Unified Traffic Ticketing System in Gulf Countries
An Application of Systems Engineering

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1.0 Project Overview

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1.1 Overview

- There are many unifying forces in the world which bring together resources, intelligence, and strategies all aimed toward solving a problem.

- In the Gulf region, there is a long trail of unaccounted for traffic violations.

- The offenders are often foreigners of the neighboring countries which comprise the Gulf region, namely: Bahrain, Kuwait, Oman, Qatar, Saudi Arabia and the United Arab of Emirates.

- The violations can range from offenses as simple as running a stop sign to more serious violations of hitting a pedestrian or crashing into another vehicle.

- Little known truth behind these traffic violations is that most, if not all, of the perpetrators currently are not held accountable or brought to justice.
1.2 Introduction

- Gulf Cooperation Council (GCC)
- The GCC has many objectives among them includes; formulating similar regulations in various fields such as religious, finance, trade, customs, tourism, legislation, and administration
- Despite these commendable efforts, the GCC still fails to recognize the need for uniformed set of laws and procedures in governing their roadways and the lives of the citizens
- The implementation of *Systems Engineering* is urgently needed to develop and maintain an unified traffic ticketing system (UTTS) in the Gulf region.
Map of The Six Countries

- Kuwait
- Bahrain
- Qatar
- Saudi Arabia
- UAE
- Oman
1.3 Problem Statement

- Drivers of Arabic states who get tickets while driving in non-home states are often surprised to find that no traffic tickets have been issued against them.
- That because law enforcement is not able to even identify the offenders when they are from another country in the region due to the inability to detect or scan foreign license plates.
1.4 Project's Objectives

- Creating a unified traffic ticketing system for the six countries
- Enacting traffic laws and procedures
- Ensuring that the integrated, uniformed traffic laws and procedures are being implemented throughout the countries
- Keeping accurate records for all traffic violations, violators and vehicle identification information
- Issuing penalties to all violators
- Reducing traffic violations.
1.5 Project’s Challenges

- Concerns to:
  1. Whether the technology and the hardware will **interface properly and consistently produce the desired outcome**
  2. The integration of the countries in the Gulf region regarding their current traffic laws and practices
  3. The following groups who are expected to **challenge the need and validity of utilizing a new technology**:

**Traditionalist/Conservatism**

**Religious**

**Pragmatists**
1.6 Interrogatives

WHAT:

Traffic violators currently are not held accountable when driving their car in an Arab state other than their homeland country in the Gulf region.

WHO:

- GCC
- Courthouses
- Gulf Countries Customs and Boarder Protection
- Police officers
- Drivers of Gulf countries
- Police Departments in all six countries
- Auto Insurance companies

WHERE:

- Saudi Arabia, Riyadh
- Diplomatic District

WHY:

- Ensure public safety
- Better traffic control
- Reduce traffic violations and violators

HOW:

- Systems Engineering V model

- Launched early 2015
- Completed by October 2018
2.0 Literature Review

2.1 Introduction

2.2 Unified Traffic Ticketing System in Other Countries
   2.2.1 USA
   2.2.2 Florida
2.2 Unified Traffic Ticketing System in other Countries

2.2.1 USA

- In the US, traffic tickets are issued from the state where violators committed the violation.
- Traffic tickets follow US people by a unified traffic ticketing system among the 50 states.
How The System Works

According to John Lare, an officer at the DMV office in Culver City, California, "There are three major databases that keep track of your driver's license info:

1) The National Driver Register (NDR) - also referred to as the Problem Driver Pointer System (PDPS)
2) The Driver License Compact (DLC)
3) The Non-Resident Violator Compact (NRVC)"
National Driver Register (NDR)

- NDR has a full list of all the drivers who are considered the "worst drivers"
- The NDR keep track of "Drivers who have had their licenses revoked or suspended, or who have been convicted of serious traffic violations such as driving while impaired by alcohol or drugs" – John Lare
- All the 50 states and the District of Colombia use this database
- Every state requires to submit latter information to the NDR, so that all NDR members/users have access to view the information
- All members are obligated to check the list before granting or renewing any driver licenses in an effort to make the highways safer for all drivers
- The NDR list consist of: 
  Name, gender, date of birth, license number, and the name of the state that reported you
Driver License Compact (DLC)

