Reducing Road-Traffic Accidents on African Roads through a Computer Simulation Programming Approach

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Abstract: The mortality rate in the West African sub-region of the world is undoubtedly very high. In Africa for example, the prevalent incidences of road-traffic accidents has been responsible for the untimely death of many innocent citizens. Also, particularly disturbing is the high number of sudden deaths scenarios that are recorded yearly among patients on an emergency transfer held up within terrible road-traffic congestions. Although this particular road-accident phenomenon is not just limited to West African Countries, it is particularly disturbing that Africa seems to be among the few remaining regions of the world where a permanent antidote or a solution approach is yet to be found and adequately implemented for the full benefits of the victims of such unpleasant circumstances. Within the Lagos metropolis in Nigeria, for example, many lives have been lost as a result of road-traffic accidents. As a result of this, there is the need to reduce the numbers of deaths of innocent citizens on West African highways through a simulated programming approach which will ultimately help to adequately cater for the security, safety and welfare of the African people and also reduce the mortality rate within the African continent. Thus, in this research work, a simulated programming approach will be applied to reducing road-traffic accidents on West African high-ways.

Key words: Road-traffic, accidents, programming approach, simulated programming approach, mortality rate.

INTRODUCTION

Road-traffic accidents have been occurring at an alarming rate. Ghastly road-traffic accidents have been a common occurrence along major high-ways in some West African countries. Causes of such accidental occurrences ranges from reckless driving by drivers who are drunk to the deplorable state of the roads available, and over-speeding by over confident drivers. Another major source of concern which has over the years acted as a major source of accidents, is the state of the road-traffic congestions. Statistics have shown over the last decade that road-traffic congestion is responsible for over 50% of most accidents on the major high-ways in some West African countries. For example, the Lagos Metropolis in Nigeria, road-traffic congestion is a major cause of various degrees of accidents which has claimed the lives of many prominent, innocent and unsuspecting victims on a daily, weekly, monthly and yearly basis.

The purpose of this research work is to provide a new approach as a solution by simulating road-traffic control devices digitally, using an event-driven programming language to achieve this purpose, thus producing a model which will finally help in reducing or minimizing the rate of road-traffic accidents on our high-ways, especially in Nigeria, and other West African countries.

In this research work, such traffic-control devices will be simulated by using a programming approach, through design, implementation and demonstration of the significance and effectiveness of such simulated models.

The model will be applicable to all forms of roads associated with West African countries, cities and other African countries. These range from express-roads to inter-state roads, intra –state roads, and finally inter-country roads.

This will go a long way in reducing the mortality rate recorded as a result of road-traffic accidents, and also prolong the lives of useful, intelligent, productive and innovative citizens of the African continent and also worldwide. It will also go a long way to improve the quality of educational standard of a nation, and finally improve the economy and well-being of the society at large.
Relevant Workdone:

The Influence of Vehicle Speeds on Accidents Rates and Their Consequences:

This research work was carried out by Alvydas Pikunas et al (2004). The purpose of this research article was to identify the influence of vehicle speeds on accidents rates and their consequences. In this research work, the desired speed depended on several factors such as speed limits, vehicle types, traffic density, road environments, road geometry, time and driving experience. From the traffic engineering point of view, a driver’s desired speed is the speed which drivers usually want to maintain in different traffic situations. When traffic is heavy, most drivers are in a platoon and the traffic situation is such that some drivers attempt to overtake the leading vehicle or adjust their speed to the vehicle in front. However, during peak hours, urban freeways usually have severe traffic congestions. The random variation of traffic also contributes to the fact that it is not always possible to maintain the speed which a driver desires. This prompted Alvydas et.al to carry out a research work on the influence of vehicle speeds on accident rates and their consequences. The research work of Alvydas et.al is relevant to this present research work because it was focused towards solving road-traffic accidents. The difference is that this present work is focused on an event driven programming approach.

Comparative Research of a Motor Car:

Motion in the Case of the Loss of Contact with the Road Surface:

This research paper was the work carried out by Ona Lukoseiviciene, et al (2004). The paper described the car motion on the road when the contact between its wheels and the road surface is lost. A simulation of such car motion was carried out using a mathematical package called Maple 6 for the two cases considered; (a) the car flies off a horizontal surface (b) the car runs over a springboard. Their work also presented the graphs of these motion parameters and evaluated the influence of air resistance in both cases. Their work is relevant to this present research work, because it deals with issues which could help in avoiding road accidents.

