Mobile Communication Safety on Road Transport

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Abstract: - Telecommunication industry is the world's fastest growing industry with 5.3 billion mobile subscribers (that's 77 percent of the world population) around the globe. This significant rise in cellular phone use has served as the catalyst for major road accidents. They can be extremely distracting and cause careless and unavoidable accidents. Many people have been injured and even killed because of wireless customers and their over-bearing cell phones. With the aim of preventing such types of accidents, we propose a highly efficient automatic electronic system for early detection of incoming or outgoing call, an antenna located on the top of driver seat used for detecting when the driver uses mobile phone and an safety application named (Profile Changer) has developed using J2ME that will automatically loaded on the drivers cell phone which helps in reducing the risk of accidents from occurring, while also ensuring the user need not worry about missing urgent calls. We have extended our research by evaluating the outcome obtained with 2010 study from the US National Safety Council and we have also shown the extent to which this application helps to reduce economic losses in India.

Key-Words: - Mobile application to prevent accidents; cell phone while driving; Indian Economic loss due to cell phone accidents, Driver detection, Distraction.

1 Introduction

Indian telecommunication industry is the world's fastest growing industry with 826.93 million mobile phone subscribers as of April 2011. It is also the second largest telecommunication network in the world in terms of number of wireless connections after china. Mobile telephony experiences growths at rates such as 15.34 million subscribers a month, which were added in April 2011. Due to rapid change in technology the demand for better and faster cellular communication also increases. This growth can be seen in the increasing revenues of major telecommunication (expected to reach a size of ₹ 344,921 crore (US$76.92 billion) by 2012 at a growth rate of over 26 per cent) and also led to increase intensive research and development toward cellular system. For last 15 years, an explosion has been noticed in the number of mobile communication subscribers and it appears that this growth is likely to continue well into the future. It is projected that India will have 1.159 billion mobile subscribers by 2013. Furthermore, projections by several leading global consultancies indicate that the total number of subscribers in India will exceed the total subscriber count in the china by 2013. But on the other side of the coin, India has recorded maximum number of road accident in the world overtaking china to reach No.1 position according to the report "Decade of Action for Road Safety 2011-2010" released by World Health Organization (WHO). It also recorded road traffic crashes cause grief and suffering for the family members of the deceased and injured, also result in economic losses to victims, their families, and nations as a whole, to the tune of 1-3% of their respective gross national product. Many different studies have shown that when drivers use a cell phone while driving increases the accident risk [6] [7] [8]. This risk also extends to pedestrians [9] [10]. For example, it is estimated that mobile-phone use for one hour a month increases accident risk by 400–900%. Other studies show that a high percentage of accidents among youngsters are due to mobile phone use [11]. The increased accident risk is due to the fact that drivers using the phone are distracted from their main task, resulting in slower reaction time which leads to accidents.

1.1 Global System For Mobile Communication

Globally, GSM is the most dominant mobile phone network. As mentioned earlier it is originally a 2G digital technology based on TDMA. GSM works on three frequencies 900 MHz, 1800 MHz and 1900 MHz. To make efficient use of frequency bands GSM networks uses combination of FDMA (frequency division multiple access) and TDMA (time division multiple access). GSM was first deployed in Europe in the early 1990's and was the first 2G technology to allow limited text messaging (SMS – short message service). Like CDMA, GSM has evolved into third generation (3G) extensions which allow for higher data rates. These extensions can be commercially recognized as GPRS (General Packet Radio Service), EDGE (Enhanced Data Rates for GSM Evolution), 3GSM and HSPA (High Speed Packet Access).

1.1.1 GSM Network Architecture

The general architecture of GSM network is shown in figure 1. The GSM system consist of several functional elements including mobile switching centers (MSC), base stations (BSC) with associated base transceivers (BTS), an operation and maintenance centre (OMC) and gateway MSC.GSM mobile terminal or mobile stations communicates across the Um interface, known as the air interface, with a base BTS in the small cell in which the mobile unit is located. This communication with a BTS takes place through the radio channels. The network coverage area is divided into small regions called cells. Multiple cells are grouped together form a locations area (LA) for the mobility management.

