Integrated Cargo Gate Vehicle Processing System

Port of Miami
Miami-Dade County Seaport Department
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Description: Port of Miami

A department of Miami Dade County, the Port of Miami ('Port") is among America's busiest ports and it is recognized throughout the world with the dual distinction of being the Cruise Capital of the World and the Cargo Gateway of the Americas. Over four million passengers passed through the Port last year, as well as approximately 7.5 million tons and over 800,000 TEUs (twenty-foot equivalent units) of cargo. This commercial trade contributes over $17 billion annually to the South Florida economy and helps provide direct and indirect employment for over 176,000 jobs. An important force behind the development of the Port to world-class status, however, has been the unwavering support of its elected officials and civic leaders. They recognized the importance of the Port of Miami to the economic wellbeing of the community. As a result, Port Management has been able to development of infrastructure, acquire the equipment and implement the latest technological innovations to meet the demands of its cruise and cargo customers.

With approximately 520 acres dedicated to rolling stock, container yards, refrigerated warehouse space, gantry crane facilities, seven modern cruise terminals, and administration offices for the use of the Port, government agencies, several shipping lines, maritime organizations and cruise lines, the Port offers a wide variety of choices of popular multi-day cruises. Ports-of-call easily reached from Miami extend from the Bahamas to the Eastern and Western Caribbean, Mexico, Key West, South America, and beyond. In addition, the Port has partnered with the Greater Miami Convention and Visitors Bureau to promote awareness of Miami as the premier

homeport and an emerging port-of-call as well as a destination offering pre-cruise and post-cruise activities.

Part of the success of the Port can be attributed to its strategic geographic location, which places it at the crossroads of the major shipping lanes in the hemisphere as well as its close proximity to many popular cruise destinations. Additionally, the Port benefits from Miami's emergence in recent years as the international business center of the Americas, with an increasingly sophisticated and diversified trade-supported community.

The Port is a major player in international and local economies generating global economic activity with interactions between Miami-Dade County and numerous trading partners. The Port serves many leading shipping lines that call on more than 100 countries and 250 ports across the world, serving the markets of Asia, the Caribbean, Central America, Europe, the Middle East, North America, and South America. Latin America and the Caribbean continue to account for more than half the cargo tonnage moving through the Port of Miami, ensuring its continued distinction as the Cargo Gateway of the Americas. The shift in Asian trade to East Coast ports via all-water routes through the Panama Canal has resulted in the Far East being the fastest-growing region for the Port. Trade with Asian countries represent more than one-fourth of the total tonnage handled at the Port of Miami, while Europe accounts for the remaining share; with the announced enhancement of the Panama Canal, both cargo and cruise businesses are expected to grow as new services will claim the Port of Miami as their preferred port-of-call.

Introduction

The Seaport Integrated Cargo Gate Vehicle Processing System is one of the most important and recently implemented Applications at the Port of Miami. Important aspects of the system goals, development process and accomplishments are discussed: Why was the system needed? What were the premises for the agreement between stakeholders and developers? How the system-requirements were defined and then implemented observing fully integration with the existing legacy at the Port; what were the benefits and costs? What were the key-performance indicators defined and measured during (and after) the development process? How the solution looked like at the end and how users' expectations were met and surpassed.

Finally, this paper explains why the system is worthy of the AAPA Information Technology Award based on its high level of innovation, the efficient use of cutting-edge technology, as well as its wide applicability and reusability as a model for other ports in the nation and worldwide.

Goals and Objectives: The Business Case

The Port, as the largest container port in Florida, was faced with the implementation of all the necessary security and business requirements without impacting the speedy movement of cargo in and out of the Port.

Manned-manual processing at each lane of the security gates was not being effective anymore and especially during peak-hours either the quality of the enforcement or the flow of commerce (or both) were often adversely impacted.

As mandated by Florida Statues, only individuals who had passed security background checks, or had been designated as “authorized visitors” could be granted access to restricted areas of a port, therefore the Port needed to create a dynamic screening system tied to all other security-related systems: Personal Identification and Credentialing, Permitting, and Access Control. The need for such system was then scoped and implemented in partnership with SAIC (Science Applications International Corporation) and the result was the most advanced Seaport Gate Security System in The United States and one of the most advanced of its class in the world.

Due to the considerable volume of vehicles that are processed through the Port’s security gates on a daily basis (3,000+), the limited number of gates and the finite number of available security personnel, it was evident that an automated system with rapid data entry/retrieval requiring minimal keystroke counts would be essential. Data capture peripherals would also be needed to meet the processing time requirements. Issues regarding the earning potential of the companies and drivers (trip-count) also had to be taken into consideration. Any significant lag time between the arrival to the Port’s bridge and the moment of granting access via the Gate Security System to the controlled areas of the Port could cause a financial impact to the customers.

