Design of Vehicle Accident Prevention System Using Wireless Technology

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Abstract- Driver drowsiness is a significant factor in vehicular accidents and therefore different technologies are being put in place to bring it to the barest minimum. This paper takes in-depth look at vehicle accident prevention system using wireless technology, eye blink sensor and automatic braking system to ensure that the vehicle slows down and comes to a halt when drowsiness is detected, and the system (circuit) is not reset within the threshold period programmed in the microcontroller of the system. The wireless technology which is the backbone of this project work was achieve through radio frequency wave, is then used to send an information (slow down there is halt car ahead) to other vehicles at a transmission distance of wavelength 0.69m with a frequency of 433MHZ. simulation software (Proteus) was used to critically analyzed the model of the design of the vehicle accidents prevention system using wireless technology. It was ascertained from the results that the vehicle accidents prevention system using wireless technology is an effective technology for vehicle accidents prevention due to driver drowsiness. The design of the vehicle accident prevention system using wireless technology, with the aim of sending information to other vehicles at a distance through RF module when drowsiness is detected was successfully implemented.

Index Terms- Wireless Technology (RF module), Wavelength, drowsiness, Automatic Braking system, Eye Blink Sensor.

I. INTRODUCTION

From the beginning of 2017, road traffic accident in Ghana has rampantly been in the increase, and one cannot deny the fact that many prominent people have lost their lives as a result of this unfortunate situation at stake; many have attributed this to the poor road network in Ghana neglecting the major causes of road accident [1]. There are many factors that contributes to the massive vehicular accident in Ghana of which drowsiness cannot be an exception. Annually many drivers in the U.S sacrifice sleep, and often overlooked dangerous behavior that results in nearly 83.6 million of them being sleep-deprived while behind the wheel every day, an estimated 5,000 lives lost in drowsy driving related crashes last year, all at an annual societal cost of something like $109 billion [2]. Causes of road traffic accidents are attributed to fatigue driving, especially drivers who travel long distance, over speeding, overtaking, overloading and non-maintenance of vehicle due to the poor nature of road [3]. The effects of driving while intoxicated result in drowsiness, loss of focus and inability to judge distances and reaction times [4]. Available statistics indicates that over 10,000 vehicles are involved in road traffic accidents which results in over 10,000 people getting injured through road traffic accidents. The statistics also shows that at least six (6) people are killed in road traffic accidents daily with 25% of the accidents victims involved are below the age 16 years and another 25% being in the range between 25 and 35 years of age, it is also found that speed is a contributory factor in 60% of the road traffic accidents cases while 70% of these road traffic accidents occur on straight and flat roads with male as the road traffic accidents victims [5].In spite of the existence of powerful technologies, statistics shows that vehicular accidents are very disheartening. For instance, at least 1.2 million people are killed every year, globally through road accidents, with about 20 – 50 million suffering from various form of non – fatal injuries; over 90% of these road traffic accidents occurs in low – income and middle – income countries; for the situation at hand, it is predicted that road accidents will be the fifth leading cause of death by 2030 if an immediate action is not taken to curtail this unfortunate situation [6].

II. METHODOLOGY

This paper focuses on the detailed description of the methods employed to achieve the stated objectives and demystify the procedure of designing the model of the system. Programming and simulation was used to analyze the model to foretell the effectiveness of the design under study. Computer Software (proteus) was used in the circuit design and the simulation of the model of the vehicle accidents prevention system using wireless technology, automatic braking system and the eye blink sensor. Matrix laboratory (MATLAB) was used in analyzing the experimental results of this design.

III. DESIGN CONCEPT

The design focuses on the measurement and control of the eye blink using IR sensor to prevent vehicular accident whenever the driver becomes drowsy in the process of driving. The eye blink sensor serves as the detection unit which determines whether the driver is either drowsy or not during driving period and also the input to the control unit. The IR transmitter is used to transmit the infrared rays into the eyes. The IR receiver is used to receive the reflected infrared rays of the eye. If the eye is closed, it implies that the output of the IR receiver is high otherwise the output is low. Thus the high or low of the output of the IR receiver determines whether drowsiness is detected or not. The Arduino Uno microcontroller is the principal component of the design, a power supply maintains the output voltage at a constant value of 5 V required by the microcontroller, a relay which uses a low voltage circuit for switching in order to control the state of the vehicle motor, braking motor and the buzzer. A buzzer which issues a warning signal to prompt the driver when drowsiness is detected, traffic indicators to alert nearby vehicle drivers, automatic braking system which gradually brings the vehicle to a halt and a wireless technology unit that sends information to vehicles in a transmission distance of wavelength of 0.69m.