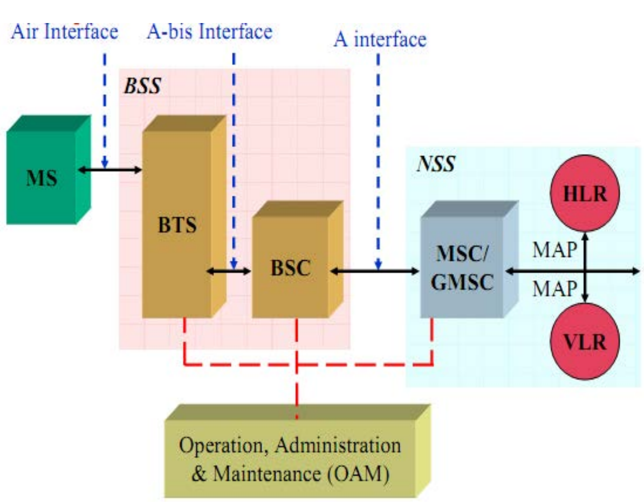


Figure 1 GSM Network Architecture

BSC are connected are connected to MSC through dedicated line or radio communication link. The BSC reserves radio frequencies, manages the handover of mobile station from one cell to another with in the BSS (base station subsystem). MSC interface to the PSTN (public switched telephone network) is called the gateway MSC. MSC incorporate functions including home location register (HLR), visitor location register (VLR), authentication register (AuC) and equipment identity register (EIR) [30]. The HLR and VLR together with MSC provide the call routing and roaming capabilities of GSM. The HLR stores information both permanent and temporary about each of the mobile station that belongs to it. The VLR register maintains information about mobile station that is currently physically in the region covered by MSC. VLR becomes important when user leaves the area served by his home MSC. The two registers are used for authentication and security purpose. The EIR is a database that contains a list of all valid mobile equipment on the network, where each mobile station is identified by its international mobile equipment identity (IMEI). It helps in security and prevents uses of network by mobile station that haven been approved. The AuC holds the authentication and encryptions keys that are stored in each user SIM card for authentication and encryption over radio channel [29]

1.2 Driver Distraction

Driver distraction is one form of inattentiveness and is a major contribution towards accidents. Distraction occurs when a driver "is delayed in the recognition of information needed to safely accomplish the driving task because of using mobile phone while driving either it compels or induces the driver's shifting attention away from the driving task". Dialing and holding a phone while steering can be an immediate physical hazard, but the actual conversations always distract a driver attention. Evidence strongly suggests that this behavior is increasing rapidly as a result of the exponential growth in the use of mobile phones more generally in society. When drivers were conversing on either a handheld or hands-free cell phone, their braking reactions were delayed and they were involved in more traffic accidents than when they were not conversing on a cell phone [28].It also shows that the distraction caused by mobile phones can impair driving performance in a number of ways, e.g. longer reaction times (notably reaction to traffic signals), impaired ability to keep in the correct lane, and shorter following distances.

1.3 Statistics

The global death toll from road accidents is estimated to reach 1.9 million people annually by 2020 up from the current 1.3million [34]. The current figure is equivalent to wiping out the entire population of a country like Mauritius. A major cause for this type of road accident is driver distraction. Due to this type of distractions, almost 1.3 million people die each year on the world's roads, making this as the ninth leading cause of death globally. In India alone with latest figures of 1,05,000 annual deaths due to road accidents has overtaken China reports World Health Organization in its report on “Decade of Action for Road Safety 2011-2020” [35]. In India, the death toll rose to 14 per hour in 2009 as opposed to 13 in previous year. By 2030, road accidents are projected to become the fifth biggest killer as per Global Status Report on Road Safety.

Since major part of the accident reported in India, we implemented our electronic system & profile change application in Indian accidental statistics and shown how far the system helps in reduction of accident and we have also shown the extent to which this system helps to reduce the economic losses in India.

1.4 Legislation and Enforcement

According to recent research from University of Sydney, it’s proved that People talking on cell phones while driving are at least four times more likely to be involved in a collision, using a hands-free device does virtually nothing to reduce the risk [9][15]. Researchers at the University of Toronto and New England Journal of Medicine found the risk of having a traffic accident while using a cell phone or similar device to be the same as drunk driver [28]. To reduce these kinds of road accident, many countries have taken steps to legislate on mobile phone use, and a wide range of laws are being adopted: some countries focus laws on particular high-risk groups, such as young drivers, while others have applied a blanket ban on use of all mobile phones (handheld and hands-free), license cancellation, fine etc., while others are not to legislate at all on this issue. In New Delhi, India use of cell phones when driving, including use with a hands- free unit was banned from 2001. Despite concrete laws and penalty levied on breaking road rules, the number of accidents on Indian roads is increasing with every day. Till to date, there is a lack of research that examines the effectiveness of legislation in sustaining reduced levels of use of mobile phones and even less evidence on the effects of these laws in reducing road traffic injuries or fatalities.

In-spite of these ban and various strict laws against cell phone use while driving, drivers are still unlikely to altogether give up using their cell phones while on the road due to various factors like,

- Users don’t want to miss any emergency calls like business and personal.
- Calling for help in a Medical Emergency. (Life-saving communication tools)
- Obtaining directions when lost.
- Alerting authorities of crime progress.

2 Theoretical Backgrounds

Researchers and scientists proposed various ways like developing a model or devices or an application to prevent the usage of mobile phone during driving. But still each has its own demerits.

