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He obtained his Bachelor Degree in Computer Science from University of Madras and his Master degree in Computer Science from Bharathidasan University and M.E. CSE from ANNA University and Ph.D. in CSE. He has published many papers in referred International and National Technical Journals. Also he has published 3 book chapters in Springer. His thirst in his field made him to publish 13 Patents under his field and 4 Patents are waiting for Grant.

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VLSI Technology for Future Automotive and Mobility System

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ABSTRACT

Since the first introduction of microprocessors in automobiles in the 1970's, the world has witnessed their dramatic growth as well as their contribution to all aspects of vehicle performance. As the global demand for personal mobility continues to grow, the automotive industry needs to accelerate the development of solutions to social issues such as environment, energy security, traffic accidents, and urban traffic congestion.

To address these issues, Most of the OEMs seek out the ultimate goal of "Zero Emission" and "Zero Fatalities" through vehicle electrification and vehicle intelligence. The electric vehicle is a symbol of electrification, where components are fully electrically-powered and controlled. Autonomous driving technologies, such as advanced sensing, dynamic driving context interpretation, vehicle maneuver planning and controls, exemplify vehicle intelligence.

This paper provides an overview of the contribution of VLSI (Very Large Scale Integration) to enhancing vehicle electrification and vehicle intelligence, as well as the perspectives for future mobility systems.

I. INTRODUCTION

Since the first introduction of microcontroller units (MCU) into automobile engine control, the performance of engines has significantly evolved in terms of power, fuel efficiency and emissions.

In addition to engine controls, electronics have seen a wave of expanded functions. Today, the number of electrical control units (ECU) in automobiles has increased to over fifty, Thus reaching ~40% of Total Car Cost as shown in Fig. 1

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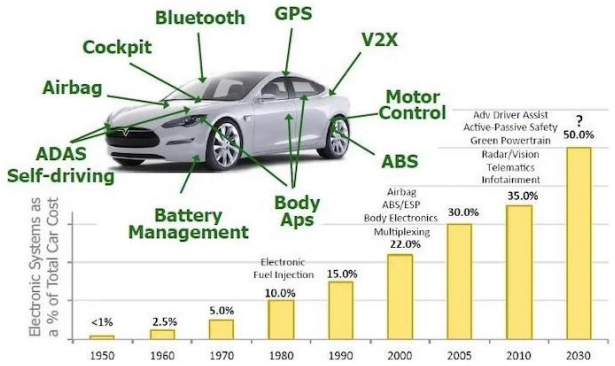

Fig. 1. Evolution of ECUs and their Cost share

One hundred and ten years has passed since the advent of mass-production of automobiles. Current annual production volumes already exceed eighty million, and automotive markets are expected to grow even further. However, with the progress of motorization, automotive systems face serious social issues, such as energy security, global warming, urban congestion, and traffic accidents. Fig. 2 shows the increasing trend in energy consumption [1].

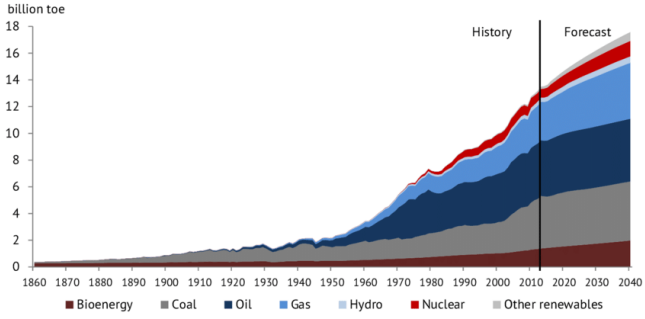

Fig. 2. Energy Consumption Scenario

Energy consumption has tripled in thirty years, yet most sources of energy are still based on fossil fuels. According to IPCC (Intergovernmental Panel on Climate Change), global mean surface temperature has increased about 1 degree Celsius since pre-industrial times caused by anthropogenic greenhouse gas (GHG) emissions [2]. Fig. 3 shows the trend in global average temperature since 1894. As for urban congestion, we estimate that the resulting global financial loss has reached over 500 billion dollars. Lastly, the World Health Organization (WHO) reported that there were 1.35 million road traffic deaths globally in 2018 [3].

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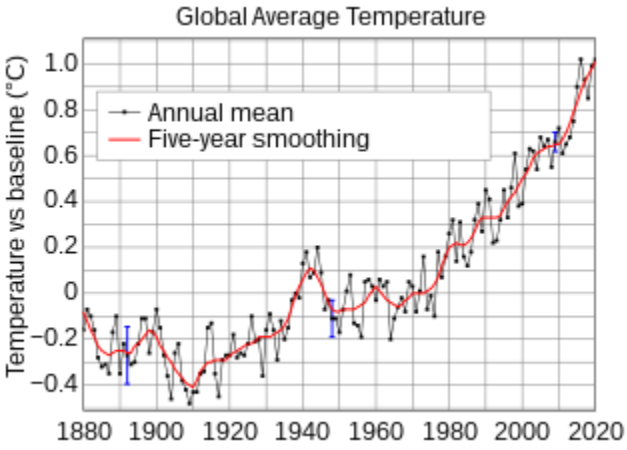

Fig. 3 Global Average Temperature [2]

Every Automotive OEM and it's System Supplier believes that the key to solving these issues is "Vehicle Electrification" and "Vehicle Intelligence".

II. VEHICLE ELECTRIFICATION

Vehicle electrification has potential to accelerate the reduction of CO2 by leveraging energy efficiency (Fig. 4). In addition, electrification encompasses a diverse array of energy sources, for example, electricity and hydrogen generated from fossil fuels, solar, wind, nuclear, and biomass. On the other hand, conventional internal combustion engine vehicles (ICEV) and hybrid vehicles (HV) are only able to use oil as an energy source (Fig. 5). To reduce CO2 levels, we need to reduce the use of fossil fuels.

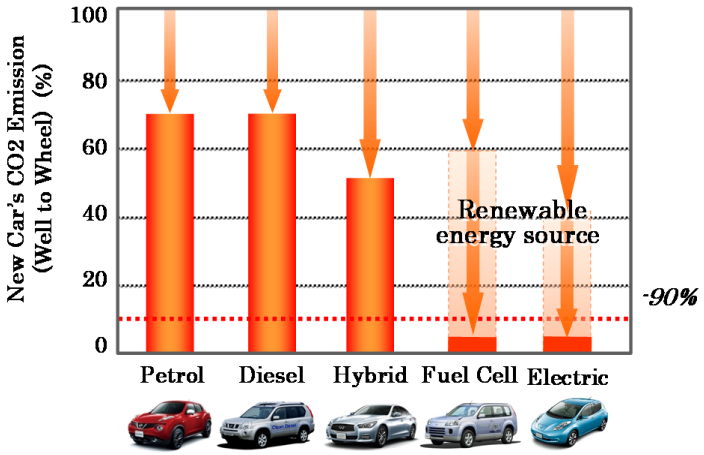

Fig. 4. Opportunities to reduce CO2 emissions

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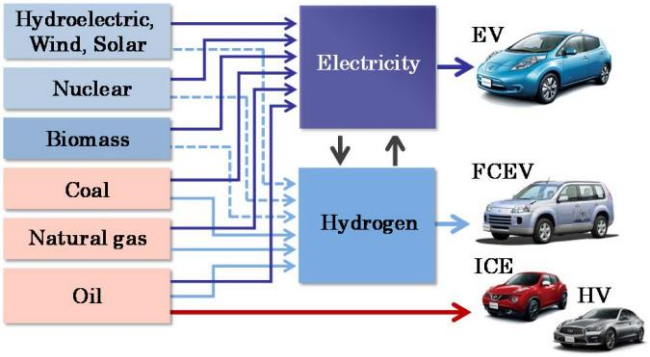

Fig. 5. Energy source diversity by vehicle type

Therefore, the new Automotive Powertrain strategy emphasizes the conversion from fossil fuels to renewable energy sources. An embodiment of this mindset, Most of the Global OEMs released all-electric vehicles (EV) and some of the Globally best-selling EVs in 2021 are provided for reference [4]. The key devices of electrification are the inverter and battery controller, which will be the key components in the new frontier of LSI (Table 1) as represented in (Fig. 6) EV System.

