e-Blitz – Solution to Support Transit Automotive Vehicle Inspection

Gustavo Henrique Carvalho e Silva[1]
Lucas Cassela[2]
Luciano Marques Inácio[3]
José Gonçalo dos Santos[4]

Instituto Federal de Brasília,
Campus Taguatinga. Quadra QNM 40,
Área Especial numero 01 - Taguatinga Norte (Taguatinga)
72146000 - Brasília, DF - Brasil
[1]lukeraaa@gmail.com
[2]gustavo.silvadf@gmail.com
[3]lucianominacio@yahoo.com.br
[4]jose.santos@unieuro.com.br

Abstract. This paper presents the structure of a new system model for traffic inspection in Brazil. It shows the evolution of technological developments in order to help vehicles monitoring, and one of the approachs is the highway traffic monitoring. It was identified that this approach brings inconvenience for the society, like slow local traffic, complicating for the Traffic Agency, to accurately identify the cases that requires a traffic agent intervention. In this context, the project aims this market by optimizing agents' work, providing more effective local operations, improving accuracy on direct supervising to vehicles and providing a better life quality to citizens. In short words, it presents a solution to support traffic departments, regarding a direct approach, identification which vehicle should be inspected, type of inspection to be done, information of violations, resulting in improvement in the impact of vehicle traffic flow where the operation is done. Consequently, strategic decision-making can be done based with more accuracy. To build this solution, it is being applied the Rational Unified Process to the development of the software that integrates image capture with an IP Camera with embedded OCR.

1 Introduction

In Brazil, until May 2013, according to the [6] National Traffic Department (DENATRAN), the Brazilian fleet surpassed the 76 million motor vehicles.

The importance of supervising actions on vehicles at strategic points in the cities is relevant to curb crime and lead to fullfilment of legal requirements.

Nowadays it is really difficult to efficiently moni-

tor large areas, highlighting those that are located in large circuits where there are a big influx of people and vehicles. This has been an aggravating factor in satisfactory performance of traffic surveillance operations.

The human resource is relevant in this project. On a side, the supervisor controlling departement employee who is exposed to danger. This model minimizes this impact by separating the vehicles of low level of risk from the ones of high degree of risk. On

the other side, the citizen, the vehicle driver suffering surveillance, creating congestion on roads where the inspection occurs. The project reduces holding because it exaclyidentifies which vehicle should be stopped.

An important point is the integration and distribution of data among controllingdepartements. Such a system will be created using, therefore, computer with Core I3 processor and IP capture camera with embedded OCR. From data captured by the system, information can be distributed adding value to decision power of other controlling departments.
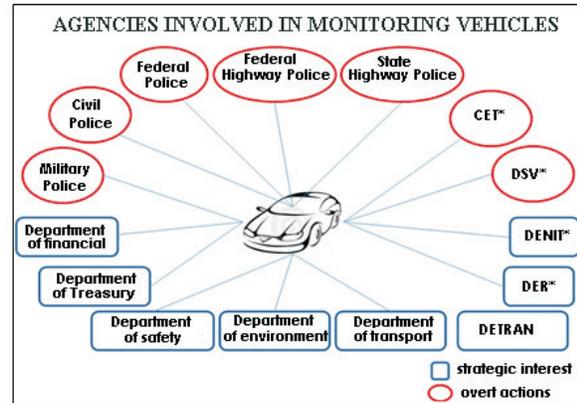
Figure 1: Departements involved in monitoring vehicles. Source: http://www.prefeitura.sp.gov.br

2　Control

The real importance is the provision of information to the traffic authorities and other departements involved. At the lowest level, information on the situation of the vehicle, while it is being checked by the system, will guide the agent who will do the job.

- If it is a stolen vehicle, the officer goes into action or; - If it is a vehicle with administrative constraint (overdue fines, unpaid taxes) another agent will do the same.

