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Traffic Prediction Techniques: Comprehensive analysis

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Abstract - *In the modern era, the road infrastructure failed to cope up with the exponential increase of road traffic. There is a thrust to find a smarter ways to deal with such transportation system. Intelligent Transport System is at the forefront edge of this, one of the points is exact and hassle free forecasts that guarantee smooth and bother free driving and authoritative experience. In such manner, ITS being looked into for quite a few years and furthermore a field of consistent growth of works and advancement after some time, there is a wealth of writing on traffic expectation. Traffic datasets generated through the application of IoT are operated upon by the existing techniques. Traffic flow analysis is conducted to tackle the issues of traffic forecasting. Paper presents a systematic analysis of previous aggregate work on traffic prediction, highlight the marked changes and presents future directions for research work.*

Key Words: **Traffic prediction, Traffic Dataset, IoT, Traffic flow, traffic forecasting.**

1. INTRODUCTION

Intelligent transportation system technique in electronic or non electronic forms for producing information through advanced sensors, computers and communication technology that improve process of traffic forecasting. ITS is wide field providing assistance in the field of driver assistance, inter vehicle communication, air traffic control, road sign prediction, number plate detection, congestion control, dynamic routing etc. ITS caters to the multidimensional needs of traffic management overlapped with number plate detection and road traffic signal prediction[1].Most of issues of traffic prediction are caused due to existing infrastructure however some of the issues are also caused by poor management of traffic flow and congestion control[2].ITS tackles the issue of poor management of traffic flow by the use of accurate traffic monitoring and control strategies. The distributed and shared judgment and care management has be remolded an open issue at all levels of traffic forecasting systems. For the estimation of traffic prediction it requires the information that is simple and diverse from the sensors and skills[3].To work efficiently there should be a ITS software system in this environment. But this system also requires credible and timely information to ensure that software can work securely and produce results within specified time. Computer systems make the interaction between human and computational devices very natural so that users can get desired data in a transparent manner. The newly introduced gadgets like mobiles, PDAs, laptops etc. make every information available anywhere at any time. By using ITS, interactive feedback loops and video games, we can analyze the traffic related behavior changes that may occur. ITS is associated with many applications and in long term it is viable to get feasible into larger frameworks in health care.[4]According to researchers it is suggested that use of ITS and emergence in technology is efficient enough to aware users about the current traffic and provide preventive measures. The ITS also enable user for behavior change. Distinct elements of ITS are enhancement in decision making anw objective oriented. Diverting the traffic greatly depend upon the awareness of driver which will be accomplished by the use of ITS. Routing adherence is greatly impacted by this mechanism. with the help of transportation system drivers can analyze his behavior and prepare himself for taking appropriate action[4].

2 .Related work

To tackle the requirements of systematic review, background analysis is conducted. The background analysis present the existing techniques that are comprehensively used to predict on road traffic. O.U.Chinyere et al. discussed examination encounters of building a keen framework to screen and control street traffic in a Nigerian city. A half and half approach got by the intersection of the Structured Systems Analysis and Design Methodology (SSADM) and the Fuzzy-Logic based Design Methodology was conveyed to create and actualize the framework. Issues were related to present traffic control framework at the '+' intersections and this required the plan and usage of another framework to take care of the issues. The subsequent fluffy logic based framework for activity control was recreated and tried utilizing a prominent crossing point in a Nigerian city; infamous for extreme activity logjam. The new framework dispensed with a portion of the issues distinguished in the current activity checking and control frameworks. Traffic flag controller is playing increasingly and more critical parts in present day administration and control of urban traffic. C.Xiao-feng et al. introduces a shrewd traffic flag controller in light of multi-microcomputer innovation. The architecture and crucial elements of the clever traffic flag controller U initially presented in detail, at that point the human-PC interface in light of visual innovation intended for the controller is figured, and lastly an application case by and by is talked about[6].L.Kdqj discussed propelled activity data benefit framework not just give opportune and precise traffic data for activity administration work force who can adequately adjust the traffic administration control framework to an assortment of traffic conditions and street