Table 1. Key devices of electrification

Key Device	Function
Inverter	● Output Control ● Regeneration Control
Battery Controller	● Status Monitoring ● Protection ● Failsafe

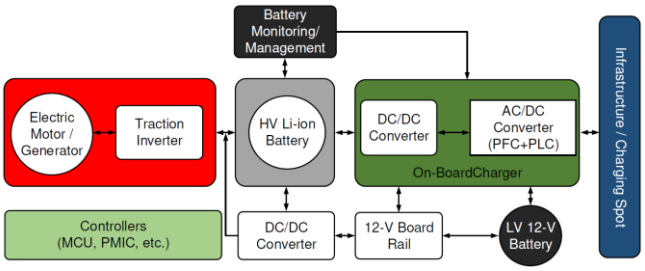

Fig. 6 Blocks within an EV System [5]

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The Key components, in an EV system that requires miniaturisation, higher efficiency, lower power dissipation and cost reduction through VLSI are

1. Power Management IC (PMIC)
2. Microcontroller (MCU)
3. High Power IGBTs or SiC MOSFETs
4. Sensing & Monitoring blocks
5. Various Protection & Isolation circuits

The Simplified Block diagram of this whole system is represented in Fig. 7. The switches are controlled via the MCU and isolated gate drivers for the high side (HS) and low side (LS) of the inverter leg. The PWM signals are commonly generated using the space vector modulation (SVM) scheme. As the motor operates, the voltage, current and position signals are sensed and fed back to the controller to modify the modulation of the inverter. One such feedback method is field oriented control (FOC).

A good modulation scheme, fast feedback and accurately sensed signals are required for efficient motoring [5].

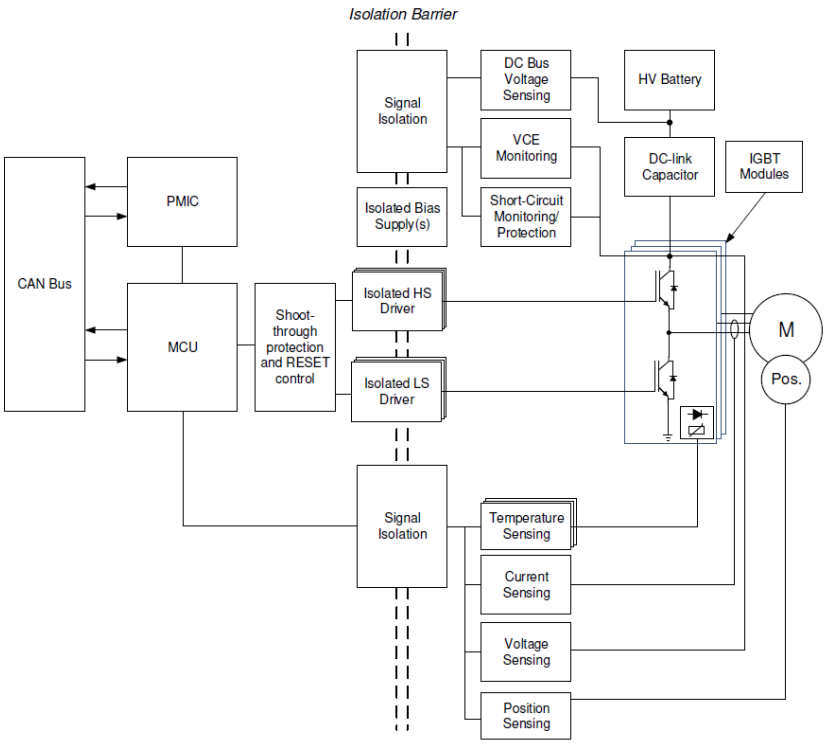

Fig. 7 EV Inverter Block Diagram [5]

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III. VEHICLE INTELLIGENCE

Reports show that more than 90% of traffic accidents are caused by the driver [6]. To aid the driver and reduce human error, more than 20 years ago, OEMs started development of the "Safety Shield" concept whereby the vehicle leverages various barriers, from normal driving to post-accident, to provide continuous support against dangerous situations. The result of these efforts includes some groundbreaking technologies, such as (Fig. 8)

1. Around View Monitor
2. Lane Departure Prevention
3. Back-up Collision Intervention
4. Forward Emergency Braking
5. Blind spot detection etc.,

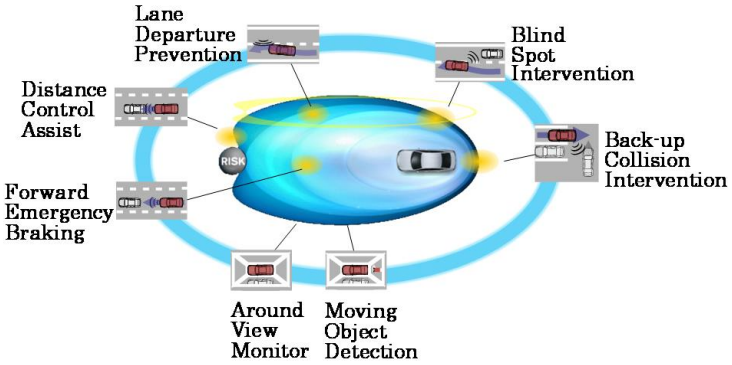

Fig. 8. All-around SAFETY SHIELD technologies

To further improve safety, OEMs are progressively launching even more autonomous driving technologies to enable safe autonomous driving in a single lane on congested highways in the coming years. This will include risk-avoidance and lane-changing functions, which facilitate driving on multiple-lane roads.

For autonomous driving, the core technology functions to support or replace the driver's actions include sensing, cognition, decision, and actuation by on-board systems. Fig. 9 shows the on-board cameras, sensors and actuators required for autonomous diving.

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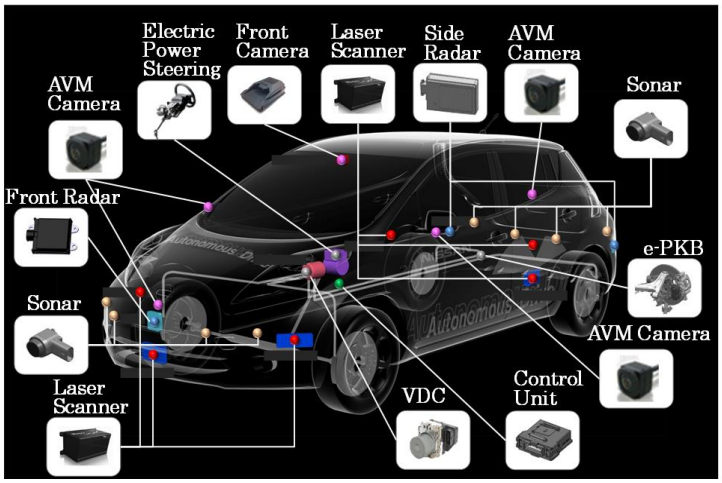

Fig. 9. Key devices for autonomous driving

Needless to say, a "brain," mapping out a driving plan, is needed for processing the information from various sensors, predicting the behavior of surrounding traffic, and deciding the next actions.

In addition to these four core functions, an evolution of supporting technologies, such as human machine interface (HMI), map, connectivity and E/E architecture, is necessary. Positioning accuracy required for driving in urban areas is reported to be about 20 to 30 cm. Therefore, navigation maps must be so precise that they are on a three-dimensional level.

Additionally, to support unexpected situations that may arise during autonomous driving, dynamic information, such as weather and traffic conditions, should be reflected in real time.

Furthermore, over-the-air (OTA) updates would be necessary to immediately address changes in the environment such as traffic regulations. Because of the connection with the outside network, the on-board electrical/electronic architecture (E/E architecture) must have a security system.Lastly, a further explanation of the details of human machine interface (HMI) is needed. Autonomous driving systems would not completely replace the driver. The driver must still take full driving responsibility. This is why HMI is imperative for autonomous driving. The system should be designed such that it requires relatively little eye movement and the driver is fully aware of the vehicle's behavior at all times.

Full-TFT meter consoles with 3D graphics and heads-up display (HUD) systems, exhibiting higher CPU and GPU performance than conventional displays/cockpits (Table 2) are required to realize full communication between the driver and the vehicle.

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Table 2. Requirements for HMI

Description	Present Vehicles	Autonomous Vehicles
Cockpit type	Analog/Digital meter display	Full TFT cockpit display
CPU	100 MHz	2 GHz
Memory	4 MB	4 GB
GPU	No 3D graphics	3D graphics

IV. INTELLIGENT MOBILITY

In addition to vehicle electrification and vehicle intelligence, OEMs believe that connectivity between vehicles and social infrastructures will be imperative.

One example of the connectivity with social infrastructures is shown in Fig. 10. Today, in the Hawaiian island of Maui, the supply of electricity by wind power exceeds demand during nighttime and early morning hours.

In order to solve the mismatch between supply and demand, several hundred Nissan LEAFs are participating in test studies to charge on-board batteries when supply exceeds demand and discharge to the grid during peak demand hours [7]. In addition, Hawaii and the U.S. The Department of Energy reaffirmed their commitment to the clean energy initiative in 2014, which leads the way in eliminating the dependence on oil by setting the goal of achieving 100% renewable energy by 2045 [7]. This surplus in electricity should continue to vastly grow, therefore we estimate that it is possible to shift the supply-demand peak using 16,000 Nissan LEAFs, which is equivalent to one-third of all passenger vehicles in Maui.

