**GHANA INSTITUTE OF MANAGEMENT AND PUBLIC ADMINISTRATION (GIMPA)**



**SCHOOL OF TECHNOLOGY**

**ACCIDENT DETECTION AND ALERT SYSTEM**

**By**

**PELET KWASI NARH**

**216016088**

**MONTH YEAR**

**PROJECT TOPIC**

**(EXPLAIN IF NECESSARY)**

**A Dissertation Submitted**

**to the School of Technology, Ghana**

**Institute of Management and Public Administration, Accra,**

**in partial fulfilment of the requirements for the degree**

**of Bachelor of Science in Information Communication Technology**

**By**

**PELET KWASI NARH**

**216016088**

**MONTH YEAR**

**DECLARATION**

I declare that except for the references to other people’s work, which have been duly acknowledged, the work presented here was carried by us, undergraduate student at the Ghana Institute of Management and Public Administration reading Information Communication Technology, under the supervision of ‘supervisor’.

I declare that this work has never been submitted partially or wholly to any institution for award of a certificate.

………………………………………. ………………………………..

Date

(Student)

………………………………………. ………………………………..

Date

(Supervisor)

# INTRODUCTION

## Research Background

Growth in technology and infrastructure has made our lives so much easier. The invention of vehicles has greatly improved as well as affected our way of living. A vehicle is a machine that transports people or cargo. Vehicles come in various forms, namely, aircrafts, land crafts or ground vehicles and watercrafts or marine crafts (Wong, 2008). Skateboards, bicycles, trucks, carts, rollerblades, vans, mopeds motorbikes, just to name a few, are some forms of vehicles. Vehicles such as bicycles, cars, buses and the like have enhanced our means of transport; saving time and energy. Vehicles have therefore made substantial contributions to the efficiency or betterment of transportation. Vehicles have become a necessity due to its many advantages.

Although the advantages are quite insurmountable, automobiles have their disadvantages as well. Some of these disadvantages are as follows (Camila, 2015):

* Pollution: Most cars, a very great percentage of them, produce carbon monoxide when the engine is on. This is poisonous to the environment since the carbon monoxide is harmful. This causes air pollution.
* Cost is also incurred when fuelling, repairing and insuring the cars.
* The car decreases physical activity. Before the vehicle, movement such as walking, jogging or running required quite the energy which, although may be tedious, ends up keeping up worked out; burning some calories and hence a little bit healthier the we usually would be. The invention of the car has taken this away from us. Transport has become so much easier; just by hitting some pedals and steering, one is able to easily get from one place to the other. The decrease in activity has therefore increased the likelihood of getting diseases. It is also easy for a person to become obese.

The demand for vehicles; mainly automobiles or cars have become very high. With this increase in demand has however raised a major problem brought about by vehicles; road accidents. Both pedestrians and drivers fall victims to these road accidents. Road accidents or traffic collision are caused when a vehicle hits or collides with another vehicle, pedestrian, animals, road debris or other stationary obstructions (trees, buildings, poles, etc.).

According to the World health Organisation, about one million, two hundred and fifty thousand (1,250,000) people die in road accidents yearly with young males below twenty-five years of age making about seventy-three percent of the number (Sminkey, 2015). Between January and September 2018, there have been reportedly ten thousand and fifty-one (10,051) car crashes caused by sixteen thousand two hundred and eighty-one (16, 281) vehicles. In these accidents, a thousand, seven hundred and ten (1,710) people have lost their lives and nine thousand, nine hundred and seventy-three (9,973) have suffered injuries (Statistics, 2018).

There are several significant causes of road accidents. Some of these causes are as follows:

* Poor driving skills
* Making calls while driving
* Negligence to road signs and disregard of traffic regulations
* Improper maintenance of vehicles
* Driving while tired
* Drunk-driving
* Over-speeding
* Bad roads
* Non-existent road signs

## Research Problem

A lot of the transportation done is through road transportation. With the increase in demand for automobiles, so has the number or car accidents. Emergency response when these accidents occur is slow.