In statistical terms, the traffic data are collected and are available to the engineering department that by using such data can accomplish more effective actions of improvement projects on roads, where vehicles pass.It is true to say that other statistics can be leveraged with this data collection.

Among the beneficiary supervising departements are highlighted traffic supervising departments, the police, strategy and planning departments and linked departments. Figure 1 shows a drawing of the organizational structure in Brazil.

In figure 1 The departements involved in vehicle tracking system are shown.There are two types, according to their degree of interest:

- **Highlighted in circles** are overt action agencies that act directly in surveillance and need the data to make more effective inspection; and

- **Inside rectangles**, the departements of strategic interest, which need the data generated by monitoring for statistical compilation and they are support to preventive actions and preparation of educational programs, among other strategic actions.

This project shows the construction and development of agile and guided surveillance, turning it auxiliary instrument into the monitoring of vehicles and inclusion of tight integration among the agencies involved.

To develop this Project, it was used the [10] Rational Unified Process methodology (RUP), which uses orientation approach to objects in its conception, designed and documented using notation [9] Unified Modeling Language (UML) to illustrate the processes in action.

Based on the information presented, it can be noticed that, with the increasing use of motor vehicles, traffic control becomes more complex. As vehicles move, they need to share time and available space with other cars and pedestrians.

Thus, the two major challenges for traffic surveillance are security and fluidity. So that vehicles and pedestrians can move safely, it is required that traffic [2,4] laws are followed. When the application processes of these rules are not agile, congestion occurs.

The emergence of Automatic license plates reading systems [3] (LAP) has allowed to introduce new

concepts in electronic traffic monitoring equipment: multifunctionality.

The coupling of the [3] LAP system for monitoring equipments (fixed radar, electronic barrier and static radar) turned them into multifunctional devices, enabling the simultaneous monitoring of different traffic [2,4] law violations. For example, the same equipment can monitor speeding, identify whether there are administrative restrictions against the treasury, pending litigation, product of theft / robery and other occurrences that can be introduced in identification.

The multi-functionality improves the supervision and provides savings to the system becuse it uses the same infrastructure (cameras, CPUs and software) for different applications, as if they were several devices into one.

The equipment can record traffic data such as volume of vehicles, speed, vehicle classification and reading license plates, which can be transmitted online to a database that feeds traffic monitoring system in real time.

This applicability provides traffic conditions for the press, internet and public in general, information for Variable Message Signs System, automatic incident, detection systems, data for the operation and supervision of the road system and statistical data for urban planning.

The capture and image processing is an important step in the inspection process. It is not enough that the equipment accurately identify the vehicle or the [3] LAP correctly read the license plates.

The project by OCR camera surveillance system installation was developed for the improvement of systems installed in the country and by watching examples compared to foreignn countries, in the case, Canada, in cities where the use of software and operations occur, it can be observed that it is possible to combine technology and intelligence of control departments to the crime and vulnerability indicators, providing better answers through efficient investments. System

information about the system can be seen on the site [5] Universo Online (2012) in which a Canadian company provides video monitoring system.

Consequently, this system contributes to quick identification of vehicles involved in traffic investigation, because only those who are irregular will be stopped..

The capture and storage of all license plates, in important areas of the city, allows the formation of statistics for the analysis of traffic flow intelligence. The system takes about 300ms (milliseconds) to recognize a vehicle and it can recognize up to two vehicles per second.

Guided by the integrated system design, images and derived information enables every integrated agency, acting in their respective area of competence, briefly summarizing as follows:

The Civil, Military and Federal Police will use images and integrated information, contained in the databases of police and partner agencies, for monitoring criminal activities, identifying irregular vehicles and vehicles involved in crimes. There is the possibility of having real-time view of incidents arising from murders, bank robberies and trades, lightning kidnappings, robberies and theft of vehicles from the administrative occurrences. Checkpoints will be established in parts of the territory of the city / municipality, as prioritized indicators, facilitating the activities, identification and action with vehicles, as appropriate.

