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Android Operated Smart Automobiles

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ABSTRACT

As we are progressing rapidly towards the modern age in technology and that how automation has been a crucial part of our day-to-day life, in a sense has made us lazy. But as to this context, it has also made our life more secure, safer and seamlessly efficient. Vehicles which were mostly analogue in the structure are presently becoming more digital. Now, automobiles are not only an electronic-mechanical machine but electronic-programmable machine. In this paper, we are proposing to have an android infotainment system for vehicles such as Auto-rickshaws. The 2nd proposed system is the Adaptive Emotion Detection, that would save many lives to come, this would be a third-party application in vehicles. Android operated smart automobiles, is classified into two types, Android Infotainment (Android Automotive Operating System) and Android Auto. Such, systems are low-cost, safer, efficient and much more accurate for transportation, which was provided by Google since its initial investment and idea in 2005. This system will have a standard Android, as an Operating System (OS), which is an open-source, along with apps such as Google Maps, Assistance and other third-party applications.

Keywords: Android auto, Infotainment systems, automotive operating systems, embedded systems, assistance driving mode

1. INTRODUCTION

Development in vehicles by integrating it with new digital systems for safety and efficiency has transpired since 2005, the influential part of which is played by Google. As Android phones have become more powerful in the sense of processor, have extensive storage size, excellent entertainment widgets and possessing faster and cleared communication medium. Where most of the users around the world are using android Google has strived to work and keep investing to make it a common platform for all the automobiles manufactured. In 2005, Google had only implemented client software for proprietary platforms in the vehicle that was Google Earth. Which was a great product then but had its drawbacks related to safety and embedding porting of a desktop application in the client's car was supposed to be the PHASE 1. Then in 2010, which was the PHASE 2, they added cloud-based APIs for mapping a connected vehicle that had partners such as Tesla, BMW, Mercedes and many more for navigation purposes. Following that, PHASE 3 was a Kickstarter as the Android platform was booming, so they unveiled Android in 2014 but implemented in 2015. Which was known as Android Auto, and by 2015 it was the Infotainment platform which had Google assistance, driving mode and much more, that was integrated directly in the car or maybe in the screen of the vehicle [1]. Recently, in 2019, concern with safety, there was an advanced update where it had a touch and wireless support which was much safer as drivers would be able to concentrate while driving.

Since 2005, an initiative taken related to the smart vehicle has been a goal for team Google, as their vision is "a safe and seamless connected experience in every car". Where they have intensely worked on those vision terms 'safe' and 'seamless', that was, presented in the recent Google I/O 2019. Apart from cars we also move to vehicles such as auto-rickshaws which are primary means of transportation in India. They are 3-wheeled vehicles used for public transport. Also, we propose having a 3rd party application in android auto and automotive operating system which is related to Adaptive Emotion Detector to minimize disasters and for safety purpose.

2. PROPOSED SYSTEM

Android has now become a significant part of automotive industries since 2015 since customers won't think about purchasing a vehicle without it having the feature of Android Auto in it. After all Android Auto has become virtually an industry-standard in automotive industries all because of Googles efforts since 2005, android auto was also heavily related to the customers and the OEM choices in the perspective of the automotive industries. OEM which is Original Equipment Manufacturer which in case of, vehicles are those companies that manufacture

vehicle parts and that are assembled and installed by the major automotive industries. So basically, OEM is manufacturing vehicle parts compatible with the android infotainment systems. In the Google, I/O 2014 conference, the first car to be transformed was Kia Soul (manufactured and marketed by the Kia Motors) for the event's purpose which had Android Auto. I/O 2019, was its 6th annual meeting where the Google Assistance Driving mode, was introduced in which there was the concept shared about the Android automotive operating system which is an embedded Infotainment platform. So here we propose to have a system integrated not only for cars but something known as auto-rickshaws in India as it's an essential mean of transportation [11]. Since Google maps, has been launched in Auto-rickshaws, there should be the implementation of an Android automotive operating system. The 2nd part proposed is the applications that developers are developing to enhance the productivity of the Android auto and the Infotainment. Also, the automotive OS in cars which is about the Emotion detection which would be a 3rd party application that will save lives of many drivers, such as to alert the driver when they are too tired or sleepy, intoxicated or in anger mood. This Emotion detection can also be in the Google Assistance Driving mode.

3. OPERATED SMART VEHICLE

The existing systems in mid-range vehicles have a native interface which is analogue such as fuel display indicator, speedometer, signal light indicators, and much more. In case it is digital, they would have their, own proprietary platform which in the years to come would be difficult to update. But due to Android auto, Android automotive operating system and a new system introduced as Assistance Driving mode would be quite beneficial. Android auto is a software application in your smartphone that can be used, in a vehicle, which has become quick and more accurate since then. All of these systems in an automobile, being operated would make it a smart automotive vehicle.

