

MotoTrack: MERN-based MotoTrack is a motor lifecycle management system for a vehicle. and Maintenance Management

Abhinav Singh¹, Abhishek Kumar Gond², Anoop Kumar³, Saurabh Jaiswal⁴ (Students, Digvijai Nath P. G. College, Gorakhpur) and Dr Pawan Kumar Pandey⁵, Mudit Dubey⁶ (Assistant Professor Digvijai Nath P. G. College, Gorakhpur)

Abstract: The classical vehicle maintenance tracking system in most developing and urbanising areas relies heavily on physical booklets, scattered, or manual memory. Due to this, vehicle owners frequently fail to keep important service appointments, whilst enduring. The reason is that high long-term maintenance costs result from inadequate maintenance. To address this issue, this paper introduces MotoTrack, a web-based vehicle lifecycle platform developed using the MERN stack (MongoDB, Express.js, React.js, and Node.js). The MotoTrack is determined by the main idea of establishing a direct, organised connection between the vehicle's use and the owner's maintenance plan—without relying on heavy file uploads or offline document storage. The site provides a user with a straightforward dashboard. enter car information, record maintenance costs, and inspection of future service functionality according to the odometer. On the other hand, the system gives an in-depth analysis of fuel and service costs. The technical explanation is provided in this paper. system architecture, the various building blocks with which this platform is built, and the applications this platform can have in practice. The final result demonstrates that digitalising vehicle tracking with web technologies not only prolongs the vehicle's life but also gives the owner a traceable, expected financial footprint.

Keywords: Vehicle Management, MERN Stack, lifecycle tracking, Maintenance Analytics, Web Application, Digital. Ecosystem, Data-Driven Governance.

I. INTRODUCTION

And the automotive industry is a very significant component of our lives. infrastructure, however, those who own and control are the people. There are frequent financial and mechanical issues with these cars because of inadequate tracking [1]. One of the chief causes of this is the long, sequence of non-structured maintenance schedules. Before a vehicle reaches its critical failure point, it flakes off in a thousand ways. kilometres of corrosion, erosion, fluid loss and part. fatigue. Each service not taken results in a toll on the. vehicle's lifespan [2]. This makes owners pay 15%. to 30% higher than the routine repair costs in an emergency. preventative maintenance. Also, it requires effort. time-consumingly record these dates, a good deal of statutory. There are missed deadlines (such as PUC and Insurance) that result in heavy fines [7].

Nowadays, nearly everybody has internet access and a smartphone. connection. The penetration of digital infrastructure has occurred over a short period. India presents us with a terrific opportunity to resolve it with help from technology [6]. We created MotoTrack to eliminate the. reliance on paper handouts and manuals. It is a fully developed online platform using the modern MERN stack.

emphasising strictly on the fast, numerical data entry and not cumbersome image uploads [3].

Vehicle owners will be able to list their vehicles directly on MotoTrack. service logs online. This model of data ensures this. that users receive timely notifications on their vehicles, and owners receive a genuine image of how they are spending on fertiliser and services. In this paper, I will discuss the design of the system and the tools we use. utilised, and the increased advantages of this project to the greater. automotive ecosystem.

II. GOALS OF THE PROJECT.

We created MotoTrack with some distinct, problem-solving objectives in mind:

A. Eliminating Hand Tracking Dependencies.

The primary objective is to end reliance on material services. guides and memory. At the time of vehicle data recording. transferred into a safe digital computer in the form

of a digital ledger. eliminated, which has a direct positive impact on the owner's compliance. with service schedules.

B. Fair Cost Analytics.

In conventional arrangements, the owners are unable to visualise how much a vehicle costs them over time; costs are notoriously difficult to estimate. scattered through all kinds of paper bills. On our site, users are enabled to. adding together to determine the amount they charged per gallon of fuel and for services. This data is presented in easy-to-understand money charts that reflect the actual price of ownership.

C. Better Vehicle. Life and Safety.

In most cases, the vehicles result from poor performance. No oil change was performed, nor was brake wear addressed. With direct digital tracking, the ratio of required services to in-use services is drastically reduced. The owners are promptly informed and the. On-road failures are very unlikely to be caused.

D. Easy to Use.

Many vehicle owners are not ready to employ intricate fleet—management software. We would have made a very. easy-to-use, convenient, mobile-friendly User Interface (UI) that anyone can operate. researches the application of simple applications. The system relies solely on rapid textual and statistical feeds, eliminating the need to scan and upload large files. document images.

III. TECHNICAL AND SYSTEM ARCHITECTURE.

IMPLEMENTATION

The MERN stack was used to construct it because MotoTrack is very scalable and capable of high traffic. JavaScript is both front-end and backend—an efficient procedure.