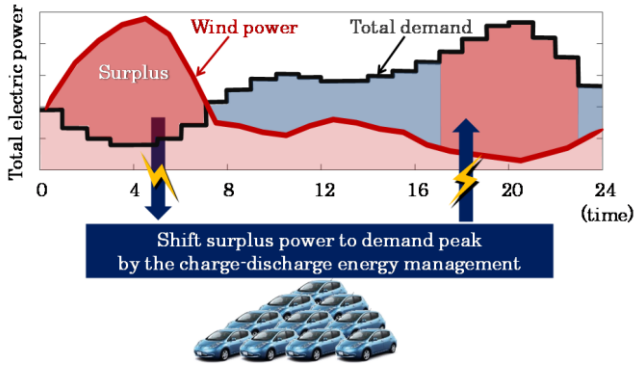

Fig. 10. Trend of supply and demand of electricity in the Hawaiian island of Maui

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Another example of the link with social infrastructure is traffic control. Traffic congestion is often the result of a chain of events caused by reduced speeds from variations in the grade of the highway. As vehicles are forced to get closer together, abrupt speed changes cause shock waves to form in the traffic stream, rippling backward and causing even more vehicles to slow down.

An effective way to avoid this type of traffic congestion would be to control the speed of each vehicle as well as the distance between them using a "*vehicle to infrastructure*" (V2I) system (Fig. 11).

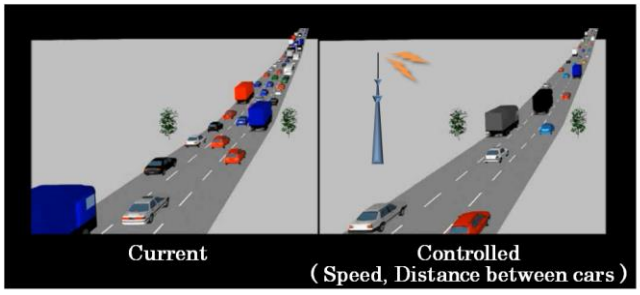

Fig. 11. Simulation of traffic on the Tomei Expressway in Yamato city, Japan

V. SUMMARY

This paper provides an overview of intelligent mobility realized by vehicle electrification and vehicle intelligence. In addition, it suggests new application opportunities for VLSI, such as electric powertrain, battery, sensors, camera, AI and connected vehicle management systems. LSIs must be optimized to vehicle application in response to growing automotive demand.

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Online Monitoring For On-Board Diagnostics Parameter (Software Module)

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1. ABSTRACT

OBD (On Board Diagnostics) is one of critical tool used for the emission control in today's automobiles. OBD generates fault codes when any system/component non-compliance is detected. Commercially available tools fetch fault codes from OBD and are providing only limited information/access of basic data to engineers. These tools are black box type of tools which provide very limited flexibility. Also the data storage capacity of these diagnostic tools is very limited. This paper informs about new indigenously developed OBD scanning tool which provides complete access to engineers, good flexibility and large storage capacity with added features like time and cost saving.

Keywords: *Automobiles, Emission control, Good flexibility, Large storage capacity, OBD scanner*

2. INTRODUCTION

Computer programs and embedded systems have been part of the cars from long time. Most of the car owners are not aware the price of the second-hand car is decided based on the information available on these computers using wired and wireless technology for car users has become very easy. This information available in cars can be seen by the owner with the help of their smartphone and cloud technologies. As per the recent changes in the automobile industry paradigm, automobiles are mandatory to develop on eco-friendliness, safety etc…As many additional services and safe and convenient automatic internal control system have been introduced to provide more comfort and safety of the customers. The benefits of OBD are encourages design of durable and robust emission control systems and helps keep emissions low by identifying emission controls in need of repairs. The most one of the OBD is works for life of the vehicle.

3. METHODOLOGES

3.1ON-BOARD DIAGNOSTIC (OBD)

On Board Diagnostic is a comprehensive electronic system, which detects exhaust emission related failures in passenger vehicles, light duty trucks and heavy duty vehicles, which run on combustion engines. These types of engines produce toxic exhaust emissions like HC, CO, and soot. The amount of these emissions is regulated by law in many countries (see emissions regulation map). To fulfill these legal requirements, complex exhaust emission control and cleaning systems are installed by OEMs. These systems and the related components have

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to be monitored by a so called On Board Diagnostic system. The OBD laws require that all components and subsystems which have an emission impact and which are connected to an Engine Control Unit (ECU) need to be monitored and diagnosed. The components can be divided into:

Sensors: O2 sensor, temperature sensors, pressure sensors, etc.

Actuators: Fuel injectors, ignition coils, throttle blades, EGR valve, etc.

On the system side, several subsystems have to be monitored such as a malfunction of a complete subsystem which leads to a certain emission increase. Such subsystems are:

- ✓ Fuel Injection System
- ✓ Ignition system
- ✓ Exhaust gas cleaning system

The law requires only diagnostics on components which lead to an increase of exhaust emissions. However, failures of components which lead to a degradation of the OBD diagnostic system have also to be detected.

3.2 AZURE IOT CLOUD

IoT Hub is a managed service hosted in the cloud that acts as a central message hub for communication between an IoT application and its attached devices. You can connect millions of devices and their backend solutions reliably and securely. Almost any device can be connected to an IoT Hub.

3.3 MQTT INTEGRATE

MQTT is a publish/subscribe protocol that allows edge-of-network devices to publish to a broker. Clients connect to this broker, which then mediates communication between the two devices.When another client publishes a message on a subscribed topic, the broker forwards the message to any client that has subscribed.

4. SOFTWARE DESIGN

4.1 ANGULAR

Angular is an application design framework and development platform for creating efficient and sophisticated single-page apps. Angular is a development platform, built on TypeScript. As a platform, Angular includes:

- ✓ A component-based framework for building scalable web applications.
- ✓ A collection of well-integrated libraries that cover a wide variety of features, including routing, forms management,client-server communication, and more.
- ✓ A suite of developer tools to help you develop, build, test, and update your code.

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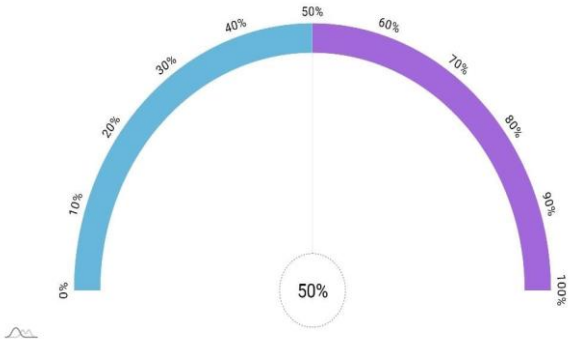
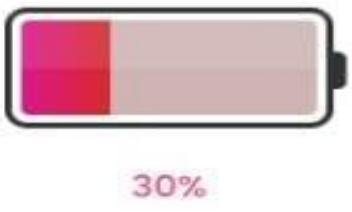
ANGULAR

4.2 AM CHARTS

AM charts is an open-source tool, build on top of our JavaScript Maps and JavaScript Charts products.



Animated gauge Vehicle Speed



Battery

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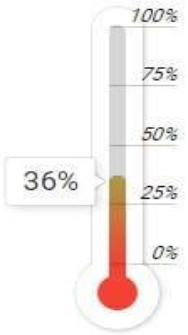
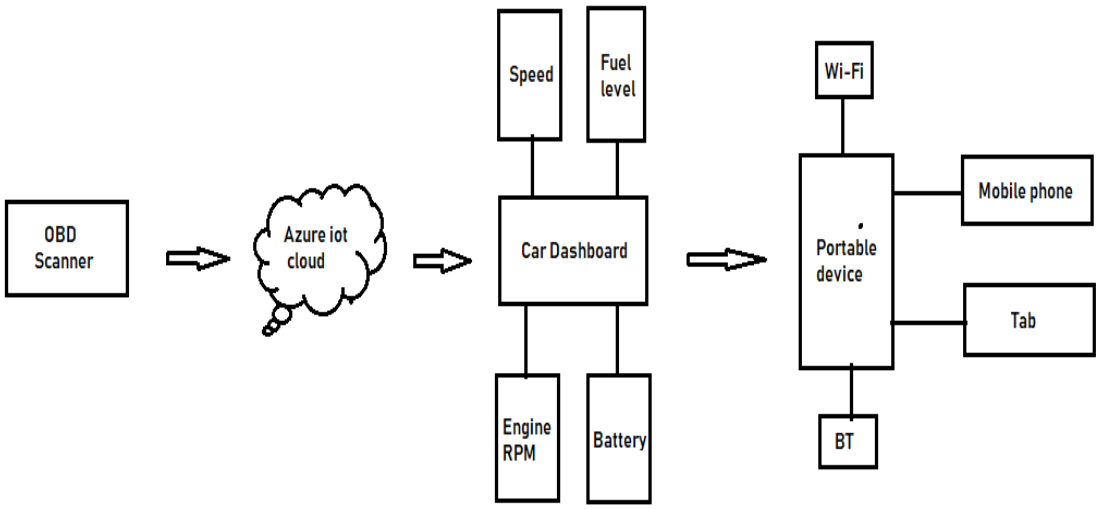


Thermometer

Engine RPM

5. BLOCK DIAGRAM



Block diagram of the On-Board Diagnostics

6. CONCLUSION

The OBD port still remains important to vehicle health, safety and sustainability. Although the number and variety of connected devices for vehicles increases, not all devices report and track the same information.

