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REAL-TIME DRIVING INSIGHTS USING HISTORICAL "ATTENTION LEVEL" DATA FROM GOOD DRIVERS

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ABSTRACT

Proposed herein is a technique that introduces a novel mechanism to increase the effectiveness of new drivers by providing real-time alerts that can be generated by comparing a new driver's attention level with an attention level inferred from a group of good drivers that have safely driven different segments of the new driver's current journey path. This technique of using individual segments versus an entire path increases the availability of good driving data that can be applied to derive useful insights. In one implementation, this augmentation mechanism can be used within a network edge application that may be deployed within a Fog node inside the vehicle. The novelty of this technique is the use of a very recent Electroencephalography (EEG) dataset generated from good drivers who have driven individual segments within a same journey path.

DETAILED DESCRIPTION

Driving is a common and an essential skill developed by humans around the world. The skill development for driving involves a basic theoretical knowledge and intensive practical knowledge that is gained through experience. Often, newcomers learn the skill by taking practical lessons from a driving education specialist. After passing a driving test, they are on their own in the real-world passing through local streets, highways, and congested traffic. An exception to this is younger people such as teens in the 15-17 age range who are typically accompanied by an adult (e.g., family member) for the first few years to provide supervision. After the initial years, teens are also on their own in real-world roads. They learn by making mistakes and sometimes these mistakes are very costly and even result in life loss.

A number of these mistakes are easily avoidable if we have the ability to share real-time best practices to the driver. Current applications in the market provide the ability to track a trip, provide real-time traffic insights, offer best time to travel to avoid congestion, provide the ability to share accidents or incidents among drivers, among others. None of the current applications provide the ability to learn from good drivers who have traveled effectively and safely to provide such information to new drivers who are planning to take trips across the same path used by good drivers in the past.

The ability to compare the current driving performance of a driver traveling a given path with the past driving performance of a community of good drivers who have traveled different segments within the same path may significantly increase the chances of avoiding common mistakes and hence reduces life losses.

This proposal provides a novel mechanism to compare the attention level of a current driver with the attention level of a community of drivers who have traveled different segments between a source and a destination of a route being traveled by the current driver in order to provide real-time useful insights to the current driver if his/her attention level is less than desired. Current applications do not compare a driver's attention level to an always up-to-date attention level dataset of good drivers who have driven a same segment in a journey path.

Researchers have validated that human attention level can be accurately detected by processing Electroencephalography (EEG) signals emitted from neurons in the human brain. EEG headsets that detect and transmit brainwave signals are available in the consumer market. These headsets can transmit data to a local computing device, mobile phone, etc. via a wireless connection. This proposal leverages EEG headsets that are worn both by good drivers and new drivers to determine the attention level of the drivers.

A community of good drivers can opt-in to participate in the data collection process. The data transmitted from the EEG handset worn by good drivers can be transmitted to a local router (e.g., an Internet of Things (IoT) edge device) installed within the car that can be processed by an application (e.g., a "Good Driver Data Collection" application) running as a network edge application. The "Good Driver Data Collection" application can record the attention level data, current date and time, and corresponding GPS locations constantly or on a prescribed basis. When the car reaches the destination, the attention level data for the entire journey can be uploaded to the cloud. Applications running within the cloud can process the data and determine attention level(s) for specific segments between the source and destination.

A mapping of "segment -> attention level value" can be stored for future reference. As additional good drivers travel the same segment, multiple attention level samples may become available resulting in "Segment A -> {AL1, AL2, AL3, AL4, AL5....}". This attention level (AL) sampling data can be further granulized based on the date and time of the day at which a given segment is travelled. Consider an example, as follows:

Segment A travelled between 9:00 - 10:00 AM on a Monday - {AL11, AL12, AL13, AL14, AL15, AL16}

Segment A travelled between 5:00 - 6:00 PM on a Monday - {AL21, AL22, AL23, AL24, AL25, AL26}

Segment A travelled between 9:00 - 10:00 AM on a Tuesday - {AL31, AL32, AL33, AL34, AL35, AL36}

Segment A travelled between 12:00 - 01:00 PM on a Tuesday - {AL41, AL42, AL43, AL44, AL45, AL46}

Segment A travelled between 5:00 - 6:00 PM on a Tuesday - {AL51, AL52, AL53, AL54, AL55, AL56}

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Segment A travelled between 10:00 - 11:00 PM on a 31st December - {AL81, AL82, AL83, AL84, AL85, AL86}

Segment A travelled between 3:00 - 4:00 PM on a 4th July - {AL91, AL92, AL93, AL94, AL95, AL96}

For each segment, each day of the week, each time of day, etc., the mode (the value that appears most often in a set of data) can be determined and used as the minimum recommended attention level. For example:

Segment A travelled between 9:00 - 10:00 AM on a Monday - {AL11}

Segment A travelled between 5:00 - 6:00 PM on a Monday - {AL22}

Segment A travelled between 9:00 - 10:00 AM on a Tuesday - {AL33}

Segment A travelled between 12:00 - 01:00 PM on a Tuesday - {AL44}

Segment A travelled between 5:00 - 6:00 PM on a Tuesday - {AL55}

....

