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Implementing RFID Technology for Vehicle Tracking in Bangladesh

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ABSTRACT

Vehicle tracking has increased in use over the past few years and, based on current trends, this rise should continue. Tracking offers benefits to both private and public sector individuals, allowing for real-time visibility of vehicles and the ability to receive advanced information regarding legal existence and security status.

On a busy road, identifying unregistered vehicles are very tough and troublesome for the authority. In Bangladesh traffic polices do not have any technology that can identify quickly fraud registrations on full roads. Traffic polices gets very late information about illegal vehicles and identifying those is more difficult. The current manual checking is also annoying for legal paper holders.

This paper looks at the reality of existing problems of recognition of vehicles by traffic control department of Dhaka –the capital of Bangladesh and a feasibility study to implement RFID technology to solve this.

Keywords: RFID, RF-Reader, RF-Tag, BRTA-IS

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1. INTRODUCTION

Dhaka, the capital city of Bangladesh is spread over an urban area of about 2000 sq. km, and has approximately 10 to 11 million people. Residential, commercial, and industrial areas and slums are scattered throughout the metropolitan area. Rapid growth in population and fast urbanization has led to the demand for better transportation facilities. Existing roads were not planned to accommodate the growth. Certain road links, i.e. east- west and north-south, are insufficient to provide for the efficient movement of traffic. As such, some roads and intersections are nearly always congested.

Within the past 35 years, the number of vehicles plying the streets of Dhaka has seen explosive growth, with registered vehicles growing from 35,800 to 400,000. The largest growth had been in the number of 2-stroke 3-wheel auto rickshaws, called Baby Taxis in Bangladesh. In an attempt to limit the number of baby taxis registered in Dhaka, limits have been placed on the number of new vehicles that can be registered within the city. Now the CNG Taxis have taken place of the 2-stroke 3-wheel auto rickshaws. No one knows the exact total number because of frauds.

Bangladesh Road Transport Authority is the only regulatory body for road transportation for the Government of People Republic of Bangladesh. It is under the control of the Ministry of Communications (MoC). The number of unregistered vehicles is very large and limitations on registration of certain types of vehicles have resulted in more unregistered vehicles plying the roads. All parties agree that, there should not be any vehicle without proper certificates of Registration, Route Permit and/or Fitness.

Traffic control system especially checking vehicles is full manual in Bangladesh and also too hard to find out the unauthorized vehicles. Lots of vehicles, which have fake registration number, expired route permits, fitness certificates, tax token are hard to find when they are in rush and having proofs on paper. And always the papers are easy to copy and fake copies can be easily kept in similar vehicles to camouflage traffic polices. If a fraud owner has two or more vehicles of same model and if one of them is registered, then it becomes easy to run all the vehicles on road by that fraud owner by just keeping false copies of actual paper. It is approximately impossible to identify fraud license holders where all the vehicles are moving on road.

The research is mainly aimed to identify a more suitable technical solution for supporting the business processes. This has been observed that, though latest developed information systems has made the business functions more easy to perform and more easy to manage by BRTA, but still there are lack in total system as real data are not accurate as they have been usually collected from the road sides.

Therefore we are proposing a solution to track down those vehicles easily and management will be able to make more accurate decisions that are directly related to number of vehicles on roads and highways and handling them effectively according to a preplanned policy.

In 2003, BRTA engaged DCL-CMG consortium for developing a total ICT solution for BRTA. The objective of the project; code name BRTA-IS, is to provide an application system to BRTA in order to assist them in total overall management, control and supervision of road transport systems in Bangladesh. With this application system in place, BRTA is able to enforce the Bangladesh motor vehicle laws, rules, regulations and policies more effectively. Integration with other local authority such as the Police Department and Road Safety Cell will further enhance and diversify the scope of coverage for BRTA.

BRTA-IS is subdivided into 4 major modules, namely-

a) Vehicle and Driving Information System (VDIS)
b) Human Resource Information System (HRIS)
c) Customer Information System (CSI)
d) BRTA Web

After development of the BRTA-IS, the system can help management to fetch literally any sort of report based on the stored information in the central database. Generating executive summary report is very easy to get now by higher authority.

This has opened the chance to implement the new technology (say RFID) by just add another module to the existing modules of BRTA-IS and in a right time.

