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# Driver stress detection using motion and EEG sensor

**N Ageela [1], K Kalapriyadharsini [2], P Mythili [3], M Nandhini priya[4], Dr.S Jayachitra [5]**

[1,2,3,4,] Final MEE, [5] Associate professor

[1,2,3,4,5] Medical Electronics Engineering,Sengunthar College of Engineering

*Abstract*- **Driver stress is an increasing problem in the transportation industry. It causes a lot of cognitive skills, resulting in poor driving and an increase in the likelihood of traffic accidents. Prediction models allow us to avoid or at least minimize the negative consequences of stress. The physiological signals of low frequency and voltages, after amplification and filtration can be easily transmitted with low noise interference in the signal. Here the accelerometer sensor has been incorporated on the driver's hand gloves which monitors the sudden rotation on the steering wheel. And the EEG sensor has been used to detect the abnormalities in the brain due to the occurrence of stress and also the heartbeat sensor can be used detect the changes in the heart rate and blood pressure. And these signals are given as an input to the arduino. Then the signals are transformed to the Max 232 , and GSM . The information has been transformed to mobile for further processing.**

## I. INTRODUCTION

Almost all the road accidents has been occurred due to driver stress and this lead to loss of life. This project aims to minimize the loss of life by detecting various physiological parameters. This device will be compatible and economical.

This A large amount of research has been recently conducted on stress detection from physiological signals that are influenced by activation of the sympathetic nervous system. Some of the useful physiological parameters include electroencephalogram (EEG), electrocardiography (ECG), galvanic skin response (GSR), photo plethysmography (PPG), and electromyogram (EMG).It demonstrated the possibility of extracting suitable features from EEG signals.

System is designed to detect the driver stress using the various physiological sensors. It is a device that uses a EEG sensor that is placed on the head to detect the stress level of the driver and the inertial motion sensor is attached with the gloves worn by the driver. The inertial motion sensor can be used to detect the steering wheel movement and also the heart beat sensor is used to detect the changes in the heart rate and the flow of blood pressure. The signals are extracted by the sensors and transformed to the arduino microcontroller Atmega328. The arduino can be used to convert the physiological signals into digital form. The max232 can be act as a dual transmitter or receiver. And these signals are transfer to stress prediction classifier and it can be used to detect the stress level of the driver. When the driver having high stress the alarm will generated and the information will be send to the driver's mobile through GSM which is attached to the device. The device produced alarm and also the vehicle gets stopped automatically

Stress: Physiological or biological stress is an organism's response to a stressor such as an environmental condition. Stress is the body's method of reacting to a condition such as a challenge or physical and psychological barrier. Stimuli that alter an organism's environment are responded to by multiple systems in the body. The autonomic nervous system and hypothalamic-pituitary-adrenal (HPA) axis are two major systems that respond to stress. The sympathoadrenal medullary (SAM) axis may activate the fight-or-flight response through the sympathetic nervous system, which dedicates energy to more relevant bodily systems to acute adaption to stress, while the parasympathetic nervous system returns the body to homeostasis. The second major physiological stress, the HPA axis regulates the release of cortisol, which influences many bodily functions such as metabolic, psychological and immunological functions. The SAM and HPA axes are regulated by several brain regions, including the limbic system, prefrontal cortex, amygdala, hypothalamus, and stria terminalis. Through these mechanisms, stress can alter memory functions, reward, immune function, metabolism and susceptibility to diseases.

In addition, it is more likely that the driver stress detection accuracy rate would increase as more parameters are integrated. These methods have a constraint, which defines the usage of multiple sensors that are needed to be placed on the driver's body or to be installed in the vehicle. Too many sensors on the body can cause discomfort for the driver as well as increase the implementation costs. Thus, the primary goal of this study is to develop a stress predicting driver assistance system using a single sensor metric, namely, the steering wheel movement (SWM). SWM behavior is analyzed based on the driver induced motion of the steering wheel. The motion is recorded by utilizing an inertial motion unit (IMU) sensor, which consists of an accelerometer, a gyroscope, and a magnetometer sensor module, and is typically designed as a wearable glove system. Even though lots of researches found to utilize the accelerometer or motion sensor to classify the stress conditions, the accelerometer is used here for an entirely different purpose—to indirectly measure the vehicle speeds and body movements. Some studies, measure the steering wheel movement to derive stress states, but there has been practically no research conducted that involves usage of them motion sensor to derive steering wheel movement. Even though a similar method is possible by placing the sensor on the steering wheel, it restrains the flexibility of the steering wheel in the sense that the sensor unit installment requires modifications to be made to the steering assembly, and it will be tedious to dismantle the assembly conveniently after the analysis. On the contrary, our wearable glove stress detection system can be used widely by different users in different vehicles

## II. HARDWARE

Hardware system is constructed with power supply unit, Microcontroller –ATMega 328p which is High Performance,Low Power AVR, accelerometer sensor, heart beat sensor,EEG sensor, GSM.

