



UNC CHARLOTTE

The WILLIAM STATES LEE COLLEGE of ENGINEERING

### Senior Design Project Description

<b>Company Name</b>	<i>NASCENT Technology</i>	<b>Date Submitted</b>	<i>11/14/2018</i>
<b>Project Title</b>	<i>Redesign of a Hardware-Firmware Product using New Off-the-Shelf Components (NAS_EDGE)</i>	<b>Planned Starting Semester</b>	<i>Spring 2019</i>

#### 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:

<b>Discipline</b>	<b>Number</b>	<b>Discipline</b>	<b>Number</b>
Mechanical		Electrical	3
Computer	3	Systems	
Other ( )			

#### Company and Project Overview:

NASCENT Technology, LLC is headquartered in Charlotte, NC and is the 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 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 and firmware for both the kiosk and 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.

The “brain” for the NASCENT kiosk solution is a proprietary product called EdgeCOM, the most feature-rich version of the RemKon family of products. The EdgeCOM device is a single-board computer that manages voice, video, data, as well as several physical I/O attributes (e.g. vehicle presence detection via a buried inductive ground loop). The board architecture is completely proprietary, although it is loosely based off of early iterations of the beagle bone platform and leverages commercial off-the-shelf chipsets and components. The operating system is an optimized (i.e. stripped down subset) version of ubuntu/Linux. In the early days, RemKon was way ahead of its time. The RemKon device consolidated Audio, Video, I/O Controllers and touch screen display into a single device, consolidating the capabilities of five “commercial-off-the-



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shelf” products used previously.

The goal of the RemKon Redesign project is to design, build, and operate a replacement for the EdgeCOM product with a solution based upon widely available commercial alternatives, leveraging open source resources to the maximum extent possible. We envision the project team evaluating (and selecting) a commercially available Single Board Computer [SBC], Computer On Module [COM], and/or System On Module [SOM] offering. We anticipate the circuit board selection will also require a companion or “daughter” board that the team will design. The team will then write all of the embedded software necessary for the device to function within the NASCENT product line (including a few additional future feature sets that will be formalized during the scope of work phase of the project.). The project will culminate with the team retrofitting their device into a NASCENT kiosk at an operational commercial site (most likely Norfolk Southern’s Charlotte terminal) and demonstrate the device’s performance in this production environment.

### **Project Requirements:**

NASCENT needs a new Kiosk controller to upgrade our current offering that provides backwards compatibility while improving system performance. Our current product is weak in such areas as full motion & streaming video, database management, processor speed and memory size. Our desire is to have a UNCC project team work closely with our engineering team in an embedded environment to develop a better product solution for NASCENT.

Hardware:

- SBC/COM/SOM selection,
- 2-30vdc
- 60w PoE
- Gb Ethernet
- LVDS
- Stereo Speaker Amp
- Microphone(s)
- Phone Handset
- ANC & AEC
- RS232 & RS422/485
- Keypad and 2 Line LCD interface
- Industrial Digital I/O Ports
- USB Host ports
- Latching Relays
- Controlled Voltage Outputs
- Fan /w Tach
- Temperature Sensor
- ESD Protection
- SNMP

Software:



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- Linux OS
- RemKon 2.x API Protocol
- VOIP/SIP
- Internal Web Page
- SNMP
- ANC or AEC solutions (in lieu of hardware)
- Video display and Streaming

Design Options:

- Selectable Digital I/O Pins
- Wireless; WIFI
- Bluetooth
- NFC
- Hardware or Software AEC and/or ANC
- Addition of remaining current product's features

### **Expected Deliverables/Results:**

- Selection of a commercial-off-the-shelf SBC/SOM/COM solution. Design and construction (NASCENT can assist with executing the board fabrication) of a daughter/carrier board if required to bridge a functionality gap between NASCENT's hardware specification and the commercially available capabilities.
- Development and testing of all necessary firmware. Key features will include:
  - Support all of NASCENT RemKon 2.x API Protocol commands and responses
  - Support all I/O interfaces and software listed under Project Requirements above.
- Demonstrate functionality of all hardware and software interfaces: I/O's, serial, USB, I2C, make & receive VIOP calls, control microphones and speakers, stream video, display video, host web page. Ideally, the team will install the new product in a NASCENT kiosk and exercise its functionality.

### **Disposition of Deliverables at the End of the Project:**

Hardware developed is the property of NASCENT. We will ask the team to produce an "extra" hardware set to use for their Expo.

All materials and tools purchased and used in the design, development, and completion of this project are to be given to NASCENT at the end of the UNCC Expo.

NASCENT will photograph and document the team's progress to completion and the Expo and display this collaboration on our company web site. <https://www.nascent.com/>

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

Linux, embedded programming skills, c++, web design, device/component selection, analog and digital electronic design, Printed Circuit Board [PCB] layout.