Virtual Tollgate using Machine Learning

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ABSTRACT
The traffic at toll gates is increasing day by day which leads to loss of time as well as fuel and pollution which is now a major concern. Even though there are smart payment gateways such as FASTAG the vehicle still needs to move in lower speeds to get detected by the readers. Our system is to implement a way smarter tollgate using machine learning algorithms. In these a tracking device is placed inside the corresponding vehicle and the path travelled by the vehicle for a day is retrieved as an image and pushed to the server through the internet connectivity provided in the device. In the server the received image is processed using the machine learning algorithms fed into it and allots the fare accordingly. The bill is generated on a monthly or weekly basis and sent to the user/owner of the vehicle. The utilization of mechanized cost assortment frameworks in numerous metropolitan urban areas would be an effective advance towards the congestion of the city roadways in substantial clog of traffic. As we as a whole know, transportation is the strength of our nation's economy. There are different usage conventions in remote sensor organizations, for example, drain and segments, for example, RFID, NFC in this manner empowering decrease in activity expenses and rousing credit only exchanges. If there should arise an occurrence of manual cost assortment framework time utilization is much far more regrettable just as fuel consumption and most significant is the climate, the measure of air contamination that is made at the tollgate site is at elevated level, so our created framework will decrease time wastage and lessen air contamination as well as preserve fuel. The sole reason for this paper is to decrease the difficulties brought about by manual cost assortment frameworks and pass the subject’s vehicle through the cost obstruction in a matter of a couple of moments without stop.

Keywords: RFID, NFC, Arduino, Stolen vehicle, Internet of Things (IoT), congestion, E-Wallet

1. INTRODUCTION
The traffic at cost entryways is expanding step by step which prompts loss of time just as fuel and dirty which is currently a significant concern. In highways, one needs to pay a fee to use that road which is referred to toll and those payments are done at toll gates. But in those tollgates, the traffic congestion is increasing day by day since the number of automobile users increased. Even though there are smart payment gateways such as FASTAG. The vehicle still needs to move in lower speed. In [1-3] proposed electronic cost framework for Washington Metropolitan Area. Free stream ringing with fixed transponders undersides of vehicles and the peruses were situated under the parkway surfaces (1960s and 1970s). Norway wide spread usage of this transponder and peruses innovation. In [4-7] counselling the deeds and assets by that distributed computing and QR scanners can be included and used in the vehicle as a result to create the cost method mechanized, consequently dropping the period snared across cost charge instalment, this accelerate the cost charge instalment advancement. In concentrated by specialists and furthermore applied in different freeways, extensions, and passages require such a cycle of Automatic Toll Plaza. ATP is fit for deciding whether the vehicle is enlisted or not, and afterward illuminating the administration community going to handle infringement, charges, and taking an interest accounts. The most amazing favourable position of this [8]ATP framework is that it is fit for wipe out blockage in cost square, particularly during those seasons when traffic is by all accounts higher than ordinary. This recovered data will be shipped off the framework through GSM module and the regarded sum will be deducted from client’s record and it will be informed to the portable number which has been enlisted previously. On the off chance that the regarded sum is deducted effectively the obstruction will open and the vehicle is permitted to leave the tollgate. If not
the obstruction will stay shut. In this framework the making out of edge, framework working is
delineated and information data is easily trade over among automobilist and specialists of Toll, along
these lines by this framework we can diminish a potential blunders by human and with a less traffic we
get an efficient assortment of cost framework. Since Raspberry Pi is empowered with IOT vehicles
information base can be made and it very well may be connected to the worker utilizing an application
introduced in any PC. It gives a [9-24] adaptable frontend for cost entryway specialists to have a total
update of the vehicle, cost gathered and soon. Vehicle client can likewise energize his vehicle card
utilizing this electronic application. Application additionally shows the proprietors balance in the card
and soon.

Our framework is to execute a way more intelligent tollbooth utilizing AI calculations. In these
a GPS beacon is put inside the relating vehicle and the way went by the vehicle for a day is recovered
as a picture and pushed to the worker through the web availability gave in the gadget. In the worker
they got picture is prepared utilizing the AI calculations took care of into it and distributes the passage
likewise. The bill is produced on a month to month or week by week premise and sent to the
client/proprietor of the vehicle.

