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Research Article

Safe Automotive Navigation System using Human Eye Sensitivity Detector

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Abstract

Even with all the advancements in vehicle safety technology, the number of people killed in auto accidents continues to rise drastically. The most common cause for automobile crashes are due to the distraction of drivers. One reason is misjudging the path due to the flash of light thrown by the opponent vehicle. The objective of human eye sensitivity detector is to identify the human eye sensitivity while driving the vehicle. The prototype includes spectacles with eye sensitivity level sensor which has been programmed using Arduino Uno. Eye when over exposed to light radiation the corresponding eye sensitivity will be displayed before it blinks. When eye sensitivity goes beyond the normal limit the speed of the vehicle will be reduced automatically, by means of programming. The prototype developed will benefit the drivers during night travel in particular.

Keywords: Navigation System; Vehicle accidents; Human eye sensitivity; Automatic Braking System.

Introduction

Vehicle accidents are most common if the driving is inadequate. These may happen if the driver is drowsy or if he is alcoholic. Driver drowsiness is recognized as an important factor in the vehicle accidents. It was demonstrated that driving performance deteriorates with increased drowsiness resulting in crashes constituting more than 20% of all vehicle accidents. But the life lost once cannot be re-winded [1-3]. Advanced technology offers some hope to avoid these crashes up to some extent [4-5].

The present work involves the measure of the eye blink using IR sensor. The IR transmitter is used to transmit the infrared rays in the eye. The IR receiver is used to receive the reflected infrared rays of eye. If the eye is closed the output of IR receiver is high otherwise the IR receiver output is low. This is to know that whether the eye is closed or in open position. The output is then fed to logic circuit to reduce the speed of the vehicle [5-7].

To analyze the eye movement and tracking, image processing technique is employed which treats images as two dimensional signals while applying already set signal processing methods. It is a type of signal dispensation in which input is image, like video frame or photograph and output may be image or characteristics associated with that image. The images from camera are converted into digital form that are thereby enhanced and performed with some filtering and logic operations on them, to extract some useful and desired information [8-10]. The proposed work warns the driver when he/she fails to blink eye due to unconsciousness through an alarm indicator and to reduce the speed of the vehicle. A car simulator study was done to collect physiological data for validation.

Proposed System

LDR circuit is designed and the spectacles with eye sensitivity level sensor are designed and programmed using Arduino UNO. The eye sensitivity level will be displayed before it blinks. When the eye is over exposed to light radiation or when eye sensitivity goes beyond the limit the speed of the vehicle will be reduced automatically by means of programming. The prototype proposed can be made available at lower costs and can be used by the drivers easily and it has a long life time. By this device alarm will warn the driver, when he gets sleep as it checks for the blinking of eyes. This device is reliable and does not require any additional manpower. The model can track eye region robustly and correctly and can avoid the accident

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as well [8-9,11]. The total essence and the functioning of the proposed work is represented in a single block diagram shown in Fig. 1. The block diagram mainly consists of six parts. They include LDR, Eye Blink Sensor, LCD, Speed Sensor, Arduino uno and Buzzer. Fig. 2 shows the hardware setup of the proposed system.

