SMART ST. AUGUSTINE MASTER PLAN

June 26, 2019

EXECUTIVE SUMMARY

St. Augustine has a vision to implement smart city components to make the nation's first city on the first smart cities. The first phase of the project is a smart parking system in the historical downtown. Later phases will expand this system and then add sensors on the street infrastructure, transponders on for-hire vehicles and automated vehicles improving transportation around the city.

The St Augustine Smart City project is intended to be a "signature" project as part of the Smart Region Plan adopted in 2017 by the North Florida Transportation Planning Organization (North Florida TPO) and partner agencies. The project will have the following components:

Broadband Wireless – High speed internet connectivity. Foundational for Internet of Things (IoT) ecosystem and public Wi-Fi.

Integrated Data Exchange - Foundational activity for the sharing of information for all IoT devices and stakeholders

Small-cell Device Development – Foundational activity to design device enclosures consistent with the historic and archeological character of the city.

Truck Parking Management System – System to manage timing and of truck deliveries.

For-Hire Vehicle Management System – Use GPS transponders on for-hire vehicles (pedicabs, taxis, carriages, trolleys/trains, low-speed vehicles, rental scooters/scoot coupes, bike rentals, tour buses/coaches, etc.) to manage access fees and route restriction.

Dynamic Messaging Signs - Provide street side dynamic messaging signs to direct traffic to available parking and best traffic flow during events and emergencies.

Smart and Connected Signals - Connected vehicle technologies to improve travel times, reliability and safety for vehicles and pedestrians.

Bridge Closure Notification System – Provide notifications via traffic information systems when bridges are open for boat traffic. Allow vehicles to avoid traveling through downtown when other options such as SR 313 are available could save travelers time.

Automated Vehicle Shuttles– Automated Vehicle (AV) circulator for access to and from the parking garages with destinations. This strategy can assist visitors who are mobility challenged with accessing the full experience of the City.

Public Safety and Surveillance Systems – Detection and camera systems to deter and solve crime and provide crowd management.

Bicycle and Pedestrian Sensors - Identify bicycle and pedestrians crossing at intersections and mid-block to provide enhanced lighting at night and to notify drivers through connected vehicle technologies

Smart Kiosk – On-street kiosk can provide visitor information about local businesses and events. Kiosk can be used for wireless broadband hot spots.

Smart Lighting - Use of sensors and LED to optimize power consumption and improve safety.

Smart Waste Management - Use smart trash cans to optimize resources for the handling and removing waste in the street environment.

Street Flood Notification System - Identifies locations where street flooding is eminent or occurring to route travelers around this safety hazard.

The St. Augustine Smart City project will implement components that will provide for safe and coordinated movement of multiple modes of transportation while enhancing downtown St. Augustine and the surrounding neighborhoods. Visitors to St. Augustine bring jobs to the city but also as the volume of the visitors grows it makes life more difficult for the residents. By using smart technologies to better manage the many vehicles that want move around the city it will make it easier for the residents and visitors. The projects help preserve the historic feel for future generations while permitting for increasing numbers of visitors and businesses. While the specific projects have not been determined without this focus the divide between the wealthier historic district and the rest of the residents will continue to grow.

The following table summarizes the lead agencies and total costs for each deployment.

	Lead Agency	Total Costs
Foundational Projects		
Broadband Wireless	CoSA	PPP
Integrated Data Exchange	TPO	PPP
Small-cell Device Development	TPO	$300,000
Traffic and Parking Projects		
Smart Truck Parking System Phase 2	CoSA	$525,000
For-Hire Vehicle Management System	CoSA	PPP
Dynamic Messaging Signs	FDOT / CoSA	$1,575,000
Smart and Connected Signals	FDOT	$700,000
Bridge Closure Notification System	FDOT	$250,000
Automated Vehicle Shuttle	JTA	$1,800,000
Safety and Satisfaction Projects		
Public Safety and Surveillance System	CoSA Police	$282,000
Pedestrian and Bicycle Sensors	FDOT / CoSA	$320,000
Smart Kiosk/Wayfinding	CoSA	$500,000
Smart Lighting	CoSA	$2,250,000
Smart Waste Management	CoSA	$750,000
Street Flood Notification System	CoSA	$180,000
TOTAL COST		**$9,432,000**

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INTRODUCTION

St. Augustine can make nation's first city the nation's first fully smart city. A smart city collects, communicates and analyzes data to improve the wellbeing of the city. By developing a data infrastructure, installing sensors and camera systems, and performing analytics St Augustine can make the city more desirable for visitors and residents. The city has already begun implementation of a smart parking system with the current phase completed at the end of 2019. Once completed additional phases include the implementation of smart city projects to improve the livability of the city. Later phases will expand the parking system and then add sensors on the street infrastructure, transponders on for-hire vehicles and automated vehicles improving transportation around the city.

Need

St. Augustine, Florida was the nation's first continuously occupied European settlement in North America. The town plan was originally laid out in the late sixteenth century for foot traffic, walking, for horses, and horse-drawn carriages. Today, St. Augustine is home to 13,000 people and visited by over 6 million visitors annually. Growing volumes of vehicles, pedestrians, trucks and for-hire vehicles is overwhelming the limited parking and street infrastructure downtown. This congestion is a risk to the historic areas and endangers the City's cultural charm. Addressing overcrowding, congestion and mobility is the City's highest priority to maintain and protect resources and livability in the City.

