Car Accidents Prevention System

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ABSTRACT
With today's busy life, it is imperative to conserve any spare time as we spend generous amount of our daily time driving. Using arduino sensors to send notifications to the nearby drivers in the occasion of any accidents or road blockage will defiantly achieve the purpose of this research. Results showed that such approach could be adapted successfully in the automobile industry.

Keywords
Arduino sensors, Communicating automobiles, User Experience, Health care, E-Business.

1. INTRODUCTION
Arduino sensors supports data exchange so that it is valuable and used in terms of message exchanging between moving automobiles. The idea of the research relies on how to save drivers time by sending them information about road acceding or any blockage caused by road hazards.

2. RELATED WORKS
In this section, we discuss the relevant developed systems and provide analysis and comparisons. The existing works presented are classified into smart phones-based systems and WSN-based systems. The former requires Smartphone device to operate, whereas the latter is based on the existence of a wireless sensor network communication.

First, we discuss the mobile Smartphone's-based systems. Mobile Smartphone's are equipped with various sensors that can help to aid in safety enhancements for drivers on the road. The work presented in [5] includes the design and development of smart phones application to detect car accidents and provide situational awareness to emergency responders. Authors presented the architecture for the presented prototype

Smartphone based accident detection system and empirically analyze its ability to resist false alarms.

A smart system is developed in order to understand the user behavior using Smartphone sensors [11]. The aim of this work was to analyze the sensory data acquired using a Smartphone to design car independent system that does not need vehicle-mounted sensors. The vehicle's speed, acceleration, deceleration, and deflection angle information are estimated using accelerometer, gyroscope, and magnetometer sensors.

Authors of [9] proposed a driver warning system based on the 3-axis accelerometer sensor of an Android-based smart phone to record and analyze various driver behavior and external road situations that may potentially be dangerous to the health of drivers. Authors stated that the efficient use of these data can educate a dangerous driver on how to safety and efficiently operate the vehicle.

Second, we discuss the WSN-based systems. WSN-based systems are cost effective in terms of installation, reliability, and maintenance compared to cable-based technologies. Authors of [6] presented a Wireless Sensor Network (WSN) based system for traffic monitoring and safety of mobility. A microscopic cellular model is used to estimate traffic flow and occupancy over time on a road segment.

The work presented in [7] includes the design and development of a novel safety approach to increase safety for highways using the WSN and Bluetooth protocol. In this approach, vehicles are organized into ad-hoc networks and sensed data is exchanged between vehicles.

An early warning system for drivers is proposed in [8] where it aims to provide early warning for drivers of potentially dangerous situations that may arise. The proposed system is based on the WSNs and magnetic sensors. Sensor nodes are deployed along both road sides every few meters. Each sensor node is equipped with a magnetic sensor in order to sense the presence of vehicles on the road. Sensor nodes are organized into ad-hoc network in order to exchange the information about the passing cars. Then all sensed data are transmitted to the vehicles, where onboard computers can be used to predict dangerous situations and then warn the drivers.

Authors of [10] presented a hybrid architecture of vehicular ad hoc networks based on WSNs that relies on a fully distributed approach with no centralized infrastructure elements for coordination and communication. The proposed work is based on two communication protocols, which are IEEE 802.11p and IEEE 802.15.4.

As discussed above, the existing approaches are categorized into smart phones-based and WSN-based approaches. The former requires the development of a mobile application for Smartphone devices (Android, IOS, Windows Mobile, …) and exploit the existence of sensors in the smart phones, whereas the latter is based on the existence of a sensor network which need to be deployed along the highway, and employ a sensor device in a vehicle in order to collect and process the sensed data from distributed sensor nodes. Smartphone-based approaches are efficient in terms of reliability. However, drivers are required to own a Smartphone device in order to obtain the safety applications. One the other hand, WSN-based system is efficient in terms of cost and reliability, but there is a requirement to install sensor nodes along the way in order to perform the safety functionality.

3. SYSTEM DESIGN AND IMPLEMENTATION
The ADS system contains two separated systems, which are the Arduino system and the android application. The Arduino system works by requesting the car location from the android application, which in its turn get it using GPS and send it to the Arduino system, the Arduino system will send the value of the accident location to the android application to process it and show the alarm type to the driver.

4. THE ARDUINO SYSTEM

As previously explained, the main role of the Arduino system which acts as a sensors which detects an accident and process it to chick whether the pressure value equal or greater than the minimum value of the danger, if the value scores the minimum value of the danger, the system shall request the location from the android application as explained previously. The direction of the car is then allocated by using a built-in compass in the Arduino system which afterwards initiate a flag number to control the number of sending times, Finally, the system will send a string contain direction, flag number, accident value and the location of the accident.

