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Smartphone Enabled Nonintrusive T&D Detection

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Abstract:—Now-a-days the most top dangerous behaviors for drivers is Texting-while-Driving(T&D).There has been many mobile phone applications and interesting systems that have been used to detect and reduce T&D. However, to make the System practical, there must be a key property that will be used to distinguish Driver's mobile phone from passenger's. There are many existing solutions to this problem which involve user's manual input, or utilize specific localization devices to determine driver's location. Contrast to all of this solution, In this paper, we propose a method which automatically detect T&D without using any additional devices. The basic idea of our system is when a user is using the mobile phone, the smart phone embedded sensors (i.e., gyroscopes, accelerometers) will collect the connected information that includes touch-strokes, holding orientation and vehicle speed. . The collective information will then be examined to see if there exists any specific T&D patterns. In addition with the infrastructure free and high accuracy, the method does not access the content of messages and therefore is privacy-preserving.

Keyword: *Gyroscopes, Accelerometers, Mobile phone applications, Data-driven pattern recognition, Text-Drive.*

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I. INTRODUCTION

Smart-phone's are considered as small computers; they run an operating system that is often common between devices to ensure compatibility. Most can do multitasking, running more than one program which helps the user do things quicker and easier. Calling and texting is most basic task which each user use to do. According to our search "Messaging/calling" category accounts for 12 percent of time spent in apps, the report says. Data communication has become faster. Smart-phone's have advantages but a disadvantage also one of the things is hazardous distraction. Total concentration is required when it comes to driving, and using a mobile phone can compromise this focus. You need to keep both hands on the steering wheel to be the most effective driver. When you text, read messages or talk on a cell phone without a hands-free device, not only is your focus compromised, but you can't keep both hands on the wheel. Cell phone use when you are driving can also affect your alertness of the surroundings, which can make you prone to collisions.

Texting while Driving (T&D) is one of the top Dangerous behavior's for Driver. It is act of composing, sending, reading text message, emails, or making similar use of the web on a mobile phone while operating a motor vehicle. Many systems have been recently developed to help to reduce the desire to T&D .However such system required manual activation and that becomes problem. Therefore, the key challenge in detecting T&D is to find a way to determine whether the mobile utilize belongs to the driver or to a passenger. Existing solution to this problem generally rely on the user's manual input, or utilize specific localization device to determine whether a mobile phone is at the driver's location. When a user is composing message, the Smartphone embedded sensors (Gyroscope, accelerometers) collect the associated information such touch strokes, holding orientation and vehicle speed. By this it will distinguish driver from passenger.

II. LITERATURE REVIEW

In 2015, a study by the University of Southern California found that 87%of drivers agreed texting behind the wheel is dangerous, but a survey by AT&T found that 61% of drivers admitted to texting and driving. In addition, one third check their e-mail and 17% admitted to taking a selfie while driving. Twenty two percent of drivers using a social media app behind the wheel cited "addiction" as the reason and 30% of those who used Twitter admitted to doing it "all the time".[4]

The International Telecommunication Union states that "texting, making calls, and other interaction with in-vehicle information and communication systems while driving is a serious source of driver distraction and increases the risk of traffic accidents". There are about 1.6 million crashes in the US every year involving cell phone use, of which 500,000 cause injuries and 6,000 cause fatalities. Texting while driving is now the top cause of death among teenagers—texting and driving accounts for 11 teen deaths every day in the US. Overall, texting is involved in about 25% of all car accidents in the US.[6]

Distracted and careless driving has a different aspects on public health crisis that requires a multi-faceted response, so while Impact's message remains the same—to end it—the formats and venues to spread it vary. Many evidence-based curricula and guides for different

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professional fields, and for different target audiences has been developed. Impact of teenager Drivers offers countless free resources to educators, first responders, healthcare professionals, parents, community members, and teens and teen organizations.[7]

For a T&D detection system to be practical, a key property is its capability to distinguish driver's mobile phone from passengers'. Existing solutions to this problem generally rely on the user's manual input, or utilize specific localization devices to determine whether a mobile phone is at the driver's location. In this paper, we propose a method which is able to detect T&D automatically without using any extra devices. The idea is very simple: when a user is composing messages, the Smartphone embedded sensors (i.e., gyroscopes, accelerometer) collect the associated information such as touch strokes, holding orientation and vehicle speed. This information will then be analyzed to see whether there exists some specific T&D patterns.[1]

Transit-hound cell-phone detection system effectively detects, alerts, and timestamps unauthorized cell-phone use during vehicle operation, but consumer driving habits on the roads are a completely different animal.[5]