II. The Problems on Road

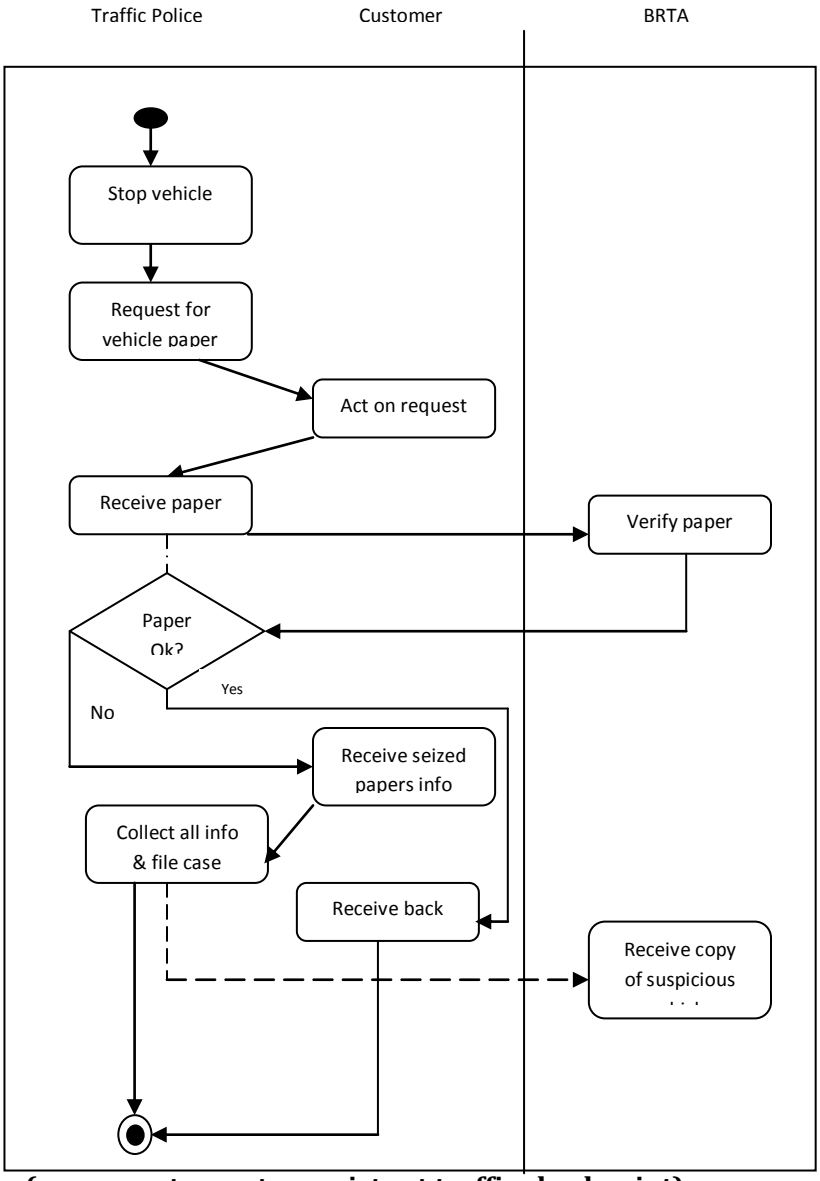
Checking Certificates:

As the owner gets the certificates, BRTA also provide the information to traffic police so that legal and authorized vehicles can run on roads, load on routes are within limit and rate of accidents due to unfit vehicles can decrease. The common checking method is manual and very tough in rush hours on a highway.

Analyzing the current situation, the following major activities have been identified at the checkpoints– (reference: BRTA-IS Systems Requirement Specification):

- Vehicles are stopped at Traffic Checkpoint.
- Vehicle's papers are verified.
- Decision made based on right/wrong activities.

To get the real picture a sequence diagram is given below.



In this current system (no computer system exists at traffic checkpoint):

- **i.** Latest report on the hand of traffic police is absent. In case of any report traffic personnel require going to BRTA office to get detail.
- **ii.** Paper based information may be copied by fraudsters and can run several vehicles with a single registration number, route permit certificate and/or fitness certificates.
- **iii.** Not easy to verify route permission by a newly appointed traffic personnel.
- **iv.** Complaints against traffic personnel are very likely, as no proof record is possible to keep by the owner.
- **v.** Very tough to stop suspected vehicles as it may hamper other major legal riders.
- **vi.** Correct information about number of vehicles that are passing in a day through a particular route is hard to measure.

III. Solution

Current Options:

a. Papers (Blue book, License, Route Permit & Fitness Certificate):

BRTA and traffic police department have been using the traditional techniques of issuing original papers since the starting.

b. Sticker:

BRTA and police are now attaching stickers on CNG 3-Wheelers after checking papers. They paste BRTA stickers on every vehicle. Both BRTA and police officials' informed that the vehicles having no stickers would be considered faulty and illegal and that action would be taken against them.

c. Barcode:

We may think of Barcode as in some countries departments are using this. But all the above options have modern challenges that may not be overcome easily.