In developing countries such as Ghana, where there exists problems or reluctance of the governing bodies in incorporating disruptive technologies in business processes, response to emergency situations are quite slow. Most victims in vehicular accidents who suffer grave injuries risk losing their lives when these emergency medical aids or paramedics do not provide aid in time. Survivors and families affected by road traffic crashes have a range of physical, psychological and legal needs. A broad and integrated approach to aid the victims can mitigate the short and long-term effects of experiencing a crash and can help those affected return to function and independence. An effective post-crash response requires integration of injury care, mental health services, legal support and legislation, and data on crashes and injuries (Post-Crash Response: Supporting those affected by road traffic crashes , 2016).

A major problem is having the news communicated to the emergency services in time. When an accident occurs, the news often reaches the emergency medical technicians late. Sometimes observers make the call to the police or the emergency medical technicians (EMT). The observers then give directions to the emergency medical technicians for them to come give aid to the victims. Giving directions orally is however a problem since is it not accurate and people are not able to accurately give directions. Some platforms such as WhatsApp allow users to send their geolocations to others for them to be found. Its however been noticed through personal observations that the location sent is often not accurate.

## Research Purpose

The purpose of this course is to suggest, design, develop and implement an accident detection and alert system. This system would be able to detect whenever an accident occurs through the use of pressure sensors, an accelerometer and a gyroscope. The system would also be able to send an alert to the right personnel (the police, the fire service and the emergency medical technicians). This alert would contain the precise location of the crash site.

## Research Objectives

The research objectives are as follows:

* To suggest an accident detection and alert system that would identify when an accident occurs and immediately send an alert message containing the accident’s precise location to the authorised personnel for immediate help.
* To design an accident detection and alert system that would identify when an accident occurs and immediately send an alert message containing the accident’s precise location to the authorised personnel for immediate help.
* To develop an accident detection and alert system that would identify when an accident occurs and immediately send an alert message containing the accident’s precise location to the authorised personnel for immediate help.
* To implement an accident detection and alert system that would identify when an accident occurs and immediately send an alert message containing the accident’s precise location to the authorised personnel for immediate help.

## Research Significance

This platform, the accident detection and alert system, when introduced, would enable emergency medical technicians and all other required personnel quickly react to accidents. Locating the crash or accident site would be made significantly easier for the emergency medical technicians. Mortality rate through accidents would be greatly reduced when crash victims are attended to earlier than usual as compared to the average response time of the emergency medical technicians; especially for people who fall victims to accidents that occur away from people.

## Research Outline

Various sections of this thesis would be highlighted in the various chapters as discussed below:

### Chapter Two (Literature Review)

This chapter would highlight some of the major publications concerning road accidents, traffic hazards and possible solutions published in literature or available online. This literature review would be done by discussing, sections, concepts and relationships between the various literature. The literature review would done for the following purposes:

* The literature would aim at developing the background and understanding in the field of the topic.
* The review would also address various developed works that cater for the current problem if they exist.

### Chapter Three (Methodology)

This chapter would focus on the research method being used in the thesis. The methodology to be used would be the Design science research method. This methodology aims in developing an artefact to solve a problem and as this thesis aims to solve a problem through the implementation of an artefact, this methodology is best suited for the thesis.

### Chapter Four (System Analysis and Design)

The system’s analysis and design chapter would in detail give a description of the current processes in attending to crash victims as well as a description of how the proposed solution work.

### Chapter Five (Summary, Recommendations and Future Improvements)

This chapter would summarise the various chapters and highlight some recommendations which would ensure the success of the proposed system. Future improvements of how the system would be refined would also be stated.

# LITERATURE REVIEW

## Theoretical Background

In this contemporary era, mobile phones have become a necessary device used by all people. The Internet has also become an easily accessible commodity; with almost complete ubiquity. These mobile phones provide communication functionalities as they are equipped with network connectivity capabilities. In highly populated countries, everyday people lose their lives because of accidents and poor emergency facilities. These lives could be saved if medical facilities are provided at the earliest time. The detection and alerting or reporting of car crushes or accidents have to be done in real time to avoid latency. This section of the paper will first investigate the current knowledge of accident detection and alert systems to find the most important indicators of the onset of causes of accidents.

