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GSRTC Efficiency Exhortation System

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Abstract: ***The main aim of the project is to provide an easy and hassle-free environment for the GSRTC personnel to perform data related task and optimize the results. With the advancement in technology, Machine Learning has attained a level which can compete human in terms of accuracy in work. So with that perspective in mind, The project is dealing with such algorithms which can give bus Maintenance updates, Estimated fares, Seasonal flow allotment, etc. and makes work optimal and less cumbersome for the personnel.***

Keywords: Jupyter Python, Data Clustering, Data Classification, GSRTC, Optimize, Machine Learning

1. Introduction

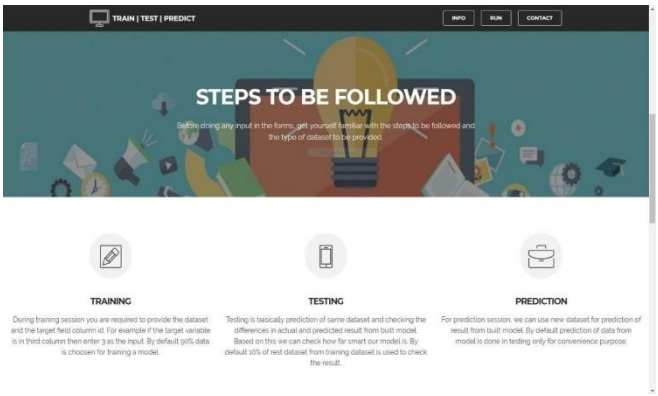
A Machine Learning based service developed for G.S.R.T.C to help them optimize their transportation system.

Exhort: To support and boost the efficiency of the GSRTC.
Optimize: To optimize routes, routine, schedule, cost and work force of buses using Machine Learning Algorithm.

It can be easily adopted by G.S.R.T.C. or some other similar organization with minor changes in the services for their optimization purposes. It will provide various recommendation to a GSRTC personnel based on the algorithm designed and calibrated to provide various optimization suggestions for GSRTC which will result into increased efficiency.

Current System frontend built using PyCharm and backend machine learning algorithms using Python Libraries. It is currently calibrated on whole Vadodara division depot and all the Destinations connected to it. It can be used on a broad basis if launched as a Web Service.

2. Requirement Analysis



All accumulated requirements are then tested through many feasibility constraints and then prioritized accordingly.

2.1. Functional Requirements

It should also satisfy the following requirements:

2.1.1. The system should provide satisfactory amount of informative instructions or guidelines to help GSRTC personnel find fields with possibilities of enhancements.

2.1.2. The system should provide powerful functions to help GSRTC personnel to retrieve required statistical data.

2.1.3. The systems should allow users to retrieve up to date GSRTC information and improve performance of GSRTC personnel in selective tasks.

2.1.4. The system should be able to work and collect information in poorly managed data sets.

2.1.5. The system should provide effective statistical information to GSRTC personnel and back to Administrators.

2.1.6. Developing system interfaces which can call and implement specific data processing in the system.

In accordance with the above requirements, the machine – learning based framework for enhancing performance of GSRTC system should require minimize human operation and supervision, so as to reduce the cost of manpower and the loss from human mistakes and to enhance the extension services.

2.2. Non-Functional Requirements :

2.2.1. Ease of use -organization personnel can use the software to their benefit.

2.2.2. Ease of distribution and integration -software available and readily integrated for services.

2.2.3. Extendibility- allow personnel to add new functionalities as per advancement in organization

3. Literature Review

From: GSRTC Divisional Office (Vadodara)
GSRTC is Gujarat State Road Transport Corporation. It is a Government State Transport Undertaking of Gujarat for passengers facilitating with Road Public Transport in mofussil

/ City Services. GSRTC operates within the state of Gujarat, India and neighboring states. It has an overall workforce of 40,000 personnel around all divisions.

The current system has been integrated and trained with live database of transport for the year 2016, 17 and 18 from the Statistical head of Vadodara.The database being very much raw, required to be cleaned and filtered. Applying multiple Pandas library functions and methods to transform it into a smooth and clean dataset.

4. Project Modules

4.1. Route Exploration

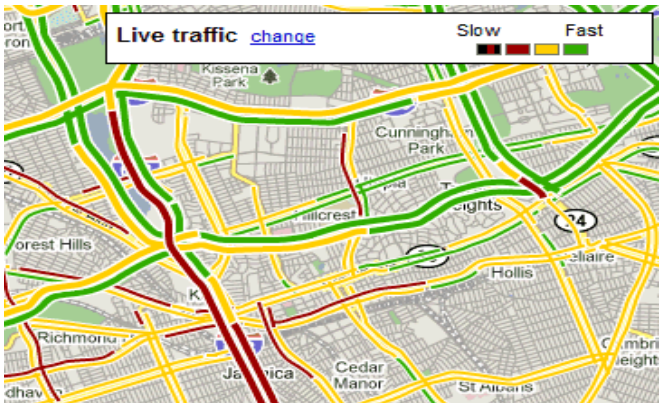
The process of including or excluding particular Destinations in order to improve feasibility and efficiency for Route Traversing. The system suggests, whether adding a stop/pickup point in between the source and destination of current bus route would add value to the company and simultaneously also maintain Journey duration and customer satisfaction. This is calculated through a feature named "EPKM" Earning per kilometer, which is a ratio of total fare received from all passengers to total distance traversed by the bus in between source to destination including pickup and drop off points. The algorithm identifies if the EPKM increases substantially landing a little impact on Journey duration and Bus Maintenance, the stop is feasible.

