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Smart steering in automobiles for safe driving

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ABSTRACT

Automobiles have been an integral part of the modernization and development of civilization. Right from the beginning of the industrial revolution, there were a huge number of automobiles manufactured. This called in for the need for safety measures to be implemented into the vehicle for protection of the passenger in case of accidents. Various safety measures were implemented in this domain, such as functions like Seat belt, Anti-lock Braking System, Safety Airbag System and many more. The accident toll continued to increase over the years despite these safety measures. These accidents were caused by human negligence such as drunken driving, drowsiness, unhealthy condition and a lot more. This paper, hence, proposes a system in which the driver cannot drive under the influence of alcohol and also a basic level health condition test to check if the driver is fit to drive. It also has a system that can sense if the driver is sleepy and alerts the driver back to his senses if found sleeping. This can ensure the complete safety of the passenger while driving and can reduce the accidents to almost zero values that are caused by the above mentioned human faults. To add to the safety in case of any accident the system houses a crash detector and flame detector along with GPS and GSM modules to alert the nearby authorities to get to the rescue. As a whole, the system can provide unimaginable safety assurance against fatal accidents and hence save precious life's.

Keywords*— Car safety system, GPS, Sensors, GSM, Microcontroller*

1. INTRODUCTION

Road accidents have increased all over the world. According to recent surveys by the Ministry of Road Transport and Highways under the Government of India, it is seen that most of the accidents occur due to the negligence of the driver and due to improper care given to the casualty if in case of an accident. It was recorded that about 150,000 people die every year in road accidents.

This tool can be brought down by integrating sensors and automating the automobiles which would alert the emergency services to the site of the accident hence increasing the survival rate of the victim.

This paper proposes the idea of preventing an accident from occurring even before the driver would start the vehicle. The integration of various sensors into the system ensures that the driver needs to be fit enough to drive the vehicle and hence restricting an accident which might occur in the future if the driver is allowed to drive.

2. LITERATURE SURVEY

This section aims to shed light on the different implementations and ideas associated with this topic as well as those that have helped in the formulation of the idea.

Xian Li, Hui Huang and Ye Sun [1] describes a vehicular automation system in their paper. They used a GSR sensor to monitor the stress levels during driving. They used a sitting posture sensor cushion which is an array of tribal-elements covering the sitting area on the driving seat. This provided the necessary information regarding the pressure the human body experiences during a drive.

Barış Guksa and Burcu Erkmen [2] describes a vehicular automation system that uses a smart phone in order to detect the user's drowsiness. It uses the smartphone's camera to capture the driver's images and check if he is awake or not. It provides a voice alert as well as a phone alert to the driver in the event that he is found to be sleeping.

Vivek Gupta, Vikramsingh Mane, Manash Ranjan Pradhan and Kapil. B. kotangale [3] describes an IoT based car automation that uses Raspberry Pi at its core. They proposed monitoring the different parameters such as temperature, humidity, fuel indication, speed of a car and also the location of a car based on the IoT concept.

3. METHODOLOGY

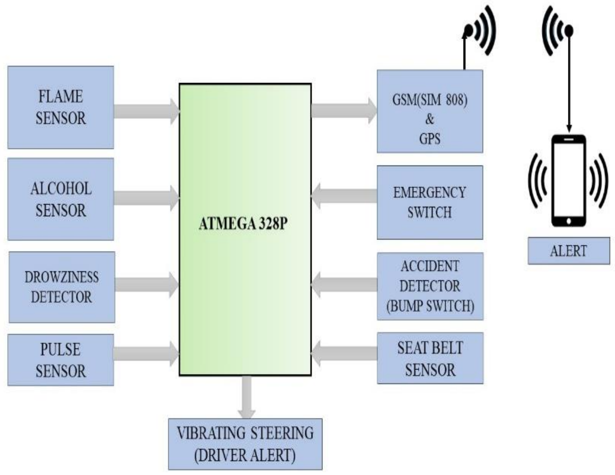

Fig. 1: Block Diagram

This section shows an overview of the system. Figure 1 shows the block diagram of the proposed system.