In receiving part, the Arduino system will chick the direction, it will firstly chick if the car is in the same direction (roadside) of the accident otherwise the alarm will be ignored. It is important to mention that the system will also chick the flag number to determine if the system have already received the alarm, else the system will receive the alarm and process the flag number again in order of determining if it have to resend it again to another car behind based on the limit of sending times.

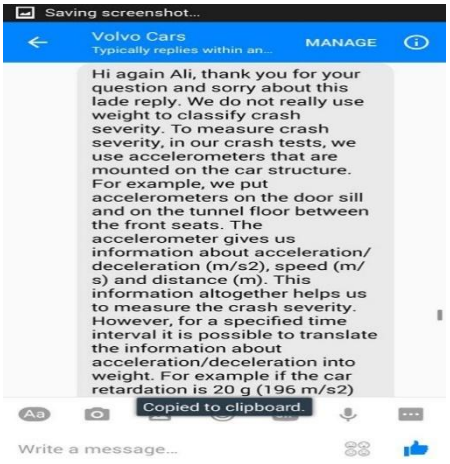
5. ANDROID APPLICATION

The android application shall send the location of the car when asked by the Arduino system.

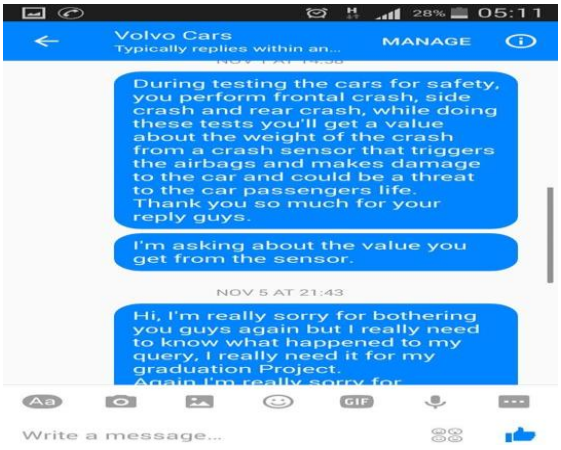
When the android application receives the alarm string from Arduino system shall process the accident value to determine alarm type and show it to the driver with the alternative way if the driver will not to.

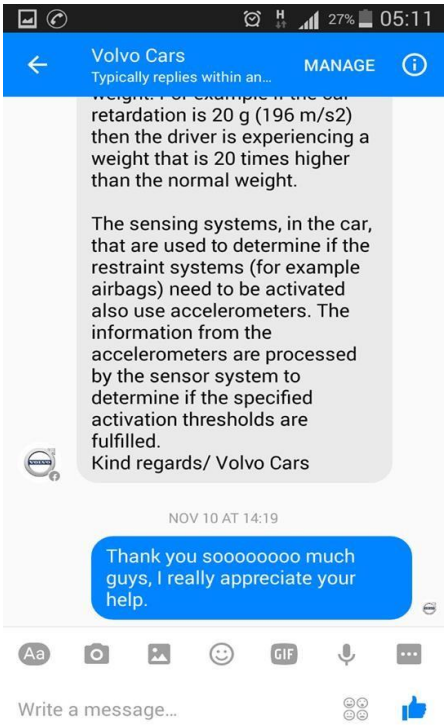
5.1 Arduino System Components

1. Force Sensitive resistor: In the prototype, this sensor can measure force up to 1000Newton.



To fortify our research, we consulted and used the Volvo automotive group strategy to determine which accidents that trigger the alarm





