UNIVERSITY OF EDUCATION WINNEBA

COLLEGE OF TECHNOLOGY EDUCATION KUMASI

DESIGN AND CONSTRUCTION OF VEHICLE ACCIDENT PREVENTION SYSTEM USING EYE BLINK SENSOR

BY

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DECLARATION

STUDENT'S DECLARATION

I hereby declare that this project, with the exception of quotations and references contained in published works which have all been identified and duly acknowledged, is entirely my own original work, and it has not been submitted in part or whole for another degree elsewhere.

Candidate's Signature…………………….……..   Date………………………

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SUPERVISOR'S DECLARATION

I hereby declare that the preparation and presentation of this work was supervised in accordance with the guidelines for supervision of project as laid down by the University of Education, Winneba.

Supervisor's Signature: ……………………………   Date………………………

PROF. WILLIE K. OFOSU

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DEDICATION

This research work is dedicated first to Almighty God, secondary to my lovely sister, Sarah Koomson at Electricity Company of Ghana, Tarkwa District for her supportive contribution to my education.

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ABSTRACT

Vehicle accidents are recently increasing at a fast rate and diverse technologies are being introduced to minimized vehicular accidents. This project work provide means of accident prevention system using eye blink sensor and automatic braking system to ensure that the vehicle gradually comes to a halt when drowsiness is detected and the driver fails to respond to the warning signal from the buzzer within the stipulated time. The hazard warning lights of the vehicle are also activated to alert other road users especially drivers behind during the stipulated time before the vehicle comes to a halt. Software package (Proteus) and programming language c + + were used to validate the model of the vehicle accidents prevention system using eye blink sensor and livewire software was used in the circuit design. It was observed from the results that the vehicle accidents prevention system using eye blink sensor with automatic braking system is an effective technology for vehicle accidents prevention due to drowsiness. The design and construction of the vehicle accident prevention using eye blink sensor with automatic breaking system with the aim of solving the problem of inability of the existing system (technology) to come to a halt when drowsiness is detected was successfully implemented. In view of this positive results of this project work, it was recommended that, the Government of Ghana and automobile manufacturers should promote and finance this project for mass production of vehicle accident prevention system by the used of eye blink sensor with automatic breaking system in other to replace the existing technology without the automatic breaking system. Implementing this technology in vehicles will help reduce drowsy related road accidents and hence this project work has relevance. This project work could be better by further studies to improve on driver alertness by using wireless technology to send signals to nearby vehicles when the driver is drowsy instead of the hazard warning lights of the vehicle.

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

Accident, according to Colleen et al (1989), is an unintended event or unstabilized situation that produces injury or damage not directly resulting from a cataclysm of natural phenomenon or an event that cannot be managed. However, Ruediger et al (1999), viewed accident as a random, rate and multifactor event often preceded by a situation in which one or more elements of the traffic stream have failed to cope with some conditions at the time and resulting in unintended injury, death or damage to property.

It can be observed from the above explanation that, road accidents are unexpected and undesirable events with negative consequences occurring without the intention of the victim, especially one resulting in damage or harm to human lives and properties causing burden on individuals, organizations and nations of the world. The main types of accidents are road accident, domestic accident, and occupational accident. With road accidents as the main focus; there are a lot of causes of such accident. Some are alcohol abuse, drowsiness on the part of the driver, mechanical or electrical fault of the vehicle, poor road construction; pedestrian's mistaken use of road.

Vehicular accidents also known as road accidents and the use of an eye blink sensor in preventing it, is the backbone of this project. Vehicular accidents claim more lives in Ghana daily and therefore have been the concern of Ministry of Roads and Highways and its major stakeholders to combat it to its minimum. Driving to save lives, time, and money in spite of the conditions around one and the actions of others is the slogan for defensive driving. Vehicle accidents are most common if the driving is inadequate.

These often happen especially if the driver is drowsy or alcoholic. Driver's drowsiness is recognized as an important factor in the vehicle accidents. It was demonstrated that, driving performance deteriorates with increased drowsiness with resulting crashes constituting more than 20% of all vehicle accidents. But the life lost once cannot be regained. Advanced technology offers some hope to avoid these up to some extent.

This project involves measuring and controlling the eye blink using IR sensor. The IR transmitter is used to transmit the infrared rays in our eyes. The IR receiver is used to receive the reflected infrared rays from our eyes. If the eyes are closed, it means the output of IR receiver is high otherwise the IR receiver output is low. This is to know whether the eye is in closing or opening position. This output is given to a logic circuit to indicate the final output by signalling an alarm.

1.2 Statement of the Problem

Driver drowsiness resulting in reduced vehicle control is one of the major causes of road accidents, (Harefuah, 2003). Road accident is a major national issue in Ghana. Statistics show that, four people die daily on Ghanaian roads due to road accident, (GRSP, 2011). Estimates show that, Ghana loses over 230 million dollars yearly due to road accidents with more than 1600 deaths, (www.ghanabusinessnews.com, 2011). The loss correlates to 1.7% of the country's Gross Domestic Product. The NRSC announced in 2010 that, there were 19 fatalities per 10,000 vehicles in Ghana. Statistics showed that 43% of the fatalities involved pedestrians and 53% involved occupants of vehicles. 23% of all pedestrian fatalities involved children below the age of 16 years. The major cause of road accidents in Ghana is due to over speeding. This accounts for 60% of car crashes in the country, (www.ghanabusinessnews.com, 2011).

Driving performance deteriorates with increased drowsiness with resulting crashes constituting 2%-23% of all vehicle accidents. The National Highway Traffic Safety Administration (NHTSA) conservatively estimates that, 100 000 reported crashes are caused by drowsy drivers each year in the U.S. alone. These crashes result in more than 1500 fatalities, 71 000 injuries, and an estimate of $12.5 billion in diminished productivity and property loss. Many efforts have been made recently to develop on-board detection of driver drowsiness. A number of approaches have been investigated and applied to characterize driver drowsiness. It is based on this reason that this project is to be designed to prevent sleep related accidents in other to ensure the safety of individuals and properties.

1.3 Objectives of the Study

The main objective of the project is to design and construct an automated alertness and drowsiness monitoring system for vehicle accident prevention using an eye blink sensor.

1.4 Research Question

How will the use of vehicle accident prevention system using eye blink sensor prevent vehicular accidents due to drowsiness of a driver?

1.5 Scope of the Study

The project is applicable in fields where consciousness is of much priority since it requires constant eye contact for operation.

1.6 Significance of the Study

This project on design and construction of vehicle accident prevention system using eye blink sensor would augment the body of knowledge in diverse ways. To start with, police makers could come out with strategies to reduce numerous deaths caused by drowsy related vehicular accidents to the barest minimum in Ghana.

The project would conscientise transport operators, organizations as well as the general public on the increasing nature of drowsy related road accidents as well as it effect on the nation. In addition, design and construction of vehicle accident prevention system using eye blink sensor with an automatic breaking system would create a platform for future studies into drowsy related vehicular accidents and its effect on human lives and properties.

1.7 Limitations of the Study

Longer eye blink duration, thus slow eyelid movement is a shortcoming of this project, since the eye blink sensor will activate if blinking rate elapses normal blinking rate.it is only applicable in fields where individual are present since it requires constant eye contact for operation.in addition, opaque object coming in between the sensor and the eye can cause the system to malfunction.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This project takes an in-depth look at an innovative driver state monitoring system, which would be developed to assist drivers. The system is designed to help drivers manage their physical and mental resources properly when they are behind the wheel. The article begins by explaining the motivation that led to the development of the system and then goes on to discuss the characteristics of the physical and cognitive states under observation as well as the system hardware and software components.

Human error is known to be a causal factor in many accidents. There are, however, various aspects of driver error, and an analysis of these aspects can be used to derive better engineering solutions for human- machine interaction. Various proposals have been put forward as the basis for an analysis of human error including Norman (1981), Rasmussen (1982) and Reason (1990). Human error is explained by shortcomings in perception, interpretation of information, decision-making, information recall and direct performance of an action. However, general physical and cognitive aspects such as attention and fatigue also play an important role, because they affect other cognitive processes. The driver's state has a crucial influence on performance reserves at any point in time and consequently on the conditions that determine the driver's ability to operate the vehicle safely.

Accident statistics Pack et al 1995 provide grim evidence of the effects that driver fatigue can produce. The percentage of accidents caused by fatigue varies between 5 – 25 % depending on the individual study. One essential characteristic of these accidents is the disproportionate severity of injuries, as can be seen from the graph (Fig. 2.1). The explanation for this phenomenon can be derived directly from the effects of fatigue. When drivers are tired, they fail to take any action at all to avoid an accident (especially braking or steering). Fatigue impairs perception and the ability to make the decision to react, and it also degrades actual performance of the actions.

2.2 Types of Accident

The main types of accidents are

- Domestic Accident
- Occupational Accident and
- Road Accident.

2.2.1 Domestic Accident

Domestic accidents are accidents that do occur at home and other institution premises to occupants, guests and trespassers.

2.2.2 Occupational Accident

Accident that occurs in the course of a person's employment and is caused by the hazards that is inherent in, or is related to it.

2.2.3 Road Accident

Road vehicle accident is an unintended collision of one motor vehicle with another, a stationary object, or person, resulting in injuries, death and/or loss of property, (Segen's Medical Dictionary, 2012). Vehicular accident in this country has become one of the growing concerns to most Ghanaians in recent times. This is as a result of the tremendous effect of road accidents on human lives, properties and the environment.

