Promoting road safety through behavior and attitude change through community policing and ICT

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Abstract:

The increasing number of road accidents globally and the cost to world economies calls for all possible actions to mitigate their effects on the economies. The major cause of these accidents especially in developing countries is due to human errors which can be mitigated through attitude and behavior change. This paper discusses how a combination of community policing and Information and Communication Technology (ICT) can promote road safety through behavior and attitude change. It describes the technological solutions and their implementation in a case study in Uganda. The collaborative participation of all stakeholders is expected to create positive results in the medium term.

Keywords: ICT and road safety, Community policing and ICT, road safety and behavior change, Community policing

Around the world, road traffic crashes cause 1.2 million deaths and 50 million injuries per year. The majority of the casualties are the 15 to 44 age group who are the wage earners and child-raising group. The loss cause many households to fall into poverty. The accidents are mainly due to poor roads, poor driving, over-speeding, lack of adequate policing among others. Without preventative action, it is estimated that road traffic crashes will be the world's third-leading cause of disease and injury by the year 2020 (United Nations, 2008).

In the developed world, road traffic accidents were among the ten leading cause of disease burden, and in the developing world they were the biggest cause of injuries and the eleventh cause of lost years of healthy life in 1998. Ms Carter-Foster of United States had this to say during the United Nations 62nd General Assembly (GA/10694) on Easing Global Road Safety Crisis:

> "1.2 million people worldwide, more than 3,000 daily died on the roads, a toll comparable to that of malaria, tuberculosis, while 30-50 million were left injured or disabled. Most of these deaths occurred in developing countries where the losses took a significant toll on family and national income, reduced gross domestic product by 1% or more which exceeded funds received in development assistance. Losses due to road traffic injuries were preventable and should not be accepted as the price for mobility or economic growth and development".

The cost to world economies is very high, for example in Europe, the annual costs of accident with fatalities is estimated at Euro 50 billion and accidents with severe injuries the figure is Euro 40.5 billion. The global cost of road accidents in developing

and emerging nations is at least US$100 billion a year, which is more than twice the total aid received from all bilateral and multilateral sources (World Health Organisation, 2009)

In Uganda, recent statistics indicate that there are some 17,000 accidents yearly, up from 12,000 in 2000. Road accidents claim up to 2,000 lives annually, which is attributed to poor road designs, failure to observe traffic laws and general lack of information on how best people can use roads. Uganda has 600,000 vehicles and it is estimated that there are 160 deaths per 10,000 vehicles in Uganda per year, which is very high compared to other countries such as Kenya with 51 deaths per 10,000, and 26 deaths per 10,000 in South Africa (Safe Car Guide, 2009). As more vehicles get on the road every year, chances of getting involved in accidents increases.

According to the police annual report on road accidents, the number of people killed in accidents in 2006/07 was 2,838 while those killed in 2007/08 was 2,035, a reduction of 803 deaths from the previous year. In spite of this reduction, many people are continuing to die in road accidents, and many get hospitalized due to accidents, as more vehicles get imported into the country.

Accidents disproportionately affect the younger populations in society, and many are left as orphans or disabled thereby negatively impacting on their years of productive work. It is estimated that Uganda loses up to $200 million annually due to traffic accidents.

Many of these accidents are caused by human error which accounts for about 80% and relates to the attitudes and behavior of the drivers (see Figure 1).