Many attempts have been made to detect and report car accidents however, currently, detection of accidents and their locations are still problematic as well as other information related to it, leading to high mortality in crash victims. The purpose of this research is to chapter tracking systems in vehicles in real-time. This chapter would also review measures taken in detecting accidents using sensor devices such as pressure sensors, accelerometers, gyroscopes and the like. Systems responsible for sending to alerts to certain authorised personnel (examples given could be police, fire service, emergency medical technicians and the like) would be discussed. The alerts could be alerts containing messages such as location or geo-coordinates to aid in navigation (to the crash site for instance). This project implies a system which is a solution to the drawback of late communication and response to accidents.

This chapter would highlight some of the major publications concerning road accidents, traffic hazards and possible solutions published in literature or available online. This literature review would be done by discussing, sections, concepts and relationships between the various literatures. The literature review would be done for the following purposes:

* The literature would aim at developing the background and understanding in the field of the topic.
* The review would also address various developed works that cater for the current problem if they exist.

## Attempts to Detect and Alert Accidents Cases

Vehicular accidents are one of the leading causes of fatality. (Aarya et al., 2018) The time between an accident’s occurrence and the emergency medical personnel’s dispatch to the accident location is a very important factor in improving the survival rate of the victims after the accident. Devices that aid in reducing that time between an accident occurrence and the first responders, accident alert and vehicle tracking systems have been designed and implemented over the years. This accident alert and vehicle tracking systems sense when a traffic accident occurs and immediately notify emergency units.

Among the various attempts to detect and alert accidents, Shete et al. (2015) tried to solve automobile thefts in their attempt, they developed an intelligent vehicle tracking and locking system in which the user will be able to interact with the system and to control his or her vehicle through an android based smart phone. Their aim was to design such tracking system that reduces the time and cost to find out the stolen vehicle. If the rate of vibration exceeds a set threshold value it will automatically send the messages to the nearby hospitals and as well as the relatives of the victim. Rathinakumar and Manivannan (2012) stated that, accidents mostly occur due to drunk driving and not using seat belts. The main cause of accidents as investigated were due to driver drowsiness and driving tired, which could be noticed by the help of eye blink sensors, which will not start the vehicle and also report the status of the driver to the base station along with the vehicle ID. Their system includes three modules; automatic speed control module, accident detection and information sending module and security enabling module. In case of any accident, the vibrator in a vibration sensor increases beyond the limit and information is sent to GSM module, The GSM then sends a message to the respective authorities.

Kumar and Jayasree (2014) researched into and attempted to aid vehicle accident victims using MEMS sensor and GPS, GSM .This system will be placed in a moving vehicle. The ARM controller will poll GPS module in prefixed intervals and sends the vehicle location information (Latitude & Longitude) to central station over GSM network .This module provides information about the accident to the hospital and police station. Pingle and Ahirrao (2016) in their paper tried to save people’s lives from car accidents by using GSM and GPS model. They designed a system that had accuracy in detecting accidents in significantly less time and sends the location information to medical centres within seconds containing the time, geographical coordinates and angle in which a vehicle accident had occurred. The message is sent through the Internet Dongle and the location of the accident is detected using GPS module. When the accident occurs the alert message is sent automatically to the rescue team and to the police station & family members. Amin and Nasir (2014) tried to help the drivers because during an accident the driver may not be in a physical condition to report the accident manually in other words by himself or herself. They proposed a freeway incident detection system utilizing the car air bag sensor and accelerometer, GPS to locate the place of accident and GSM to send the location of the accident. Wakure and Patkar (2014) in their paper discussed when the car accident occurs. When accident occurs, the accelerometer will detect signal and will send signal to the AVR controller; a microcontroller will then enable airbag to blow and a message with the accident’s location is sent to certain pre-programmed numbers such as ambulance, police station, etc via GSM. That message will give longitude and latitude values. From these values, the location of accident can be determined. Abinaya and Devi (2014) provide security to the vehicles by the use of an engine locking system which prevents the vehicle from unauthorized access.