The Traffic Engineering Center (TEC) throug monitoring strategic routes, will act in reported irregularities of vehicles in the following cases:

- Vehicle without inspection;
- Irregular licenses or pending taxes;
- Fines which justify its arrest or new penalties;
- Transiting in prohibited place and time, or in rotation (vehicle, trucks / buses and motorcycles), in addition to enabling research in general, such as scaling, traffic flow and the movement of public transport.

The role of the Traffic Engineering Center and the Military Police, particularly, focus on the priorities stablished strategically, taking into account criminal and administrative interests in fleet control, combining police database, the Department of Traffic – Traffic Department, the National Department Traffic – DENATRAN, the Transport Secretary, among others, as shown in Figure 2.
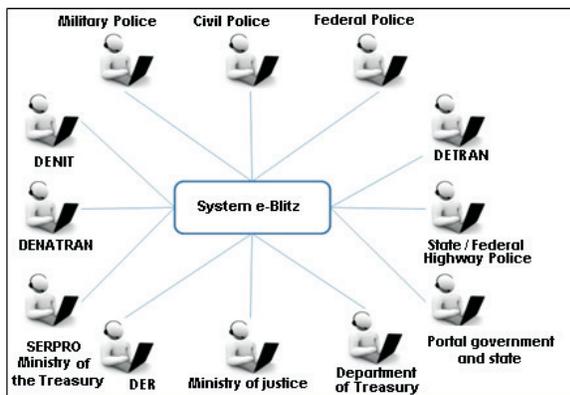

Figure 2: Integrated data and information System.

Figure 2 shows the structure of the system e-Blitz, which is the Solution to Support Inspection Motor Vehicle Traffic, the object of this project, which aims to implement data integration, enabling agility in the flow of information and elimination of rework, which increases the operational efficiency of the agencies involved.

The integration among the collegiate bodies will occur because of the possibility of using data from the Information System, coming from crossing and sharing and signaling special alerts.

This enables control, registration, storage and sharing of databases of records and facts raised against the person, property (robbery / theft of vehicles) and traffic facts, for example.

System management is will be stablished by the higher courts of the three levels of government participants, from the references defined by the Technical Committees, Intelligence and Institutional Relations, considering their security and stability. Thus, allowing

all partner agencies the autonomous use of the system, access to databases, research systems, issuance of configurable reports and images, with levels and passwords as protocols require. The following agencies can be involved:

- Department of Transport / Traffic Engineering Company – CET, Department of the Environment – Vehicle Inspection, Department of Finance – Taxes, Department of Urban Security;

- Public Security Bureau – Military Police, Civil Police, Technical and Scientific Police, State Traffic Police, Department of Finance – Taxes, Department of Management – Traffic Department;

- Federal agencies: Ministry of Justice / DNIT, Federal Police, Federal Highway Police, the Brazilian Intelligence Agency – ABIN, National Traffic Department – DENATRAN;

- Municipalities conurbated with the city where the system is installed, through the Integrated Management Offices.

3 Factor

The current inspection generates inconvenience to organizations and population. The proposed solution to support automotive vehicle traffic monitoring eliminates these factors.

Currently, according to the report of [7] DENATRAN (2013), the vehicle fleet of the Federal District is approximately 1.4 million vehicles and part of these vehicles is not properly licensed, causing damage to public money.

"In addition, there are vehicles circulating without compulsory insurance and in case of accident, third parties involved lose their right to be made up for the failure of the vehicle owner".

Information provided by MARCELO Esrom CUPTI MADEIRA Manager of the Policing Management and Traffic Supervisory Board Policing and Traffic Surveillance, Department of Traffic in Distrito Federal – DETRAN / DF, in an interview at the Directorate of Policing and Control Transit – DIRPOL.

The DETRAN-DF is the potential customer for

the product. This department has database with information of vehicles which are in circulation. On the other hand, the DETRAN-DF can provide, by means of agreements, database for the purpose of statistics and information extraction to other organs of the Distrito Federal.

