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Design and Precautionary Measure for Mobile Phone Accidents While Driving

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Abstract: *In general the Usage of cell phone is increasing worldwide in recent years, with more than 652 million Subscribers in India one step behind China as of July 2010 . At the same time if we consider the risk associated with usage of mobile phone while driving, India is way ahead of china. According to World Health Organization (WHO) in its first ever Global Status Report on Road Safety says, India has recorded maximum number of road accidents in the planet . According to Indian National Crime Records Bureau at least 14 people dies every hour in road accidents. Various Statistics also reveal that a large portion of road accidents in India is caused due to mobile phone usage while driving. Although various measures and rules placed on mobile phone usage, still it's highly impractical to prevent this type of events. In order to overcome this serious issue, we developed an application which helps in reducing the number of mobile accident considerably and we further extend our research, by comparing the obtained results after installing this application with recent study of US National Safety Council, conducted on 2010 and we also shown how far this application helps in reducing economic losses in India.*

Keywords*-Mobile phone accidents; usage of mobile phone while driving; Accident in india due to mobile phone usage.*

I. Introduction

Mobile phones can be an essential means of communication when we are away from the office or home and it can be an important security asset in the event of an emergency. However, there is considerable concern that using a mobile phone while driving creates a significant accident risk to the user and to other people on the road, because it distracts the driver, impairs their control of the vehicle and reduces their awareness of what is happening on the road around them.

A. ***Distraction***

Distracted driving is any activity that could divert a person's attention away from the primary task of driving. *All* distractions endanger driver, passenger, and bystander safety. These types of distractions include:Texting,Using a cell phone or smartphoneBut, because text messaging requires visual, manual, and cognitive attention from the driver, it is by far the most alarming distraction.

Using a cell phone while driving, whether to talk or to text, is a major distraction that causes car accidents. Dialing and holding a phone while steering can be an immediate physical hazard, but the actual conversations always distract a driver attention. Distraction are broadly classified in to two categories

1) Physical distraction (Visual and Mechanical) and 2) Cognitive distraction.

B. ***Physical Distraction***

When using a hand-held mobile phone, drivers must take away one hand from the steering wheel to hold and operate the phone (Mechanical Distraction). They must also take their eyes off the road, at least momentarily, to pick up and put down the phone and to dial numbers (Visual Distraction). While using a hand-held phone, the driver always continues to simultaneously operate the vehicle (steer, change gear, use indicators, etc) with only one hand. Although the physical distraction is far greater with hand-held phones, there is still some physical activity with hands-free systems. Even though they do not need to be held during the call, the driver must still divert their eyes from the road to locate the phone and (usually) press at least one button

C. ***Cognitive Distraction***

When mental (cognitive) tasks are performed concurrently, the performance of both tasks is often worse than if they were performed separately, because attention has to be divided, or switched, between the tasks and the tasks must compete for the same cognitive processes. When a driver is using a hand-held or hands-free mobile phone while driving, she or he must devote part of their attention to operating the phone and maintaining the telephone conversation and part to operating the vehicle and responding to the constantly

changing road and traffic conditions. The demands of the phone conversation must compete with the demands of driving the vehicle safely.

D. Indian Statistics

Due to this type of distractions, in 2009 nearly one hundred and thirty five thousand people died in Indian road accidents according to National Crime Records Bureau. In India alone, 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.

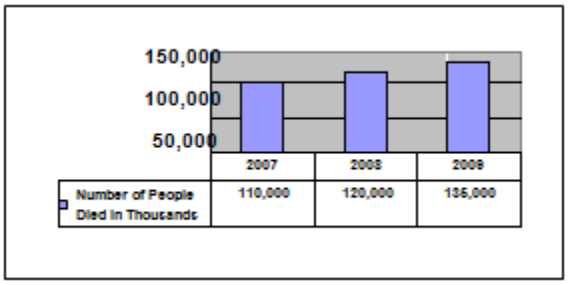

Figure 1 Accident Deaths year wise in India

Many studies highlight the usage of mobile phone and presence of alcohol while driving is the major cause for road accidents. In order to observe which is more dangerous either a mobile phone usage or presence of alcohol during driving. We extend our research by collecting special studies and data from various article and research organization. According to their research report by considering parameters like number of accidents, Brake on time, Brake force etc., Almost 90% of the studies proves usage of mobile phone while driving exhibited greater impairment than intoxicated drivers while remaining 10% studies says effect of both remains same. From these facts, we can conclude that mobile phone usage while driving is the foremost concern, which need to address.