In their paper, it was discussed that accident could also be detected through the behaviour of the driver using sensors whether he/she is drowsy or drunk. The place of the vehicle identified using Global Positioning system (GPS) and Global system mobile communication (GSM). This system designed for users in land construction and transport business, provides real-time information such as location, speed and expected arrival time of the moving vehicles, all in a concise and easy-to-read format. Pham, Drieberg and Nguyen (2013) presented the development of the vehicle tracking system's hardware prototype. In their prototype, the system will provide users with the capability to track vehicle remotely through the mobile network. Specifically, the system will utilize GPS to obtain a vehicle's coordinate and transmit it using GSM modem to the user's phone through the mobile network. The developed vehicle tracking system demonstrates the feasibility of near real-time tracking of vehicles and improved customizability, global operability and cost when compared to existing solutions. Anand Gunadal, and Anjaney Koujalagi, Santosh Karavade, and Shivkumar Konnuri (2014) introduced a system for accident detection, they used MEMS (Micro electro Mechanical System) this device is "an accelerometer device which can detect a tilt or a sudden jerk in any of the 3 axis(x,y,z)". They used GSM and GPS modules to send location to nearest hospital. They tested the project using a bicycle and they had succeeded. Their problem is in unavailability of a sensor that measures the distance of the near cars. ( Hussain et al., 2015 ) developed a system that will reduce the possibility of crashing by using arduino microcontroller and GPS, GSM modules and vibration sensor and they added a key that will abort the messaging process in cases of false positives. The system detects the accident when the vibration sensor sense crash, Arduino receives the signal from vibration and coordinates from GPS and send a message through GPS to hospital. (Monisha, et al, 2014) developed an Authentication and Accident Intimation System, this system consist of three modules:" SMS Ignition Module: This is user defined module. When the car starts it sends a short message service (SMS) to the owner of the car and if a reply is received, the user is enabled to crank the car. The Malfunction Module helps to send message to the service centre if there is any malfunction in the car. The Accident Alert Module sends alert message to hospital or to the specified person when the car encounters an accident."They used UART for the communication between the microcontroller and GPS,GSM modules. This system would provide high security.(Rajeswari, et al., 2016) introduced a system that control the vehicles speed, the system employs zigbee sensor which provides warnings and automatic breaks when collision occurs. They used a photoelectric sensor and a microcontroller for reducing the vehicle speed". The brake is made to act like a switch and only when the brake is applied several times will the system start working else it will not. They used a GPS receiver to know the speed of vehicle and collision is detected based on that speed monitored by GPS and send the location and time of the collision from the GPS data processed by micro controller using GSM network.

(Amin, et al. 2012) designed a system for tracking stolen vehicles and accidents. The system contains GPS and GSM modems connected with a microcontroller. GSM technology is used to communicate the vehicle position (in the form of latitude and longitude coordinates) through SMS. Sensors such as vibration, alcohol and fire detectors detect signal in case of an accident occurrence and send a signal to the connected microcontroller. The controller in the vehicle automatically lock the brakes. Meanwhile a message is sent to the necessary help and thus ambulance service and required aid can reach in the shortest time possible.

(Amin, et al., 2013) designed a system that detects an accident from the map matched position of a vehicle by utilizing the GPS speed data and map matching algorithm and send accident location to an Alert Service Centre, they used GPS to provides speed and position in every 0.1 second. The position data will be used in the map matching algorithm to locate the vehicle on the road; the present speed will be compared with the previous speed in every 0.1 second through a Microcontroller Unit. Whenever the speed is falling below the safe set threshold speed, the system will generate an accident situation. It will check the vehicle location from map matching module and generate an accident situation if the vehicle is found outside the road network. (Nandaniya, et al., 2014) designed a system to detect accidents. The system envisioned an automatic collision detection and warning system relying on GPS module and a GSM modem. In the case of an accident the system detects it using the fact that the vehicle would be suddenly decelerated in such a condition. An accelerometer continuously monitors the acceleration of the vehicle and will detect accelerations greater than threshold value and send the data to the microcontroller via an ADC. The controller compares this with the threshold set value and immediately sends an SOS message to pre-set numbers. With this message the controller also transmits the GPS coordinates of the vehicle which it continuously obtains from the GPS module.