Heidi (2006) reported that 1.2 million people in the world lose their lives through road accidents every year. This number has risen to 1.3 million people who lose their lives globally every year and between 20 and 50 million people sustain various forms of injuries annually as a result of road accident. The most affected of these consequences of road accidents are the people in the age bracket of 15 and 29. Road accidents cost the world an amount of US$518 billion annually, (World Health Organization, 2009). It is estimated that if nothing is done globally to curtail the rampant nature of road accidents and most especially the causes of deaths of casualties before they are sent to hospitals then by the year 2020, 1.9 million people will be killed by road accidents in the world, (World Health Organization, 2011). A research conducted by Salim and Salimah (2005) also indicated that road accident was the ninth major cause of death in low-middle income countries and predicted that road accident was going to be the third major cause of deaths in these countries by 2020 if the trend of vehicular accident was to be allowed to continue.

Media reports reveal that there is a high road accident rate in Ghana, when compared with other developing countries. In 2001, Ghana was ranked as the second highest road accident-prone nation among six West African countries with 73 deaths per 1000 accidents, (Akongbota, 2011). The Ghanaian Times newspaper reported on the 16th day of November, 2011 that a total of 1,986 lives were lost in the country through road accidents from January to October, 2011, The Ghanaian Times (16th November, 2011).

2.3 Causes of Road Accident

Many researchers have come out with the causes, effects and recommendations to vehicular accidents in Ghana and elsewhere. For instance, Obeng (2008), identified that the numerous accidents on our road networks have been linked to various causes which include over speeding, drink driving, wrong over taking, poor road network and the rickety vehicles which ply on our roads.

According to World Health Organization (WHO) (2004), road accidents were the ninth most important cause of deaths, out of a total of over 100 identified causes, around the world. Forecasts however, suggest that, as a cause of death, road accidents will move up to the fifth place by 2030, resulting in an estimated 2.4 million fatalities per year (WHO, 2009), unless immediate action is taken.

Furthermore, the National Road Safety Commission (NRSC) has identified over twenty causes of road accidents in Ghana which include unnecessary speeding, lack of proper judgment of drivers, inadequate experience, carelessness, wrong overtaking, recklessness, intoxication, over loading, machine failure, dazzling and defective light, boredom, skid and road surface defect, level crossing and obstruction. Other factors are inadequate enforcement of road laws and traffic regulations, use of mobile phones when driving, and failure to buckle the seat belt, (National Road Safety Commission, 2007).

In spite of all these factors, Ocansey (2010) observed that poor vision of drivers could also be a major contributory factor to road accidents. It was obvious that the actual factors which may be influencing the traffic crashes in Ghana have not been identified since most of the factors stated above have not yet been tested with any mathematical and statistical tool to ascertain the truth or otherwise of their contributions. Elsewhere, the causes of road accidents have also been linked to one or combination of the following four factors, equipment failure, road design, driver's behavior and poor road maintenance. However, studies have shown that over 95% of all road crashes are caused by the behavior of the driver and the combination of one or more of the other three factors, (Driving guidelines).

According to the country report on Road Safety in Cambodia, road accident is caused by human factors (road users), road defects and vehicle defects. It was found in the report that road accident in Cambodia was increased by 50% in five years while the fatality rate was doubled. To help reduce the rate of road accident it was suggested that Road Accidents Safety Committee was set up, accident data system was established, accident evaluation policy and driver training measures were to be put in place, (Ung Chun, 2007). In spite of all these facts, some Ghanaians still associate some of the road accidents in Ghana to superstitions, witchcraft and evil forces. Are accidents caused by witches or irresponsible government policies? It is therefore believed that as a result of these spiritual activities, most people die in road accidents so that more blood would be obtained by the witches, wizards and the evil forces for their spiritual activities, Okyere (2006).

Some researchers have also attributed the escalating number of carnage on our roads especially in sub Saharan Africa to bribery and corruption. In a study conducted in Russia to find out the contribution of corruption to road toll, it was found out that people were paying as much as US800.00 to obtain driving license without going through any form of driving school ("Russia" Today,2010). There is enough evidence in South Africa that the government uses over R500 million annually from the Road Safety Fund to fight fraud, bribery and corruption (Arrive Alive, n.d) According to Chitere and Kibua (2004) the transport industry of Kenya is so much fragmented with the transport ministry, office of the president and other agencies playing conflicting roles which create bureaucracy, bribery and corruption in the industry since security personnel (police) fail to check and introduce transport laws.

2.4 Causes of Casualty's Death in Road Accident

The cause of death of casualties has been associated with many factors such as secondary collision, failure of drivers and vehicle occupants to put on seat belt and riders failing to put on helmet, Afukaar et al (2008).

Studies have shown that sleep related accidents tend to be more severe and as such most people are killed. This situation is as a result of the driver's inability to prevent and stop certain actions such as applying the brakes before collision and steering onto the main road if the vehicle veers off the road.

2.4.1 Sleep Related Accident

Driving performance deteriorates with increased drowsiness with resulting crashes constituting 2%-23% of all vehicle accidents. The National Highway Traffic Safety Administration (NHTSA) conservatively estimates that 100 000 reported crashes are caused by drowsy drivers each year in the U.S. alone. These crashes result in more than 1500 fatalities, 71 000 injuries, and an estimated $12.5 billion in diminished productivity and property loss.

Homes and Reyner (1995) suggested that due to the inactive nature of the sleeping driver to control the vehicle prior to the accident, sleep related accidents have high risk of death as compared with the other forms of road accidents. Furthermore, in a research conducted in the North Carolina, sleep related accident was found to be the most severe accidents among all other types of road accidents, Allan et al (1995). SWOV (2006) state that, "The next question is whether fatigue also plays a role in the occurrence of road crashes. The answer is an unambiguous yes." According to RoSPA, "Driver fatigue is a serious problem resulting in many thousands of road accidents each year"

However, obtaining accurate data regarding the extent of the problem is not easy, as a result of the difficulty of identifying whether or not fatigue was a factor in a specific accident. According to Rodenstein (2008), “Awareness that sleepiness causes many road accidents may be hampered by the lack of questions about sleepiness in police accident report forms, especially when there is death or serious injury. Whereas in many countries these forms refer to alcohol or drugs and they omit references to acute or chronic sleepiness.”

A number of studies have attempted to quantify the problem. Horne and Reyner (1995) attempted to assess the incidence, time of day and driver morbidity associated with accidents where the driver falling asleep was the most likely cause. They identified “sleep related accidents” by the following criteria:

- Blood alcohol levels above the legal limit,
- The vehicle either runs off the road or collides with the back of another vehicle,
- There is no attempt to apply the brakes beforehand (hence no skid marks),
- There is no mechanical defect (for example, tyre blow-out),
- Good weather and visibility,
- Elimination of speeding or driving too close as causes,
- Police officers at the scene suspected sleepiness as the prime cause,
- For several seconds immediately before the accident the driver could have seen clearly the point of run off or the vehicle hit.

They concluded that, “Sleep related vehicle accidents are largely dependent on time of day and account for a considerable proportion of vehicle accidents, especially those on motorways and other monotonous roads.” Their results indicate that such accidents accounted for 16% of road accidents in general and over 20% of motorway accidents, with distinct peaks at 02.00, 06.00 and 16.00 hours.

Fatigue was highlighted as a factor in some of the 624 accidents included in the final database. Results indicated that:

- Fatigue was a factor in only 6% of the total accidents,
- 37% of the accidents where fatigue was a factor were fatal,
- 29% of the cases with fatigue as a factor were single truck accidents,
- Two time periods were identified as being important; 02.00 to 02.59 (when the driver's biorhythm is at a low point), and from 15.00 to 15.59 (when it is nearly the end of the working day),
- Nearly 90% of fatigue accidents happen on highways or on inter-urban roads. Fatigue as an accident cause plays only a minor role in cities.

Attentiveness is the major factor to ensure safe driving but fatigue turns to be the severe cause to drowsy driving.

Also Harefuah 2003 driving whilst sleepy is an important contributor to road accidents.it seems that sleep deprived workers and especially physicians working in shift, are at an increased risk.

2.4.2 Attention

Attention is a concept, which they have all experienced and which seems plausible to us. However, it actually refers to a multi-faceted phenomenon. Attention is an essential prerequisite, which enables a person to select information, which is coming from the person's surroundings, process the information and control action (James, 1890). Attention can be focused intentionally in an attempt to locate information or unintentionally as a result of physical stimulus. Attention can be focused on one specific area, or it can be divided to a certain extent between several areas. Training and factors such as fatigue and motivation can influence the degree to, which attention and cognitive resources can be divided. Another aspect of attention is vigilance, which means maintaining focus. A person needs to be vigilant to perform a task over a long period of time. All of these factors are important for drivers, because they make available the cognitive and physical resources needed to carry out an activity.

2.5 Fatigue and Safety

Fatigue is another phenomenon that influences a person's ability to perform a task on various levels. Hacker (1989) defined fatigue as a "state in which performance capabilities are temporarily impaired by continual activity demands which exceed the ongoing capacity to restore performance capabilities." A dangerous situation occurs when the driver of a vehicle suffers from psychological fatigue (temporary impairment of information acquisition and processing capabilities).

