Car Accident Notification based on Mobile Cloud Computing

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Abstract— the aims of this paper is to design and implement a mobile application for car accident notification. It sends an electronic report and notification including the location and type of incidents. Road traffic accidents (RTA) are one of the main causes of death across the Gulf Cooperation Council (GCC). Governments are spending Billions of dollars in the building road and infrastructure in order to reduce the number of RTA fatalities. Cloud Computing can play a significant role in reducing the number of RTA fatalities. In order to avoid many cases of deaths, a post-accident emergency reporting system is much needed. Gulf Arab countries are recorded the highest number of deaths and injuries because of road accidents. Therefore, the proposed notification application apps help to notify an accident immediately using easy steps, which will save the life of many people.

Index Terms— Car Accident Notification, Mobile Cloud Computing, Mobile Application, web design, mobile applications

I. INTRODUCTION

GCC cooperation council (GCC) are recorded a high number of deaths and injuries in the world because of road accidents. The road accidents currently occupy a large proportion of the focus of researchers because they direct the impact on the lives of people [1]. People's lives are one of the priorities of governments according to initiated several laws to ensure the safety of people and the preservation of their lives. The increase in the number of car drivers and the number of traffic has negatively affected community, economics and moral society [2]. Many studies have discussed the role of using information technology in order to reduce the number of road accidents. The implementation of modern methods of data analysis will help to minimize the loss of human lives, as well as economic losses because of road accidents. The government enacted laws and regulations to control road accidents. In addition, use efficient technologies and systems to monitor road safety, and the use of radar to monitor the speed of cars on the roads. As well as the application of intelligent control, systems to monitor the road traffic jam and the implementation of traffic control signals to control the navigation of cars and pedestrian crossing. These systems produce a huge amount of data. Therefore, there is a need to analyze these data, and discover the relationship between the attention of the driver and road accidents. Furthermore, the study of weather impact on the road fatalities will help to identify the target and reduce the road hazards. On the other side, the term cloud computing is mean that the user is using remote servers hosted on the Internet. This will help to store, manage, and process the stored data on a local server instead of personal devices [3]. The user of cloud computing can access the cloud via the Internet using mobile, tablets and personal computers for reaching the data, software, and services as shown in Fig. 1. The aims of this paper to explore and review the current directions and tools for preventing and reducing the car accident in Oman. This paper depicts the design and implementation of a mobile application for accident notification and creates a database center for car accidents data using the public cloud storage. Then mining and analysis these data in the cloud for generating important information about the accident such as numbers of accidents, the type of accidents, location, etc. Lastly, build an alarm system based on direct messaging and personal monitoring to follow and control car accident.

II. ROAD ACCIDENT IN OMAN

Statistics show an increasing number of road accidents in Oman at an alarming rate since it becomes a source of big concern to the community. There is a need to find a solution, which is involving all member of society, whether governmental or even individuals. The reports issued by world health organization (WHO) indicates that the Sultanate of Oman recorded 10000

Fig. 1. The Cloud Computing users and services

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accident, which led to 680 deaths, as well as 7550 injuries. The main factors for the car accidents are included, high-speed, using the mobile phone when driving, fatigue, wrong overtaking, stand sudden and not leaving enough distance and safety defect in the condition of the car. The road death rate in Oman is of 30.7 deaths per 100,000 populations, which consider as a very high rate compared with the global average of 19 deaths per 10,000 as illustrated in Fig. 2.

![Fig. 2. Roads death rate per 100,000 in some countries (Source WHO)](image)

According to the reports of the Royal Oman Police (ROP) about Traffic Road Accident (TRA), there were a low number of accidents 6279 in 2015, down from 6717 in 2014 and 7829 in 2013. Table 1, shows that the total number of people died in 2015 is 675. This number is less than the number of deaths reported in 2014, which is equal to 816 and 913 in 2013. Fig. 3 presents the number of road accidents in Oman for the period of 2004-2015 (Source ROP’s).

![Fig. 3. The number of road accident in Oman 2004-2015 (Source ROP’s)](image)

| Year | Number of accidents | Number of deaths | Number of Injuries |
|------|---------------------|------------------|--------------------|
| 2015 | 6279                | 675              | 3624               |
| 2014 | 6717                | 816              | 3835               |
| 2013 | 7829                | 913              | 10802              |
| 2012 | 8209                | 1139             | 11618              |
| 2011 | 7719                | 1056             | 11437              |
| 2010 | 7571                | 820              | 10066              |
| 2009 | 7253                | 953              | 9783               |
| 2008 | 7982                | 951              | 10558              |
| 2007 | 8816                | 798              | 8531               |
| 2006 | 9869                | 681              | 7548               |
| 2005 | 9247                | 698              | 6658               |
| 2004 | 9460                | 637              | 6636               |