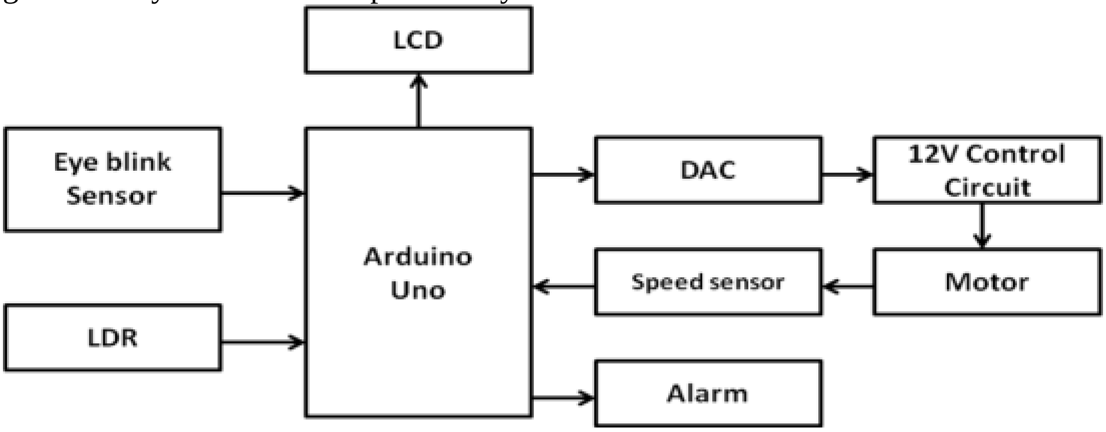

Fig. 1. General Block Diagram

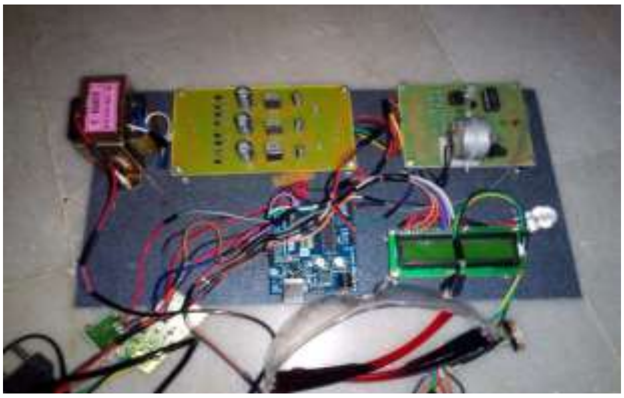

Fig. 2. Hardware setup

Results and discussion

Blinking takes place at 3.998 seconds, if the light source with the intensity of 170 lumens is kept at a distance of 30 cm away from the eyes (Fig. 3). Blinking takes place at 2.877 seconds, if the light source with the intensity of 170 lumens is kept at a distance of 20 cm away from the eyes (Fig. 4).

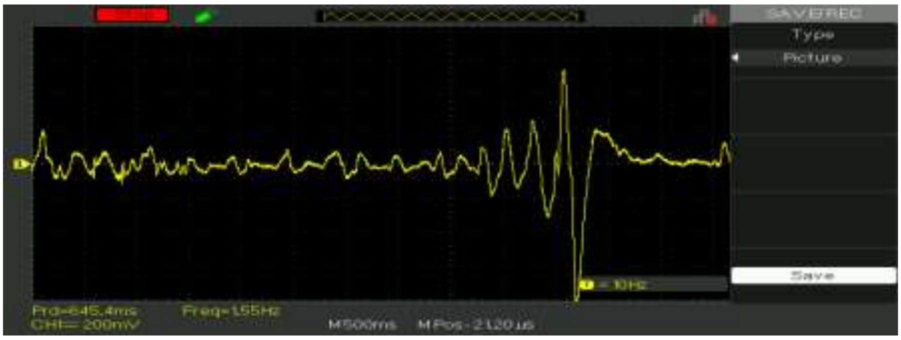

Fig. 3. Blinking at a distance 30 cm

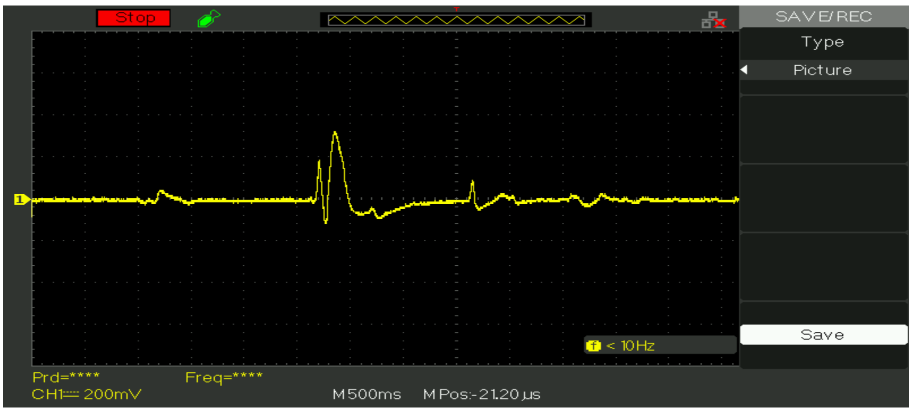

Fig. 4. Blinking at a distance 20 cm

Blinking takes place at 1.652 seconds, if the light source with the intensity of 170 lumens is kept at a distance of 10 cm away from the eyes (Fig. 5). The inference from the Fig. 3 to 8 is, if the distance between the eyes and the light source is reduced, then the time taken for the eye blinking is also reduced.