3.1 Android Auto:

Google has a purpose that is having a safe and seamless experience in every vehicle. Their vision is "A safe and Seamless connected experience in every car" [1], which broadly divided into auto momentum and native embedded built. Auto momentum is primarily, growth, hardware, and software. Native embedded built is about vehicles having a widescreen display about navigation, notification and media support. Where one only, needs to connect their Android device and hit the road with four main features know as Google Assistance, Navigation, Communication and Entertainment [5]. Android auto is a software application that, is connected to the vehicle.

3.2 Android Automation Operating System (OS):

This widget is an embedded infotainment platform in Android automotive OS that has been, adopted and extended to be a turn-key platform for in-car Infotainment. As unlike Android auto, this system remains embedded in the vehicle itself for much more intense and seamless experience. Polestar 2 an electric car by Volvo that was introduced in the mid-2019 and supposed to be launched by 2020 [2],[4] is an example of the Android automated operating system. Even if you forget your Android phone, you can use the inbuild Android automotive OS embedded in your vehicle.

3.3 Assistance Driving Mode:

Assistance driving mode is a new concept, where it will overcome the feature of the Android auto where along with touch support it would also have wireless assistance, hence there would be no need for plugging in the vehicle. That would be suggestive where it would operate via voice like the one in your android phone known as the google assistance. The android driving mode would be much safer, improved User Interface (UI) and efficient then, Android auto.

4. ADAPTIVE EMOTION DETECTION

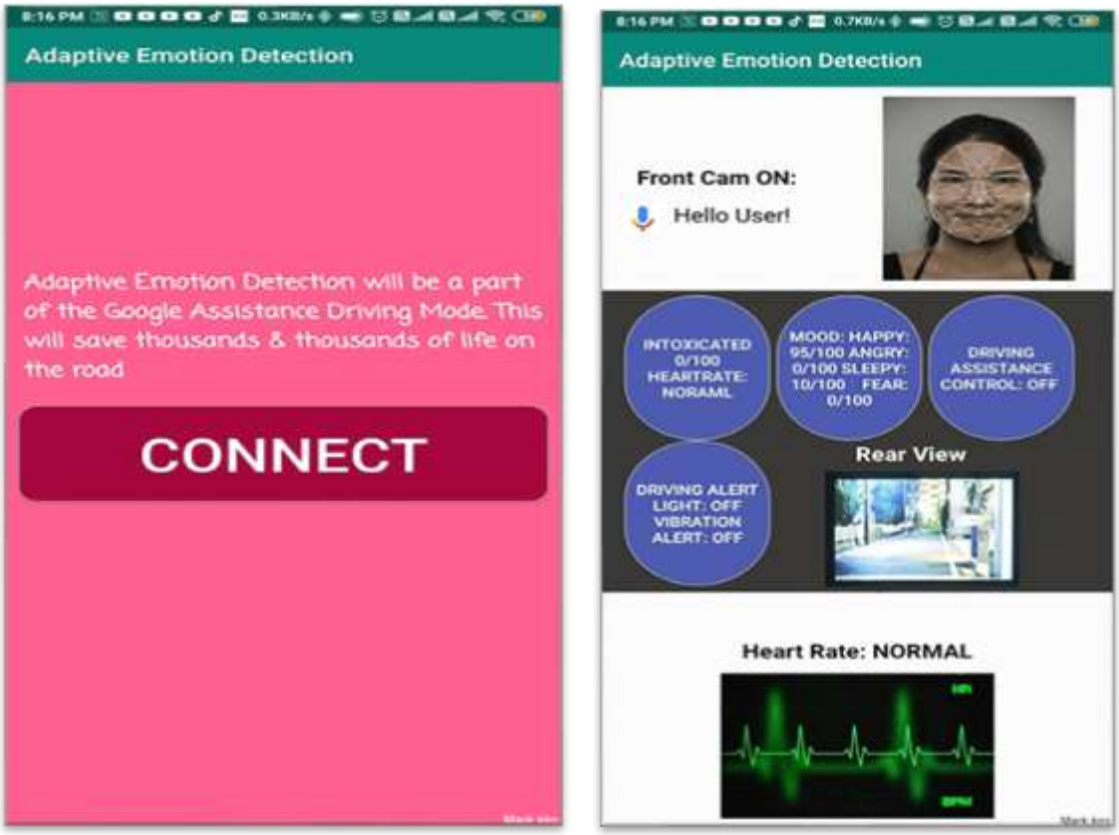

Figure 1: Android application screen layout view

Earlier, we spoke about the 3rd party applications in vehicle, and here Adaptive Emotion Detection (AED) is one of it that we have proposed. This application would be in the Android automated operating system as well as in Google assistance driving mode. This application would be speech and touch supported. The application has an interactive UI, it is simple to use and user-friendly, but the main point of this application is to provide safety while driving. In the case of an unusual pattern in the users face emotion, it would go through its Artificial Intelligence (AI) algorithm to check and react according to it.