It is important to the city to not only support the downtown but develop ideas that can improve the lives of all the residents. The projects will also be applied to tie the entire city together, providing new opportunities for the disadvantaged West St. Augustine neighborhood. While the specific projects have not been determined without this focus the rest of St. Augustine will continue to be left behind.

North Florida Smart Region

A Smart Region utilizes innovative and emerging technologies to collect, analyze, and utilize data from many sources to enhance the region's livability. There are many aspects to a smart region, including waste, water, energy, healthcare, and mobility. The focus of this Smart Region Plan is on the safe and efficient movement of goods and people.

A smart region collects information from a wide variety Internet of Things (IoT) technologies and merges data from multiple sources into one data management system. With a diverse and widespread dataset, in-depth analyses can be conducted, and new connections can be made that haven't previously been discovered within the region. A smart region brings with it a hotbed of activity surrounding emerging technologies that draw in tech startups and other businesses. This can create growth in addition to providing unique and cutting-edge services to the region. This Smart Region plan was developed with a partnership of federal, state and local governments, the U.S. Navy and the private sector.

A coalition of agencies, local governments and the private sector have partnered together to form the North Florida Smart Region Coalition. The coalition has a vision to:

1) **Eliminate Fatalities** – provide a safer transportation network to work toward a goal of zero deaths.
2) **Improve Travel Time Reliability** – provide a transportation network that is consistent and reliable for users.
3) **Reduce Greenhouse Gas Emissions** – provide multi-modal options and reduce congestion.
4) **Provide Ladders of Opportunity** – provide multi-modal options that are accessible, reliable and affordable for individuals with varied needs.
5) **Grow North Florida** – provide a transportation network that encourages commerce and presents business opportunities through Smart Region implementation.

The St Augustine Smart City project is intended to be a Smart Region "signature" project.

Current Progress

Phase I of the smart parking project will be completed in early 2019 with a total cost of $1.2M. The phase includes the following components:

- Deploy Automated License Plate Recognition (ALPR) Cameras on the Historic Parking Garage to accomplish the following:
  - Real-Time Capacity measurement of the garage with the intent of pushing that information to digital signage, mobile applications, websites and other solutions as outlined in Phase II or later.
  - Permit Management using the license plate as a credential for mobile payment or permit managed parking in Phase II or later.
  - Identify scofflaws or other law enforcement targets via real-time notification to St. Augustine PD dispatch upon entry to the garage.
- Deploy Automated License Plate Recognition (ALPR) Cameras on two Mobile Parking Enforcement vehicles for automated enforcement of on-street and off-street paid parking and residential permit areas.
- Convert Pay Stations from "Pay and Display" to "Pay by Plate" using the vehicle's license plate for the credential rather than the printed receipt displayed on the dashboard.
- Replace a majority of legacy parking meters with new Pay Stations using "Pay by Plate" as outlined above for metered parking spaces.
- Deploy a City of St. Augustine branded Mobile Application for digital payment of parking for both on-street and off-street public parking areas for those that do not choose to use the pay station.
- Deploy a City of St. Augustine branded web portal for purchase of parking permits.
- Deploy a new Enforcement Application to be used by Parking Enforcement personnel for writing tickets, integrated with the mobile ALPR solution. The new solution will include a web portal for reviewing and paying of citations if desired by the violator.
- Complete integration with Third Party Data collection and analytic provider to consolidate all parking data in order to gain insight, streamline processes, and optimize revenue.

FOUNDATIONAL PROJECTS

A smart city is not just a network of sensors, but it requires strong communication network and a central data repository. The foundational systems for the master plan are:

Broadband Wireless

Broadband is foundational to smart city projects. The connectivity allows the Internet of Things (IoT) ecosystem to send and receive the data from a central database for control and future analytics. The broadband can be provided as Wi-Fi to the public via the proposed smart kiosks or independently through shared-use of the street rights of way. The broadband will provide information to visitors and residents about the businesses and services.

Costs

Implementation of the broadband wireless network will be sought through a public-private partnership where in exchange for the public's use, the partner will have access to the public right of way to deploy devices and advertise through the public Wi-Fi experience.

Integrated Data Exchange

Although not a highly-visible component, the deployment of an Integrated Data Exchange (IDE) is a fundamental building block to gain the full benefit of Smart Cities projects. Without the development of way for information to be shared and data analytics to be performed the implementation of the field equipment and operation of an AV system will not function to its full potential. The IDE will be used to store data from the smart parking system and future sensors to support analytics and reporting. A data-centered architecture featuring a repository capable of storing big data in various format, a data lake, is proposed.

Initial development of the IDE is underway with data from the North Florida TPO. The proof-of-concept will be deployed mid-2019.

Costs

The exchange and easily be expanded to included St. Augustine. Upfront and ongoing costs are dependent on the amount and type of data being stored.