The ATmega 328P (Arduino Nano) acts as the heart of the system. To this, the various application specific sensors are interfaced to work as one unit. A slot sensor is used to detect whether the driver is wearing the seat belt or not. The gas sensor is used to detect the alcohol consumption of the driver. It is used to check if the alcohol level is beyond the permissible limit. A flame sensor is used to check if there is any fire in the engine compartment. A pulse sensor is integrated with the steering wheel to continuously monitor the heartbeat of the driver. The drowsiness detector used here is an IR based wearable spectacles. An alternative for this is a camera mounted on the rear view mirror. A bump switch at the bonnet of the car is used for accident detection. An emergency switch is placed inside the car which the driver can use to alert the authorities such the fire brigade, emergency service personnel, etc. in the event of an accident. The GSM and GPS modules are used to alert the authorities of the location of the driver in the event of an accident or in case of driving under influence.

3.1 Hardware requirements

(a) ATmega 328P: It is a high performance, pico-power, 8-bit AVR RISC based microcontroller that is capable of executing powerful instructions in a single clock cycle, hence approaching throughputs of 1MIPS per MHz

(b) Flame sensor: The flame sensor module is sensitive to a flame. It detects flame or a light source of wavelength in the range of 700nm-1100nm. Its detection point is about 60 degrees and is particularly sensitive to the flame spectrum.

(c) Alcohol sensor (MQ3): It is a low-cost semiconductor sensor which can detect the presence of alcohol gases at concentrations from 0.05 mg/L to 10 mg/L. It's conductivity increases as the concentration of alcohol gases increases. It has high sensitivity to alcohol and good resistance to disturbances due to smoke, vapour and gasoline. It has high sensitivity and response time. It is stable and has a long life.

(d) Pulse sensor: The pulse sensor has two sides, one side has the LED placed with the ambient light sensor and the other has the circuitry. The LED is placed over a vein on the human body. The LED emits light which will fall on the vein. The flow of blood causes the light to be reflected back which is detected by the ambient light sensor. This is monitored over time to determine the heart beats.

(e) Slot sensor: It consists of IR LED and Photodiode mounted facing each other enclosed in a plastic body. When the light emitted by the IR LED is blocked because of some obstruction, the level of the photodiode changes. This change in the logic level can be sensed by the microcontroller or by discrete hardware.

(f) Bump switch: It is one of the simplest sensors which can perform obstacle and collision sensing. The extended lever allows the implementation to be simple, which closes the switch on colliding with an obstacle.

(g) IR based Eye blink sensor: It is an IR based sensor. The variations across the eye will differ as per eye blink. If the eye is closed the output is high or logic 1, otherwise, the output is low or logic 0. This is given to logic circuits for further use.

(h) GSM + GPS Module (SIM 808): At the heart is a powerful GSM cellular with integrated GPS. It is an all-in-one cellular phone module that lets us add location-tracking, voice, text, SMS and data as per our needs. Its quad-band 850/900/1800/1900MHz – allows one to connect onto any global GSM network.

3.2 Software requirements

Arduino IDE: The Arduino integrated development environment or IDE for short, is a cross-platform application that is written in the programming language Java. It is used to write and upload programs to Arduino compatible boards, but also, with the help of 3rd party cores, other vendor development boards.