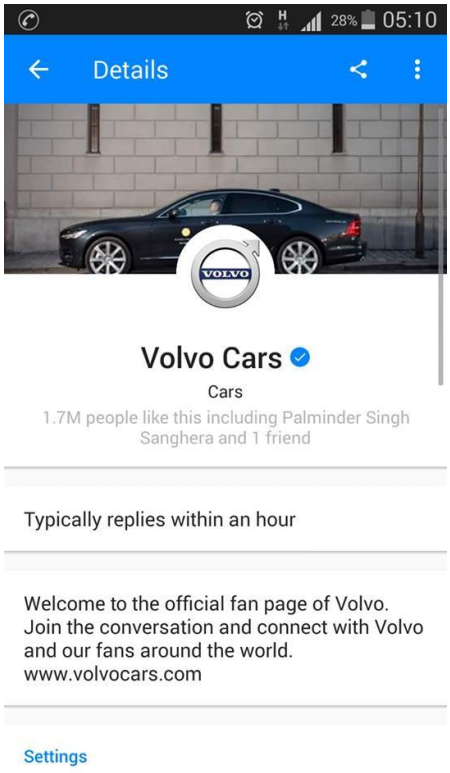


Figure 2: Volvo Strategy

1. Electric compass: get the direction of the car as one of two values either forward (zero 180̊) or backward (181,̊ 360̊).
2. Bluetooth: connect the application on the driver mobile phone with the Arduino system in the same car.
3. WIFI: gave the ability to the Arduino systems to communicate and send or receive data.
4. Arduino mega: have many input / output bins and compatible with external battery and have enough capacity.

6. ANDROID APPLICATION

The android system consists of several parts, which are as follows:

1. GPS Class: provide location information.
2. Select Class: provide the available Bluetooth device and connect with it.
3. Search Class: search the Bluetooth devices that can connect with the application and show the devices on select layout.
4. Bluetooth Class: this is the main class provide the feature of communication with the Arduino system.
5. Chat Class: analyse the alarm type, show it to the driver with accident location, and send the manual alarm.

7. DISCUSSION

Based on the increasing numbers of automobile's around us, the number has reached over a billion cars worldwide and over 1.4 million cars in Jordan, and based on the fact that cars is ranked as the most important in transportation field as a benefit. In the opposite side, the drawback arise were the risk of human life is the most serious drawback in the event of accidents.

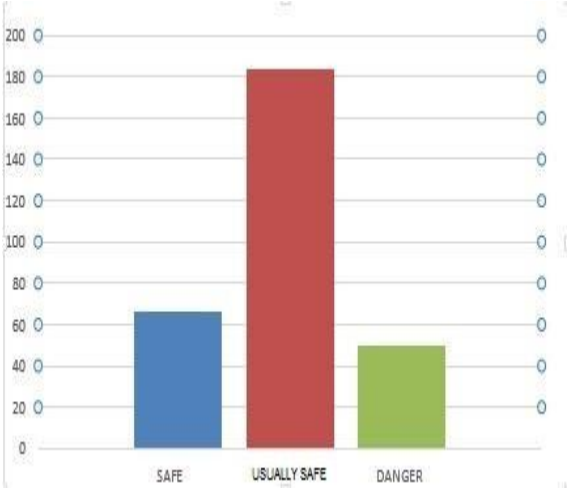
Of course, one of the main obstacles is that the road may get stalled traffic, which in its turn might become a reason of probable accidents to cars coming from behind, and may Cause troubles for the authorities who is responsible of evacuating the injured peoples.

To examine whether our proposed system will be beneficial for drivers or not, it was mandatory to handout a six questions questionnaire on three hundred randomly chosen people in city of Zarqa and the results came out as followed:

1. Have you ever driven a car?

This question was to determine how many people is expert domain.

The Ratio on this question was 70% answered (YES) to 30% answered (NO).



As we see, the numbers of the expert domain are higher than non- expert domain.

2. Is it safe to drive a car in our streets?

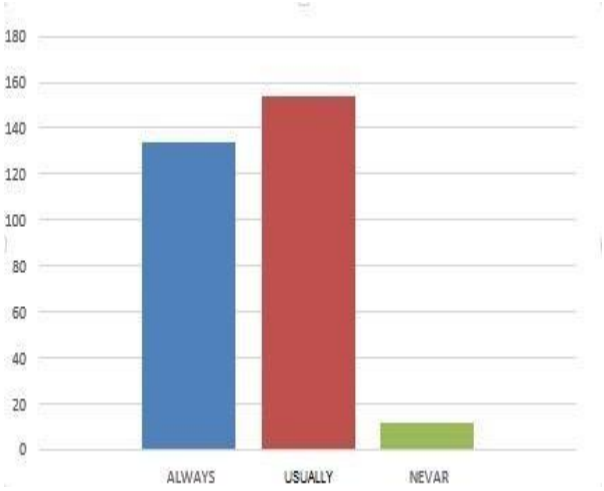
This question was to see if driving cars is generally safe.

From this figure we can see that 61.3 % answered (Usually safe) and

16.6 % answered (Danger) while 22 % answered (Safe), based on these numbers we can see that there is a good percentage of the people believe that cars are not safe and need more safety systems.