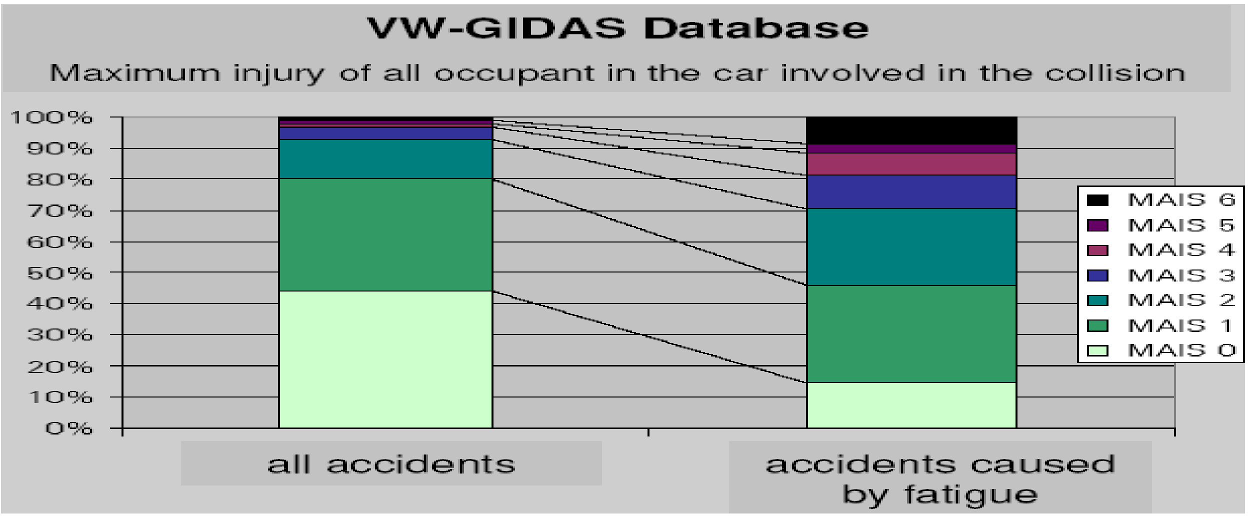

Figure 2. 1 : Maximum Injury of all Occupants in the Car Involved in the Collision

Maximum Injury In Car Collisions Overall In Relation To Maximum Injury In Car Collisions Caused By Fatigue. (VW's fatigue detection technology, von Jan. T).

2.5.1 Factors Influencing Fatigue

The Australian Transport Safety Bureau (2003) suggests that three general factors influence fatigue:

- Lack of sleep
- Time of day
- Time spent on task.

2.5.2 Lack of Sleep

Sleep is an important physiological function. When people do not obtain enough sleep they build up a 'sleep debt'. Sleep debt refers to the difference between the minimum amount of sleep needed to maintain appropriate levels of alertness and performance, and the actual amount of sleep obtained (Rosekind, 1999). Research has found that as little as two hours sleep loss on one occasion can result in degraded reaction time, cognitive functioning, memory, mood and alertness. Cumulative sleep debt significantly reduces alertness and performance, especially on attention based tasks such as driving (Rosekind, 1999; Dinges, 1998; Hartley and Arnold, 1995; EPDFS, 1997).

2.5.3 Time of Day

Humans possess a neurobiological based sleep-wake cycle called a circadian rhythm or body clock (EPDFS, 1997; Folkard, 1997). Research has shown that there are two periods during the 24 hour circadian cycle where the level of sleepiness is high. The first period is during the night and early morning, and the second is in the afternoon (Hartley et al, 2000). During these periods of sleepiness, many functions (alertness, performance and subjective mood) are degraded (Rosekind, 1991).

The effect of the circadian rhythm in road crashes was demonstrated by Pack et al (1995) who analyzed North Carolina road crash data. This study found that fatigue-related crashes corresponded to circadian variation in sleepiness, with a major peak during the night and a secondary peak midafternoon. Wylie (1996) examined the loss of alertness and degraded performance of 80 male truck drivers from the USA and Canada. One method used in this study involved continuous video monitoring of a driver's face for eyelid droop and other fatigue induced facial expressions. It found that drowsiness peaked between late evening and dawn. The study also found that 'time of day' was the most consistent factor influencing driver fatigue.

2.5.4 Time Spent on Task

Prolonged physical activity without rest leads to muscular fatigue. Similarly, a prolonged mental workload without rest will lead to reduced alertness and disinclination to continue the effort (Grandjean, 1988). Research based on driving tasks has shown that the length of time on a task affects performance. As time spent on a task is increased, the level of fatigue is increased, reaction time is slowed, vigilance and judgment is reduced and the probability of falling asleep during the task is increased (EPDFS, 1997; HORSCOCTA, 2000).

2.5.5 Categories and Symptoms of Fatigue

Table 2. 1 : Graph of sensitivity of the eye blink sensor

CATEGORY	SYMPTOMS AND EFFECTS OF FATIGUE
Physiological	• reduced psychophysiological stimulation
Cognitive	• reduced alertness and vigilance • information processing and decision-making takes longer
Motor	• reaction time increases when critical events occur • control reactions are more variable and less effective • reduced preparedness to react

Brown (1994) believes that the main effects of fatigue are a progressive withdrawal of attention from traffic and what is happening on the road combined with a more risky approach to decision making.

Brown suspects that reduced alertness is most often the result of eyelid closure, which accompanies fatigue. He also describes another effect of fatigue on drivers as "driving without awareness" (DWA). When road and traffic conditions are not very demanding, the driver's attention is gradually diverted from traffic to distracting thoughts.

2.5.6 Effect of Driving Hours on the Onset of Fatigue

As discussed above, the relationship between crash risk and time spent driving is not generally one which has been well-researched. However, some studies do exist. Hanowski et al, (2009) undertook a naturalistic driving study, the aim of which was to examine the effect of change in drivers' hour's regulations in the US to permit an additional hour of driving (from ten to eleven hours).

This study did, however also conclude that drivers who were able to arrange breaks flexibly when they began to feel fatigued were better able to manage the problem. It is difficult to establish a direct relationship between time spent on the (driving) task and accident risk. Time of day is an additional important factor because of the effect of circadian rhythms on alertness. Circadian rhythms control sleep and wakefulness. During daytime they generate a drop of vigilance in the mid-afternoon and a very alert period towards the end of the afternoon (Philip et al, 2007).

For minibus drivers there are a number of other important factors which will affect their likelihood of suffering from fatigue. These can be divided into three categories; personal factors, journey type factors and external factors, which are discussed in turn. No studies have been found which specifically address the question of the effect of number of days spent driving on fatigue.

2.5.7 Personal Factors

According to Horne and Reyner (2001) whilst the drivers' hours regulations refer to "adequate rest" there is little guidance on what is meant, and no acknowledgment of the fact that "adequate rest" is not the same as adequate sleep. The amount of sleep needed is highly dependent on individual circumstances, varying with factors such as age and general fitness level. Other personal factors which will affect fatigue include shift patterns, with drivers being particularly vulnerable during their first night working a nightshift and early in the morning after a long night shift (Horne and Reyner 2001). Physical fitness is also important, with some medical conditions having a known association with fatigue accidents. Obstructive Sleep Apnea is one such condition, and whilst it is covered by some countries' Physical Fitness to Drive regulations, it is not covered in all countries (Rodenstein, 2008). In a sector like coach travel, where drivers may cross national boundaries, this is a factor which could warrant further research.

2.5.8 Drink Driving Factors

Drink-driving is another factor which was identified by Clarke et al (2007) as a contributor to death of casualties in road accidents. The reason for this could be link to the inability of the drunk driver to control the vehicle as a result of sleeping, Home et al (1990).

There were 1106 car drivers who were killed in road traffic crashes in 2005 at Britain and Wales and a study into this data by Clarke et al (2007) showed that 40% of those who died worn no seat belts and most of them were people between the age 17and 29 years. It was further identified that the desire for buckling the seat belt increases as one grows beyond 30 years, Clarke et al (2007).

2.5.9 Journey Type Factors

In the case of long-distance tourist travel by coach, there are a number of factors which could work together to compound the potential problem of fatigue. Whilst the schedule over the duration of the tour may incorporate a diverse range of journeys and incorporate scheduled stops for visits and meals, these will not necessarily mitigate the risks. It is likely that there will be long stretches of driving on motorways or other inter-urban routes, which are known to have a higher incidence of fatigue accidents due to the lower mental stimulation and lower levels of concentration required. If working to a set itinerary which requires the coach to be at specific destinations by certain times, the opportunity to take breaks may be limited by the schedule that is being worked to. In addition, any stop involves the safety, welfare and wishes of the passengers. The coach driver may not be able to make an unscheduled stop and would not be able to expect the passengers to sit and wait whilst they take a break. This is likely to make it more difficult for the driver to have any flexibility over decisions about when and where to take breaks, making it more likely that drivers would feel forced to continue even if they began to feel tired. The breaks that are scheduled in will not necessarily be at a time, location or duration that fits in with the driver's need to rest. For example fatigue has been shown to be a serious problem for automobile and truck operators (O'Hanlon, 1978; McDonald, 1984).

2.6 Legislation

It is not a specific offence to drive whilst tired, though it may be that a tired driver is more susceptible to committing other offences. The main approach of strategies to limit fatigue in professional drivers has been to limit the hours worked. In Europe, drivers' hours are governed by two sets of regulations, the purpose of which is to ensure that excessive hours are not driven. Within the EU the relevant legislation is Regulation (EC) No 561/2006. Outside the EU it is the "European Agreement on the Work of Crews of Vehicles Engaged in International Road Transport" (AETR) which sets out the relevant limits. In addition, some countries have their own national legislation for purely domestic operations. The regulations cover two elements of the drivers' schedule; driving time and rest periods. Rest periods are categorized as either daily or weekly rest.

2.6.1 Driving Time

Weekly driving time shall not exceed 56 hours or the maximum working time laid down in the Working Time Directive No. 2002/15. Maximum 90 hours in any two consecutive weeks. Not more than 4 hours without taking a break of 45 minutes or several breaks of at least 15 minutes taken over the 4 hours. The daily driving limit is 9 hours but this can be extended to 10 hours twice a week.

2.6.2 Driving Breaks

After four and half hours, a driver shall take an uninterrupted break of not less than 45 minutes unless he takes a rest period. This break may be replaced by a break of at least 15 minutes followed by a break of at least 30 minutes each distributed over the 4½ hour driving period. (EU regulation, Art 7)

2.6.3 Rest Period

Rest periods are categorized as either daily or weekly rest.

- Daily rest and
- Weekly rest.

2.6.4 Daily Rest

11 hours in the 24 hour period commencing at the end of the last daily or weekly rest period. This may be reduced to 9 hours no more than three times between any two weekly rest periods.

