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Autonomous Vehicle and Intelligent Navigator

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Abstract

In todays' scenario, consumption of alcohol is drastically increasing especially in youth. More often people party in clubs and consume alcohol. This leads to accidents on roads when they drive. Moreover accident happens because driver lack viewing capability and that increases the risk of accidents. The virtual support that we are designing provides protection of drivers as well as public on roads. With the help of brain sensor the system will support in detection of whether the driver is fit to drive, and when united with ultrasonic sensors and image processing which will help in object detection and avoidance. The whole system, being autonomous system will include a GPS module which can help in determining the location and can help in path planning and navigation. This system is named AVIN (Autonomous Vehicle and Intelligent Navigator).

Keywords: *AVIN, GPS, brain sensor, image processing*

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INTRODUCTION

Our motive is to design a system which will provide a safe driving experience to driver with the chances of an accident reduced to a very significant level. The whole system consists of sensors like NeuroSky Brain sensor, Ultrasonic modules, GPS module and a camera. NeuroSky brain sensor is used to detect the alpha, beta and theta brain waves of the driver. Whenever a person is drunk the Theta waves begin to appear and gradually increase due to state of drowsiness. Alpha waves gradually decrease and the region of alpha waves gradually expands. In the end the Beta waves gradually enhances and the area of beta waves is increases. These parameters can be used to detect the condition of the driver and can be classifies as drunk or stable[1–3]. The car will be surrounded by ultrasonic sensors which will help in detection of cars in front, left and right side. With some given tolerance a warning can be given at first place and then necessary action can be taken if driver does not respond in manual mode. This avoids the chances of collision and can reduce the impact of collision (worst case). Image processing is equivalent to give vision system to a car which will help in object detection and taking necessary action. Sensors and camera have their own limitations w.r.t their range. The combined data will be collaborated and the output from the controller will be in favor of accident avoidance and collision[4, 5]. GPS (Global Positioning System) will help in determining the latitude and longitude of the car. This data can be transferred to google maps to show the current position of the vehicle on the map. With a desired algorithm developed the navigation can be achieved and in autonomous mode the car can drive to the destination, with the help of sensors and camera monitoring the object collision can be avoided and all the traffic rules can be followed[6, 7].

The inter vehicle communication will help in communication of cars within a range and will share the desired drive plan with cars within that range so that other cars can take preventions. Various calculations are there and priority will be given according to various parameters[2]. XBee is a radio frequency module used for transferring the data from one car to other car for inters vehicle communication. This protocol will be used to transfer and receive the information within a desired range. The whole system will be implemented in a car which will have a manual mode and an autonomous mode. This whole system will act as a virtual assistance and will help in safe, smooth and accident free driving.

