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Car Service Maintenance and Assistance Using IoT

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ABSTRACT: Most of the Car driver/owner may not have proper knowledge on vehicle faults identification. So it is important to share the details of defects to the service centers. When people went for car servicing, there the service providers need to plug-in to the car manually and need to check where the actual problem is. As more and more number of vehicles is increasing, it is difficult for them to identify for each vehicle. Vehicle drivers/owners may or may not have proper knowledge to explain the fault clearly. Maintenance is also required not only for major parts like Engine, but also for small parts like lights, tires etc. prediction of faults needs to be required for proper maintenance.

Predictive maintenance need to be made in order to identify the faults in advance. So maintenance cost can be reduced. We can predict the faults of the car using OBD devices. The data from this OBD device is collected and make the data available to the user. The main theme of the project is to monitor the status of the car time to time and maintain all those records in a mobile app. whenever the vehicle is taken for service, based on the data available in the application servicing will be provided.

KEYWORDS: Car Service, Predictive Maintenance, Corrective Maintenance, Preventive Maintenance, IoT, OBD

I. INTRODUCTION

Various parts of the vehicle will start ruining out as the usage Increases and time passes. So, it is very important to service the parts of the car at regular intervals. Servicing plays an important role in car's life. In order to do servicing to the car, First the faults of the car need to be identified. After Identifying it is important to maintain the recovered Faults. So, fault prediction and maintenance are 2 important activities to be made.

Types of Maintenance:
There are 3 types of maintenance. They are:

- Predictive Maintenance
- Corrective Maintenance
- Preventive Maintenance

Preventive Maintenance:
It is the process of analyzing the historical data of the car and helps to know when the maintenance is required. It helps in the reduction of expenditure on sudden breakdown or unexpected failures.

Corrective Maintenance:
It is done whenever the fault is identified. After Identifying the damage or fault, service is provided to the identified failure In order to restore the operational condition of a system.

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Predictive Maintenance:
Predictive maintenance is the process of analyzing the present status of the car and by using this data, it predicts whatever the maintenance is required.

II. LITERATURE REVIEW

[1] Hindawi Journal of Advanced Transportation Volume 2018, Article ID 8061514, 10 pages https://doi.org/10.1155/2018/806151 Uferah Shafi,1 Asad Safi , 1 Ahmad Raza Shahid,1 Sheikh Ziauddin , 1 and Muhammad Qaiser Saleem2 through "Vehicle Remote Health Monitoring and Prognostic Maintenance System" helps in predictive maintenance of the vehicle by using machine learning algorithms. Algorithm named "Sequential Pattern Mining Algorithm" is used. Machine Learning algorithms can be used to solve big problems in the automotive industry. Classifiers such as Decision tree, SVM, RF, K-NN algorithms are used for fault prediction. [2] T Gayathri has defined "A Survey on Vehicle Health Monitoring and Prediction System" in International Journal of Computer Science Trends and Technology (IJCST) which explains the usage of sensor data to mine the data and predicts the health of the vehicle and also warns the driver's drowzyness and drunken. We can monitor the health of the car continuously at the regular intervals and the faults can be identified and displayed on to the LCD screen which is integrated with the aurdino controller.

[3]https://www.researchgate.net/publication/335976970 Deep Learning Based Car Damage Classification and Detection "Deep Learning Based Car Damage Classification and Detection" by Mahavir Dwivedi , Malik Hashmat, Shadab, Omkar S N, designed a system for vehicle damage classification/detection which can be used by insurance companies to automate the process of vehicle insurance claims in a quick fashion. Deep Learning models can be used for damage classification task. We can integrate AI and data to provide a novel approach for automating the vehicle damage insurance claims. [4] Prof. Gaffar G. Momin | Aakanksha P. Purkar | Naresh S. Lokhande | Affanali A. Sayyad | Roshani R. Chavhan defined "A Review on Vehicle Health Monitoring System" which continuously monitors and notify the owner about the air pressure of tire, quality of exhaust gas, wear of breaks, leakage of oil, the excessive heating of the engine or the blockage in fuel, pipe, etc. Data can also be sent to the control server and web server for extensive data mining and it can be useful for advertising corresponding vehicles.

