

Data Analysis of Toll Plaza

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Abstract: In our everyday life people come across many problems. Out of which one of the biggest problems faced by the people who travel a lot is the current toll paying system. Nowadays as there is an increase in population it has led to a vast difference between the number of vehicles on roads as compared to the previous years. Each individual ponders his very own necessities which he needs to fulfil, however appropriate services are not provided by the administrations. As the problems cannot be solved overnight it needs proper analysis and accordingly appropriate measures should be taken.

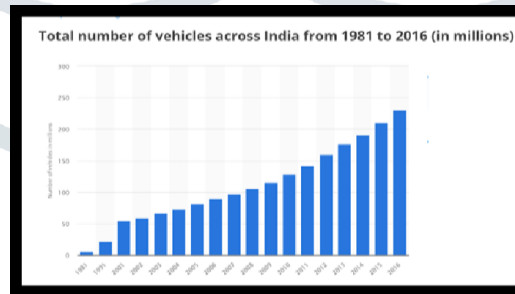


Fig1. Indicates This statistical graph represents increase in the number of vehicles in across India. The number has increased by a large number.

Keyword: Toll plaza, Traffic.

I. INTRODUCTION

As there is a rapid growth in development happening around us, system related to public also need an update where they can make use of these services without any complications. [6] As there is development the transportation system has become more complex. Considering the problem with lots of complexities, toll related issues is one of them. As the population before was not as much as compared to now, people used to face less problems. [2] Because of an improved transportation foundation, a colossal blitz can be seen at the toll plaza for paying the toll charges. Now as the population has touched its top mark, every individual cannot afford to waste a single second anywhere. Toll system is the issue where every citizen needs to wait for ample of time in queues despite of being ready to pay whatever the amount is. Technologies have upgraded a lot but the problem of standing in queues has not got any solutions yet. Due to infrastructural growth has improved the road conditions which inversely affected in increase of vehicles. Subsequently the toll booths also have increased in order to have the substantial development of infrastructure.

[3] Another imperative issue identified with toll courts is limit. Although dynamic path design arrangement might be ideally utilized in current facilities, toll clients may in any case experience the ill effects of long hold up times if the limit isn't sufficient to deal with all vehicles, particularly during peak hours. [7] It is equally important to explore the vehicle impact hazard in the upstream toll plaza territory. These days practically all roadways have toll plaza's that are manually administered, where an administrator gathers money from the driver and gives back a receipt. Since this system can be moderate, we frequently experience congested driving conditions at toll booths. Customized methodology of toll paying system can save time and labor. An automated toll system can be used to overcome the problems or difficulties that are faced in manually operated system.

II. LITERATURE REVIEW

Many surveys have been made till date for reducing the traffic caused at the toll plazas.

Sharpe, C.A. and Lindsley, R.P [5] in their paper stated that then innovation identifies with a framework for computerized toll gathering which naturally tracks charges wherever expenses are charged for entering predetermined topographical areas. Specifically, the creation identifies with a mechanized toll accumulation system which utilizes Global Positioning System ("GPS") innovation to bring down expenses.

Xu, Z., Di, X., Wang, H., Xu, J., Adomat, R. and Zhang, C.[8] in their paper proposed another methodology of robotized toll entryway of a computerized driving vehicle. In this methodology enables the vehicle to choose an ideal toll door and to naturally pass the toll door by utilizing object recognition, 3D condition development, virtual line generation, path planning and movement control. This information-based situation demonstrates that the proposed approach cannot just see the condition well for this reason however can likewise design suitable directions while experiencing complex scene close near squares.

Al-Ghawi, S.S., Hussain, S.A., Al Rahbi, M.A. and Hussain [1] In their work proposed an ease and effective technique called Electronic Toll Collection utilizing RFID modules that automatically gathers the toll from moving vehicles when they cross the toll court. They additionally expect that driver keeps up a prepaid record, with the goal that toll charge is deducted automatically from the driver's record at toll square. If the balance in the driver's record is low or if the vehicle isn't outfitted with a RF framework, the toll door stays close. In such a case vehicle driver should settle the toll regulatory expense in real money and gather the receipt. The driver gets a SMS message on his/her mobile about the subtleties of the instalment and there is no requirement for him to stop the vehicle.

Nagothu, S.K [4] In their work they are proposing to make geofences utilizing GPS by giving scope and longitude of the side of the toll plazas. By contrasting the situation of the vehicle and toll square, the driver of the vehicle can be charged from the record.

III. DATA COLLECTION

The following dataset used in this is completely real time data. The data was collected by conducting a survey, which was made using google forms. The survey was distributed amongst the people who travel frequently.