Small-cell Device Development

One of the challenges in working in a historic city such as St. Augustine is the need for integration of devices into a standard "small cell" device cabinet that is capable of housing multiple device types and vendors but is not visually obtrusive and is consistent with the character of the area.

As part of this task, we will work with the FDOT's Traffic Engineering Research Laboratory to develop a set of standard specifications for these housings and components. Once an initial set of standards and specifications are developed, an invitation to negotiate will be issued to entice private sector partners to demonstrate and prove these criteria met the requirements for the project.

Costs

This task is anticipated to cost $300,000 in professional services and laboratory time for the development of design and specifications, testing and acceptance requirements and systems management of the demonstration of vendor technologies.

TRAFFIC AND PARKING PROJECTS

Growing volumes of vehicles, trucks and for-hire vehicles is overwhelming the limited parking and street infrastructure downtown. This congestion is a risk to the historic areas and endangers the City's cultural charm. Addressing overcrowding, congestion and mobility is the City's highest priority to maintain and protect resources and livability in the City.

Smart Truck Parking System

There are only limited truck parking and delivery locations in downtown St Augustine. When spaces are not available, trucks circulate the city through neighborhoods resulting in unneeded congestion and pavement wear. A study completed in 2016 recommended a commercial vehicle management plan that addresses parking, traffic and historic preservation needs in the city of St. Augustine. A comprehensive parking strategy was developed that includes the follow elements:

Time Restricted Loading Zones
Truck parking management will expand the use of the smart parking system to commercial vehicles. There will be designated time restricted truck loading zones. Trucks will be limited to loading during low volume hours in the morning. This will reduce conflicts with resident and visitor parking.

Redesign of Existing Parking Areas
Existing lots will be redesigned to include truck loading zones. By redesigning the lot, no automobile park spaces will need to be compromised and freight and commercial vehicles.

Smart Parking Management
The truck parking spots will be managed by the same pay-by-plate parking system that has been implemented for personal vehicles. This will provide real time information on parking availability and enforcement.

Truck Routes
Dedicated truck routes will be created to reduce noise and pavement wear and damage in areas where large trucks are not consistent with historic areas, structures and neighborhoods.

Costs
$525,000 to deploy all strategies, $24,200 per year for operations

For-Hire Vehicle Management System

Tours and other for-hire vehicles are an integral part of the City's tourism industry, though the high volume of operators and their slower speeds create significant congestion. These for-hire users include: pedicabs, taxis, carriages, trolleys/trains, low-speed vehicles, Segways (which are a type of Electric Personal Assistance Mobility Device or EPAMD), rental scooters/scoot coupes, bike rentals, tour buses/coaches and any vehicles used for touring and transportation for hire. A 2017 study recommended the use of GPS transponders on for-hire vehicles to provide real time location information that the vendors can use in their own applications and will support enforcement of routing and timing restrictions.

Cost
Transponder cost will be covered by the vehicle operators. System will require development of back office software to collect and support monitoring and enforcement.

Dynamic Messaging Signs

To fully realize the benefits of a smart parking system parking information needs to be effectively communicated to visitors. Utilizing the data from the Phase I smart parking project dynamic messaging signs can be installed to direct visitors to the best available parking. Future phases can utilize connected vehicle to provide information directly to the vehicles. Signs can also be used in emergency or special events to direct traffic to key corridors.

FDOT and the City of St Augustine are in the process of installing several DMS and small parking count signs on the major entry points to the city.