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Vehicle's diagnostic get much attention from industry and researchers in recent years. The variety and heterogeneity of vehicle diagnostics implementation has been the major reason which makes it interested. This paper presents a technique to analyse diagnostics from vehicle that connected to OBD and process the diagnostics data using Raspberry Pi. People can also send a command to their own vehicle by using this application. Although the process occurs only the delivery of vehicle diagnostic data to user's smartphone, Raspberry Pi is more suitable viewing the ability of Raspberry Pi that can be multitasking. In the future research that related to OBD scanner, its recommended to use OBD scanner with Bluetooth rather than Wi-Fi, because it's more energy saving, easier to use and more stable.

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ONLINE MONITORING OF OBD PARAMETERS (HARDWARE MODULE)

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ABSTRACT

Our project presents the design and development of On-Board Diagnostic (OBD) device for cars and its working was based on OBD-II standards defined by SAE. Our device shows the real-time status of vehicle's systems and sub-systems including engine speed rpm, coolant temperature, pressure etc, and Diagnostic Trouble Codes (DTCs).The software used in this system has been primitively developed which shows the faults in the system. This device helps the user to understand real-time status of vehicle as well as it makes easier to check the malfunctioning in vehicles systems and subsystems by displaying Diagnostic Trouble Codes DTCs

***Key Words*: automotive, connected cars, parameters, cloud**

1. INTRODUCTION

OBD stands for On-Board Diagnostics.OBD is a computer based system designed to reduce emissions by evaluating the performance of major engine components. The system also monitors the performance of the ignition system and transmission operation. It generally functions by placing different kinds of sensors in vital areas of the vehicle. The system reports back to the diagnostic system whether those specific areas are working perfectly .On-Board Diagnostics is a computer system inside the vehicle that tracks and regulates the performance. The computer system collects information from the network of sensors inside the vehicle, which the system can then use to regulate or alert the user about the performance of the vehicle.

2. METHODOLOGIES

RASPBERRY PI

Sometimes you need to access a Raspberry Pi without connecting it to a monitor Perhaps the Pi is embedded in something like a robot, or you may want to view some information from it from elsewhere. Or perhaps you simply don't have a spare monitor! You can connect to your Raspberry Pi from another machine. But in order to do so you'll need to know its IP Address. Any device connected to a Local Area Network is assigned an IP address. In order to connect to

your Raspberry Pi from another machine using SSH or VNC, you need to know the Pi's IP address. This is easy ifyou have a display connected, and there are a number of methods for finding it remotely from another machine on the network.

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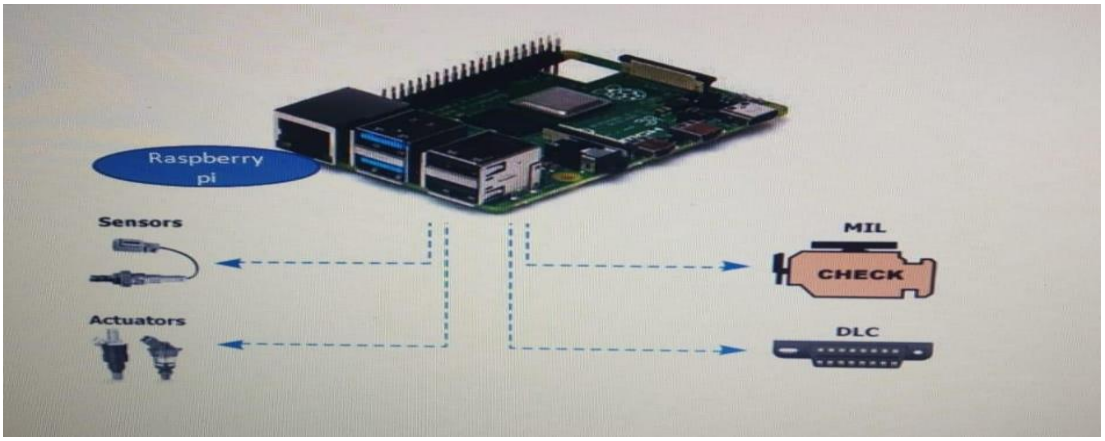

A system in the engine's on-board computer that monitors the performance of almost every emission-related component for malfunctions. When a malfunction is detected, information about the malfunctioning component is stored. Technicians can download the information with a "scan tool" to help fix vehicle. A basic OBD system consists of a Raspberry Pi, which uses input from various sensors (e.g., oxygen sensors) to control the actuators to get the desired performance. The "Check Engine" light, also known as the MIL (Malfunction Indicator Light), provides an early warning of malfunctions to the vehicle owner. A modern vehicle can support hundreds of parameters, which can be accessed via the DLC (Diagnostic Link Connector) using a device called a scan tool. A mechanic who wanted to access diagnostic information typically had to buy a tool for every different vehicle make. OBD-I scan tools that support multiple protocols are supplied with an array of different adapter cables. It is a computer-based system originally designed to reduce emissions by monitoring the performance of major engine components.

RASPBERRT PI SIMULATOR

Raspberry Pi simulator that allows users to write code to control emulated hardware, and that currently lets users interact with an LED and collect data from a sensor. The simulator shows a graphic of a Pi wired to a combined humidity, temperature, pressure sensor and a red LED via a breadboard, a plug board that allows circuits to be wired together rapidly. Users can type in a side panel to enter Node.js JavaScript code, which can be used to control the LED and collect dummy data from the simulated sensor. That code can be executed using a command line at the base of the panel

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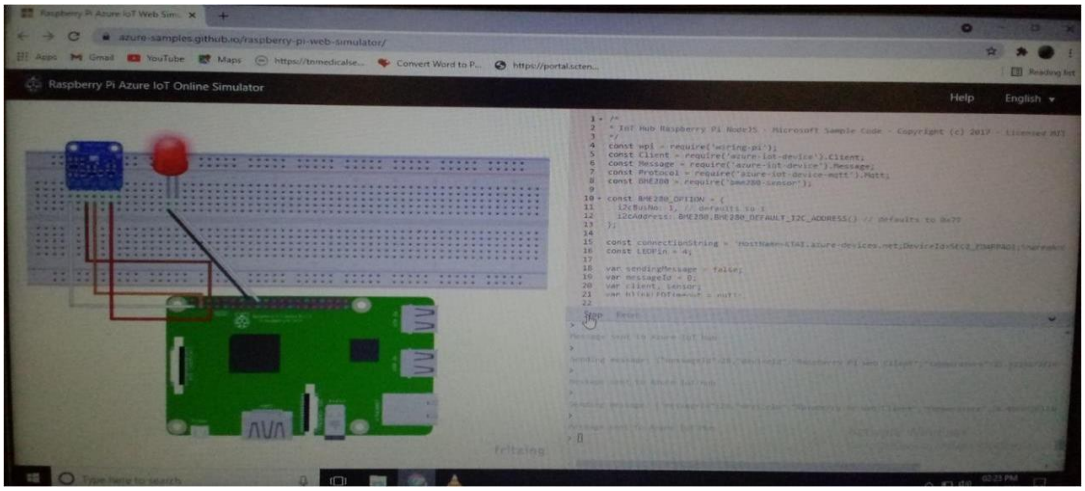

PYTHON: Python is a powerful programming language that's easy to use easy to read and write and, with Raspberry Pi, lets you connect your project to the real world. Python syntax is clean, with an emphasis on readability, and uses Standard English keywords.

3. ON-BOARD DIAGNOSTICS

OBD stands for On-Board Diagnostics.OBD is a computer based system designed to reduce emissions by evaluating the performance of major engine components. Implementation began in 1994and Full Implementation achieved in 1996 Over 150 million ,OBD II-equipped vehicles operating in the United States today.Vehicle Applications (< 14,000 pounds) Passenger cars, Light-duty trucks, Medium-duty vehicles and engines. OBD requirements adopted for heavy-duty vehicles in 2005 (HD OBD, > 14,000 pounds) and Full implementation in 2013. On Board Diagnostic is a comprehensive electronic system, which detects exhaust emission related failures in passenger vehicles, light duty trucks and heavy duty vehicles, which run on combustion engines. A system in the engine's on-board computer that monitors the performance of almost every emission-related components for malfunctions Uses information from sensors to judge performance of emission controls o Sensors do not directly measure emissions Mostly software that runs diagnostics in the background.