- DLC is a part of American Association of Motor Vehicle Administrators items
- DLC is a "pay now concept" among the member states
- It forces one to take action for one's bad driving in other states immediately in the home state
- (DLC) signed by 45 states plus the District of Columbia
- Every state who is a member of DLC is required to share or report out-of-state convictions to each other
- Georgia, Massachusetts, Michigan, Tennessee and Wisconsin are not DLC members for political reasons
- However, this fact does not mean if one gets tickets in those states will not be reported to the home state department, but the process takes longer and the chance of the violator being reported is less
Non-Resident Violator Compact (NRVC)

- NRVC is like the **middleman** between the NDR and DLC
- Wisconsin, California, Montana, Oregon, and Alaska are not members of NRVC
- It is a way for DMV to have control of **ones driving privileges** by suspending the driver’s license **until the tickets issued in other states are resolved**

![Figure 2.0: Traffic Tickets made by CA Residents](image)

![Diagram showing NRVC, DLC, and NDR](image)
2.2.2 Florida: Uniform Ticket Citation

- In Florida, a similar system was implemented successfully.
- The system is intended to incorporate the cities in Florida in a single system.
- Florida is still in transition from paper-based methodology to electronic base.
- Two types of ticket:
  - Yellow (written by hand)
  - White (generated by computer)
- When one gets a traffic ticket in Florida, three choices are available:
  - Pay the ticket and take the points
  - Pay the ticket and attend electronic traffic school
  - Fight the ticket
The content of the ticket is as follows:

- **Citation number** (which is the big black series of numbers and letters)
- **The county** in which one received the ticket
- **Personal information**
- **The cause or reason** for the ticket
- **The name of the police officer**
- **Signature**
Problems Associated with The UTC

- Manual ticketing system
- Random selection of the court where the violator should appear to the ticket
- Refusal to sign the ticket because of the court location
- Inadequate public knowledge regarding how to read the tickets
3.0 Case Studies Analysis & Discussion

3.1 Overview

3.1.1 Saudi Arabia

3.2 Cost & Benefit Analysis

3.3 System Requirements
3.1 Overview

- The successful implementation of a new **unified traffic ticketing system** for the Gulf region is expected to provide the following:

  ➢ **Application of The New UTTS:**
    - The UTTS will apply all the new standardized, integrated laws agreed upon through the work of the GCC
    - Through the use of UTTS, each country will **changeover from written tickets** to an **electronic format**
    - Each country in the region will be **fully trained and equipped** to use the UTTS.

  ➢ **Issuance of Tickets:**
    - Each ticket will contain the correct name and matching driver's license number, vehicle plates information, and clearly state the cause or reason for the ticket
    - The ticket will contain the accurate date and time it was issued, along with the name of the officer who issued it.
3.1 Overview Cont’d

- Processing The Tickets:
  - All ticket information will be sent to a centralized database to be stored and processed
  - The UTTS will provide access to this information to any of the six countries in the Gulf region
  - The court system will provide reasonable dates and hours of operation for those who work
  - The courts system will provide a right to a speedy trial for offenders choosing to challenge their tickets.
  - The court system will provide an accurate accounting system to keep track of and to receive fines, fees and payments made on tickets.
3.1.1 Saudi Arabia

- **A Paper-based System**

- **Electronic-based**

High-Level Operational Concept Graphic (OV-1): AS-IS

High-Level Operational Concept Graphic (OV-1): TO-BE
## 3.2 Cost and Benefit Analysis

<table>
<thead>
<tr>
<th>Category</th>
<th>Details</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Database Management System</td>
<td>According to Oracle company website: License fee + maintenance fee for such complex project is $300,000/year</td>
<td>$300,000/year</td>
</tr>
<tr>
<td>Information Security System</td>
<td>According to Krishnamurthy Narayanaswamy, Professor at LMU &amp; CEO of CS3 company &quot;the cost of an information security system, including the license fee, maintenance fee is about $1 million/year&quot;</td>
<td>$1,000,000</td>
</tr>
<tr>
<td>Network System</td>
<td>According to Johann Schleier-Smith, Co-Founder &amp; Chief Technology Officer of Jump Start Technologies: &quot;in the database world, for every 50 million users, 500 servers are needed costing $7000 / each * 400 = 280k&quot;</td>
<td>$2,800,000</td>
</tr>
</tbody>
</table>
| Training Program            | - A person cost $100/hour  
- The total number of police officers in Gulf region need to be trained to the software is: the total number of police cars in Gulf region (475,648) * 2 = 951,296  
- Cost of training = 951, 296 * $100                                                                                              | $91,529,600   |
| TV Advertisements           | According to Mazen Hayek, marketing and sales manager at MBC channel "the cost of a minute of advertisement in the channel = $23,000". 120 minutes of advertisements will be needed to promote the system: 120 * 23,000 (cost of a minute) | $2,760,000    |
| Laptop and Com.             | The cost of a laptop and com. = $200 * 475,648 (number of police cars)                                                                                                                                 | $95,129,600   |
### 3.2 Cost & Benefit Analysis Cont’d