arrange limit, yet in addition help street clients, viably staying away from roads turned parking lots, diminishing auto collisions. Notwithstanding, the existing dynamic activity data is discharged for generally group of onlookers. On the off chance that the majority of the drivers utilize the dynamic traffic data to design ongoing travel courses, at that point the in general activity framework might be bothered generally, and another road turned parking lot appear in the meantime maintaining a strategic distance from the current activity stick. In light of the GIS spatial information demonstrate and the hypothesis of multi-operator, we ponder a dynamic activity data administrations innovation in view of collective multi-specialist techniques all together to show signs of improvement travel way through upgrading the communication what's more, coordinated effort between the data suppliers and voyagers. At that point the test model framework is outlined what's more, created in view of the swarm stage and java language, and some analysis data is produced by the prototype system[7].B.Singh and A.Gupta deals with the expanding activity i.e major issue everywhere throughout the world. Wise Transportation System (ITS) answers these issues with the assistance of new advancements. ITS is an incorporated framework that executes an expansive scope of correspondence, control, vehicle detecting and hardware advances to take care of and deal with the traffic issues. ITS is being utilized as a part of the created nations since past two decades, however it is as yet another idea when creating nations like India, Brazil, China, South Africa and so on is concerned. In the present examination we have considered four noteworthy parts of the ITS i.e., Advanced Traveller Data System (ATIS), Advanced Traffic Management System (ATMS), Advanced Public Transportation System (APTS), and Emergency Management System (EMS). Target of the paper is to ponder different ITS engineering and model and audit such models to get top to bottom of their design. Subsequently engineering and created models throughout the times of four noteworthy branches of ITS have been inspected here to make an examination investigation of various models that have been produced by the scientists in their examinations. It will prompt the holes in the information which can be additionally considered. The paper features the conclusions extricated from the investigations of various frameworks and furthermore gives what's to come scope in the field of ITS to make it more easy to use and open.[8] H.O.Al-sakran suggested As of late notoriety of private autos is getting urban activity more swarmed. As result traffic is getting to be plainly one of vital issues in huge urban areas in everywhere throughout the world. A portion of the activity concerns are clogs and mischance which have caused a colossal exercise in futility, property harm and ecological contamination. This exploration paper introduces a novel smart activity organization framework, in view of Internet of Things, which is included by ease, high adaptability, high similarity, simple to redesign, to supplant conventional traffic administration framework and the proposed framework can enhance street activity hugely. The Internet of Things depends on the Internet, organize remote detecting and discovery advances to understand the canny acknowledgment on the labelled activity protest, following, observing, overseeing and handled naturally. Paper proposes a design that coordinates web of things with operator innovation into a solitary stage where the specialist innovation handles successful correspondence and interfaces among countless exceptionally dispersed and decentralized gadgets inside the IoT. The design presents the utilization of a dynamic radio-recurrence distinguishing proof (RFID), remote sensor advances, question specially appointed systems administration, and Internet-based data frameworks in which labelled activity items can be consequently spoken to, followed, and questioned over a system. This examination shows a review of a structure conveyed traffic reproduction display inside NetLogo, an operator based condition, for IoT activity checking framework utilizing versatile specialist innovation.[9]T.Osman et al. discussed incorporates the plan and usage of a clever and robotized activity control framework which takes points of interest of PC vision and picture handling systems. Alongside regular PC vision strategies; this paper presents two new techniques which has low preparing cost. One of the techniques has been developed with the assistance of equipment what's more; the other one is outlined without equipment bolster. This is a finish activity administration framework which has possessed the capacity to decrease roads turned parking lots and clog on re-enacted condition. It distinguishes the quantity of vehicles on every street and relying upon the vehicles stack on every street, this framework allots improved sum of holding up time (red flag light) and running time (green flag light). This framework is completely robotized framework that can supplant the regular pre-decided settled time based activity framework with a progressively oversaw activity framework. It can likewise distinguish vehicle condition on street and auto-change the framework as indicated by the changing street conditions which makes the framework insightful. The composed framework can help tackling traffic issues in occupied urban communities to an awesome degree by sparing a lot of worker hours that get lost attending to stuck streets. This examination concentrates on factors, ease picture preparing and activity stack adjusting.[10]Y.Wang et al. As indicated by city open travel issue trademark, the fundamental body of a paper has been submitted and has worked out one sort of in view of the Internet of things outline intelligent transportation framework. That framework gathers information by vehicle terminal and transfers information to the server through the system and makes information obvious to the purchaser passing an algorithm in the server. One viewpoint, the customer may ask about open travel vehicle data by Web. On another viewpoint, the shopper can know open travel vehicle data by station terminal. The investigations have tried that the intelligent transportation framework can offer open travel vehicle data to numerous shoppers with helpful way along these lines this framework can take care of the city mass travel issue.[11] X.Yu concentrated on the fundamental structure of canny urban Traffic Management System Based on Cloud Figuring and Internet of Things, proposed the design of canny urban

Traffic Management System Based on Distributed computing and Internet of Things. The paper made a profound research on the data observing in light of Internet of things, estimation and the shrewd displaying segments what's more, learning coordinating segment. Mass estimation was acknowledged by the utilization of the distributed computing stage. The framework generally understands the shrewd observing what's more, administration of urban traffic and understands the reason for keen dig of urban traffic. Traffic management with the implication of sensors is complex and required accuracy. Techniques devised so far still requires further enhancements for increasing accuracy of prediction.