[5] Girish N, Mohammed Aqeel Arshad in "Car Damage Detection using Machine Learning" in which damage is detected using machine learning by analyzing the images of the damage occurred which helps in claiming insurance in International Journal of Advanced Research in Computer and Communication Engineering. Mask RCNN and transfer learning based damage detection of the vehicle is generic after testing, and can also better adapt to the diverse elements of damaged car images. Even though the model was trained on a very small dataset, good results were achieved. [6] Rakshata P, Padma H V, Pooja M, Yashaswini H V, Karthik V "Car Damage Detection and Analysis Using Deep Learning Algorithm for Automotive" used deep learning mechanisms car damage detection and extraction of original features before the incident for timely insurance claims. Convolution neural networks (CNN), the driver behind computer vision applications, are fast evolving with advanced and innovative architectures to solve almost any problem under the sun related to the visual system and Mask- RCNN is the next evolution of object detection models which allow detection with better precision and accuracy.

III. EXISTING SYSTEMS

All the existing systems are detecting failures and giving the information to the driver through the dashboard in the car at that particular time.

PROBLEMS OF EXISTING SYSTEM

- Even though the faults are identified automatically, the driver or owner needs to explain the faults clearly to the service provider.
- Those who want to buy a car in second hand; they are not able to detect the exact faults of the system.

IV. PROPOSED SYSTEM

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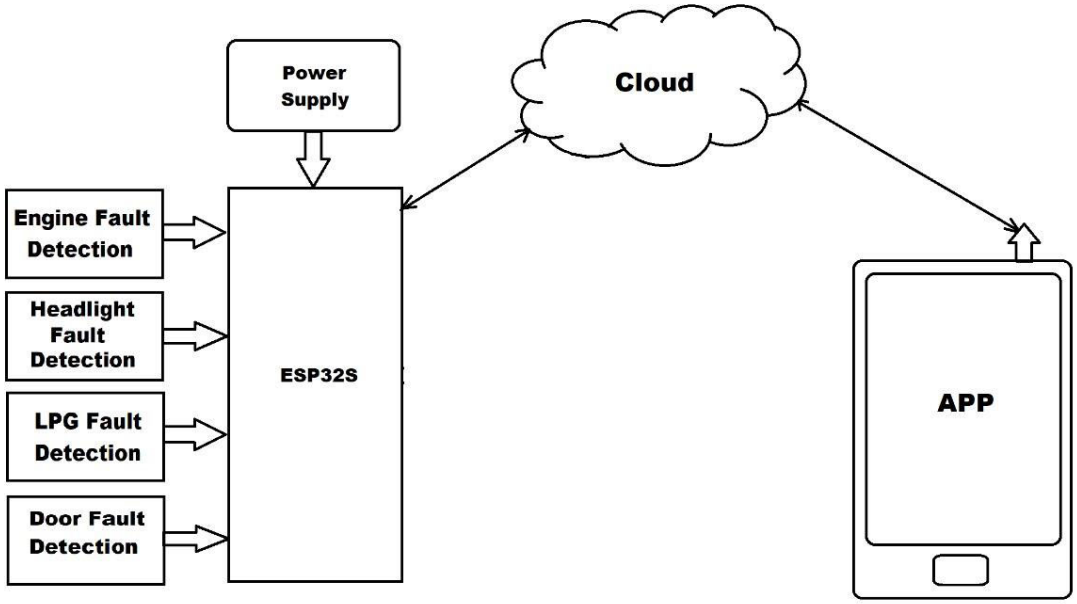
We will develop an Interface where the users can directly monitor the health of the car. This Interface displays the information regarding the car through scanning the QR code assigned to the each car. This Interface also provides the predictive maintenance report time to time based on the current status of the car.

BENEFITS OF PROPOSED SYSTEM

- Easy identification of faults makes the task of service providers easier.
- It reduces the time consumption for Identification of the faults.
- Even, the persons who are illiterate or with less knowledge can easily identify the faults through QR code scanning.

Block Diagram describing functionality of proposed system



- Initially Sensors collect the data.
- Then the collected data is transmitted to the ESP32S board which is a microcontroller.
- Then the microcontroller analyses the signal range and identify the car part which is defected.
- The detected information is passed into the mobile Interface through the cloud.
- In the mobile Interface, QR code scanner is available.
- Whenever the car is taken for the service, then the service operator can directly access the information of the car by scanning the QR code.
- Whoever wants to find the faults of the car they can scan this QR code and can know them.
- The faults in the mobile application are represented in the form of LED lights.
- Each LED light is assigned with different color.
- Whenever the fault is identified the LED light corresponding to that particular failure will be turned on. Otherwise it will be turned off.
- Based on the current status of the car, predictive maintenance information will be given.

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V. MODULES DESCRIPTION

Communication Module:

It is used for transmitting data from the hardware to the application.

