Introduction

The AP is an artificial intelligence–based companion that will be resident in software and chips embedded in the automobile dashboard. The heart of the system is a conversation planner that holds a profile of you, including details of your interests and profession.

A microphone picks up your answer and breaks it down into separate words with speech recognition software. A camera built into the dashboard also tracks your lip movements to improve the accuracy of the speech recognition. A voice analyzer then looks for signs of tiredness by checking to see if the answer matches your profile. Slow responses and a lack of intonation are signs of fatigue.

This research suggests that we can make predictions about various aspects of driver performance based on what we glean from the movements of a driver’s eyes and that a system can eventually be developed to capture this data and use it to alert people when their driving has become significantly impaired by fatigue.

The natural dialog car system analyzes a driver’s answer and the contents of the answer together with his voice patterns to determine if he is alert while driving. The system warns the driver or changes the topic of conversation if the system determines that the driver is about to fall asleep. The system may also detect whether a driver is affected by alcohol or drugs.
What is an artificial passenger?

“The AP is an artificial intelligence–based companion that will be resident in software and chips embedded in the automobile dashboard”.
✓ It is a Natural Language E-companion.
✓ It is a Sleep preventive device in cars to overcome drowsiness.
✓ It is a Life safety system.

What does it do?

✓ Detects alarm conditions through sensors.
✓ Broadcasts pre-stored voice messages over the speakers.
✓ Captures images of the driver.
During the night times the driver could get sleepier which may be porn to accidents. So in order to overcome the sleepiness the driver could have taken one of the following or all the below precautions.

- Use of simulation drinks (e.g.: coffee and tea)
- Some tablets to prevent sleeping.
- Miniature system installed in driver’s hat.

As these methods are some times inefficient and it may affect the health conditions of the driver. So in order to overcome the disadvantages of these methods IBM introduces a new sleep prevention technology device called as “ARTIFICIAL PASSENGER” which was developed by Dimitry Kanevsky and Wlodek Zadrozny.

This software holds the conversation with driver to determine whether the driver can respond alertly enough.

The name artificial passenger was first suggested in new scientist magazine which was designed to make solo journey safer and more bearable.

Early techniques for determining head-pose used devices that were fixed to the head of the subject to be tracked. For example, reflective devices were attached to the subjects head and using a light source to illuminate the reflectors, the reflector locations were determined. As such reflective devices are more easily tracked than the head itself, the problem of tracking head-pose was simplified greatly.
Virtual-reality headsets are another example of the subject wearing a device for the purpose of head-pose tracking. These devices typically rely on a directional antenna and radio-frequency sources, or directional magnetic measurement to determine head-pose.

Wearing a device of any sort is clearly a disadvantage, as the user's competence and acceptance to wearing the device then directly effects the reliability of the system. Devices are generally intrusive and will affect a user's behavior, preventing natural motion or operation. Structured light techniques that project patterns of light onto the face in order to determine head-pose are also known.

The light patterns are structured to facilitate the recovery of 3D information using simple image processing. However, the technique is prone to error in conditions of lighting variation and is therefore unsuitable for use under natural lighting conditions.
Why Such Systems?

According to the national survey in UK and USA, it is observed that driver fatigue annually causes

- 100,000 crashes
- 15000 deaths
- 71,000 injuries
- Which cause annual cost of $12.5 billion.

A majority of the off-road accidents observed were preceded by eye closures of one-half second to as long as 2 to 3 seconds. A normal human blink lasts 0.2 to 0.3 second

Advantages of using this system:

- Artificial Passenger is broadly used to prevent accident.
- Artificial Passenger device is also used for entertainment such as it telling jokes and asking question.
- Artificial Passenger component establishes interface with other drivers very easily.
- Open and close the window of a car automatically and also answer a call for you.
- If the driver gets a heart attack or he is drunk it will send signals to vehicles nearby about this so driver there become alert.
- Provide a natural dialog car system that understands content of tapes, books and radio programs.
Fig: Showing the dashboard of the car where the whole artificial system is generally attached
Devices Used In Artificial Passenger

The main devices that are used in this artificial passenger are:-

- Eye tracker or Camera.
- Voice recognizer or speech recognizer.
- Touch sensors.