(Sonika, et al., 2014) invented a new vivid scheme called Intelligent Transportation System (ITS). The objective of this scheme is to minimize the delay caused by traffic congestion and to provide the smooth flow of emergency vehicles. The concept of the scheme is to green the traffic signal in the path of ambulance automatically with the help of RF module. The main server finds the nearest ambulance to the accident zone and sends the exact accident location to the emergency vehicle. The control unit monitors the ambulance and provides the shortest path to the ambulance at the same time it controls the traffic light according to the ambulance location and thus arriving at the hospital safely. (Prabha, et al., 2014) designed a project that provides an optimum solution to save the people’s lives when they meet with an accident. An accelerometer can be used in a car alarm application. When a vehicle meets with an accident immediately, the Vibration sensor will detect the signal or if a car rolls over, and Micro electro mechanical system (MEMS) sensor will detects the signal and sends it to ARM controller. Microcontroller sends the alert message through the GSM MODEM including the location to police control room or a rescue team. So the police can immediately trace the location through the GPS MODEM after receiving the information.

(Keil ARMIDE, Jose, et al., 2013) re-solve the problem of the delay between accident occurrence and first responder dispatch to use in-vehicle automatic accident detection and notification systems, which sense when a traffic accident is likely to occur and immediately notify emergency medical technicians. It can automatically detect traffic accidents using accelerometers and immediately notify a central emergency dispatch server after an accident, using GPS coordinates. Along with the data it will send the number of the vehicle too, they used ARM7 controller, accelerometer, GSM connections, and GPS to provide situational awareness responders.

## Literature Review Summary

This literature review began with a brief summary of literature pertaining to the detection of an accident and alerting to emergency units. The on-going debate of reliable and valid detection and alerting continues, although progress towards a consensus is being made.

Based on the information presented above, it is quite unclear which metric of detection and alertness method is most appropriate. Nonetheless, evidence suggests the GSM and GPS have been successful in the various approaches to report accident cases. The life of the individual is however more important than the occurrence of the accident, therefore the detection and immediate report of the accident is of much importance.

Clearly, no single variable reliably detected accident 100 per cent of the time. Therefore, a multivariable approach will most likely provide a more reliable detection of accident. A particular metric may be more effective for a given incident while other(s) may serve as a backup if the first fails to properly detect accident.

As discussed, most of the past research is based on group average estimates. It is well known that there is no “average” human; therefore, care must be taken in basing conclusions on the “average” which may lead to forming inaccurate conclusions. After reviewing the systems vis-à-vis the trending news of rapid road accidents and car breakdown in Ghana, the salient objectives of the system were brought to light to help propose an effective, quality and appreciative system. This paper therefore employs the use of a pressure sensor, an accelerometer and a gyroscope to build a more robust system to detect an accident.

# RESEARCH METHODOLOGY

## Introduction

In building or developing systems, some tools, devices and paradigms must be taken into consideration to help solve the problem. As a result, we would consider the design science methodology paradigm as our fundamental basis for this research since this project is a design science project. The whole of this chapter aims to provide the basic methodology for solving problems and therefore elaborates on the design science methodology.

## Design Science Methodology

Vaishnavi & Kuechler (as cited in Hevner et al., 2004) presented a set of guidelines for dealing with design science research within the context of information system. However, a key insight can be gained by identifying and understanding the existence of three design science research cycles in any design research project as shown in the figure below (Hevner 2007).

|  |
| --- |
|  |
| Figure 1: Showing Design Science Processes (Takeda et al., 1990) |

Therefore, for the purpose of this study, design science methodology was chosen because, it is an outcome driven methodology, in essence, it produces an output (artefact) which in this case would be the accident detection system. The end point will be appropriate for the research being undertaken. The adoption of the design science methodology for this project seeks to create an artefact that serves human purpose and to save human lives. It is more interested in finding solutions to identified problem, designing the solution, developing the solution, implementing the solution, testing and evaluating the solution.