OBD PARAMETERS (Monitor)

- Battery Level
- Fuel Level
- Tyre pressure
- Coolant temperature
- Oil level
- Engine Speed
- Engine rpm
- Brake system
- Emergency assistance

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ALGORITHM / TECHNIQUES / TOOLS USED

On Board Diagnostic using algorithm Tools are used:

- OBD Scanner
- Portable devices
- Remote system
- OBD Module

BLOCK DIAGRAM

BASIC OBD PROCEDURE

- System waits for right monitoring conditions
- Observes Signals Entering the Computer
- Directly from the component/system, or
- Related to performance of component/system
- Verifies Performance /Functionality / Rationality
- Malfunction criteria
- Notifies Driver of Fault
- MIL illumination
- Unique fault code storage
- Freeze frame information

BENEFITS OF OBD

- Encourages design of durable and robust emission control systems
- Helps keep emissions low by identifying emission controls in need of repair
- Provides for effective/inexpensive emission inspections
- Works for life of the vehicle

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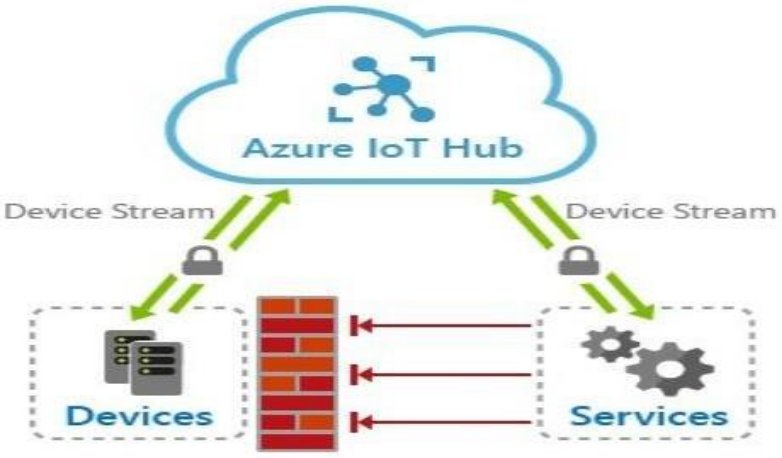
4. AZUREIOT CLOUD

Azure IoT Hub is Microsoft's Internet of Things connector to the cloud. It's a fully managed cloud service that enables reliable and secure bi-directional communications between millions of IoT devices and a solution back end. ...

Cloud-to-device messages let you send commands and notifications to your connected devices.

Azure IoT Hub provides a cloud-hosted solution back end to connect virtually any device. Extend your solution from the cloud to the edge with per-device authentication, built-in device management and scaled provisioning. In cloud-to-device messages, reliably send commands and notifications to your connected devices and track message delivery with acknowledgment receipts. Automatically resend device messages as needed to accommodate intermittent connectivity. Azure IoT Hub is a Platform-as-a-Services (PaaS) managed service, hosted in the cloud that acts as a central message hub for bi-directional communication between an IoT application and the devices it manages. Azure IoT. Connect devices, analyze data, and automate processes with secure, scalable, and open edge-to-cloud solutions. Help safeguard physical work environments with scalable IoT solutions designed for rapid deployment. IoT security. Strengthen your security posture with end-to-end security for your IoT solutions.



5. RESULT

When a malfunction is detected, information about the malfunctioning component is stored Technicians can download the information with a “scan tool” to help fix vehicle Information also used by Smog Check inspectors Information is communicated in a standardized format so one tool works with all vehicles (SAE and ISO standards)

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6. PROPOSED SYSTEM

- Our system previously indicates the failure of the parameter which are monitor by using sensors. hence, wecan avoid the huge failure and accidents of the vehicles.
- This System Proposed Before going to the repair station you can try to know and repair the vehicle in advance in this system using online mode.

7. CONCLUSIONS

This project describes about On-Board Diagnostics and Driver Profiling to the user. The project proposes the use of an Android application to fetch and display the Diagnostics Trouble Codes (DTC) from the car Engine Control Unit (ECU) and thereby facilitates self-car maintenance. The proposed android application processes hexadecimal data of the DTC stored in the car ECU and presents them in a user-readable manner to the user. The proposed android application is also capable of providing a simple, immediate and cost-effective profile of the driver's behavior. This proposed method is by means of tracking GPS co-ordinates of the moving car resulting in a Driver Score. The Driver Score defined as the probability risk of the driving behavior leading to an accident for the observed trip for this approach. This project also proposes an alternate, detailed and novel approach to profile the driver visually and analytically using Machine Learning and Data Analytic techniques. The proposed driving behavior analysis method [3:17 pm, 14/01/2022] : utilizes OBD interface to collect a number of critical driving operation data, i.e., vehicle speed, engine speed (RPM), throttle position, and calculated engine load. The driver behavior is profiled visually using K-means clustering algorithm along with the Elbow method to engine speed and vehicular speed. The visualization assists the user to interpret bad driving behaviors. The driver‘s behavior is profiled analytically by setting thresholds to engine speeds, throttle valve and engine load resulting in a Driver Score. The Driver Score is defined as the percentile of bad driving behaviors over the observed period. The results from all the proposed approaches assist the user.

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Online Networking Dashboard for Monitoring Vehicles

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ABSTRACT

The automotive industry is facing new and pressing challenges. The automotive industry is a major industrial and economic force worldwide. Safety is important concern too, keeping your car in good condition. A connected vehicle can send information and also connect to the emergency services in case of an accident. A constellation computer chips and sensors placed throughout a connected car collect a performance data, which is processed in the cloud to predict when a part might require maintenance. Automotive electronic system that provides vehicle self-diagnosis and reporting capabilities. Computer system inside of a vehicle that tracks and regulates of a vehicle that tracks and regulates a car's performance. Computer system collects information from network of sensors inside the vehicle, which the system can then use to regulate car or alert the user to problems. The rising trend of Autonomous Things is largely driven by the move towards the Autonomous car, that both addresses the main existing safety issues and creates new issues. The autonomous car is expected to be safer than existing vehicles, by eliminating the single most dangerous element - the driver. The parameters monitoring modules grant a way to automatically updating of the vehicle's condition to the user through which the user can be never bothered about the health of the vehicle. It reduces the stress of the users about the vehicle and ensures protection of the vehicle.

Keywords*: *Automotive, Cloud, Connected cars, Multiple devices, Parameters.

1. INTRODUCTION

The tangible devices connect and interact with each other over a wireless network. Connected objects (or things) share data with each other and operate without any intervention by humans. The possibilities that technologies bring for the automobile industry are really immense. Connected cars facilitate fast transmission of data and increase drivers' response time through enhanced vehicle communication. The sensors embedded in different components of a car collect data and share it to a platform. This data is then processed by an algorithm that can analyze the future outcomes of the component based on its performance. It also helps a person to take necessary steps to prevent its car parts from sudden breakdown. Just like dashboard indicators of a vehicle, this system alerts the driver about probable malfunctions. By using these technologies, a person can confirm the performance of its vehicle and repair its car parts before they break. Using OBD scanner to collect the sensed

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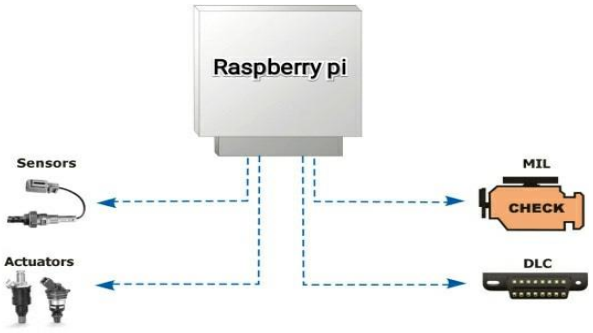
data and these data will sent to the cloud for analyze the performance. Using MQTT integration, we can analyze multiple devices data and shared to the service room and the owner of the car. Connected cars are generating car data attributes that specify location, engine status, speed, and much.

2. BLOCK DIAGRAM

3. METHODOLOGIES

3.1 On-Board Diagnostics

A system in the engine's on-board computer that monitors the performance of almost every emission-related component for malfunctions. When a malfunction is detected, information about the malfunctioning component is stored. Technicians can download the information with a "scan tool" to help fix vehicle. A basic OBD system consists of a Raspberry Pi, which uses input from various sensors (e.g., oxygen sensors) to control the actuators to get the desired performance. The "Check Engine" light, also known as the MIL (Malfunction Indicator Light), provides an early warning of malfunctions to the vehicle owner. A modern vehicle can support hundreds of parameters, which can be accessed via the DLC (Diagnostic Link Connector) using a device called a scan tool. A mechanic who wanted to access diagnostic information typically had to buy a tool for every different vehicle make. OBD-I scan tools that support multiple protocols are supplied with an array of different adapter cables. It is a computer-based system originally designed to reduce emissions by monitoring the performance of major engine components.



