VEHICLE HEALTH MONITORING SYSTEM

SATYANARAYAN SAHOO

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ABSTRACT:-

Vehicle Health Monitoring System is a fitness instructing app designed based on the Machine Learning Algorithms. The system offers the right guidance to the vehicle enthusiasts and day to day user clients to improve their engine's health by offering a right schedule, right maintenance, right services, right health tracker, etc. Now-a-days due to the increase in the use of auto-mobiles the business of servicing and maintenance has rapidly increased. Therefore, this AI-based app provides guidance to users who are willing to solve their issue at a basic stage rather than going on later to make a big hole in their pockets.

PROBLEM STATEMENT:-

The Problem Statement of my topic is to build a Machine Learning Model for examining and analyzing the user needs and their requirements for his/her vehicle. It actually prepares a category for the fitness of the vehicle's engine according to their sound waves , vibration and heat dissipation of the engine. As a result, the system creates a possible solution/suggestion that changes based on the circumstances.

CUSTOMER NEED ASSESMENT:-

1. Safety: Safety is a top priority for customers when it comes to their vehicles. Customers need a system that can alert them in real-time if there are any potential safety risks, such as engine or transmission failures.
2. Maintenance: Regular maintenance is necessary to keep a vehicle running smoothly and to prevent costly repairs. Customers need a system that can help

them keep track of their vehicle's maintenance needs and alert them when it's time for a tune-up or oil change.

3. Convenience: Customers lead busy lives and don't have time to deal with unexpected breakdowns or repairs. They need a system that can provide them with convenient solutions such as remote diagnostics.
4. Cost: Customers want to get the most value for their money. They need a system that is affordable and provides them with cost-effective solutions for maintaining their vehicle's health.
5. Compatibility: Customers need a system that is compatible with their vehicle make and model. They want to be sure that the system will work with their vehicle's existing technology and won't cause any compatibility issues.

MARKET/BUSINESS NEED ASSESMENT:-

1. Market Size: The market size for vehicle health monitoring systems is growing rapidly due to the increasing demand for advanced safety features in vehicles. According to MarketsandMarkets, the global automotive sensors market size is expected to reach $40.4 billion by 2025.

2. Key Features: Some key features that a vehicle health monitoring system should have include real-time monitoring of engine performance, transmission performance, and battery health, predictive maintenance alerts, and remote diagnostics and repair capabilities.

3. Market Trends: The market for vehicle health monitoring systems is expected to continue to grow due to increasing consumer demand for safety features in vehicles and advancements in technology such as the Internet of Things (IoT) and Artificial Intelligence (AI). Customer Satisfaction: A vehicle health monitoring system can improve customer satisfaction by providing a convenient and reliable solution for monitoring their vehicle's health and reducing the likelihood of unexpected breakdowns. This can lead to increased customer loyalty and retention, as well as positive word-of-mouth referrals.

4. Regulatory Compliance: In some industries, such as transportation and logistics, there are regulatory requirements for vehicle safety and maintenance. A vehicle health monitoring system can help businesses meet these requirements and avoid fines and penalties.

5. Improved Operations: A vehicle health monitoring system can improve a business's operations by providing real-time data on vehicle performance, allowing the business to make informed decisions on maintenance and repairs. This can help optimize the use of vehicles, reduce downtime, and improve overall efficiency

TARGET SPECIFICATION AND CHARACTERIZATION:-

The target customers for a vehicle health monitoring system would be fleet managers, individual vehicle owners, and automotive service providers. Fleet managers would be interested in the system to monitor the health of their fleet, individual vehicle owners would want to ensure their

personal safety and the safety of their vehicle, and automotive service providers could use the system to diagnose and repair vehicle problems.

We could target individual customers as well as businesses (i.e both B2C and B2B)

B2C:
We can start boosting our software by targeting the top 10% elite peoples who own exotic machines and are generally bike/car enthusiasts and always want their engines to be in a perfect condition , we provide them with a solution using a software that they can manually install into their machines.
Later on we can make our monitoring model more efficient and affordable and enter into the machines that are used by the middle class society.

B2B:
We can sell our software to the car/bikes companies or engine manufacturers who need a monitoring system in their displays and they can give it as an extra accessory that are given at the time of purchase.