<table>
<thead>
<tr>
<th>New Management</th>
<th>$5,806,800/year</th>
</tr>
</thead>
<tbody>
<tr>
<td>- The new management needs an estimated 100 employees as follows:</td>
<td></td>
</tr>
<tr>
<td>30 people as “Data Reviewer”</td>
<td></td>
</tr>
<tr>
<td>20 Global Management including (Human Resources, Accounting and lawyers)</td>
<td></td>
</tr>
<tr>
<td>40 People IT Management (Networking, Software, Developers)</td>
<td></td>
</tr>
<tr>
<td>- 10 people for call center</td>
<td></td>
</tr>
<tr>
<td>According to Ministry of Labor in Saudi Arabia, the average salary of an employee in Gulf countries is $4839/month.</td>
<td></td>
</tr>
<tr>
<td>- 100 employees * 4839/month * 12</td>
<td></td>
</tr>
<tr>
<td>Software &amp; Programmers</td>
<td>$200,000 + 30,000/year</td>
</tr>
<tr>
<td>- According to Krishnamurthy Narayanaswamy, Professor at LMU &amp; CEO of CS3 company “the cost of a software for this project is about $200,000 divided as follows:”</td>
<td></td>
</tr>
<tr>
<td>- Hire 10 programmers with cost of $200/hour</td>
<td></td>
</tr>
<tr>
<td>- Total hours needed per programmers 100 hours</td>
<td></td>
</tr>
<tr>
<td>10 programmers * 100 hours/programmer * 200 (cost of an hour)</td>
<td></td>
</tr>
<tr>
<td>- Maintenance fee is about $30,000/year</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>$193,419,200</td>
</tr>
</tbody>
</table>
3.2 Cost & Benefit Analysis Cont’d

- The UTTS is expected to provide the following benefits:
  - Savings on healthcare treatment expenses
  - Safety
  - Processing time
  - Financial benefits

<table>
<thead>
<tr>
<th>Table 2.0: Traffic Tickets made by Gulf people in UAE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Country</strong></td>
</tr>
<tr>
<td>#1 Oman</td>
</tr>
<tr>
<td>#2 Saudi Arabia</td>
</tr>
<tr>
<td>#3 Qatar</td>
</tr>
<tr>
<td>#4 Kuwait</td>
</tr>
<tr>
<td>#5 Bahrain</td>
</tr>
<tr>
<td>Total:</td>
</tr>
</tbody>
</table>
3.3 System Requirements

- The UTTS shall reduce the traffic violations in the six countries by an estimated 20% every year through implementation and enforcement of the new traffic laws and regulations.
- The UTTS shall keep accurate records for each ticket that will contain the correct name and matching driver’s license number of the offending driver, the vehicle plates numbers, and clearly state the cause or reason for the ticket.
- The UTTS shall apply all the new standardized, integrated laws and penalties in all the six countries of the Gulf region through the aid of the GCC.
- The system shall provide training sessions for all system stakeholders.
- The system shall inform all the Gulf drivers about the new system and understanding the new procedures via communication media.
- The entire ticketing process shall be managed electronically via Database Management System.
- The system shall reduce the time of processing tickets from 30 to 4 days.
- The UTTS shall have database protection via Information Security System.
- The UTTS shall provide access to the data to all authorized users in all the six countries.
- The system shall ensure reliability and maintainability by conducting backups for all the data at the end of each day and updating all integrated software every month.
4.0 Implementation Methodology: Systems Engineering Processes

4.1 Introduction
4.2 Systems Architecture
4.3 Heuristics
4.4 Concept of Operation
4.5 Risk Analysis
4.6 Software / Hardware Development
4.7 Testing, Verification and Validation
4.2 System Architecture

High-Level Operational Concept Graphic (OV-1): AS-IS
4.2 System Architecture Cont’d

High-Level Operational Concept Graphic (OV-1): TO-BE
4.2 System Architecture Cont’d

Block Definition Diagram (BDD) for UTTS

- BDD represents all the stakeholders of the system and what type of interface is needed or used to communicate with the system.