Recently huge improvement has been evolved in printing industry and we have found even false money has become impossible to identify. Therefore papers are not enough to overcome the critical situation and very hard to implement in speedy and busy roads.

Special stickers may take some time to copy but when it would become older then the fraud owners would take the same chances.

About bar code the most important thing is the reader requires to bring very close to the tags (and in line of sight). And paper tags are easily become useless if they are wet and torn.

New Solution:

To overcome above problems we need to think something new and cheap and that can be enhanced to meet future needs. The technology must suit and work in busy and rush environment without many disturbances to other legal riders and owners.

This technology will help streamline operation of public transport and check violations like not plying on bus lanes, not stopping at bus stops, overspending etc. This will also help track down vehicles involved in crimes or offences.

Therefore, the best solution is using Radio Frequency Identification (RFID) Technology.

IV. Challenges

- Even in six figure production quantities, the simplest of these tags is more expensive (say tens of pence) than a printed barcode – this extra cost, plus the potential greater infrastructure capital cost, has to be bettered by other benefits in the distribution chain or represent an application for which the barcode is not suitable e.g. Smart Cards.
- There is a high cost (long pay-back) for integrating RFID technology into existing control systems.
- External influences such as metalwork, material dielectric properties and radio Interference can constrain RFID remote reading.
- There are currently ranges of RFID application numbering systems, which need unifying to increase uptake. [The International Standards Organization (ISO) and Electronic Product Code [EPC] Global consortium, amongst others, are working to address this issue.]
- Currently there exist no internationally agreed frequencies for RFID operation (other than 13.56 MHz, which is primarily used by smart cards but can also be used by other RFID tags) and permitted scanner/reader powers differ between countries. This limits product take-up. [For example, there are significant differences between the USA and European UHF frequencies.]
- **Employee Unwillingness:** Traffic police are not interested to use automated system because they do not have knowledge about the advantage of Information Technology and they feel comfort to use traditional work system, which they are using for long time. To use automated system they need to take proper training and maximum employee are not interested to take training in the mid/end level of their service.

V. RFID Advantages

- Not requiring line of sight access to be read.
- The tag can trigger security alarm systems if removed from its correct location.
- Scanner/reader and RFID tag are not (so) orientation sensitive.
- Automatic scanning and data logging is possible without Operator intervention.
- Each tag can hold more than just a unique product code.
- Each item can be individually 'labeled'.
- Tag data can be comprehensive, unique in parts/common in parts, and is compatible with data processing.
- With the right technology a plurality of tags can be concurrently read.
- It can be read only or read-write.
- There is a very high level of data integrity (character check sum encoding).
- Provides a high degree of security and product authentication – a tag is more difficult to counterfeit than a barcode.

- The supporting data infrastructure can allow data retrieval and vehicle tracking anywhere provided the scanner/reader is close enough to the tag.
- Since each tag can be unique they can act as a security feature if lost or stolen.
- The technology is rugged and can be used in hostile environments such as down oil wells (heat and pressure) to carry data to remote equipment.
- The technology lends itself to being updated, for example, as a car goes through its life its service record can be electronically logged with the car.
- The technology could be inserted within a suit so that when it is sent to the cleaners it automatically gets the right cleaning procedure applied to it.

VI. Investment appraisal:

The rough table is as below.

Item Name	Total (TK)
RFID accessories estimated for Dhaka city	15,000,000/-
Computer accessories	12,000,000/-
Logistics & Support	6,000,000/-
Training & HR development	5,000,000/-
BRTA-IS Up-gradation cost	3,000,000/-
Total	**41,000,000/-**

Table-1: Investment appraisal

Tangible and intangible benefits of using RFID technology

The RFID system will earn a lot of government revenue. Many times vehicle's are not updating its status and going on road. As a result many accident and other problems come out. There are approximately **400,000/-** motor vehicles have registered in Dhaka Metropolitan city.

Within these there are 10**%** vehicles which are known fake in renewal/update information. It requires approximate **TK. 1,000/-** per year renewal and permit fee, which gives approximate amount of TK **40,000,000/-** have not gone to government's accounts. Average Amount of Registration Fee is **18,800**/-. And 4% of vehicles have fake registration certificate then Govt. is yet to get **18,800/- x 16,000/- = TK. 300,800,000/-**

Therefore it is very clear that if RFID Implementation project is taken, the Govt. of Bangladesh will be benefited in huge.