Moreover we can further spread it to bigger machines used in the industry to check upon their health status. For eg: We can deploy it in a place such as amusement parks where there is generally a lack of negligence in the maintenance of the rides which leads to fatal accidents which can be avoided.

BENCH MARKING:-

Our software rather than focusing on the overall performance of the vehicle focuses on the engine of the vehicle and specifically the hardware. A bad vehicle produces an engine sound which is much more amplified than the sound of a good vehicle. It may also include sounds of bearings drying up due to less oil or pristine cranking with each other due to excessive overheating or hydraulics maybe being faulty. Hence, in the automotive industry, such monitoring can also be useful for detecting potential problems in a vehicle's engine, transmission, or other systems.

APPLICABLE CONSTRAINTS:-

The Constraints that are applicable for this system are:

- ➢ Data Collection and Storage
- ➢ Data maintenance
- ➢ Accuracy in collection of data
- ➢ User Engagement
- ➢ Technical Issues resolving
- ➢ Good Data Handler
- ➢ Good technical knowledge to the user.
- ➢ Appropriate sensors

BUSINESS MODEL:-

If we go on to sell our product to the individual customers we can charge them a particular subscription fee in order to use our product, as they need service centers to repair their vehicles once it's broken down we can suggest them nearby certified service centers which provides them the solution at the affordable cost and in order to do so we would charge a nominal fee to the service center too.

If we sell our product to the companies then we could make a deal with them regarding the terms and conditions and accordingly charge them for like a full time subscription.

FINAL PRODUCT PROTOTYPE:-

- ➢ The app will collect information from the hardware sensors attached to the engine such as sound, vibration etc. from the audio/vibration/heat sensors.

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                    │   Sensor   values   │
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│ Service    center   │      │  garages (motor)     │
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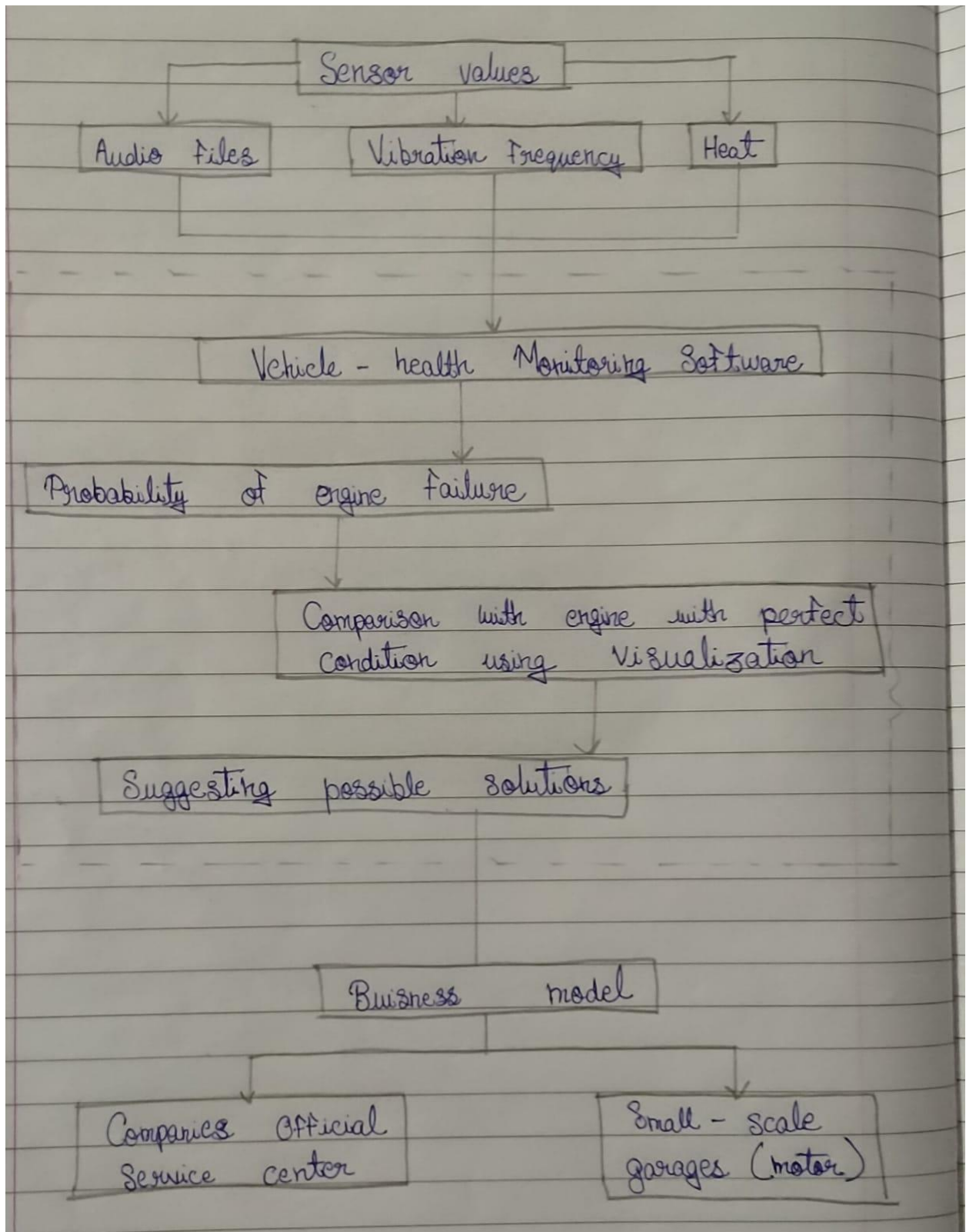
➢ The system then analyses all of the data provided by the sensors, and it offers all of the directions with alarms to the consumers, such as type of failure, a list of possible solutions with information, a nearby repairing center, and so on.
➢ The tracker will track the engine's performance based on how well they perform.
➢ Suggesting online best possible service centers nearby according to the type of failure.

