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Intelligent System to Identify Unauthorized Automobiles using Internet of Things

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Abstract — In cities vehicle checking and analysis is a prominent task. These tasks are accomplished by traffic policeman and include various manual works. We present a system to automate the existing task using the technologies Internet of things (IoT) and Artificial Intelligence (AI). The proposed system checks the details of the vehicle and isolates unauthorized automobiles, detects the overall traffic in a specific area, road damage analysis and automated fine collection and toll collection. This system is composed of a two module. Module one embedded with a unique code located in the vehicle and Module two is a scanning device in which the unique code is obtained and further processed in the receiving end using which other details of the vehicle is gathered from the cloud storage. This paper mainly focuses on multiple checking of vehicles using RFID wireless communication, OFDMA technique for numerous access and Artificial Intelligence to predict the traffic and road damage analysis. This system operates using radio frequency communication, and replaces manual task in vehicle invigilation process.

Keywords:-RFID, OFDMA, Multiple Access, Road damage analysis

I. INTRODUCTION

Safety is the first and foremost thing for all activities. In order to ensure the safety, accidents need to be prevented. Majority of accidents occur due to improper condition of the road and due to vehicle which doesn't have proper fitness certificate (FC). All motorists must be insured according to motor vehicles act, 1998. Some find loopholes in escaping from paying insurance. This project may prevent non-payment of insurance and other authorized certification for vehicle users.

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Theft vehicle can also be identified while checking. This project may create some awareness in users to maintain proper certifications for the vehicle. The main motive is to smartly identify unauthorized automobiles, automated fine and toll collection. The data of the vehicles collected on a specific route may be used to analyze the road damage due to vehicle movement on that specific route.The entire data may be used to predict the future traffic using Artificial Intelligence [10]. This framework is progressed to existing framework as producing the module in the vehicle has least potential outcomes. Internet of Things (IoT) is increasingly integrated with run time applications [1]. The checking gadget is regular to all gadgets to be examined so it is easy to use. This filtering gadget is associated with the Network and utilizing the novel code the important subtleties of the vehicle is gotten. The helpful filtering gadget is fit for checking a specific objective gadget and it can likewise be proposed in a manner to examine various numbers of vehicles and get the information for further handling utilizing Artificial Intelligence. The planned framework in is set to be used in toll plazas for robotized charge gathering by including the ledger of the client in the back-end database where extraordinary id in the module is a key to get to data about the vehicle. Checking subtleties of the vehicle and distinguishing counterfeit vehicles by contrasting the number plate subtleties and subtleties acquired from our framework is an extra checking technique. Execution of our assignment decreases human strain in invigilation of automobiles and prompts improvement of the nation. Robotization is the key objective of this system. This system makes care and fear in people to keep up suitable accreditation for the vehicle. Desire for future traffic, sullying and road damage using the accumulated instructive file is our focal points .Hence subsequently it is assumed that vehicle invigilation and checking isn't any increasingly a manual task.

II. PRELIMINARIES

In this section, we review wireless technology RFID- Radio Frequency Identification Technology and Multiple access technology OFDMA- Orthogonal Frequency Division Multiple Access.

A. Radio Frequency Identification Technology

An RFID is special tag, or transponder, consists of a small chip and an antenna to receive and transmit data. This chip can able to store a unique ID or sequential number or other related information based on the tag's type of memory,

which can be read-write, read-only or write once read-many. The antenna, which is attached to the small chip and transmits data from the chip to the reader equipment. Typically, a larger antenna indicates that is useful for revive long range and longer read range. The tag is fixed in an object to be recognized, such as a product, case, or pallet, and can be scanned by mobile or stationary readers using radio waves. Active RFID tags have a transmitter and their own power source (typically a battery). The power source is used to run the microchip's circuitry and to broadcast a signal to a reader (the way a cell phone transmits signals to a base station). Passive tags not uses battery. The Active RFID device usually works using ultra-high frequency (UHF) band and offer a range of up to 100 m [9]. RFID offers highly reliable data gathering harsh environments. RFID mechanism provides modern capabilities as well as an efficient technique to gather, control, manage, disseminate, store, and analysis the raw data. It reduces manual data entry operation and give way for new automation development and solutions. RFID's data provide greater automated tracking capability than existing system, and it create the opportunity to reduce abhor, improve inventory management and new age market intelligence system, leading to lower operational costs and increased over all profits of organizations. RFID mostly uses technology for data collection and analysis of information, so we use RFID concept in our purposed system.