One of the proposed solutions is to use technology to fight distracted driving. Some of the gadgets that have already been introduced to the market or are in the planning stages include: (1) *Anti Sleep Devices:* these devices require you to answer questions in order to ascertain a safe period of uninterrupted driving time; (2) *Alert Systems:* these systems send audible alerts when you are changing lanes without a signal, crossing into other lanes, or driving too close to the edge of the road; (3) *Collision Warning Systems:* these gadgets gauge how far you are from other vehicles, particularly the vehicle in front of you, and advise you to slow down and create a greater space to avoid a collision; and (4) *Apps that Prevent Cell Phone Use in a Moving Vehicle:* these apps would prevent cell phones from functioning inside moving vehicles.

Companies have developed and invested in new technologies to prevent a driver from using a cell phone when the driver is behind the wheel and each came up with different innovative solutions. Some of them are listed below.

Illume Software's *iZUP* solution uses GPS to detect if you're driving on a highway. It runs in the background and comes to life when it detects you are moving faster than a preset velocity, typically 5 mph. Once it detects that the phone is moving more than the preset value, it interrupts the normal operation of the phone with the iZUP application. Subscribers cannot text or make phone calls while the car is moving.

DriveAssist by Aegis Mobility is a network-centric solution. It uses a phone’s GPS to detect when the car is moving and it redirects all phone communications to a message center which explains that the caller is unavailable because they are driving. It also defers text messages [33].

ZoomSafer and iSpeech's *Drive Safely* focus on using text-to-speech technology to read text messages to you while you're driving. Safe Driving System's *Key2SafeDriving* and obdEdge's *cellcontrol* use a hardware dongle in the car that communicates with the user's cell phone via Bluetooth. When the phone gets within range of the dongle in the car, key2SafeDriving turns off the use of the phone and texting[32]. *Cell Control* application installed on a cell phone will prevent incoming and outgoing calls while a car is in motion.

T-Mobile recently unveiled its new application *Drive Smart Plus* that disables the phone once the driver begins to move the car. A GPS system tracks the vehicle's movement and turns off the phone, preventing the driver from receiving texts and calls. Calls are routed directly to voicemail and texts are silenced.

PhonEnforcer application which automatically turns off the cell phone when the user is driving. This patent pending process enhances driving safety by stopping mobile phone use [25].

Listed below are the some of the patent application filed to prevent mobile phone usage while driving.

Japanese patent application JP 10 233836 entitled "On Vehicle Portable Telephone System" discloses a system and method where incoming calls received within a moving vehicle, when the vehicle exceeds a predefined speed limit, are directed to a voice mail system where the caller is invited to record a voice message, before the call is closed. In this Japanese patent application, the objective of emergency calls and risk associated with outgoing call are failed to deal with it.

US Patent "Method for automatically switching a profile of a mobile phone" [26] discloses a method of measuring a current environmental noise value and compared with a predetermined noise value to calculate a noise difference. Then switching the profile of the mobile phone based on the value of the noise difference. In this patent User able to get call when struck in traffic signals, Risk of Outgoing call and Emergency call are failed to deal with it.

Another Japanese patent application JA 10 013502 entitled "Portable Telephone Set Used for Vehicle" discloses a system and method where incoming calls received within a moving vehicle, when the vehicle exceeds a predefined speed limit, are blocked by a computer on the vehicle which forces no wireless communications can be carried on. With such a system, the call recipient within the moving vehicle has no chance of knowing that an incoming call has been received. In this Japanese patent application, the objective of emergency calls is not met. Since user knows in advance that he will not get any calls while driving which may encourage the user to drive quickly to reach the destination in short time which in turn increase the risk of accidents.

In-spite of various mobile applications, system or devices exist, we still see the number of accidents due to cell phone usage was increasing gradually. The following are some of the demerits or users negative feedbacks of the above products.

- ✓ Lack of ability to decide whether cell phone is used by the driver or passenger.
- ✓ Lack of ability to provide provision to attend incoming emergency call.
- ✓ User/driver has to start the application before he starts driving. High possibility that user may fail to start the application.
- ✓ Most application relies on GPS or Bluetooth device which should always ON. It may also affect the mobile battery life.
- ✓ Many application turnoffs the cell phone while driving. It not only would the driver's cell phone be unusable but any of the vehicle's other occupants cell phones would be as well and it also take away the driver from making any outgoing call in emergency situation like Calling for help in medical emergency, obtaining directions when lost.
- ✓ Failed to deal when the user struck in the traffic signal since many application work relays on speed.
- ✓ Increase stress and encourage harsh driving (User know in advance that he will not get any call unless stop the vehicle which may encourage the user to drive quickly to reach the destination in short time)

3 Our Methodology

On the basis of the results of the studies mentioned above, we propose a profile changer application that will significantly reduce the risk of accidents occurring because the driver is using a mobile phone while also ensuring the user need not worry about missing urgent calls.