How does eye tracking work?

Collecting eye movement data requires hardware and software specifically designed to perform this function. Eye-tracking hardware is either mounted on a user's head or mounted remotely. Both systems measure the corneal reflection of an infrared light emitting diode (LED), which illuminates and generates a reflection off the surface of the eye. This action causes the pupil to appear as a bright disk in contrast to the surrounding iris and creates a small glint underneath the pupil. It is this glint that head-mounted and remote systems use for calibration and tracking.

1. **Hardware**: Head-mounted and remote systems

   The difference between the head-mounted and remote eye systems is how the eye tracker collects eye movement data. Head-mounted systems, since they are fixed on a user's head and therefore allow for head movement, use multiple data points to record eye movement.

   To differentiate eye movement from head movement, these systems measure the pupil glint from multiple angles. Since the unit is attached to the head, a person can move about when operating a car or flying a plane, for example. For instance, human factors researchers have used head-mounted eye-tracking systems to study pilots' eye movements.
as they used cockpit controls and instruments to land airplanes (Fitts, Jones, and Milton 1950).

These findings led to cockpit redesigns that improved usability and significantly reduced the likelihood of incidents caused by human error. More recently, head-mounted eye-tracking systems have been used by technical communicators to study the visual relationship between personal digital assistant (PDA) screen layout and eye movement.

Remote systems, by contrast, measure the orientation of the eye relative to a fixed unit such as a camera mounted underneath a computer monitor. Because remote units do not measure the pupil glint from multiple angles, a person's head must remain almost motionless during task performance. Although head restriction may seem like a significant hurdle to overcome, Jacob and Karn (2003) attribute the popularity of remote systems in usability to their relatively low cost and high durability compared with head-mounted systems.

Since remote systems are usually fixed to a computer screen, they are often used for studying onscreen eye motion. For example, cognitive psychologists have used remote eye-tracking systems to study the relationship between cognitive scanning styles and search strategies (Crosby and Peterson 1991). Such eye-tracking studies have been used to develop and test existing visual search cognitive models. More recently, human-computer interaction (HCI) researchers have used remote systems to study computer and Web interface usability.

Through recent advances in remote eye-tracking equipment, a range of head movement can now be accommodated. For instance, eye-tracking hardware manufacturer Tobii Technology now offers a remote system that uses several smaller fixed sensors placed in the computer monitor frame so that the glint underneath the pupil is measured from multiple angles. This advance will eliminate the need for participants in eye-tracking studies to remain perfectly still during testing, making it possible for longer studies to be conducted using remote systems.
2. **Software**: Data collection, analysis, and representation

Data collection and analysis is handled by eye-tracking software. Although some software is more sophisticated than others, all share common features. Software catalogs eye-tracking data in one of two ways. In the first, data are stored in video format. ERICA's Eye Gaze[TM] software, for instance, uses a small red x to represent eye movement that is useful for observing such movement in relation to external factors such as user verbalizations. In the other, data are stored as a series of x/y coordinates related to specific grid points on the computer screen.

Data can be organized in various ways—by task or participant, for example and broken down into fixations and saccades that can be visually represented onscreen. Fixations, which typically last between 250 and 500 milliseconds, occur when the eye is focused on a particular point on a screen. Fixations are most commonly measured according to duration and frequency. If, for instance, a banner ad on a Web page receives lengthy and numerous fixations, it is reasonable to conclude that the ad is successful in attracting attention. Saccades, which usually last between 25 and 100 milliseconds, move the eye from one fixation to the next fixation. When saccades and fixations are sequentially organized, they produce scan paths. If, for example, a company would like to know why people are not clicking on an important link in what the company feels is a prominent part of the page, a scan path analysis would show how people visually progress through the page. In this case, such an analysis might show that the link is poorly placed because it is located on a part of the screen that does not receive much eye traffic.
Artificial Passenger

Fig: Former CMU professor Richard Grace is shown on a TV monitor while testing a DD 850, a dashboard-mounted infrared camera that can detect when a driver is starting to fall asleep. The device will beep to alarm a sleepy driver.