2.1 Gaps in literature

Analysis of literature indicates that dataset used is offline and is not derived with the application of IoT. sensor data utilization within traffic related application is the prime cause of interest. Accurate prediction related to traffic to drivers involved along with direction sensing is missing in existing literature. Advanced application framework construction for traffic prediction is the solution for the problem.

3. Comparison tables

The comparison of various techniques that can be used to predict traffic is listed as under:-

Title	Technique	Datasets	Parameters	Merit	Demerit
A Consumer Transceiver for Long-Range IoT Communications in Emergency Environments[12]	IEEE802.11ah Wi-Fi protocol, Time Domain Least Square(TDLS)	--------	Packet Error Rate(PER), MSE	Increased range of service	Time of execution is substantially high
The advantages of IoT and Cloud applied to Smart Cities[13]	ClouT architecture which is combination of cloud and IoT is discussed	--------	-------	Sensorisation , Actuatorisation layer along with IoT have been added in CIaaS layer to extract data out of API's	CSaaS layer is still not completely defined.
Combining KNN Algorithm and Other Classifiers [18]	KNN, C4.5, SVM And Naive Bayes Classifier(KNC)	20 UCI Datasets	Accuracy for classsification	Higher accuracy	Execution time not considered
Short-term traffic flow prediction using seasonal ARIMA model with limited input data[14]	SARIMA	3-Lane roadway in Chennai, India	Flow of vehicles' accuracy through MAPE	More accurate results even with data shortage	More time for computations
Smart Disease Surveillance Based on Internet of Things (IoT) [15]	IoT in the field of health care	Central Health Ministry	Prediction accuracy	Fast prediction of patterns of disease, help to take measures on time	Inadequate data managers, low budget, lack of technical advisory group
Optimising Power Consumption of Wi-Fi inbuilt IoT Devices[16]	Reduce power consumption of Wi-Fi enabled devices	--------	Power consumption of various processors	Wi-Fi is better than other technologies in terms of range and security	No parameters enhancements are suggested
Spatial and Temporal Patterns in Large-Scale Traffic Speed Prediction[21]	Unsupervised methods(k-means, self organising maps, principal component analysis) to find out global trends	Road network from Outram park to Changi in Singapore.	Prediction accuracy MSE	Spatial and temporal trends found which was not possible through use of SVM	Need to incorporate these found patterns into route guiding algorithms

Data Mining for the Internet of Things: Literature Review and Challenges[17]	Review of various data mining techniques and its applications is performed	--------	3 views of data mining--> knowledge, technique, application view.	Big data, data mining are hot topics to discover deep.	Parameter optimization is not considered
An Aggregation Approach to Short-Term Traffic Flow Prediction[24]	Integration of MA, ES and ARIMA using NN	National Highway 107, Guangzhou, Guangdong, China	RMSE, PAE and MAPE	Accuracy is high	Situation involving multiple detectors is missing
Internet of things: Vision, applications and research challenges[19]	Review of IoT along with the challenges is discussed.	--------	-------	IoT applications are described ensuring its efficient use in future work	No parameter enhancement mechanism is considered
Utilizing Real-World Transportation Data for Accurate Traffic Prediction[23]	H-ARIMA+(Hybrid model of HAM and ARIMA)	Los Angeles County Transport Network	MAPE and RMSE	Short term and Long term prediction accuracy better than ARIMA, ES, NNet	Data from each sensor is studied individually. need for spatial correlations between sensors
Smartphone Based Automatic Abnormality Detection of Kidney in Ultrasound Images[20]	Viola Jones algorithm, SVM, Genetic algorithm	Ultrasound images from ultrasound scanner	Prediction accuracy	Benefits rural people, can be used for emergency	Only cyst and kidney stone is considered
Smart video surveillance system for vehicle Detection and traffic flow control[22]	Image Processing->Background Subtraction using Threshhold Adjusting process	Video Database	False Rejection Rate(FRR), False Acceptance Rate(FAR), Total Success Rate(TSR)	Prediction accuracy is increased by the use of video surveillance	Cameras not for night vision, situations to suspect danger not covered.
Traffic Flow Forecasting Using aSpatio-temporal Bayesian Network Predictor[25]	Bayesian Network	--------	Accuracy through MMSE	Prediction accuracy is improved since pre-processing reduces the impact of error	No real time dataset is considered

Table1: comparison of traffic prediction techniques

4. CONCLUSION AND FUTURE SCOPE

Traffic prediction using the application of fog computing is critical that can be used to monitor time critical applications such as preventing road accidents. The relevant information is required to be transferred to the source so that user who can be a driver can take appropriate action regarding route towards the destination is the prime objective of this study. Dataset derived from sensor will be used to construct real time traffic prediction framework. Accuracy will be the key parameter that could be enhanced by the application of proposed methodology.

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