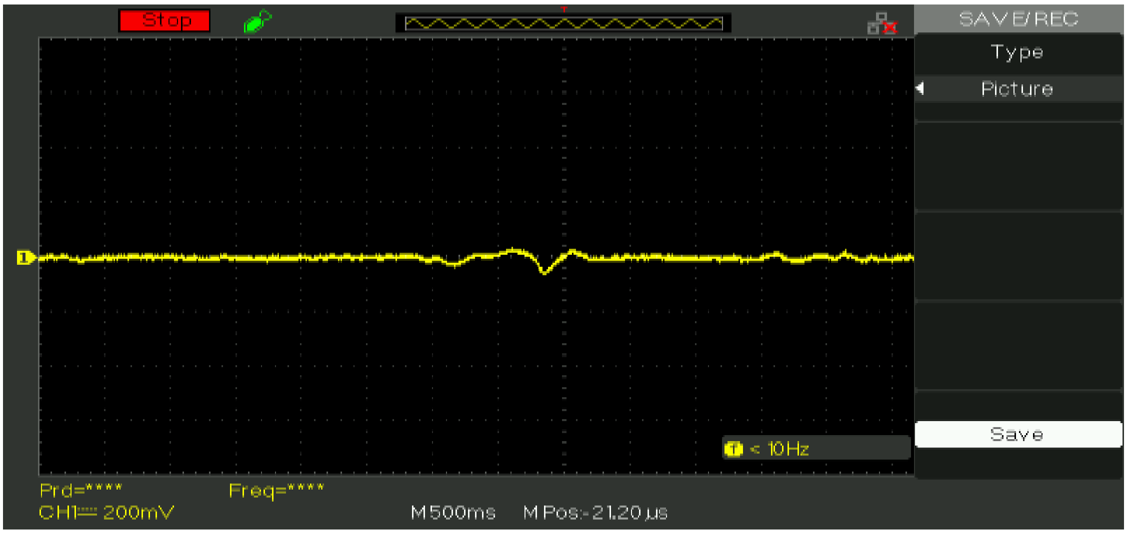

Fig. 5. blinking at a distance 10 cm

Electrooculography for source2

Blinking takes place at 2.751 seconds, if the light source with the intensity of 220 lumens is kept at a distance of 30 cm away from the eyes (Fig. 6). Blinking takes place at 1.472 seconds, if the light source with the intensity of 220 lumens is kept at a distance of 20 cm away from the eyes (Fig. 7). Blinking takes place 1.029 seconds, if the light source with the intensity of 220 lumens is kept at a distance of 10 cm away from the eyes (Fig. 8).