**On-street Parking Dynamic Message Sign
San Jose, CA**

Costs
$175,000 for each cantilevered messaging sign, with a total of $1,575,000 for a deployment of nine signs at the entrances of downtown.
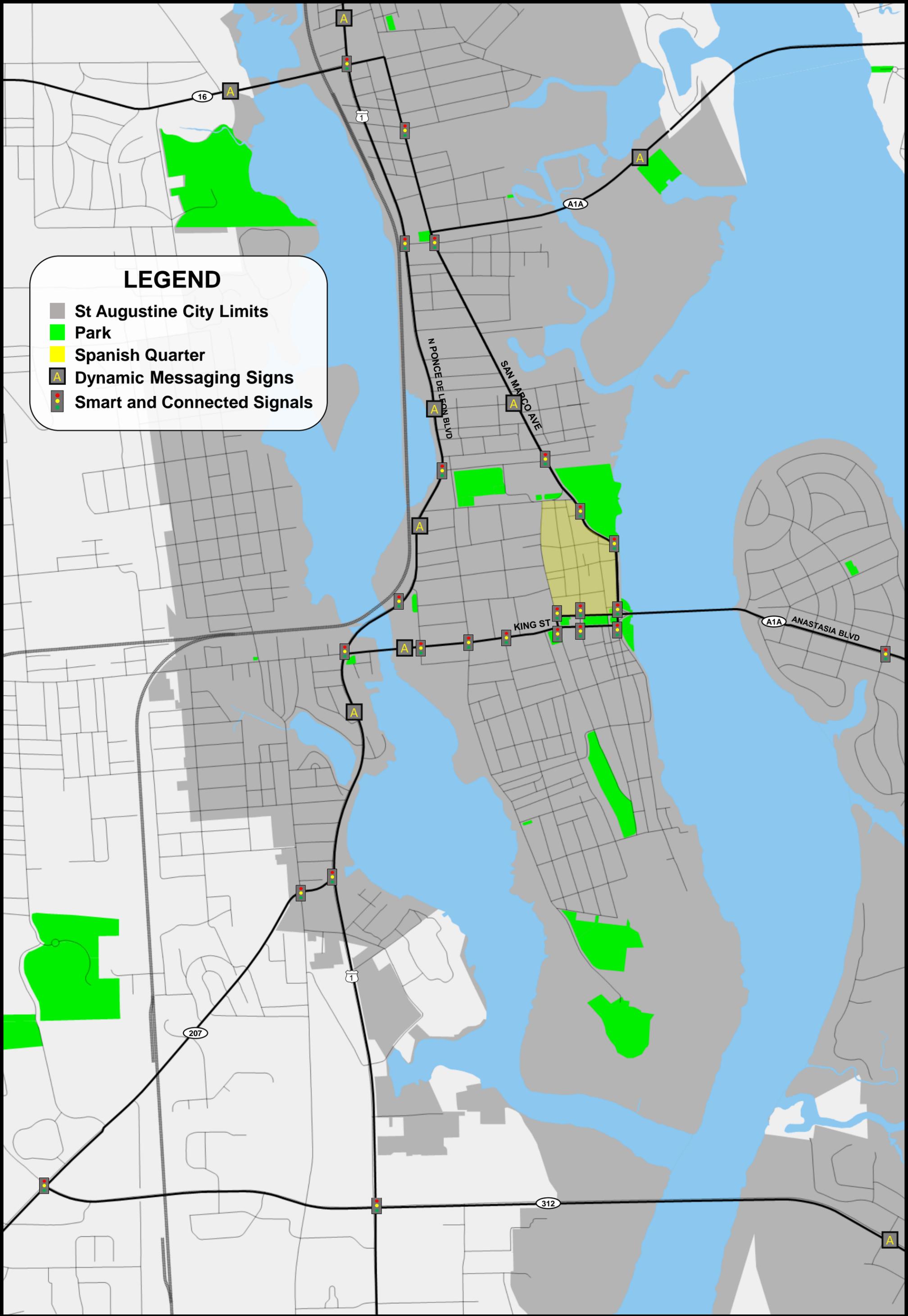
Smart and Connected Signals

Traffic is constantly changing depending on the day of the week, hour of the day, current events, weather and other factors. Smart signals communicate with other signals to adapt to changing traffic conditions to reduce the amount of time that cars spend idling. Connected signals communicate with connected vehicle systems
The signals can also communicate with connected vehicles to send signal information to the vehicles to allow them to pace towards a signal reducing idle time but also from the vehicle to the signal to best time the lights to reduce current traffic levels. Devices can be added to transit vehicles to provide signal priority reducing delays and travel times and making transit more competitive. Pilot projects have shown a reduction of travel times by 40 percent and connected signals reduced vehicle maintenance and operations costs by 25 percent by reducing vehicle breaking and idling. No traffic studies are available now to fully quantify the benefits of deploying smart and connected signals

The proposed signal enhancements will be deployed along the major corridors into the city. Potential streets include King Street, Ponce De Leon Blvd (US 1), San Marco Ave US 312 and Anastasia Blvd (A1A). Adaptive signals have been previously proposed along King St as part of bridge closure notification system.

Figure 1 shows the location of the proposed dynamic message signs and connected signal deployments.

Costs
Proposed deployment of 24 upgraded signals around the city would cost $700,000.

LEGEND

- St Augustine City Limits
- Park
- Spanish Quarter
- A Dynamic Messaging Signs
- Smart and Connected Signals

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SAN MARCO AVE

KING ST

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St Augustine Smart City Master Plan
Smart Signals and Messaging Signs

Figure 1

Bridge Closure Notification System

The bridges across the Tolomato and Matanzas Rivers are vital links to the residents of the city. The Bridge of Lions is a moveable bridge that must open for boat traffic. A notification system will integrate with existing travel apps and dynamic messaging signs to better direct traffic when bridges are blocked. This same system can integrate with weather sensors to close the bridges during high winds and other weather events. Allowing vehicles to avoid traveling through downtown when other options such as SR 312 are available could save travelers time.

Costs

The deployment costs be minimal since system will make use of already proposed dynamic messaging signs and connected signals. The costs for development of adaptive or semi-adaptive alternate signal timing plans are included in the costs for the connected signals component.

Automated Vehicle Shuttles

St Augustine has a vision of being a "Park Once Community." To meet this vision transportation needs to be provided from central parking garages to destinations throughout the city. Electric Automated Vehicle (EAV) shuttles will provide transportation access to and from the parking garages with destinations. This strategy can assist visitors who are mobility challenged with accessing the full experience of the city. EAVs can be integrated with the other smart city projects including: smart kiosk, dynamic messaging signs and smart and connected signals.

Proposed initial implementation is a route that moves people along Cordova Street between the existing historic downtown parking facility, a proposed remote parking facility on King St and the future parking facility south of the Lightner Museum.