....

Segment A travelled between 10:00 - 11:00 PM on a 31st December - {AL86}

Segment A travelled between 3:00 - 4:00 PM on a 4th July - {AL96}

<u>Driving data comparison processing</u>

Similar to good drivers, new drivers are also to wear the EEG handset. The EEG signal data from a new driver can be transmitted to a local router (e.g., IoT edge device) installed within the car and processed by a "Driving Assistant" application running as a network edge application. The user interface of the application can be made available via a mobile device interface or through an on-board navigational interface within the car. The "Driving Assistant" application could also be integrated with mapping applications. Consider an example, as illustrated in Figure 1, below.

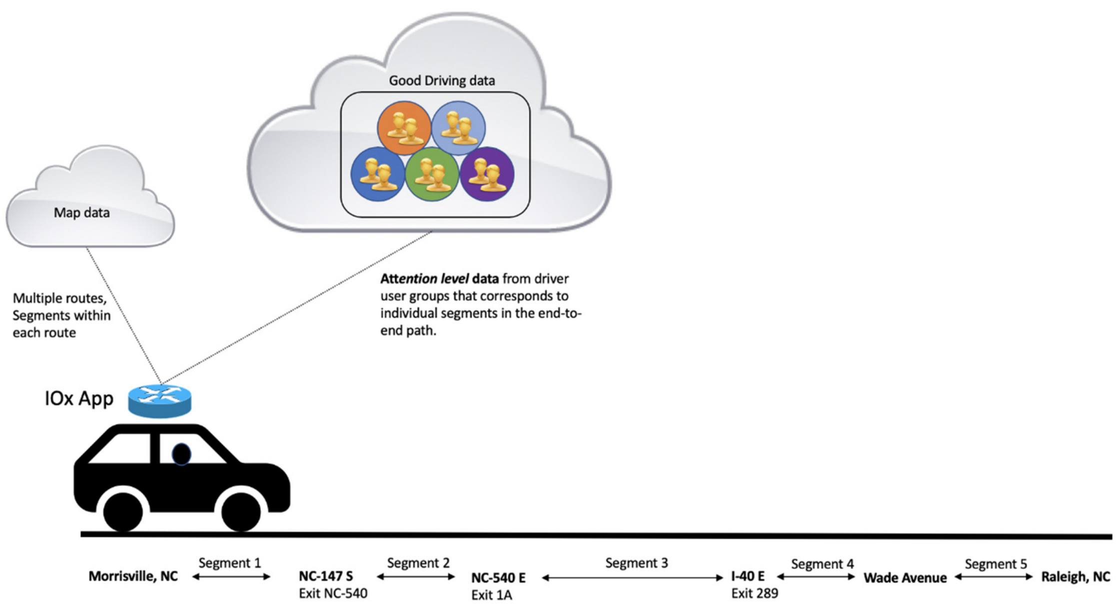

Figure 1 – Multiple segments along the travel path from the source to destination

When the driver begins the journey, he/she inputs a destination location which triggers the "Driving Assistant" application to fetch map data and display one or more routes available to reach the destination from the current location. The driver chooses a particular route and starts the journey. The "Driving Assistant" application sends the complete route information to the cloud that hosts "Good driving data" and retrieves the recommended "attention level" for each segment within the route based on the date, day, time, etc. at which each segment will be travelled. The application can monitor the "attention level" of the current driver received from the local EEG handset and compare it with the recommended "attention level" for the current segment being travelled. If the attention level is less than desired, the application can provide a warning level in the dashboard display and/or as an audio prompt, as shown in Figure 2, for example.

