Vehicle Fare Detection Using Geocoding With QR Code

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Abstract- *An idea based on the development ofan Android based vehicle fare detection system which can accurately measure the distance and also can give solution to the fare payment difficulties using a payment gateway, all accumulated in a single system has been proposed in this paper. Our main goal is to digitize the current system in such a way which would be of convenience both for the driver and the passenger. The system is developed using the latest technology QR code. In this system, scanners are used to capture the QR code which is tagged in each vehicle which contains relevant details of the driver and the vehicle. The distance is calculated using the geocoding algorithm and the speed detection algorithm. The payment is done through a payment gateway. The QR code is encrypted using algorithm. In the present day RFID (Radio Frequency Identification) has been used for this purpose. In order to overcome the issues of RFID tags QR code is proposed.*

Keywords- Vehicle fare detection, QR code, Geocoding, Radio Frequency Identification.

I. INTRODUCTION

Today, in context with the technological advancement in every sphere of life, digital taxi fare detection system is not anymore an unfamiliar term. An auto rickshaw / taxi is one of the chief modes of transport in India. A large number of people use these vehicles for their daily commute and every time they pay some fare because there is no check on the reading of meter. Auto rickshaw meter tampering in India has become quite common because the current meter calculates fare on the basis of the rotations of the wheel and this system can be easily tampered. Hence, it is necessary that we should have something that can cross check the reading of the meter and guide us the right fares. This daily problem of the public encouraged us to work in this area and we came up with an idea of ANDROID BASED FARE METERING SYSTEM with the latest technology QR code.

In this study, we focused on detecting the fare according to a vehicle. The approach of detecting the fare helps to avoid invalid payments and provide safe, secure, effective strong system in real world transport system. Recent trends in the market have shown an increase in the use of QR codes than can be scanned and read by camera in a smartphone. QR codes are easily readable barcodes that when scanned with a QR decoder (usually available on smartphones) can translate the code into a URL, a telephone number, a bit of text, or other data even using it for payment and transfer of money.

In this Android based application, both the driver and the customer can register and login using personal information. The driver or the vehicle owner can login to the application and enter the details resulting the generating of unique QR code which is encrypted using the algorithm. The unique QR code generated for the vehicle / driver can be scanned by the customer for the relevant information about the vehicle and the driver. The application also finds the distance travelled using *geocoding algorithm and the speed detection algorithm*. Hence the application helps to cross check the reading of the meter and guide us the right fares. The application integrates a *payment gateway* which is approved by the government hence enables an ease of transaction. We have included many additional features like *emergency SOS* call button, *SMS system* which regularly updates the customer on each ride on the vehicle for security purposes. *24/7 support* and *road side assistance* can be initiated within the application. With the payment gateway integration the customer can pay the fare within the application hence enhancing the digital India scheme. Manual payment is also supported by the application by providing the SMS message.

1.1 QR code

QR code (abbreviated from Quick Response code) is the trademark for a type of matrix barcode (or two-dimensional barcode) first designed in 1994 for the automotive industry in Japan. A barcode is a machine-readable optical label that contains information about the item to which it is attached.It consists of black modules arranged in a square grid on which information can be captured and read by the camera. Data is extracted from patterns presented in both

horizontal and vertical components of the image. It offers a number of benefits such as:

- High capacity
- Less storage space
- Readable from any direction
- Structured appending
- Cost effective over traditional barcodes.

Fig 1.1 QR Code

The Quick Response system became popular outside the automotive industry due to its fast readability and greater storage capacity compared to standard UPC barcodes. While scanning the processor locates the three distinctive squares at the corners of the QR code image, using a smaller square (or multiple squares) near the fourth corner to normalize the image for size, orientation, and angle of viewing. The small dots throughout the QR code are then converted to binary numbers and validated with an error-correcting algorithm.

1.2 ANDROID

QR Code based vehicle fare detection application does the functionality of the hardware fare meter in this paper with the help of geocoding and speed detection. We assume that all the pre-defined hardware for the real world systems are implemented as we already have existing fare detection system only minor upgrades have to be done in order to fit the scanners. This paper talks about the android application. Android is a mobile operating system by Google based on the modified version of the Linux kernel and other open source software. Android is basically designed primarily for touch screen devices such as Smartphones and Tablets, Wear OS, Digital glass, Android TV and Android Auto that is used in cars. Android has evolved a lot over the years and has quickly become the dominant mobile platform across the globe. Android is designed to make the world in our finger tips. Android gives a whole new digital world in different areas of our daily life. Android also brings the market flooded with smartphones and hence enables more people to use different technologies that are available to them. Android also helps to get updated and also keep updating the technologies in order to provide more to the peoples.

1.3 GEOCODING

Geocoding is the process of taking input text, such as an address or the name of a place, and returning a latitude/longitude location on the Earth's surface for that place. Reverse geocoding, on the other hand, converts geographic coordinates to a description of a location, usually the name of a place or an addressable location. Geocoding relies on a computer representation of address points, the street / road network, together with postal and administrative boundaries. Sometimes the term can be used in a broader sense the characterization of a neighborhood, locality, etc.