4.2. Fare Estimation

The process of setting up a fresh fare for newly launched bus, based on multiple features such as distance, bus sitting capacity, duration, departure time, terrain, operation type, etc. The system suggests rates for the new bus based on the past scenarios trained in the system and their per km rate factor. For a particular query fired, the system will create a cluster of all relevant cases and deliver output fares based on the trained dataset features with their relevance percentage.

4.3. Terrain and Traffic indulgence

Setting the Fare and Time for the journey such that keeping in mind the Terrain and Traffic conditions for respective destinations. Bad terrains and cumbersome traffic may result in increased bus maintenance charge and low mileage ultimately resulting in less revenue generation.Terrain indulgence is calculated based on the elevation gained factor and deviation of altitude through contour maps during the trip. Traffic indulgence is calculated based on the color(Red, Yellow or Green) of path on google maps for a 100 meters distance patch on the bus route. For instance, a buffer/delay of 28 sec is added to the bucket for every 100 meters of red(heavy traffic) patchon the route based on real time location of bus.

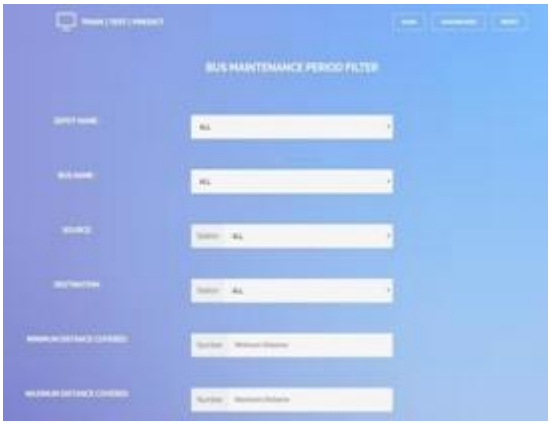


4.4. Bus Management

Aspect of this module is to implement equal traversal of each bus every month so as to maintain equally healthy condition and low maintenance. The system suggests as to which particular bus should be planned to run for the upcoming trips based on algorithms across ratio of number of operated days monthly basis to distance travelled and passengers accommodated.

4.5. Bus Maintenance

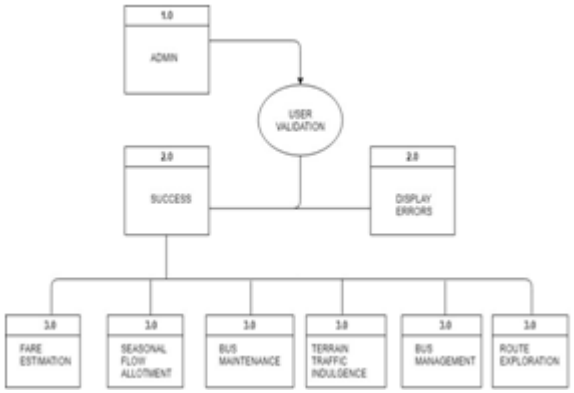
This module is to suggest the organization regarding discarding or adding some buses based on its maintenance or performance aspects. The system keeps a track of wear and tear of buses and the time since its last maintenance session. The bus health is calculated by running algorithm over certain features such as fuel consumption, spare parts(tyre tubes, batteries, lubrication) , depreciation on bus, insurance on buses, Diesel KMPL, oil KMPL, load factor and other miscellaneous charges. Furthermore, based on all the scenarios the system will suggest the percentage health of bus and provide its upcoming maintenance date.



4.6. Seasonal Flow Allotment

This module deals with suggestion for adding extra buses to run on particular routes for selective seasonal peak time frame or festival routine in order to cope up with the rush. System keeps a track of sitting capacity of bus and compares it with the passengers travelled; Over a period of years, there are certain patterns which keeps on repeating about rush wherein passengers exceed extensively the sitting capacity of the bus. Such scenarios usually occur during festivals. In order to cope with the rush, the system suggests setting an additional bus to the particular route for a specific required duration which results in a win-win situation for both passenger(comfortable journey) and the company(revenue generate).