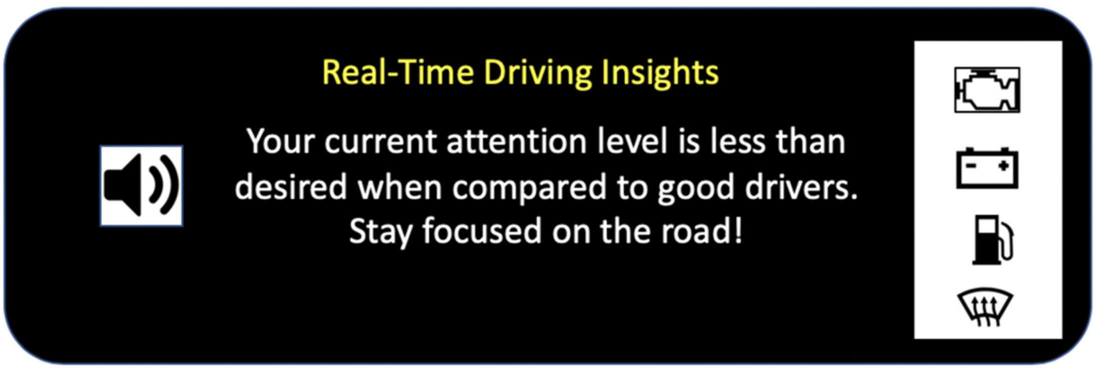

Figure 2: Insights provided to a driver by the augmentation system

In contrast, if the driver’s attention level is more than desired, the application can provide appreciative and/or motivating commentary to the driver to continue driving with the desired attention, as illustrated in Figure 3, below.

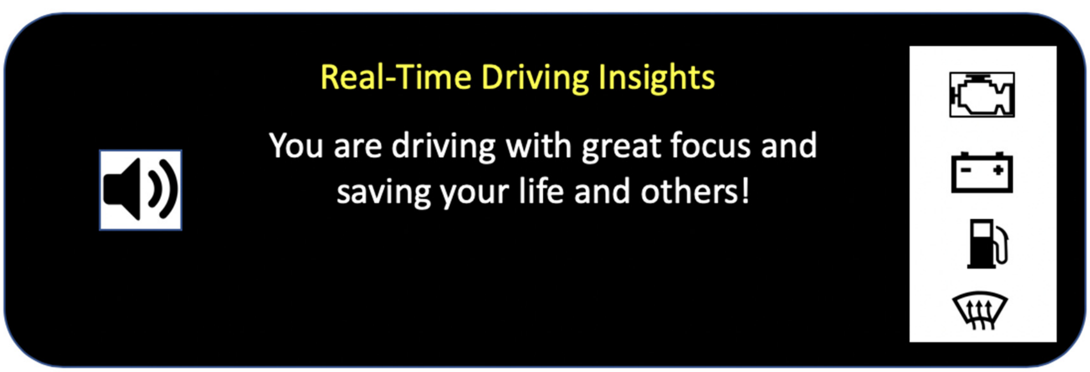

Figure 3: Comments provided to a driver by the augmentation system

If the current driver changes the route (e.g., took a wrong road and hence gets rerouted by the map, changes the destination, etc.), the "Driving assistant" application can send the updated route to the "Good Driving data" source in the cloud in order to retrieve the recommended "attention levels" for the updated segments based on the date, day, time, etc. at which each segment of the updated route will be travelled.

In different implementations, the good driving dataset can be maintained by transportation departments or offered as a service by providers. Good drivers can opt-in to share operational data to the good driving database and the system may not store any personally identifiable information within the dataset. In one implementation, the augmentation mechanism can be used within a network edge application that may be deployed within a Fog node inside the vehicle.

Various advantages may be realized by the technique proposed herein including, but not limited to providing automated, contextually relevant, and useful insights from good drivers, which may serve as a simple, real-time, and scalable mechanism for coaching new drivers. Additionally, the technique proposed herein may provide for reducing the possibility of accidents. Further, the technique proposed herein may provide for reducing human life losses as vehicle crashes are the leading cause of the teen deaths.

Rather than using standalone EEG signals, that may not involve comparison to a dataset retrieved on-demand based on the journey path to detect attention, the novelty of this technique is the use of a very recent EEG dataset generated from good drivers who have driven individual segments within a same journey path, which can be enhanced by various alert functionalities described herein. Further, in contrast to datasets collected from simulated environments, the technique proposed herein provides for collecting datasets from real-world environments in which road conditions, physical structures along a journey path can change over time, etc. Thus, such datasets may provide a more accurate representation of the attention levels of drivers who have driven an exact path in the very recent past as opposed to simulated datasets.

In summary, a technique is proposed herein that introduces a novel mechanism to increase the effectiveness of new drivers by providing real-time alerts that can be generated by comparing a new driver's attention level with an attention level inferred from a group of good drivers that have safely driven different segments of the new driver's current journey path. This technique of using individual segments versus an entire path increases the availability of good driving data that can be applied to derive useful insights.