An event-driven DS identification system, called Automatic Identification of Driver's Smartphone (AIDS). Its core is to fuse heterogeneous sensory information extracted from the common vehicle-riding actions approaching the vehicle, standing still while opening the door, entering the vehicle, closing the vehicle door, and starting the engine — to identify the driver's phone[3]

The prototype of AIDS is implemented on multiple Samsung Galaxy S5s running on Android TM platfrom. In addition, we evaluated the impact of varying sensor qualities in other smart phones by employing Apple iPhone 6S plus running on iOS platforms. According to our measurements, the EMF readings from iPhone 6S plus show relatively greater magnitudes than those from Galaxy S5 even when both devices are placed at the exact same location. However ,the magnitude of EMF variances monitored when the user enters the vehicle and starts the vehicle does not differ much from each other.[2]

III. RESEARCH METHODOLOGY

According to whether the system can distinguished drivers cell phone from passenger, existing system to detect or to prevent T&D can be classified into two categories. In first case the once activated blindly block all the messages. For example, Drive mode blocks user from reading or typing anything. Text-STAR is slightly smarter in the sense that they estimate the speed of cell phone at the time of messages are sent and disable texting when the speed is above 10mph or more. This approach cannot distinguish between the drivers phone and passenger phone, thus will also stop passenger from using their phones in vehicle. More specifically when we find a mobile phone user is editing messages we need to determine in a statistically manner,

- whether the speed of the vehicle decreases, and
- whether the vehicle is taking turns, and
- whether the user is holding the phone uprightly

To detect this pattern, the first important task is to determine when the messages are being composed. More specifically we will show later those we need to know when these touch strokes occur. This task can be easily fulfilled if we argue that this approach is not only privacy-intrusive, it is such as ios and android restrict privileges granted to application. This means that an application cannot read users input unless it receives the focus on the screen.

Touch stroke associated with texting, we will find out accompanies with the touch strokes, whether there exist the T&D patterns. More specifically, to validate the existence of the first pattern, we obtain the car speed using the mobile phone GPS sensors. Then the average car speed before touch strokes occur, and the speed during these touch strokes are compared to see whether the decrease of the car speed is significant. To see whether the third pattern exists, we utilize the accelerometer in the Smartphone to obtain the orientation of the Smartphone and see if it is held uprightly. To obtain an objective conclusion, all of the decisions are made through hypothesis testing and then the conclusions are integrated together.

From our survey about the possible patterns about T&D, we found that most people have the similar pattern when they are composing messages. When a user is typing, the thumb is used to type and the other four fingers are used to hold the cell phone. Furthermore, we found that when the user is typing a special key, the space bar, the associated motion of Smartphone exhibits a reliable and distinct pattern.

In particular, associated with the hit of the thumb on the space bar, the Smartphone has a sharp rotation around x-axis, when the thumb is released, due to the resistance force of the supporting hand; there is also a rotation back around x-axis. Correspondingly, the gyroscope sensor about x-axis (abbreviated as gyro-x) will record a positive peak, followed by a negative peak. Instead of using any extra devices, the method leverages some patterns associated with how smart phones are used in moving vehicles.

In particular, some build-in sensors in smart phones collect the associated information and analyze, through hypothesis testing to see whether these T&D patterns exist. We justify why the space bar is selected instead of other soft keys. Firstly, unlike other soft keys such as letters or numbers which can be located at different locations for different touch screen keyboard configurations, the space bar is consistently located at the bottom centre in almost all Smartphone's including Samsung, HTC, iPhone, Sony, Nokia, and Windows Phone. This platform-independent property of the space bar is crucial to achieve a high accuracy for detecting touch strokes. Secondly, when a user is typing messages, the distance of space bar to the rotation axis, which is usually the Forefinger is the maximum among all the other soft keys. Accordingly, the rotation change caused by tapping the space bar can be observed more clearly than others.