Our Profile Changer application has various stages:

- ✓ Using the mobile phone to measure the current speed of the vehicle.
- ✓ Comparing the current speed with a predefined threshold speed.
- ✓ Capturing incoming calls and, before the phone rings, blocking the call once the vehicle speed has exceeded the threshold value.
- ✓ Sending a message to the caller once the call is blocked.
    - Before Step (3) the profile changer should determine whether the call is an emergency call. A call is considered to be an emergency call if the caller has called from the same number 3 times within 5 minutes of the 1st call.
- ✓ The user should not be allowed to make any outgoing calls irrespective of the vehicle's speed.

Figure 2 Application Setting Panel

Driving Profile - It can be set to either Enable or Disable. By default it set to enable when profile changer loaded in to the mobile.

Driving Time – Max. time to reach the destination can be set. Its values are 30min, 45min, 60min and 2hrs.

Threshold Speed – Max. speed above which user will not get call. Its values are 0m/s, 2m/s, 4m/s, 8m/s and 16m/s.

3.1 Measuring Current Speed

By using J2ME API GPRSInfo.GPRSCellInfo, we obtain the information from the mobile tower the mobile is connected to with the help of MCC, MNC, LAC & CELLID.

Mcc = mobile country code

Mnc = mobile network code

Lac = Location area code

Cellid = current cell id

This application exploits Wifi or GPRS communications to connect loc8.in server for transfer these obtain data from mobile phone which results in JSONObject. After parsing this JSONObjectArray, we can get the latitude and longitude of the device. From the obtained data, we can calculate the distance between two corresponding latitudes and longitudes by using the coordinates API's method. From the obtained distance, we can workout the speed from a simple calculation. Once the current speed is obtained, it is compared against the threshold speed, and if it exceeds it, then it starts listening for any incoming call events. Here we didn't use GPS technology to obtain speed of the vehicle because the strong or weak GPS signal affects the accuracy, e.g., if it is a cloudy day it would slow down the signal transmission or even detect no signal.

Figure 3 Distances, Speed with LAT and LONG

3.2 Profile Changer Handling the Incoming Call and SMS

To get incoming call event, we need to implement J2ME's PhoneListener API, which listens for all acts on phone events, such as incoming calls, call disconnection, and so on. Once our application receives any incoming call event, it starts following the process to ensure the user is uninterrupted while driving based on various conditions. Figure 4 (a) & (b) shows the incoming call handling operation using profile changer application.

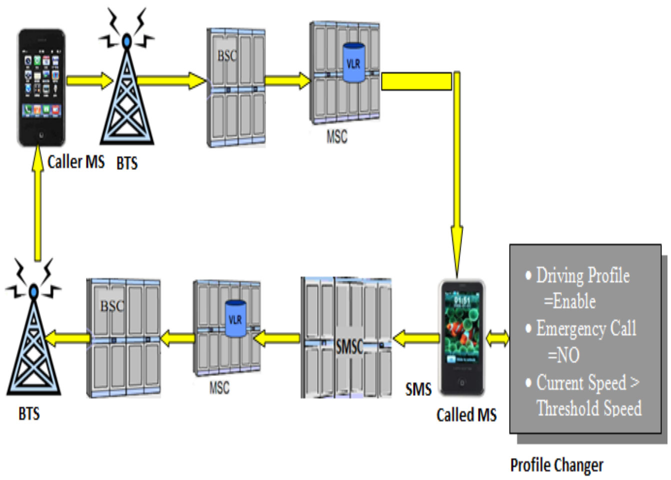


Figure 4(a) Incoming call operation when NO Emergency call

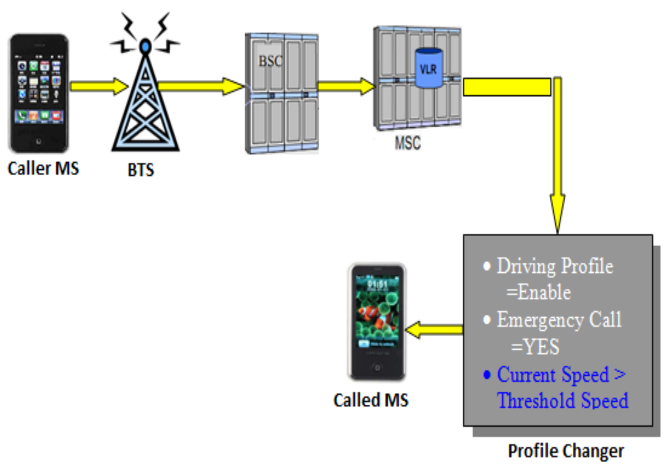


Figure 4(b) Incoming call operation when there is Emergency call

When a caller initiates a call by dialing a number in his mobile it directly send a request to the BTS which he comes under. BTS there by sends the request to the BSC to which it is connected and from the BSC, the request is made to the MSC. Subsequently MSC sends a request to the HLR to check the information about the caller like account balance (if pre paid), area of the caller etc. After checking all the details the HLR sends a acknowledgement message to the MSC that the caller is O.K. to make a call or not. Once the message received by MSC it establishes an air link between the both parties and the call gets connected. Before the phone get rings profile changer checks for driving profile. If driving profile is disabled then all incoming calls will be allowed.