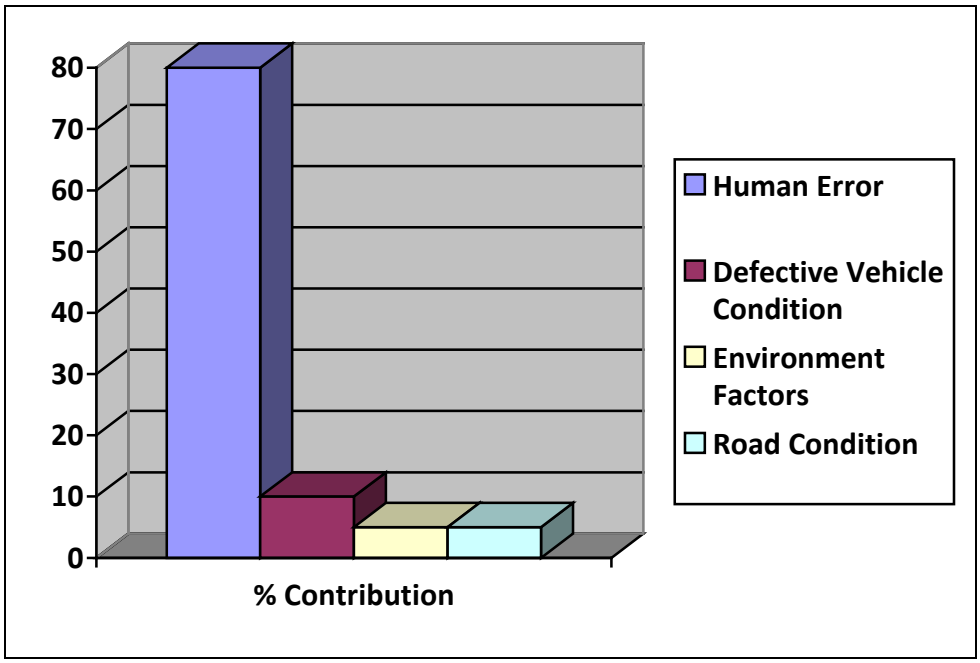


Figure 1: Accident causes in Uganda (Source: Nasasira,2009)

These human errors can be reduced if the users of the roads paid particular attention to the regulations governing the use of the roads. Lack of appropriate mechanism to

monitor the users of the roads and the dependence on the small number of traffic police officers does not help to improve the situation. It is imperative to note that one of the attributes that brings about the human error is through the lack of appropriate structures to assess the suitability of a driver before they are given licenses allowing them to drive. The number of driving schools operating without a curriculum and the fuzzy process of assessing and approving ones application to acquire a driving permit increases on the number of human errors. This has created a behavior shift of disregarding good driving practices.

The problems faced by the Uganda community especially on road accidents and their concerns can be discerned from a letter to the newspaper.

> " …. Our roads are sodden with blood and claim lives at frightening rates. More people are perishing on the roads as every stakeholder, passengers, myself inclusive laments on and on. Does the traffic Police Officers really appreciate the contribution of overloading to accidents, especially on our rough roads?
> A 14-seater tax crams in 30 passengers and the traffic Police Officers will simply exchange a "few words" with the driver and that is it. I was unfortunate to board a taxi from Masindi to Hoima on February 12 at around 7.30pm. After a kilometer into the journey, the taxi had about 27 passengers. Whoever waved down the taxi was let in. The ambience inside was unbearable, but only three of us protested. The rest simply sat, not saying a thing. It was dark and visibility was poor, but the senseless driver kept driving at 120km/hr. When I threatened to report him to the Police, he scoffed at me, laughing loudly as if to rub in "what will they do". Surprisingly, all the other passengers seemed OK and quiet all through the dreadful journey.
> I believe passengers have the power to force sense into such drivers. Thank God we reached safely; we could have perished, due to a combination of overloading, recklessness, greed and grave irresponsibility on the part of the passengers. The police work under severe constraints. They cannot do much if the passengers are careless with their lives. Do not just look on when someone is driving recklessly. We have so much to live for, let us value life" (New Vision , 18/2/2010)

Government Interventions in Road Accident Reduction

The Government of Uganda has undertaken short, medium and long term measures to reduce accidents on the roads through the 3 "Es" of education, engineering and enforcement and issuing appropriate regulations. In 2000 the Government of Uganda developed a five year road safety program with a three year National Road Safety Action Plan whose implementation started in 2004. This action plan focuses on (a) institutional capacity building i.e. a new highway code that has now been translated into local languages; introduction of road safety in primary school curriculum; development of syllabi for drivers and instructors; and providing key regulations to mitigate accident occurrences and improvement on road safety that include speed limits, drunken driving, use of mobile phones, safety belts, speed governors, driving permits and motor cycles. In addition, the government has committed itself to spend

15% of the national budget each year on upgrading and maintenance of the road network. (b) implementation of government interventions, which are a big challenge due to lack of a reliable tracking mechanism for bad behaviors.

