Artificial Passenger – A Solution To Driver Drowsiness Using Face And Speech Recognition

Pauline C[1], Rakshitha B T[2]
[1, 2] Dept of Computer Science and Engineering
[2]Assistant Professor, Dept of computer Science and Engineering
[1, 2] Atria Institute of Technology, Bangalore, Karnataka, India

Abstract- *An Artificial Passenger (AP) is a sleep preventive device that would be used in a motor vehicle to overcome driver drowsiness. IBM has developed a prototype that has a conversation with a driver, tells jokes and asks questions which is intended to determine whether the driver can respond alertly enough. It is a natural language e- companion that acts as a life safety system. This system makes sure that the driver doesn't cause an accident due to drowsiness and also controls the vehicle's authentication.*

Keywords- Artificial Passenger, authentication, driver drowsiness, e-companion, prototype

I. INTRODUCTION

According to national survey in UK and USA, it is observed that the driver fatigue annually causes 2,40,000accidents and in India, 2,31,000 accidents. Majority of the accidents observed were caused by eye-closure of the driver by a second or as long as 2 to 3 seconds. It is said that ,according to the research normal human eye blinks last 0.2 to 0.3 second.This system was developed to prevent these type of accidents.The AP is a telematic device, developed by IBM, that interacts verbally with the driver to reduce the likelihood of them falling asleep.This system uses a microphone for the driver, a speech generator and the vehicle audio speakers to converse with the driver. A camera to evaluate the driver's facial state and a voice analyzer to evaluate how active the driver is. It also has a conversation planner which has details of the driver's interests and profession. An accident gps tracker is also installed to the system.

It is equipped so as to engage the driver by holding conversations, playing verbal games, controlling the vehicle's stereo system.It also monitors the driver's speech patterns continuously to detect any kind of tiredness.It is integrated with wireless services to provide weather and road conditions, driving directions and other such notifications.If a driver seemed to be too tired, the programmed system opens all the windows, ring the buzzer, increase the music volume, or even spray the driver with ice water.It detects alarm condition through sensors. It broadcast spre-stored voice messages over the speakers and captures images of the driver.

Review of Existing Techniques and Research

In research paper[1], the system uses IBM approach where it uses a microphone and speech generator to converse with the driver. This system determines three-dimensional head pose, eye gaze direction, eye closure, blink detection and face detection using image analysis from multiple video sources.

In research paper[3], vehicle security system is enabled. It performs real time user authentication using face detection and microprocessor based control system fixed on board with vehicle. It uses Linear Discriminant Analysis (LDA) algorithm which discriminates much of the features rather than looking for exact pattern based on Euclidean distance with large samples of data.

II. PROPOSED SYSTEM

The proposed system poses some extra features added to the existing system. It is to bring out the best services of Artificial Passenger. The AP is an artificial intelligence-based companion that will be resident in software chips embedded in the automobile dashboard.

The various components of artificial passenger are:

1. Conversational Planner –Holds a profile of the driver including the details of the driver's interests and profession. Instructs the NLP to produce the response.

2. Microphone – Picks up the replies from the driver and breaks it down into separate words with speech recognition software.

Figure 1. Microphone (for speech recognition)

3. Camera – built into the dashboard, used to track facial expressions of the driver but also tracks the lip movements to improve the speech recognition.

4. Eye Tracker – measures corneal reflection of an infrared light emitting diode (LED), which illuminates and generates a reflection off the surface of the eye.

Figure 2. Eye Tracker

5. Voice Analyzer – looks for signs of tiredness by checking if the answer matches the profile. Slow responses and lack of attention may be signs of fatigue.

   If the driver replies quickly and clearly, the system judgesdriver to be alert and continues the questioning as planned.If the response is slow or doesn't make sense, the voice analyzer assumes the driver may drowse anytime and acts to get his/her attention by telling jokes or playing music, etc

6. Automatic Speech Recognition (ASR) – There aretwo ASRs used in the system,

   a. Speaker independent: It will decode the driver voice and the decoded voice signals will output to Natural Language Processor (NLP)

   b. Operates with a voice car media, decodes tapes, audio books, telephone mails.Decoding outputs of the ASR module is analyzed by Intelligent text processor and sent to conversation planner.

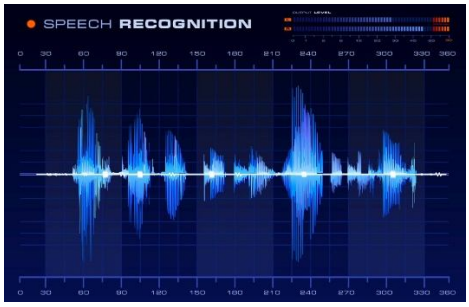

Figure 3. Speech Recognition software

7. Natural Language Processor (NLP) – Processes the decoded signal of textual data from ASR module, identifies semantic and syntactic content of the decoded message, produces variants of responses and sends this data to the driver analyzer.

8. Driver Analyzer – Receives the textual and voice data from NLP and measures the time of response. This concludes about driver's alertness and informsthe conversation planner.

9. Alarm – If the conversational planner receives information that the driver is about to fall asleep then it activates an alarm system.

Figure 4. Alarm detection system

10. External Service Provider – Linked to the dialog system by wireless network and connected with ~ Car media, driver profile, conversation planner and the Driver Analyzer module. It controls the interruption of a conversation between the driver and the car dashboard (For example, to deliver an urgent message about traffic conditions on an expected driver route). It constantly updates the NLP library.