B. Multiple Access

The picture *(Fig.1)* represents the working of system when multiple users are involved and OFDMA technique can be used. In our system OFDMA is used for multiple accesses to avoid data collision when collecting multiple data from multiple RFID tags simultaneously. The below image speaks to the working of framework when various clients are included and OFDMA strategy can be utilized [2]. In our framework OFDMA is utilized for numerous entrances to stay away from information crash when gathering various information from different RFID at the same time.

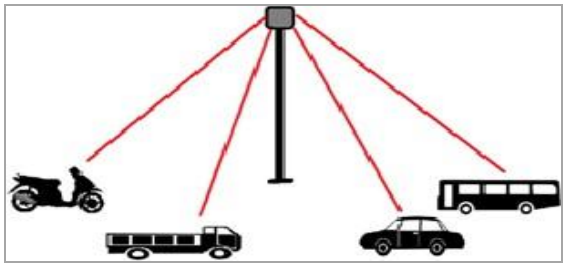

Fig. 1. Representation for multiple accesses.

C. Orthogonal Frequency Division Multiple Access

Orthogonal frequency-division multiple access (OFDMA) is a common multi-user type of digital modulation technique. This scheme use subset assigning concept to achieve multiple accesses in OFDMA by assigning subsets of subcarriers to specific consumers. The information collected from feedback about the network environments, adaptive user-to-subcarrier allocation can be achieved. If the assignment is done appropriately quick, this further increases the OFDM robustness to fast fading and narrow-band co-channel interference, and makes it possible to achieve improved system spectral efficiency. Unlike numbers of sub-carriers can be assigned to different users in view to support distinguished Quality of Service (QoS), i.e. to manage and control the error probability and data rate of separately for each consumer. OFDMA is likely an alternative to merging OFDM with time-division multiple accesses or time domain statistical multiplexing communication. Low date rate consumers can send incessantly with low transmission energy instead of using a "pulsed" high power carrier. Continuous delay, and smaller delay, can be achieved. OFDMA can also be defined as a mixture of frequency-domain and time-domain multiple access, where the resources are separated in the time–frequency space, and slots are allotted along the OFDM symbol index, as well as OFDM sub-carrier index. The behavior of broadband wireless powers the designers of OFDMA to make choices, and those choices have balances. For every advantage engineered, there is always a value. The various flavors of OFDMA *(Fig.2)* are about the loads of mobility and speed of handoffs, the size of the cell, spectrum range, channel sizes, and more.

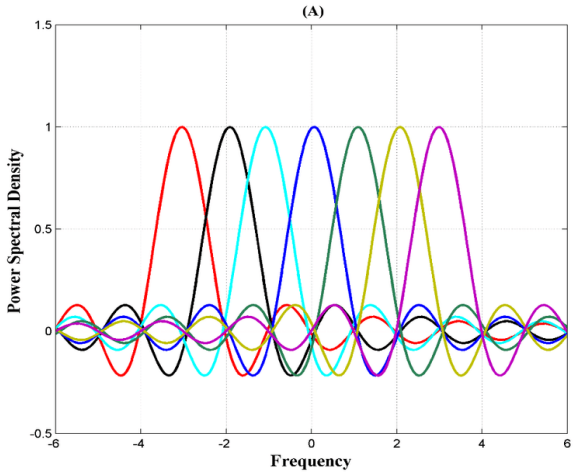

Fig. 2. OFDMA signal representation

III. RELATED WORK

In the existing technology vehicles are invigilated manually *(Fig.3)*. and fines are issued and obtained individually.

Fig. 3. Invigilation and identification of unauthorized automobiles manually

Further advanced checking is done by capturing the image of the number plate and obtaining the number via image processing and then identifying the details of the vehicle. Road damage analysis has no proper data of vehicles passing on that route. Future traffic prediction also has minimum accuracy.