BDD (Block Definition Diagram)
4.2 System Architecture Cont’d

Internal Block Diagram (IBD) for UTTS

- IBD shows the internal structure of the UTTS
4.3 Heuristics

- Heuristics play an important role of providing a way forward for ill-defined problems.
- A systems engineer will use heuristics that use principles of abstraction, to solve or clarify a problem.
- Here are list of heuristics that fit to this project:
  - "Quality can not be tested, it has to be built in" (E. Rechtin, 1990)
  - "The product and process must match" (E. Rechtin, 1990)
  - "Performance, cost, and schedule cannot be specified independently. At least one of the three must depend on the others" (E. Rechtin, 1990)
  - "Simplify, simplify, simplify" (E. Rechtin, 1990)
  - "A model is not reality" (E. Rechtin, 1990)

## 4.5 Risk Analysis

<table>
<thead>
<tr>
<th>Risks</th>
<th>Mitigation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1- Poor project implementation by the contractors.</td>
<td>Setting up financial penalties as well as requiring past performance ranking</td>
</tr>
<tr>
<td>2- Drivers resistance to information sharing in all the six countries.</td>
<td>The drivers must be informed that the shared information is limited to: driver license information, car registration and history of traffic violations.</td>
</tr>
<tr>
<td>3- Man/Machine Problems: Frustration in learning the new system</td>
<td>Provide enough training to all the system users</td>
</tr>
<tr>
<td>4- Traffic regulation are varied among the six countries</td>
<td>The public shall be informed via media campaigns</td>
</tr>
<tr>
<td>5- Political risks (conflicts between different groups of people, law complications, policy changes)</td>
<td>Provide lobbying and educational campaigns to all the leaders of the six countries could mitigate the risk</td>
</tr>
<tr>
<td>6- System complexity and lack of knowledge and resources</td>
<td>Education and scheduling interviews</td>
</tr>
</tbody>
</table>
4.5 Risk Analysis Cont'd
4.6 Hardware & Software Development

- The software will be able to support all the data and features for all six countries in the Gulf region
  - Oracle Database Management System
    1. Highly Reliable
    2. High performance
    3. Supports large databases

- Conduct backup for all the data in the system by the end of each day
- Perform all the required software maintenance
4.7 Testing, Verification and Validation

- Multiple test runs will need to be conducted before and after the new system is launched.
- These runs will involve all the traffic departments in the six countries.
- Among the categories that will need to be tested are:
  1) The reporting features
  2) Processing speed: response time and accuracy
  3) Integration and sharing features
  4) Storage capacity
  5) Overall efficiency of the system.
4.7 Testing, Verification and Validation Cont’d

- **System verification** will involve number of steps:
  - Verifying the reliability of the system for road safety
  - Checking the real time features of the system, and the correct reading of license
  - Verifying backups to make sure files are retrievable
  - Checking the communication/reporting capability

- **System validation** to assure that the system does exactly what it is designed to do and the desirable measures can be reproduced in a consistent manner
5.0 Improvement Methods

5.1 Lean Methods

5.2 Quality Tools
5.1 Lean Methods

- The UTTS should be able to eliminate the following type of waste:
  1- Inventory & Ticket Processing Wait Time
  2- Unnecessary Movements

- Payment at the border upon checkout is not the best option!
  - “The total number of people from the Gulf region who came to UAE by car during the holiday of Eid al-Fitr in 2014 was 166,210” (41,552 cars)

✓ A time-cutting option would be that each country will get paid by the other country once the violators pay off their fines.
5.1 Lean Methods Cont’d

- The following table summarizes the Lean results:

<table>
<thead>
<tr>
<th>Category</th>
<th>Old System</th>
<th>New System</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inventory</td>
<td>High</td>
<td>Zero</td>
</tr>
<tr>
<td>Processing Time</td>
<td>Up to 30 days</td>
<td>4 days</td>
</tr>
<tr>
<td>Unnecessary Movements</td>
<td>95 %</td>
<td>5 %</td>
</tr>
</tbody>
</table>
5.2 Quality Tools

- Quality in a process measures its excellence and absence of deficiencies.
- Applying the quality principles will result in “Quality products, quality design, quality features and quality processes” (Oppenhiem, class notes, Quality, 2008).
- The UTTS will undertake the following tools:
5.2 Quality Tools Cont’d

Continuous Improvement:

• The fundamental principles for incorporating and maintaining quality for UTTS are:
  
a) Establish strong communications throughout every department and stakeholder

b) Value employees by creating an atmosphere where recommendations and improvements to the project are encouraged and rewarded

c) Cultivate teamwork cooperation among the employees

d) Avoid undue criticism and negativity

e) Promote an environment of continuous learning and innovation.
5.2 Quality Tools Cont’d

Improving The 5S’s:

• In the old system, there were more inventories, which made it difficult to maintain and locate files due to poor 5S’s implementation.