E. Measures taken by Government

Initially, almost all the countries around the world bans the usage of hand-held devices while driving by considering the fact of deviation in driver's concentration and their physically incapacitated because of holding the phone to his ear, which slows reaction time and could result in accidents. During that time most of the countries are encouraged to use hand-free devices. Few years later, researchers found even the usage of hand-free device doesn't show any improvements. Later various studies carried out to establish the fact of risk involved in hand-free device. 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 and using a hands-free device does virtually nothing to reduce the risk . As of results of these types of studies, various governments from all part of the countries ban the hand-free devices too. In New Delhi, India use of cell phones when driving, including use with a hands- free unit was banned from 2001.

In-spite of these ban and various strict laws against cell phone use while driving in India, 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
- Obtaining directions when lost
- Alerting authorities of crimes in progress

II. Theoretical Background

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

Japanese patent application 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" 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 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.

They are also some of the mobile application exists to prevent mobile phone accidents like PhonEnforcer which automatically turns off the cell phone when the user is driving. This patent pending process enhances driving safety by stopping mobile phone use . Even this application increase the risk of accidents as discussed above and chances of missing some important calls are also high.

From the above study, if we implement the above techniques in preventing mobile phone accidents there is high possibility of harsh driving and also there is every chance of missing important calls.

III. Methodology

By keeping all the above facts from studies, we proposed a safest application which will significantly reduce the risk of mobile phone accident at the same time the user don't have any stress on missing emergency calls.

Our mobile application comprise various stages (1) Measuring the current speed of the vehicle in mobile phone (2) compare the current speed with predefined threshold speed (3)

By capture incoming call event and even the phone before the phone rings,we block the call once the speed is beyond the threshold value4)send the message once the call is disconnected.

Handling incoming call event and SMS:

In order to get the incoming call, we need to implement J2ME's phone listener API which listens for all act on phones event like incoming call, call disconnection etc. once the application gets any incoming call event stars following process to make user uninterrupted while driving based on various condition

First application checks for driving profile. if driving profile is disabled then all incoming call will be allowed the message sent to user depends on various condition.

- If caller callsfirst time then he receives first message "user is driving"call back sometime which is shown below fig

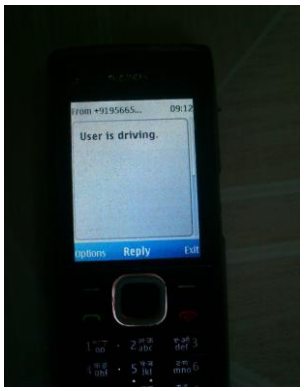

Fig-SMS receiving formet

Handling outgoing call enents:

For outgoing calls event we need to implement phone listener API which listens all act on phone events like call initiated and call disconnection etc.once user set in driving profile as 'enable' these application will block the user from making outgoing call irrespective to vehicle speed.

IV. Practical Experimentaion

we carried out our research by installing this application to 10 mobile users who travel frequently to

analyse the risk factor involved and we compare these obtained results with risk estimated model is carried out by NSC.
From recent study of national safety council US conducted on 2011,provides risk estimation report which expalis risk of mobile phone while driving by considering various factor which is shown in below fig

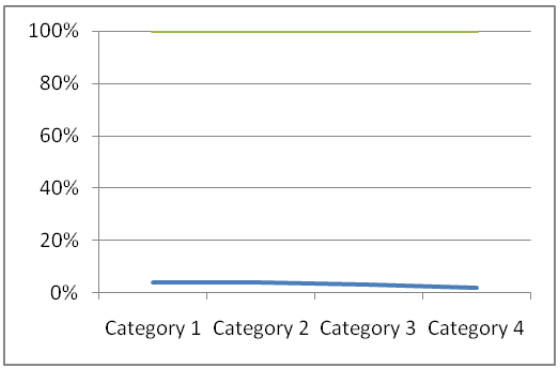

Fig-% of accident being reduced after application being fixed.