Where as government has put in place the different interventions, successful implementation of these interventions still remains a major challenge and this abets the number of accidents on the roads. There hardly exists any tracking mechanism in that once someone commits a crime and he is charged he can commit a similar offence several times as each charge is independent of the previous. This implies the charges do not act as deterrent to committing an offence. Lack of ICT enabled systems that could offer real time history about the person who has committed an offence enables the culprits to perform similar offences without any remorse. Because of the number of offences, it is not possible to manually track the culprits. If there existed real time feedback systems, persons who have committed a number of offences could easily be accorded harsher punishments which in turn would stimulate the change in attitude and behavior , and eventually a reduction in the number of accidents.

Community Policing

Community Policing is a policing concept that uses the community as an integral part of policing and allows the community to effectively participate in the policing activities. According to Trojanowicz and Carter (1988), community policing is a proactive, decentralized approach that depends on community residents for input into police delivery of services. It neutralizes the undue influence of special interest groups that are receivers of preferred services. Wong (2001), further defines it as the transformation of public security work to be part of the whole society. Community policing has been used for many years in many countries as a strategy, where the community get involved to control crime by identifying suspects and bringing them to the attention of the police. Community policing offers proactive policing within the limited resources available to the police.

Community policing is cognizant of the fact that the police can not be everywhere at all times and that crimes take place within communities and therefore the communities can contribute to averting crime. The objectives of detecting crimes, criminals and addressing the root causes of crime, as well as the fear of crime is drawn from a community centered perspective (Kasinge, 2003). The Ugandan public has been slowly growing in its appreciation of the role and operations of the police and small steps have been made towards a community policing approach (Mushemeza, 2008). Community policing creates “civilian police” officers or crime preventers, who do not need to be paid or facilitated to report, inform, or prevent crime. They provide the necessary intelligence information on which the police can act. As long as the society is sensitized, educated and constructively engaged, they will fill the gaps left by lack of resources needed by the police to fill the gaps (Uganda Police, 2009)

Community policing depends on mutual trust between the Police and the community, such that a good partnership must be developed between them. The community wants to see that action is taken against wrongdoers. The created trust enables the police to have access to valuable information from the community that can provide solutions, prevent crime and provide safety to everyone. For community policing to succeed, the

police and the community must see themselves as collaborators to promote safety for everyone society.

Community policing has been active in some parts of Uganda, and in particular a few areas in Kampala city to address crime. Where it has been active, the annual crime report 2007 indicated a decrease in actual committed crime by 31% from 2006 (Police Habari, 2008). This implies that community policing works.

Community policing and ICT

Uganda has got about 10 million mobile phone subscribers, and some of the phones are embedded with high-end technologies of taking videos and pictures. These mobile phone subscribers are everywhere, with the largest number in Kampala and other urban areas. With adequate attitude change they can influence and enforce proper road usage, when working together with the Police. Encouraging all these mobile phone subscribers to be part of the community policing can go a long way in promoting behavior and attitude change in road users.

There has been several initiatives in many countries where Information and Communication Technology (ICT) has been applied to support road safety. The electronic stability control (ESC) systems in Europe reduced accident risks by 20% (Europa, 2006). Researchers have also indicated that there are 3 Es (Engineering, Education and Enforcement) which have been found to be effective to address road accidents.

ICT can be used to support all the three Es, but for this project the focus will be on the two Es of Education and Enforcement. Education, sensitization or awareness campaigns about the consequences of not complying with road safety regulations are vital in influencing road user behavior and also change people's attitude. Targeting driving licenses which facilitate people's freedom of movement can influence people's behavior. Awareness that every citizen is concerned with bad driving behavior and there is a mechanism of communicating the bad behavior and enforcing it, can change people's behavior and attitude in the long run. Tackling the third E - enforcement with ICT can make enforcement more effective. The Police force can be provided with instant information which they can use to track road abusers, and discipline them appropriately. The reinforcement of safe behavior through behavior modification has been successfully implemented in some countries, where the reduction in accidents was reduced by 80 percent (Saari, 1994)