Apart from emotions, it would also check for heart rate to give an accurate response to the user and alert him/ her. In the case of driver feeling sleepy, it would provide with vibration to warn as well as give a speech response. It would be able to overtake the driving control, lower the speed and stop the vehicle, which would be same if the driver is intoxicated. If the driver is in an angry mood, it will provide with required help to cheer them up and give, further assistance. You can see the User Interface of the application in figure number 1. The application has features such as,

- Heart Rate: Normal/ Fast/ Abnormal,
- User camera view,
- Vehicle rearview,
- Mood: Happy/Angry/Sleepy/Fear,
- Intoxicated,
- Driving Alert: Vibration/ Light,
- Driving assistance control.

4.1 Components required A and B:

4.1.1 Hardware components,

- Android Operating System
- OBD II, On-Board Diagnosis

4.1.2 Software components,

- Android Studio
- Programming Language, Java, Kotlin or C++
- Different simulators.

5. ANDROID AUTOMATED AUTO-RICKSHAWS

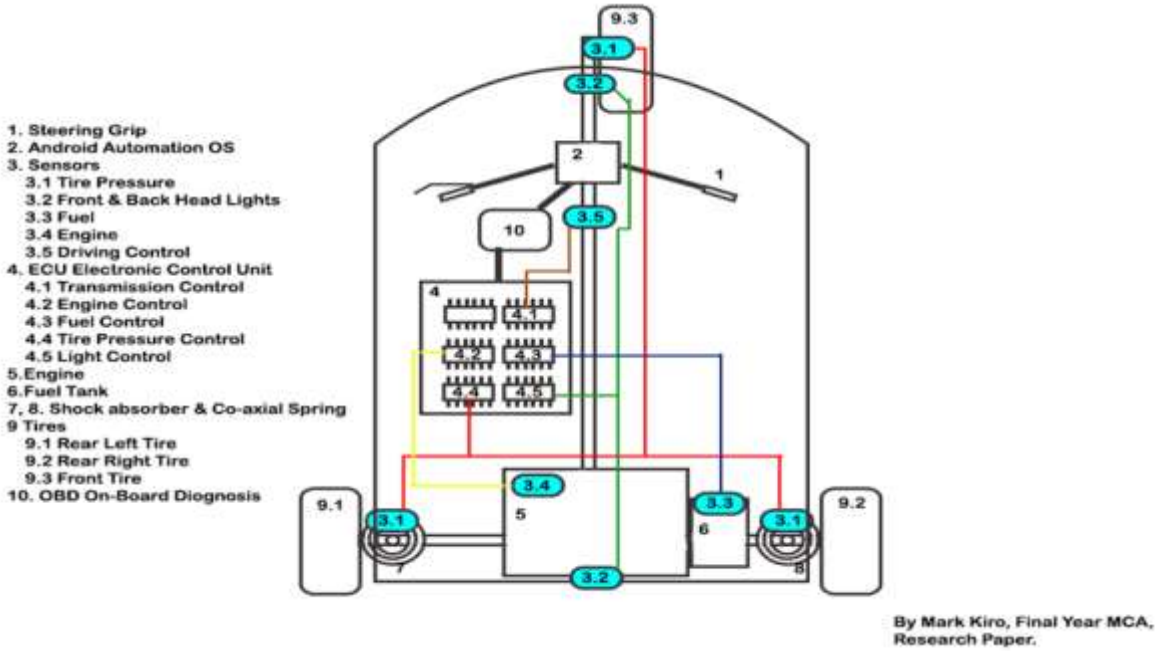

Figure 2: Android OS embedded in auto-rickshaw, Design Model

Android automotive operating system in auto-rickshaws is a new concept proposed, here in figure 2, we can have a look at the design model of an auto-rickshaw having Android system embedded in it. In Delhi, android auto using Google maps have been, implemented in many auto-rickshaws, and one will be able to find such a vehicle using Google maps [10]. The steering drive grip in-between the auto-rickshaw would have a display screen which would be more than 7inch or so, that would provide information about the vehicles fuel capacity, tire pressure, engine performance and much more. The information about the vehicle would be provided by an OBD II device which is a port having several pins used for self-diagnosis and to report capabilities via a port. OBD stands for On-Board Diagnosis, which previous version was the ODB developed in 1980. Some of the function of an ODB II port is as follows,

- Display fuel status,
- Engine statues,
- Speed of this vehicle,
- Detect the sensors via ECU,
- State about various computing units,
- Tire pressure,
- Navigation lights,
- RPM status,
- Throttle position,
- Temperature, and much more.