Toll plazas collect fee manually *(Fig.4)*, few automated toll collection systems in present are FASTag which uses RFID technology and the other is BookMyToll.

Fig. 4. manually collecting Toll Fee

Automated Toll Collection System (ATCS) for collecting tax and other fee automatically where in a unique RFID tag is attached to the windshield of the vehicle [4]. The BookMyToll System uses mobile payment via Android phone application and the mobile is detected using a intelligent device near Toll Plazas. Vehicle certifications are checked manually and traffic bill is provided manually for improper or outdated certifications.

IV. PROPOSEDSYSTEM

The proposed system executes in two ways (i)single access for manually verifying a specified vehicle and (ii)multiple checking for simultaneously verifying multiple vehicles and automatically isolating unauthorized vehicles and automatically notifying the concerned officials as well as the users of the vehicle. The RFID scanning device *(Fig.5)* is common to all devices to be scanned so it is user friendly. This scanning device is connected to the Network and using the unique code the necessary details of the vehicle is obtained [4].

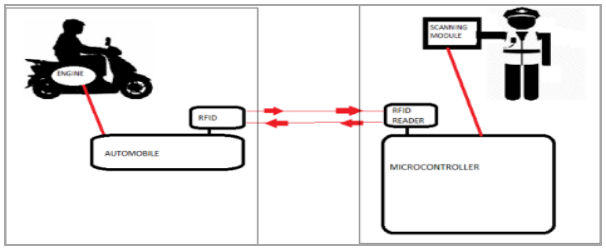

Fig. 5. Representation for single scanning .

The handy scanning device is capable of scanning a particular target device and it can also be proposed in a way to scan multiple numbers of vehicles and obtain the data for isolating unauthorized vehicles and notifying them [3]. Those data can be further processed using Artificial Intelligence for prediction of various results such as traffic and road damage. The number of scanners installed can be increased and placed in various positions *(Fig.6)* to get more accurate results in real time. The arranged system can also be utilized in toll squares for robotized fee collection*(Fig.7)*.

Fig. 6. Types of positioning the scanners

Checking nuances of the vehicle and recognizing fake vehicles by differentiating the number plate nuances and nuances gained from our structure is an extra checking system. In this framework when multiple clients are included OFDMA strategy can be utilized. In our framework OFDMA is utilized for numerous entrances to stay away from information crash when gathering various information from different RFID at the same time

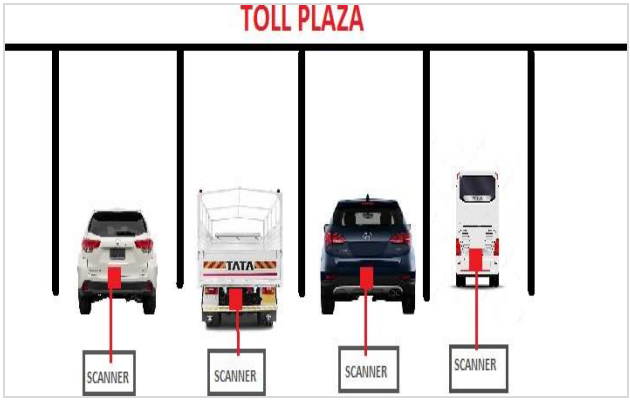

Fig. 7. Automated Toll fee Collection

A. Unauthorized Vehicle Identification

The proposed module mainly concentrates on identification and isolation of unauthorized automobiles. The unique code collected from the RFID tag is used to collect the details of automobile certifications like Registration Certificate (RC), Insurance copy, Fitness Certificate (FC), pollution Under
Control Certificate (PUC) and isolate the vehicles which has expired certifications. The code from the RFID tag is recovered and the data is compared with the clouded database and using certain database query the necessary data is obtained [5]. By using the recognizable proof the segregation of unapproved cars is accomplished. The exceptional code gathered from the RFID tag is utilized to get to the individual subtleties of vehicle and separate the vehicles which have terminated affirmations. The code from the RFID tag is recuperated and the information is contrasted and the obfuscated database and utilizing certain question the important detached information is gotten. The diagram *(Fig.8)* represents the architecture of implementing the task of isolating the unauthorized vehicles. The designed system in is set to be utilized in toll plazas for automated fee collection by including the bank account of the user in the back-end database where unique-id in the module is a key to access information about the vehicle.
Checking details of the vehicle and identifying fake vehicles by comparing the number plate details and details obtained from our system is an additional checking strategy.