3. Is the driver is at risk of accidents:

This question was to determine the possibility of having an accident while driving.



44.7 % answered (Always) and51.3percentage answered (Usually) while 4 % answered (Never); based on these numbers we can see that the possibility of having an accident while driving a car is very high.

4. Do you see that the drive system needs more protection: This question was to determine if the cars need more safety systems?

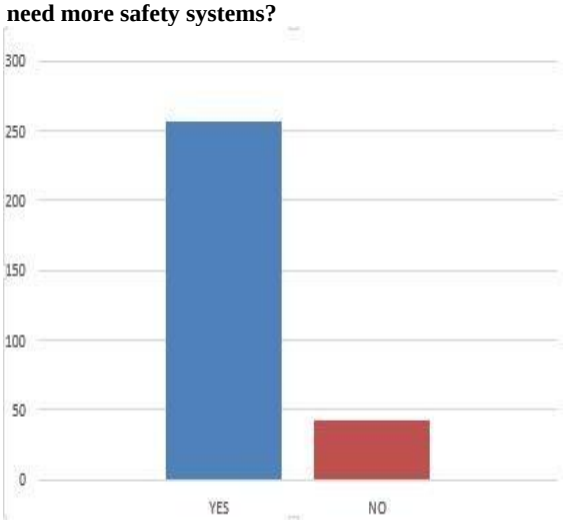


Figure (1.3.4): Questionn

From this figure we can see that 85.7 % answered (YES) and

14.3 % answered (NO), based on these numbers and the numbers from question two we can see that most of the people think that cars are not safe and need more safety systems.

5. Would an accident affect other cars behind it?
This question was to determine if the accident could cause another accident or cause turbulence on the road.

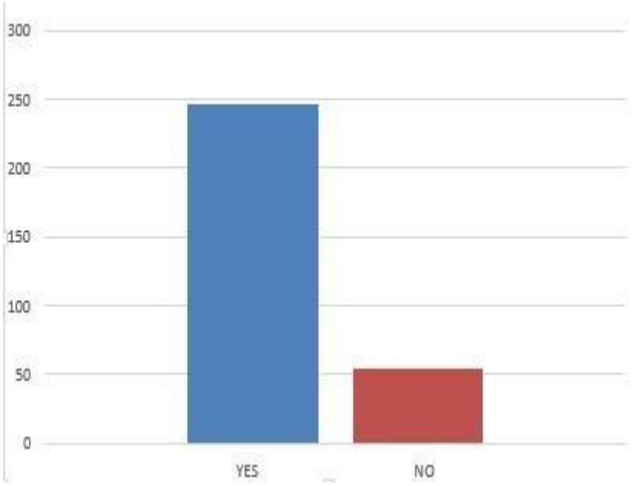


Figure (1.3.5): Questionnaire

More than 82% answered (YES) and 18% answered (NO), based on such answer, it is obvious that there is a huge possibility of having an accident and / or turbulence on the road while there is an accident.

6. Will there be any positive effect if drivers knew about the accident before they reach it:
This question was to determine if there is a positive effect on prior knowledge about an accident before reaching it.

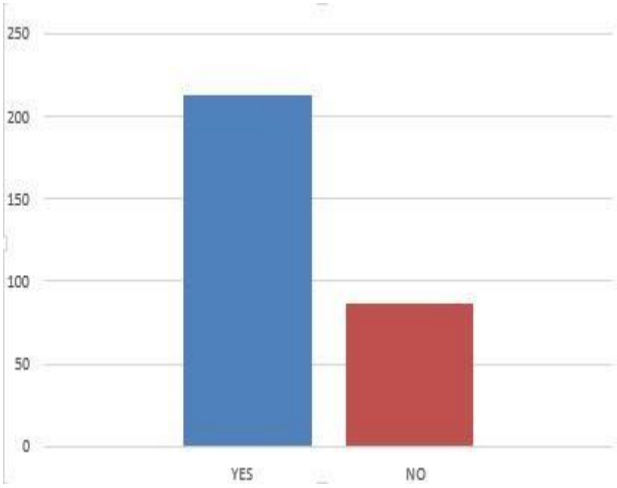


Figure (1.3.6): Questionnaire

With the score of 71%, answering (YES) and 29 % answered (NO); it is obvious that there is a huge acceptance for the main idea in propose solution.

8. CONCLUSION

As a conclusion, it obvious that such approach would be beneficial especially when applying the results to the drivers sector. The application will save huge amount of time in the presence of traffic accidents not to forget the lifesaving impact.

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