This system was not only designed with keeping gearheads (vehicle enthusiasts) in mind; rather, it was designed with individuals of all ages and mind. The program will give solutions to the consumer correctly without any risks based on their vehicle's engine condition. In the future, I plan to include factors like temperature , torque (rpm) , air pressure etc. in this app because engine health is not the only significant factor; overall body of the machine is equally crucial. As an bike enthusiast, I understand the importance of the vehicles in human existence. This has a big market. Providing this type of service to customers will make them happy and satisfied.
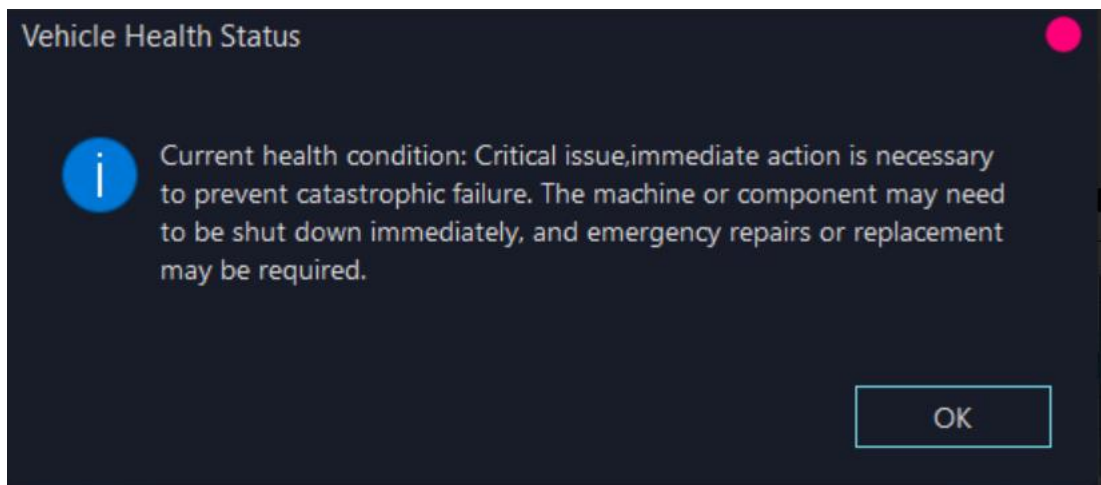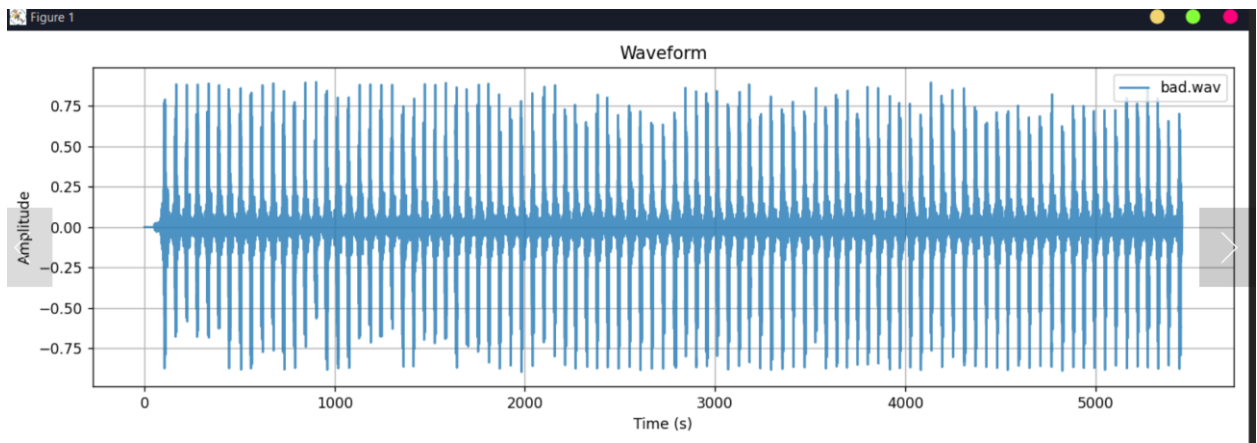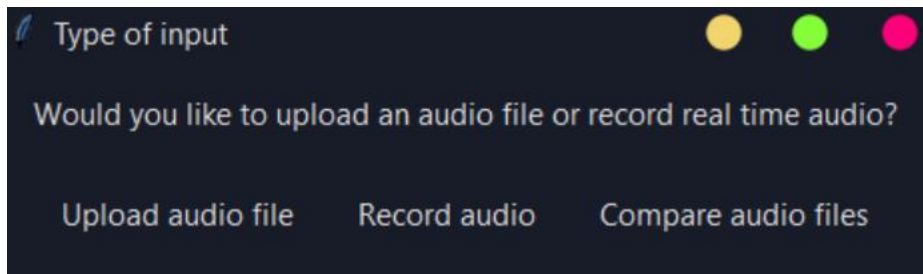