The use of ICTs in community policing recognizes the potential that ICTs can enable the role and function of community policing. ICTs in this case enable the fast transmission of information across communities and can support the early warning mechanisms. The multiple functionality of ICT does provide for the development of multiple solutions designed for the different communities. Use and application of Information Communication Technology (ICT) is seen as a great enabling tool to improve the management of security and safety of people and community by sharing information and improving dialogue and interaction between individuals and groups and the police personnel on a regular basis (Manzar, Unknown)

The project is based on the assumption that the community will be willing to use their mobile phones to provide the relevant information to the authorities for appropriate

action on bad driving. The solution empowers the community to provide information and in so doing instill within the drivers and users of roads a cautious mindset as they are not in position to know who can easily report to the police and other authorities about their behavior. ICTs have been used in health to enhance behavior change, in agriculture to provide market information, in business for auctioning among others. (Banks 2008)

ICT has not been used only as a tool by the police departments for office activities, but also to reach out in addressing security issues in the communities. Radios, Television and websites have been used to this effect. The application of ICT in community policing helps to increase the quality, quantity and the speed of access to and distribution of information to prevent and manage crime.

The paper proposes the application of ICT and in particular Short Message Services (SMS) solutions in promoting road safety through behavior and attitude change through community policing. The paper proposes the architecture and technological solutions that will be used. The methodology to be used is also discussed before the conclusion.

Architectural solution

The architectural design of the solution is presented in Figure 2:

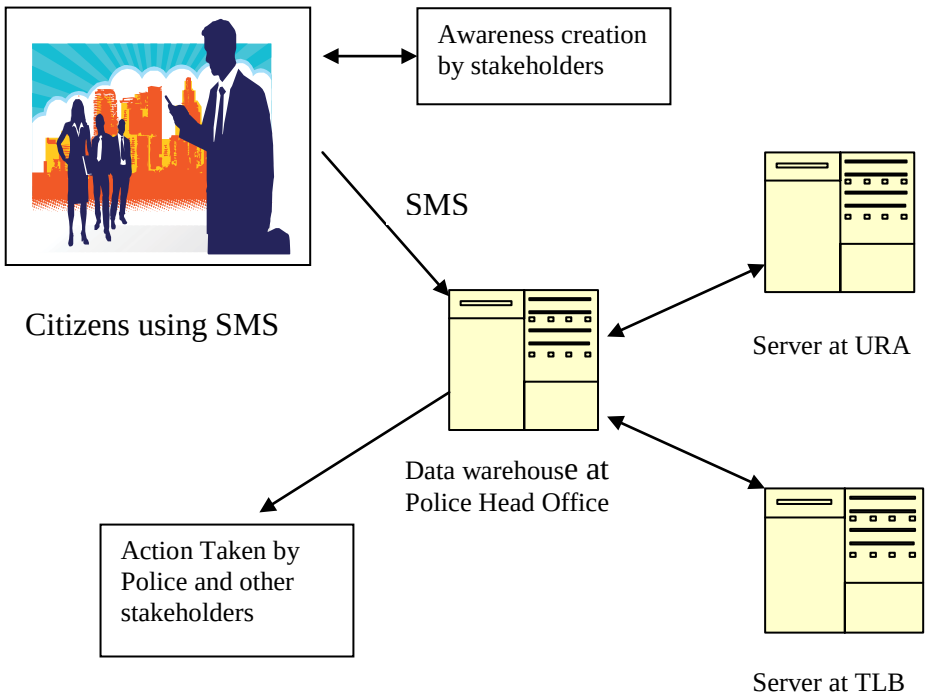
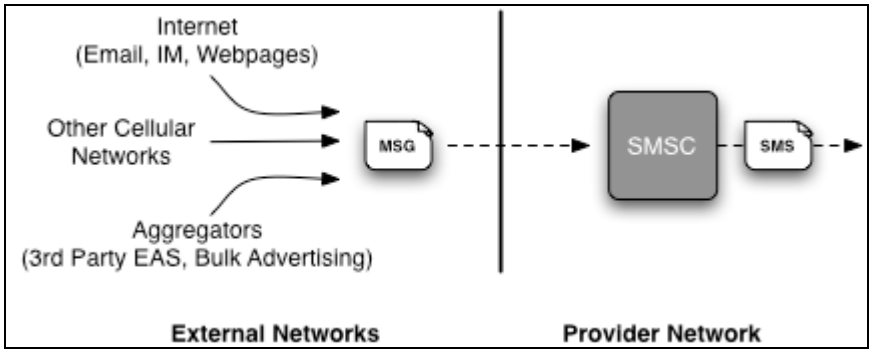