The rapid and efficient action of the supervising agent reduces the response time of preventive and repressive actions of public safety. With this data, integrated partner agencies, as shown in Figure 1, observed their skills, benefit with the collected data

It is noticeable that the requirement is an important necessity to create effective control of the data capture, and also the reliable information to make decision.

4   Controling Departments

The overt action departments, which act directly in surveillance, need the data to make effective approach, among them are **The National Traffic Department (DENATRAN)**. DENATRAN is the highest executive department of the National Traffic System. With administrative and technical autonomy, has jurisdiction over the entire Brazilian territory. This authority is also responsible for establishing procedures on learning and enabling vehicle drivers, issuing documents, registering and licensing vehicles. To this end, its functions are subdivided into the following coordinators.

The State Department of Motor Vehicles (**DMV**) is a municipality of the State Executive Branch that oversees the transit of vehicles in their respective jurisdictions, the Brazilian territory. Among its responsibilities is to determine the stablishment of rules for training and supervision of drivers.

The Federal Highway Police (**PRF**) is a Brazilian police institution under the Ministry of Justice, whose main function is to perform the patrol ostensibly on federal highways. Thus, they fight crime on federal highways in Brazil.

The state military police are the 27 public security forces that make the ostensive policing and the preservation of order, exclusively in ostensible policing within the states and the Distrito Federal. They do effective road patrol, focusing on traffic control on roads.

State and local control agencies and statistics, are also involved in the context of the monitoring of vehicles. These were identified in the project as strategic interest departments, which need the data generated by monitoring for statistical compilation, support for preventive actions and preparation of educational programs, among other actions of strategic interest.

Data from the [1,6] National Traffic Department (Denatran, 2013) show that over the past decade, the number of cars circulating in large Brazilian cities increased approximately 1.5 times. Some cities such as Brasilia and Manaus were the ones which most experienced increase in the number of cars. In 2003, the Federal Capital had a 557,000 car fleet. In April 2013, it reached 1.07 million, an increase of 90%. While the city of Manaus, Amazonas had 124 000 cars in its fleet. At the same time, it grew 138%, reaching the mark of 297 thousand cars in circulation.

The list, according to a report [8] G1 news website (2012) – LIST OF BRAZILIAN STATES IN ACCORDANCE WITH THE SIZE OF THE FLEET, the Brazilian states,according to the size of the fleet of cars follow this order: São Paulo (20,537,980 million), Minas Gerais (7,005,640), Paraná (5,160,354), Rio Grande do Sul (4,808,503), Rio de Janeiro (4,489,680), Santa Catarina (3,414,195), Goiás (2428705), Bahia (2308978), Pernambuco (1,774,389), Ceará (1,711,998), Espírito Santo (1262848), Distrito Federal (1,245,521), Mato Grosso (1173125).

Another 14 states have fleets that do not exceed the total of 1 million cars. They are: Mato Grosso do Sul (972,529), Pará (969,667), Maranhão (796,083), Rio Grande do Norte (731,263), Paraíba (698,556), Piauí (582,777), Rondônia (561,811), Amazonas (530,814), Alagoas (438 788), Sergipe (427,048), Tocantins (394,628), Acre (151,320), Roraima (125,451), Amapá (115,323).

Based on these data, it is concluded that the project has broad applicability in instances of identification context and data generation, not only the administrative organs but also for statistical and control departments, considering the increasing number of vehicles in the country.

5   Reference in Technology

It presents an approach in technology used to build the software product.

C # – (pronounced "C charpe") is a programming language created for the development of a variety of applications that run on the NET Framework. C # is a simple and powerful language with safe and oriented typing style.. Various innovations in C # allow rapid application development while retaining the expressiveness and elegance of C-style languages. Visual C # is an implementation of the C # language by Microsoft. Visual Studio supports Visual C # with a full code editor, compiler models of project templates, designers, code assistant, a powerful and easy to use debugger and other tools. The.NET Framework library class provides access to various operating system services and other useful and well structured classes that significantly accelerate the development cycle.

