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Evaluating Predictive Traffic Modeling Techniques for Smarter Urban Transport

Dr. S. T. Shirkande[1], Chankeshwara Yash Sanket[2], Choudhary Krishnal Sharad[3], Veer Pratik Dipak[4], Waghmode Nikhil Dhanajay[5]

[1]*Principal S. B. Patil College of Engineering*
[2,3,4,5]*Department of Computer Engineering, Savitribai Phule Pune University*
shri.shirkande8@gmail.com, yashchankeshwara@gmail.com, krishnalchoudhary92@gmail.com, pratikveer55@gmail.com, waghmodenikhil910@gmail.com

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Abstract

Emerging population and transportation in today's world, traffic has become a challenging issue to be addressed. Most of the metropolitan cities are facing various traffic-related issues. This poses the need for a smart traffic system, which could tackle the external environment and provide energy efficient transportation system. Intelligent transportation system (ITS) is required to support traffic management system in smart cities. The existing systems concentrate on the traffic prediction to yield better results. The work in this paper proposes a Smart Traffic Prediction and Congestion Avoidance System (s-TPCA) which helps in better identification of the traffic scenario that in turn helps in predicting and avoiding the congestion. The proposed work uses Poisson distribution for prediction of vehicle arrivals from recurring size. The framework comprises traffic identification, prediction, and congestion avoidance phases. The system checks for the fitness function to determine the traffic intensity and further use predictive analytics to determine the traffic level in future. This also integrates fuel consumption model to save time and energy. The proposed s-TPCA system outperforms the conventional systems in terms of delay and proves to conserve energy.

INTRODUCTION

In recent times, machine learning becomes an essential and upcoming research area for transportation engineering, especially in traffic prediction. Traffic congestion affects the country's economy directly or indirectly by its means. Traffic congestion also takes people's valuable time, cost of fuel every single day. As traffic congestion is a major problem for all classes in society, there has to be a small-scale traffic prediction for the people's sake of living their lives without frustration or tension. For ensuring the country's economic growth, the road user's ease is required in the first place. This is possible only when the traffic flow is smooth. To deal with this, Traffic prediction is needed so that we can estimate or predict the future traffic to some extent. In addition to the country's economy, pollution can also be reduced. The government is also investing in the intelligent transportation system (ITS) to solve these issues. The plot of this research paper is to find different machine learning algorithms and speculating the models by utilizing python3. The goal of traffic flow prediction is to predict the traffic to the users as soon as possible. Nowadays the traffic becomes really hectic and this cannot be determined by the people when they are on

roads. So, this research can be helpful to predict traffic. Machine learning is usually done using anaconda software but in this paper, I have used the python program using command prompt window which is much easier than the usual way of predicting the data

LITERATURE SURVEY

[1], the proposed method for traffic flow prediction is intended to provide increased accuracy for more precise traffic movement forecasting. The author notes the potential for further enhancements as deep learning technology continues to advance. The study focuses on improving current traffic control systems and aims to benefit traffic management in smart cities. The model can be applied to improve traffic flow and enhance traffic control in real-world scenarios.

In [2], Accurate traffic flow data is important for improving travel decision-making, reducing congestion, and lowering carbon emissions. Intelligent transit systems (ITSs) provide better accuracy for traffic flow prediction and are essential for the success of advanced traffic and public transportation systems. Real-time and historical data from various sensor sources are used for traffic flow dependency, but the large dataset dimension has made most existing traffic flow prediction systems and models somewhat inadequate. Transportation management is becoming more data-driven due to the increasing use of traditional sensors and new technologies.

In the paper [3], in order to predict road traffic in smart transportation systems, a classification model called m-KNN (Modified k Nearest Neighbour algorithm) was utilized, along with Principle Component Analysis (PCA) for feature extraction. To improve the accuracy of them-KNN method, a preprocessing technique was applied to the training data, resulting in significant performance improvements. Accurately predicting road traffic is a crucial aspect of modern transportation systems, and this proposed method has proven to be valuable tool in achieving this goal. International Journal for Research in Applied Science Engineering Technology (IJRASET).