IV. Block Diagram

The Vehicle accident prevention system using wireless technology, eye blink sensor and automatic braking system of the design is represented by the block diagram in figure 3.1

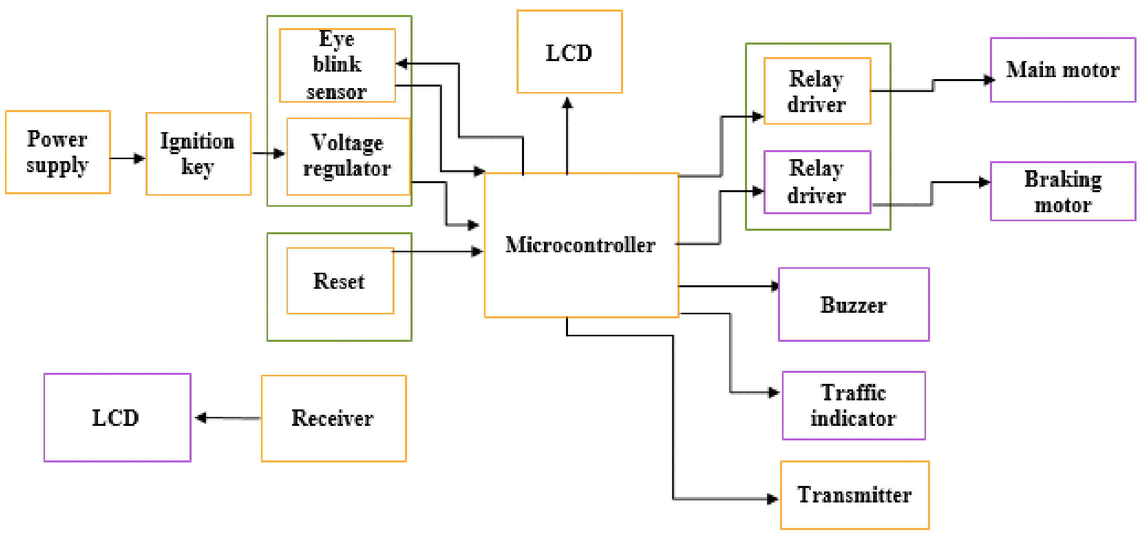

Fig 3.1 Block Diagram of The Design

The Vehicle accident prevention system using wireless technology, eye blink sensor and automatic braking system is represented by the logical model of the design in figure3.2