2.6.5 Weekly Rest

Starts after six, and it should be a 24 hour period from the end of the previous weekly rest period. A driver may extend a daily rest period into either a regular weekly rest period of at least 45 hours or a reduced weekly rest period of less than 45 hours but at least 24 hours.

In any two consecutive weeks a driver shall take at least two regular weekly rest periods, or one regular weekly rest period and one reduced weekly rest period of at least 24 hours. However the reduction shall be compensated by an equivalent period of rest taken en bloc before the end of the third week.

2.6.6 Characteristics of Sleep Related Accident

As a group, sleep-related crashes have certain characteristics that set them apart from other crashes. Compared to non-sleep-related crashes,

- They are more likely to occur at night or in midafternoon, times when people have a natural propensity to sleep.
- They are also more likely to involve a single vehicle running off the roadway, to occur on higher-speed roadways, and to result in serious injuries.
- Typically there is no indication of braking or other attempts to avoid the crash. The driver is often alone, and is especially likely to be young and male (NCSDR/NHTSA, 1998; Pack et al., 1995; Horne and Reyner, 1995).

While these characteristics are typical, some sleep-related crashes follow very different profiles. In addition to run-off-road crashes, sleepy drivers also are likely to be overrepresented in rear-end and head-on collisions (Knipling and Wang, 1994).

According to Horne and Reyner (2001) sleep-related vehicle accidents are typically characterized by vehicles running off the road or colliding with the rear of another vehicle, with no attempt to apply the brakes beforehand, resulting in high impact speed.

2.6.7 Prevention of Sleep Related Accident

The research identified that in order to reduce the risk of drowsy driving and its related crashes,

- Get enough sleep:

American Academy of Sleep Medicine recommends adults get seven to eight hours of sleep each night in order to maintain good health and optimum performance.

- Do not drink alcohol:

Alcohol can further impair a person's ability to stay awake and make decisions; taking the wheel after having just one glass of alcohol can affect one's level of fatigue.

- Do not drive late at night:

Avoid driving after midnight, (driving between midnight and 6:00 am) which is a natural period of sleepiness. Strohl et al (1998).

- Take breaks while driving:

If one becomes drowsy while driving, it is recommended he or she pulls off to a rest area and takes a short nap, preferably 15 to 20 minutes in length.

In spite of all these preventive measures discussed above, with the aid of technology application, we have decided to design and construct a system that will monitor the driver's eye state of blinking to know whether one is feeling drowsy or not when behind the wheel.

This project involves controlling accident due to unconsciousness through Eye blink. Here an eye blink sensor is fixed on a spectacle and worn by the driver where if the driver loses consciousness whiles driving it indicates through an alarm circuit.

2.6.8 System Components

The basic model of the system mainly includes;

- Hardware;
  I. eye closure sensor
  II. microcontroller
  III. buzzer

2.6.9 Eye Closure Sensor

We used an eye blink sensor, which is suitable for vehicle- based applications to monitor the driver. The sensor is positioned so that we can monitor the driver's head and especially the eyes. This is suitably achieved by fixing the sensor on a spectacle which will be worn by the driver. We want to measure the movement of the eyes and eyelids with the aid of the eye blink sensor.

The output should include parameters such as the opening and closing of the eye (eyelid data). The change in eyelid spacing (the distance between the upper and lower eyelid) over time can be used to calculate the frequency and duration of eyelid motion and other parameters. Parameters derived from eyelid motion are then used to generate an estimate of the driver's fitness/ fatigue level. An assessment of attentiveness is based on head and gaze position.

Figure 2. 2 : Spectacle with an Eye Blink Sensor, (https://www.google.com.gh).

2.7 Operational Criteria

The functional requirements must be fulfilled in a variety of situations. These operational criteria are essentially divided into ambient criteria and person related criteria.

2.7.1 Ambient Criteria

The system must continue to operate reliably regardless of ambient lighting conditions. It must be able to handle the full range of light intensity that is likely to occur during vehicle operation, ranging from total darkness to direct sunlight. The system must also be able to handle rapidly changing lighting conditions (e.g. travel along a tree-lined road with sunlight from the side). On systems that operate in the near-infrared range, consideration must be given in particular to near-infrared interference and the effect of the windows in the target vehicle. The system is designed for use on the road. Typical vibration must not impair system reliability or cause system failure. During vehicle testing, the system must operate in the standard test temperature range without any restrictions.

2.7.2 Person-Related Criteria

There must be no dependence on the driver's physical appearance including hair style. Ethnic origin (Asian, African or Central/South/North European/American), sex, make-up and prosthetic changes to the person's face must not affect system performance. The system must be able to measure eyelid spacing through glasses even in unfavorable lighting conditions. It has to accommodate different styles of glasses and lens types (mineral glass, plastic and tinted/untinted lenses) and prescriptions. The only exception relates to sunglasses that filter out a significant amount of infrared light.

2.7.3 Measuring Eyelid Opening

Precision measurement of eyelid movements is a basic prerequisite for determining the driver's fatigue level. The distance between the eyelids is used for example to calculate lid opening and closing speeds, eyelid closure time and blinking frequency. It is also used to determine how wide the eye is opened and other parameters. The system must provide the current distance between the eyelids for both eyes at the sensor frame rate. Output must not exceed a defined latency level.

2.7.4 Accuracy

The sensor-processing unit should be capable of detecting the position of the eyelid edges with an accuracy of less than one pixel. Variation in measurement errors is particularly critical. Rapidly changing measurement errors create major problems during fatigue monitoring. Key parameters such as eyelid opening speed are derived directly from the distance between the eyelids, and false discontinuity on the blinking curve leads to very critical measurement errors. Measurement errors that remain constant over time are somewhat less critical. A small, constant offset or factor on eyelid opening data can be tolerated.

2.7.5 Status Output

The system should provide a status signal, which is output in real time or nearly so. This is necessary to achieve reliability and an alarm rate, which is acceptable to the customer in a number of situations, which occur when the vehicle is in traffic.

2.7.6 Reliability of the Status Value

The "Blink" status is used to trigger a warning as soon as the driver's eyes have been closed for a certain length of time. Latency must be minimal in order to provide timely warning to the driver. The fatigue level is determined by measuring the distance between the eyelids. The "Blink" status must be highly accurate. If "Blink" remains set for a defined length of time, a downstream unit (buzzer) will warn the driver. Long blinks will lead directly to a driver warning. If the "Blink" status erroneously indicates a long blink, a false alarm would be sent to the driver. The "Blink" status must never lead to a warning if the eyelids were not actually closed for the defined length of time. However, long blinks should always be detected if possible. 95% of long blinks should be detected using the "Blink" status.

This issue presents also a big challenge for the image processing functions. The requirements placed on other status values are less stringent.

2.7.7 Calibration

The system design must ensure that no calibration is needed over the system's lifecycle. However, automatic calibration without the need for user intervention is acceptable. There should also be no need for calibration during installation or service. The sensor aperture angle should ensure that there will be an adequate field of view despite the usual installation tolerances.

Figure 2. 3 : Module for Eye Blinks Detection, (Catalog No. 9008 of Enable devices).

Microcontroller is a general purpose device, which integrates a number of the components of a microprocessor system on to single chip. It has inbuilt CPU, memory and peripherals to make it as a mini computer. The output from the eye blink sensor is imputed into the microcontroller which performs the necessary calculations and operations to determine whether the eye is closed or opened.

A buzzer or beeper is a signaling device that beeps to keep the driver conscious depending on the output of the microcontroller. Eyes opened means off whiles eyes closed means a 'blink' is detected and the buzzer will beep.

2.7.8 Summary

In recent years, an increasing number of drowsy driving biobehavioral monitors have become available. These are a widespread hope that such technologies will be a key component in effective management and prevention of drowsy driving.

Paraveenkumar, B. and Mahendakan, K. 2014 and Prashanth et al (2015), did similar work on this project which only looks at the used of an alarm to issue a warning signal when the driver is drowsy but this project will take an in-depth use of automatic breaking system in addition to alarm and hazard light to reduce the speed of the car and finally stop or park the vehicle if the driver refuses to attend to the warning signal from the buzzer.

CHAPTER THREE

METHODOLOGY

This chapter as the name implies deals with a detailed description of the method used and explains the process of designing the logical model of the real – system. Computer – based experiment (simulation and programming) was used with the model to describe, explain and predict the behavior of the real – system under study. Computer software package (livewire) was also used in the circuit design of the vehicle accidents prevention system using eye blink sensor with an automatic braking system. Excel was the statistical tool used in analyzing the experimental results of this project work.

3.1 Block Diagram

The block diagram of Fig 3.1 depicts the total blue print of the proposed project. The total essence and the functioning of the project are represented in the block diagram. The block diagram mainly consists of 12 parts. They include

LM324 Comparator, Eye Blink Sensor, LCD, Microcontroller, Buzzer, Traffic indicator, Brake controller, DC motor 1, DC motor 2, Voltage regulator, ignition Switch and Battery.

The various parts of the vehicle accident prevention system using eye blink sensor with an automatic breaking system are shown by the block diagram in figurer 3.1.

