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Design of Embedded Prototype for Drivers Aid using Iot

A.Vidhyaseker[1], R. Dukadevi[2], B. Lokapriya[3], M. Madhumitha[4], M. Namita[5]
Assistant Professor[1], Student[2, 3, 4, 5]
Department of Electronics and Communication Engineering
Akshaya College of Engineering and Technology, Coimbatore, India

Abstract:
This project is designed to measure the brainwave of drivers and establish a brain-computer interface (BCI) system for drowsiness detection. The proposed BCI system consists of a physiological signal acquisition module and an embedded signal processing module. The embedded signal processing module is used for real-time detection of drowsiness and trigger Automatic Braking System. In addition to that MQ-2 Alcohol sensor and Accelerometer sensor are used so that whenever it detect alcohol or frequent head nodding condition, the system apply ABS. By this system the unexpected accidents can be avoided which saves lots of human lives. The reading taken from brainwave sensor used in this project can be uploaded to cloud and it can be seen in Android mobiles. The microcontroller communicates with internet by the use of ESP 8266 Wi-Fi module.

Index terms: Brain Computer Interface (BCI), Drowsiness detection, cloud, Automatic Braking System (ABS).

I. INTRODUCTION

With the advent of new technology application of biometrics in embedded system get increased. By this method the accuracy of the system is improved. In recent time the number of accidents is increased which is due to many reasons. One of the prime reasons is drowsiness of drivers and their carelessness. To avoid that the system is proposed which includes the brainwave pattern detection of drivers. Brainwaves are introduced to be used as biometric to identify current state of each individual person. This is possible due to unique pattern i.e. each human has a unique patterns for their respective thoughts. The technology used to process the brain wave is called as Brain Computer Interface System. It is a new technology which creates a direct communication link between the human brain and computer. BCI controls mechanical devices according to the thoughts of human brain i.e. machines are controlled by electrical signals generated by the human brain. It has several other applications like robot control, Authentication system, evaluating psychological conditions etc…Automatic braking system is used to avoid the accidents occurred because of the delay of driver to apply brake.ABS take artificial control of braking system by taking certain sensor readings.ABS is most important system because instead of expecting the fast response from drivers during emergency to apply brake this predefined system will take care of it. so that lots of innocent people lives can be saved.

II.PROPOSED SYSTEM

To optimize driver and passenger safety through driver fatigue detection methods the system proposes a smart automatic braking system and a alcohol sensor to prevent drunken person taking the vehicle. With the help of ultrasonic sensor and accelerometer the vehicle is capable of stopping automatically in case if the person sleeps or if he is drunken. For this the current state of the driver can be obtained with the help of brainwave sensor. The proposed method provides a feature to detect the distance of the vehicle from the vehicle ahead and behind of this, for this a ultrasonic sensor is used. The data from this sensor is further sent to arduino. First the mental state of the driver is obtained with the aid of electrode and sent to tiva cortex m4 microcontroller. The data's from the tiva controller, alcohol sensor, Accelerometer sensor is also sent to arduino. Arduino is programmed in such a way that all the obtained data is processed and an automatic braking system comes into action depending upon the data received from Tiva cortex M4 microcontroller. The system has two main controllers: Tiva Cortex M4 and Arduino UNO microcontrollers. THE purpose of Tiva is to obtain data from the electrode placed near the frontal lobe of forehead and to give this data as input to Arduino. Arduino on the other hand obtains data not only from Tiva but also from sensors such as ultrasonic sensor, Alcohol sensor and from accelerometer sensor. Flow of the proposed system is that, whenever the data from the electrodes exceeds threshold frequency value it indicates the sleepy state of the person, this data is stored in cloud as well as sent to arduino and by receiving this information will provide automatic braking system with the help of ultrasonic sensor. Ultrasonic sensors has dual roles it helps in automatic braking system as well as helps the driver in maintaining appropriate distance from other vehicles in front and rear as per traffic rules. Brake cannot be applied abruptly, doing so will result in damage hence an accelerometer is used which will first reduce the speed of the vehicle and later stops it. This proposed system not only prevents accident it also helps cab owners in improving their business. Since the data regarding the activity of driver is being stored in cloud, the cab owners can review it periodically and can change the shift of the drivers accordingly so that the health of the drivers is also taken into account.