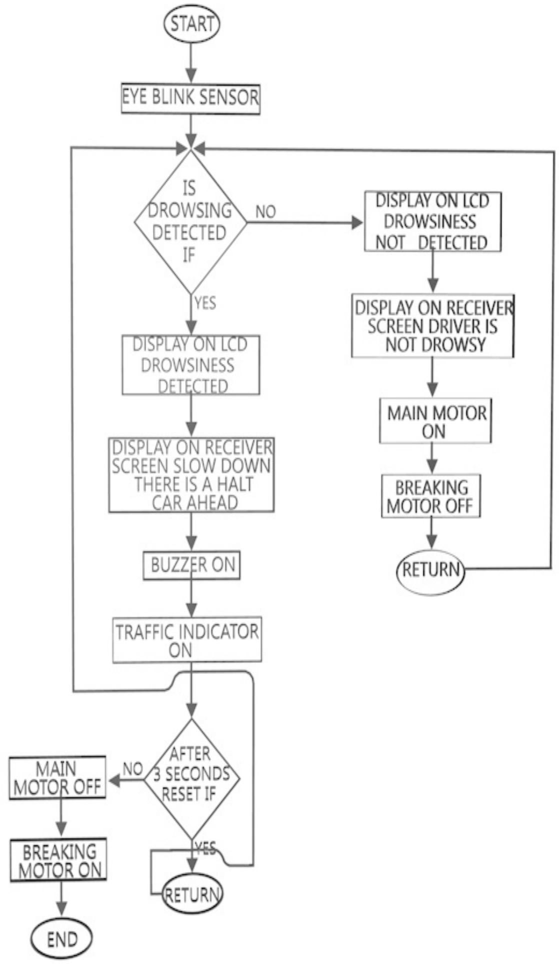

Fig.3.2 The Logical Flow (Flow Chart) Model of Vehicle Accident Prevention System using wireless, eye blink sensor and automatic braking system.

The circuit diagram of the vehicle accident prevention system using wireless technology, eye blink sensor and automatic braking system of the design is shown in figure 3.3

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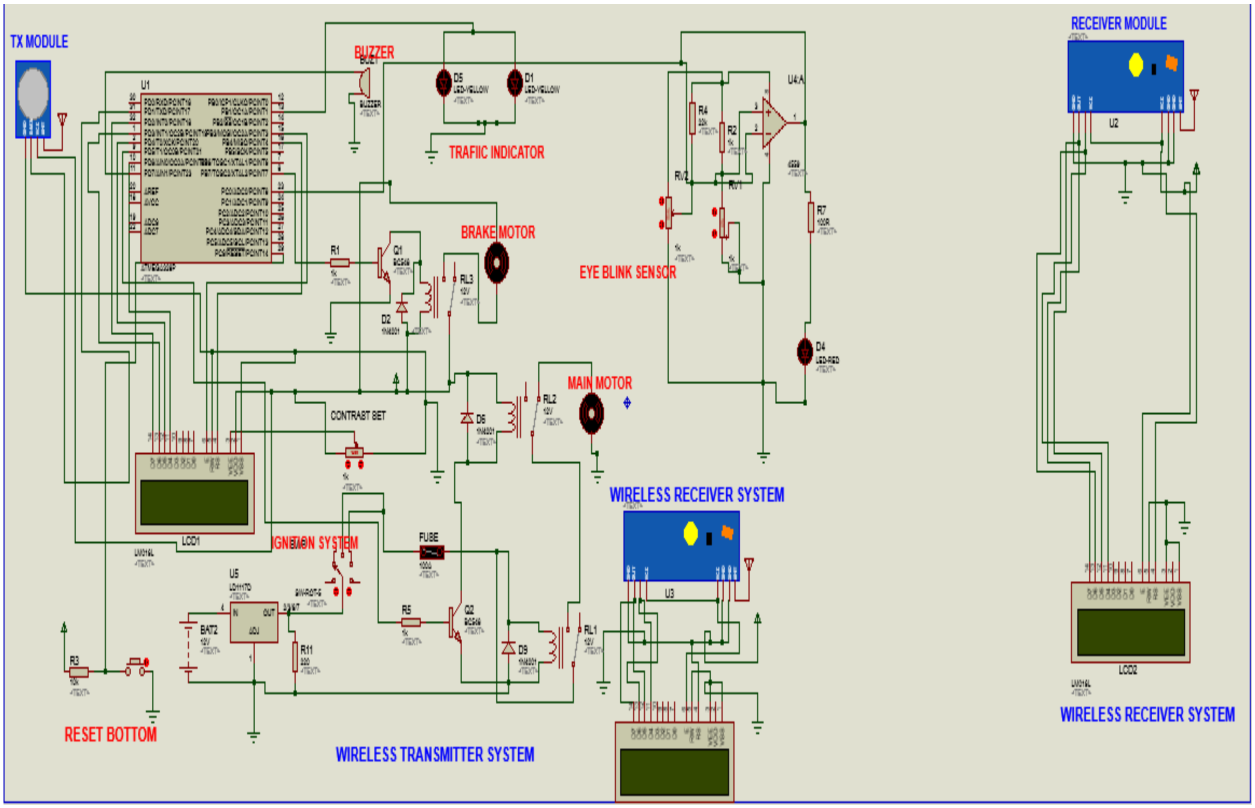

Fig.3.3 The Circuit Diagram of Vehicle Accident prevention system using wireless technology, eye blink sensor and automatic braking system.