EAV Shuttle

Later phases can connect to West St Augustine providing a ladder of opportunity by reducing commute times for residents traveling to jobs throughout the city.

A candidate route for the implementation of an automated vehicle shuttle service is provided in Figure 2.

Costs

Based on the proposed route with 10-minute headways initial cost would be $1,800,000 and $500,000 per year for operations. Vehicle costs are likely to change significantly over the coming five to 10 years as the technologies for EAV batteries and collision avoidance systems mature and become more mainstream.

St Augustine City Limits
Park
Spanish Quarter
EAV Shuttle Route

N PONCE DE LEON BLVD

SAN MARCO AVE

A1A

A1A ANASTASIA BLVD

HISTORIC DOWNTOWN PARKING FACILITY

Orange St

POTENTIAL TRAIN STATION AND REMOTE PARKING LOT

FLAGLER COLLEGE PARKING GARAGE

King St

Cordova St

FUTURE PARKING FACILITY

Bridge St

St Augustine Smart City Master Plan
EAV Shuttle Routes

Figure 2

CITY OF
StAUGUSTINE.
EST. 1565

HNTB

SAFETY AND SATISFACTION PROJECTS

Most of the sights and shops in the Spanish Quarter must be accessed by foot. Pedestrians conflict with vehicle traffic on the narrow and busy roadways. Projects are proposed that will improve the safety and experience of the visitors and residents by reducing crime, vehicle collisions and visual appeal of the city.

Public Safety and Surveillance Systems

Large crowds can attract crime, terrorism and other disturbances. The congestion makes it difficult for first responders to react to any disturbance. Sensors can be used for safety and surveillance including:

- Gunshot detection system that notifies local law enforcement when gunshots are fired. ShotSpotter is a web of devices that triangulates the location of the gun shot allowing first responders to respond to issues quickly. By being able to respond sooner to assess an incident and determine if rescue services are needed, there is potential to improve the survivability of the victims of violent crimes.
- Gas or chemical sensors installed on light poles or signals. The sensors will both detect these types of events and to track the spread any dangerous substance.
- Pan-tilt-zoom surveillance cameras to verify reported incidents and identify crimes that may occur. The cameras will also support crowd control and provide a deterrent.
- Pedestrian counters to provide real-time data for crowd management and for future analytics.

ShotSpotter sensor with pan-tilt-zoom surveillance camera at an intersection in Washington, DC.

The sensors can not only be installed in the downtown but can be used in high-crime areas to deter and solve crimes. Reduced crime increases visitor attraction and home values for residents.

Costs

The costs of deployment of ShotSpotter within this area are $282,000 for deployment and in each subsequent year. This cost is based on deployment at 10 locations on light poles.

Pedestrian and Bicycle Sensors

Attaching additional sensors to existing light poles and traffic signals can enhance safety for pedestrians and bicycles. Sensors can include:

- Bluetooth™ technologies to identify the location of buses and pedestrians and provide notify drivers using time-activated warning signs and signal preemption.
- Smart lighting devices to intensify street lights when a pedestrian is making the mid-block crossing at night.
- Pedestrian and bicycle detection sensors to automatically activate the walk signal without having to press the crossing button and to increase the pedestrian walk time when needed.

Pedestrian detection sensor (FLIR™) installed at the SR 13 and Haley Road Intersection in Jacksonville.

Pedestrian and Bicycle safety sensors can be installed along the high tourist corridors: King Street, San Marco Ave and Anastasia Blvd (A1A). The sensors can also be installed in other high pedestrian areas including near schools and in West St Augustine.