Hence, it can be deduced that the behavioural science aims to; Understand nature or reality, discover, generate and propose scientific claims, provide justifications or validity of scientific claims. Also, the design science seeks to; Create artefacts, constructs or model to solve problems, evaluate performance of artefacts created and implemented, build artefacts to achieve specific purposes and for some specific reasons.

Based on the comparison above, we can clearly conclude that, the design science methodology is a problem-solving approach for organizations and even the society for creating, building and evaluating artefacts which are all objectives of this study to solve the problem. (Hevner et al., 2004).

### Awareness of Problem

Awareness of the problem cannot be overlooked if this design science methodology research will be successful. It is obvious that there wouldn’t have been the need to provide solution if there is no problem. In this regard, there have been various media reports and journals about how car accidents have resulted to loss of lives, properties and drastic economical loss to the government of Ghana and the World as a whole. The research problem was identified through observation. Several accidents victims have reported to the media their observation a few minutes before the accident occurred.

### Suggested Solution

The proposed solution would involve building an artefact to detect accidents and report its geographical location to emergency units.

### Design

Necessary tools and the design science paradigms are taken into consideration to help solve the problem and as such this section provides the insight of the methodologies which best fit to the accident detection and alert system. The methodology of concern is the Rapid Application Development and the reasons are because, the project data scope are well defined and narrow, and the project decisions can be made by few number of people and many others. Therefore, in designing the system, I will be relying on the client-server architecture which has proven to be more successful and efficient in designing, developing and building embedded systems.

#### Client Server Architecture

This is a computing model in which the server hosts, delivers and manages most of the resources and services to be consumed by the client. In the proposed system, the pressure sensor or transducer will be used to indirectly measure the speed of the car and its impact in case of a collision, the accelerometer will be used to measure the rate of change of velocity of the car. As part of its operation, the accelerometer is used to detect and monitor vibration in rotating machinery. It will therefore be used to measure how stabilised the magnitude and direction of the car is, whereas the gyroscope will also be used to measure the orientation and angular velocity of the car. All these measurements are very necessary in the sense that for a moving car to get an accident, there will be a sudden change in velocity of the car, a spinning effect of the wheels, rotation or the car will somersault. These data will be gathered and parsed to the Arduino Uno micro controller, the A7 module (GPS and GPRS) data will be sent through the GSM module to the database which will send a notification to any specified recipient. Real time monitoring is sent to the web application to be viewed by the admin and the data are saved in the database.

|  |
| --- |
|  |
| Figure 2: Client Server Design Architecture |

#### Rapid Application Development (RAD)

This is a complete methodology system development tool adapted for projects by individuals and organizations if the output of the project is need within shortest possible time. RAD makes use of various techniques and tools to facilitate development and low costs as compared to the traditional system development life cycle.

RAD is important to individuals and organizations due to some factors as listed below:

* The market is now globally competitive due to changing requirements over time.
* The data scope or objective of the project is well defined and narrow.
* IT is viewed as a cost method, hence once system delivers and money is earned vital to organizations.
* Systems going to be accepted if users are also involved in developing systems
* The project technical architecture is defined and clear with key technology component in place and tested.

Due to the use of several embedded systems which are manufactured such as the Arduino Microcontroller, and other sensors Accident Detection and Alert tags and reader have predefined manufacturing codes to help facilitate the programme but some algorithms will be developed for some special detection.

RAD methodology could involve:

* Tools such as Computer Aided Software Engineering tools
* Prototyping tools which are used to create prototypes and that would evolve to become the final system.
* Requirement gathering method through JAD workshops
* Software reuse of existing components

Advantages of RAD include:

* Components reusability increase
* Increased customer or user feedback stimulation.
* Potential consideration of relative magnitude risk control.
* Faster time for completion of project.

Disadvantages of RAD include:

* May depend on individual performance or strong team performance.
* Requires high end developers.
* Highly dependent on modelling skills.

#### Phases of RAD

|  |
| --- |
|  |
| Figure 3: Phases of RAD Hevner et al., 2004 |

Phases is RAD briefly discussed:

* Requirement Planning Phase

Users, managers as well as IT personnel meet, discuss and agree upon the project scope, requirements, constraints and time managements. When all the stakeholders have agreed upon the important issues and obtains management authorization to continue, then this phase ends.