Fig: Eye-Tracker
Architecture

Fig: General architecture
Artificial Passenger

Microphone:
For picking up the words and separate them by some internally used software for Conversation.

Camera:
This will track the lip movements of the driver and also used for the improvement for the accuracy of the speech recognition.

External service provider:
Linked to the dialog system by wireless network system Coupled with
✓ Car media, driver profile, conversational planner.
✓ Driver analyzer module

It controls interruption of a dialog between the driver and the car dashboard (for example, interrupting a conversation to deliver an urgent message about traffic conditions on an expected driver route).

Temperature indicator:
This component is used to measure the temperature inside the vehicle and it also helps in maintaining the steady temperature

Door lock sensor:
This sensor alarms when the door is not locked.

Odor sensor:
This sensor will periodically sprinkles the sweet air inside the vehicle.

Speaker:
This generally used for the entertainment purpose.

**Working Components**

\[\text{Fig: Working components of AP}\]
There are some of the components which supports for the working of the system:

- ✔ Automatic Speech Recognizer (ASR)
- ✔ Natural Language Processor (NLP)
- ✔ Driver analyzer
- ✔ Conversational planner (CP)
- ✔ Alarm
- ✔ External service provider
- ✔ Microphone
- ✔ Camera

**Automatic Speech Recognition (ASR):**

There are two ASRs used in the system:

- ✔ Speaker independent: It will decode the driver voice and the decoded voice signals will output to Natural Language Processor (NLP)
- ✔ 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 it will output data to conversational planner.

**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 outputs this data to a text input of the driver analyzer.

**Driver analyzer:**

Receives the textual data and voice data from NLP and measures the time of response using a clock. This time responses, concludes about drivers alertness and it will output to the conversational planner. This analysis is both objective & subjective.
**Conversational planner:**

This is generally referred as the heart of the system and it instructs the language generator to produce the response. If the driver continues to be in a perfect condition, then conversational planner instructs the language generator to continue the conversation otherwise the language generator is instructed to change the conversation.

**Alarm:**

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

**External Service Provider:**

Linked to the dialog system by wireless network system as it is coupled with

- Car media, driver profile, conversational planner
- Driver analyzer module.

It controls interruption of a dialog between the driver and the car dashboard (for example, interrupting a conversation to deliver an urgent message about traffic conditions on an expected driver route).

**Microphone:**

It picks up the words and separate it using speech recognition software.

**Camera:**

A camera built into the dashboard used to track the lip movement of the driver to improve the accuracy of the speech recognition.
Applications

The following are the applications of the artificial passenger:

- Artificial Passenger is broadly used to prevent accident.
- Prevents the driver, falling asleep during long and solo trip.
- If the driver gets a heart attack or he is drunk it will send signals to vehicles nearby about this so driver there become alert.
- In any problem it alerts the vehicles near by this, so the driver there become alert.
- Opens and closes the doors and windows of the car automatically.
- It is also used for the entertainment.
- It provides a natural dialog car system that understands content of tapes, books and radio programs.
- This system can also be used in other situations such as
  - Security guard
  - Operators at nuclear plants
  - Pilots of airplane.
  - Cabins in airplanes.
  - Water craft such as boats.
  - Trains and subways.
Future Enhancements

To provide us with a shortest-time routing based on road conditions changing because of weather and traffic, information of about the cars on the route, destination requirement (as flight has been delayed or cancelled).
Conclusion

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 a driver safety.

A primary objective of the invention is to provide a system and method for monitoring driver alertness with a single camera focused on the face of the driver to monitor for conditions of driver fatigue and lack of sleep.

A secondary objective of the invention is to provide a system and method for monitoring driver alertness which operates in real time which would be sufficient time to avert an accident.

A third objective of the invention is to provide a system and method for monitoring driver alertness that uses a computer vision to monitor both the eyes and the rotation of the driver's head through video sequences.
Bibliography

✓ L R Bhal et al. “Performance of the IBM speech recognition system

✓ www.freepatentsonline.com/4682348.html

✓ www.slideshare.com

✓ www.about.com

✓ www.answers.com

✓ www.google.com

✓ www.wikipedia.com