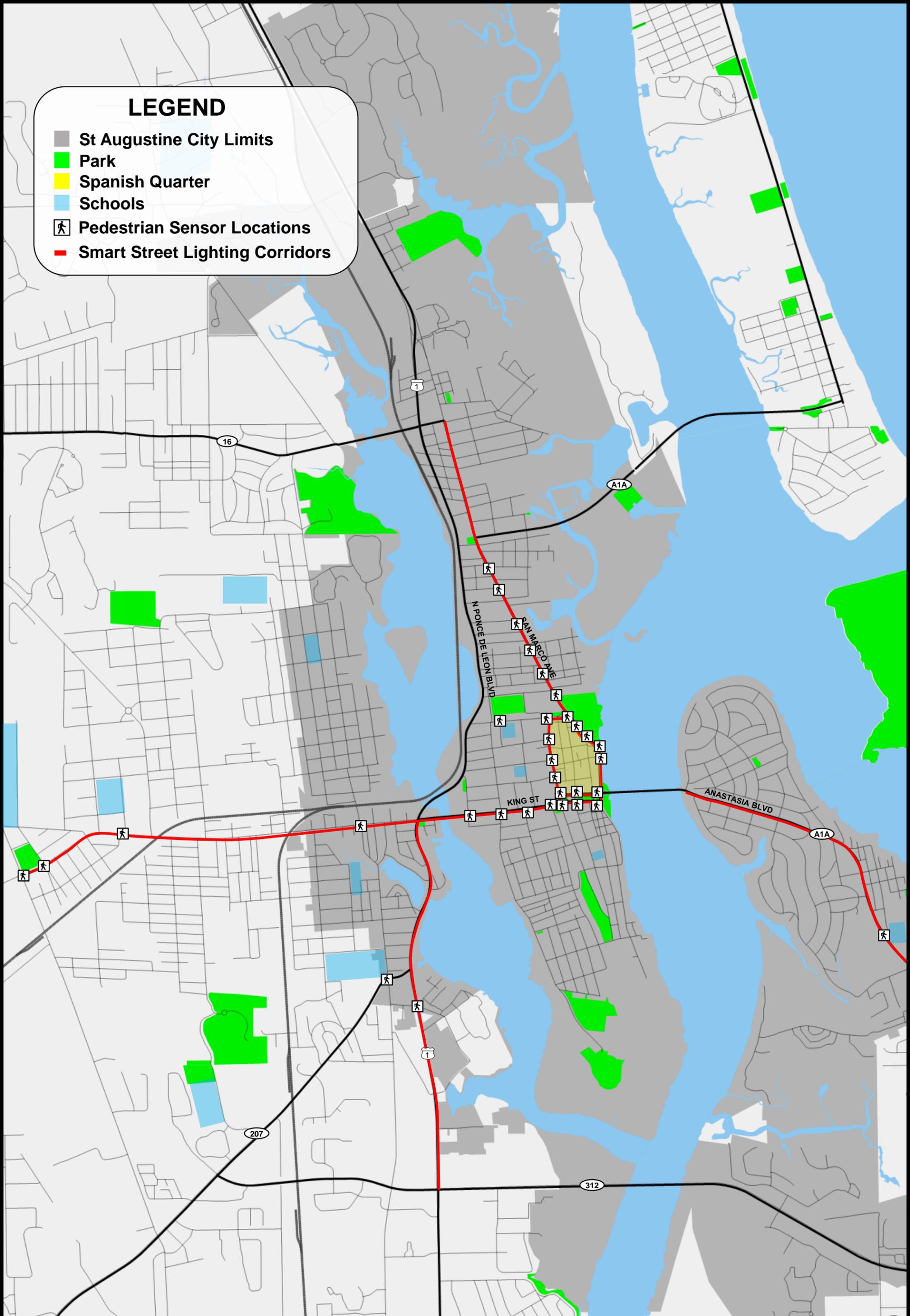The proposed pedestrian and bicycle sensing corridors are outlined in Figure 3.

Costs

$10,000 per signal for the pedestrian sensor and visual pedestrian alert. Integration with DSRC would be part of a DSRC deployment and is covered in the connected vehicle corridor deployments project. A total of 32 sensors are proposed for a total of $320,000.

LEGEND
- St Augustine City Limits
- Park
- Spanish Quarter
- Schools
- Pedestrian Sensor Locations
- Smart Street Lighting Corridors

St Augustine Smart City Master Plan
Smart Lighting and Pedestrian Sensors

Figure 3

Smart Kiosks/Wayfinding

Effectively communicating with visitors often requires personal interaction through flyers, visitor centers or information desk. Smart kiosk can provide information to visitors about local businesses and events. The kiosks can provide on local businesses and current events as well as Wi-Fi, charging stations and emergency call buttons. The kiosks will leverage big data collection, collect new data for analytics and provide special event information for visitors. Kiosk can also provide connections for mobility assistance and can be repurposed to display emergency messages. The kiosk can interact with an EAV to provide mobility to the handicapped and elderly.

The information on the kiosk can also be built into a smart phone app to allow visitors to prepare for their trip and seek information not just at the kiosk locations.

Kiosks can be installed at the major entry points to the Spanish Quarter. Candidate locations are shown on

Current St Augustine directory kiosk (left) and example of smart kiosk (right)

Cost

$50,000 per kiosk for hardware and installation. $10,000 annually per kiosk for operations and maintenance. O&M and deployment costs can potentially be offset by advertising costs. A total of 10 kiosk are proposed for a total of $500,000.