In this[4] paper, by using various various computational techniques to improve the performance and precision of our predictions. Specifically, we employed a Support.Vector Machine approach to distinguish between classification and regression tasks, with the ultimate aim of forecasting the values of our target variables.

In [5], the EAM (Efficient Automation Model) presented in this study demonstrates the benefits of automating the training and generalization of deep learning algorithms to achieve reliable and high-performing traffic prediction models. The numerical results indicate that the EAM has yielded promising results in terms of prediction accuracy and resource allocation.

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allocation.

In [7], The SVM mo del offers strong learning capabilities and the ability to generalize well, especially when dealing with small sampleproblems. However, PSO maystruggle with local optimal solutions, though the addition of a mutation operation can address this issue. The PSOM model has few parameters, a simple program, and a fast convergence rate. In this study, a traffic fatalities prediction model based on PSOM-SVM was developed, which optimized SVM parameters. The results showed that the

PSOMSVM model outperformed the neural network and BPNN methods in terms of prediction accuracy, as it avoided the problem of overlearning andoffered excellent generalization capabilities. While this model's application is limited to parameters like highway ect,

mileage, vehicle number, population size, and traffic fatalities, it is possible to supple-

ment additional parameters in future studies to consider additional unknown factors.

LIMITATIONS OF EXISTING WORK

The system requires a reliable internet connection for real-time updates and tracking. Integration with maps may be limited to certain regions. The application's performance depends on the server and database handling capabilities, especially during high traffic. The scope of traffic prediction may be restricted by geographical location

PROBLEM STATEMEN

To overcome the problem of traffic congestion, the traffic prediction using machine learning which contains regression model and libraries like pandas, os, numpy, matplotlib.pyplot are used to predict the traffic. This has to be implemented so that the traffic congestion is controlled and can be accessed easily. Users can collect the traffic information of the traffic flow and can also check the congestion flow from the start of the day till the end of the day with the time span of one hour data. In this way, Users can know the weather conditions of the roads that

they would probably opt to take. This also tells the accuracy of the traffic by comparing their mean square errors of the past year's data and the recent year's data. Users can also know how many vehicles are traveling on average by the traffic prediction.

PROPOSED SYSTEM

The proposed system, Diploma World, is designed as an integrated academic collaboration platform built with a Python backend and a React frontend. The methodology followed during development was iterative and user-centered, ensuring that the final product meets the actual needs of teachers and students.

Diploma World is an academic platform designed to enhance resource sharing among teachers and students using a Python backend and React frontend. The system features secure user authentication, efficient resource management, and real-time notifications. The development methodology was iterative and user-centered:

- **Requirement Gathering:** Feedback from teachers and students guided feature selection.
- **System Design:** A modular architecture with RESTful APIs ensured seamless communication between backend and frontend.
- **Implementation:** Core functionalities like authentication, resource uploads, and role-based access were prioritized.
- **Evaluation:** Pilot tests confirmed improved performance, usability, and security.

Overall, the proposed system offers a centralized, secure, and user-friendly solution that overcomes traditional resource-sharing limitations and enhances academic collaboration.

SYSTEM REQUIREMENTS

Software:

- Operating System: Windows, Linux, or MacOS
- Web Browser: Chrome, Firefox, Safari, or any modern browser
- Back-end Framework: Python
- Database: MySQL.
- Development Tools: XAMPP, VSCode (for development), Postman (for API test-ing)
- **Hardware:**
- User Device: Minimum 2GB RAM, modern processor for users and shop owners.
- Server: Minimum 8GB RAM, 4 CPU cores, SSD storage, high-speed internetconnection for handling multiple user requests.