VII. Deployment

For the best use, the system will take the form of client/server architecture. The following diagram shows this architecture:

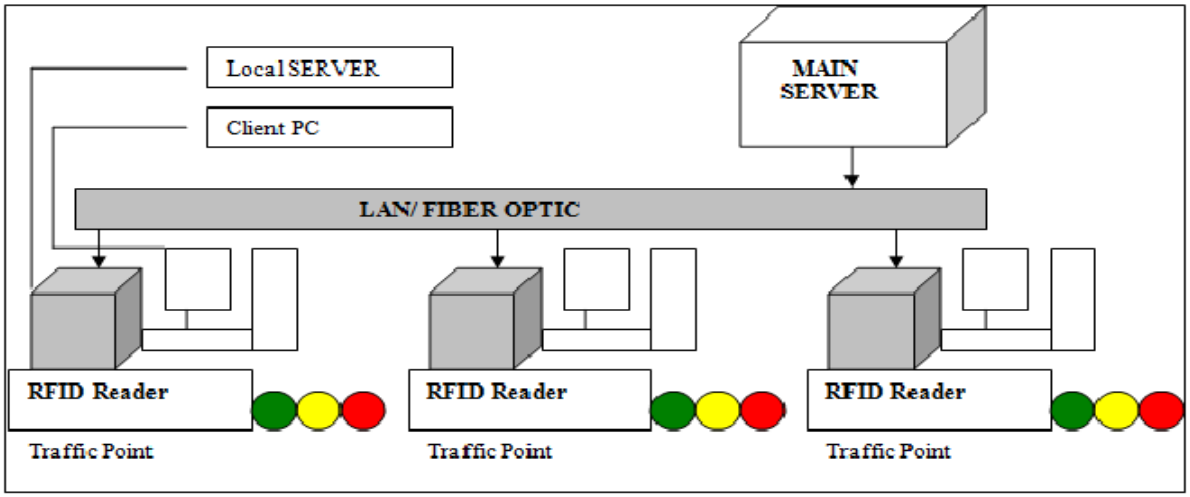


Figure 2: - at Traffic Checkpoint

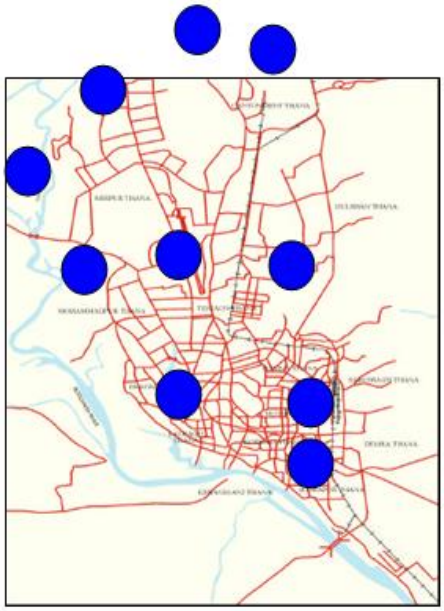


Figure 3: RFID Traffic Checkpoints for Dhaka

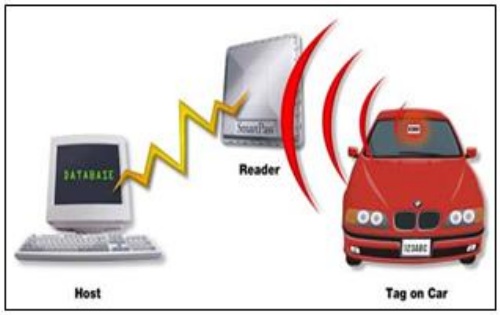


Figure 4 : a reader is reading RFID tag.

In operation, the reader's antenna broadcasts RF energy over an adjustable area called the read zone or reader footprint. The tag on the vehicle reflects a small part of this RF energy back to the antenna, and the reflected radio waves denote the tag's unique identification code and other stored data. The reader then transmits this code to the BRTA's host system to determine the vehicle's compliance. The tag-to-reader identification process takes only milliseconds[7].

