is a need for immediate medical attention. There are many cases where an accident victim gave up as a result of no or delayed medical attention.

In the simulation scenario shown in Figure 7, the rescue team transports the accident victims to the nearest hospital. The rescue team has an option of several hospitals, but the algorithm is designed such that the rescue team locates the nearest hospital.

FIGURE 5: SCENARIO SHOWING VEHICULAR MOVEMENTS ON THE ROADS

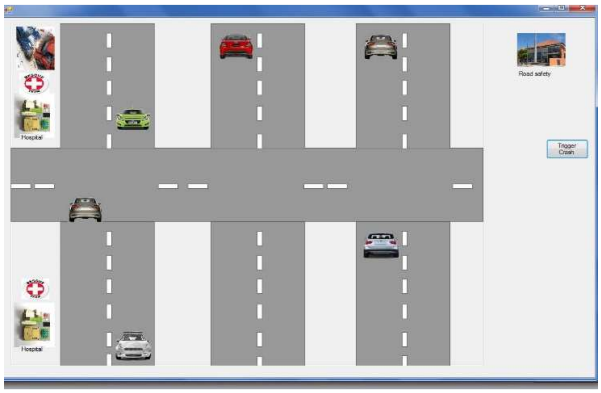


FIGURE 6: SCENARIO SHOWING THE ADVANCEMENT OF RESCUE TEAM TO THE ACCIDENT SCENE

FIGURE 7: SCENARIO SHOWING RESCUE TEAM RACING TOWARDS THE NEAREST HOSPITAL

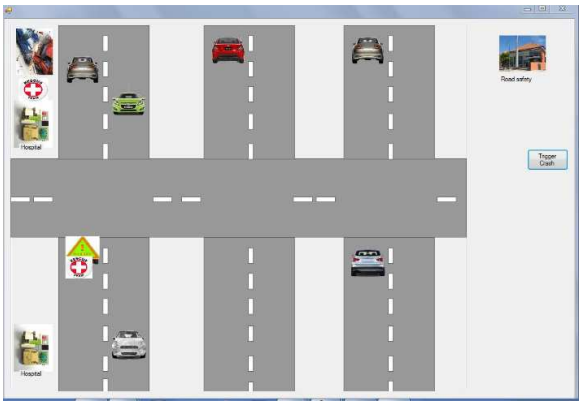


FIG. 8: SCENARIO SHOWING RESCUE TEAM CLOSER TO THE NEAREST HOSPITAL

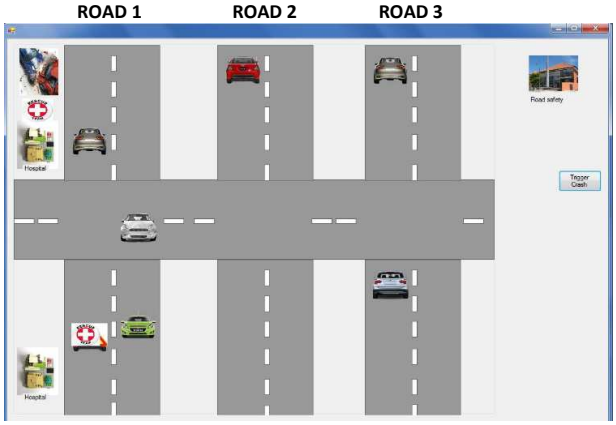


FIG. 9: SCENARIO SHOWING ARRIVAL AT HOSPITAL AND COMPLETION OF TASK BY THE RESCUE TEAM

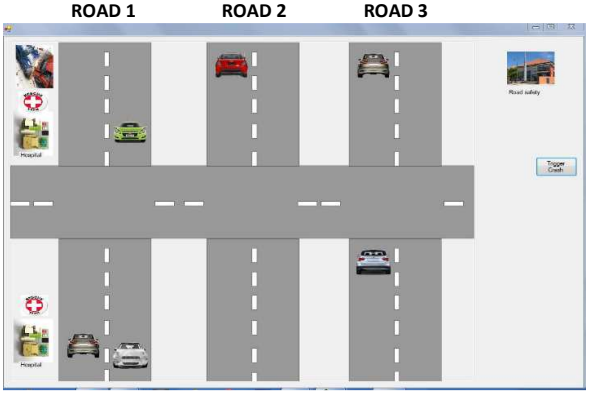


Figure 8 further shows the nearness of the rescue team to the hospital. In Figure 9, the rescue team has finally arrived at the hospital and they are set for the next set of alert from the FRSC station

V. CONCLUSION

It is therefore hoped that this solution would improve the live saving possibility of road accident victims that have hitherto died cheap and unnecessary death. To reduce the rate of death of accident victims caused by unavailability of emergency medical attention, vehicle Emergency Alert System needs to be applied to transportation system in Nigeria.

VI. RECOMMENDATION

The researcher therefore recommends that this proposed system should be adopted by Nigeria Transport System to enhance transportation system in Nigeria. The researcher also recommends that people should register their vehicles with FRSC.

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