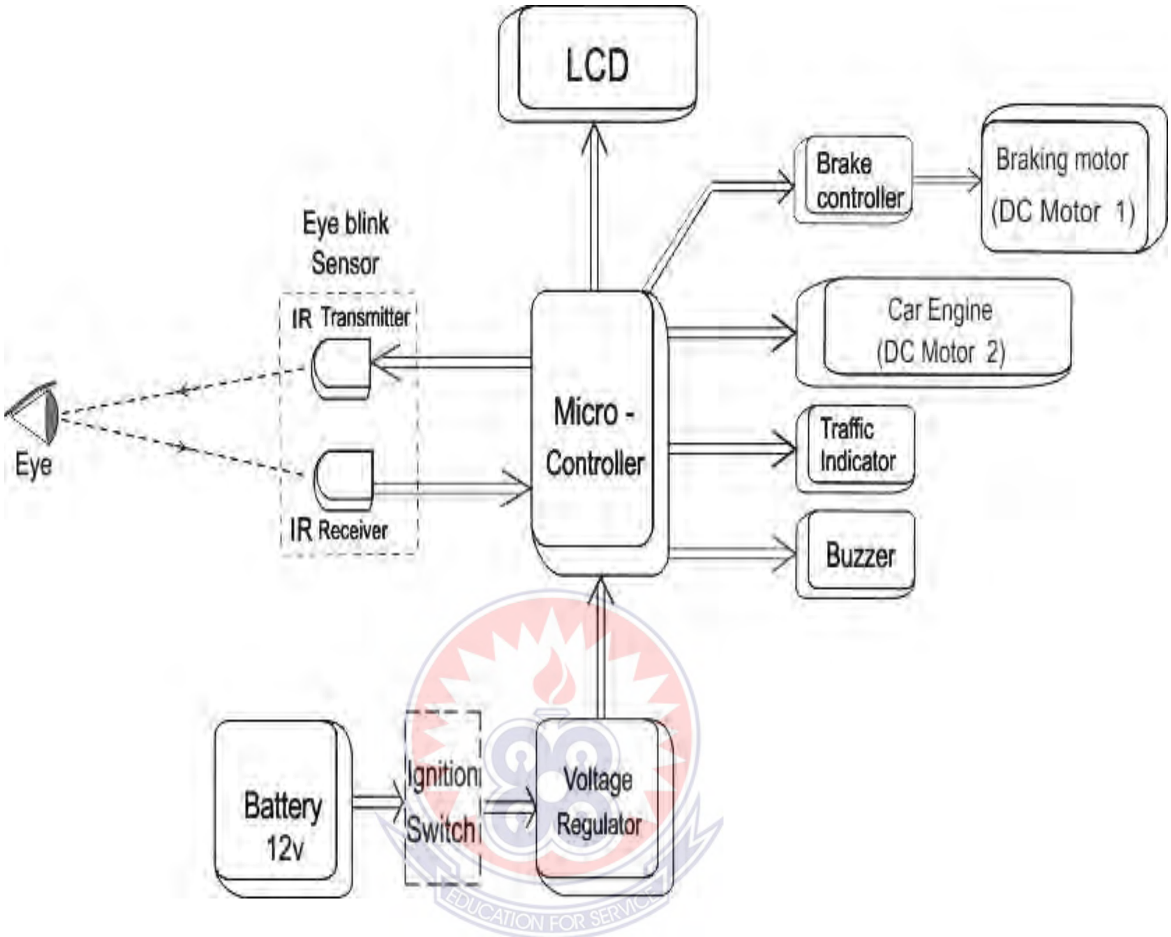

Figure 3. 1 : Block diagram

The Purpose of such a model is to advance a system to detect fatigue symptoms in drivers and control the speed of vehicle to avoid accidents by means of an automatic braking system.

The vehicle accident prevention system using eye blink sensor with an automatic breaking system is represented by the logical (flowchart) model in figure 3.2.

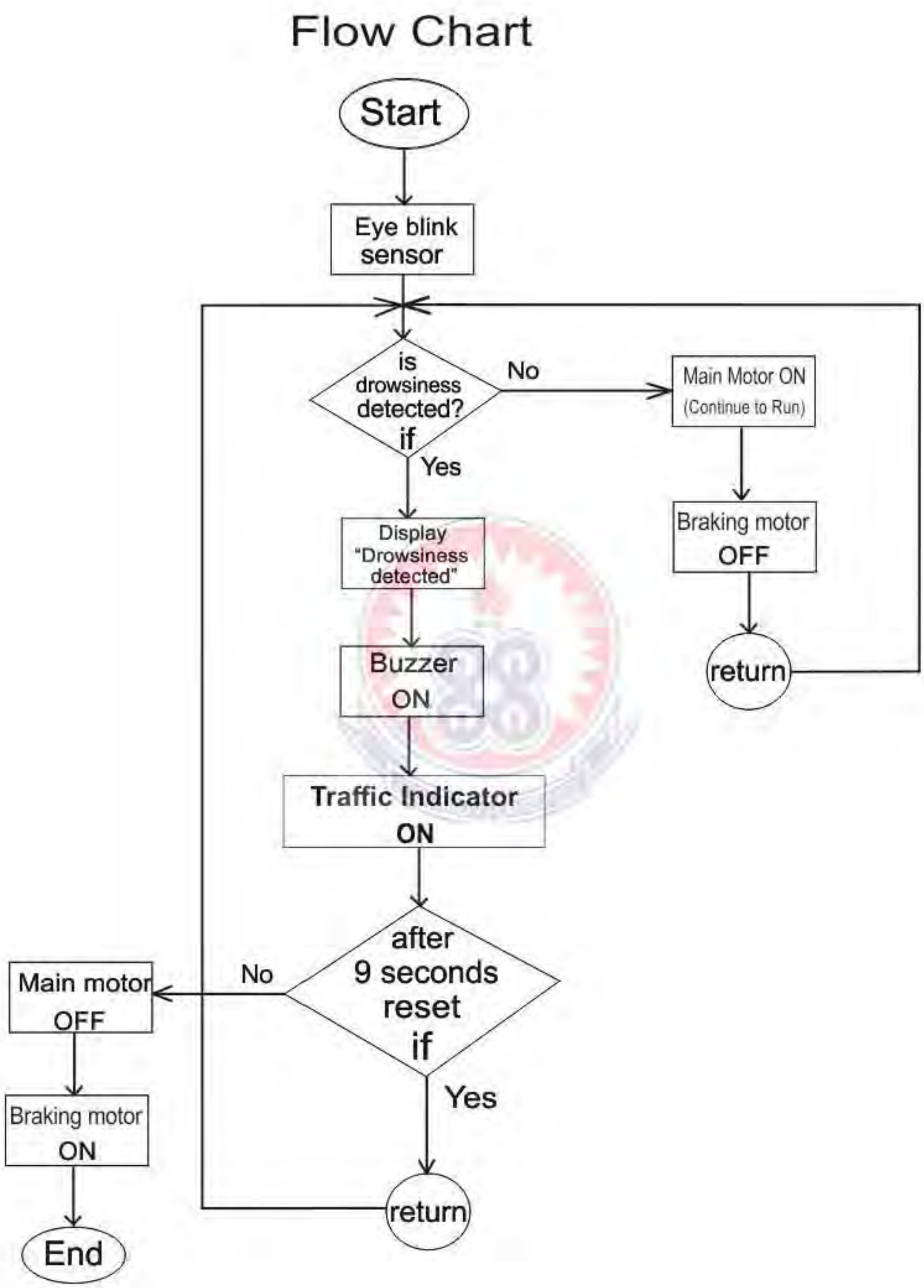

Figure 3. 2 : The Logical Flow (Flow Chart) Model of Vehicle Accident prevention circuit Using Eye Blink Sensor

The detailed description of the components and connections of the logical (flowchart) model in figure 3.2 are shown by the circuit diagram of the vehicle accident prevention system in figure 3.3.

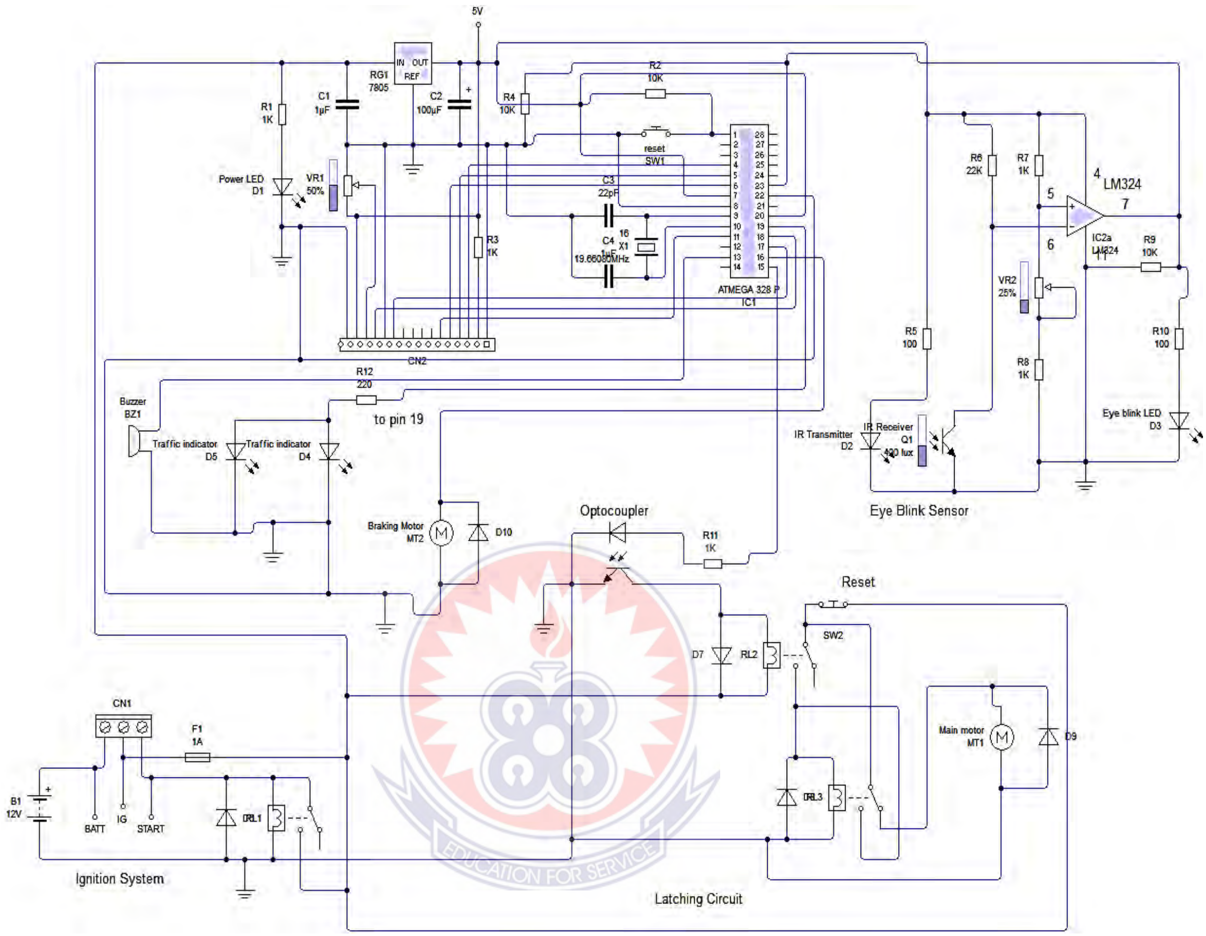

Figure 3. 3 : Circuit Diagram for Vehicle Accident prevention system

3.2 Mode of Operation

The system consists of a microcontroller and an eye blink sensor for driver blink acquisition and an adaptive braking system designed using dc motor for providing precise positioning of the brake pad to control the speed of the vehicle.