This survey was based on various parameters that affect the swift working of toll system. The dataset contains 12 attributes like age, how many times do they travel in a month, how much do you pay etc.

Previously there were no such options provided to the travelers like, no different lanes for large and small vehicle, number of lanes were less. Many new facilities are now being added for the traveler's convenience.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1	Timestamp	Age	Are You Aware Of Do You Like To	Are There Long	How Frequently Do You Travel	How Many Max	How Much Time	How Much Do You Pay	How Frequently Do You Pay	How Do You Pay	Are You Satisfied	The Suggestions (If Any)			
2	2019/01/29 131-40	Yes	No	Maybe	0-5 times	0-2	0-10 mins	151-200 rupees	0-5	Cash	No	2	Smart paying system		
3	2019/01/29 118-30	Yes	No	Yes	0-5 times	6-5	21-30 mins	151-200 rupees	0-5	Cash	No	2			
4	2019/01/29 618-30	Yes	No	Yes	0-5 times	0-2	11-20 mins	0-50 rupees	0-5	Cash	No	2			
5	2019/01/29 618-30	Yes	No	Maybe	0-5 times	3-5	0-10 mins	0-50 rupees	0-5	Cash	Yes	3			
6	2019/01/29 618-30	Yes	No	Yes	0-5 times	3-5	21-30 mins	51-100 rupees	0-5	Cash	No	1			
7	2019/01/29 718-30	Yes	Maybe	Yes	More Than 15	0-2	0-10 mins	0-50 rupees	0-5	Cash	Yes	3			
8	2019/01/29 718-30	Yes	No	Yes	0-5 times	3-5	0-10 mins	51-100 rupees	0-5	Cash	No	1			
9	2019/01/29 618-30	Yes	No	Yes	6-10 times	3-5	21-30 mins	101-150 rupees	0-5	Cash	No	2			
10	2019/01/29 118-30	Yes	No	Yes	0-5 times	3-5	11-20 mins	200 and above	0-5	Cash	No	3			
11	2019/01/30 941-50	Yes	No	Yes	11-15 times	3-5	11-20 mins	151-200 rupees	6-10	Cash	No	2			
12	2019/01/30 118-30	Yes	No	Yes	0-5 times	3-5	0-10 mins	151-200 rupees	0-5	Cash	Maybe	3			
13	2019/01/30 118-30	No	No	Maybe	0-5 times	0-2	11-20 mins	0-50 rupees	0-5	Cash	Maybe	2			
14	2019/01/30 118-30	Yes	No	Yes	0-5 times	0-2	11-20 mins	101-150 rupees	0-5	Cash	No	1			
15	2019/01/30 118-30	Yes	No	Yes	More Than 15	0-2	0-10 mins	51-100 rupees	More Than 15	Cash	No	0			
16	2019/01/30 118-30	Yes	Yes	Maybe	0-5 times	0-2	0-10 mins	151-200 rupees	0-5	Cash	Maybe	3			
17	2019/01/30 118-30	Yes	Maybe	No	0-5 times	3-5	0-10 mins	51-100 rupees	0-5	Cash	Yes	4			
18	2019/01/30 118-30	Maybe	No	Yes	More Than 15	3-5	21-30 mins	101-150 rupees	0-5	Cash	No	2			
19	2019/01/30 118-30	Yes	No	Maybe	0-5 times	0-2	0-10 mins	200 and above	0-5	Cash	Maybe	2			
20	2019/01/30 118-30	Yes	No	No	0-5 times	0-2	0-10 mins	200 and above	0-5	Mobile Wallets	No	2			
21	2019/01/30 118-30	Yes	No	No	0-5 times	0-2	0-10 mins	0-50 rupees	0-5	Cash	Maybe	3			
22	2019/01/30 141-50	Yes	No	Yes	0-5 times	0-2	0-10 mins	200 and above	0-5	Card	No	1			
23	2019/01/30 118-30	Yes	No	Yes	0-5 times	3-5	11-20 mins	101-150 rupees	0-5	Cash	No	2			
24	2019/01/30 118-30	Yes	Maybe	Yes	0-5 times	3-5	0-10 mins	51-100 rupees	0-5	Card	Maybe	2			
25	2019/01/30 118-30	Yes	Yes	Maybe	0-5 times	3-5	11-20 mins	101-150 rupees	0-5	Cash	Yes	3			
26	2019/01/30 118-30	Yes	Maybe	Yes	0-5 times	0-2	0-10 mins	51-100 rupees	0-5	Cash	Yes	5			
27	2019/01/30 118-30	Maybe	No	Maybe	0-5 times	3-5	0-10 mins	51-100 rupees	0-5	Cash	Maybe	2			
28	2019/01/30 118-30	Yes	No	Yes	6-10 times	0-2	0-10 mins	0-50 rupees	6-10	Mobile Wallets	No	3			
29	2019/01/30 131-40	Yes	No	Yes	0-5 times	0-2	11-20 mins	101-150 rupees	0-5	Cash	No	0	Please		

Fig.2 Dataset collected through google forms.