RFID Implementation:

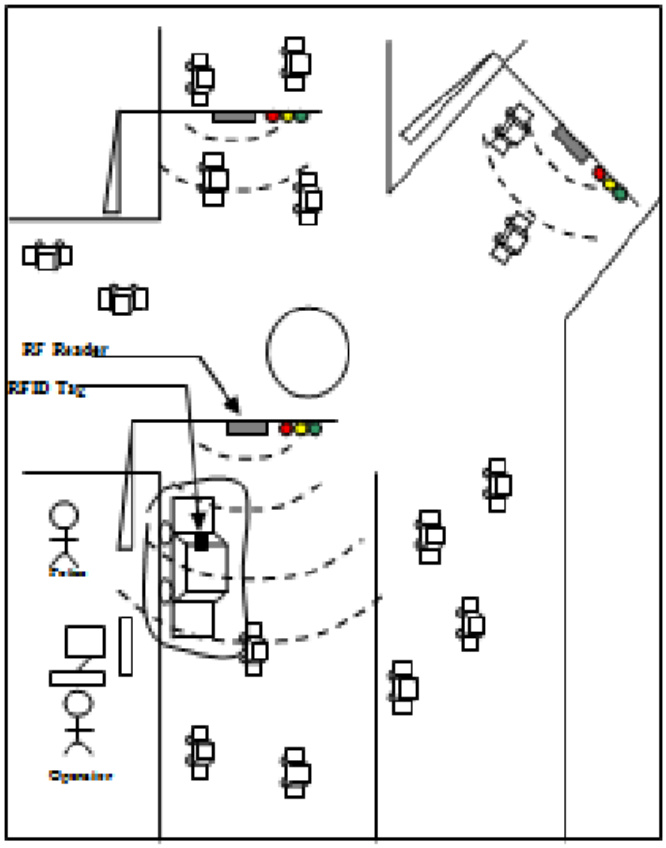


Figure 5: System Deployment at one check-point

How the RFID Tag information would be linked in BRTA-IS:

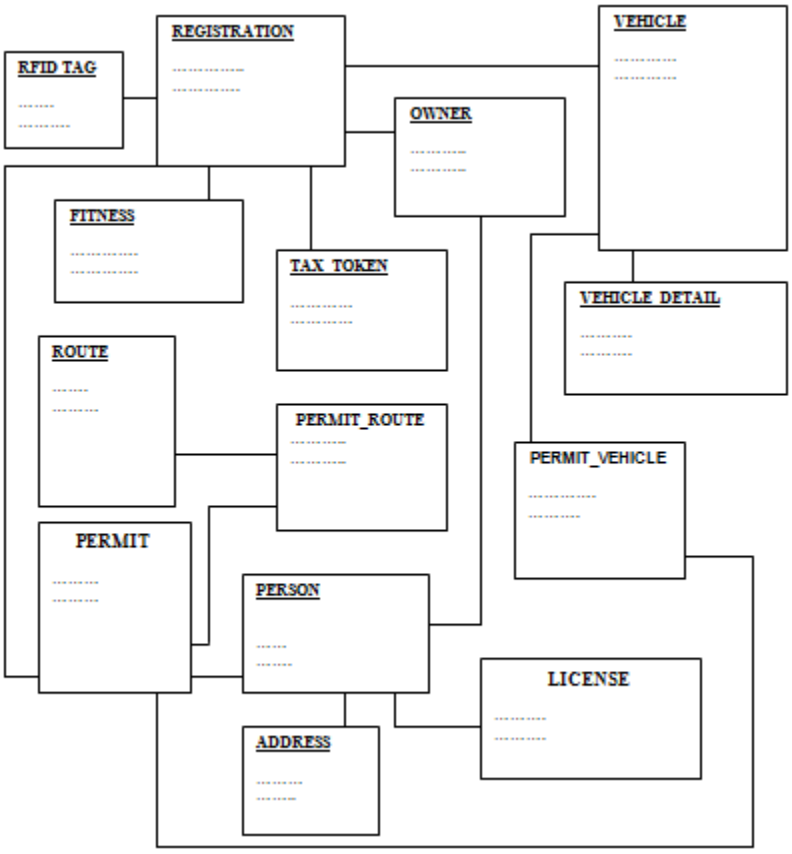


Figure 6: Relational Diagram for the System

VIII. Conclusion:

In contrast, manual, visual-based identification, tracking, and enforcement systems are labor intensive and expensive. The inefficiencies of those systems can result in significant revenue losses for government agencies.

The private sector may be primarily responsible for leading the development and enhancement of technologies which further expand vehicle tracking capabilities.

Governments throughout the world can play a role by providing incentives to companies developing tracking alternatives, or mandating the use of certain technologies on all vehicle travel to or within their country. The project described above demonstrated the viability of the tracking technologies and the cost savings that can accrue through their use. As they progress, more quantifiable information will be available, allowing for Government companies to make more informed decisions regarding vehicle tracking and the associated technologies. Government agencies can automatically detect and screen motor vehicles for compliance with federal, state, and municipal vehicle regulations, as well as process enforcement.

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