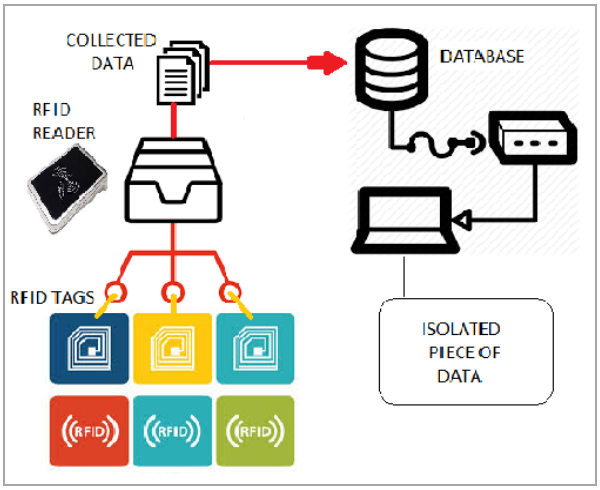

Fig. 8. System architecture

The data flow diagram *(Fig.9)* for acquiring details of unauthorized vehicles is depicted in the diagram above and the step by step process of accomplishing this task is indicated in a clear and understandable manner.

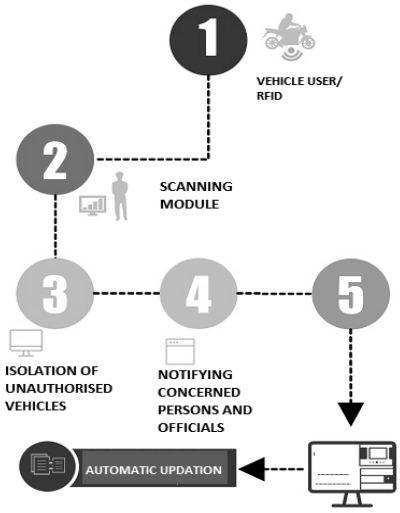

Fig. 9. Dataflow diagram

B. Road Damage Analysis

The data set containing the traffic through particular route and percentage of damage caused through different vehicles (predicted after the survey) can be obtained at regular intervals and real time analysis of road damage can be obtained. These data can be further applied to the neural network to predict the future results of road damage due to vehicle movement in a particular route. Road damage occurs *(Fig.10)* due to factors such as natural calamities and vehicle movement. The overall outcome of traffic measures and that has been processed then can get the data of EAL (Equivalent Axle Load) within a period of time that appropriately 99 days or below then get the effect of the damage by using statistical test Wilcoxon Signed Ranks Test and paired T test [8]. The statistical test of Wilcoxon Signed Ranks Test data used in this statistic test uses ordinal data, the data comparing road damage conditions between phase I (before) and second phase (after) surveys (*Table-1)*. The condition of road damage is obtained from the grouping of road damage value based on Dirgolaksono & Mochtar Method. There are various stages involved in obtaining the final result. By calculating the percentage of causes of damage by different types of vehicle moving on road using various parameters such as number of vehicles, effect of damage and Equivalent Axle Load over an interval of 99 days repeatedly we are able to increase our data sets for future prediction in order to near accuracy.

Fig. 10. Road damage due to natural calamities and vehicle movement

Table-1: Results of damage caused by various categories of vehicles after a survey

Information	Motor cycle, bicycle	Sedan, jeep, station wagon	Small bus	Bus	Truck/ 2 axis tank 3/4"	Truck/ 2 axis tank	Truck/ 3 axis tank	Truck/ truck trailer	Truck semi-trailer
Number of vehicle	2287	1430	79	91	1022	494	253	211	244
Effect of Damage	0	0.0004	0.2174	0.306	0.175	5.2064	5	4.982	10.183
Interval	99	99	99	99	99	99	99	99	99
Equivalent Axle Load	0	56.61	1707.46	2766.85	21999.04	0.0004	0.2174	104069	245980.55
TOTAL	761264.79								
% Cause of Damage	0.00%	0.01%	0.23%	0.37%	2.98%	34.42%	17.61%	14.8%	33.27%