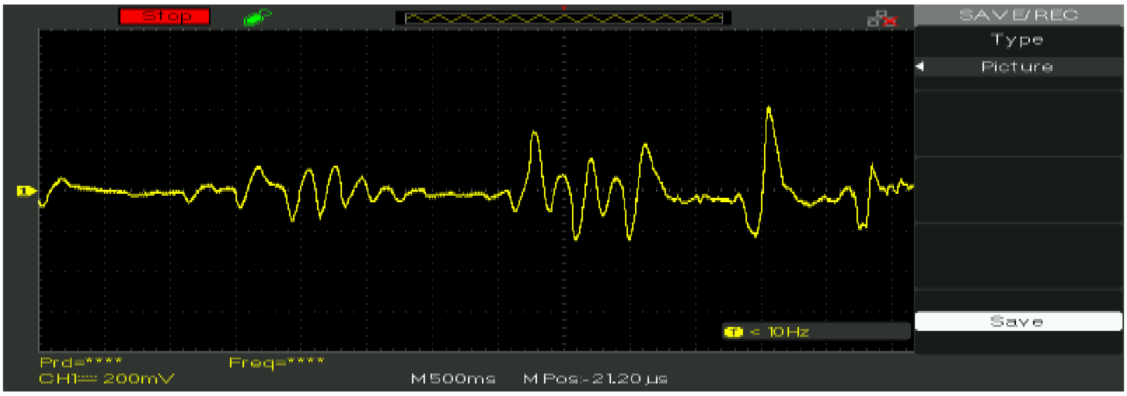

Fig. 6. Blinking at a distance 30 cm

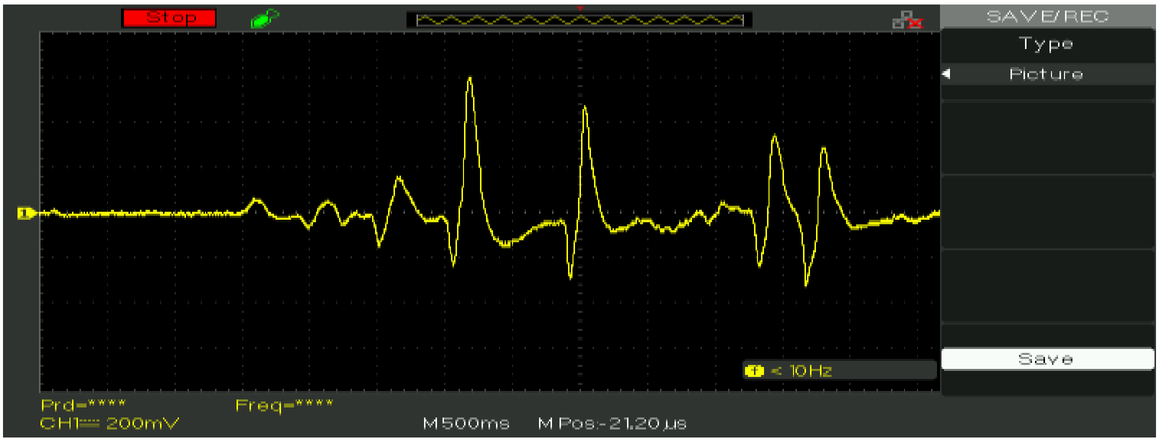

Fig. 7. Blinking at a distance 20 cm

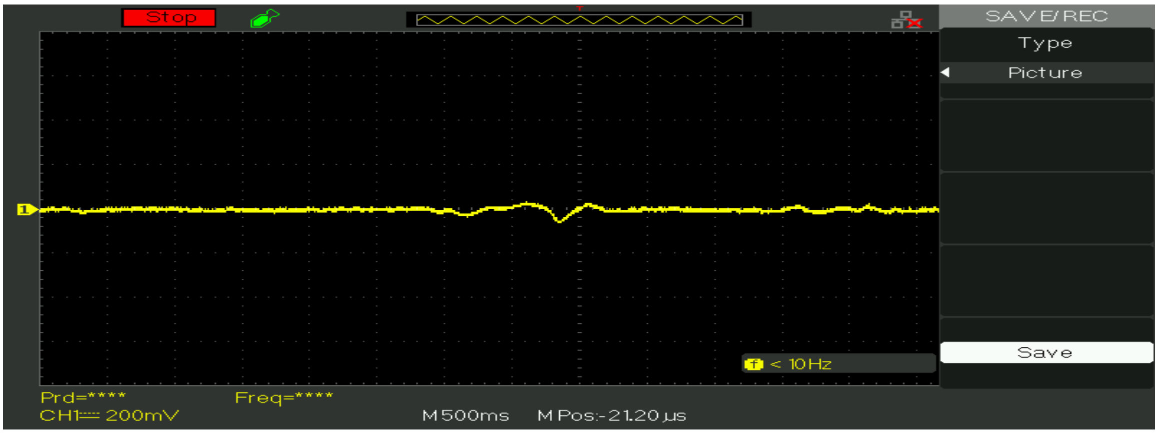

Fig. 7. Blinking at a distance 10 cm

From the comparison between the source 1 and source 2 the inference is, if the light intensity is increased then the time taken for the eye blinking is reduced.

The present work has an active market for people who travel long distances at night time. The eye blink sensor is suitable for detecting eye blink rate, just like the common detector. It has a high sensitivity and fast response time. Whenever there is a drastic variation in the blinking activity of eye, the alarming situation will be indicated by means of buzzer to the driver, and then the engine will stop. Instead of alarm we can use Automatic Braking System which will reduce the speed of the car directly. The Variation across the eye will vary as per eye blink. When the eye is closed, the output is high otherwise the output is low. This is to identify whether the eye is in the closing or in the opening position. If the driver closes his eye for more than 3 seconds, the alarm sound will be produced, and then the engine will be stopped automatically.

Conclusions

The detection of human eye sensitivity was quite difficult in early days. With the prototype developed one can detect the eye sensitivity accurately in lesser time. The eye blink sensor is used mainly to detect the eye opening and closing. The present project also warns the driver who fails to blink eye due to unconsciousness through an alarm indicator and one can reduce the vehicle speed. The prototype can be implemented using the Anti-lock Breaking System. Pressure sensor may be incorporated on the steering of the vehicle to detect the case of driver's drowsiness.

Conflicts of interest

Authors declare no conflict of interest.

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