Otherwise, it will again check whether it is emergency call (if user has called thrice in a 5 minute duration, then it is an emergency call) or not.

If it is emergency call, the application allows that call without checking for speed as shown in figure 4(b). Otherwise, it disconnects that call and sends a message to the user through Short Message Service Center (SMSC) as shown in figure 4 (a). The message sent is based on various conditions:

- ✓ If the caller calls for the 1st time then he receives the message: "User is driving... please call back after XX minutes, and if it is an emergency, call twice more continuously."
- ✓ If the caller calls for the 2nd time within 5 minutes from the 1st call made, then he receives the message: "User is driving... please call back after XX minutes, and if it is an emergency, call one more time continuously."
- ✓ If the time interval between 2 calls is more than 5 minutes than application will consider it as first call.

Here, XX is difference between the total time of the journey (set in the setting panel) and the time of the incoming call.

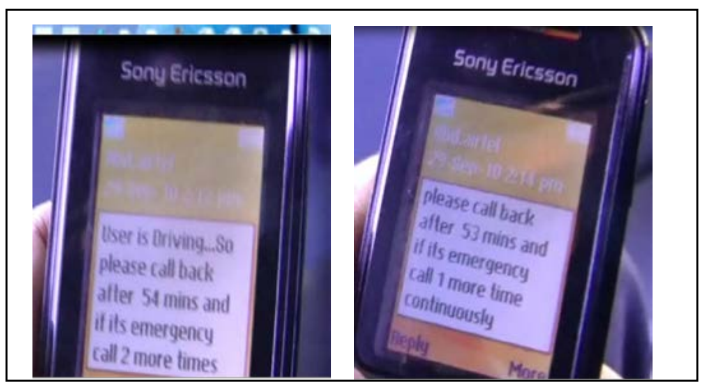


Figure 5 SMS received by the caller after 1st and 2nd try respectively

In situations like when the travel time exceeds the driving time set by the user before the start of travel, then caller receives the message: "User is driving... please call back afterwards". Here the value of XX will not be sent to the caller. These situation can be avoided if we use GPS maps & navigation system where driving time can be estimated real time depending upon driving speed, traffic, route selection etc.,

3.3 Handling the Outgoing Call Event

To get outgoing call event we need to implement PhoneListener API which listens all act on phone events like call Initiated, incoming call, call disconnection etc. Once driving profile set as 'Enable' this application will block the user from making outgoing call unless driver stop and turn off the vehicle in safe place as shown in figure 6.

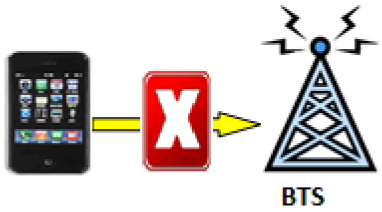


Figure 6 Outgoing call operation

4 Automatic Mobile Detection System

The circuit is mainly designed to start the profile changer application automatically on the driver's phone by switching mobile phone OFF and then ON without human intervention before he get any incoming call. This was done because there is high possibility that the user may fail to start the application before he starts driving and to run profile changer application only on the phone used by the drivers, and not on the phone used by the fellow passenger. This profile changer application will automatically end when the driving speed is below the threshold speed for more than 2 minutes by assuming the user has completed the task of driving which eliminate the unnecessary memory used by mobile phones if the user failed to stop the application running in the background.

An electronic circuit was designed for automatic detection of incoming & outgoing call on driver's phone. Though various commercial systems do exist for detecting mobile-phone use indoors, and these could theoretically be implemented in a car. The trouble is that these Commercial systems are not able to discriminate mobile-phone use by a passenger instead of the actual driver. The biggest problem for the system is posed when phones are used by all passengers except the driver. In this case, the detection system was able to discern that it is not the driver who is using the mobile phone. This circuit will get triggered ON when the vehicle gets started.