SYSTEM DESIGN

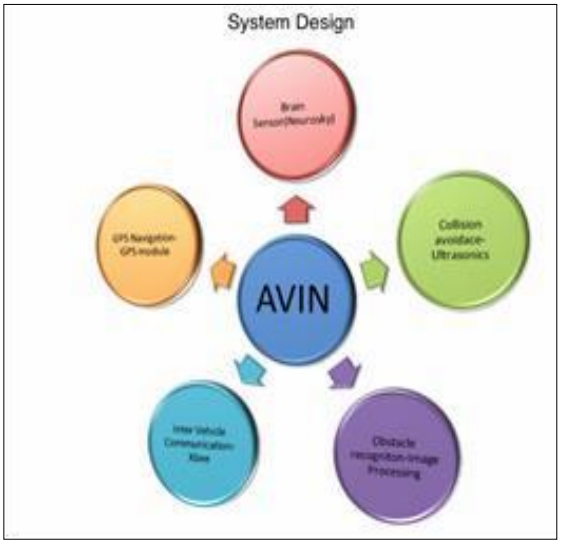

Fig. 1: *System Design.*

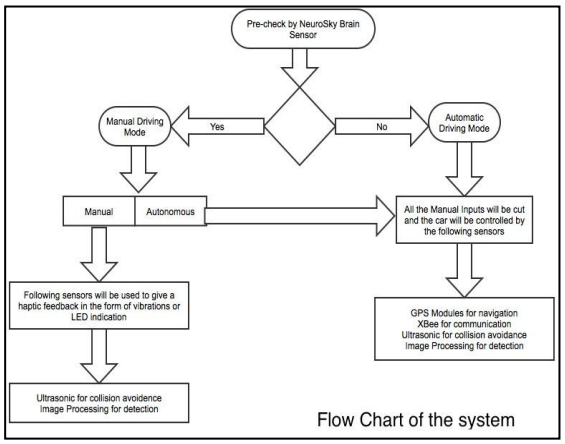

Fig. 2: *Flow Chart of System.*

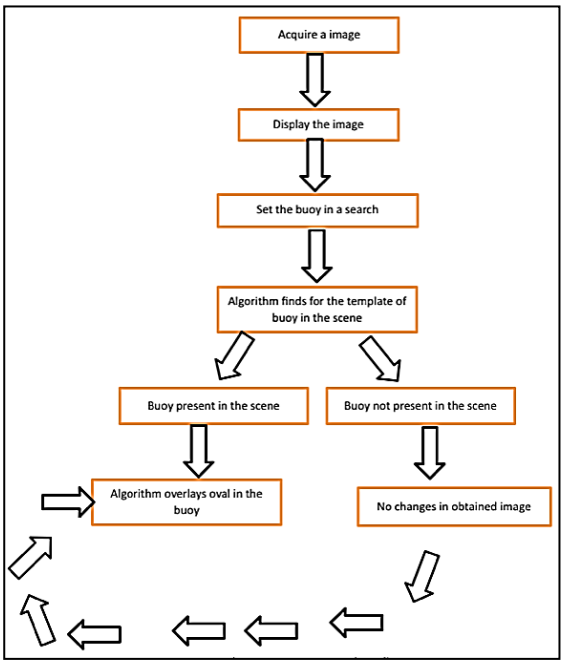

Fig. 3: *Image Processing Flow.*

RESULTS AND OBSERVATION

Neuro Sky Brain Sensor

The output from the sensor will be the comparison between the saved alpha, beta and theta waves and the current driver's waves. There will be some tolerance given for wide range of people and the comparison will be done with the reading taken by the sensor. The determined output from the sensor will be fed in the software.

There will be two types of output –

Drunken person

If driver is found to be drunk then his Alpha, Beta and Theta waves changes drastically compared to the normal person as follows.

Theta(θ) waves

Theta(θ) waves begin to appear and progressively enhances after consuming alcohol, as persons are driven in to the state of sleepy and the central nervous system gets inhibited.

Alpha (α) waves

Alpha (α) waves gradually decreases and the region of alpha (α) waves is expanded after consuming alcohol.

Beta (β) waves

The cerebral cortex remains in an excitable condition after consuming alcohol, which leads to Beta (β) waves progressively enhanced and the area of Beta (β) waves are extended.

The program detects these changes and the car will switch to autonomous mode. This leads to autonomous driving by the car itself to the default location, which will be the home of the driver (the location can be different too). The computer will reject all the manual inputs in this mode so that intensity of accidents can be reduced to zero[3].

Normal Person

In this mode driver will have the option of manual mode and autonomous mode. This selection has to be done by the operator. If he chooses manual mode the car will be run according to driver wish and sensors will sense the environment and will give warning in the form of hepatic feedback. In autonomous mode the driver will provide the GPS location.

Following are the observation by the Neurosky brain sensor:

1. When a person is in deep sleep his attention level is minimal and his meditation level is maximum.
2. When a person just wake up after his sleep his attention level starts to increase and meditation level starts to decrease which means his beta waves start showing.
3. When a person is doing normal activities like walking, talking, sitting etc the attention level is at maximum depicting high beta waves are produced in brain.
4. When a person is driving a four wheeler the meditation level and the attention level increases which shows high beta and delta waves are produced in the brain.
5. When a person is taking sharp cuts in a bike his attention level goes maximum and mediation level decreases. This shows high beta, high alpha and delta waves are produced at the same time.