Microsoft SQL SERVER – is a DBMS – relational database management system developed by Microsoft. It was created in partnership with Sybase in 1988 initially for OS / 21 platform. This partnership lasted until 1994 with the release of version for Windows NT and since then Microsoft keeps the product. As a database, it is a software product whose primary function is to store and retrieve data requested by other software applications, those on the same computer or those running on another computer over a network (including the Internet). There are at least a dozen different editions of Microsoft SQL.

Security – Concern over the security of the data used in the application implements to transparent data encryption (TDE). This encryption of E/S in real time is a decryption of data and log files. The encryption uses a DEK (database encryption key), which is stored in the record of the beginning of database for availability during recovery. The DEK is a symmetric key protected by a certificate stored in the master database server or an asymmetric key protected by an EKM module. TDE protects data "at rest", that is, data and log files. It provides the ability to fit many laws, regulations and guidelines established in various sectors. This allows software developers to encrypt data using AES encryption algorithm (Advanced Encryption Standard or Advanced Encryption Standard, in Portuguese) and 3DES (Triple Data Encryption Standard), without changing existing applications.

EKM – SQL Server provides data encryption capabilities with EKM (Extensible Manager keys) using the Microsoft Cryptographic API provider (MSCAPI) for encryption and key generation. Data encryption keys and encryption of keys are created in key containers and are to be delivered by a provider before they are stored in the database. This approach enables key management, which includes a key hierarchy of encryption and key backup, to be handled by SQL Server

OCR – Optical Character Recognition, or OCR, is a technology that allows you to convert different documents, such as scanned paper, PDF files (Portable Document Format) and images captured with a digital camera into searchable and editable data.

IP CAMERA – is the one that works without a computer at the place where the monitoring will be done, It will simply require an IP network. This type of camera has infrared LEDs that allow the capture of images in complete darkness, allowing detailed visualization of the site. In addition to this facility, there is the possibility of direct recording images in computers (24/7) or only when there is movement on site.

FIRMWARE – It concerns the scheduled operational instruction set directly programmed on the hardware of an electronic device, whose data is stored in an integrated circuit. Also known by the nomenclature 'embedded software', the firmware constitutes a set of operating instructions that are programmed directly in the electronics hardware.

6 System Architecture

This section is aimed to present the logical architecture of the components involved in developing the system as shown in Figure 3.

Figure 3 shows the architecture of the solution and eBlitz, where the C # language is used for application development. Below is the translation of these high-level languages, it is performed by the CTS (Common Type System) that passes basic class of the.NET Framework, which communicates with the low-level operating system.

7 Minimum Requirements for Installation

Below the hardware and software configurations:
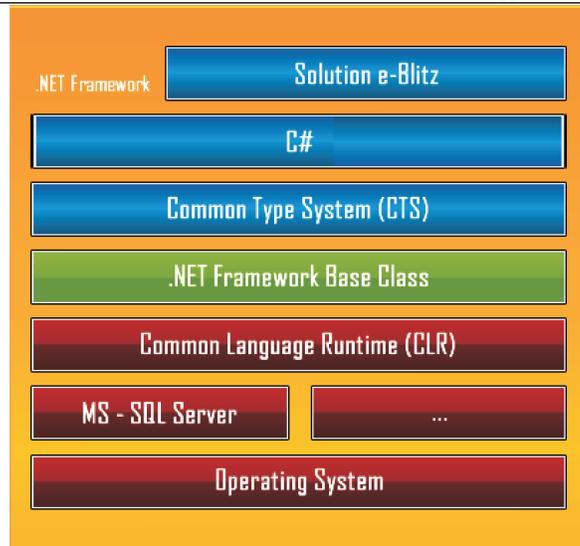
Figure 3: System Architecture