In this circuit we need two power supplies. Majority of the ICs are worked on regulated DC power 5v with GND. While Relay drive worked on DC 12v with GND. This power supply unit consists of transformer, rectifier, filter & regulator. AC voltage typically 230v RMS is connected to a transformer which steps that AC voltage down to the level of the desired AC voltage. A Diode rectifier then provides a bridge rectified voltage that is initially filtered by a simple capacitor filter to produce a DC voltage. This resulting DC voltage usually has some ripple or AC voltage variations. The output voltage from the capacitor is more filtered and finally regulated using voltage regulator, which maintains the output voltage constant irrespective of the changes in supply variations, load variation and temperature changes. Here we use one fixed voltage regulator namely LM7805.The IC 7805 is a+5 voltage regulator.

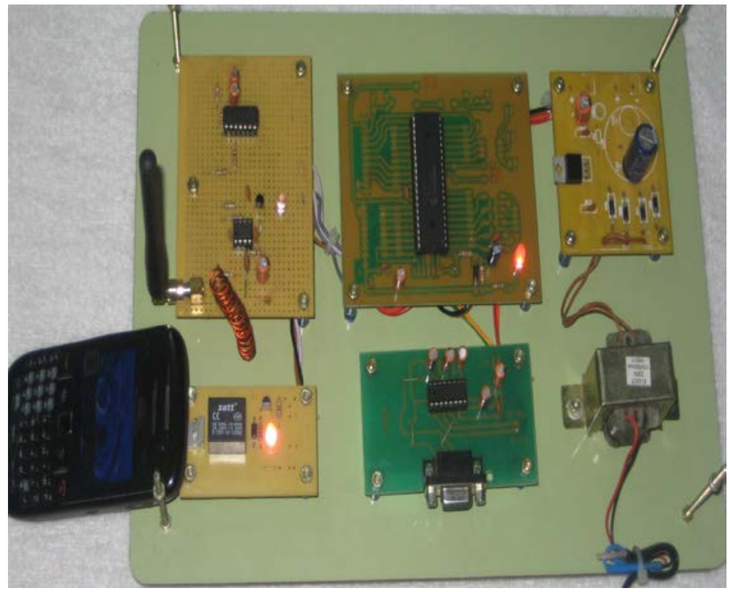
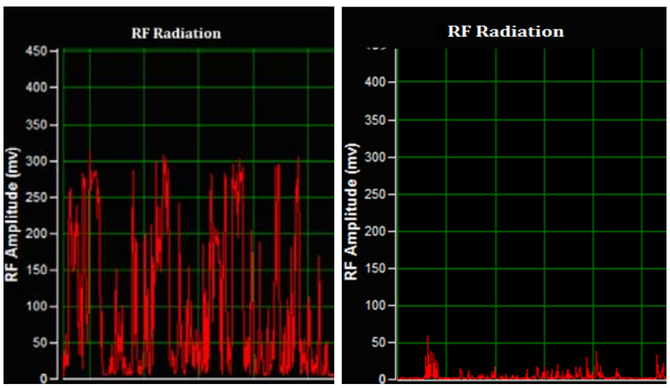


Figure 7 Automatic Mobile Phone Detection System

The RF amplifier circuit can detect both the incoming and outgoing calls, SMS and video transmission even if the mobile phone is kept in the silent mode. The moment the bug detects RF transmission signal from an activated mobile phone, the LED blinks and it continue until the signal transmission ceases. Here the circuit uses a 0.22μF disk capacitor to capture the RF signals from the mobile phone. The disk capacitor along with the leads acts as a small gigahertz loop antenna to collect the RF signals from the mobile phone. The combinations of both antenna and rectifier produce a direct current. Op-amp IC CA3130 is used in the circuit as a current-to-voltage converter with capacitor connected between its inverting and non-inverting inputs. The rectified DC voltage is stored in a large capacitor and is digitized by an analogue–digital converter (ADC) for subsequent storage and processing using a microcontroller. The voltage obtained with this system depends, among other factors like, Signal strength, on the distance of the phone from the antenna and the relative orientation between antenna and phone. This part of the circuit should be placed inside the vehicle; on the top of driver's seat to receive the RF radiation emitted by mobile phone. This set-up facilitates more trustworthy discrimination of driver use of mobile phone.

The output of RF amplifier stage is given to PIC16F917 microcontroller which executes the voltage analysis algorithm. The microcontroller is programmed in such a way that, once the voltage level obtained from the RF amplifier stage is greater than voltage value stored in EPROM of microcontroller, it will activate the relay circuit which will switch OFF and then ON the mobile phone. Furthermore the algorithm's output is transmitted to laptop for recording and further analysis using MAX232 which is an integrated circuit that converts signals from an RS-232 serial port to signals suitable for use in TTL compatible digital logic circuits. Other alternative method to switch OFF and then ON mobile phone is by using Bluetooth wireless technology. For this we need to modify the above circuit faintly by replacing the relay circuit unit with external Bluetooth device which will automatically paired with driver's mobile phone.