It operates by means of switching on the ignition system thus allowing current to flow through the circuit.

When drowsiness is detected by the rate at which the driver blinks his or her eyes, the microcontroller receives signal from the eye blink sensor through the comparator circuit and then start its process by switching off the engine and activates the buzzer for nine(9) seconds, and if not being reset, continue its process by activating the traffic indicator of the vehicle to alert the nearby vehicle and then starts its braking process gradually by allowing current to flow through the brake motor to limit the speed of the vehicle in a gradual manner until it comes to a halt. It then displays on the LCD that drowsiness is detected when the driver is feeling drowsy, and also displays drowsiness not detected when the driver is in normal state (not drowsy).

3.3 The Micro-Controller Module

The Atmel ATmega328 is a 32K 8-bit microcontroller based on the AVR architecture. Many instructions are executed in a single clock cycle providing a throughput of almost 20 MIPS at 20MHz.

The ATmega328 is the main brain of the artefact which contains the program code. It receives signal from the eye blink sensor when drowsiness is detected, process it and then send the information to the LCD display. It then sends signal to the optocoupler controlling the main motor to stop current flowing through the motor and then activates the braking motor.

A buzzer or beeper is a signaling device, usually electronic which gives out a continuous or sporadic buzzing or beeping sound in the form of alerting or warning.

The eye blink sensor consists of the infrared transmitter and receiver. Infrared transmitter is one type of LED which emits infrared rays generally called as IR Transmitter. Similarly IR Receiver is used to receive the IR rays transmitted by the IR transmitter.

One important point is both IR transmitter and receiver should be placed straight line to each other as shown in figure 3.4.

The transmitted signal is given to IR transmitter whenever the signal is high, the IR transmitter LED is conducting it passes the IR rays to the receiver. The IR receiver is connected with comparator. The comparator is constructed with LM 324 operational amplifier. In the comparator circuit, the reference voltage is given to inverting input terminal. The non-inverting input terminal is connected to the IR receiver. When the IR rays between the IR transmitter and the receiver is interrupted, the IR receiver will not conduct. So the comparator, non-inverting input terminal voltage will be higher than the inverting input. Now the comparator output becomes high in the range of +5V. This voltage is given to microcontroller for processing and the schematic diagram is shown in figure 3.4.

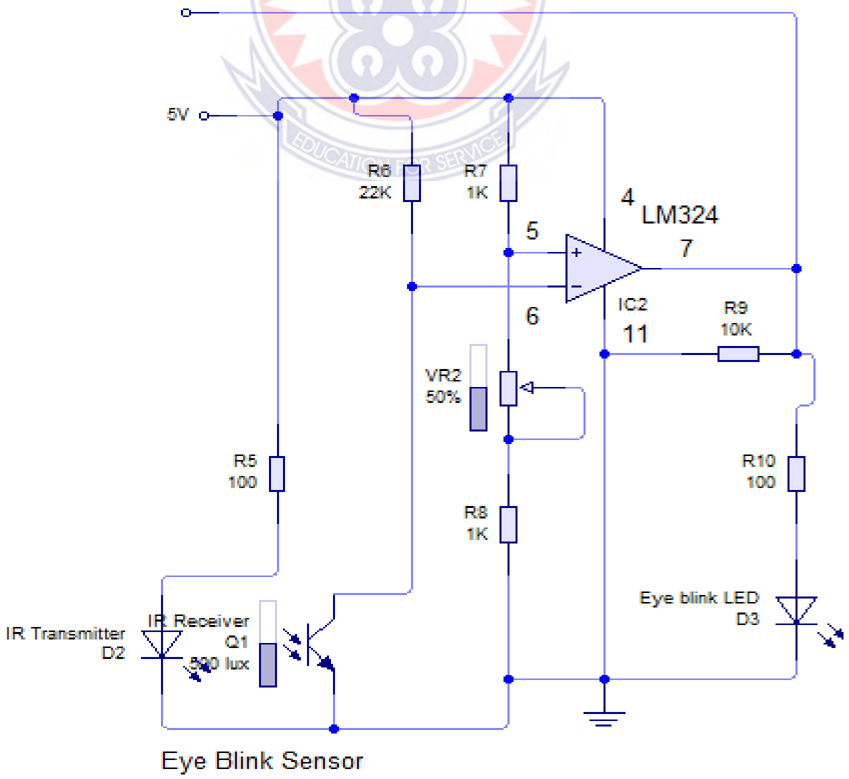

Figure 3. 4 : Schematic view of the Eye blink module

Liquid Crystal Display which is commonly known as LCD is an Alphanumeric Display. It means that, it can display Alphabets, Numbers as well as special symbols. The LCD is used to displays information if drowsiness is detected or not detected.

The battery is the power source of the project which supplies power to the entire circuit. The battery's most important function is to provide power to the circuit in order to start the motor as well as traffic indicator and the buzzer when drowsiness is detected. The voltage of the battery is 12 volts with current rating of 5 amps.

3.4 The Voltage Regulator Module

The voltage regulator circuit uses a voltage regulator IC 7805 with capacitors to regulate the input voltage (12 volts) to 5 volts to suit the micro-processor for it perfect functioning.

A circuit diagram having regulator IC and all the above discussed components arrangement revealed in the figure 3.5.

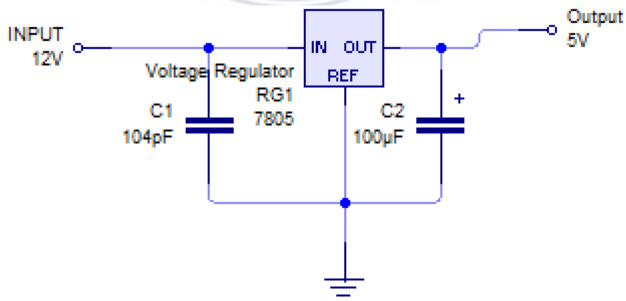

Figure 3. 5 : Regulated Power Supply Circuit

3.5 The Traffic Indicator and the Buzzer Module

This circuit flashes an LED on and off with a sound produce by a buzzer for the purpose of alerting or warning the nearby drivers before the engine lock is activated in order to avoid accidents.

This circuit is programmed in an A stable operating mode which generates a continuous output via Pin 19 of the micro-controller in the form of a square wave. This turns the LED (D1) on and off according to the traffic indicator code loaded into the micro-controller. The buzzer module helps in giving out the beeping sound, the circuit connections are shown in figure 3.6.

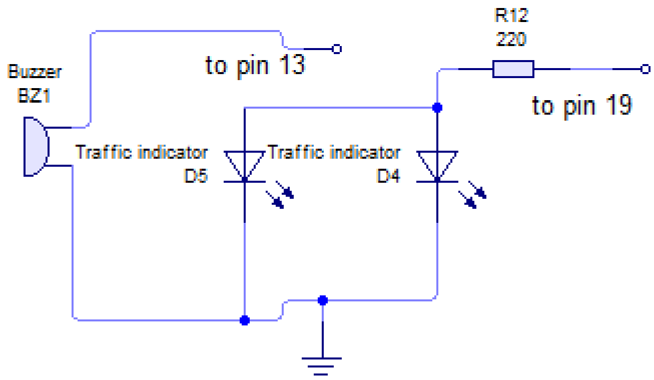

Figure 3. 6 : Schematic view of the traffic indicator and the buzzer

The braking system is designed to stop the acceleration of the main motor which controls the speed of the vehicle gradually when drowsiness is detected. It is controlled by braking code loaded in the micro-controller and it schematic diagram is shown in figure 3.7.

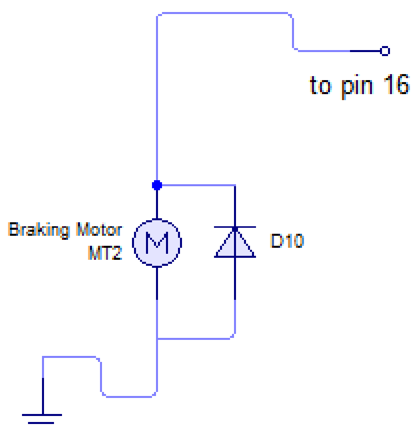

Figure 3. 7 : Schematic view of the braking circuit

Ignition system is the main part of the project which allows current to flow from the battery to the circuit. As the key slides into the slot, it pushes a set of tumblers in the ignition into a precise pattern to allow the key to be rotated to close the ignition circuit. That circuit then delivers power to the motor through the hold on circuit, which turns the motor to allow it to operate.