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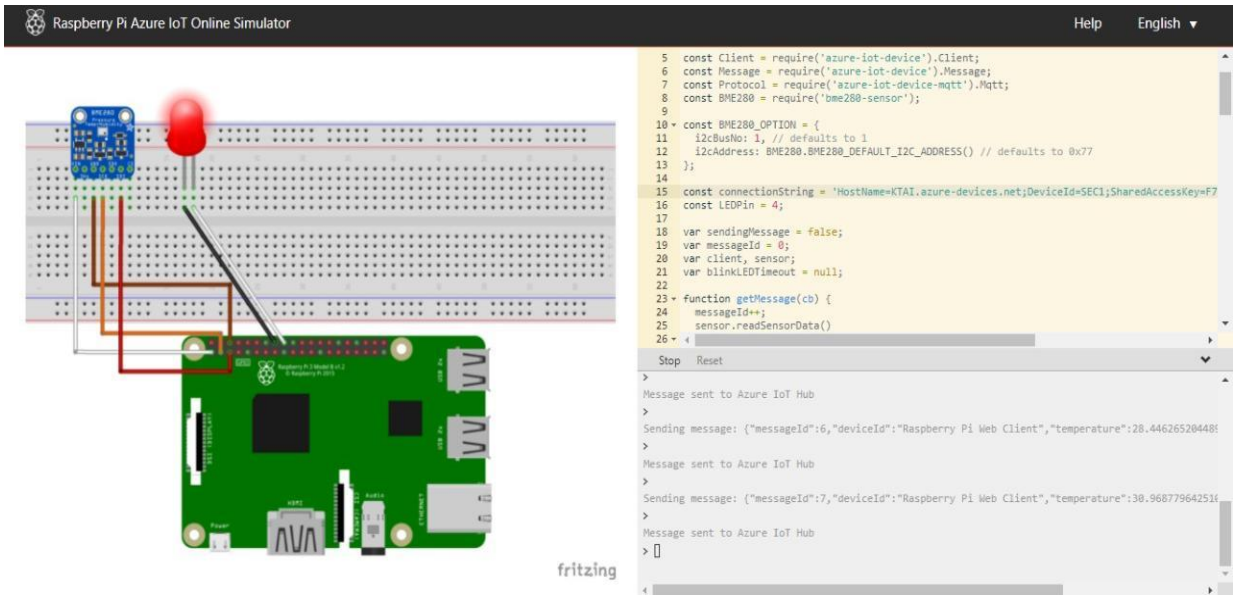
3.2 Raspberry Pi Simulator

Raspberry Pi simulator that allows users to write code to control emulated hardware, and that currently lets users interact with an LED and collect data from a sensor. The simulator shows a graphic of a Pi wired to a combined humidity, temperature, pressure sensor and a red LED via a breadboard, a plug board that allows circuits to be wired together rapidly. Users can type in a side panel to enter Node.js JavaScript code, which can be used to control the LED and collect dummy data from the simulated sensor. That code can be executed using a command line at the base of the panel.



3.3 Azure IOT Cloud

Azure IoT Hub provides a cloud-hosted solution back end to connect virtually any device. Extend your solution from the cloud to the edge with per-device authentication, built-in device management and scaled provisioning. In cloud-to-device messages, reliably send commands and notifications to your connected devices and track message delivery with acknowledgment receipts. Automatically resend device messages as needed to accommodate intermittent connectivity. Azure IoT Hub is a Platform-as-a-Services (PaaS) managed service, hosted in the cloud, that acts as a central message hub for bi-directional communication between an IoT application and the devices it manages. Azure IoT. Connect devices, analyze data, and automate processes with secure, scalable, and open edge-to-cloud solutions. Help safeguard physical work environments with scalable IoT solutions designed for rapid deployment. IoT security. Strengthen your security posture with end-to-end security for your IoT solutions.

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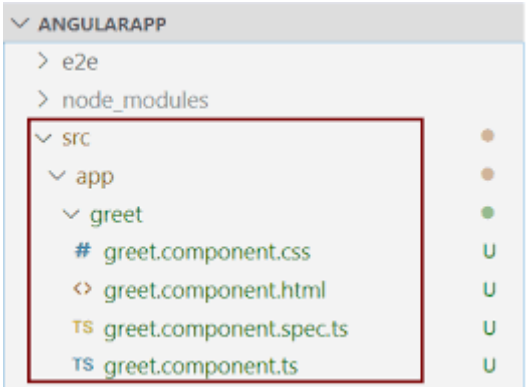
3.4 Angular

Angular is an application design framework and development platform for creating efficient and sophisticated single-page apps. Angular is a development platform, built on TypeScript. As a platform, Angular includes: A component-based framework for building scalable web applications. A collection of well-integrated libraries that cover a wide variety of features, including routing, forms management, client-server communication, and more. A suite of developer tools to help you develop, build, test, and update your code. Components are the building blocks that compose an application. A component includes a TypeScript class with a @Component() decorator, an HTML template, and styles. Every component has an HTML template that declares how that component renders. You define this template either inline by file path. Angular extends HTML with additional syntax that lets you insert dynamic values from your component. The Angular CLI is the fastest, straightforward, and recommended way to develop Angular applications. As an application framework, Angular includes a collection of well-integrated libraries that cover a wide variety of features. The Angular libraries include routing, forms management, client-server communication.



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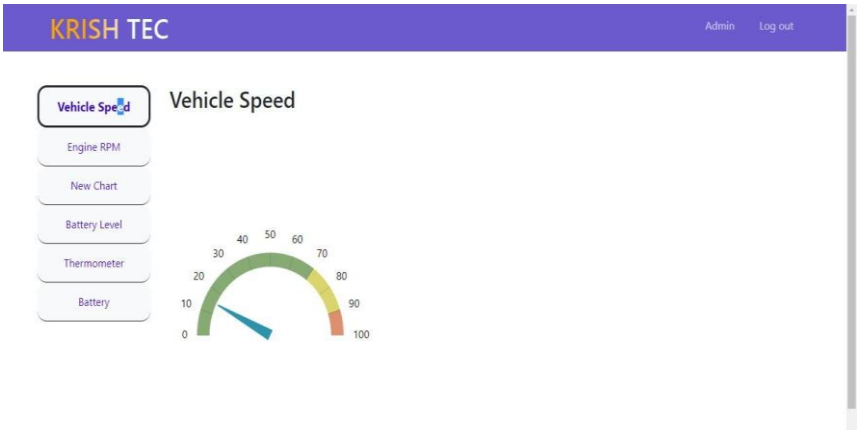
3.5 MQTT Integration

MQTT is an OASIS standard messaging protocol for the Internet of Things (IoT). It is designed as an extremely lightweight publish/subscribe messaging transport that is ideal for connecting remote devices with a small code footprint and minimal network bandwidth. MQTT clients are very small, require minimal resources so can be used on small microcontrollers. MQTT message headers are small to optimize network bandwidth. MQTT allows for messaging between device to cloud and cloud to device. This makes for easy broadcasting messages to groups of things. MQTT can scale to connect with millions of IoT devices. Reliability of message delivery is important for many IoT use cases. This is why MQTT has 3 defined quality of service levels: 0 - at most once, 1- at least once, 2 - exactly once. Many IoT devices connect over unreliable cellular networks. MQTT's support for persistent sessions reduces the time to reconnect the client with the broker. MQTT makes it easy to encrypt messages using TLS and authenticate clients using modern authentication protocols.