2. *SYSTEM DISCRIPTION*

2.1 *PIC MICROCONTROLLER:*

The PIC architectures have these advantages:
Small instruction set to learn
RISC architecture
Built in oscillator with selectable speeds
Easy entry level, in circuit programming plus in circuit debugging PICKit units available for less than $50
Inexpensive microcontrollers
Wide range of interfaces including I²C, SPI, USB, USART, A/D, programmable comparators, PWM, LIN, CAN, PSP, and Ethernet
• Timer0: 8-bit timer/counter with 8-bit prescaler
• Timer1: 16-bit timer/counter with prescaler, can be incremented during Sleep via external crystal/clock
• Timer2: 8-bit timer/counter with 8-bit period register, prescaler and postscaler
• Two Capture, Compare, PWM modules
- Capture is 16-bit, max. resolution is 12.5 ns
- Compare is 16-bit, max. resolution is 200 ns
- PWM max. resolution is 10-bit
• Synchronous Serial Port (SSP) with SPI™
(Master mode) and I2C™ (Master/Slave)
• Universal Synchronous Asynchronous Receiver Transmitter (USART/SCI) with 9-bit address detection
• Parallel Slave Port (PSP) – 8 bits wide with external RD, WR and CS controls (40/44-pin only)
• Brown-out detection circuitry for
Brown-out Reset (BOR)
*Analog Features****:***
• 10-bit, up to 8-channel Analog-to-Digital
Converter (A/D)
• Brown-out Reset (BOR)
• Analog Comparator module with:
- Two analog comparators
- Programmable on-chip voltage reference
(VREF) module
- Programmable input multiplexing from device
inputs and internal voltage reference
- Comparator outputs are externally accessible
*Special Microcontroller Features***:**
• 100,000 erase/write cycle Enhanced Flash
program memory typical
• 1,000,000 erase/write cycle Data EEPROM
memory typical
• Data EEPROM Retention > 40 years

• Self-reprogrammable under software control
• In-Circuit Serial Programming™ (ICSP™)
via two pins
• Single-supply 5V In-Circuit Serial Programming
• Watchdog Timer (WDT) with its own on-chip RC
oscillator for reliable operation
• Programmable code protection
• Power saving Sleep mode
• Selectable oscillator options
In-Circuit Debug (ICD) via two pins
CMOS Technology:
Low-power, high-speed Flash/EEPROM
technology
Fully static design
Wide operating voltage range (2.0V to 5.5V)
Commercial and Industrial temperature ranges
Low-power consumption

Limitations

*2.2 GSM Modem***:**

GSM is a cellular network, which means that mobile phones connect to it by searching for cells in the immediate vicinity. A GSM (Global System for Mobile Communication) modem is a wireless modem that works with a GSM wireless network. A wireless modem sends and receives data through radio waves. A GSM modem can be an external device or a PC card. An external GSM modem is connected to a computer through a serial cable or a USB cable. A GSM modem requires a Subscriber Identity Module (SIM) card from a wireless carrier in order to operate. The SIM is a detachable smart card containing the user's information. GSM modems support a common set of standard AT Commands. The GSM modem works at 900 MHz-1800 MHz.

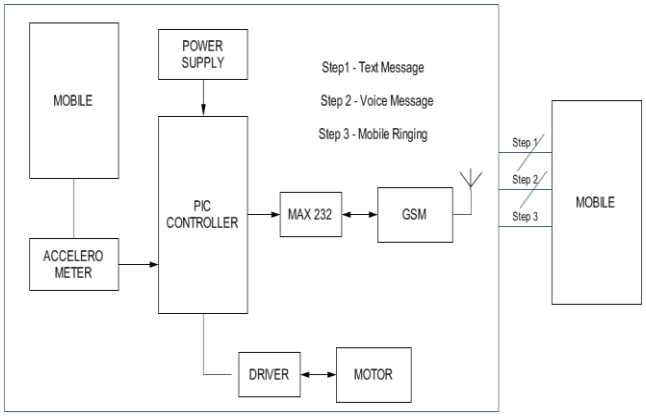

Fig 2.Block Diagram

2.3 GSM ARCHITECTURE

The GSM system architecture consists of three major interconnected subsystems that interact between themselves and the users through certain network interfaces. The subsystems are: Base Station Subsystems(BSS), Network and Switching Subsystems(NSS) and the Operation Support Subsystem (OSS). The Mobile Station (MS) is also a subsystem but is considered to be a part of the BSS.

The BSS provides and manages radio transmission parts between the MS and the Mobile Switching Centre (MSC). Each BSS consists of many Base Station Controllers (BSCs) which connect the MS to the NSS via the MSCs. The NSS allows MSCs to communicate with networks like PSTN and ISDN. The OSS allows the system engineers to monitor, diagnose and trouble shoot all aspects of GSM system.

The MS communicates with the BSS via radio-air interface. The BSS consists of many BSCs which connect to a single MSC and each BSC controls upto several hundred Base Transceiver Stations (BTSs). Mobile Handoff between two BTSs is under the control of BSC. This reduces the switching burden of MSCs.