Discussion

Background and Project Description: Owed to the complex composition of personal and company data, the project was developed through the active participation of

representatives from SAIC, the Port of Miami Security Division, Miami-Dade Police Department (MDPD), U.S. Customs, Port of Miami Operations Division, and the Port of Miami Finance Division; consulting services from a Java-Expert were also contracted to program the middleware. Those representatives attended intensive Joint Application Design (JAD) meetings in order to ensure that all of the identified objectives and needs were met.

The Port of Miami's Cargo Security Gate System is the most technologically advanced Cargo Gate system in the United States. It is used to control access to the restricted cargo-areas of the Port. All vehicles entering the restricted area must be screened before access is granted. By the use of cameras, proximity readers, magnetic-stripe readers, biometrics, OCR readers, card-imagers, cameras and microphones all vehicles and persons are screened and equipment information is captured and stored.

All drivers must have a current Port of Miami ID, a valid visitor card, or a valid driver's license to enter the restricted area; when a driver's license is used, the 5-in-90 rule is enforced by the system. The driver would present a form of ID to one of the devices and then authentication of said ID is done; only if all requirements to allow entry are satisfied, access is granted. If access is granted, a gate pass is issued for the individuals inside the vehicle (driver and passenger(s)).

A gate pass for trucks is a paper printout showing the date and the time when access was granted, name of driver and his/her ID-number, and a list of the equipment brought into the restricted area. For cars, an electronic gate pass is created showing

similar information. This system also allows trucking companies to review their gate transaction logs and balances via a web-site.

The Gate system is integrated with the Credentialing, Access Control, Accounting, Radiation Control, and Permit Systems. Real-time integration with the Terminals will soon be implemented to assure that both visitors and cargo have pre-authorized clearance from the Terminal Operators. Terminal Operators will also benefit with outbound cargo information after the link is put in place.

Because both our credentialing and our access-control systems have been fully integrated to TWIC (Transportation Worker Identification Card), our gate system will also very soon be able to read and authenticate TWIC cards at the gate stand including clearance as per the TWIC Hot List. (The original biometric readers will be replaced by the vendor with a model that satisfies the new business and security requirements).

Via its integration to the Port's Permitting System, the new Gate Security System validates that the required insurance coverage as well as the company's registration with the State of Florida are current and active. The existence of a valid company's permit and/or a registration with the Port is also validated.

The Port encourages its business partners to open private accounts where they can pre-deposit moneys and specify their intended use; those accounts are maintained by the Accounting System. The Gate Security System interfaces with the Accounting System and with the Tariff Control System to retrieve the accounts' current balances as well as to apply debits (charges) for scale-weight based on the tariff table.

Without any operator intervention the system validates the ID card within two seconds and returns the driver information and picture to the officer.

All validation problems (i.e.: expired card, invalidated card, BOLO, etc.) are returned to the officer in the form of alerts in which case a Rejected Gate Pass is issued and all other inbound lanes are forcibly closed to allow that vehicle to use the escape route that would take him directly to the outbound lanes.

If the validation process returns with a successful result, the officer verifies the image on the screen matches the face of the driver at the lane (Or the video that shows on the VON monitor at each station at the command center); then, the registered company information is selected from a drop down list containing only the company(s) that said driver is allowed to work for, and the selection is validated for permit status and insurance expiration. The officer authenticates the company name on the screen is the name on the truck. At this point the security check is complete.

In preparation for the soon-to-be-established link to the terminal yards, the type of equipment and its identification numbers (Container, Trailer, Chassis, etc.) are also entered. If requested by the trucker, the scale weight is captured and a scale weight fee (Cash or Credit) is applied.

After the process is completed, the officer presses a <get-next> button on the transaction handler screen that basically stores the gate pass in the database, prints it for verification at the terminal yard, sends the <open-exit-gate-arm> message to the controller, and gets the next transaction available in the queue.

The process is much simpler for cars, and the outbound processing is faster and simpler for both cars and trucks.

In the Outbound process basically once the gate pass number is entered, the system returns the driver's information and image to the screen for the officer to validate that the driver who entered is the driver that is exiting. The system validates the gate pass (checks to ensure that it has not already been processed outbound, the driver has spent excessive time in terminal yard, etc.) and returns any exceptions via an alert on the screen. Again, in preparation for the automated link with the terminal operators the type of equipment and its identification numbers (Container, Trailer, Chassis, etc.) are also entered in outbound.

The system provides two important additional features: Lane Administration and Lane Watcher. Those two options give maximum flexibility to officers in the command center to set up lane working conditions as well as to follow up key-performance indicators lane-by-lane. The system also provides an ample variety of statistical and self-auditing reports for the use of managers in the three main user areas: security, operations and finance.

Objectives and Methodology: The system objectives were clearly defined at the beginning of the project; they were then included in the Project Charter upon approval from the stakeholders. The Port needed the system to fulfill these high-level goals:

1- Minimize transaction duration and vehicle turnaround

2- Enforce all Port business rules

3- Enforce all Federal, State, Local, and Port security rules

4- Fully integrate new system to the existing Port legacy

To achieve those goals, the Rational Unified Modeling Language and Methodology were followed throughout the system life cycle. Goals and Requirements were defined, Events, objects, actors, and use-cases were also defined and described and then the development phase was accomplished using a mixture of conventional procedural and object oriented methods. A Total Quality-Control Approach to Project Management minimized the risk throughout the implementation of the system by the use of unit and system tests associated to project milestones.