III. RELATED RESEARCH

It is very important to design a system to reduce the accidents due to Drowsiness of drivers and their carelessness because of that many innocent people have lost their lives. Biometric signals are used to solve the problems in biomechanical system [1].Accidents due to drowsiness of driver is avoided by continuously monitoring them by using EEG signals and by the

using that the drowsy state of driver is predicted and whenever the drowsy state is detected the designed system will send some warning message to the driver. The wearable biosensor for EEG detection with the blink pattern detection will replace the existing complicated and high cost systems [2]. The brain computer interface (BCI) system having 3 electrodes for measuring brain waves and the system is programmed with some threshold values by comparing the present values with that threshold values the drowsy state is detected and by using IoT the alert message is automatically given to the respective persons android mobile [3]. By analyzing brain wave alcohol consumption of driver is also detected [4]. Research shows that every persons have unique brain wave pattern and heart beat during their different states. Low cost EEG signal system can be also be developed by using single dry electrode for getting the brainwave pattern after that analyzing it by using specific algorithm we can predict the drowsy state [5]. Automatic Braking System consists of the control of speed and acceleration by monitoring these parameters the effective smooth and stable ABS system is developed [8]. ABS for collision avoidance can be developed by using brake-initiation model and a deceleration pattern [9]. In some systems ABS monitor the speed, lighting, moving pattern and brake patterns. Intelligent ABS is designed in such a way that the system will take the control only during uncertain conditions and then give the control to the driver [10]. Smart robotic module can be developed to demonstrate this system which is designed by considering the parameters like size and speed. small size and high torque robots are designed by using ultrasonic motors and the motor drivers are used for better outputs each motor driver is capable of supporting 2 or more motors so the system design become easy [15].

IV. SYSTEM DESIGN

A drowsiness detection system based on a brain-computer interface (BCI) headset having 2 electrodes is proposed. The headset is mounted on the user's head to compute the brain wave frequencies. The signal received from BCI headset is processed to remove the external noise. The computed frequencies is then compared by the threshold frequencies of the brain state and a particular decision like whether an individual is in an active state or in a drowsy state can be taken. If any individual is in a drowsy state, Automatic Braking System. An individual user's sleeping pattern while working is stored on the cloud so that it can be used for analyzing an individual's brain state while driving. The system is designed with 2 models such as transmitting and receiving model. Transmitting model consists of two main parts – Bio Sensor & Tiva controller. The EEG signals obtained from the driver via electrodes are transferred to data acquisition unit which is then forwarded to Tiva controller**,** Tiva controller is powered using external power supply. The data processed by Tiva is sent to Wi-Fi module, to the receiving model and displayed through an LCD display.

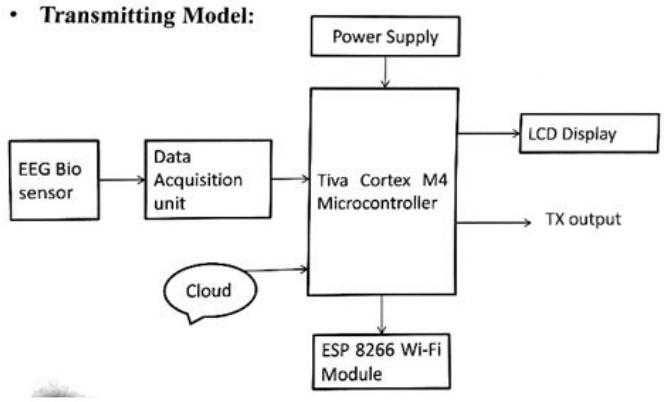

Figure.1. Block Diagram of transmitting model

The receiving model consists of inputs from sensors such as ultrasonic sensor, Alcohol sensor, Accelerometer sensor & the output of transmitter model is also given as one of the inputs. Arduino is programmed in such a way that depending upon the values from Transmitter and alcohol sensor motor driver in controlled and a result brake is applied thus the motor stops. In addition arduino also periodically displays the current status.

