



Design and Implementation of Emergency Smart SOS on Highways and Wadis in the Sultanate of Oman

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Abstract: The Sultanate of Oman has seen a significant increase in automotive usage and car ownership due to the country's recent economic growth, urbanisation, and infrastructural development over the last four decades. As a result, road traffic accidents (RTA) have become a significant public health concern. Due to scarcity and limited access to data in the past, there is a paucity of literature on the motorization problem in Oman. The medical team's delay will result in significant fatalities. Due to not completing all the necessary paperwork before being transferred to the hospital, several deaths have occurred. Many individuals are dying as a result of not being able to call the hotline because they are either unable to call or do not have access to the direct contact information for the helpline's emergency service. In this work, we're attempting to identify one of the main issues surrounding fatalities that occur after accidents. Another issue is that people spend their weekends visiting public areas like wadis in the sultanate and other sight-seeing locations. Typically, the road condition is worse at the wadis. As a result, they are unable to contact the approved emergency service right away due to the uneven road surface or any other issue with their vehicle. We design and implement a system for accident location identification and provide emergency SOS services which can save lot of fatalities.

IndexTerms – Accidents, GPS, GSM, Highways, ROP, Smart SOS, Sultanate of Oman, Wadis

I. INTRODUCTION

Traffic accidents are one of the main global problems, due to the serious health and financial effects on any society. Between 20 and 50 million people have non-fatal injuries and over 1.2 million people die on the world's roadways each year [1]. Over 90% of all traffic fatalities worldwide take place in low- and middle-income nations. The cost to governments of the losses from road traffic casualties is estimated at US\$ 518 billion, or 1% to 3% of their gross domestic product (GDP) [1]. Through its rapid economic expansion, industrialization, and infrastructure developments over the past forty years, Oman has seen a tremendous transformation [2]. This has been mirrored in the rise in car ownership and usage. However, a number of issues including traffic accidents come along with this expansion. One of the cutting-edge nations using effective strategies to lessen the impact of traffic accidents on both the local and global levels is Oman. The number of people killed in automobile accidents is quite high in developing nations (Ali, 2010). In the Sultanate of Oman, which has a population of 3,632,000 and is situated on the southeastern coast of the Arabian Peninsula, fatalities from traffic accidents are expected to treble by 2030 and rank as the fifth greatest cause of death globally. Additionally, it is anticipated that by 2020, road deaths will rank third among all causes of death and disability in the Sultanate of Oman. According to reports, the Sultanate of Oman has the third-highest rate of road fatalities in the Middle East and the highest rate in the Arabian Gulf Cooperation Council (GCC) (Mazharul and Hadhrami, 2012; WHO, 2013a, b; Farag et al., 2014). Due to its natural resources, the Sultanate of Oman has undergone fast cultural and economic transformation over the past several decades, which has resulted in an increase in the number of vehicles on the road and a wider network of roads[3],[4][5]. This study was conducted in Salalah, Sultanate of Oman, to evaluate road users' awareness. In this research project, we are attempting to investigate all facets of accidents and the ease with which we may inform the Royal Oman Police (ROP) or health department of a concern in order to obtain quick location identification and administer first aid to the injured. Additionally, this study will assist in setting up an emergence Save Our Souls (SOS) service for persons who are travelling to wadis and experience an accident or need assistance due to challenges. We can prevent many tragedies by seeking early information from the concerned department and ROP in the event that a car is impacted in a dip, its tire is punched, or any other assistance is needed at certain sites.

Objectives of the Research Work

The objectives of the work are

- i. To investigate the aspects of accidents and immediate identification of location
- ii. To provide the helpline for those people who are travelling to Wadis and sudden any accident of any help required coming up with those difficulties
- iii. To design and implement the system for accident location identification and provide emergency SOS service.
- iv. To save the life of humans by providing the immediate medical treatment within time.
- v. To carry out the performance analysis of designed system

Purpose of This Work

Research proposal is an innovative idea to save the life of humans. This idea and the implementation of this project will help to academic student to get involve in research work. This is an innovative idea to implement in the Sultanate. The country is one of the fast growing and developing in the infrastructure. The basic mode of transportation is four wheels for a common man. This country has lot of site seeing places and wadis where the people spend time with their families. As the rates of accident are comparatively more in these areas, so it required to get the immediate helpline service for the medical facilities. This idea of project can provide the emergency services which can be save lot of fatalities.