Mobile Application:

It is the main interface which was used by the user to determine the status of the car. Predictive maintenance can be determined using this application.

Sensor - Actuator Module:

It is the module through which the data is collected from the sensor.

OBD Device module:

It is the module where the data is analyzed and where the faults are detected.

Predictive maintenance notification module:

In this module the predictive maintenance is made and the faults are predicted to the user through notification in mobile application.

DESIGN CONSTRAINTS

These are limitations on a design; these include imposed limitations that you don't control and limitations that are self-imposed as a way to improve a design. The following are common types of design constraint.

9 Types of Design Constraint

- **Commercial Constraints:** Basic commercial constraints such as time and budget.
- **Requirements:** Functional requirements such as specifications of features for a website.
- **Non-Functional Requirements:** Requirements that specify intangible elements of a design For example, a non-functional requirement that a building be accessible.
- **Compliance:** Compliance to applicable laws, regulations and standards.
- **Sensory Design:** Beyond visual design, constraints may apply to taste, touch, and sound and smell For example, a brand identity that calls for products to smell fruity.
- **Usability:** Usability principles, frameworks and standards for example, the principle of least astonishment.
- **Style:** A style guide or multiple style guides related to an organization, brand, product, service, environment or project For example, a product development team may follow a style guide for a brand family that constrains the colors and layout of package designs.
- **Principles:** The design principles of an organization, team or individual For example, a designer who uses form follows function to constrain designs.
- **Integration:** A design that needs to work with other things such as products, services, systems, processes, controls, partners and information.

Design Constraints of our project

Non - Functional requirements: Non-functional requirements in our project include Security, Availability, and performance.

Integration Constraint: Various modules are integrated In order to monitor the health status of an Individual car.

Commercial Constraint: The budget required to develop this project is minimum and also the time required for completion is 5 months.

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SYSTEM ARCHITECTURE

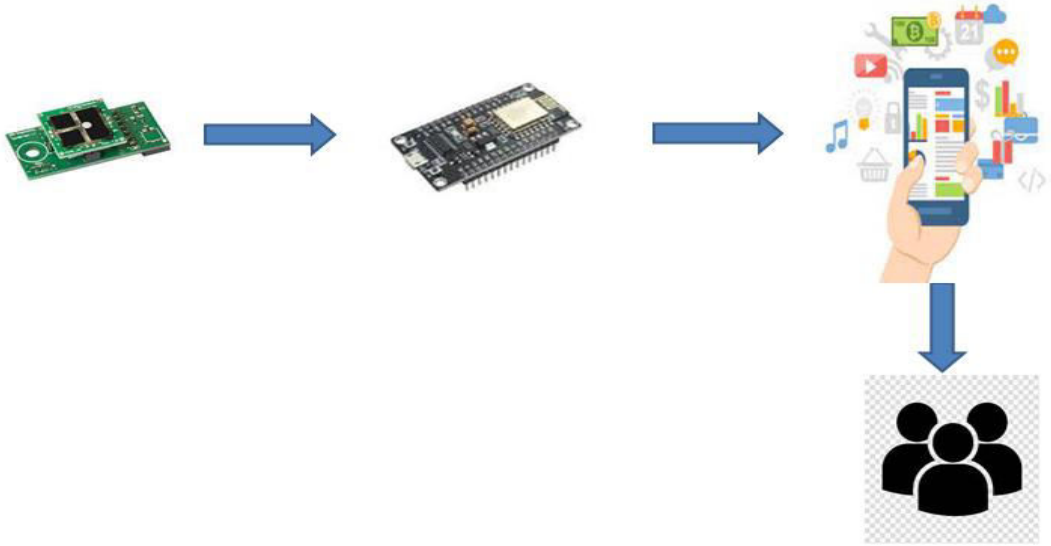

Fig: Propose system architecture

- Here in the above design, Architectural view of entire proposed system is shown.
- Whenever the user starts car, the sensors which are located at various locations in the car starts functioning.
- The sensors collect the physical data and convert them into the electrical signals.
- These electrical signals are transferred to the MCU, and then the MCU analyzes them and validate.
- Whenever the faults are identified, these faults are displayed into the mobile app.
- All the screens in the application are displayed with respect to the modules which are specified.

Algorithm Design:

An algorithm is a series of instructions, often referred to as a "process," which is to be followed when solving a particular problem While technically not restricted by definition, the word is almost invariably associated with computers, since computer-processed algorithms can tackle much larger problems than a human, much more quickly Since modern computing uses algorithms much more frequently than at any other point in human history, a field has grown up around their design, analysis, and refinement The field of algorithm design requires a strong mathematical background, with computer science degrees being particularly sought-after qualifications It offers a growing number of highly compensated career options, as the need for more algorithms continues to increase.