4. RESULTS



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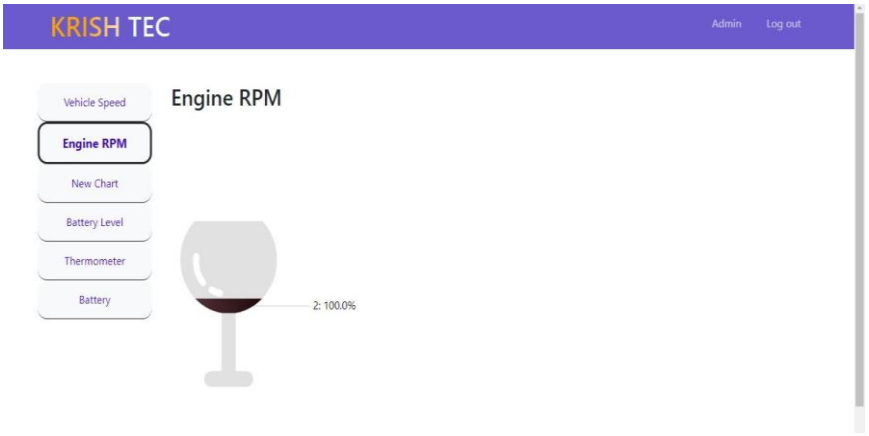

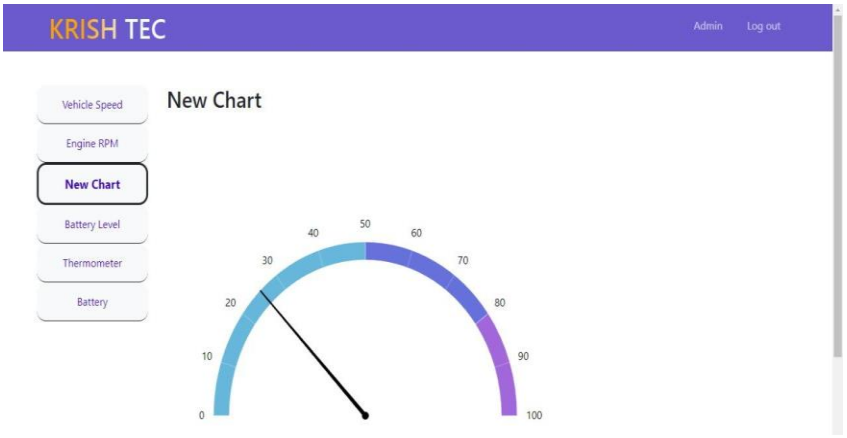

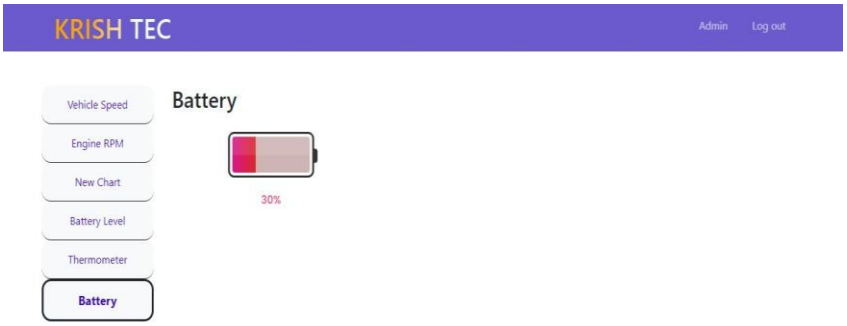

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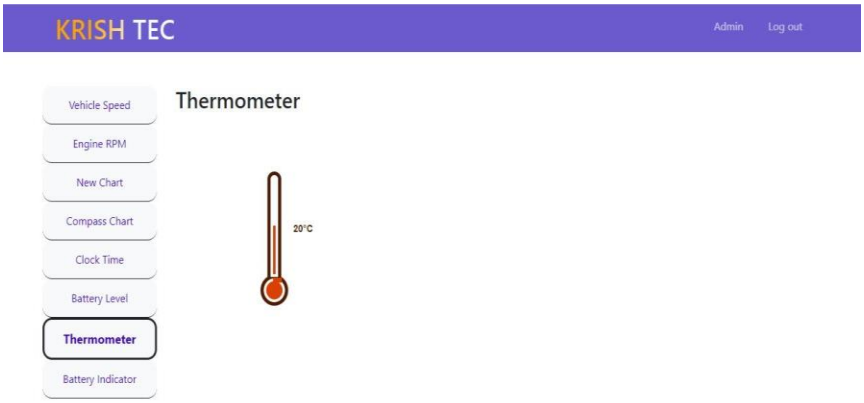

5. CONCLUSIONS

As newer innovations automotive vehicles achieve economies of scale and customer acceptance, the nature of business is likely to keep changing. The inclusion and participation of analytics software vendors, applications service providers, and infrastructure stakeholders will play a greater role in the system and lead to a redistribution of roles in the industry. Automakers will be faced with a number of challenges in this transformation and need to take a number of steps to reinforce their core value propositions as the ecosystem of connected cars evolves. Evolution in this field has brought in the emergence of trailblazing development in automobiles in terms of connected and automated cars. Its usage has revamped car inspection and maintenance capabilities and presented new mediums of entertainment. IoT applications in the automotive industry are increasing day by day. With the enhancement in the technology of Internet of Things, more refined automobile use cases will pop up that will completely change the way in which we interact with our vehicles.

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AI Based Autonomous Car Driving Using Brainwaves

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ABSTRACT

In the current world, all types of cars are coming into the market, but not all people are not driving a car except a few. This paper considers the development of the brain-driven car. The purpose of our project is to control the car by physically disabled and abled person and also to reduce the accidents[1]. Since these cars will run on what the individual is thinking, they will not require any mechanical action of the driver. Most researchers hope that their work will eventually be incorporated into a machine with general intelligence (known as strong AI). Here, we use a methodology of AI (Artificial intelligence) which is the latest and advanced technology. It works on the asynchronous mechanism of Artificial intelligence. Also using the algorithm of Deep Learning algorithms gives fast processing and the major one of our projects is a dataset (human brain signal) for controlling the car. By using the brain signal the car will move automatically by what the controller is thinking. This is one of the advanced technologyin automobiles[2].

Keywords: *AI, Deep Learning, EEG headset*

1. Introduction

The branch of computer science is concerned with making computers behave like humans. The term was coined in 1956 by John McCarthy at the Massachusetts Institute of Technology. Currently, no computers exhibit full artificial intelligence. The best computer chess programs are now capable of beating humans. Today, the hottest area of artificial intelligence is neural networks, which are proving successful in several disciplines such as voice recognition and natural-language processing. Devices that pick up brain waves and translate them into mechanical action are being developed to control prosthetic limbs, robots, and video games. But now comes the Brain Driver, a car that is driven entirely by your thoughts and does not require to perform any mechanical operation of the vehicle. Brain-controlled technology has been implemented in all types of vehicles such as cars, bikes, bicycles, etc[1].**Artificial Intelligence** is an approach to making a computer, a robot, or a product to think how smart humans think. AI aims to improve computer functions that are related to human knowledge, for example, reasoning, learning, and problem-solving. Artificial intelligence (AI) is the ability of a computer or a robot controlled by a computer to do tasks that are usually done by humans because they require human intelligence and discernment. AI will provide human-like interactions with software and offer decision support for specific tasks. AI technology is important because it enables human capabilities understanding, reasoning, planning, communication, and perfection. It gives perfect accuracy of the output[2].A regular car requires a human driver sitting behind the steering wheel and doing all the tasks from steering to navigating to gear-

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shifting, it also may lead to making accidents. On the contrary, A self-driving car, also known as an autonomous vehicle, driverless car, or robotic car, is a vehicle that is capable of sensing its environment and moving safely with little or no human input. The future of this technology may have an impact on multiple industries and other circumstances. It may prevent accidents.So, the AI technology is entered into the autonomous vehicle is taken into the next stage which is AI-based autonomous car driving using brain waves. In this method, the car is fully controlled by the brain, hence not requiring any mechanical action. Finally, the organization of the study is to AI-based brain signal-controlled car to fully controlled by a brain is to become predict the accidents, accuracy and time-saving. This technology is not only used in a car but also used in various vehicles.

2. Literature review

a. Brain Controlled Car for Disabled Using Artificial Intelligence (Neuro Car)

This paper features about brain controlled car that uses asynchronous mechanism of artificial intelligence. This is of prime use to the physically disabled as it does not rely on any physical movements on the part of the individual. The car integrates signals from a variety of sensors like video sensor, weather monitor sensor, anti-collision sensor, steering sensor, Global positioning sensor among the others. Automatic navigation system ensures that the route to all the areas are mentioned in the database for selection by the driver. Automatic security system ensures the safety of the driver from the other autonomous vehicle. This system ensures that the handicapped is able to thrive individually without needing to depend on others for monitoring.This is an era of technology and artificial intelligence is going to conquer the globe in the years to come. With a few modifications to the existing system and an unanimous support from the government and the society, this project can be used to serve the disabled in greater ways and bring about a revolutionary change in the society. Thus the integration of bioelectronics with the automatic system is going to be the hour of the need for all futuristic vehicles.The brain is incredibly complex. All thoughts or actions are the result of simple electric signals in the brain is a gross understatement. There are about 100 billion neurons in a human brain. Each neuron is constantly sending and receiving signals through a complex web of connections. The driver has to think really hard and concentrate a lot to produce the distinct brain patterns which train the brain-computer interface to produce the corresponding sustained physical motion of the car[3].