1. Processor: Pentium Core i3

2. Processor speed: 1 GHZ

3. RAM: 4 GB

4. Video Memory: 1 GB

5. Operating Systems: Windows 7 (any version)

6. Space: 200 GB free disk.

8   Development Technology

Presents the tools used to develop the project:

1. EA – Enterprise Architect

2. Microsoft Visual Studio 2010

3. SQL Server Management Studio.

9   Conclusion

It is concluded that the implementation of this project can achieve the desired results, such as: minimize inconvenient to society, identifying the real offender efficiently to be mechanism of security to the inspecting traffic officer and produce data to improve statistics.

By theoretical analysis and the issues raised about the traffic surveillance system presented here, new trends showed up related to supervision and inspection of automotive vehicles as well as the ways that the institutions involved look for reducing levels of approach that do not result in accurate identification of the offender.

The solution e-Blitz brings improvements. But the agents alone can not guarantee success. It should coexist data integration environment between the institutions involved, which give support to people to work safely. Significant results start to happen when the effective mass criticism of these institutions are trained and effectively apply the correct inspection process.

In short, the system identifies whether the inspected vehicle is the product of a theft or if the vehicle has only a delayed penalty, tax or whether it is search and seizure reason given by the court for nonpayment of the loan.

When people agree with atittude which can provoke risk, good results can not be achieved. On the other hand, conscious careful employees should get best results

To achieve continuous improvement of traffic inspection process is necessary to overcome existing barriers, because changes usually increase fear and anxiety and make people feel more uncomfortable.

Normally, a sense of potential loss can put in risk a process of change that would only bring benefits.

REFERENCES

[1] AGENCY BRAZIL – REPORT INCREASE IN VEHICLE FLEET IN BRAZIL. Available in: http://agenciabrasil.ebc.com.br. Accessed on 15 October 2013.

[2] BRAZILIAN CODE OF TRANSIT – Law No. 9503, OF 23 SEPTEMBER 1997. Available at: <http://www.planalto.gov.br/ccivil_03/leis/l9503.htm. Accessed on 15 October 2013>.

[3] TRANSPORT ENGINEERING COMPANY AND CASCAVEL TRANSIT – CETRANS. ELECTRONIC SURVEILLANCE. Available at: <http://www.cetrans.com.br>. Accessed on: May 20, 2011.

[4] NATIONAL COUNCIL OF TRANSIT – CONTRAN. RESOLUTIONS AND DECISIONS. Available at: <http://www.denatran.gov.br/contran.htm>. Accessed on: May 19, 2012.

[5] Canadian company has video surveillance system to Alagoas. 2012. Available at: <http://7segundos.ne10.uol.com.br/index.php/noticia/2012/02/27/empresa-canadense-apresenta-sistema-de-videomonitoramento-para-alagoas>. Accessed on 15 October 2013.

[6] DENATRAN – REPORTS WITH VEHICLE FLEET DATA IN BRAZIL. Available at: <http://www.denatran.gov.br/frota2013.htm>. Accessed on 15 October 2013.

[7] DENATRAN – DF REPORTS OF VEHICLE FLEET DATA. Available at: <http://www.denatran.gov.br/download/frota/FrotaMunic2013.rar>. Accessed on: August 1, 2013

[8] G1 – LIST OF BRAZILIAN STATES IN ACCORDANCE WITH THE SIZE OF THE FLEET. Available in: <http://g1.globo.com/carros/noticia/2011/02/frota-de-veiculos-cresce-119-em-dez-anos-no-brasil-aponta-denatran.html>. Accessed on: August 1, 2013.

[9] GUEDES, Gilleanes TA UML 2: A practical approach / Gilleanes TA Sao Paulo: Novatec Publisher, 2009.

[10] Kruchten, Philippe. Introduction to RUP – Rational Unified Process Rio de Janeiro: EditoraLtda Modern Science. 2003.