II. LITERATURE REVIEW

The previous work and related work carried out by various researchers about the traffic accident cause and safety and awareness in the sultanate of Oman are discussed below:

1. **Ahmad M. Abu Abdo et al[6]** has carried out the assessment of traffic safety and awareness among road users in Salalah, Sultanate of Oman. The results have showed that only a very small portion of participants entirely adhered to the speed limits; the majority utilised a cell phone while driving and did so when they were tired.
2. **Ahmad M. Abu Abdo[7]**, proposed to investigate the traffic Accidents Causes in Sultanate of Oman and carried out the analysis of the factors affecting numbers of traffic accidents and fatalities and injuries resulting from traffic accidents in the Sultanate of Oman. Results revealed that disregarding traffic laws, speeding, and reckless driving were ranked as the three biggest contributors to traffic accidents, fatalities, and injuries. Finally, recommendations were made to Omani decision-makers for inclusion in present and/or future policies[7].
3. **A.H. AL-Zahrani et al[8]**: has carried out the study on various traffics accident characteristics in the Jeddah and recommends countermeasures to improve safety of road. There were 8,346 accidents, 11,336 injuries, and 936 fatalities in Jeddah city throughout the course of the four-year period (1985-1988). A daily average of 5.9 accidents, 8 injuries, and 0.66 fatalities result from this. However, this data on RTAs indicates a declining trend.
4. **M. Mazharul Islam et al[9]**: The purpose of this research is to offer an overview of the expansion of motor vehicles and evaluate the pattern of road traffic accidents in Oman using routinely collected time series data by ROP from 2000 to 2009. The study's conclusions may have significant policy ramifications for Oman's strategy for transportation and road safety.
5. **Gift G. Lukumay et al [10]**: The purpose of the study was to investigate traffic police officers' perspectives on the treatment given to road traffic injuries (RTI) victims before to hospitalisation. The study's conclusions paint a picture of a situation where the police first responders lack the knowledge, skills, equipment, and materials necessary to treat RTI victims on the scene before rushing them to more extensive treatment.
6. **Amira K. Al-Aamri et al [11]** undertook a systematic analysis on the underlying interactive effects of age and gender on the severity of fatal and non-fatal RTI outcomes in the Sultanate of Oman,. The findings show how urgently it is to develop early gender-sensitive road safety interventions aimed at inexperienced male and female drivers.
7. **Islam Al-Bulushi et al [12]**. have studied the essential elements of heavy vehicle crashes in Oman and identified the essential driving habits that affect the likelihood of fatalities. The study's findings suggest that Oman needs to implement a more thorough crash investigation mechanism.
8. **Dr. G. Venkata Ramana et al[13]**: has investigated the causes of accidents in Muscat in order to improve highway safety. The findings indicated that consistent efforts by the ROP, ongoing monitoring of operating speeds, and harsh penalties for high-speeding cars will considerably aid in the decrease of accidents. Monitoring the usage of mobile devices while driving is also necessary because it would dramatically reduce accidents.
9. **Siham Gaber Farag1 et al[14]**. conducted a number of statistical analysis for the traffic accidents typical of the road network in Dhofar, Sultanate of Oman. The findings of this study can be used to investigate the scope and key characteristics of traffic accidents for a certain network system or location as well as to pinpoint risky areas and the key factors that may be taken into account when developing accident prediction models (APMs).
10. **Eman Yousuf Al-Maimani et al [15]**: The goal of this study is to investigate accident risk factors linked to driving habits among Omani drivers and their perception of risk. Young and male drivers were shown to be much more likely to be involved in traffic accidents and those with little to no driving experience between one and five years—make up the group with risk-taking attitudes.
11. **Halima AL Hamdania et al[16]** This study intends to offer a remedy for educating Omani citizens on how to teach driving regulations, particularly in Oman. The results of this study have demonstrated the value of such an educational system in helping people understand the significance of following traffic laws and regulations from a young age. Additionally, it has been suggested to create a mobile app.
12. **Hamed Al-Reesi et al.[17]** conducted research on the interaction between individual, behavioural, and environmental characteristics and risky driving behaviours among new drivers in Oman. The findings shed new light on Oman's driving habits and will help the nation develop and put into practise appropriate road safety policies.

From the literature review we have identified that no work is done on design and implementation of Emergency SOS on Highways and Wadis in the Sultanate of Oman.

III. IMPLEMENTATION OF SOS SYSTEM

The proposed system is designed in such a way that it can detects the exact accident location of the accident and reaching of the ROP/Health department and to the family members in a lesser time by means of using the Global Positioning Systems (GPS) module and intimates about the accident to the nearest hospital soon after the accident. This alert message SOS is sent to the nearest hospital in a shorter time, which can help in saving the lives of victim. When the accident occurs the alert message is sent automatically to the nearest hospital and to the family members using the database. The intimation about the accident is done through Global System for Mobile Communications (GSM) module and the detection of the exact location of the accident is done with the help of GPS module as shown in figure 1. This solution provides the optimum solution to poor emergency facilities provided to the road accidents in a most feasible way.