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FLOWCHART:

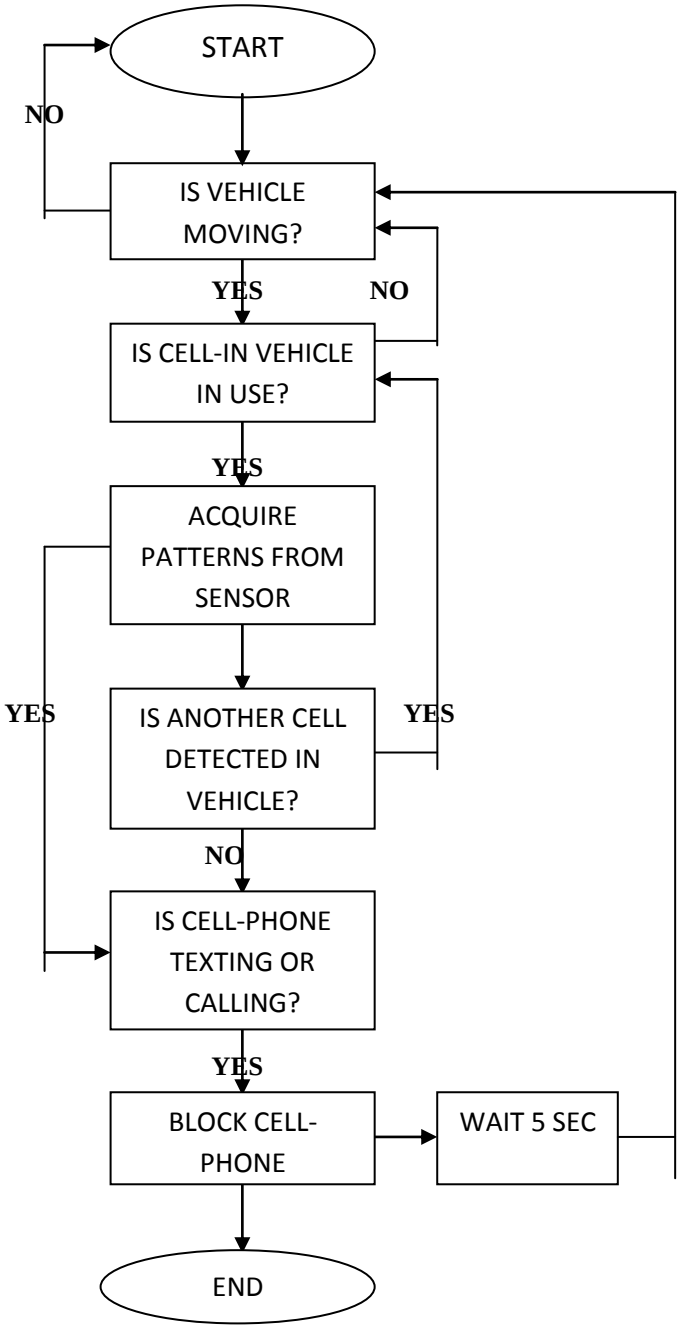

Fig.1:

Finally, we select the space bar because it is the only key that is guaranteed to be used when composing any messages Longer than two words. In the remaining sections, unless specified otherwise, all the touch strokes as referred to those associated the space bar. After we have obtained the segments which are similar to Each other, we need to construct a pattern which can represent all these templates. Using the average of all the templates can suffer from the variation in the scales. The PCA is a much better alternative to extract a pattern from these templates. We put all the templates into a matrix and then implement the PCA on this matrix. The first mode in the result is used as the final template. When we implement on-line T&D detection using mobile phones, the template was estimated beforehand using the given training data set and stored in mobile phones. The remaining computational task is lightweight and can be accomplished by most of the popular Smartphone.

We only need to find out the car speed before a mobile phone user starts to composing messages, and compared it to the car speed when he is composing messages. If there is a statistically significant evidence of decrease of car speed, then we can conclude the user is a driver. Touch strokes adjacent to each other should be regarded as one process of composing messages. In addition, we found through experimental data that for both passengers and drivers, the distribution of touch strokes is by no means uniform. Instead, they are distributed as clusters. A touch stroke cluster includes a number of touch strokes occurring in a short period of time. This observation fits well with the reality since if possible; people always prefer to finish a message as soon as possible. Therefore, a better definition of 'the start time of composing a message' should be the occurrence time of the first touch stroke in a touch stroke cluster instead of the occurrence time of each touch stroke

IV. CONCLUSION

In this paper, we propose a novel method which is able to detect T&D. Instead of using any extra devices, the method uses some patterns associated with how Smartphone's are used in moving vehicles. Drivers will not be able to receive calls, their Smartphone's will be totally blocked and will not allow them to either receive calls or reply to text messages. Due to this project the road accidents will be reduced to greater extent .There will be a safer environment for both driver and passenger. In particular, some build-in sensors in Smartphone's collect the associated information and analyze, through hypothesis testing to see whether these T&D patterns exist. We believe the proposed T&D method could be utilized for Usage-based insurance and provide support for many anti-T&D mobile phone applications.

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