b. EEG-Based Brain-Controlled Mobile Robots: A Survey

EEG-based brain-controlled mobile robots can serves powerful aids for severely disabled people in their daily life, especially to help them move voluntarily. In this paper, we provide a comprehensive review of the complete systems, key techniques, and evaluation issues of brain-controlled mobile robots along with some insights into related future research and development issues. We first review and classify various complete systems of brain-controlled mobile robots into two categories from the perspective of their operational modes. We then describe key techniques that are used in these brain-controlled mobile robots including the brain-computer interface techniques and shared control techniques. This description is followed by an analysis of the evaluation issues of brain-controlled mobile robots including participants, tasks and environments, and evaluation metrics. We conclude this paper with a discussion of the current challenges and future research directions.The major

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difference between brain-controlled mobile robots and other brain-controlled devices is that these mobile robots require higher safety because they are used to transport dis-abled people. Many researchers have developed various brain-controlled mobile robots using different BCI techniques as well as other techniques such as intelligence techniques (in sensing situations, localization, and path planning) and shared control techniques so as to make these robots safer. The cost of EEG is effectively high and cannot take to any places and it take time to analyse the result[4].

c. A brain controlled Wheelchair to navigate in Familiar Environments

While brain–computer interfaces (BCIs) can provide communication to people who are locked-in, they suffer from a very low information transfer rate. Further, using a BCI requires a concentration effort and using it continuously can be tiring. The brain controlled wheelchair (BCW) described in this paper aim sat providing mobility to BCI users despite these limitations, in a safe and efficient way. Using a slow but reliable P300 based BCI, the user selects a destination amongst a list of predefined locations. While the wheelchair moves on virtual guiding paths ensuring smooth, safe, and predictable trajectories, the user can stop the wheelchair by using a faster BCI. Experiments with non dis- abled subjects demonstrated the efficiency of this strategy. Brain control was not affected when the wheelchair was in motion, and the BCW enabled the users to move to various locations in less time and with significantly less control effort than other control strategies proposed in the literature.To develop a brain controlled wheelchair for navigation in familiar environments, we decided to use a slow but reliableinterface for destination selection, and motion guidance for safe and autonomous navigation. The results obtained with healthy subjects demonstrate that our strategy enables them to move the wheel chair in a building environment safely, efficiently, with limited effort and in a reasonable time.To manufacture the wheelchair it takes more cost and the thinking capability is more important[5].

3. Research methodology

Fig.1 Shows To implement the AI based Autonomous Car Driving, we have to choose a vehicle which has a Bluetooth or Wifi connection, it could be connected with a computerwith EEGcaptured signals,then we have to take a decision from which direction we have to go (left,right,straight,forward,stop) for example, if we give a right direction command to the car suddenly the EEG captured right command signal and send to the computer, similarly it can captured the signal for left, forward, stop direction command which the signal is called Training set. Minimum we can store one thousand command like this. Then we have to prepared the algorithm to train the signal. After that when we driving a car we have to give the direction,for example if we think to go the forward direction, the computer automatically captured the signalby EEG. Then the captured signal is compared with previous signal. This technique is called Pattern matching. If the pattern is matching it can trigger the signal. Then the triggered signal is sent to the Microcontroller with the help of Bluetooth or Wi fi connection to the Robo Car. After that the car can start moving.

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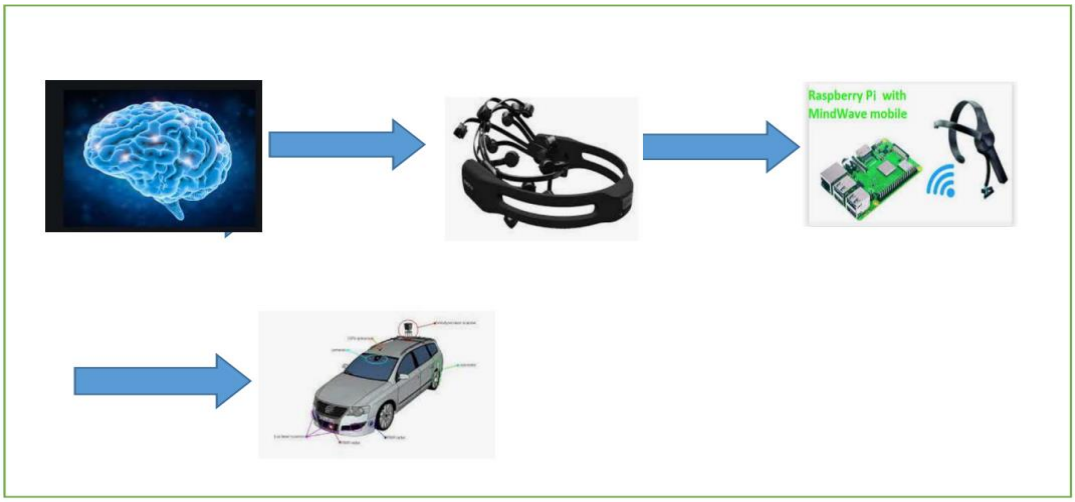

Fig.1.Brain controlled car

In this project, it has many methods like brain captured sensor method, EEG based method but here, we are using online dataset method which has the dataset already in online., so we have to train the signal using the Deep learning Algorithm because it gives the better output and fast processing.This method used in many fields like car, Ambulance and other automobiles etc,

4. Results

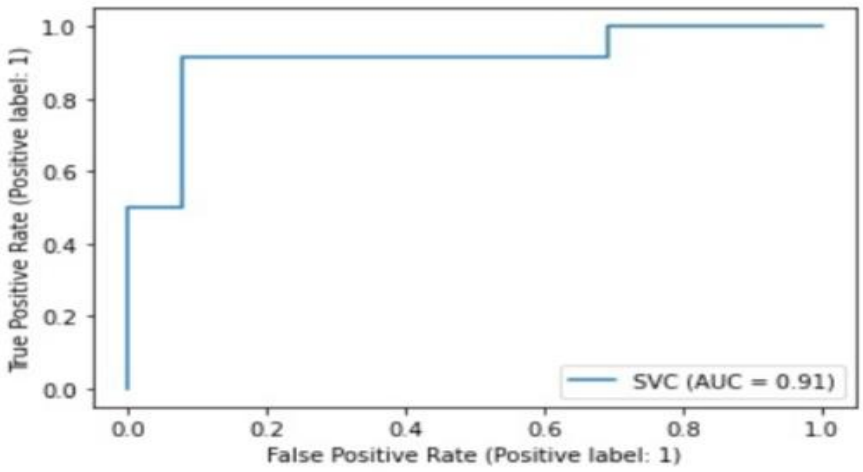

Fig.2.Result of Proposed System

This is the graph of proposed system Fig.2 shows the time and accuracy level rate of the project. By using the deep learning algorithm it gives the fast processing and better output. Compared to existing method.

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5. Discussion

In this method by using the dataset for comparing the signal it gives a proper output. that is controlling the car like the direction of left, right, straight, forward, stop. Comparing to the previous method it gives a accuracy level increases and take less time to reach the destination. By using the AI based autonomous car using brainwaves it is one of the latest technology in the automobile field. This emerging technology can make even the physically challenged person to be abled.

6. Conclusion

This technology would allow the driver to control the car with their mind itself. Drivers will be able to control their vehicle much faster than they would do with the conventional method.By using deep learning algorithm method we obtain the results like command left, right, straight, forward, stop. By introducing this method is useful for the all the peoples to drive a car easily and quickly. But don't stop this method here itself and make it to move to the next step of the technology.

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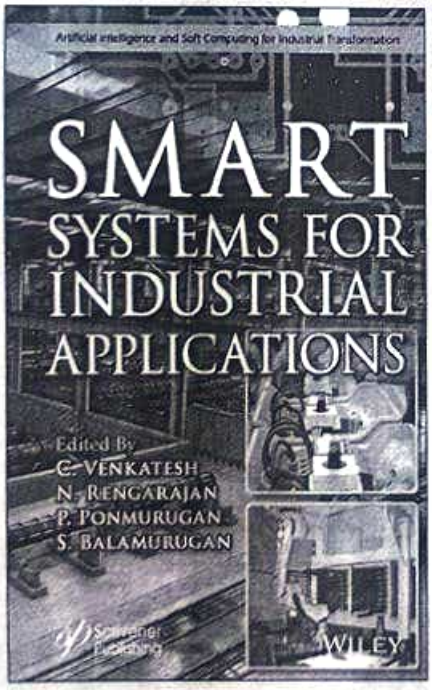

Smart Systems for Industrial Applications

N. RENGARAJAN, C. VENKATESH, P. PONMURUGAN

Dieses Buch beschreibt die Entwicklung und den neuartigen Einsatz von c. 1/4nut cher intell gent n elektrischen Systemen. In einer zusammenfassenden Darstellung werden die Vorteile, Funktionen und r.

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