LEGEND
- ▢ Spanish Quarter
- 📍 Smart Kiosk
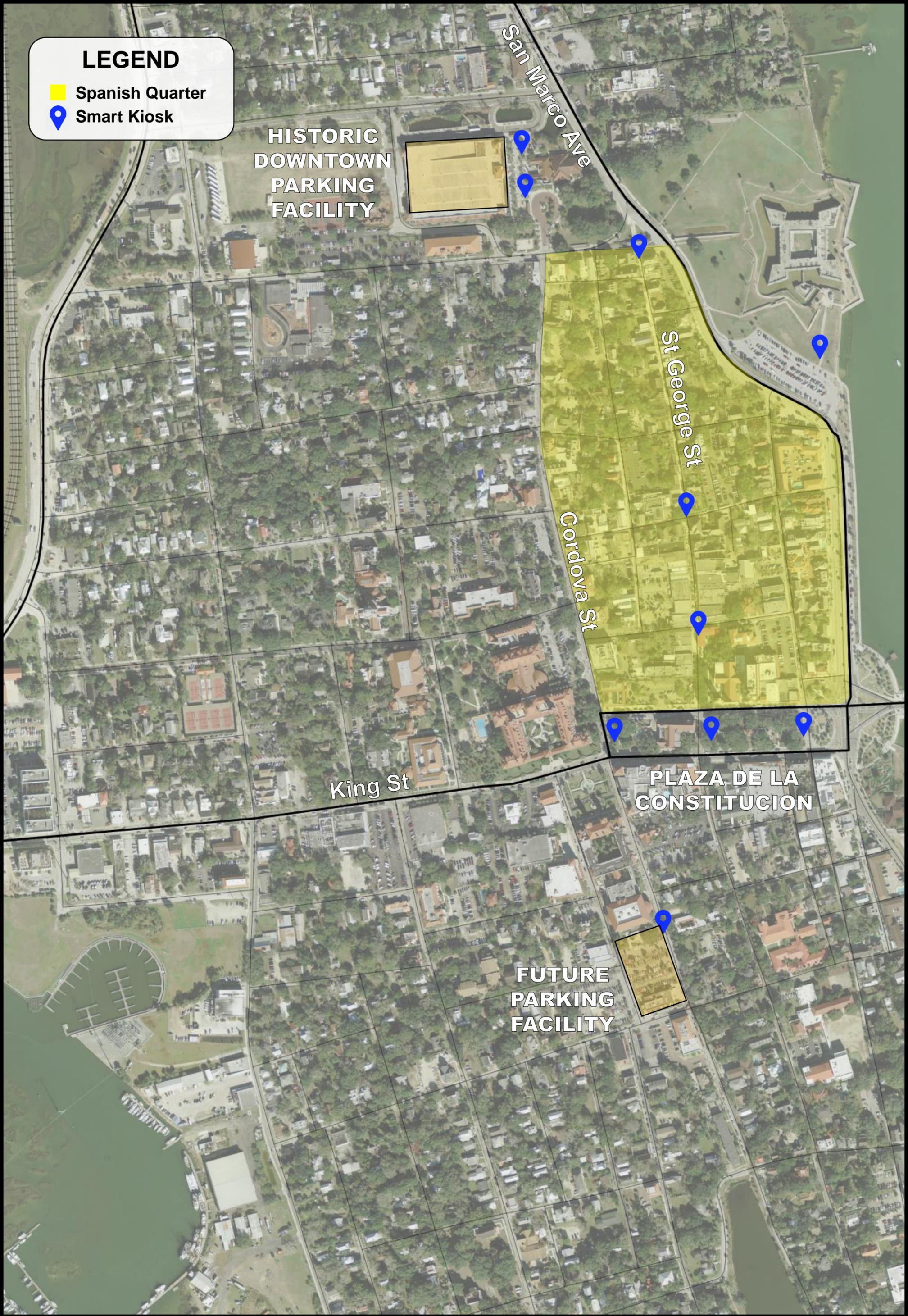
HISTORIC DOWNTOWN PARKING FACILITY

San Marco Ave

St George St

Cordova St

King St

PLAZA DE LA CONSTITUCION

FUTURE PARKING FACILITY

Smart Lighting

Street lights make an area safer and more inviting at night but powering and maintaince can be major expenses. Upgrading existing lights to LED also can include the installation of additional sensors and capabilities to create smart lights. In addition to the conversion to LED, the smart lighting system will include the installation of control unit and sensor(s) in each lamp pole or group of lamp poles, communication units and a management center application/system. These components are connected through a reliable and secured wired or wireless network that enables two-way communications - for monitoring and control functions. These sensors will provide data to enhance the predictive maintenance functions, reduce outages and save resources when maintaining the system.

Smart street light installed in Jacksonville by GE

One optional enhancement is the ability to brighten and dim lights. In normal operation lights can be dimmed to reduce light pollution and electricity consumptions. Alternatively, when a pedestrian is identified as crossing in a mid-block, the lighting levels will be increased to be more consistent with the lighting standards at intersections where pedestrians are anticipated. The ability to dynamically brighten and dim lights on demand could be a significant public safety resource for first responders, or to provide temporary lighting for special events.

Reduced electric cost using LED lights allows for the installation of additional lights with no increase in city electric bills. Additional street lights can enhance neighborhoods and increase safety.

All the lights in the St Augustine should be upgraded to LED with the lights on main corridors enhanced with additional sensors and capabilities. Lights should be added to major vehicle and pedestrian corridors where they do currently exist.

The locations where smart lighting are proposed were shown on Figure 3.

Costs

Cost will depend on scope and capabilities. For basic capabilities to upgrade an existing light cost $1,200. New installation cost $4,500 per new light post. New light post every 160' for 7.5 miles is proposed for $2,250,000.

Smart Waste Management

The perception of the safety and security of the street environment is highly influenced by its cleanliness. Smart trash cans to optimize resources for the handling and removing waste. The cans provide notification when full and needing to be emptied and can provide notification when there is movement due to an animal or a person searching through the garbage. Smart trash cans will be deployed throughout the downtown area. In addition to proving a cleaner and more attractive environment, the costs for maintaining the and removal of the trash collected is estimated to be less than conventional systems.