III. LITERATURE REVIEW
A number of studies were done to discuss and analysis of road traffic accidents. Reference [4], depicts the using of cloud computing and the risk areas of cloud services. In addition, the challenges and future directions of implementation of cloud computing services are presented. Kim presents the benefits of using current cloud models, the architecture of cloud computing and the threats can be created using the cloud computing. The paper indicates that the main risk areas are the governance and regulation and espionage. Reference [5], views a full understanding of the cloud computing design challenges and tracks the important research in this area. They present the state-of-the-art of cloud computing implementation and illustrates the main architectures and methods of good design of a cloud computing. Also, display the concept of cloud computing and some of the related technologies such as Utility Computing, Grid Computing, and Virtualization. As well, present the type of cloud with its drawback and benefits. Reference [6], presents good guidance and information associated with cloud computing implementation. In addition, reviews the existing research directions of cloud computing models and technical issues related to cloud computing and tips for the realization of case scenarios. They review the cloud computing implementation and present a technical review of conducting research and preparation of reports. In addition, it illustrates the understanding of the requirements and solutions available, challenges and activities of existing research. Reference [7], emphases on the areas of cloud computing and its concept. This paper discusses four types of cloud computing, which can be classified into a public cloud, a Private cloud, a Community cloud and a hybrid cloud. In addition, this paper focuses on the future issues of cloud computing and state-of-the-art research. Also, display an overview of the cloud-computing concept. Reference [8], surveys of state-of-the-art vehicular cloud computing. In addition, the classification of vehicles cloud applications is presented. The most important of these applications, such as cloud formations, extensive applications, cloud communication systems, security issues, extensive applications and broad aspects of privacy. In this paper will display the design of vehicular cloud computing architecture VCC. The benefit of this paper is to give a full idea of the vehicular cloud environment by understanding the mechanism, the service and the application that use it. There are many application implementations in the field of vehicular clouds such as parking a lot of data cloud, an airport as a data center, Managing evacuation, Shopping mall data center, Optimizing
traffic signals and Road safety message. Reference [9], focus on the using of the cloud computing in education and presents a modern study of how improves the cloud services. The benefits of using the cloud are including cost-effective, more scalable, and providing remote access. They discussed the cloud computing, deployment, and development of cloud models for a university website. Reference [10], he implements a vehicular ad hoc networks (VANET) communication in order to achieve success in the field of vehicles. They present vehicle drivers communication and exchange of information and news about road conditions, traffic status, and locations of traffic accidents. The Vehicular ad hoc network is adopted based on cloud infrastructure and mobile computing. VANET depends on the unity of speed, which is called roadside units (RSU). It is measured on the side of the road units or vehicles where the significance ranging from 0-200. RSU may be used for small streets because the difficulty of measuring food decade during high speeds. Reference [11], present Machine-to-Machine (M2M) platform service based on infrastructure cloud. The paper focuses on analyses the M2M services security needs and requirement. The protocols for the new message have fixed security aspects and requirements. It used authentication technologies and policies to implement the network access. The main objective of this work is to study the security mechanisms of M2M/IoT networks, to produce security aspects and protocols of M2M/IoT network, define the scenario and architecture of M2M/IoT. The software and platform layer will be used in this thesis. This thesis contains applications, integration, APIs and middleware. Reference [12], presents the implementation of a large database for the Internet of Things data, multimedia data and sensor readings. IoT consider as an integrated part in the cloud computing, which it has physical attributes, virtual personalities, and identities. This work implements the Amazon EC2 as allocated cloud database. The IoT is used to test the database with other types of models such as MongoDB, Redis, and MySQL. It focuses on three important visions of the IoT such as Things-oriented Vision, Semantic-oriented Vision, and Internet-oriented Vision. Reference [13], presents the framework design for analysis road accident factors such as human driving, road, weather, vehicle, nature of traffic and experience of drivers. The most important factor is the lack of awareness of driver behavior and knowledge. The goal of this work is to implement a cloud solution for managing road accidents and analyzing the collected data. It facilitates the communication with government agencies in order to provide comprehensive information about traffic. The Wireless sensor network (WSN), ParkNet mobile system, fourth generation wireless, tracking system and GPS, is implemented for achieving best accuracy. Reference [14], views the important activities of current and future directions of research in the field of cloud computing. Fault-tolerance is currently a focus of studying issues related to the environment of cloud computing. This paper presents building block Fault Detection (FD) for getting high performance, reliability, scheduling and load balancing. FD algorithms are used to present continuous services and reliable for wireless and wired networks. This work aims to develop an FD for cloud computing and Middleware that can be integrated with multi-cloud computing systems. Reference [15], discusses the current concerns related cloud computing solutions for car accident systems in the Gulf region, which is recorded high death ratio. This paper reviews a modern development for an accident handling systems based on cloud computing services and Mobile cloud computing. Reference [16], design and implement a neural computing model to predict and analysis the car accident in Jordan. He implements a multilayer perceptron (MLP) model for estimating the number of road accident over time. Analysis and recorded the number of a car accident, the type, and the reasons for accidents. The model is achieved a very good accuracy and call precision for classifying the accident types. The paper proposed an analytical study for controlling the increasing of a car accident and predicting the number of a car accident in the future.