4. IMPLEMENTATION

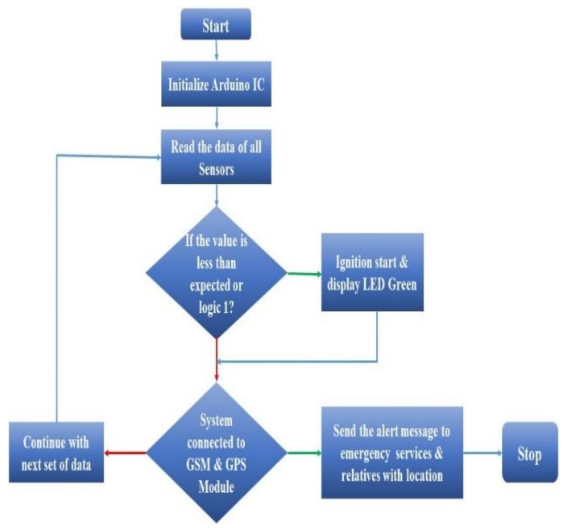

Fig. 2: Flowchart of the system

The system operation begins with the initialization of the microcontroller. It initializes the various pins for inputs and outputs. The various sensors connected with the microcontroller keep providing data that they measure. The loop starts by first checking the slot sensor. If the driver has not worn the seat belt it will give an alert. Next, it checks the alcohol sensor to see whether the driver is perfectly alright or drunk. If he is found to alcohol levels above a certain level, the ignition is inhibited as well as his GPS coordinates are sent to his relatives. Following this is the pulse sensor that is mounted on the steering wheel. It keeps monitoring the driver heart beat rate. When this data is found to be abnormal, an alert is provided. In the case of repeated abnormality, the emergency personnel are alerted. Inside the engine compartment, the flame sensor keeps monitoring the engine. Once there is any spark or a flame that may lead to disastrous consequences, it sends an alarm that relays information about the fire. In the event of an accident, the bump switch placed at the bumper or the bonnet relays a logic one to the microcontroller. The microcontroller, in turn, send the GPS coordinates of the vehicle in the event of an accident. Another safety feature is the presence of the emergency switch. In the event of an accident, if the bump switch fails, the driver can manually use the emergency switch to send out a distress signal to alert the authorities of the accident. The blink sensor keeps checking the driver's alertness. It counts the interval between blinks to determine whether the driver is awake or sleeping. If it is found that the driver is found to be sleeping, a gentle vibration is given to the driver through the motors placed in the steering wheel. If the same continues over a period of time an alert is sent to the driver's relatives so that they can call the driver and wake him up. Once the basic parameters which include the slot sensor, alcohol sensor and pulse sensor are checked, and it is found that the driver is fit to drive, the ignition is started. During the drive, all the sensors are active, as they monitor the driver at all times in order to provide complete safety to the driver.

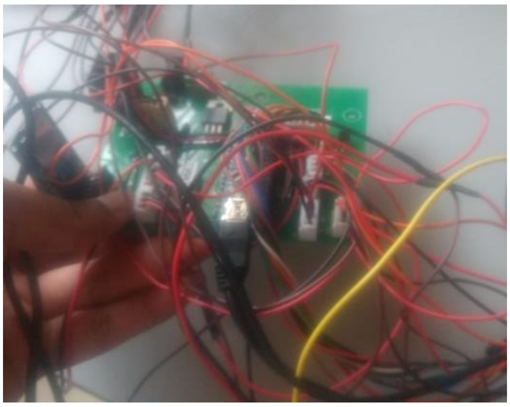

Fig. 3: Hardware setup (internal)

Fig. 4: Final hardware setup (external)

5. RESULT

In doing this project, we achieved our required outputs and a working prototype was implemented. The output of the system displayed using the Arduino IDE is shown.

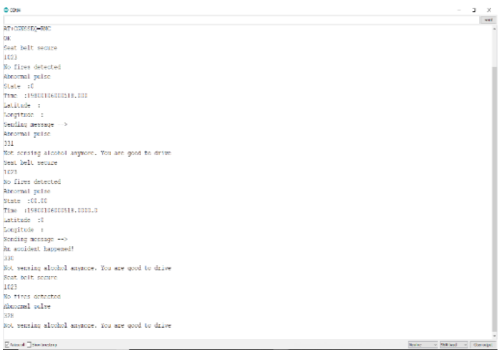

Fig. 5: Serial Monitor (Arduino IDE output)

This shows the various sensor readings as well as the alert messages along with the GPS coordinates.

6. CONCLUSION

A successful prototype was implemented which achieved the set goals to monitor the driver while he is driving as well as act as an accident preventive mechanism by sensing the driver's condition prior to the commencement of the drive. It also alerts the authorities about the vehicle in case of an accident. Through this system, we hope to reduce the number of road accidents by a significant number.

7. FUTURE WORKS

Going forward, the proposed system can be incorporated with the technologies that will be predominant in the days to come. Taking 5G as an example, the reduced latency will allow the sensors to read and transmit data more efficiently. Also with the arrival of self-driving cars, the proposed system when incorporated in such a vehicle, working in tandem with the 5G cellular networks will allow the cars to communicate with one another, which may prove to be of vital importance in the event any health-related issue crops up during a drive.

8. ACKNOWLEDGEMENT

"Success is the abstract of hard work and perseverance but most important of all is the encouraging guidance"

So, I acknowledge all those whose guidance served as a beacon of light and crowned our efforts with success. I would like to express my heartfelt gratitude for the Head of the Department and project guide Dr. Manju Devi for the continuous support and guidance given throughout the period of work.

Last but not the least I extend my heartfelt thanks to my parents and all my friends for their encouragement, moral support and affection throughout my period of study.

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