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DESIGN AND EVALUATION OF A REAL-TIME FLEET MANAGEMENT SYSTEM

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***Abstract*— A supply chain consists of all parties involved directly or indirectly, in fulfilling a customer request. The supply chain includes not only the manufacturers and suppliers, but also transporters, workhouse, retailers and even customers themselves. Within each organization, such as a manufactures, the supply chain includes all functions involved in receiving and filling a customer request. These functions include, but are not limited to, new product development, marketing operations, distributions, finance, and customer service. Supply chain management (SCM) is the management of an interconnected or interlinked between network, channel and node businesses involved in the provision of product and service packages required by the end customers in a supply chain. Supply chain management spans the movement and storage of raw materials, work-in-process inventory, and finished goods from point of origin to point of consumption. It is also defined as the "design, planning, execution, control, and monitoring of supply chain activities with the objective of creating net value, building a competitive infrastructure, leveraging worldwide logistics, synchronizing supply with demand and measuring performance globally.**

***Key words*— real – Time traffic information; time dependent travel time, dynamic vehicle routing.**

I. INTRODUCTION

Fleet management is the management of a company's transportation fleet. Fleet management includes commercial motor vehicles such as cars, ships, vans and trucks, as well as rail cars. Fleet (vehicle) management can include a range of functions, such as vehicle financing, vehicle maintenance, vehicle telemetric (tracking and diagnostics), driver management, speed management, fuel management and health and safety management. Fleet Management is a function which allows companies which rely on transportation in business to remove or minimize the risks associated with vehicle investment, improving efficiency, productivity and reducing their overall transportation and staff costs, providing 100% compliance with government legislation (duty of care) and many more. These functions can be dealt with by either an in-house fleet-management department or an outsourced fleet-management provider. According to my research from the independent analyst firm M/s Birla Corporation Ltd, the number of fleet management units deployed in commercial fleets in India will grow from 1.5 million units in 2009 to 4 million in 2014. Even though the overall penetration level is just a few percent, some segments such as road transport will attain adoption rates above 30 percent.

The most basic function in all fleet management systems, is the vehicle tracking component. This component is usually GPS-based, but sometimes it can be based on GLONASS or a cellular triangulation platform. Once vehicle location, direction and speed are determined from the GPS components, additional tracking capabilities transmit this information to a fleet management software application. Methods for data transmission include both terrestrial and satellite. Satellite tracking communications, while more expensive, are critical if vehicle tracking is to work in remote environments without interruption. Users can see actual, real-time locations of their fleet on a map. This is often used to quickly respond on events in the field.

II. REAL TIME FLEET MANAGEMENT

Fleet Controller is Paragon's fleet management software solution that enables real-time vehicle activity to be tracked automatically against the planned routes and schedules. This gives transport managers real-time visibility of how the day's plan is progressing and provides an accurate picture of transport and service performance.

Use Paragon Fleet Controller to:

- Compare planned versus actual performance reports at the end of each day, highlighting any significant deviations, changes or anomalies for continuous performance improvement.
- Manage customer's delivery expectations in real time and reduce service failures.
- Automatically pre-advise customers of an updated delivery time when the vehicle is an agreed number of minutes away.
- Refine scheduling parameters to tighten up planning for greater consistency and improved fleet management efficiency.

Fleet Controller is available with a standard certified interface for connection with a range of leading tracking systems (normally requiring just an internet connection).

Companies can significantly improve their customer service achievement, respond efficiently to problems or delays that arise, ensure delivery schedules are legal and achievable, and unearth hidden inefficiencies for continuous performance improvement.

This fleet management software can be used as a standalone transport and customer service management system, or in conjunction with any of the Paragon planning systems.

III. Dignity of Proposed real-time fleet management system

Simple dignity. If this sounds all soft and squishy. A chance meeting outside my company where the truck parking is available Show last month provides a clue on how to avert a pending disaster.

I had moderated the Fleet Forum panel discussion on "Managing our Fleet in the Real World" with transporters 2013 Truck Fleet Innovators: Aman Road Lines, Raebareli; Bansal Shifters; Rajdhani Transport Ltd.; and Prakash Road Lines Ltd. These guys are no slouches in the fleet management world, but one reason for the shortage of qualified drivers was absent from the discussion at the forum.

The fellow I was talking with my company a software engineer with a stake in trucking's success. He had attended the Fleet Forum and indicated he found the discussion enlightening. He told me he was surprised that none of the panelists had mentioned the very basic requirement for fulfillment in life: the need to be treated with respect and dignity.

He suggested that drivers are not treated with a great deal of respect overall, and he was quite sure that anyone coming from almost any other trade or profession would find the drivers' world nearly intolerable in a very short time.

He mentioned specifically the insanely narrow delivery windows drivers face despite weather and traffic conditions, the constant hounding by Traffic inspectors, and being told — in words and deeds — that their time is worth nothing unless they are running down the road under a full head of steam.

This man made it quite clear that he'd need to be nearly destitute before he'd consider driving as way of making a living. He said there's no dignity in driving a truck. And he's right.