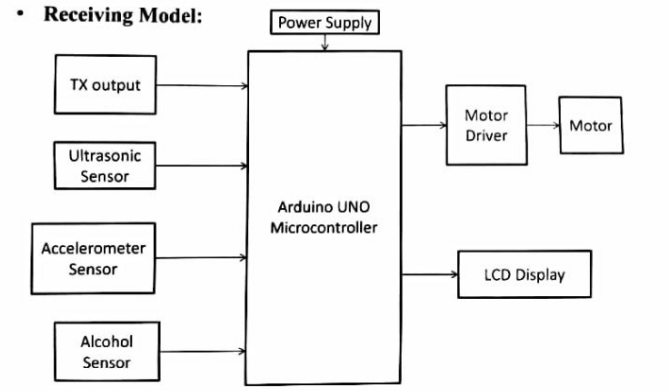

Figure.2. Block Diagram of receiving model

Algorithm:

- Measure the brainwave of driver by initializing the brainwave biosensor and then the measured values are given as an input to the Tiva cortex M4 microcontroller.
- Measure the distance, alcohol content and head moment by initializing the ultrasonic sensor, alcohol sensor and accelerometer sensor and send the measured values to the arduino microcontroller.
- Detect the Alpha wave to know the drowsy state of driver.
- IF – Alpha wave is detected

Check the condition: distance > 20

Turn off the motor

If distance<20

Display alert message and then apply ABS.

ELSE – Alpha wave is not detected

Keep on measuring brainwave

Automatic Braking System is enabled not only for the detection of drowsy state of driver but also for the conditions like alcohol detection and frequent diversion detection. Finally the measured brainwave pattern is upload to the cloud server via Wi-Fi module and it can be retrieve using smart phone as well as specific website.

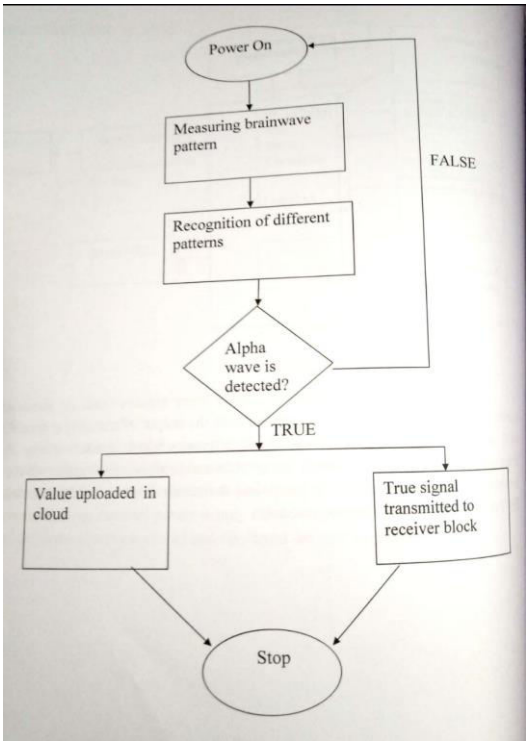

Figure.3. Flow chart for Transmitting model

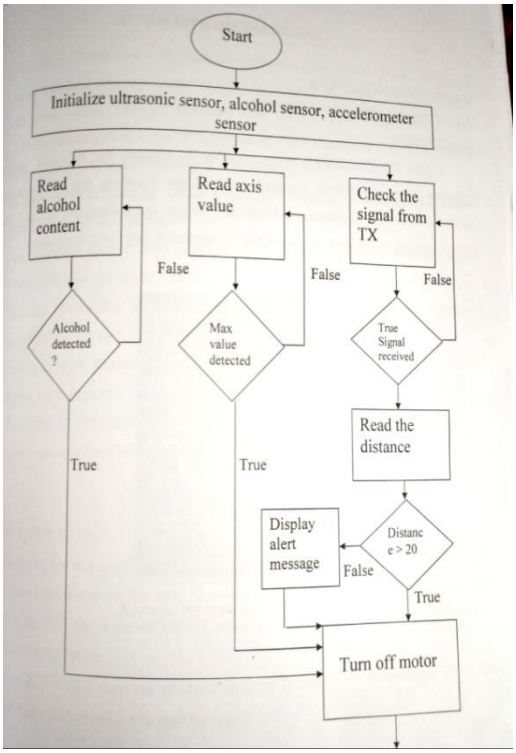

Figure.4. Flow chart for Receiving model

V.RESULTS AND OUTPUT

The system is tested in two cases – when the driver fell asleep and when he is drunken. When he is in drowsy state, that data is stored is cloud as well as automatic braking system is provided. Similarly, when he is detected as drunken, the vehicle stops automatically.