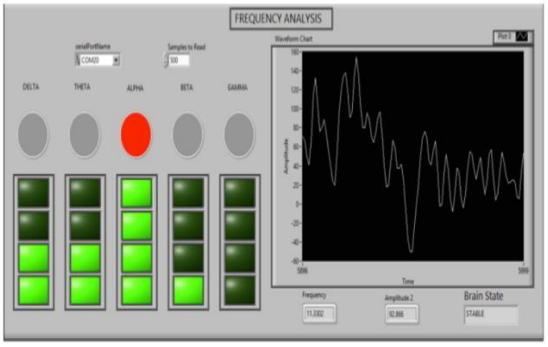

Fig. 4: *Frequency Analysis.*

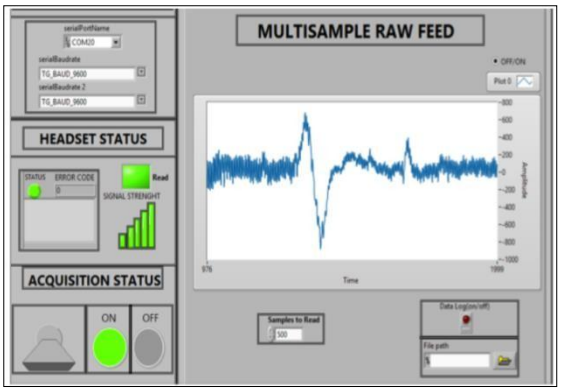

Fig. 5: *Raw EEG.*

Ultrasonic Sensor

Ultrasonic sensor will give the distance between the cars in front, left and right side of the car. This data will be used for braking of moving the car in opposite direction to avoid collision from any side of the car. The working of sensor will be done as per the mode:

Manual Mode

In this, the range will be definite wherein the output from the controller will be just a cautionary in any of the haptic or optical view. If the distance is severely reducing and the limit is reached where action has to be required, then the controller will automatically give the desired output. This

will support in avoiding accident and increasing the safety in manual mode.

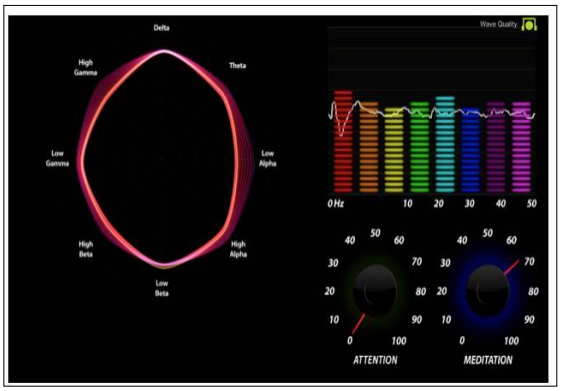

Fig. 6: *Sleeping Person.*

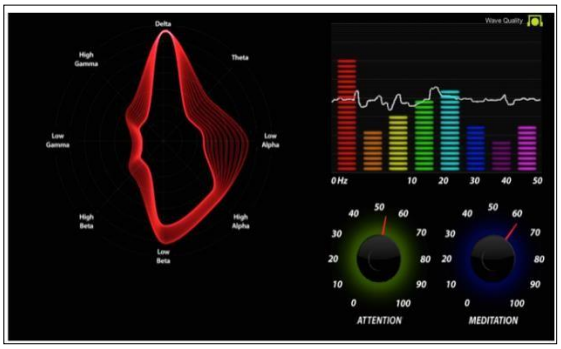

Fig. 7: *Normal Person.*

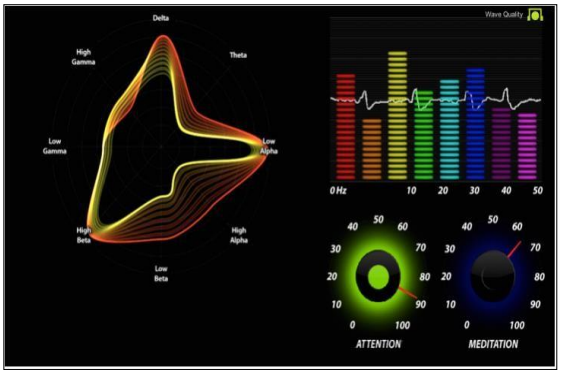

Fig. 8: *Normal Activities.*

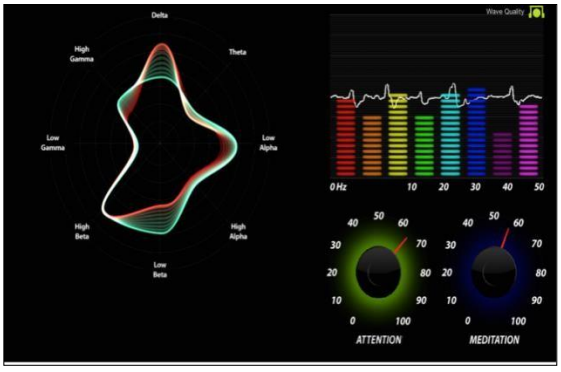

Fig. 9: *Normal Driving Conditions.*

Autonomous Mode

In this instead of a warning given to drive the controller will decide the output based on the inputs by the sensors.