Geocoder: a piece of software or a web service that implements a geocoding process i.e. a set of interrelated components in the form of operations, algorithms, and data sources that work together to produce a spatial representation for descriptive locational references. The geographic coordinates representing locations often vary greatly in positional accuracy.

1.4 PAYMENT GATEWAY

Payment gateway is a merchant service provided by an e-commerce application service provider that authorizes credit card or direct payment processing gateway may be provided by a bank to its customers, but can be provided by a specialized financial service provider as a separate service, such as a payment service provider.

A payment gateway like Razor pay that we are integrating with the application allows the user to securely transact their payment an HTTPS protocol based transaction take place. Virtual payer authentication is something that the acquirers, issuers and the payment gateways are backing to secure the process even more. PCIDSS makes it secure enough to allow the user to store their personal data in the portal or gateway for recurring payments.

The most significant advantage of a payment gateway is the fact that it allows millions of users to use it at the same time, making it possible for you to purchase or sell goods and services whenever you want.

1.5 SMS

SMS (Short Message Service) is a text messaging service component of most telephone, internet and mobile device systems.

The protocols used in this service allow users to send and receive messages to and from GSM mobiles. SMS

although commonly seen in the mobile to mobile services it can be expanded into technologies that offer services and support.

SMS is a stateless communication protocol in which every SMS message is considered entirely independent of other messages. In this system SMS is used to send alert, balance and other toll based reports directly to the user mobile. This enables the user to have a regular update on the main account balance of the wallet.

II. LITERATURE REVIEW

In this paper [1], the implementation of the proposed system consist of 3 stages. The first stage consist of extraction of the signal, which is integrated with the wheel for the core purpose of only counting the rotations. The second stage consist of the display and controlling sections, which contains the processing unit, display unit, controlling switches, GSM device, RFID reader and the RFID module.The third stage consist of web section which contains the database management system which is linked with the second stage over GSM. It mainly consist of 4 core portions.

Distance measurement in this project is calculated using the equation according to the one full rotation of the wheel is as follows:

$$D=2*\pi*R*N$$

Where the symbols resemble, D= total distance covered, R= radius of the wheel, N= number of rotations.

The second portion is the fare calculation which is calculated at the server side. It`s calculated using the distance travelled and the waiting time which can be taken from the Arduino.

The third portion is the control switches consist of 5 control switches for the operation of the system. Hire on switch, Hire off switch, Payment switch, Balance check switch, Driver ID update switch, Offline payment switch.

The fourth portion is the transaction where RFID cards are used with unique ID with a website for hosting the data values. The languages used for developing the website are PHP script, MySQL, CSS and HTML5. The corresponding fare amount will be deducted from the customers ID and added to the drivers ID through the website developed for the transaction.

Gaussian mixture model and blob detection methods has been used in paper [2] for creation of a unique algorithm for vehicle detection and tracking. This method was able to acquire 91% result using the above two methods. The Gaussian mixture model in general uses to differentiate the foreground from the background images using frames. A binary computation is used to identify the foreground images. Gaussian Mixture Model (GMM) is a function to measure parametric probability density represented as Gaussian component identities. A threshold values is calculated to define the similarities of the objective and the quality that has been learned by the GMM. Blob detection is a technique used to track the movements of an object in frame. A blob is a group pixels identifies as an object. The mechanism finds the bobs position in every image frame. Each and every position has a subtle variations in real world scenario. One light or color is selected then blob might only be few pixels.

The system finds new blobs in the new image and make meaningful connections between the seemingly different blobs present in each frame. Blob detection uses contrast in a binary image to compute a detected region, its centroid, and the area of the blob. Each class in the blob is marked as candidate blob (CB). The CB is checked for size and is removed from the algorithm to reduce false detection. When the vehicle passes through a current frame and these are compared using the k-means clustering. The moving vehicle is counted upon passing of the base line. GMMs are trained for 150 images, with typical frame rate. Pixel manipulation techniques are carried out to de-noise and filter the binary image. Blob analysis identifies potential objects and box around them. Count box is the specific region where tracking is carried out. The region is built so to reduce the redundancy in computation and higher performance. Tracking is done by searching for the centroids in the small rectangular region. If it’s not found then it is added to new found track array. Automatic vehicle counting system counts less numbers of vehicle due to the real life congestion and heavy traffic flow.
In paper [3] novel taxi ride sharing models for smart city have been discussed. Ride sharing taxies are in high demand and also they are in tested in various cities that have shown interest in them. This paper discuss the real time operation of this ride sharing system. The request enabled ride sharing allows the request to be send from the smartphones and schedule proper taxi pickup. This allows constant gain for both rider and driver alike. Passenger will not have to pay more when compared with other counterparts as they can be cheated by the driver by charging them more. The cloud is used to first find the riders taxi quickly for a request using the algorithm. A ride request generator is developed in terms of the stochastic process modeling. The real time taxi sharing problems is defined using constants such as Data model, constraints.