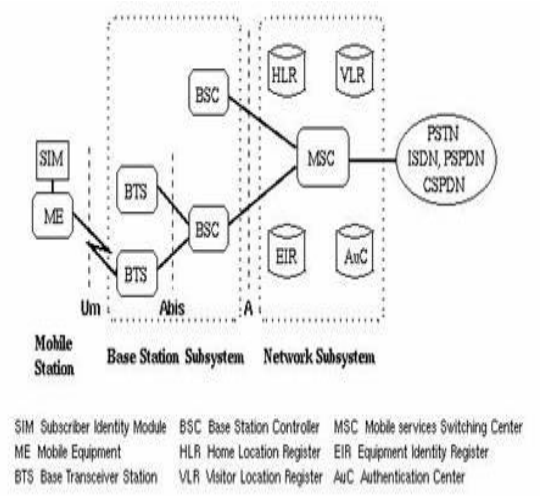

Fig 2.3 GSM Architecture

2.4 *MODEM*

A modem is a modulator/demodulator for transmitting digital information over analog wires, such as the analog telephone system's two-wire or four-wire lines. Smart modems are designed to convert data from/to a serial interface to/from an analog line. The modem is a classic DCE (data communications equipment) device, controlled via serial line by a classic DTE device (such as a computer).They also provide auxiliary services, such as dialing a particular number to set up a connection. It is possible for a modem to be in the command mode while still keeping a connection.

Fig 2.4 GSM Modem

2.5 AT COMMANDS

AT commands are instructions used to control a modem. AT is the abbreviation of attention. Every command line starts with "AT" or "at". That's why modem commands are called AT commands. "AT" is the prefix that informs the modem about the start of a command line. It is not part of the AT command name. Many of the commands that are used to control wired dial-up modems, such as ATD (Dial), ATA (Answer), ATH (Hook control) and ATO (Return to online data state), are also supported by GSM/GPRS modems and mobile phones. Besides this common AT command set, GSM/GPRS modems and mobile phones support an AT command set that is specific to the GSM technology, which includes SMS-related commands like AT+CMGS (Send SMS message), AT+CMSS (Send SMS message from storage), AT+CMGL (List SMS messages) and AT+CMGR (Read SMS messages).

2.6 TYPES OF AT COMMANDS

Basically there are two types of AT commands: basic commands and extended commands. Basic commands are AT commands that do not start with "+". For example, D (Dial), A (Answer), H (Hook control) and O (Return to online data state) are basic commands. Extended commands are AT commands that start with "+". All GSM AT commands are extended commands. For example, +CMGS (Send SMS message), +CMSS (Send SMS message from storage), +CMGL (List SMS messages) and +CMGR (Read SMS messages) are extended commands.

2.7 *ADVANTAGES OF GSM*

- Large number of infrastructure and handset vendor's giving advantage in terms of price and other commercial terms.
- Innovations ahead of CDMA e.g. single chip handsets.
- Widest choice of handsets with widespread sales and service distribution network.
- Handset availability in all price segments and ongoing introduction of wide variety to meet customer requirements.
- Easy subscription process (SIM based)
- Widespread prepaid solutions
- Seamless interoperability between networks and handsets.
- Global footprint for international roaming including SMS, data and other value added services.

GSM modem is similar to a mobile phone. The bandwidth frequency is 800 MHz to 1200 MHz. It operates at 5 Volts and has a baud rate of 9600 bits/sec. It has a circuit switching network and is possible to receive 30 messages per minute. AT commands are pre programmed in the modem. For example "AT+CMGR" is the command for message reading and "AT+CMGS" is for message sending. Other features include SMS delivery, call forwarding, call waiting and call diverting..

2.9 FEATURES Operates From a Single 5-V Power Supply

Operates Up To 120 kbit/s
Two Drivers and Two Receivers
30-V Input Levels
Low Supply Current . . 8 mA Typical
Upgrade With Improved ESD (15-kV HBM)

Conclusion And Future Work

This invension helps to reducing the risk of attending calls significantly and risk associated with intiating or making the call to almost negligible. though law has been enacted banning use of mobile phone while driving in various countries including india but still users not responding of using mobile phone while driving.

And my future work will be alerting driver by voice message and to control the speed of the vehicle.this will reduce most of the road accidents. atleast by installing the application can reduce the risk involved in mobile phone accident.

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