C. Traffic Prediction

Correct and exact traffic flow data is currently strongly recommends and most needed to all travelers, business sectors, share market and government agencies. It has the potential to help road users make better travel decisions,

alleviate traffic congestion, reduce carbon emissions, and improve traffic operation efficiency. The objective of traffic flow prediction is to provide such traffic flow information. Traffic flow prediction has gained more and more attention with the rapid development and deployment of intelligent transportation systems. The collected data set can be applied to the neural network to predict the future traffic and timely records may be used to predict the Traffic in real-time. Traffic flow prediction highly depends on periodical data and real-time traffic data collected from various sensor devices. Here we utilize our RFID data to predict the traffic. Over the past 20 years, a number of traffic flow prediction methods are introduced and implemented to assist in traffic management and control to
Improve transportation, route guidance and automobile tracking. Here this paper traffic prediction is suggested as an added advantage which can also be predicted using the data which is collected for various other purposes.

D. Automated toll collection

The designed system in *(Fig.11)* is set to be utilized in toll plazas for automated fee collection by including the bank account of the user in the back-end database where unique-id in the module is a key to access information about the vehicle [7]. Checking details of the vehicle and identifying fake vehicles by comparing the number plate details and details obtained from our system is an additional checking strategy which can be utilized in toll plazas.

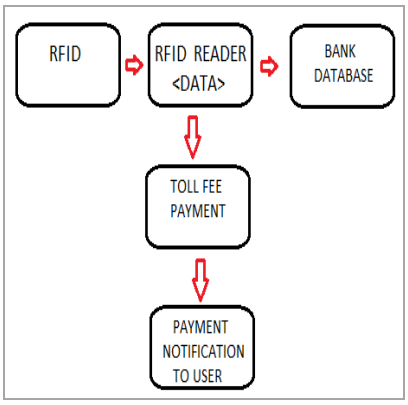

Fig. 11. Architecture for automated Toll collection

V. ALGORITHM

Vehicle unique id is received by scanning device with help of RFID-Radio Frequency Identification Technology. Using this unique id all necessary data is collected from the database. Then algorithm *(Fig.12)* verifies whether the vehicle is authorized or unauthorized. If the vehicle authorized than the system will allow the vehicle pass the tollgate and toll fee is automatically detected from user account else vehicle unauthorized means system will send notification toll officer and control office. This system also analyzes the road condition and road damages using the device which is attached in vehicle.

Algorithm: *Identifying unauthorized vehicles*

Input: Input the Vehicle Unique ID
Output: Identifying unauthorized vehicles

1. **Let** Get Vehicle unique ID and collect necessary details of the corresponding vehicle
2. **Initialize** all Scanning device and RFID reader x_i, $i=1,2,\ldots,m$.
3. **For** all x_i do
4. Collect all necessary information about the vehicles
5. **End**
6. **Iteration** number *Vehicle*←1
7. **While** (*Verifying whether certifications of the vehicle are valid*)
8. **If** (*certifications of the vehicle are valid means*)then
9. Authorize the vehicle
10. *Vehicle*← *Vehicle* + 1
11. **Else**
12. Unauthorize the vehicle and send fine notification to user
13. **End**
14. **Let** Get the list of vehicle passing through specific route
15. **Analyze** road damage due to vehicle movement and traffic prediction
16. **End**

Fig. 12. Pseudo-code of Identifying unauthorized vehicles.

The overall system outcome focuses mainly on isolating and notifying vehicles with expired certifications. The data collected to fulfill this purpose can also be utilized usefully for predicting and analyzing several other results such as traffic prediction, and road damage due to vehicle movement. The below flow diagram *(Fig.13)* depicts the flow of data in the prediction of outcomes.