B. React.js (Frontend development)

Landing Page and Dashboards: The application will be created to. entice the users with an attractive Call-to-Action (CTA) button and real-time data widgets. Our interface is founded on the following interface. React.js supports the development of dynamic and fast single-page applications. Applications (SPAs). To have a flowing, non-navigating page. React Router DOM v6 was used to reload the page. The style has been created using existing CSS frameworks. The site is also mobile-friendly and can be accessed on two laptops and mobile phones. States are well governed. to make sure that, once a new fuel cost is entered, the Page-free charts are automatically updated with analytics. refresh.

B. Backend (Node.js, Express.js)

The server code is written in Node.js with the help of. Express.js is a fast framework because it supports non-blocking I/O operations. We have also implemented RESTful APIs to process requests, such as user registration, adding and processing new vehicles. maintenance logs. The architecture is optimum. The structured JSON data does not mandate the use of multipart data as a data blob.

Authentication & Security: To ensure that the system is secure and we:, user session control, strong authentication. middleware. Mathematically salted passwords. They are already stored in the database, and it guarantees a high level of. security. Authentication is via JSON Web Tokens (JWT)—anonymous, secure, and site-visit-based.

Schema Integration: We used Mongoose for the database. level. It is a library that eases Object Data Modelling (ODM). the MongoDB connection of our Express routes. clusters. It is very relational; User documents. See a set of Vehicle documents, which in turn. Attachments of definite Service logs and Fuel logs. This allows it to be easily queried and aggregated when creating a user. analytics.

IV. USER INTERFACE AND RESULTS.

The implementation results indicate a highly efficient, functional, user-friendly dashboard. The highest level is the Main Dashboard—a component that can handle the vehicle lifecycle.



Fig. 1. The Core User Dashboard, where the registered vehicles will appear in future. aggregate financial expenditures, aggregate financial spending, services and aggregate financial spending.

Dashboard will have real-time access to:

Figure of the amount spent in revenue, at the petrol, gasoline and service.

- Fleet Management: A list of the vehicles in operation, their specifications and where they are at the moment.

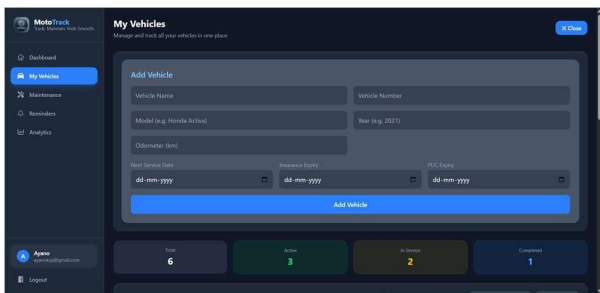


Fig. 2. Vehicle Management module in which the user can manage two assets. simultaneously.

Maintenance Ledger: New service can be easily added. design, edit, and revise numerical data—Mark without papers.

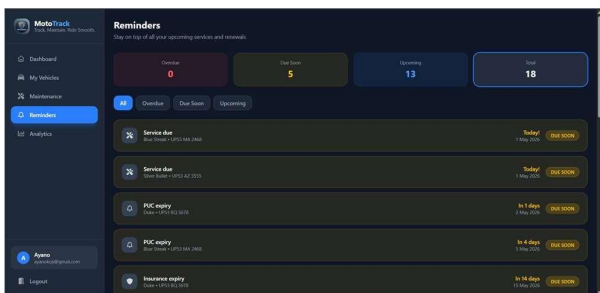


Fig. 3. The Maintenance Ledger, which will facilitate users in keeping transactional data. for services.

Smart Alerts: The device knows when typed-in compliance dates (PUC, Insurance) are triggered and triggers a visual. When time is dead, repriminations.

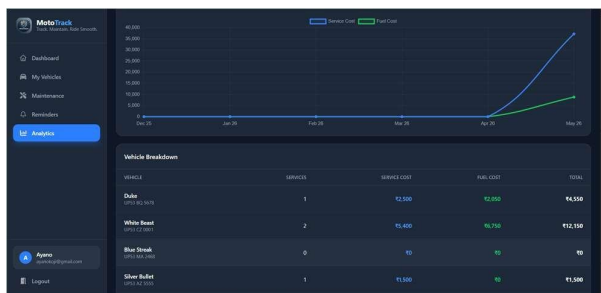


Fig. 4. Service breakdown structure (SBS) of Advanced Analytics Engine. versus fuel costs.

V. REAL-WORLD APPLICATIONS

MotoTrack is not an educational college project; it has already on the market applications:

Daily Commuters: Daily customers can scan their daily. be environmentally safe and make their own cars. reliable for work.