Engine Control Units (ECU) will have various microprocessors which would provide data from the sensors, in our case there are 5, sensors that is for the tire pressure, light indicators, fuel, engine and driving control. The sensor will also provide data from the motors such as DC motors. Which, would be controlled by transmission, combustible (fuel), light, tire and engine control. This design model will collectively provide seamless experience within the auto-rickshaw and also provide more relevant data to the driver. For example, to check the fuel status on the screen if the driver needs to refuel or not.

6. ARCHITECTURE COMPONENT

Figure 3: Android vehicle architecture component

The architecture component of the automated smart vehicle of the automobile provider which are,

- Android,
- OEM,
- 3rd Party Applications

Automobile provider is the vehicle manufacturing companies which are making their vehicle smart using these components (Android, OEM, 3rd party application). Android, as explained earlier, has become an industrial standard since 2015, it would be available with Application Programming Interface (API) so, data would be coming from the server into the vehicle via this operating system. Then OEM which, is the Original Equipment Manufacturer, they would provide with necessary hardware systems such as OBD II, various ECU's which is the Engine Control Unit and multiple sensors. This system would be installed by the automobile providers that will work according to the Android operating system. The final component is the 3rd party application which is software application such as podcast, streaming applications, music, messaging, maps and also apps such as our proposed Adaptive Emotion Detection (AED). That is developed by developers using various programming languages and, they also have to know a little bit about hardware programming in, the sense to adapt to the OEM systems.

7. DESIGN, DEVELOPMENT AND IMPLEMENTATION

7.1 Design:

The design perspective of an Android operated smart vehicle depends on the 3, factors such as design language, scalability and usability. As, current design languages are, based on the inspiration of the vehicles interior design appearance, where earlier it was pretty general for every vehicle to have the same design and colour combination [3]. Now, most of it depends on a material grey colour values, accent blue and to have typography such as large font and viewable text. All of this creates a minimum distraction for the user or driver. Scalability can be, explained as to adapt to more screen size and inputs such as voice control, touchpad and rotary support. The last factor which is usability is to provide natural extension feeling of the device in the vehicle, to get started faster, get information at a glance, and easier to access apps. This factor all together provides seamless experience during driving. Here we also have provided with the design UI for the 3rd party application, which is the Adaptive Emotion Detective (AED) along with the design model for the android automated auto-rickshaws.

7.2 Development:

Development depends on factors of the OEM products, programming and its hardware, where for the safety purpose of the Android automated vehicle, it has to follow a life cycle which is to detect, warning sign and speed control. This safety factor is for the Adaptive Emotion Detection (AED) that would be a 3rd party application in a vehicle that would provide with valuable information for the market in the form of data. Detection would check for any changes in the user facial and physical changes, according to the changes it would warn the user/ driver. Finally, AED would take speed control and decrease the speed of the vehicle. Whereas auto-rickshaws having an automated system integrated into it would provide with a seamless experience for the driver as well as the passenger, here its development depends on the OEM of this 3-wheeled vehicle and the financial investment. The design model for the Android operated smart auto-rickshaw is, shown in figure number 2.

7.3 Implementation:

There are existing Android In-Vehicle Infotainment (AIVI) systems along with the use of Android auto but, those are still not yet launched for commercial purpose and, as for the emotion detection feature, it is still in the testing phase. The concept of auto-rickshaws having an android infotainment system embedded in it that would be something new for the 3-wheeled vehicle. Figure 2, is the design model that shows how the automotive operating system is, integrated via the OBD II, which will diagnose the physical-system and its sub-system. Which will display it back to the screen to display the fuel availability, tire pressure, distance covered and much more. For emotion detection, figure 1 shows us the Android view that would be the 3rd party application in the Android automotive operating system and the assistance driving mode. Also depends on the OEM products such as to monitor heart rate, vibration in the seat, alerting lights and so on, to manufacture such hardware to be compatible with the software application.

8. CONCLUSION

Soon vehicle would be much safer and seamless to drive, along with valuable data that would be collected, through this. Which is the adaptive emotion detection and android automated operating systems in auto-rickshaws, they would provide with the possibility of new technologies to be developed. The emotion detection feature would provide safety, and Android in auto-rickshaws will provide with a seamless experience. The characteristic of the android auto-rickshaws would become a standard for efficiency plus, the emotion detection application would provide all-in-one support in the assistance driving mode and the automated operating systems.

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