The Research Methodology is following these steps.

- i. The research is beginning with the site survey at the highways, Wadis and mountain areas where the roads are prone to accidents and unavailability of electricity and internet connectivity.
- ii. After the survey collecting the data required for these locations.
- iii. Design of SOS system
- iv. Implementation and Execution of designed kit



Figure 1 Working of Smart Save Our Souls[18]

The block diagram of proposed system is shown in Figure 2 and consists of Arduino, MEMS, GSM, and GPS systems

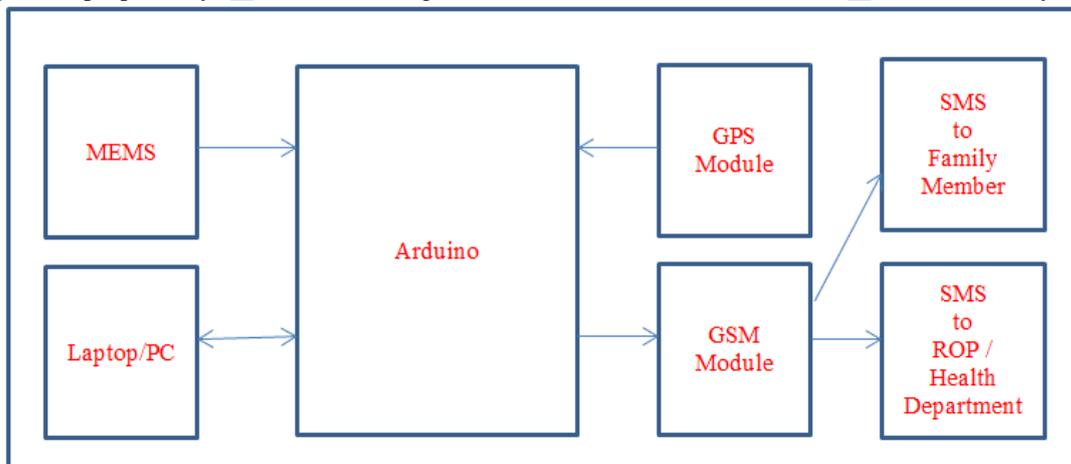


Figure 2 Block diagram of Smart Save Our Souls

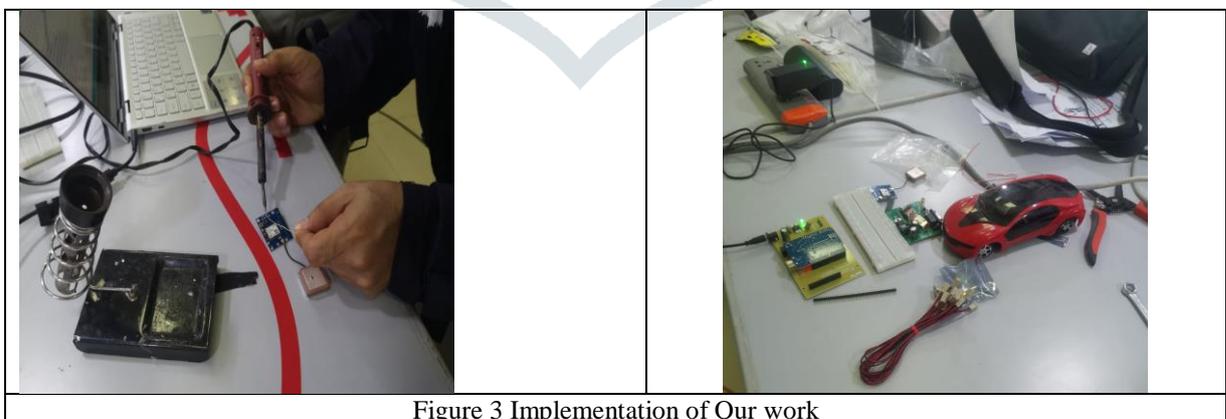


Figure 3 Implementation of Our work

The details steps carried for proposed system implementation is depicted in figure 3

BENEFITS OF PROJECT

- Gives the emergency service to the accident people.
- Sends contact information to the ROP immediately.
- Detects the correct location of accident
- Provides the Help services at the highways and wadis
- Provides the fire fighting and any emergency services at the residential areas

- Provides immediate medical treatment.

IV. RESULT ANALYSIS AND DISCUSSIONS

After execution of the source code we obtain the results from the setup as follows.

Figure 4 shows the complete project setup along with the hardware, initially the mobile number of the parents and ROP/Hospital is registered within our module.

As soon as the driver turn-on the vehicle, the module initiate the program with the location message to the parents mentioning the latitude and longitude as shown in the figure 5 as the vehicle status mentioned in the short message service (SMS) as to be stable.