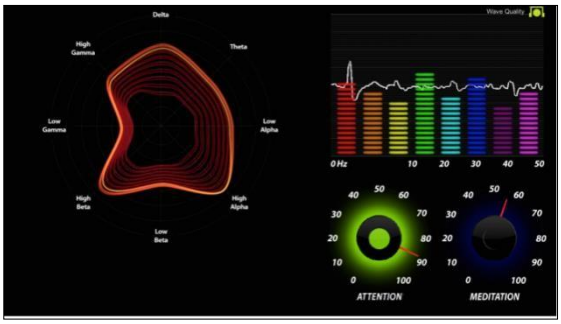

Fig. 10: *Driving.*

Image Processing

Image processing is used for environment analysis The vision system is designed in such a way that it detects the object and its movement and that data is send to the microcontroller. This data is used to take the desired decision of braking, moving to different lanes to prevent collision etc.

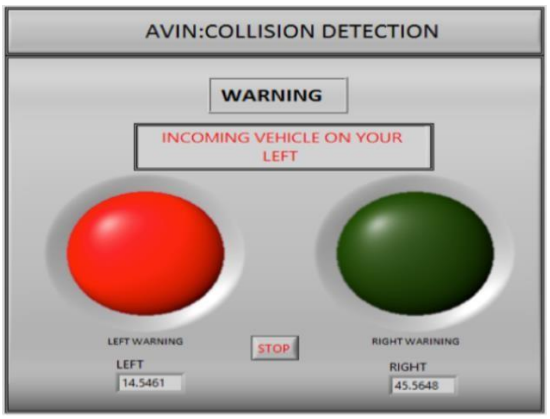

Fig. 11: *Collision Avoidance Front Panel.*

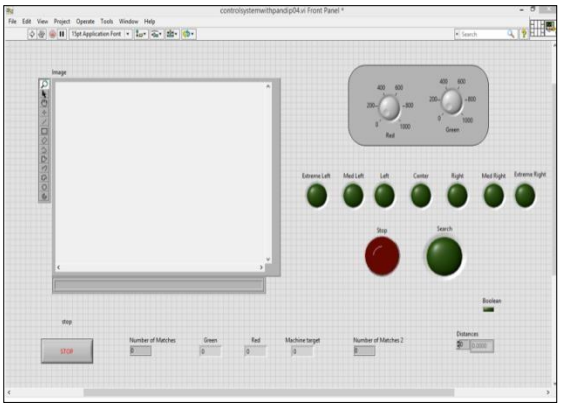

Fig. 12: *Image Processing Front Panel.*

The working of image processing is same as ultrasonic sensor in manual and autonomous mode.

XBee Communication and Inter Vehicle Communication

XBee is a radio frequency module with the range of 1 KM. By this we can make a protocol so that each car within the range of 500 meters can communicate and can share data like ahead traffic, the instant drive plan of that particular car, the speed by which other car are approaching and in which direction they are going.

This will help in taking suitable decision instantly and help in traffic monitoring which can be used for increasing safety. When a driver is taking a left (e.g.) the car will indicate and will share this information to others and other cars can take decision like braking or lane changing as per the condition. This whole system is in real time and will refresh all values every second so as to increase safety and reduce the risk of losing life of road.

CONCLUSION

The projected hypothesis summarizes the motive to prevent drivers from causing accidents due to drunken driving. Hence the application of such a system in automobiles can achieve a better and a safer environment for the people and other vehicles.

The prime advantage of the system being its robustness and affordability only makes it more economical and practical for daily customers.

Apart from the primary observation the system may find further application in data sharing, planning and decision making in an inter-vehicle information encoding-decoding procedure.

FUTURE PROSPECTS OF THE PROJECT

1. We are working on navigation of the car with the help of Digital Compass, GPS module.
2. With the integration of these two modules and proper algorithm applied, we can achieve the navigation of the car.
3. FFT for accurate frequency analysis of the brain waves.
4. In future, LIDAR sensor can be used for creating a 3-D map of the environment.
5. Ultrasonic sensors can also be used for adaptive cruising.
6. Speech recognition can be implemented to increase safety in cars.

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