IV. DATA VISUALIZATION

We performed various operations on the collected data using R programming:

1.Barplot

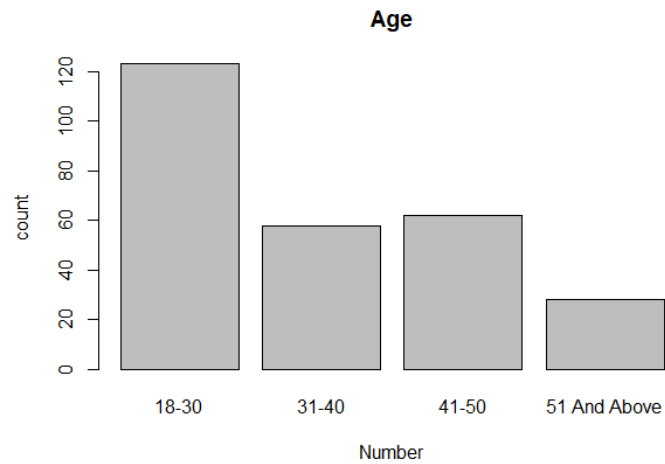


Fig 3. Through barplot we can analyze the age group of travelers who travel frequently.

2.Boxplot

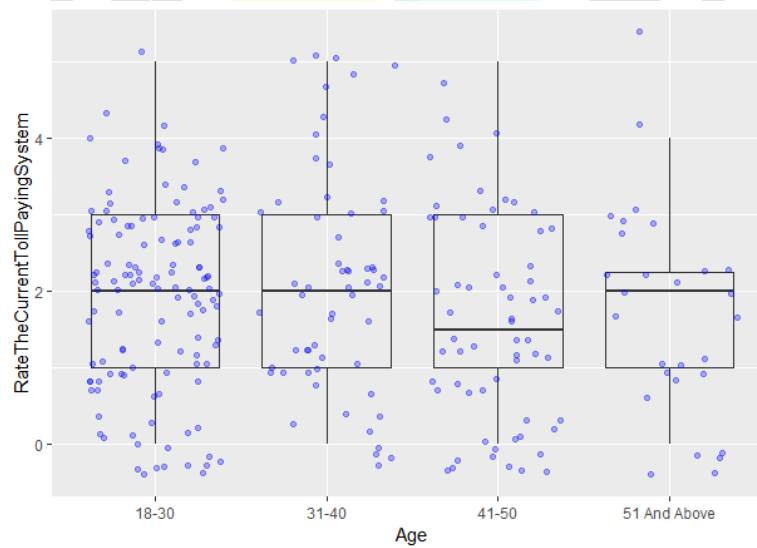


Fig 4. Through Boxplot we can analyze the Age and the Rating given by the travelers.

3. Histogram

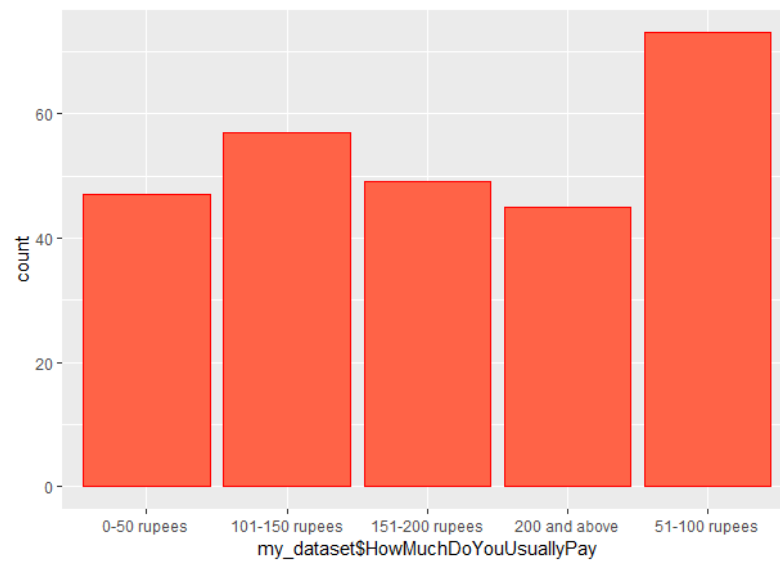


Fig 5. Through histogram we analyze the amount of fare paid by travelers.