• For example, the police department in the West area of Riyadh city alone lost approximately 2200 tickets in 2013.
6.0 Ethical Issues

Privacy and Security Breaches:

➢ Who will have access to the networks?

➢ What kind of information will be accessible?
7.0 Lessons Learned

- Computerized systems can be useful in generating substantial development and growth. Such systems could serve as a means to bring people together and solve their issues.

- It is time for the Gulf region to harmonize and integrate its basic operation systems like traffic control.

- No system can function without the support of the public and the leadership.

- Success is achieved when people collaborate with each other towards a common vision.
8.0 Conclusion

- With the successful implementation of the new UTTS, the Gulf region unites all the six countries into one, and takes road safety to a higher level.
- The Unified Traffic Ticket System increases the accountability in the six countries.
- Different cultures in the six countries have been unified throughout the use of the UTTS.
- From concept, to production, to operation, Systems Engineering was applied throughout the entire process of the creation and implementation of the new UTTS.
Thank You For Listening
References


References


References Cont’d


DoD Architecture Framework (DODAF), Vol 1.2


Oppenheim, B. (2008) Lean Thinking, Loyola Marymount University, Class Note

Oppenheim, B. (2008) Quality, Loyola Marymount University, Class Note

4.2 System Architecture Cont’d

Operational Node Connectivity Description (OV-2):

- **Police Officers**
  - 1. Driver Info / Car Registration / Insurance
  - 2. Send violation ticket statement
  - 3. Update violation ticket status

- **Gulf countries Customs and Border Protection**
  - 1. Report the Driver Status
  - 6. Report violation ticket status
  - 7. Request appearance

- **Drivers**
  - 9. Report the ticket statement with all details

- **Police Departments**
  - 4. Report the ticket
  - 5. Record points affect the insurance rate

- **Auto Insurance Company**
  - 8. Validate all the information

- **Court**
  - 7. Request appearance

- **Cooperation Council for the Arab States of the Gulf**
  - 8. Validate all the information
### 4.2 System Architecture Cont’d

**Operational Information Exchange Matrix (OV-3):**

<table>
<thead>
<tr>
<th>No.</th>
<th>Source</th>
<th>Destination</th>
<th>Exchange Information</th>
<th>Exchange Type</th>
<th>Timeline</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Police officer</td>
<td>UTTS</td>
<td>Driver info.</td>
<td>Electronically</td>
<td>Just-In-Time</td>
</tr>
<tr>
<td>2</td>
<td>UTTS</td>
<td>Police Department</td>
<td>Ticket statement</td>
<td>Electronically</td>
<td>JIT</td>
</tr>
<tr>
<td>3</td>
<td>Police Department</td>
<td>UTTS</td>
<td>Ticket statement</td>
<td>Electronically</td>
<td>JIT</td>
</tr>
<tr>
<td>4</td>
<td>UTTS</td>
<td>Auto Insurance company</td>
<td>Ticket statement</td>
<td>Electronically</td>
<td>JIT</td>
</tr>
<tr>
<td>5</td>
<td>Auto Insurance company</td>
<td>UTTS</td>
<td>Insurance rate /points</td>
<td>Electronically</td>
<td>Within 24 hours</td>
</tr>
<tr>
<td>6</td>
<td>UTTS</td>
<td>Court</td>
<td>Ticket Statement</td>
<td>Mail service</td>
<td>Within 24 hours</td>
</tr>
<tr>
<td>7</td>
<td>Court</td>
<td>UTTS</td>
<td>Appearance letter</td>
<td>Mail service</td>
<td>Within 24 hours</td>
</tr>
<tr>
<td>8</td>
<td>GCC</td>
<td>UTTS</td>
<td>Ticket statement</td>
<td>Electronically</td>
<td>JIT</td>
</tr>
<tr>
<td>9</td>
<td>UTTS</td>
<td>Drivers</td>
<td>Ticket Statement Package</td>
<td>Mail service/Email</td>
<td>Within 4 days</td>
</tr>
<tr>
<td>10</td>
<td>UTTS</td>
<td>Customs &amp; Boarder Protection</td>
<td>Driver Status</td>
<td>Electronically</td>
<td>JIT</td>
</tr>
</tbody>
</table>