Latching circuit is a combination of relays that will activate when drowsiness is being detected and then sustain the circuit until the reset button is pressed. Usually if the relay needs to be control by a microcontroller, a transistor is use because the relay needs a higher voltage or current than the microcontroller can provide. Although some microcontrollers can give enough current to switch a relay, but most of them is incapable of doing that.

The diode (freewheeling diode) in parallel with the relay coil (solenoid) is needed to suppress the feedback voltage that occurs when the transistor is switching-off and ensures that the magnetic field stored in the coil collapses for another cycle of operation to commence and these arrangements are shown in figure 3.8. That feedback voltage can reach hundreds of volts, which can completely destroy the driving transistor.

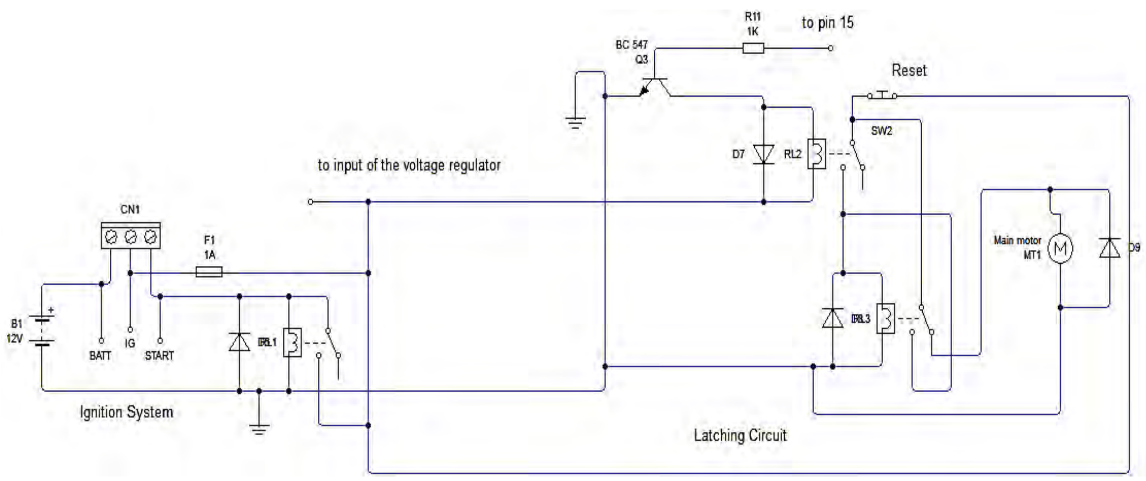

Figure 3. 8 : Schematic view of the ignition and the latching circuit

The ATMEGA328-PU is the micro-controller controlling the whole system. It receives analog signal from the eye blink sensor, process it and sends information on the LCD when drowsiness is detected.

LM7805 is a voltage regulator which regulates the input voltage (12v) to 5v to satisfy the micro-controller and the sensor circuit since they need 5v to operate. The eye blink sensor is used to sense and compare the blinking acquisition of the driver's eye if abnormal, signal would be sent to the microprocessor for activation. The crystal used is to help the micro-controller in oscillating under the frequency of 16MHz.

The Liquid Crystal Display (LCD) used is a 16×2 display type for displaying whether drowsiness is detected or not detected.

3.5.1 Component Analysis

Testing was done on individual components to ascertain their viability and specification through physical observation and using a digital multi-meter. The following are the test carried out on the components.

3.5.2 Testing the programmable IC

The IC was inserted into the Arduino Uno programmable board and a simple LED blinking code was then uploaded to the IC, the LED was blinking indicating the IC is in its good working mode. The test was performed again and the LED was blinking according to the programing code.

3.5.3 Testing an LED (Light Emitting Diode)

The multi-meter was set to the continuity mode and the probes of the multi-meter were connected to the terminals of the LED, thus positive side to the long leg of the LED and the negative to the other leg. The multi-meter was powered ON and the LED glow which indicated that the LED was in a good condition.

3.5.4 Testing a Buzzer

The multi-meter was set to the continuity mode and the probes of the multi-meter were connected to the terminals of the buzzer, the multi-meter was powered ON and the buzzer beeped which indicated that the buzzer was in a good condition.

3.5.5 Testing a Diode

With the multi-meter placed at the continuity mode, the positive lead of the multi-meter was connected to the anode and the negative to the cathode and the multi-meter was powered ON and it's displayed a reading between 0.6 and 0.7v.

3.5.6 Testing a Motor

The multi-meter was set at the ohms mode ,the multi-meter was powered ON and used to test the resistance between both terminals of the motor and the multi-meter displayed the resistance of the motor indicating that the coil is intact.

After the testing of the above components, some other components were tested after they have been placed on the printed circuit board.

3.5.7 Construction Procedure

The microcontroller was placed on the right position on the printed circuit board (pcb) where there would be enough space for other components to be installed, Pin 8 and pin 22 of the microcontroller were connected to the GND terminal of the sensor then to ground of the supply also Pin 7 and pin 20 of the microcontroller were connected to the positive terminal of the sensor and then to the positive output of the voltage regulator (VR1) where Pin 14 of the microcontroller was connected to the signal input of the sensor.

Pin 4, 5, 6 and 7 of the microcontroller were connected to the LCD terminals 11, 12, 13 and14 and LCD terminal 1, 5 and 16 were connected to ground, further more LCD terminal 2 and 15 were connected to the positive output terminal of the voltage regulator through R3 (100ohms).

The ground and positive output terminal of the supply were connected to both ends of the variable resistor and then the middle terminal to the LCD pin 3 where Pin 4 and 6 of the LCD were connected to the pin 18 and 17 of the IC, also Pin 19 of the microcontroller was connected to the traffic indicator LED through 1kΩ resistor.

Pin 15 was connected to the positive terminal of the opt-coupler through R15 (100ohms) and the output of the opt-coupler to the motor 2.similarly Pin 16 of the micro-processor was connected to the positive side of the motor 1 and the other terminal of the motor 1 to ground.

The output terminal of the comparator was connected to the pin 14 of the micro-processor and the output signal of the eye blink sensor to the non-inverting input of the operational amplifier. All connections were done through soldering thus using a lead and soldering iron.

3.5.8 Experimental Work

The vehicle accident prevention system using eye blink sensor was tested at electrical and electronics Amatrol laboratory at Takoradi polytechnic at Takoradi. The results were tabulated and included in the project report as shown in chapter four (4).

Digital multimeter (voltmeter) and a variable resistor was used to record the eye level in percentage and drowsiness level in millivolt, also digital voltmeter, rheostat and a stop clock was used to record the sensitivity of the eye blink sensor. All circuit diagrams and block diagrams were design with the aid of computer software programs such as livewire and CorelDraw. Also a computer software package (proteus) and programming language c + + were used to validate the model of the vehicle accidents prevention system using eye blink sensor with an automatic breaking system. The electronic components used is the design and construction of the vehicle accidents prevention system using eye blink sensor with an automatic breaking system were purchased from both Ghanaian and Japanese open market and soldered on a printed circuit board.

Figure 3. 9: Shows the system (circuit) under test.

Figure 3.9 shows a shot taken during the calibration of the eye blink sensor system at electrical electronics Amatrol laboratory at Takoradi Polytechnic Takoradi in the western region.

Figure 3. 10: Shows the circuit (system) under test at the Amatrol Laboratory.

Figure 3.10 shows a shot taken during the testing of the sensitivity of the system on the power and control electronics work station at Amatrol Laboratory at Takoradi Polytechnic in the western region.

Figure 3. 11: Shows the circuit under test at Uew – K

Figure 3.12 shows the final testing at Electrical and Automotive Department at university of Education Winneba Kumasi Campus with my supervisor Professor Willie K. Ofosu with the aim of making sure that the prototype of the system corresponds to the design model. The results were tabulated and included in the project report as shown in chapter four (4).

Rheostat, Digital multi-meter and virtual terminal of the microcontroller was used to record the drowsiness level and the sensitivity of the system in millivolt and volt respectively.

All circuit diagrams and block diagrams were designed with the aid of computer software programs such as proteus, livewire and CorelDraw. Also C++ programming was used to program the microcontroller.

CHAPTER FOUR

RESULTS AND DISCUSSION

This chapter deals with the detailed analysis of the experimental results of this project work using excel as the statistical tool. The results of the experiment are however, presented analytically in the form of tables and graphs

4.1 Results

A digital multimeter and a rheostat were used to conduct an experiment on the level of drowsiness of the vehicle accident prevention system using eye blink sensor and the details of these are shown in Table 4.1.

Table 4. 1 : Experimental results on rheostat readings (the eye) against the level of drowsiness

Number of Experiment	Rheostat Readings in Percentage (The Eye) %	Drowsiness Level in Millivolt mV	LCD Display
1	0	0	Drowsiness not detected
2	22	212	Drowsiness detected
3	44	227	Drowsiness detected
4	65	246	Drowsiness detected
5	100	858	Drowsiness detected

The graphical representation of the drowsiness level against the rheostat (the eye) readings in percentage of Table 4.1 of the vehicle accident prevention system using eye blink sensor is shown in figure 4.1.