4. Pie Chart

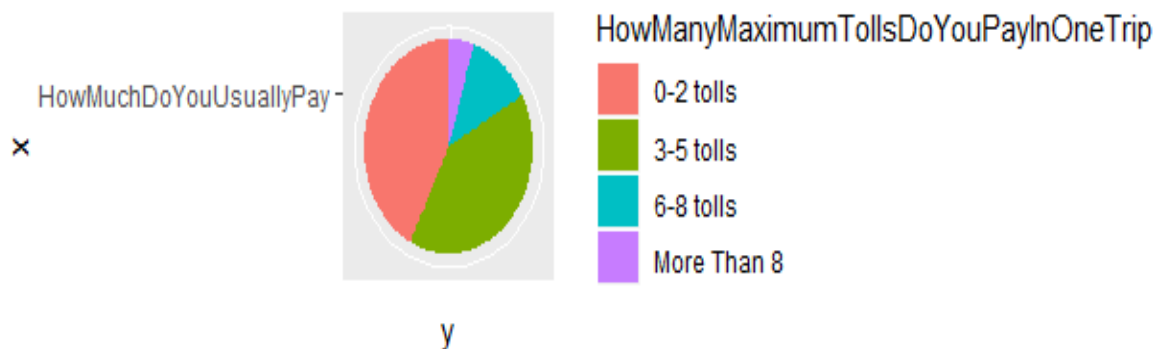


Fig 6. Through pie chart we analyze how many tolls the travelers pay during one trip.

5. Line Graph

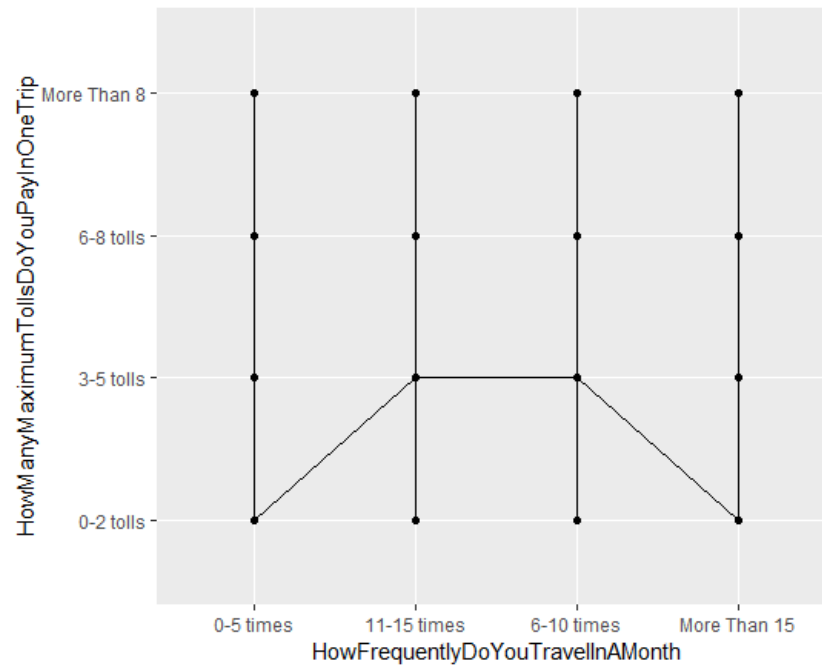
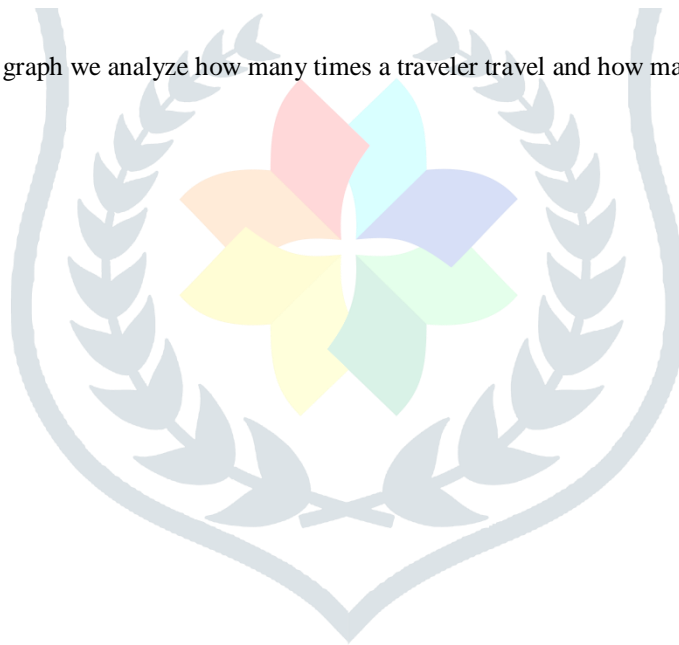


Fig 7. Through line graph we analyze how many times a traveler travel and how many tolls do they pay.