Cannabis (Marijuana) - Effects on Human Behavior and Performance:

Cannabis is one of the oldest and most commonly abused drugs in the world. Recently, tremendous advances have been made, these advances have helped Huestis M.A (2002) to elucidate the mechanisms of action of cannabis and the side effects and toxicities associated with its use. Experimental laboratory studies have identified cognitive, physiological, and psychomotor effects following cannabis. Epidemiological studies reveal that cannabis is the most common illicit drug world-wide in impaired drivers, and in motor vehicle injuries and fatalities. Driving simulator studies also indicate performance impairment following cannabis use; however, the results of open- and closed-road driving studies and of culpability studies do not consistently document increased driving risk. Clearly a combination of ethanol and cannabis use significantly increases risks. This article reviewed the pharmacokinetics and pharmacodynamics of cannabis and places special emphasis on the effects of cannabis on complex tasks such as driving and flying. This reviewed article is relevant to this present research work, since it contains one of the major factors that causes road-accidents due to drug abuse.

Engineering Solutions of Road Safety:
Problems of Road Transport:

The authors of this particular paper focused on the simulation of the motor vehicle movement (taking into consideration motor vehicle dynamics, motor vehicle hydraulic brake system influence on motor vehicle movement, interaction between its wheels with road pavements, road guardrail characteristics, interaction between motor vehicle and road guardrail at various initial conditions and at various certain pavement surface of the road section under investigation. Considering this work, and taking into consideration the presented general mathematical model and computer aided test results, it was possible to investigate various road transport traffic situations as well as to investigate various transport traffic safety problems. The work of Marijonas B. et al (2004) is relevant to the present work in this research article because it helps to investigate and elucidate various road transport safety problems, which if properly studied and implemented, will help in reducing road traffic accidents.

Risk Factors and Road Traffic Accidents in Tanzania: a Case Study of Kibaha District:

This work was carried out by Deus Daimann K. (2006) in during his Masters programme in the Norwegian University of Science and Technology. His thesis discussed the risk factors associated to the cause of road-accidents in the Kibaha district in Tanzania. The study described the composition of motor related injuries
including non-motorized casualties in Kibaha district. The thesis assessed different road safety measures taken by the local authorities to prevent accidents in the Kibaha district. His work is relevant to this present work because it is concerned with road-accidents related issues. It also contains useful information about work that has been previously carried out by others as regards this current topic.

**Africa’s Epidemic of Road Traffic Injuries: Trends, Risk Factors and Strategies for Improvement:**

In summary, this particular paper as presented by Wilson Odero helped to highlight different road-traffic injuries, the trends and also explained the risk factors and strategies for improvement in the reduction of road-traffic accidents.

**Road Traffic Injuries in Developing countries:**

This article stated that motor vehicle accidents are the leading cause of death in adolescents and young adults worldwide. Nearly three-quarters of road deaths occur in developing countries and men comprise 80% of the casualties involved. The work in this article was carried out by Odero et al. (1997). It summarized the studies on the epidemiology of motor vehicle accidents in developing countries and examined the evidence responsible for this with alcohol while drivers were driving on the roads.

Causes of Road-traffic Accidents on the African high-ways

Road traffic accidents can be caused by the followings:

(i) Reckless driving by reckless drivers
(ii) Over-speeding
(iii) Driving a car that has worn-out tyres
(iv) Driving with unchalant attitude to Road-signs and Road-side instructions
(v) The use of alcohols and other dangerous drugs by drivers before embarking on important journeys.
(vi) Driver tiredness
(vii) Lack of use of Crash helmets by motorcyclists
(viii) Bad road network

Thus, there is an urgent need to install digitalized traffic control system which will help in regulating the speed at which drivers drive on the high-ways thus reducing the rates of accidents caused on African high-ways.