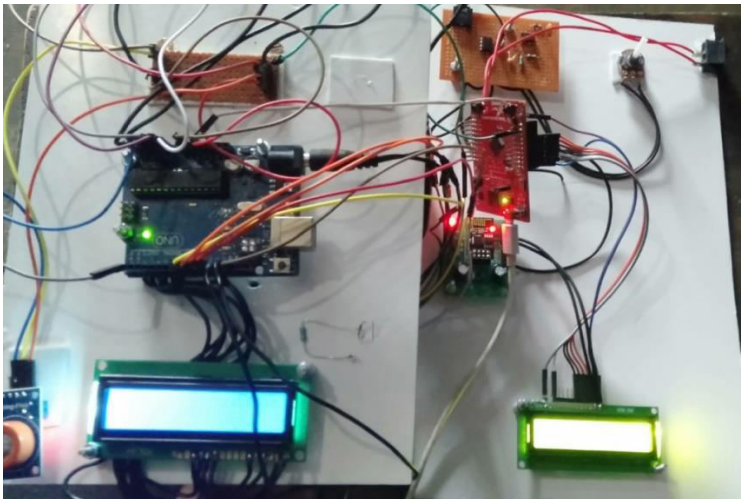

Figure.5. Hardware Output

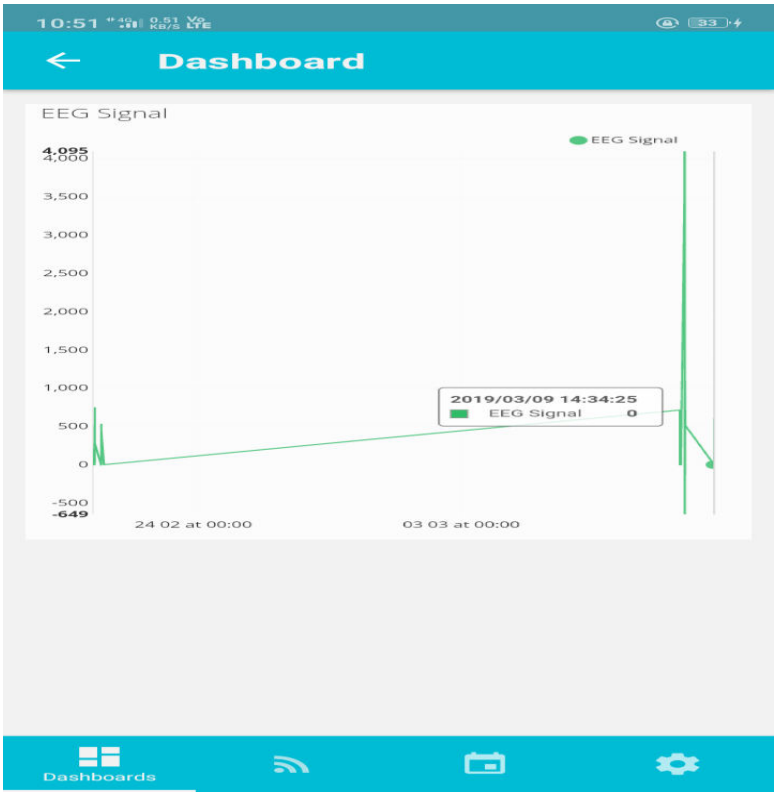

Figure.6. Iot

VI. CONCLUSION

Drowsiness is detected when the average value of low-alpha is below 0.7, high alpha is below 0.6 and theta is below 0.7 from normal condition. Low Alpha can illustrate more than other waves to detect the actual condition of drowsiness. Thus, low alpha has greater priority. Accuracy of system is high so that it provides complete solution for the accidents that occurs due to drowsiness and carelessness of drivers and also prevents drunken driver from driving the vehicle.

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