***Platform Specifications (Hardware and Software)*:** The Gate Security System is composed of five major logic components:

1- Field Equipment: Peripherals, computers, circuits, radiation portals, and connections.

2- Transactional Control Servers: Dedicated to control the field equipment and translate their local events into XML-scripted incoming/outgoing messages. These servers also send messages to field equipment to execute specific actions and/or responses requested by the Transaction Handler.

3- Radiation Control Server: Control the Radiation Portals and communicates with the Transaction Handler via a Database link.

4- Middleware: Also called “the listener”, it is a program that is continuously running on the application servers receiving messages from the Transactional Control Servers and

sending them to the Transaction Handler for processing; and vice-versa: It receives messages from the Transaction Handler and sends them to the Transactional Control Servers for processing and dispatch to the peripherals.

5- Transaction Handler: This is the GUI that allows officers working at the lane booths or at the command center to process the requests for access, one transaction at a time. Transactions are queued and dispatched following a simple-and-fair FIFO-rule. The transaction Handler “talks” with the listener and also directly with the Radiation Control Server.

There are two well-differentiated levels of complexity in this system: The complexity associated to handling the multitude of different protocols native to each type and brand of peripheral, and the complexity associated to enforcing all the necessary business and security rules that the system is expected to enforce. Both levels are successfully met.

Reliability is ensured in two ways: Redundancy, load-balancing, and Replication. All disaster recovery procedures have been fully tested.

Following, the main hardware and software components of the implementation:

- Two Clustered Application Servers
- DASD storage technique
- Workstations (Booths and command center stations)
- Field Equipment: HID Proximity Readers, Biometric readers, Card Imagers, OCR cameras, Cardinal Scales, VON interfaces, Software Controlled CCD

Color Digital Cameras, Label printers, sensors, loops, other controllers, switches and lights.

- Network – Ethernet 10/100 megabit per second
- Databases – Oracle 9.2.0.6 (Fail Safe and Replication) and Database Links to third-party components
- Development Languages – Oracle Developer 2000, Java Developer's Studio, PLSQL
- Operating Systems – Servers (Windows 2000 Server)
- Workstations (Windows XP Workstation)

Project Costs: Two major cost-components are associated to this project: Capital investment and yearly operating costs.

Capital Costs

Analysis & Design: $300,000

Programming: $200,000

Infrastructure and Construction: $3,200,000

Operating Costs (yearly costs)

Maintenance and Service Contract: $150,000

Analysis, Design, and Programming of system enhancements: $ 38,000

Performance Measures: The Port of Miami Gate Security System can be considered a model for all ports in the United States. Its success can be measured mainly in two directions: Firstly in the strengthening of the enforcement of security and business rules, and secondly the noticeable enhancement of customer satisfaction.

The security and business rules are rigorously enforced via the integration to other legacy systems: Permitting, Credentialing, Access Control, Tariff Table, and Accounting.

The enhanced customer satisfaction is achieved by streamlining the processes and minimizing the delays. Most current statistics show a continuous trend of decreasing transaction-duration as drivers have become progressively savvy in the use of the system and the interaction with the gate stand equipment at the unmanned lanes. These are the latest figures:

Transaction Type	**Average Duration (Minutes, Seconds)**
Truck Inbound	1,28
Truck Outbound	0,43
Car Inbound	0,14
Car Outbound	N/A

Justification for the Award: The Port has been among the leaders in implementing interactive security systems. The use of the most advanced available hardware technologies: proximity cards and readers, biometric readers, digital cameras, OCR cameras, truck scale interfaces; all integrated to powerful software applications, has translated into a more agile and reliable processing of data.

The new Security Gate System designed, developed, and deployed at the Port of Miami is worthy of the AAPA 2009 Information Technology Award because of its innovative use of state-of-the-art technology to solve the control of access to restricted areas in a unique, efficient, and modular way. This system has allowed the Port to meet its commerce needs, and at the same time exceed state and federal mandates while also meeting the own Port's security needs. Processing time constraints and benchmarks (flow of traffic and truck turn-around trip duration) were amply satisfied as were the original system requirements resulting from the analysis and design phases.

Conclusion

The Port is the second most important economic engine in Miami Dade County and one of the most important sources of business for the estate. Cargo represents half of the gross income for the Port. Guaranteeing a more efficient process at the gates, while enforcing all Port, estate, and local business and security rules, is one of the main goals for the Port and its partners.

The new Gate Security System fulfilled and surpassed all stakeholder expectations and original requirements; it is a model for other ports throughout the nation and it is worthy of an AAPA Information Technology Award.