2. BLOCK DIAGRAM
The following Figure 1 shows the block diagram of the virtual tollgate device that is to be placed inside
the vehicle.

![Figure 1 Block Diagram](image)

The Arduino placed in the device acts as the processor to interface the modules and send data via cloud.
The SIM7000c which is a GPRS module which sends data to the server. As far as the working goes the
GPS module detects the location of the vehicle in real time and send signals to the Arduino accordingly.
The Arduino receives the signals from the GPS module and process the data to get coordinates these
coordinates are sent to the server using the GPRS shield interfaced with the Arduino. The Sever process
the coordinates and map it as an image which is then processed using Machine Learning algorithms and
produces the fare as a result. For a particular vehicle the 3 image is generated every 24 hours and is
processed. A bill is generated and sent to the user in a monthly or weekly basis.
3. WORKFLOW

The Machine learning model is trained using tensor flow framework. The code starts by importing the essential libraries such as tensor flow, numpy and matplotlib. Training images are collected and declared into the code. With the help of these images and its calculated dare which is also fed to the system the ML code finds a way to calculate a fare.

The images are compressed to enhance the speed and also gray scaled if needed. The approximate fare is calculated manually for the training images and is fed to the system in sequential array corresponding to the images. “model.fit” method is used to train the model with the given data. Then the test image is given to the system to calculate the fare.
4. HARDWARE IMPLEMENTATION

![Hardware Blocks](image1.jpg)

**Figure 3 Hardware Blocks**

![Hardware Implementation](image2.jpg)

**Figure 4 Hardware Implementation**

The GPS tracker detects the location of the vehicle in real time and send the coordinates to the database every 10 seconds. In these papers we proposed a novel technique that will give us best results and provide flawless data transmissions shown in figure 3 and 4.
5. RESULT AND DISCUSSION

Figure 5 Output from DB

The output from the tracker is shown in the above Figure 5. The co-ordinates is stored in an array which is then mapped into an image in further processing.

5.1 Plotted map

Figure 6 Plotted Map

Figure 7 Fare Stored in DB
And finally the plotted map is fed to the trained ML model and the obtained result will be uploaded in firebase on a daily basis in an array are shown in 6 and 7.

In this paper the output is monitored through the firebase app which is cloud service helps to manage the database and in further processing of data. The accuracy of the location depends upon the GPS module and in this project the accuracy is about 100 m. The coordinates is stored as an array in the DB which is then mapped as an image. The image is further processed using ML algorithms and desired fare is provided as an output. The mapping of image and processing of image using ML is done in the second phase of the project.

6. CONCLUSION

Virtual Tollgate using ML is an innovative application of Machine learning and Artificial intelligence. It makes use of the Internet of things too. In the phase one of the paper a tracking device is developed which tracks the path of the vehicle and the processing fare is done at phase two. Our system is to implement a way smarter tollgate using machine learning algorithms. In these a tracking device is placed inside the corresponding vehicle and the path travelled by the vehicle for a day is retrieved as an image and pushed to the server through the internet connectivity provided in the device.

In the server the received image is processed using the machine learning algorithms fed into it and allots the fare accordingly. The bill is generated on a monthly or weekly basis and sent to the user/owner of the vehicle. The utilization of computerized cost assortment frameworks in numerous metropolitan urban areas would be a proficient advance towards the congestion of the city parkways in weighty clog of traffic. As we as a whole know, transportation is the quality of our nation's economy. There are different execution conventions in remote sensor organizations, for example, filter c and parts, for example, RFID, NFC in this way empowering decrease in activity expenses and propelling credit only exchanges. If there should be an occurrence of manual cost assortment framework time utilization is much far more terrible just as fuel exhaustion and most significant is the climate, the measure of air contamination that is made at the tollgate site is at elevated level, so our created framework will lessen time wastage and diminish air contamination as well as ration fuel. The sole reason for this paper is to lessen the difficulties brought about by manual cost assortment frameworks and pass the subject's vehicle through the cost boundary in a matter of a couple of moments without stop.

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