The data model consist of ride request which allows a full grown set of data equations using ride request Q and time stamp Q.t. Q.o is of the orgin point and Q.d is the destination point. Q.pw is the time window that the time interval between rider pickup. The next model is the taxi status where a set of constraints are being used which is represented by V. it is also an instantaneous state of the taxi. V.id is the unique identification of the taxi. V.t is the time stamp associated with the status. V.l is the geographical location, V.s is the current schedule of the V. from the equation it is clear that the status of the vehicle will be dynamic i.e it changes over time. In order to find an optimal solution to a multiple ride sharing request an objective function is been used. In this they have discussed based on the ride sharing request that should satisfy the condition that there should be minimum increase in the travel distance. The architecture of the system consist of different levels. The cloud is tasked with monitoring and running of multiple servers. The taxi driver and the rider will be using the same smart phone application as it is easy to provide them with different interfaces. The taxi automatically reports its location to the cloud system via the mobile application. The taxi will establish connection. A rider will get on and off the taxi is all recorded to the cloud system by the mobile application. The rider submits a new ride request to the communication server. Here the first come first serve principle is being used hence the need for a queue also arises. For each request the server sends it to the indexing server to search for the candidate taxis. A candidate taxi will receive the request and accept it. The communication server then send the ride request and the received candidate taxi will set the scheduling based on the scheduling algorithm. Each rider will asked if willing to accept new riders. If they are willing to accept then a new price figure with the deducted amount will be shown to the rider. The system automatically saves the data's hence it will be able to predict if the customer will accept or reject the request in a particular route. This enable for a smooth riding for the passenger as he/she is not bothered with requests.

The taxi searching is inducted by using the index of taxis already present in the cloud system. The road networks will be divided into grids and these grids will be able to identify the candidate taxis within that grid. This system effectively selects out the taxis that are far away from the point and that allows for faster travel time. The system is validated with the GPS system hence the location of each and every taxis in the grid was accurate. The system was able to calculate the fare for each rider without affecting the driver profit.

On road vehicle detection aims at developing driver assistance systems such as smart alerts and possible collision with other vehicle. In paper [4] robust and reliable vehicle detection is a critical step. This system presents a camera mounted on a vehicle rather than at some traffic stops in order to better detect the vehicle and its environment. The most common approach are active sensor based, radar based, laser based and acoustic based. These approaches are for detecting vehicle. An active based is called because they try to detect the object by measuring the distance the signal travelled until reflecting. These active sensors when moving in one direction can cause inference and low spatial resolution allows for the active passers to be updated or used for only smaller groups. Passive sensors are the optical ones such as the camera. One of the advantage of passive sensors are the inexpensive cost. Where we can place multiple cameras at the vehicle and can enable 360 degree vision. There are two types of vehicle detection techniques discussed and they are HG where the location of the vehicle hypothesized. HV where tests are performed in order confirm the presence of vehicle in the image.

The objective of HG is to find the candidate vehicle in the image as quickly as possible for this we employ techniques such as Knowledge based, stereo based and motion based. Inverse Perspective Mapping is been used in the stereo based. In knowledge based method a prior method is been employed. Optical flow detection in motion based method. Symmetry, color, shadow and corners are some of the objectives the method in knowledge based try to implement. The term Inverse Perspective Mapping doesn't correlate to any actual inversion of perspective mapping. It denotes an additional constraint that all inversely mapped points lie on the horizontal plane. The polar histogram was calculated by scanning different image and the number over the threshold is counted. HV methods uses the input from the HG to perform various tests like template based and appearance based. In template based method a predefined patterns and points are calculated between the image and the template. Appearance method is calculated as two class classification method. Features of neural networks and extraction features are used in the appearance based method. Detecting vehicles in different regions needs different methods hence all of these methods should be integrated in order to find the vehicle in the road. Vision based vehicle detection should be modular and reconfigurable. According to different range of operation different methods can be incorporated. The enhancement of sensor capabilities and performance. There needs to be several improvements but the system itself is needed to have a great amount of detection through the different vision and sensor configuration fitted into the vehicle.

III. CONCLUSION

In this paper we have seen many vehicle detection papers and the other smart taxi application of the detection using geocoding system. Considering the paper [3] we have decided to implement a software based vehicle fare detection using geocoding software with the user and driver application in one with different interface. The detection of the vehicle is powered down to the system where the actual system of taxi is been implemented. Many papers here discussed the issue of vehicle detection but a fare metering of charges and the taxi setups are never identified in the papers. Owing to the different paper setups we are able to come to the conclusion of a fare detection system which allows the user to pay for the charges as it is more fair and just. Easy payments using payment gateways along with the application. Geocoding helps to keep tracks of the customer's journey along with current latitudes and longitudes. Manipulation or meter tampering is not possible. Every drivers have unique QR codes which can be scanned by the customer before starting the journey which allows fast and easy retrieval of the driver details. Emergency alert will enhance the security of the ride. The customer can go through his\her previous ride history.

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