11. Face Recognition using LDA algorithm – This is used to recognize the authorized drivers.It allows the owner to choose who can drive the vehicle via wi-fi module via an app. This app is installed on the owner's phone and a nominee, so they can approve friends or family to drive the vehicle when needed.

Friends and family can drive using the guest mode just like the computers. The notification will be sent to the

owner and the nominee via app. Once approved, the driver can take a ride.

Figure 5. Camera on the stereo (for face recognition)

III. SYSTEM DESIGN AND ARCHITECTURE

This section shows the general architecture of AP and how well it is designed. It has all its components connected to each other which makes the communication and functioning of the system very easy.

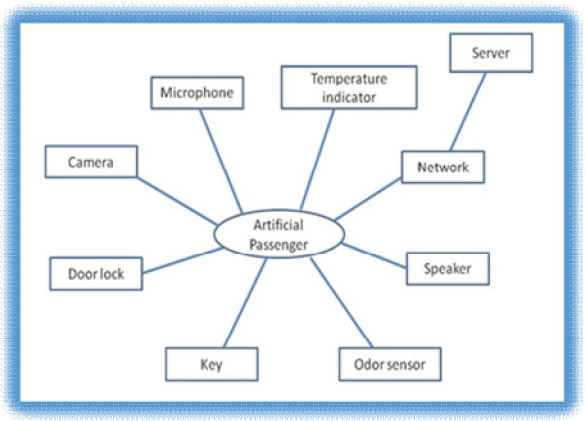

Figure 6. General Architecture

The below figure shows how the working components of AP are connected and how they collect information from each other. The conversational planner (CP) starts a conversation with the driver, and the replies received from the driver are recognized by the speech recognition software (ASR) and transmits the signals to NLP. NLP decodes it and sends the output back CP to continue the further conversation. It also informs what the CP should do next. The emergency interruption is taken care by the external service provider. The camera and speech generator play major role in this system.

IV. APPLICATIONS

- Artificial Passenger is widely used to prevent or reduce the number of accidents occurring every year.
- It is also used for entertainment such as telling jokes, playing games, etc.
- Artificial Passenger component communicates with other drivers very easily.
- If the driver gets heart attack or is drunk, it will send signals to vehicles nearby alerting the other drivers on road.
- It also informs the nearby hospitals if an accident is occurred.
- It controls who is authorized to use the vehicle and prevents vehicle theft.
- Provides a natural dialog car system that understands content of tapes, books and radio programs.
- Opens and closes the doors and windows of the car automatically when required to do so.

V. FUTURE SCOPE

It can provide with a “shortest time” routing based on road conditions changing because of weather and traffic, remote diagnostics of your car and other cars on route, destination requirements (flights delayed), etc.

This system can also be used in:Security Guard, Trains and Subways, Cabins in Airplanes and Water Crafts such as boats & ships.

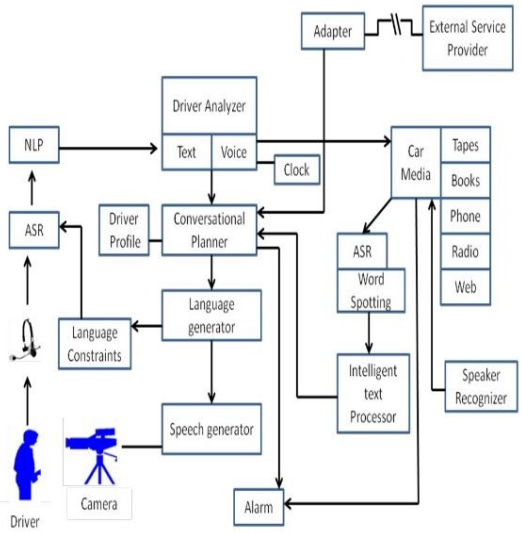

Figure 7. Working components of AP

VI. CONCLUSIONS

Successful implementation of artificial passenger would allow use of various services in car like reading e-mails, navigation, downloading music files, voice games without compromising the driver safety.

Successful implementation of safety driver manager would ensure sufficient time to avert an accident and the authentication of the vehicle.

Authentication via an app makes sure the vehicle is in safe hands and also the gps tracking would help us track the vehicle real quick.

Face recognition based authentication reduces the amount of vehicle theft and allows the owner to have the vehicle under his/her control.

Thus, this system benefits the driver in all the ways possible (to prevent driver drowsiness and vehicle theft)

Figure 8. Artificial Passenger installed in a car

VII. ACKNOWLEDGEMENT

We would like to thank all those who have helped us in carrying out this research especially our family and friends for helping us and motivating us to choose this research topic. We also take this opportunity to thank our guides for their valuable time, comments, support and suggestions on research paper. Last but not the least, we thank God Almighty for constantly showering his blessings on us.

REFERENCES

[1] Ms. Anjali Dadhich, Mrs. Neelam Sharma, "Artificial Passenger", International Journal of Innovative Computer Science & Engineering, vol. 2 Issue 1, 2015, pp. 10-15

[2] Shivam M. Tayade, et al., "Artificial Passenger", International Journal of Trend in Research and Development (IJTRD), vol. 4 Issue 5, October 2017

[3] C. Nandakumar, G. Muralidaran and N. Tharani, "Real Time Vehicle Security System through Face Recognition", International Review of Applied Engineering Research, vol. 4, Number 4 (2014), pp. 371-378