



UNC CHARLOTTE

The WILLIAM STATES LEE COLLEGE of ENGINEERING

Senior Design Project Description

Company Name	<i>NASCENT Technology</i>	Date Submitted	<i>12/1/2020</i>
Project Title	<i>Time Series Analysis of IIoT Gate Queuing Infrastructure (NAS IIOT)</i>	Planned Starting Semester	Spring 2021

Personnel

Typical teams will have 4-6 students, with engineering disciplines assigned based on the anticipated Scope of the Project.

Please provide your estimate of staffing in the below table. The Senior Design Committee will adjust as appropriate based on scope and discipline skills:

Discipline	Number	Discipline	Number
Mechanical	N/A	Electrical	
Computer	5	Systems	
Other ()			

Company and Project Overview:

NASCENT Technology, LLC is headquartered in Charlotte, NC and is a leading provider of automated gate systems for intermodal ports and terminals. NASCENT has always been an innovator. Since ushering automation into gate systems in 1996, we have been early adopters and, in some cases, the sole integrators and developers of many leading-edge technologies and concepts. We work tirelessly to leverage such technology within gate automation.

NASCENT provides an end-to-end ground-to-cloud solution for its customers. We build physical kiosks and machine-vision portals that are used to identify trucks entering and exiting facilities as well as provide a physical means to communicate with drivers. The hardware, firmware, and software from the kiosk, (ground) through portal products is of a proprietary design. In addition, we produce application software that connects data collected via the kiosk and portals and interfaces with human clerks (who are sometimes completely remote) and a facility’s terminal operating system.

NASCENT is modernizing its entire “ground-to-cloud” hardware and software technology infrastructure. NASCENT is innovating a three-tier Mist, (Edge), Fog, (Middle Tier) and Cloud micro-services architecture that will help our clientele which consists of the nation’s business marine ports, rail yards and commercial distribution centers accommodate continuous growth.



Project Requirements:

This project will build upon a previous 2019 UNCC senior project (NAS_EDGE) that assisted with identifying the new computer platform for our single-board-computer (SBC) edge computing system. The field testing and deployments for our new edge computing will start Q1 2021.

This project will focus on innovating a minimum viable product, (MVP) for a new three-tier data management infrastructure illustrated in the Figure 1 to support new analytical capabilities that shall provide multi-dimensional time series insights across our automated gate operations. The automation of gate operations is underpinned by the orchestration of Industrial of Internet Things, (IIoT) devices as illustrated in Figure 2 below.

The new IIoT analytical infrastructure will be built in the Azure cloud platform leveraging a portfolio of IIoT data capture, data storage and data analysis tools to provide real-time series insights. This team will be collaborating with NASCENT development teams in support of the overall micro-service architecture project.

The results of this project will be incorporated into the overall NASCENT technology modernization initiative to support

- Real time series insights into all aspects of gate management and status of IIoT devices to support:
 - Anomaly Detection - Latency
 - Forecasting
 - Predictive Maintenance
- Configurable performance thresholds
 - Red/Yellow/Green real time visibility