To those of us steeped in the culture, irritants like not being paid for loading and unloading, vehicle inspections and the like are standard operating procedure. To someone outside trucking, that would be abhorrent.

Another example: To run 2,500 miles in a week but to be paid only 2,450 because that's how far the computer says it is between two points — despite factors like construction-related detours — is beyond disrespectful.

We accept it because it has always been that way, or worse. But outsiders — those we are looking to recruit to fill truck seats — expect to be paid for the work they do, even if (and perhaps especially if) it's outside the normal call of duty.

The way drivers are treated by law enforcement is another cause for concern.

On a whim, any police officer can pull a truck over and strip a driver of half a week's pay with just a couple of citations, warranted or not. What's a driver to do, travel a thousand miles and miss a week's work to fight a Rs.- 500 ticket? The cops know the driver is not coming back to fight the ticket, so it's easy money.

That sort of treatment is dehumanizing, but we rarely hear industry leaders decrying that kind of behavior. Driving certainly isn't a glamorous job, but drivers don't need to be treated like criminals.

Actually, criminals have more rights than drivers in some respects. They are at least assumed innocent until proven guilty. Drivers give up a lot in the name of safety.

It's clear that the crowds of people who are not becoming truck drivers are not prepared to sacrifice their dignity to earn just a living wage.

IV. Proposed Fleet management System

Current fleet management systems are used mainly for monitoring purposes and are unable to handle in a systemic fashion various unexpected events that occur during delivery execution. Current research in the area of dynamic incident handling focuses mainly on the creation and testing of efficient algorithms that are able to handle dynamic events usually in an optimal or near optimal manner. However, such algorithms give a partial solution to the problem as in order to be effective they must be implemented in a fleet management system. The latter is able to provide real-time information about traffic or vehicle's status which acts as input data to the rerouting algorithms. There is thus a need for a holistic approach in the problem of dynamic incident handling, through the design of a real-time fleet management system that would be able not only to monitor certain vehicles but also detect possible deviations from the initial plan, and suggest new routes by using well known rerouting algorithms from the literature.

,One of the basic prerequisites for detection of possible deviation from the initial plan is to be able to predict the arrival time in the remaining customers. This can be achieved by using a travel prediction method during delivery execution. We propose a method for travel time estimation which is based on historical data from previous delivery schedules. Such methods can give very accurate results when traffic patterns at the moment of travel time prediction are similar to the historical ones retrieved from the database. However, as in urban settings there are cases where travelling times vary over time and depend on when a vehicle is traversing a particular segment we propose a second travel prediction method that uses real-time data to compute the network travel time in a dynamic manner. As the vehicle is travelling towards its destination, travel time is predicted sequentially by summing the travel time derived from speed measurements at different sections of the road. The system has an intelligent mechanism that monitors the traffic situation in consecutive time steps and decides which method gives the most accurate results. It is worthwhile to mentioning that both methods have been evaluated by using an innovative testing framework that included the design of a series of experiments which demonstrate how certain variables affect the prediction accuracy of each method.

Even if a real-time fleet management system uses accurate travel time prediction techniques, there should be a mechanism that would be able to decide whether a detected deviation is significant or not. For that reason we propose and evaluate two methods that can be used to assure that vehicle rerouting will be recommended only when the deviation from the initial plan is significant. In other words, these methods ensure that a vehicle will not be rerouted when it is not needed (i.e. when there is not a significant time violation).

V. Simulated Study of Proposed System

The system is also tested in real-life scenarios in order to confirm the simulation results. The system is implemented in two delivery companies in order to evaluate its performance in the field. Again a series of tests are used that are generated by the DoE method.

This dissertation discusses the design, testing and evaluation of a real-time fleet management system for dynamic incident handling in urban freight distributions. The main aim is to present the theoretical background for understanding the area of dynamic fleet management and at the same time to provide all the necessary details for designing and evaluating a novel system for tackling unexpected events that occur during freight delivery execution.

The urban environment was presented and emphasis was given to analyzing the unforeseen events that characterize the dynamism of urban freight deliveries. Current methods and techniques for incident handling were presented and the need for a real-time fleet management system for dynamic incident handling was identified. Then, the expected contribution of this thesis was presented and the research methodology that has been followed for the design, testing and evaluation of the system was analyzed.

This feature provides detailed information relating to vehicle and fleet costs. It assists the logistics manager by providing analysis and information concerning individual vehicle and overall fleet profitability. Features include vehicle and driver cost analysis as well as overall fleet costs.

Travel time can be defined as the total time required for a vehicle to travel from one point to another over a specified route under prevailing conditions. Its calculation depends on vehicle speed, traffic flow and occupancy, which are highly sensitive to weather conditions and traffic incidents. Nonetheless, daily, weekly and seasonal patterns can be still observed at large scale. For instance, daily patterns distinguish rush hour and late night traffic, weekly patterns distinguish weekday and weekend traffic, while seasonal patterns distinguish winter and summer traffic. It has been increasingly recognized that for many transportation applications, estimates of the mean and variance of travel times affect the accuracy of prediction significantly.