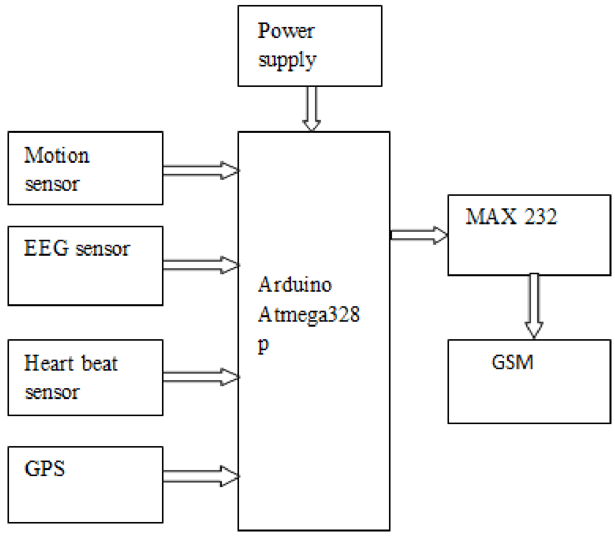
One of the most common inertial sensors is the accelerometer, a dynamic sensor capable of a vast range of sensing. Accelerometers are available that can measure acceleration in one, two, or three orthogonal axes. They are typically used in one of three modes: As an inertial measurement of velocity and position. As a sensor of inclination, tilt, or orientation in 2 or 3 dimensions, as referenced from the acceleration of gravity (1 g = 9.8m/s2);

There are considerable advantages to using an analog accelerometer as opposed to an inclinometer such as a liquid tilt sensor – inclinometers tend to output binary information (indicating a state of on or off), thus it is only possible to detect when the tilt has exceeded some thresholding angles.
Heartbeat Sensor- The Pulse Sensor Amped is a plug-and-play heart-rate sensor for Arduino. It can be used by students, artists, athletes, makers, and game & mobile developers who want to easily incorporate live heart-rate data into their projects.It essentially combines a simple optical heart rate sensor with amplification and noise cancellation circuitry making it fast and easy to get reliable pulse readings. Also, it sips power with just 4mA current draw at 5V so it's great for mobile applications.

EEG Sensor-
GSM- GSM/GPRS Modem-RS232 is built with Dual Band GSM/GPRS engine- SIM900A, works on frequencies 900/ 1800 MHz. The Modem is coming with RS232 interface, which allows you connect PC as well as microcontroller with RS232 Chip (MAX232). The baud rate is configurable from 9600-115200 through AT command. The GSM/GPRS Modem is having internal TCP/IP stack to enable you to connect with internet via GPRS. It is suitable for SMS, Voice as well as DATA transfer application in M2M interface.

## III. SOFTWARE

Platform - AVR STUDIO, system program, arduino andare all integrated onto a single chip, removing the need for external memory in most applications. Some devices have a parallel external bus option to allow adding additional data memory or memory-mapped devices. Almost all devices (except the smallest TinyAVR chips) have serial interfaces.
In System Programmer - ProgISP 172- The Atmel Dragon is an inexpensive tool which connects to a PC via USB. The Dragon can program all AVRs via JTAG, HVP, PDI, or ICSP. The Dragon also allows debugging of all AVRs via JTAG, PDI, or DebugWire; a previous limitation to devices with 32 kB or less program memory has been removed in AVRstudio 4.18. The Dragon has a small prototype area which can accommodate an 8, 28, or 40-pin AVR, including connections to power and programming pins. There is no area for any additional circuitry, although this can be provided by a third-party product called the "Dragon Rider".
Compiler – Win AVR- Micro Vision must be instructed to generate a HEX file upon program compilation. A HEX file is a standard file format for storing executable code that is to be loaded onto the microcontroller. In the "Project Workspace" pane at the left, right–click on "Target 1" and select "Options for 'Target 1' ".Under the "Output" tab of the resulting options dialog, ensure that both the "Create Executable" and "Create HEX File" options are checked. Then click "OK".




Arduino Uno is a microcontroller board based on the ATmega328 (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.

In future, shields will be compatible with both the board that uses the AVR, which operates with 5V and with the Arduino Due that operates with 3.3V. The second one is a not connected pin, that is reserved for future purposes.

## VI. FUTURE RESEARCH

This paper has presented an original method for predictinga driver's stress level based on the steering wheel movement derived from a wearable glove motion sensor and EEG sensor and also heart beat sensor. The results of the analysis indicated that by incorporating the "redundant"features elimination and stepwise feature selection of extracted features from an inertial motion unit sensor could reduce the SVM stress level prediction classifier's complexity,it maintaining the prediction rate at acceptable level. In addition, the proposed method outperformed the conventional methods which utilized the driver's biomedical signals, facial expression or speech and lane tracking that are more susceptible to noises and have high implementation cost. Future research will place a deeper focus on studying the relationship between the driver stress and driving events, including turning corners and stopping at traffic lights. The goal will be to derive a more superior stress level prediction classifier model, which will ensure reliability in real-world driving situations.

## VI CONCLUSION

A portable medical device has been developed to be used for emergency e-health applications. This device uses GSM mobile technology for the transmission of stress level to a remote location wirelessly. The advance interfacing of man machine enhances the system functionality by allowing the health specialist to operate in hands free mode by receiving data & communicating the health worker at the remote area

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