Smart trash cans in New York City

Cost

The estimate costs for placing these smart trash cans are $49,300. 15 trash cans for a total is proposed for a total of $750,000

Street Flood Notification System

St Augustine has experienced regular flooding due to storms and high tides. Flood warning sensors allow the remote collection of this information that will be shared with the major stakeholders to prepare for and manage the diversion of traffic from these unsafe conditions.

Flood warning sensors are commonly used to measure water levels at bridges and levees. There are a wide range of technologies available including ultrasonic, pressure detectors and radar. The devices can be installed as standalone weather information sensors or under a man-hole cover. Other cities on the east coast are advancing these technologies and are using them specifically to monitor and predict street flooding.

Installing sensors will allow the remote collection of flooding information that will allow for the prediction of flooding events that can be shared with the major stakeholders to prepare for and manage the diversion of traffic from these unsafe conditions.
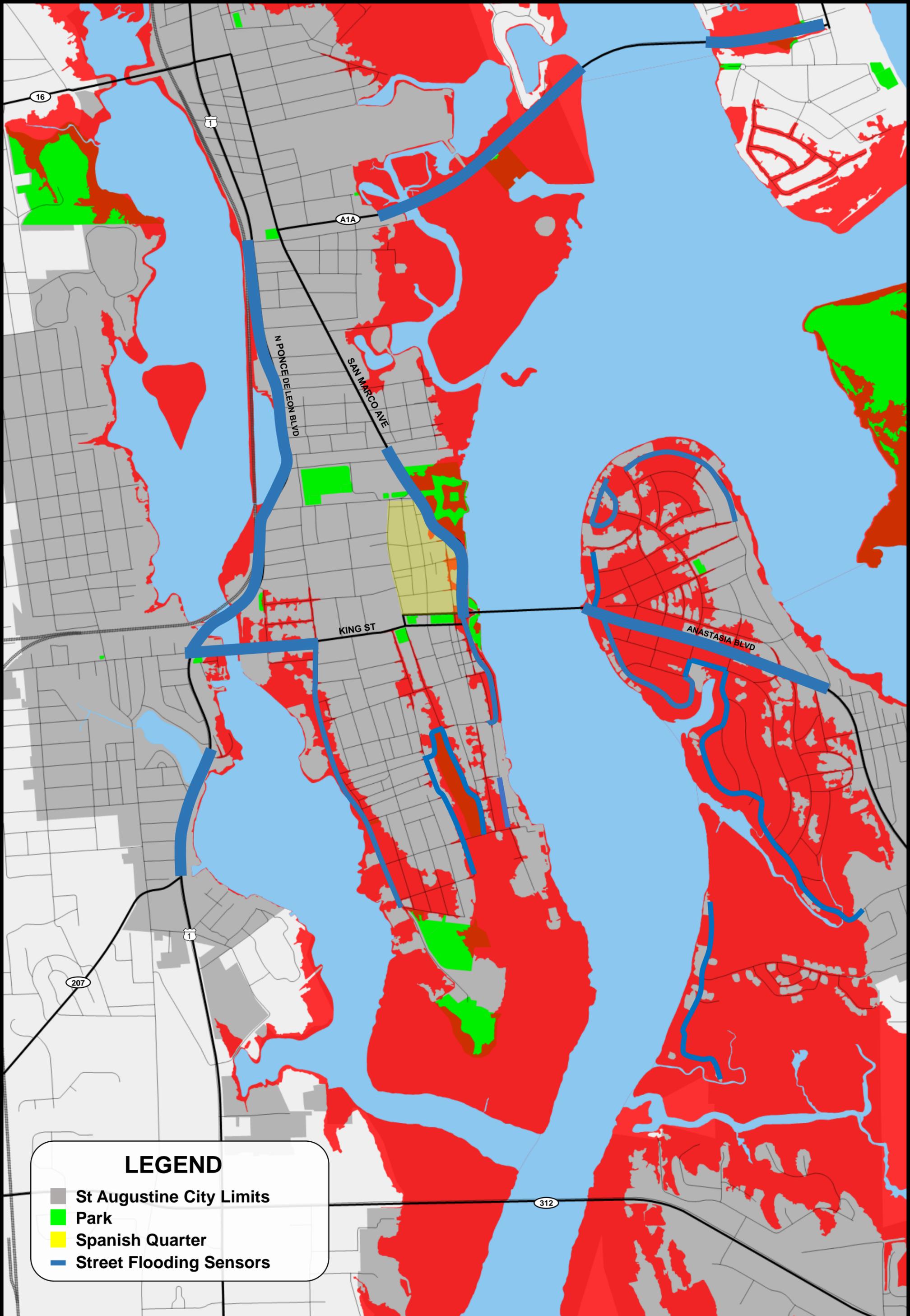
The flood-prone corridors within the city are shown on Figure 3.

St Augustine during Hurricane Matthew

Costs

The costs are based on a $3,000 per device inclusive of the installation, use of the public-private partnership broadband wireless network and software integration through the IDE. Installations at 10 key locations are proposed. A total of 60 sensors for a total of $180,000 is estimated to be needed for full deployment.

LEGEND

- St Augustine City Limits
- Park
- Spanish Quarter
- Street Flooding Sensors

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St Augustine Smart City Master Plan
Flooding Sensor Corridors

Figure 5