V. Mode of Operation of Circuit (System)

The system consists of microcontroller which is the brain of the circuit, an eye blink sensor that monitors the drowsiness of the driver, a buzzer which issues a warning signal to prompt the driver when drowsiness is detected, traffic indicators to alert nearby vehicle drivers, automatic braking system which gradually brings the vehicle to a halt and a wireless technology unit that sends information to nearby vehicles in a transmission distance of 300m and a wavelength of 0.69m. Starting the vehicle by turning -on the ignition key, allows current to flow in the circuit, the microcontroller receives a signal (normal state) of the driver and displays on LCD drowsiness not detected. The microcontroller then sends a signal to the RF transmitter, it transmits this information to an RF receiver in other vehicles in a distance of 300m and a wavelength of 0.69m and displays on the RF receiver screen, drowsiness not detected. When drowsiness is detected by the rate at which the driver blinks his/her eyes, the micro-controller receives deviation in signal from the eye blink sensor through the comparator circuit and sends signal to simultaneously activates the buzzer and the traffic indicators, the microcontroller then sends information about the fault to vehicles in the distance of 300m and a wavelength of 0.69m through the RF module and displays on the RF receiver in other vehicles that drowsiness is detected. This process will persist for three (3) seconds, and if the system is not reset by pressing the reset bottom, a signal from the microcontroller is sent to deactivate (turn-off) the engine of the vehicle by bringing on the braking motor to gradually bring the vehicle to a halt. The micro-controller then sends information through the wireless technology unit to vehicles in a distance of 300m and a wavelength of 0.69m on the receiver screen that slow down there is a halt car ahead.

VI. Results

The results of the experiment on the eye against the level of drowsiness of the vehicle accident prevention system using wireless technology, eye blink sensor and the automatic braking system is represented by table 4.1.

Table 4.1 Experimental results on the eye against the level of drowsiness

Number of Experiment	Rheostat Readings in Percentage (The Eye) %	Drowsiness Level in Volts (V)	LCD Display
1	0	0	Drowsiness not detected
2	30	1.50	Drowsiness detected
3	50	2.50	Drowsiness detected
4	85	4.25	Drowsiness detected
5	100	5.0	Drowsiness detected

Table 4.1 Experimental results on rheostat readings (the eye) against the level of drowsiness

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 wireless technology, eye blink sensor and automatic braking system is shown in figure 4.2