IV. ARTIFICIAL DESIGN
The great development in the field of information technology (IT) has helped to increase the use and effectiveness of information systems. As well as storage, retrieval, transfer and processing of the data or information quickly and accurately in the context of a business or other institution [17, 18]. As well as a great development in the information communication technology (ICT) and who has made the world a small village. In addition, the application of predicting future statistics-Systems helped to understand the type of current problems and to develop effective solutions for responding to future expansions [19]. Gulf Arab countries are recorded as countries that have the largest number of deaths and injuries because of road accidents. Road accidents are currently occupied a large proportion of the concerns of researchers that because of their direct impact on the lives of people. Fig. 4 depicted the framework of proposed notification system, which is consisted of three phases:

- The first phase is the notification mobile apps. The user needs to fill the required information of the incident involving car number, vehicle type, vehicle Status, a number of people dead and injured and the accident location based on Google Map, and tack a photo for the accident. Then click submit button to send information and store it in a database cloud storage.

- The second phase is the communication and internet company, which provides the network configuration and internet. The telecommunications companies enable users to access the World Wide Web and then send/receive data.

- The third face is the framework of the web-based notification system, which uses the stored information in the cloud storage for managing, sending a notification, and determine the location and information of the accident. In addition, generating different types of the report in order to give clear views about the status of car accident records and history.

Fig. 5 illustrates a flow chart of the proposed notification system. It clearly demonstrates the steps of the apps. The procedure starts from the accident, and then the user running the application and reporting the incident. Then the user will fill information about the incident such as the type and number of people in the car incident. In addition, the status of the injured or dead, location and photo of the accident are recorded.
The user then sends the information via the mobile application, which links with a cloud database. A confirmation message will appear for user, which confirm that the report is received as depicted in Fig. 7. Then a Web application will use the stored data and send a notification and a warning message to the official center. The person in charge will take the necessary information to contact the nearest police station and the nearest hospital in order to provide the necessary assistance and aid.

![Flow chart of the proposed notification system](image)

Fig. 4. The framework of the proposed notification system

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- The First stage is created the cloud storage database for storing the information that sends by the mobile apps.
- The second stage is the implementation of the mobile application using Eclipse, which can be installed on a mobile phone from Android market store (play store).
- The Third stage is the design and implementation of a web application for managing the notification and data analyzing. The Web application report issues much information such as the number of the accident (Day, Week, and Month), death number, the location of the accident, the injured number, and the injured condition. Different types of reports are generated based on the required information. The first report displays the number of the accidents per day, week, and month. Whereas, the other report presents the accident information based on location using the google map, which is determined the current location of the accident. Fig. 8 present the page of determining the accident location using google map services.

![Mobile Apps framework design](image)

Fig. 5. Flow chart of the proposed notification system

![A confirmation message](image)

Fig. 6. Mobile Apps framework design

![Alert](image)

Fig. 7. A confirmation message

V. PROPOSED SOLUTION

Eclipse is an integrated development environment (IDE), which used to develop the mobile application. It uses for building, coding, running and debugging the proposed application. The proposed mobile application called “Car Accident Notification”, which is installed on the Android play store. Fig. 6 presents the report accident page in Arabic and English interface. The implementation of the proposed notification system is divided into three stages.

VI. CONCLUSION

The new development in the field of information technologies and natural language processing are helped to increase a fast respond and high performance [20]. The main objective of this paper is to develop and implement a mobile application for car accident notification, which serves many departments like Accident notification, Hospital, Insurance companies, and traffic Police. The application of car accident notification is
It is included a user interface in both languages Arabic and English. The cloud-computing database is used to store data that can serve many purposes from anywhere and anytime [21]. The stored data can be used for analysis and mining manner. However, a web application is designed and linked with the cloud database in order to summarize and analyzes these data. The proposed program has helped to speed the reporting of an accident. Especially, it helps to determine the location electronically by google maps, which reduces the time needed to reach the location of the accident. As well as, overcome the language barrier and lack of contact information on the police and hospitals. Moreover, some citizens worried about reporting the incident because they do not have enough time to record report and wait until the police and ambulance are arrivals. Alternatively, the situation may be required to record full data about the incident in the police station. The last resort we have to say that there is no an ideal work and still there is a future direction for improvement. Therefore, one of the future enlargement trends of the current system is to connect it to a central database, which links with hospitals, police stations, and insurance companies in order to provide better and faster service.

![image](image.jpg)

**Fig. 8. Determine the accident location**

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