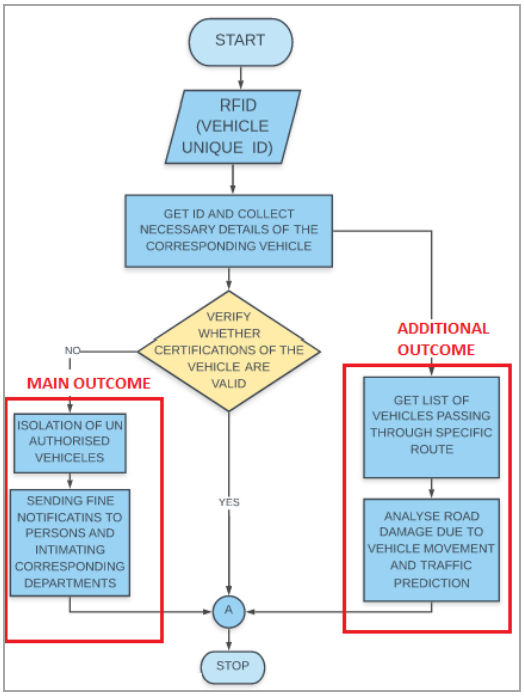

Fig. 13. Intelligent invigilation and identification system flowchart

VI. PERFORMANCE ANALYSIS

This paper concentrates on evaluating the performance of intelligent identification of unauthorized automobiles work during the automatic checking process.

All the analysis result contains 12 round and several sample data with different automobile to undergo the setup phase and checking stage using PC with Windows OS platform, Intel Core i3 2.9GHz, 16GB DDR3 RAM , 200GB Hard drive. The below *(Fig.14)* chart depicts the reduction in man power raise of automation and increase in the perfection of work as the key performance of the proposed system.

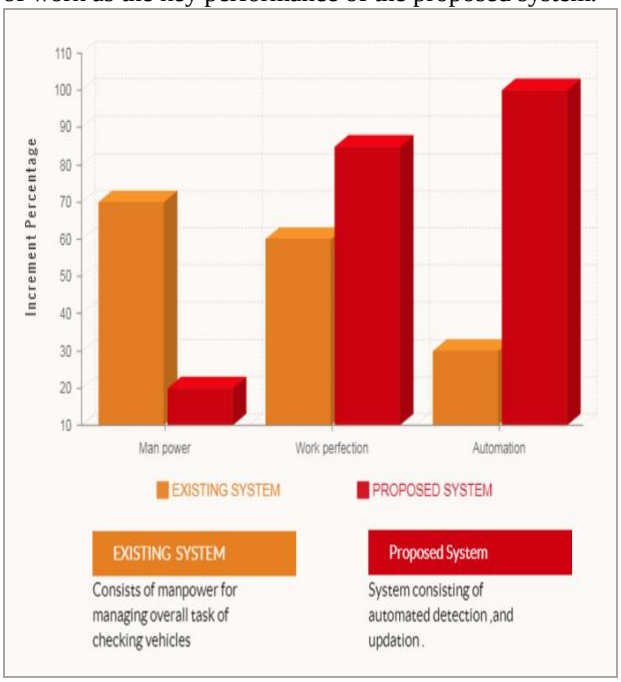

Fig. 14. Comparison of existing system and proposed system

VII. INFERENCE

The designed system is set to save the time for the traveller as well as the traffic officials. The necessary details of the vehicle are obtained in a very quick manner. Hacking the device is almost not possible. Road damage due to vehicle movement can be analyzed using the data. Future traffic can be predicted besides the cost of implementation is high. The vehicle invigilation system gets automated and by this way Fine and toll collection can be automated. Scope of this work is high accuracy, efficiency and cost effectiveness. Accuracy -The designed works with accurate datasets and predetermined details hence result must also be accurate. Efficiency -The entire system works under all conditions with full data and it run works efficiently for long life. Cost effectiveness -The system works with low cost components and can be established without any special software it is inexpensive compared to other earlier system.

VIII. CONCLUSION

This paper work reduces human strain in invigilation of automobiles and leads to advancement of the nation. Automation is the key objective of this system. This system creates awareness and fear in people to maintain proper certifications for the vehicle. Automated toll collection can also be implemented using advanced technology. Prediction and data set collection of future traffic and road damage due to vehicle movement is our advantages. Hence hereby it is concluded that vehicle invigilation and checking is no more a manual task.

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