Travel time data can be obtained through various surveillance devices, such as loop detectors, microwave detectors, and radars, though it is not realistic to have the road network completely covered by detectors. With the development of mobile and positioning technologies, the data can be more reliably collected and transmitted. More importantly, these devices can be set up on vehicles with minimal hardware using non-sophisticated communication and installation. However, travel time estimation is not so straightforward because it depends not only from the surveillance devices, but also on the prediction technique that is being used for data processing.

To handle the complex nature of operations, the logistics operation is being handled at Birla Cement through a multi-tiered structure which involves logistics teams at Plant, Region and Zonal levels. Beside this, there is a central logistics team who set the overall policy guidelines, monitor logistics performance and ensure segmental priorities as well as service requirements are met.

Logistics processes are empowered by best in class SCM processes using technology as the enabler with focus on: Network Optimization Web Based Order Management system with real time visibility of order status Customer Service level measurement on real time basis Automation at secondary service points like Railheads and Godowns.

The above charts of lead time taken by the truck. This calculation taken from M/s Birla Corporation Ltd. engaged near about 4000 trucks from April 13 to Sept'2013 for the purpose of transportation of cement. This is the best system to calculate the lead time of trucks & this calculation system was also adopted by the company M/s Birla Corporation Ltd. after our variable suggestion and correction taken by the company.

A. Result Analysis & Evaluation

Fig.1 Trucks of M/S Birla Corporation Ltd

VI. Conclusion

Information from telemetric logger recordings can provide the input data for an analysis of driver/vehicle performance. A number of systems are available that can read these charts and produce a posteriori reports on rest time, driving time and break time, as well as details of legal infringements.

This includes the monitoring of the service life of vehicles in a fleet and the scheduling of routine and non-routine maintenance and repairs. Typical features include service history, maintenance schedule reports and workshop cost analysis. In this calculation system we had taken all timing including pick traffic time, normal traffic time, vehicle accidental time, loading/unloading time & order availability time then finally lead time & freight qty. generated. In this calculation used Global Positioning System (GPS) through internet or installed to all used trucks.

Name Of the District	Distance	Despatches	Freight	Avg. Unloading Time in Minute	Avg. Speed of Trucks (Minute)	Lead Time (Minute)	Lead Time in Hrs.	No. of Trucks Used
	Avg.Km.	Ts.	Per Ts.					
0-150 KM.				-				
Raebareli	28	23097	202	180	0.67	263.96	4	1155
Lucknow	99	56872	459	180	0.67	476.15	8	2844
Sultanpur	118	24780	471	180	0.67	532.98	9	1239
Fatehpur	116	670	489	180	0.67	526.45	9	34
Pratapgarh	129	11146	458	180	0.67	565.37	9	557
Barabanki	118	27555	432	180	0.67	532.30	9	1378
Kanpur Nagar	112	1136	386	180	0.67	512.94	9	57
Unnao	130	13177	447	180	0.67	566.79	9	659
	100	**158432**	**417**	**180**	**0.67**	**478.16**	**8**	**7922**
151-300 KM.	-	-	-					
Kanpur Dehat	158	632	497	180	0.67	652.49	11	32
Faizabad	155	2181	450	180	0.67	642.30	11	109
Sitapur	178	7778	613	180	0.67	712.67	12	389
Ambedkar Nagar	220	9516	626	180	0.67	836.01	14	476
Hardoi	195	8535	647	180	0.67	762.39	13	427
Bahraich	233	27162	689	180	0.67	876.44	15	1358
Gonda	242	11894	690	180	0.67	901.52	15	595
Lakhimpur	244	6147	751	180	0.67	908.42	15	307
Sidhharatnagar	246	1006	685	180	0.67	913.61	15	50
Gorakhpur	0	0	0	180	0.67	180.00	3	0
Kannuj	257	750	637	180	0.67	945.97	16	38
Shahjahanpur	284	266	829	180	0.67	1028.10	17	13
Mainpuri	290	90	684	180	0.67	1046.27	17	5
Basti/Sant Kabir N.	224	525	604	180	0.67	847.85	14	26
	222	**76482**	**665**	**180**	**0.67**	**841.67**	**14**	**3824**
301-450 KM.								
Farrukhabad	286	1416	681	180	0.67	1033.37	17	71
Mau	0	0	0	180	0.67	180.00	3	0
Etawah	309	148	730	180	0.67	1101.61	18	7
Deoria	0	0	0	180	0.67	180.00	3	0
Padrauna	0	0	0	180	0.67	180.00	3	0
Bareilly	320	2886	796	180	0.67	1135.22	19	144
Pilibhit	344	666	860	180	0.67	1207.46	20	33
Rampur	0	0	0	180	0.67	180.00	3	0
Badaun	395	20	954	180	0.67	1359.10	23	1
	314	**5136**	**771**	**180**	**0.67**	**1116.41**	**19**	**257**
451 & Above				0	0.67	0.00	0	0
Moradabad	0	0	0	0	0.67	0.00	0	0
J.P.Nagar	0	0	0	0	0.67	0.00	0	0
Bijnor	0	0	0	0	0.67	0.00	0	0
Grand Total	**143**	**240049**	**504**	**180**	**0.67**	**1198**	**30**	**4001**

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