METHODOLOGY

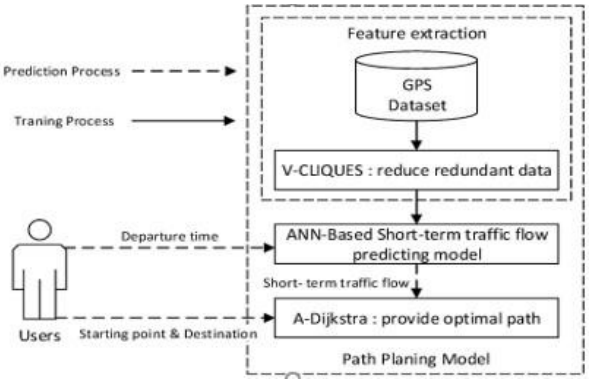

Fig1. Architecture Diagram

The System Architecture for an automated fraud detection of hall ticket in an offline examination system contains following System Architecture diagram in wich there are admin and student which connected and in database the information of the module:-

GPS Datasets: Collections of spatial coordinates and time information gathered by GPSenabled devices. They can be used for a variety of applications, including: Personal cartography: Helping you avoid getting lost Logistics: Optimizing logistics, route planning, and supply chain Retail and marketing: Measuring foot traffic, analyzing consumer behavior, and delivering targeted campaigns

- Satellite: This strategy uses a traffic prediction model to forecast the traffic value for the next time step. The model is based on the current traffic value and the G-AODV routing protocol.
- Optimal Path: Dijkstra's algorithm is a popular shortest path algorithm that can be used to find the shortest path between two points in a graph, such as a transportation network
- users: They are the actual client. They will be using the application. The user will make use of the system.

RESULT DISCUSSION

Diploma World significantly streamlines academic resource sharing by offering an intuitive resource management system. Teachers find the upload and categorization process straightforward, which minimizes search times and ensures that study materials remain current. The integrated search and filtering functionalities further enable users to quickly locate specific documents, enhancing overall productivity.

A robust authentication system paired with role-based access control secures the platform while providing a tailored experience for teachers and students. The user-friendly dashboard, powered

by a dynamic React frontend, offers real-time notifications and smooth navigation. Collaborative tools such as commenting and sharing foster an engaging academic community. Performance tests confirmed that the Python backend efficiently manages concurrent requests, ensuring scalability and stability. Overall, the results indicate that Diploma World not only overcomes the limitations of traditional resource-sharing methods but also enhances academic collaboration through improved usability, security, and efficiency.

RESULTS / OUTPUTS

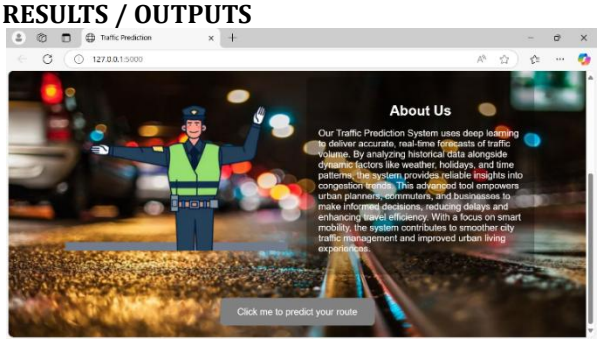

Fig 2. Home page

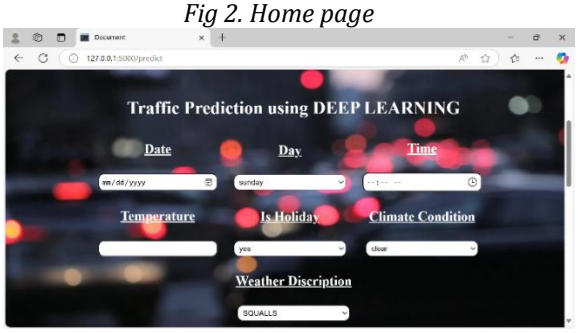

Fig 3. User Input Page

Fig 4. Final Output

CONCLUSION

A predictive traffic modeling system using a convolutional neural network (CNN) offers a powerful solution for enhancing urban transportation. By leveraging real-time and historical data, this system can accurately predict traffic patterns, optimize signal timings, detect incidents, and provide dynamic route recommendations. The integration of such technology into traffic management can significantly improve traffic flow, reduce congestion, and increase road safety.

Despite some challenges, such as high computational requirements and data dependency, the benefits of predictive traffic modeling are vast. It supports not only real-time decisionmaking but also long-term urban planning and environmental sustainability. This system is a critical step toward creating smarter, more connected cities that can better accommodate the needs of growing urban populations.

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