Results achieved from this phase may include:

* Project charter report containing business considerations.
* Providing cost and economic benefits.
* Proposed actions needed to be taken for completion of project based on economic,
* Operational factors are specified.
* Project milestones are also specified

#### User or System Design

Users have the opportunity at this stage to interact with systems analysts, as well as develop models, prototypes which give a representation of system processes, inputs, and outputs. The RAD groups or subgroups typically use a combination of Joint Application Development (JAD) techniques and Computer Aided Software Engineering (CASE) tools to translate user needs into working models. This phase allows users to update and understand as well as approve a working prototype that meets their needs. It’s an iterative process.

Results achieved from this phase may include:

* Requirement documentation containing user and systems need.
* Substitute methods for plans and cost and economic factors specified.
* Proposed solution for the business project.
* Development or Construction Phase

The Application coding, testing, and integration takes place in this stage. Construction phase is repeated as often as necessary, as new components are required or alterations are made to meet the needs of the project, however users continue to give their contribution and may suggest changes if possible.

Results achieved from this phase may include:

* System proposed system is created and ready to be used.
* System evaluation occurs to see if system satisfies user requirement needs
* Cutover Phase

This phase takes care for the time taken to move components to a live production environment and in here the environment will be a simulation until proven accurate.

Results achieved from this phase may include:

* Getting the data ready into a format to be used by new system.
* Training users to adapt to migration of new system
* Cost and economic products are ensured as estimated in the requirement gathering phase

|  |  |  |
| --- | --- | --- |
| Table 1: Summary if The Phases of Red | | |
| STAGE / PHASE | OBJECTIVE | RESULT |
| Requirement Planning | To identify information requirement | Project charter report or initial requirement report. |
| User Design | To study existing systems and bring out new system based on requirements gathered | Requirement documentation |
| Development or Construction | To develop, create and test system software and hardware | Accident Detection System and Alert Complete |
| Cutover | To provide secured environment for car users | Working Accident Detection and Alert system. |

### Implementation

Implementation is the process of moving an idea from concept to reality. The Accident Detection and Alert System is a real time and mission critical in the sense that we cannot down play its usefulness and deploy it straight away in cars on the road, it will therefore be simulated in the laboratory to test, debug and fix all the errors before it will be finally deployed in a real-life environment for its purpose.

### Conclusion

At this stage, the ends will be identified and the necessary recommendations for further research and development will be made. The output of this stage will be the results of my research.

## Summary

This chapter provided the choice of methodology to be used and the design science methodology was chosen to implement the proposed system. It described the design science as a problem-solving methodology as said by (Hevner et al., 2004). The RAD technology is also discussed and the processes involved. The information obtained as a result of this methodology is going to lay the foundation that will be used to develop the system in the subsequent chapter, which will deal with the technical aspect of the development tools to be used.

**References**

Camila, I. (2015, February 3). *TECHNOLOGY INVENTIONS*. Retrieved from CARS: ADVANTAGES AND DISADVANTAGES HOW THEY HELPED SOCIETY: https://technologyinventions.wordpress.com/2015/02/03/cars-advantages-and-disadvantages-how-they-helped-society/

(2016). *Post-Crash Response: Supporting those affected by road traffic crashes .* Geneva: World Health Organization.

Sminkey, L. (2015). *Global Status Report on Road Safety | 2015*. Retrieved from World Health Organisation.

*Statistics*. (2018, October 1). Retrieved from National Road Safety Commission: http://www.nrsc.gov.gh/index.php/statistics

Wong, J. Y. (2008). *Theory Of Ground Vehicles.* John Wiley and Sons.

Aarya, D. S., Athulya, C. K., Anas, P., Kuriakose, B., Joy, J. S., & Thomas, L. (2018). Accident Alert and Tracking Using Arduino, 1671–1674. https://doi.org/10.15662/IJAREEIE.2018.0704018

G. R. Shete, D. A. Shah, A. Gaidhani, S. D. Shinde, and S. R. Sharma, "Smartphone based Vehicle Tracking and Accident Prevention System," International Journal of Computer Applications & Information Technology, vol. 8, p. 172, 2015.