V. OBSERVATION

From the collected data we can conclude that over the past years there is a drastic increase in the number of vehicles whereas the quality and condition of the toll plazas are still the same.

As there are so many vehicles running on the traffic is increasing on a very large scale which is causing inconvenience to the travelers.

Proper management of road systems can not only help the travelers to reach their destination but can also reach safely. The main problem faced by the travelers is the traffic caused at toll plazas. As we know that every is busy and is in a hurry to reach his/her destination hence can't afford to waste so much time waiting at the toll booth. In case of medical emergency waiting in queues can be dangerous for the patient who's traveling.

Through the visualization performed on the dataset we can observe that most of the people are not satisfied with the current toll paying system. Most of the travelers have rated the current system below 4. Many issues should be solved so that the travelers can travel with ease.

VI. PROPOSE SYSTEM

As we have observed that most of the travelers are not satisfied with the current toll system. The services provided are not that gratifying hence should increase its level, so the customers can use those benefits fully and without any issues. As the main problem is the time that is spent waiting in long queues, solutions should be found as well as implemented to reduce this waiting time.

New payment methods should be discovered. People can use existing RFID based system to reduce the traffic caused. Or A new site /application can be made in which the travelers can create his/her account and which is linked to their bank account as well. Whenever a person is starting its journey, they should enter their route in the app. After the route is set the app will show how many tolls the traveler will face during his travel. And then the traveler will enter its car details and will pay whatever the amount is displayed and a QR code will be sent on his/her registered mobile no.

The toll booths will then have separate lanes for those who are paying online and for those who are paying in cash. When the traveler reaches the toll booth, he just has to scan the QR code and the barricades will open and the traveler can go ahead with his journey.

Not every customer chooses online payment some go with traditional payment methods as well. Hence for such travelers the existing toll system will remain the same but instead of having 5 lanes for cash payments there will be 3 lanes and 2 lanes can be for those who are paying online.

VII. CONCLUSION

By analyzing the collected dataset, we can conclude that most of the travelers are unhappy with the current toll paying system. If the proposed system is implemented, we'll be able to see the improvement in the traffic. The labor can also be reduced and more of technology can be used as the scanning of code will be done by the driver itself. If there is cooperation from both ends which is the government and the public, the improved system will be beneficial for the society.

VIII. REFERENCES

- [1] Al-Ghawi, S.S., Hussain, S.A., Al Rahbi, M.A. and Hussain, S.Z., 2016, March. Automatic toll e-ticketing system for transportation systems. In *2016 3rd MEC International Conference on Big Data and Smart City (ICBDSC)* (pp. 1-5). IEEE.
- [2] Bohra, V., Prasad, D., Nidhi, N., Tiwari, A. and Nath, V., 2019. Design Strategy for Smart Toll Gate Billing System. In *Proceeding of the Second International Conference on Microelectronics, Computing & Communication Systems (MCCS 2017)* (pp. 615-621). Springer, Singapore.
- [3] Kim, S., 2009. The toll plaza optimization problem: Design, operations, and strategies. *Transportation Research Part E: Logistics and Transportation Review*, 45(1), pp.125-137.
- [4] Nagothu, S.K., 2016, April. Automated toll collection system using GPS and GPRS. In *2016 International Conference on Communication and Signal Processing (Iccsp)* (pp. 0651-0653). IEEE.ss
- [5] Sharpe, C.A. and Lindsley, R.P., Texas Instruments Inc, 1996. *System for automated toll collection assisted by GPS technology*. U.S. Patent 5,490,079.
- [6] Wang, C., 2017, May. Design model of toll plaza of the highway. In *2017 International Conference on Smart Grid and Electrical Automation (ICSGEA)* (pp. 461-464). IEEE.
- [7] Xing, L., He, J., Abdel-Aty, M., Cai, Q., Li, Y. and Zheng, O., 2019. Examining traffic conflicts of up stream toll plaza area using vehicles' trajectory data. *Accident Analysis & Prevention*, 125, pp.174-187.
- [8] Xu, Z., Di, X., Wang, H., Xu, J., Adomat, R. and Zhang, C., 2018, June. Automated Toll Gate Passing. In *2018 IEEE Intelligent Vehicles Symposium (IV)* (pp. 168-173). IEEE.