Graph 1 (a) & (b) shows the mobile phone from driver seat & rear seat passenger

In this experiment, a call was made to the rear seat passenger and to the driver when the vehicle was moving. A call was maintained for few seconds, an antenna which was placed above the driver's seat captures more signal when compare to rear seat passenger as shown in graph (a) & (b). Here, we have set threshold value as 100mv, once the signal received by the antenna exceeds threshold value a relay unit will gets triggered which helps in turn OFF and ON the mobile phone. Alternately, it can be made to trigger external bluetooth device to switch OFF and ON the mobile phone. We also carried our experiment by calling to the passenger in the back seat of the vehicle here the signal received by the antenna is very negligible. In the above circuit we have used low filter to suppress the false signal.

5 Practical Experiments

We carried out our research by installing this application to 100 mobile users who travels frequently to analyses the risk factor involved and we compare these obtained results with risk estimated model carried out by NSC.

From the recent study of National Safety Council, US conducted on 2010, provides a Risk estimation report [13] which explains in details about the risk of using mobile phone while driving by considering various factors. According to the report, the DRIVER POPULATION RELATIVE RISK is determined as the weighted average of the relative risks for the two groups comprising the driving population:

Rdp = DPo + DPe × RR

Where,

Rdp = driver population relative risk

DPo = proportion of the driver population not using a cell phone

DPe = proportion of the driver population using a cell phone

RR = relative risk of crashing while using a cell phone while driving.

Similarly looking at only the cell phone using portion of the population the EXPOSED DRIVER RELATIVE RISK is:

Re = DPe × RR

Where,

Re = exposed driver relative risk

Using the above two formulas the percentage of crashes involving cell phones or the PERCENT OF EXPOSED

DRIVER RELATIVE RISK can be estimated as:

Re% = Re / Rdp × 100

Where,

Re% = percent of exposed driver relative risk

The percent of exposed driver relative risk is the percentage of crashes involving cell phone use.

Assumptions

% Cell phone drivers at any given time = 30%

% Non-cell phone drivers at any given time = 70%

Relative risk when using a cell phone while driving = 4

Driver Population Relative Risk

Rdp = DPo + DPe × RR

Rdp = .70 + (.30 × 4)

Rdp = 1.90

Exposed Driver Relative Risk

Re = DPe × RR

Re = .30 × 4

Re = 1.20

Percent Of Exposed Driver Relative Risk

Re% = Re / Rdp × 100%

Re% = 1.20 / 1.90 × 100%

Re% = 63.15%

Therefore, 63% of the crashes involve a driver using a cell phone. These 63% of crashes includes both the cases i.e., when the user tries to make a call or to attend a call. Thus the probability of one in two cases will be ½.

We modified the relative risk of exposed driver by introducing Ro and Ri parameters. Let us assume,

Percentage of user involve in accidents while making outgoing call (Ro) = 0.5 %

Percentage of user involve in accidents while attending incoming call (Ri) = 0.5 %

Now if we calculate percent of exposed driver relative risk while making outgoing call (Ro%),

Ro% = Re% x Ro

Ro% = 63.15 x 0.5

Ro% = 31.575%

Similarly if we calculate percent of exposed driver relative risk while making incoming call (Ri%) we get 31.575%. Now if we compare these results with the user who has installed this applications, we get the below findings,

Since in our application outgoing call is blocked once the Driving Profile is 'Enabled'. So there is almost negligible chance of user involving in accidents while making call. (Roa% = 0%)

Where,

Roa% percentage of user involve in accident while making call after installation of this application.

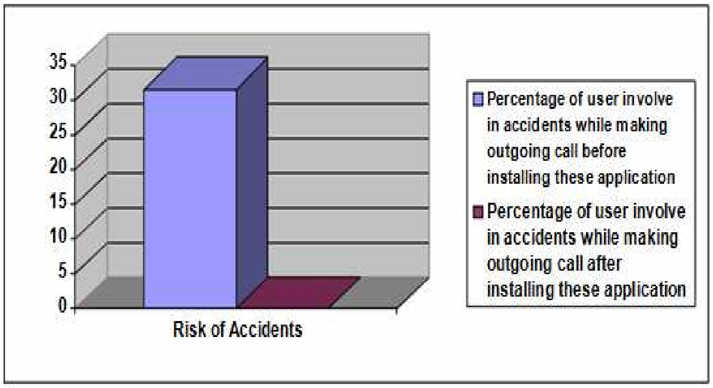


Chart 1: Ro% Vs Roa%

Now when comes to incoming call, our application eliminate all the calls which is not consider as emergency. To calculate the risk associated with the user after installing this application on mobile while driving. We install the application to 10 people out of which only 1 user got the emergency call while rest of the users also got the call during driving only one time, since our application start sending the SMS to the caller with elapsed time of the user to reach destination. So the caller makes call only after this elapsed time, by that time the user could have reached his destination safely. So out of 10 people only 1 got affected with the probability of risk associated with user after installing this application is 10%.