R. Rathinakumar and D. Manivannan, "Wireless accident information system using GSM and GPS," Research Journal of Applied Sciences, Engineering and Technology, vol. 4, pp. 3323-3326, 2012.

R. Kumar and K. Jayasree, "GSM & GPS Integrated With ARM Based Event Data Recorder for Accident Detection," IJSEAT, vol. 2, pp. 468-473, 2014.

P. P. Pingle, A. S. Marathe, and P. R. Ahirrao, "Intelligent Vehicle Accident Detection & Notification System (VADANS) Using Smart Sensor and GPS Technologies," Imperial Journal of Interdisciplinary Research, vol. 2, 2016.

M. S. Amin, M. B. I. Reaz, M. A. S. Bhuiyan, and S. S. Nasir, "Kalman filtered GPS accelerometer-based accident detection and location system: A low-cost approach," Current Science, vol. 106, pp. 1548-1554, 2014.

A. R. Wakure, A. R. Patkar, M. V. Dagale, and P. P. Solanki, "Vehicle Accident Detection and Reporting System Using GPS and GSM," International Journal of Engineering Research and Development, vol. 10, pp. 1-4, 2014.

M. Abinaya and R. U. Devi, "Intelligent vehicle control using wireless embedded system in transportation system based on GSM and GPS technology," International Journal of Computer Science and Mobile Computing ISSN 2320-088X IJCSMC, vol. 3, pp. 244-258, 2014.

H. D. Pham, M. Drieberg, and C. C. Nguyen, "Development of vehicle tracking system using GPS and GSM modem," in Open Systems (ICOS), 2013 IEEE Conference on, 2013, pp. 89-94.

A. KOUJALAGI, S. KARAVADE, and S. KONNURI, "WIRELESS BLACK BOX USING MEMS ACCELEROMETER AND GPS TRACKING FOR ACCIDENTAL MONITORING OF VEHICLES."

F. Hussain, A. Sharma, S. Bhatnagar, S. Goyal, R. Singh, and S. Jaiswal, "GPS and GSM based Accident Monitoring System," International Journal of Scientific Research and Management Studies, vol. 2, pp. 473-480.

R. Monisha, J. J. Leo, and B. T. S. Sakthi, "Car authentication and accident intimation system using GPS and GSM," in International Conference On Global Innovations In Computing Technology, 2014.

M. Rajeswari, S. Chandana, D. Pruthvi, and S. S. Ramya, "Collision Detection And Avoidance Using Intelligent Vehicle Communication Protocol," in National Conference on Recent Advances in Information & Communication Engineering (NCRAICE-2016), 2016.

M. S. Amin, J. Jalil, and M. Reaz, "Accident detection and reporting system using GPS, GPRS and GSM technology," in Informatics, Electronics & Vision (ICIEV), 2012 International Conference on, 2012, pp. 640-643.

M. S. Amin, M. A. S. Bhuiyan, M. B. I. Reaz, and S. S. Nasir, "GPS and Map matching based vehicle accident detection system," in Research and Development (SCOReD), 2013 IEEE Student Conference on, 2013, pp. 520-523.

K. Nandaniya, V. Choksi, A. Patel, and M. Potdar, "Automatic Accident Alert and Safety System using Embedded GSM Interface," International Journal of Computer Applications, vol. 85, 2014.

S. Sonika, K. Sathiyasekar, and S. Jaishree, "Intelligent accident identification system using GPS, GSM modem," International Journal of Advanced Research in Computer and Communication Engineering, vol. 3, 2014.

C. Prabha, R. Sunitha, and R. Anitha, "Automatic vehicle accident detection and messaging system using GSM and GPS modem," International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering, vol. 3, pp. 10723-10727, 2014.

S. K. Jose, X. A. Mary, and N. Mathew, "Arm 7 based accident alert and vehicle tracking system," International Journal of Innovative Technology and Exploring Engineering (IJITEE), vol. 2, 2013.