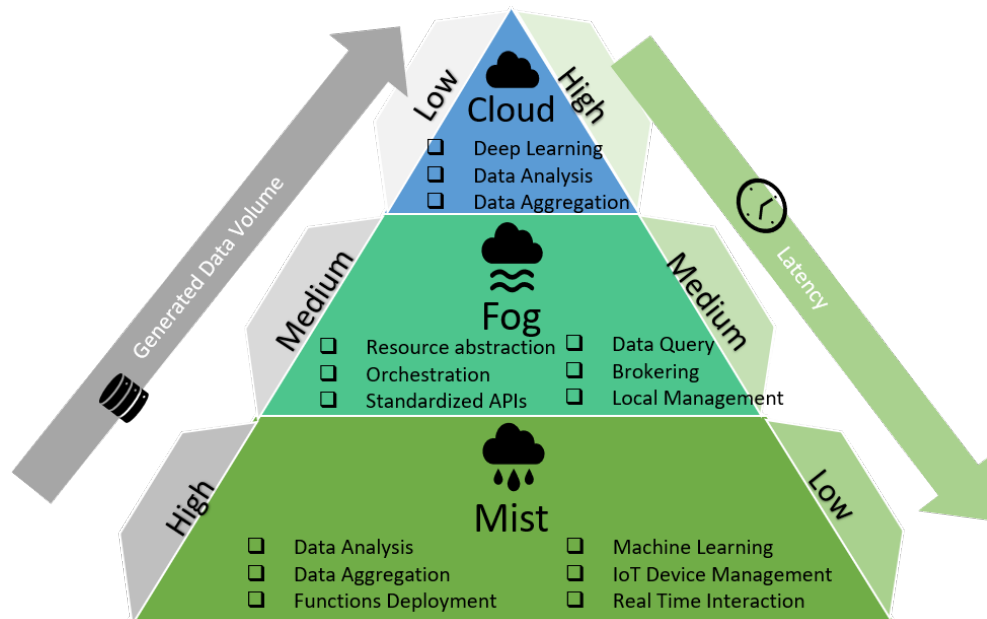


Figure 1



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NASCENT's Data Management Infrastructure

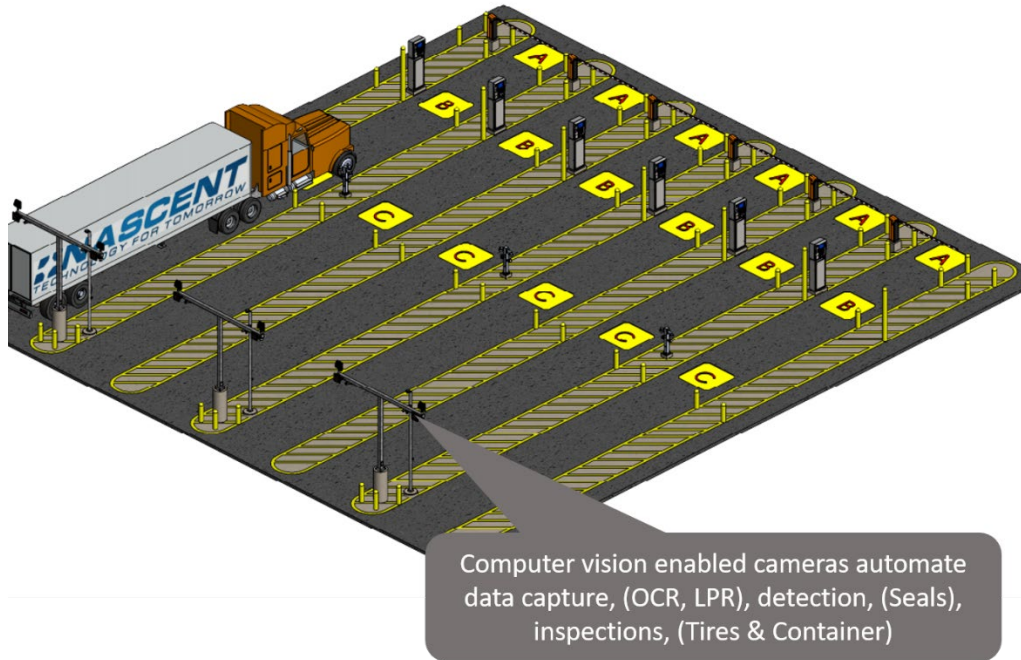


Figure 2

NASCENT's Automated Gate Operations



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Expected Deliverables/Results:

- Analysis of computer vision OCR success rate
- Analysis of IIoT SNMP MIB enabled data capture
 - Docker Hub - Container Performance Statistics
 - CPU –, Temperature, Memory, Performance, Up Time, etc.
 - Network – Latency, Packet Errors
 - Data Processing Latency
- Identify potential security intrusions
- Model patterns to help optimize future deployments of field service interventions
- Measure throughput for each phase of the queue and specific workflow item activity
- Baseline trends to optimize gate operations
- Statistical analysis to help:
 - Streamline turn-around time
 - Optimize workforce based on Time of Day (Time of Day, (ToD), Day of Week (DoW) and Month of Year, (MoY)

Disposition of Deliverables at the End of the Project:

Software innovations developed is the property of the NASCENT Technology LLC. NASCENT will collaborate with the UNCC project team to facilitate a formidable display at the UNCC Fall 2021 Expo using the MVP results that support an actual client's production operation.

List here any specific skills, requirements, specific courses, knowledge needed or suggested (If none please state none):

- Statistics with a passion for Informatics
- Awareness and passion to develop cloud micro service
- Familiarity with Industrial Internet of Things, (IIoT) capabilities
- Passion to invest the time to learn about leading edge technologies related to:
 - Three-tier computing platform – Mist/Fog/Cloud
 - Docker Hub containerization
 - Kubernetes containerization
 - Azure cloud computing data analysis capabilities
 - .NET5 development tools