Figure 2: Architecture design of the system

The system will consist of a data warehouse located at the Police Headquarter, which will store all the incoming SMS messages for processing. It will at the same time interface with other databases at the Uganda Revenue Authority (URA) and the Transport Licensing Board (TLB). The URA and TLB databases have vital information that is critical in ensuring the authenticity during the verification of the information about the motor vehicles.

Mobile enabled solutions

The mobile phone now has more capabilities that can be optimally utilized to support community participation in curbing the carnage on the roads. Whereas there are several options that are available to the user/community, the SMS is the solution of choice for this project. SMS provides an opportunity to deliver the message without being noticed as opposed to voice most especially if one is on board of a public vehicle with passengers. The SMS delivery services system over mobile networks is illustrated in Figure 3.



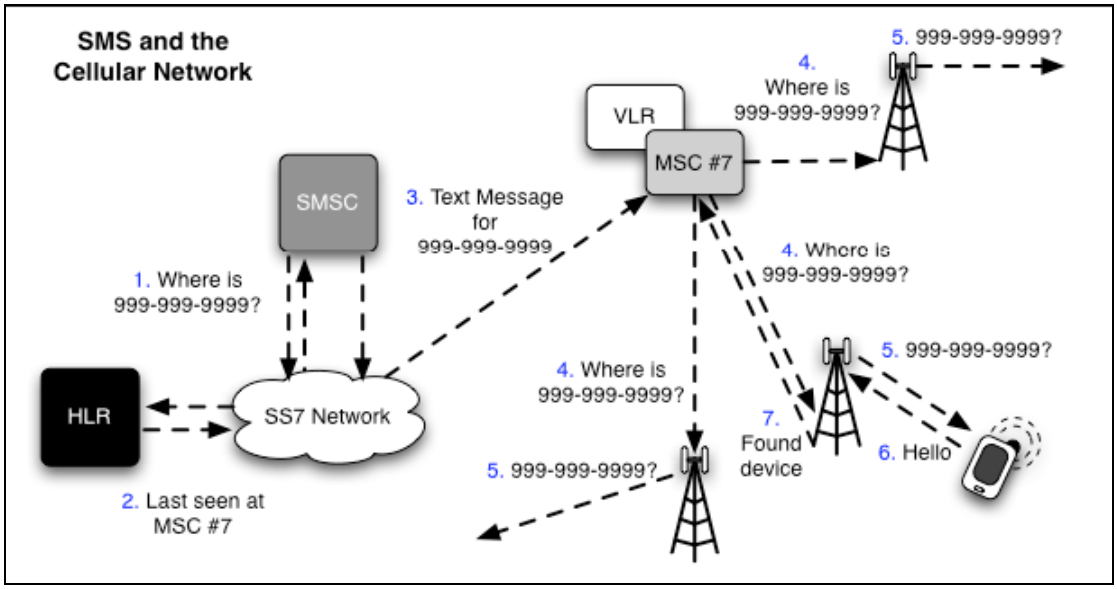
Source: Traynor (2008; P 6)

Figure 3: SMS Delivery Service System

An SMS Center is created at the Police Headquarter to collect and re-distribute the SMSs that are coming through the system. The Center receives messages from all networks, and carry out an aggressive spam filtering on all incoming messages. The filtered messages are then converted and copied into the SMS message format and encoding before they are placed in a queue for onward distribution to the respective numbers depending on the case. The SMSC uses the Key word based approach in assessing the level and immediacy of action required by the different officers.