CODE IMPLEMENTATION:

Currently we have focused on the audio part that too only the visualization part since we don't have appropriate audio dataset for training the model neither do we have any dataset or values for vibration or heat dissipation part.

One of the main problems the code solves is it analyses the sound of an engine (not exhaust) of a vehicle to analyze its health. A bad vehicle produces an engine sound which is much more amplified than the sound of a good vehicle. It may also include sounds of bearings drying up due to less oil or pristine cranking with each other due to excessive overheating or hydraulics maybe being faulty. Hence, in the automotive industry, such monitoring can also be useful for detecting potential problems in a vehicle's engine, transmission, or other systems. By analyzing the noise and vibration patterns of a vehicle, it may be possible to detect abnormalities that could indicate an impending failure. Acoustic analysis involves using microphones to capture the sound of the bike and analyzing it to detect any abnormalities in the noise patterns. For instance, certain types of engine faults may produce distinct noise patterns that can be detected through acoustic analysis. A microphone can capture the sound waves produced by the vehicle, and they are commonly used in acoustic analysis to detect faults such as abnormal engine noise or exhaust leaks. On the software side, we have used python, and libraries to record, process audio files to convert it to numerical values from which we can form graphs to analyze vehicle health.

Github link: https://github.com/SatyaTheG/engine_health_monitoring

Output screens:

We run the main.py file then according to the example select the 1st option and get the desired outputs.

Waveform

Vehicle Health Status

ⓘ Current health condition: Critical issue,immediate action is necessary to prevent catastrophic failure. The machine or component may need to be shut down immediately, and emergency repairs or replacement may be required.

OK

CONCLUSION:-

Vehicle Health Monitoring System is revolutionizing in recent days. This software plays crucial role in every human's life who owns a vehicle. It will change the lifestyle of an individual person who are conscious of their vehicle's health but lacking of proper guidance for keeping their engine robust.

Artificial Intelligence is the back bone for many revolutionalized sectors. The Vehicle Health Monitoring System based on AI technologies will be a growing product in the upcoming days. Customers require more and more personalized services, and they will soon reach for services and products that meet those needs. So the customers will be reaching the newly emerging technologies of AI.