**MATERIALS AND METHODS**

**Data Collection by Survey:**

<table>
<thead>
<tr>
<th>Accidents and their Consequences/Year</th>
<th>1997</th>
<th>1998</th>
<th>1999</th>
<th>2000</th>
<th>2001</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of accidents</td>
<td>5319</td>
<td>6445</td>
<td>6356</td>
<td>5807</td>
<td>5972</td>
</tr>
<tr>
<td>Number of accidents when driving speed was unsafe</td>
<td>909</td>
<td>1346</td>
<td>1462</td>
<td>1252</td>
<td>1350</td>
</tr>
<tr>
<td>Number of killed People</td>
<td>725</td>
<td>829</td>
<td>748</td>
<td>641</td>
<td>706</td>
</tr>
<tr>
<td>Number of Killed People when driving speed was unsafe</td>
<td>179</td>
<td>206</td>
<td>242</td>
<td>217</td>
<td>207</td>
</tr>
<tr>
<td>Number of injured people</td>
<td>6198</td>
<td>7667</td>
<td>7696</td>
<td>6960</td>
<td>7103</td>
</tr>
<tr>
<td>Number of Injured People when driving speed was unsafe</td>
<td>1730</td>
<td>2010</td>
<td>1861</td>
<td>1244</td>
<td>1864</td>
</tr>
</tbody>
</table>

Statistical Analysis of the data collected by survey about past occurrences of road-traffic accidents as performed by Oluwagbemi O.O B& W Custom Chart to depict Road-Accidents’ Occurrence Over the Past Years (1997-2001) Fig.1

Representation of these data in Pie charts illustrating various analysis of past records of Road accidents

Comparing the data in the two figures (Fig. 1& Fig.2) above, the percentages of road accidents caused by overspeeding can be analyzed.

Thus, from this analysis, it can be inferred that the number of road accidents which occurred between (1997-2001) is 85% while the number of road accidents caused by overspeeding by reckless drivers is 15%. This is just one of the major cause of road-accidents as mentioned in section 2.7. The other six factors mentioned in that section also have their respective percentages. Thus, there is the need to develop a very good prototype to reduce the numbers of accidents caused on roads, not only in Africa but also in other parts of the world.

Implementation & Simulation Using Visual Basic Programming in Designing & Constructing a Prototype of a Digital Traffic-Control System to reduce road-traffic accidents.
Fig. 1:

3D-Clustered Column Chart Analysis of Road Accidents (Performed By Oluwagbemi Olugbenga Oluseun)

![3D-Clustered Column Chart Analysis of Road Accidents](image1)

<table>
<thead>
<tr>
<th>Year</th>
<th>No. of Road Accidents</th>
</tr>
</thead>
<tbody>
<tr>
<td>1997</td>
<td>5319</td>
</tr>
<tr>
<td>1998</td>
<td>6445</td>
</tr>
<tr>
<td>1999</td>
<td>6366</td>
</tr>
<tr>
<td>2000</td>
<td>5807</td>
</tr>
<tr>
<td>2001</td>
<td>5972</td>
</tr>
</tbody>
</table>

Fig. 2:

3D Clustered Column Chart Analysis Of Road Accidents Caused By OverSpeeding

![3D Clustered Column Chart Analysis Of Road Accidents](image2)

<table>
<thead>
<tr>
<th>Year</th>
<th>No of Road Accidents Caused By OverSpeeding</th>
</tr>
</thead>
<tbody>
<tr>
<td>1997</td>
<td>909</td>
</tr>
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<td>1998</td>
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<td>1252</td>
</tr>
<tr>
<td>2001</td>
<td>1350</td>
</tr>
</tbody>
</table>

Fig. 3: [Pie chart representation]
On the 6th of February, 2007, the African Road Safety Conference was held in Ghana, Accra. Mr Magnus Opare-Asamoah, Ghana’s Deputy Minister of Transportation said in spite of the massive investments in the road sector and the many other significant strides which have helped to reduce road traffic accident fatality rates from 40.7% in 1988 to 19% at the end of 2005, Ghana was not out of the woods yet. “However, safety remained a key consideration in the development and use of road infrastructure and transport services in the country’s quest to achieve the national development agenda of a middle income status of 1,000 dollars per capita by 2015”.