The steps Involved in the proposed system are as follows:

Step 1: Starting the car.
Step 2: Sensors present at the various parts of the car collects the information from the physical surroundings.
Step 3: The information collected by the sensors is analyzed by the MCU board and detect the faults.
Step 4: The faults are stored in the cloud platform.
Step 5: The app is developed in order to monitor the status of the car time to time.
Step 6: Installation of mobile app.
Step 7: Scanning the QR code which was given to the car.
Step 8: The present status of the car is displayed in the form of LED lights.
Step 9: The notification regarding predictive maintenance will be sent and also displayed in the terminal present in the application.
Step 10: Stop

Procedure of execution of blynk APP:

Blynk was designed for the Internet of Things. It can control hardware remotely, it can display sensor data, it can store data and visualize.

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There are **3 major components** in the Blynk platform.
Blynk App – It is used to create interfaces using various widgets they provide.
Blynk Server – It is responsible for the communications between the Smartphone and hardware. We can use Blynk cloud as a server.
Blynk libraries - They enables communication with server and also process all the incoming and outgoing messages.

So every time, when we are trying to operate something in a Blynk app, the message travels to the Blynk cloud, and then through the Blynk cloud it finds its way to our hardware.

VI. OUTPUT SCREENS

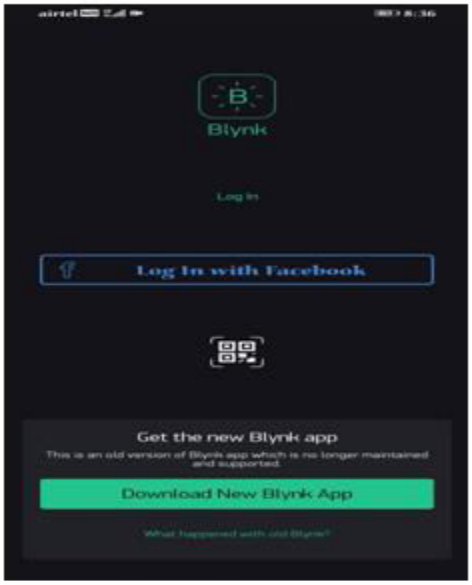

Fig 1: Blynk Login screen

Fig 2: QR code scanning screen

Fig 3 :Screen showing Engine Fault

Fig 4 : Screen showing predictive maintenance when engine fault occurs

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Fig 5: Screen showing Headlight fault along with predictive maintenance

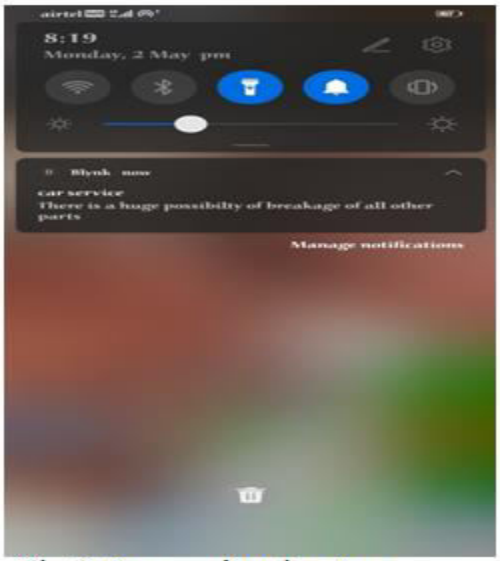

Fig 6: Screen showing App notifications in notification layout

VII. CONCLUSION

The process of finding the faults in car manually every time they occurred, results in wastage of time and also risks the life, if the fault occurred is major. This application helps to maintain the previous records of faults, So that it is easier for the service providers to repair various parts.

Also, second hand car buyers can detect the faults whenever they want to buy easily by scanning the QR code. This application can be accessed from anywhere, When the QR code is scanned once in the application without logged out. The application is developed using Cloud and Mobile application development platform provided by the Blynk.

VIII. FUTURE ENHANCEMENT

The system which we proposed, we are trying to extend this maximum. The project can be extended in many ways. We can use the history of the faults and can predict the faults which will be occurred in future, So that the maintenance cost can be reduced. We can also add Insurance details to this application, so that the car can claim Insurance very easily without any other proofs as all the information regarding the car is recorded. We can also digitalize all the documents regarding the car through this application.

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