Figure 4 Complete Project Kit

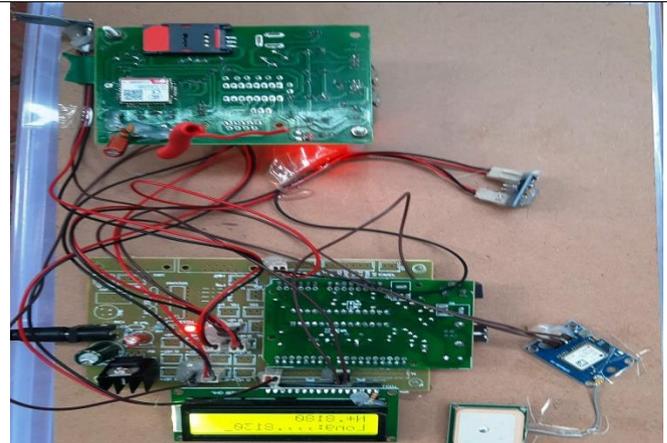


Figure 5 Working Module of the project



Figure 6 Execution of the Source Code

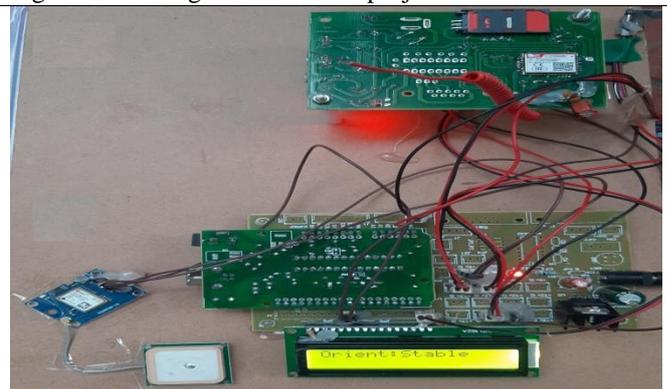


Figure 7 Orientation Stable



Figure 8 Orientation fall with SMS to Parent Mobile

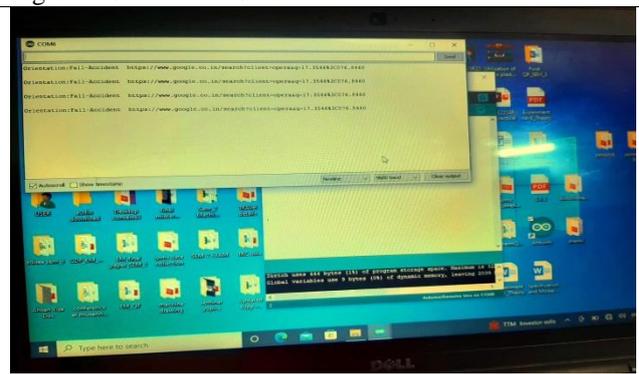


Figure 9 Orientation fall with SMS to ROP/Health Department

If any accident or mishap occurs during the trip, the (micro-electromechanical system) MEMS Sensor senses the impact and sends the signal to the GPS module to send the SMS is mentioning the location in the region of Salalah, Sultanate of Oman, the status of the vehicle as fall and emergency SOS SMS is also send to the ROP and hospital mentioning the exact location of the accident stop to the ambulance and fire department for the first aid or pickup to the hospital is arranged.

In this way the drivers and passenger’s life can be saved during the accidents or emergency as the first few minutes of the accident is the golden time for saving the precious life. The helpline service can be reaching promptly there by saving time.

The purpose of the designed accident identification and alerting system was to provide the emergency unit with information. In order to connect the accident information to the emergency unit, the GPS & GSM technologies are interfaced in the system utilising Arduino. The necessary information, including the location's longitude and latitude, the date and time, the car's current speed, and the impact value detected by the sensors, was sent to the smartphone as a result. Only lately have improvements in smartphone processing power and sensor technology made it possible to utilise cellphones to detect road accidents.

Hopefully, the development of this accident identification prototype will mark a turning point in Oman's automotive manufacturing industry toward having high standards for vehicle safety. There are certain applications for this technology that can be used by private transportation services, taxi services, and car rental agencies.

This work shall be helpful for the government agencies like ROP/Health department to take up the idea and implement it on the large scale and reduce the number of accidental related casualties in the location of wadis and the highways in the terrains of Sultanate of Oman.

V. CONCLUSION AND FUTURE WORK

The proposed system was successfully designed and executed and the desired results are obtained during the trial and actual scenarios. This designed system will be helpful for ROP/Health department in reaching the accident spot immediately and provide medical treatment. The work can be extended to share the location of the vehicle by use of IoT devices, cloud computing and machine learning algorithms can be used to predict the accident prone zones in the region of Sultanate of Oman.

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