Local delivery businesses can utilise Small Business Logistics. The route to take a long way off, round a great many two-wheelers or vans, they possess a modern working fleet. serviced.

Owners who have not lost any good resale value will be able to obtain the maximum resale value. A computer can track a car's service history if you fetch well from the second-hand market, they have demonstrated that the car is in good condition.

Environmental Impact: The user is responsible for ensuring the environmental impact is minimal. to conduct PUC inspection, change oil, the platform. implicitly helps curb excessive carbon emissions caused by engine wear.

VI. DISCUSSION

The utilisation of the MotoTrack platform tested us in various ways. benefits. Financial transparency is the most suitable. All costs are captured in the computer, where all costs are keyed. No mistake, the maintenance account. The budget is going.

Another colossal benefit is that it can be determined at any point in the lifecycle. management. Its dashboard allows users to manage their usage. test drive and feel their car. health. It is this frankness of personality that is the most desirable in a driver.

Nonetheless, they had their challenges. The system is also a user-based discipline; a user may forget to add their recent. fuel fill-up or service price, the analytics are not balanced. We are already considering UX and data optimisation, so it might still be more prudent to pursue both.

VII. CONCLUSION

One piece of evidence that the available web technologies can be put into practice is the MotoTrack project. can be easily extended to earth problems of personal property. management. It is built on the stable, sturdy MERN stack. We have had the opportunity to provide a platform that bridges. sends them information on their maintenance. The system is fast, safe,

and most light, with a picturesque circumnavigating picture-post bulge. It returns feedback to the users and gives them financial control. traceable, predictable, transparent digital ecosystem of their own. vehicles.

VIII. FUTURE SCOPE

- a. Service Centre Integration: API to allow integration. Gngling: exchanging information about services with people.
- b. MotoTrack account.
- c. Add localisation: translation of the site into other regional languages and Hindi, so that it is available across the country's districts.
- d. Machine Learning to recommend an AI Wear Predictor: AI to wear predictor. Based on experience, it is best to patch the parts when. similar vehicles.
- e. It demands light IoT integration: GPS to determine new orientations. km covered by non-odometer. updates.

REFERENCES

- [1] - Z. Y. Zhou, Maintenance needs and V. P. Gandhi, Maintenance needs. infrastructure challenges with rapid economic growth," Vol. 63, pp. Transportation Research International. 108-124, 2014.
- [2] - T. Reardon and B. Minten, Surprised by degradation: diffusion. Journal of Economic, of car-service Indian. Literature, vol. 49, no. 4, pp. 1084-1100, 2011.
- [3] - V. Subramanian React.js, node.js and mongoDB combo in. Modern architectures, Journal of Web Engineering, 2019.
- [4]- E- Gov: an asset bonanza, K. Shilpa and R. Manju. it is surveilling, International Journal of computer science and Mobile. Computing, 2020.
- [5] - Y. Wang, The analysis of digital Platform Ecosystems. Economics, consumers, Business and Management. Research, 2021.
- [6] - The Digital India and its Impact on the: A. Kumar and P. Singh . A Review, International Journal of Rural, Automotive Sector: A Review. Development, vol. 12, no. 3, pp. 45-58, 2021.
- [7] - In India: R. Sharma, S. Patel. Problems and solutions, Engineering Review, vol.31, no.1. pp. 89-98, 2018.
- [8] - V. Ramesh, S. Ganesan, Consumer behaviour towards. India: e-perception, secondhand products in India. Marketing Research, 15 2, pp. 210-225, 2020.
- [9] - S. Gupta et al., "Bringing the maintenance to the fore. The most recent web technologies imply the misuse of computers and supply chain. Electronics, vol. 190, pp. 106-115, 2022.
- [10] - N. Desai, K. Mehta, Prediction of machine lifecycle. Algorithms: Artificial intelligence: Smarts tracking learning, IEEE. pp. Artificial Intelligence. 112-118, 2021.
- [11] - H. Davis MERN apps Access to user data. Cryptography Future and the use in the modern world: Cybersecurity Journal, vol. 14, p. 200215, 2022.

[12] - Lightweight Cloud-based Databases A. Smith et al. Riding on the clouds," IEEE Transactions on Cloud computing, vol. 18, pp. 112124, 2020.

[13] - P. Kaur, H. Singh, Automated Notification Systems, [13]. Statutory Compliance, 23, pp. Tracking, vol. 23. 40-47, 2021.

[14] - M. Rodriguez has gone further to be able to come up with complete stack web agile. Developing, Software Practice and experience, vol. 50, pp. 780 795, 2020.

[15] - C. Brown, "Get the information on the expenses visible. Web Dashboard Tracking, Information Visualization, 22, vol. pp. 310325, 2023.