Rd% = Ro% -R ia%

Rd% = 31.575 – 10

Rd% = 21.575 %

Where,

Ria% = Percentage of user involve in accidents while attending incoming call after installing application.

Rd% =Differences in risk involvement of user in accident between before and after installing application.

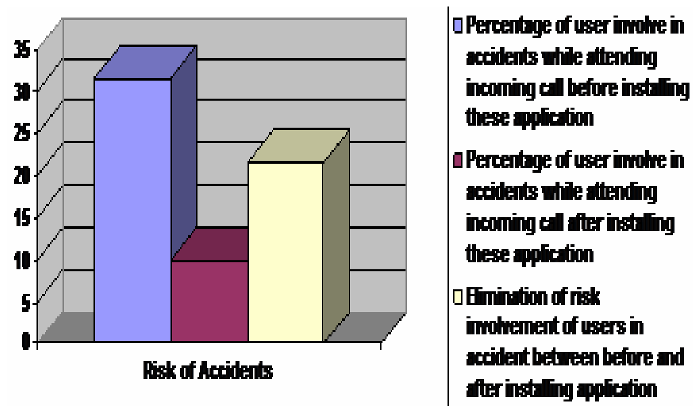


Chart 2: Ri% Vs Ria% and its difference (Rd%)

6 Indian Economic Impacts on Accidents

As per data registered by the World Health organization, nearly 13 lakh people are known to die each year in road accidents globally. Out of which more than 1.35 lakh people are killed in India. It means, 369 people die every day on Indian roads. According to Indian National Crime Records Bureau at least 14 people die every hour in road accidents when compare to 13 in previous year refer table 1.

Road Accident	Daily Statistics		Hourly Statistics	
Statistics	World	India	World	India
Deaths (2009)	3561	369	148	14
Deaths (2008)	3288	314	137	13

Table 1: Road Accidents Comparison on 2009 vs 2008

Due to coordinated interagency approaches in developed countries, the situation is improving. However, projections indicate that unless there is a new strong political commitment to prevention, the crash death rate in low and middle-income countries will double by 2020, reaching more than 2 million people per year. Road crash injuries impose substantial economic burdens on developing nations like India estimating 3 percent of gross national product.

The estimated cost includes compensation, asset loss, time and energy spent on police, hospital, court cases and Work Loss Costs value productivity losses. They include victims' lost wages and the replacement cost of lost household work, as well as fringe benefits and the administrative costs of processing compensation for lost earnings through litigation, insurance, or public welfare programs like food stamps and Supplemental Security Income. As well as victim work losses from death or permanent disability and from short-term disability, this category includes work losses by family and friends who care for sick children, travel delay for uninjured travelers that results from transportation crashes and the injuries they cause, and employer productivity losses caused by temporary or permanent worker absence (e.g. the cost of hiring and training replacement workers).

National Safety Council (NSC) estimates that 28% of crashes are caused by a driver using his or her cell phone. Financial losses due to road accidents are close to 3% of our GDP every year as per BBC report. In India, so the total cost of losses due to road accidents was ₹820 cores per day.

Road Accident	Daily Statistics		Hourly Statistics	
Statistics	World	India	World	India
Deaths (2008)	3288	314	137	13
Injuries (2008)	136,986	1,275	5,708	53
Death + Injuries	140274	1589		

Table 2: Total number of Accidents in 2008

According to NSC, total number crashes due to mobile phone usage while driving every day can be calculated as,

28% of 1589 = 445.

Therefore, 445 crash per day due to mobile phone usage.

In India the total cost spent approx. ₹820 Crores per day for 1589 crashes as per the reports obtained from BBC and NSC. Hence ₹229.6 Crores spend for crashes involved in mobile phone usage. As discussed earlier, if we install this application in mobile phone while driving the chances of involvement in crashes is 10%

So, 10% of 445 = 44.5
(Approx. 45)

Hence we can save nearly 400 crashes which in turn reduce the economic loss of India to ₹620cr from ₹820cr and with improving personal family benefits. Hence nearly ¼th of crashes and economic loss can be reduced.

7. CONCLUSION

This paper presents a low-cost, non-invasive, small-size system and a profile changer application which helps to detect the driver's use of mobile phone not the phone used by the fellow passenger in the vehicle. It also helps in preventing the road accident due to distraction to a large extent. In addition to this, implementation of above system will also helps in reducing the loss of economy. Though Engineers, researchers or scientist innovate various new technologies, methods or system to prevent road accident, but still road accident continues. To overcome this type of situation all people must educate, realize and give more attention along with newly innovated technology to decrease the rate of road accident.

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