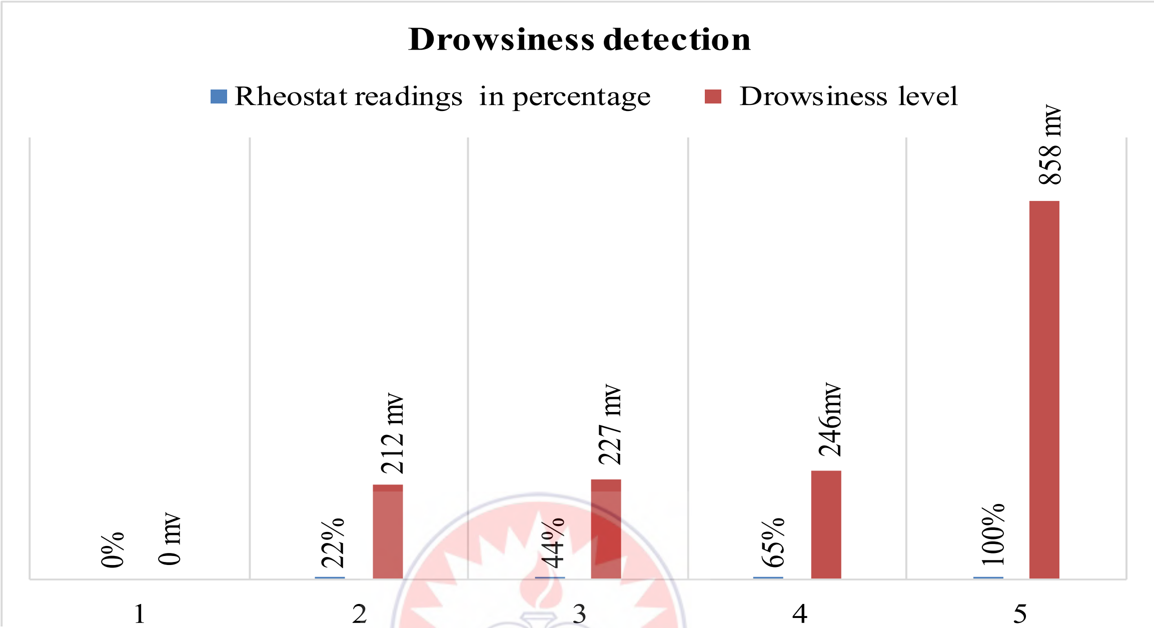

Figure 4. 1 : Graph of Rheostat Reading (the EYE) Against Drowsiness Level

The experiment conducted on the sensitivity of the eye blink sensor in rheostat readings in percentage against voltage are tabulated in Table 4.2.

Table 4. 2 : Experimental results of the sensitivity of the eye blink sensor

Rheostat Readings in percentage (%)	Voltage (V)
0 → 80	1.30
80 → 100	1.29

The graphical representation of the experimental results of the sensitivity of the eye blink sensor tabulated in Table 4.2 is shown in figure 4.2.

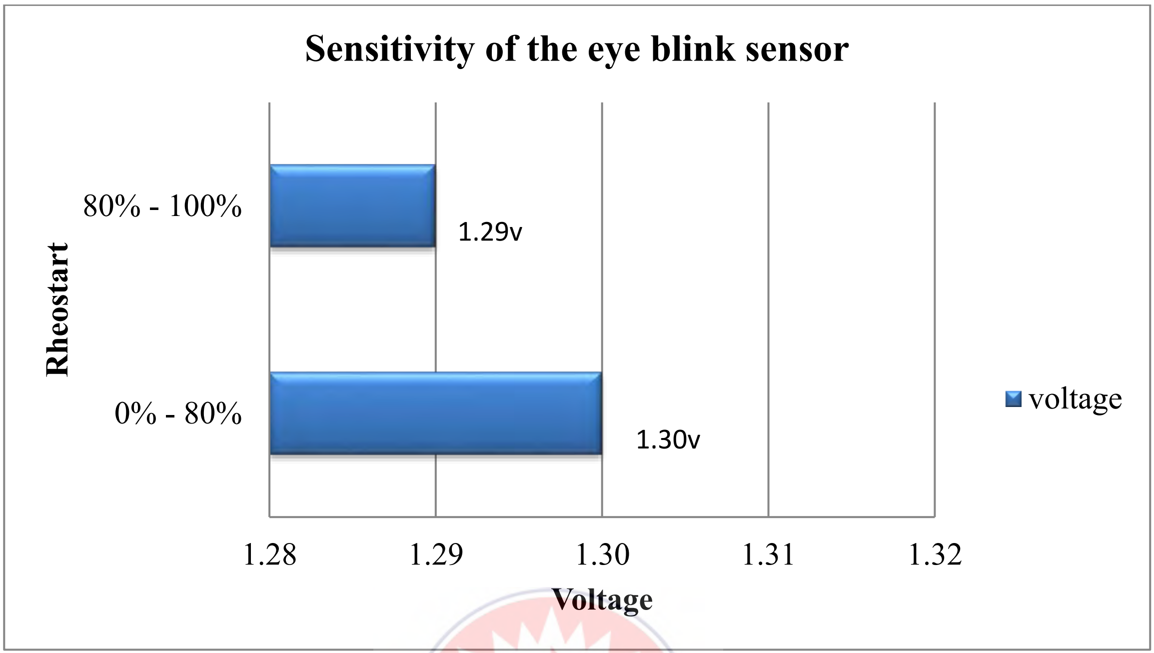

Figure 4. 2 : Graph of sensitivity of the eye blink sensor

4.2 Discussion of Results

Table 4.1 in chapter four (4) shows the detailed result of a prototype vehicle accident prevention system, using eye blink sensor with an automatic breaking system. For each test the rheostat (eye) levels were set and the drowsiness level were detected by the virtual terminal of the screen of the microcontroller. In all, five experiments were conducted at different ranges of the rheostat (eye) levels and the ranges are as follows: 0% → 0mv, 22% → 212mv, 44% → 227mv, 65% → 246mv and 100% → 858mv.

The 0% → 0mv indicate the normal eye blinking condition of the driver which shows that drowsiness is not detected. This happens when the rheostat representing the eye is set to 0% which then gives an out of 0mv reading of the digital multimeter.

The 22% → 212mv indicate the minimum level at which drowsiness is detected and this happen when the rheostat representing the eye is set to 22%, the corresponding output 212mv is then fed to the comparator through the eye blink sensor. This compared signal is fed to a microcontroller, the microcontroller is programmed such that if the difference value exceeds the normal blinking state of the driver it sends information about the fault to particular part of the system as programmed in other to achieve goal of the project. The 100% → 858mv indicate the maximum level at which drowsiness is detected.

The eye blink sensor is an infrared (I R) based and therefore at the normal vision where the eyes are opened, the IR output signal falls below the threshold value (22%). At the instant the eyes are closed for a time greater than threshold value(22% of rheostat level), drowsiness is detected which causes the output of the IR signal to rise above the set or the threshold value as shown in figure 4.1of chapter four.

Figure 4.1 of chapter four shows the minimum and maximum level within which drowsiness are detected. Table 4.2 of chapter four shows the detailed result of the sensitivity of eye blink sensor. The sensitivity (rheostat) against voltage readings of the eye blink sensor are as follows: 0% - 80% → 1.3V and 80% - 100% → 1.29V

The above rheostat readings in percentage against voltage readings shows that, when the sensitivity (rheostat) was varied from 0% to 80% a constant voltage of 1.3volts was recorded by the digital multimeter and when it was varied from 80% to 100%, the digital multimeter displayed a constant reading of 1.29volts.thus giving a voltage deviation of 0.01volt.

This gives an indication of a good sensitivity in that sensitivity of a system or circuit is the smallest unit of a given parameter that can be meaningfully detected by the instrument when used under reasonable condition. Hence the eye blink sensor used in this project work can detect 0.01volt change in the input voltage.

Figure 4.2 shows the variation of the sensitivity of the eye blink sensor. The time delayed for the eye blink sensor to respond to drowsiness is 2.5 seconds, and this was due to the integrated circuit (IC) of the microcontroller used in this project work. The time delayed by the eye blink sensor can be changed depending upon the integrated circuit (IC) of the microcontroller and also through the programming.

The above results are a clear indication that the logical flow (flow chart) model of vehicle accident prevention system using eye blink sensor with automatic breaking system in chapter three (3) figure 3.2 is achieved. Excel was the statistical tool used in analyzing these experimental results but Math lab can also be used to analyze these results.

CHAPTER FIVE

CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

The verification and validation of the logical (flow chart) model was successfully achieved by a simulation software package (proteus) and a programming language c + +.

The experimental device build by the simulation software was found to behave exactly as the real – system under study after the practical construction of the prototype was tested.

The design and construction of the vehicle accident prevention using eye blink sensor with automatic breaking system with the aim of solving the problem of inability of the existing system (technology) to come to a halt when drowsiness is detected was successfully implemented. In view of this positive results of this project work, it is feasible to venture in mass production of vehicle accident prevention by the used of eye blink sensor with automatic breaking system in other to replace the existing technology without the automatic breaking system. Implementing this technology in vehicles will help reduce drowsy related road accidents and hence this project work has relevance.

5.2 Recommendation

This project work could again be better by further studies to improve on it driver alertness by using wireless technology to send signals to nearby vehicles when the drive is drowsy instead of traffic indicators. It is therefore recommended that an automatic breaking system may be used in designing and manufacturing of vehicle accident prevention system using eye blink sensor.

It is also recommended that the Government of Ghana should promote and finance this project work for mass production of vehicle accident prevention system using eye blink sensor with automatic breaking system in other to help reduce drowsy related road accidents.

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APPENDIX

Features include:

- High Performance, Low Power Design
- 8-Bit Microcontroller Atmel® AVR® advanced RISC architecture
    - 131 Instructions most of which are executed in a single clock cycle
    - Up to 20 MIPS throughput at 20 MHz
    - 32 x 8 working registers
    - 2 cycle multiplier

- **Memory Includes**
    - 32KB of programmable FLASH
    - 1KB of EEPROM
    - 2KB SRAM
    - 10,000 Write and Erase Cycles for Flash and 100,000 for EEPROM
    - Data retention for 20 years at 85°C and 100 years at 25°C
    - Optional boot loader with lock bits
        - In System Programming (ISP) by via boot loader
        - True Read-While-Write operation