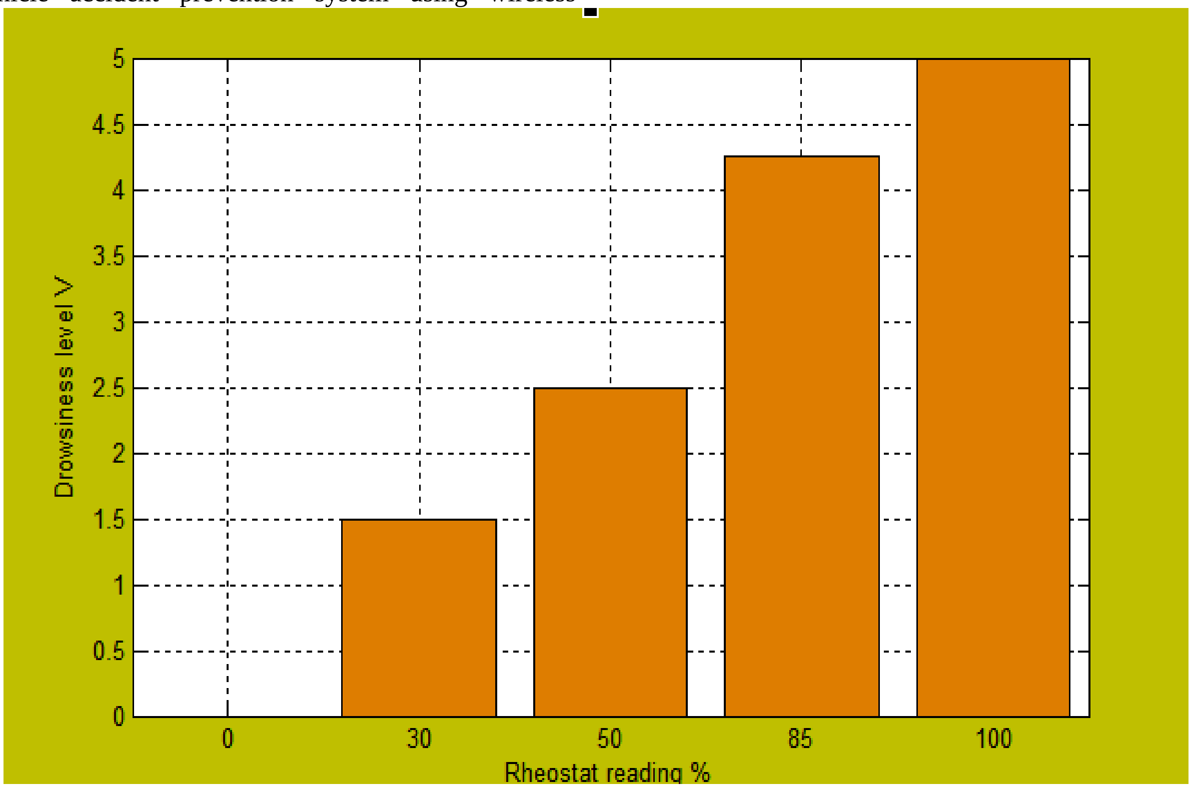

Fig.4.2 Graph of Rheostat Reading (the EYE) % against Drowsiness Level.

VII. DISCUSSION

Table 4.1 shows the detailed result of the design of vehicle accident prevention system, using wireless technology, eye blink sensor and automatic braking system. For each test the rheostat (eye) levels were set and the drowsiness level were recorded. In all, five experiments were conducted at different ranges of the rheostat (eye) levels and the ranges are as follows: 0% → 0V, 30% → 1.50V, 50% → 2.50V, 85% → 4.25V and 100% → 5.0V. The 0% → 0V indicate the normal eye blinking condition of the driver which depicts that drowsiness is not detected. This happens when the rheostat representing the eye is set to 0% which then gives an output of 0V reading of the voltmeter. The 30% → 1.5V indicate the minimum level at which drowsiness is detected and this happen when the rheostat representing the eye is set to 30%, the corresponding output 1.5V 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 the goal of the project. The 100% → 5.0V indicate the maximum level at which drowsiness is detected. The eye blink sensor is an infrared (IR) based and therefore at the normal vision where the eyes are opened, the IR output sensor falls below the threshold value (30%). At the instant the eyes are closed for a time greater than threshold value (30% of rheostat level), drowsiness is detected which causes the output of the IR sensor to rise above the set or the threshold value as shown in table 4.1. Figure 4.2 above shows the minimum and maximum levels within which drowsiness are detected. The above results are a clear indication that the logical flow model of vehicle accident prevention system using wireless technology, eye blink sensor. Automatic breaking system in chapter three (3) figure 3.2 is achieved. Metrics laboratory (MATLAB) was used in analyzing the experimental results of the design.

VIII. CONCLUSION

The certification of model was successfully achieved by a simulation software (proteus). The design of the vehicle accident prevention system using eye wireless technology with the aim sending signal (information) through a wireless technology at a transmission distance of wavelength 0.69m with a frequency of 433MHz to other vehicles when drowsiness is detected was successfully designed. The result obtained from the experiments clear indicate that vehicular accident due to drowsiness can be effectively reduce to the barest minimum by implementing the vehicle accident prevention using wireless technology.

IX. RECOMMENDATION

Further studies or research can be carryout in this area to incorporate a mechanism to retrieve previous information (incident) with date and time, whenever the system is reset in order to assist authorities to come out with clear judgment as to whether vehicle accident is due to driver drowsiness or not. It is further recommended that the Driver and Licensing Authority of Ghana, should come out with a policy in other to ensure that the vehicle accident prevention system using wireless technology are implemented in vehicles (cars) during licensing to ensure that vehicular accidents due to driver drowsiness are reduced to the barest minimum in the country.

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