Critical to the system that is being proposed is the ability to locate the source of the device from which the message has originated so that the SMSC action can be targeted on a certain route. Locating a device on the network is not an easy task. We know that many of the network providers have their services determined by the market demand such that the masts are placed in places where there is a high demanding population for the services. Implying that if one is traveling on the high way the devices can loose touch with the network and every time an attempt is made to send an SMS the network attempts to locate the device. Traynor (2008) has

described the process illustrated in Figure 4 as follows. If a mobile device is not currently exchanging messages with a base station, the network may only know a client's location at a very coarse level (i.e., the mobile device may be known to be in a specific city, but no finer-grained location information would be known). Accordingly, the SMSC needs to first find the general location for a message's intended client before anything else can be done. Once a phone is located, the network can deliver a text message. After the network attempts to deliver the text message, it tells the SMSC whether or not it was successful. On delivery, the text message is deleted from the SMSC. Otherwise, the message remains on the SMSC until a later attempt. The delivered message will be stored in the database for processing. The delivery of the messages through the Internet will also be explored as the delivery of messages over the Internet is cheaper and it is in real time as opposed to the SMS solution.



Source: Traynor (2008; P8)

Figure 4: SMS and the cellular network

Image processing

As pointed above some community members will be able to use their high-end mobile phones to capture images of number plates that will be sent using SMS for processing. These images will have to be processed to capture the registration number plates, and information stored in the database. Tushabe and Wilkinson (2009) have recently developed several algorithms that can separate letters and numbers from images that will be applied in this project. These algorithms will be modified to provide real-time solutions. They use the following steps:

- Identifying objects of interest from the image that has been sent by SMS for unique features i.e. letters or numbers of number plates.
- Extract the desired patterns i.e. actual letters and numbers from the image
- Converting the letters and numbers into text file that can be stored in the database.

Methodology

The objective of this research is to promote road safety through behaviour and attitude change using ICT and community policing. A multi-displinary team (i.e. data warehousing, data mining, artificial intelligence, image processing, mobile technology, and sociologist) will build a system that receives information from the community using mobile phones, store and process the information, and relay it to the nearest enforcing unit for appropriate actions that can prevent accidents through behaviour changes. The research will be supported by community awareness campaigns, and the behaviour changes will be monitored during the research. Community policing is a long-term commitment that requires proper planning and patience as the impact takes time to be realized. Progress will be measured through setting SMART goals, as success can be measured through gradual improvements

For successful implementation of this system the following requirements will be addressed:

- Expertise in data warehousing, data mining, artificial intelligence, image processing, mobile technology and sociologist.
- Information on the car registration numbers, the toll free number such as 999, and a message "in case of bad driving SMS" must be displayed in all PSV vehicles and public places.
- The system should be able to capture information from the SMS message that may be in form of text, image or video. The information to include vehicle number, Sender phone number, Date, Time and the Cell location. The cell location, data, and time information can be used to track the direction and the frequency of use of particular route. The sender phone number plus the other information is necessary to eliminate calls that may originate due to malice when they are repetitive. If the information is from different callers at different locations and times then you have a bad driver. The definition of a bad driver has to be made so that he/she is flagged by the system.
- The system should process the information very fast and flag off any action that may be needed.
- The system should be able to link up with other systems of Uganda Revenue Authority (URA) and the Transport Licensing Board (TRB) to capture information of specific road offenders. The project data warehouse can be periodically updated from these systems.
- The system can generate automatic warning messages to the bad drivers and owners of vehicles. The number of warnings can be determined to establish further actions.
- Using vehicle identification incidences of bad driving can be brought to the attention of the employers for disciplinary action to the drivers.
- Other remedies can include driving license withdrawal or suspension, driving licensing cancellation, and other measures in the penal code.
- There should be public awareness campaigns for a good period to bring the attention of the public and making them aware of the benefits and why they should use the technology to save the lives of their fellow citizens.

In developing this solution the prototyping methodology will be used. Through prototyping one is able to access the viability of the concept and once an agreeable

level of confidence then it is possible to scale up the role-out of the system. The successful implementation of the prototype, will lead to deployment of a working system for the Police Force.

Conclusion

The success of this research is premised on creating awareness that drivers and owners of vehicles are responsible for their actions, and every citizen is watching the driving behavior. With time, people's behavior and attitude will change and the number of accidents will reduce tremendously. In addition, success will depend on the joint efforts and participation of the police, community, government, public and private agencies working as partners. The research will start experiencing positive results in the medium term and this will enable replication of the system in other countries.

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