5. DFD (Data Flow Diagram)



6. Data Dictionary

Table Name	*Field Name*	*Data Type*	*Constraint*	*Description*
Monthly Report	Depot Name	TEXT	Not Empty	Name of depot
	Schedule Number	NUMBER	None	Route groups
	Crew duty Number	NUMBER	None	Driver/conductor pair number
	Type Name	TEXT	Not Empty	Type of bus
	Operation Type Name	TEXT	Not Empty	Operation type of bus
	Name	TEXT	Primary Key	Name of bus
	Start Place	TEXT	Not Empty	Source
	End Place	TEXT	Not Empty	Destination
	KM	FLOAT	Not Empty	Total trip distance in KM
	Start Time	TIME	Not Empty	Departure time
	Sitting Capacity	NUMBER	Not Empty	Sitting capacity of bus
	Passenger	NUMBER	Not Empty	Number of passengers travelled
	Income	FLOAT	Not Empty	Revenue generated by bus
	Operated Day	NUMBER	Not Empty	Days of operation
	EPKM	FLOAT	Not Empty	Earning per KM
	Fare Amount	FLOAT	None	Fare amount

Table Name	Field Name	Data Type	Constraint	Description
Monthly Depot Wise Costing	Operational Details	Text	Primary Key	Depot Names
	Total Gross KM.IN LACS	Float	Not Empty	Gross KM in Lacs
	Total EFF.KMS.IN LACS	Float	Not Empty	Effective KM in Lacs
	DEAD KMS & its %	Float	Not Empty	Dead KM in percentage
	MISC.EARNINGS	Float	None	Miscellaneous Earnings
	EST.REV.FOR STU.PEN	Float	None	Estimated revenue for Student
	COST ON CREWS.	Float	Not Empty	Cost on bus staff or crew
	OTHER TRAFFIC STAFF.	Float	Not Empty	Cost on other staffing
	REP. & MAINT.STAFF.	Float	Not Empty	Repair and maintenance staff cost
	FUEL	Float	Not Empty	Fuel cost
	SPARE PARTS(AUTO)	Float	Not Empty	Auto spare parts cost
	SPARE PARTS(OTHERS)	Float	None	Other spare parts cost
	AVG. LIFE NEW TYRE	Float	Not Empty	Life duration of new tyre utilized
	% NEW TYRE SCRAPPED	Float	None	Total percentage of tyres scrapped
	DEPRECIATION ON BUSES.	Float	Not Empty	Depreciation on buses
	PASSENGER TAX.	Float	None	Passenger tax
	GOVT. TAXES ON BUSES	Float	Not Empty	Government taxes
	OTHER LOCAL TAXES	Float	None	Local taxes
	TOTAL MECH B/D	Integer	Not Empty	Total Mechanical Breakdowns
	INSURANCE & INT.ON BUSES	Float	Not Empty	Insurance cost on Buses
	P.F. ON 1,2 & 3 OF “A”	Float	Not Empty	Provisional fund

Table Name	Field Name	Data Type	Constraint	Description
Operational	Rank	INTEGER	Not Empty	Rank in order

Results	Division	TEXT	Primary Key	Name various division of GSRTC functioning region
	%Cancellation	FLOAT	Not Empty	Percentage cancellation
	Total TR ER	FLOAT	Not Empty	Total target earning
	TR EPKM	FLOAT	Not Empty	Target earning per km
	LF.% Age	FLOAT	Not Empty	Average age of passenger
	Total Accident	INTEGER	None	Total accidents occurred
	Rate of accident per 1 LAC KM.	FLOAT	None	Rate of accident per 1 LAC KM.
	CREW UT	INTEGER	Not Empty	Crew utlities
	VEHICLE UT	INTEGER	Not Empty	Vehicle utilities
	Load Factor	FLOAT	Not Empty	Load/rush factor
	Parcel Earning	FLOAT	None	Income through parcel transportation
	Total OT. Hours	FLOAT	None	Total overtime hours
	Total OT. Exp	FLOAT	None	Total overtime expense
	Diesel KMPL	FLOAT	Not Empty	Diesel efficiency per KM
	Oil KMPL	FLOAT	Not Empty	Oil efficiency per KM
	Total B/D Rate	FLOAT	Not Empty	Total breakdown rate
	% Off Road	FLOAT	Not Empty	Percentage offroad route

7. Conclusion

In conclusion, there are various Information systems which help the organization to save time, cost, and energy in their operations and managements.These systems have provided a large database inventory for the organizations to store and maintain all the information.

8. Future Work

As there is advancement in technology, human expectations for Machine performing their task will increase and in order to that such software services will come into action. There will be a boom for such machine powered work as human workflow will diminish.

GSRTC Efficiency Exhortation System can be used in any transport related field as it can be operated with any database. Oneself will just have to insert the data on daily basis for more optimized and up to date results and you will have your desired optimized solution.

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Author Profile

Karan Patelis currently working as Techno-functional Business Analyst at Streebo Inc. pursued engineering Information Technology from Birla Vishwakarma Mahavidyalaya, V.V.Nagar, Gujarat. He is a data aspirant with applied management skills.