Furthermore, many years ago, in Nigeria, for instance, there were electric traffic-lights on the highways, but recently, most of the traffic lights are no longer functioning, or they have been vandalized. The simulated programming approach proposed and implemented in this research work will go a long way in restoring Digitalized traffic systems on Nigeria’s highways and other African countries, which is a new technology different from the previous electric and ineffective damaged traffic systems, thus reducing the rate of traffic accidents on our high-ways.

Based on the various sections previously discussed, there is the need to reduce the speed at which drivers drive on African highways; thus, there is an urgent need to employ a more suitable mechanism to achieve this purpose. The following sections shows the design, implementation and the output of the simulated digitalized traffic control system as programmed by me using the Visual Basic Programming language.

The Design Phase of the Digitalized Traffic-control System:

![Fig. 4:](image)

Here, in the Visual Basic Design phase, the Digitalized Traffic Control System was designed. The design phase contains timers (clocks) which have been set to different seconds based on this simulation. The timing of the clocks however, can be extended and modified by the programmer. Indeed, this is a new innovation, especially in the African Continent.

Implementation Phase: Codes Written in Visual Basic Programming Language:

The implementation phase includes the program codes that controls this Digitalized Traffic Control System.
This Digital Traffic Control Simulation Program Was Written
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Department of Computer and Information Sciences
Ota, Ogun State
Nigeria
West Africa
Friday February 1st, 2008

Private Sub ShowColourGreen()
    shpGreen.FillColor = RGB(0, 255, 0)
End Sub

Private Sub ShowColourRed()
    shpRed.FillColor = RGB(255, 0, 0)
End Sub

Private Sub ShowColourRed2()
    shpRed.FillColor = RGB(255, 255, 255)
End Sub

Private Sub ShowColourBlue()
    shpBlue.FillColor = RGB(0, 0, 255)
End Sub

Private Sub ShowColourBlue2()
    shpBlue2.FillColor = RGB(255, 255, 255)
End Sub

Private Sub ShowColourAmber()
    shpAmber.FillColor = RGB(255, 255, 95)
End Sub

Private Sub ShowColourAmberRed()
    shpAmber.FillColor = RGB(255, 255, 95)
    shpRed.FillColor = RGB(255, 0, 0)
End Sub

Private Sub cmdClick_Click()
   Cls
    shpRed.FillColor = RGB(255, 0, 0)
    shpAmber.FillColor = RGB(255, 255, 255)
    shpGreen.FillColor = RGB(255, 255, 255)
    tmrTimer1.Enabled = True
End Sub

Private Sub tmrTimer1_Timer()
   Cls
    shpRed.FillColor = RGB(255, 0, 0)
    shpAmber.FillColor = RGB(255, 255, 255)
    shpGreen.FillColor = RGB(255, 255, 255)
    tmrTimer2.Enabled = True
End Sub
RESULTS AND DISCUSSIONS

The results shown in subsequent figures shows the possibility of using simulation and modeling in providing solutions to the incidences of road-accidents on our highways.

Fig. 5 Results of the Output Phase of the Event-driven Program

The result phase shows the display of the Digitalized Traffic Light System. The red colour displayed depicts a STOP signal to oncoming overspeeding vehicle along the high-way.

This figure shows the display of the program when it both displays the RED and GREEN colour, this signal represents a stop and a get ready symbol for waiting vehicle.

The GREEN signal means get ready to go.

The AMBER colour tells waiting vehicles on the high-way to GO!. So, with this Digitalized Computer Program Controlled Traffic Light System, accident rates in African countries can be well reduced to a minimum level, thus making life better.

Discussions:

Based on the results obtained as a result of this implementation, it can be concluded that this simulated digitalized traffic control system has good tendency to reduce road-traffic accidents on African highways, since it has regulatory measure on the rate of movement of vehicles on the high-ways.
Further ways on how to reduce the incidences of road-traffic accidents on our high-ways.

(i) Installing Digitalized Traffic Control Systems on our high-ways
(ii) Drivers should avoid over-speeding and reckless driving.
(iii) Government should construct good road infrastructures.
(iv) Drivers should avoid the use of dangerous drugs and alcohols
(v) Avoid the use of warn-out tyres and follow road traffic signals.

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