

1. The Lafayette Engagement and Research Network (LEaRN) Collaborative

Lafayette Consolidated Government is excited to present The Lafayette Engagement and Research Network (LEaRN) Collaborative in response to the Smart City Air Challenge issued by EPA through Challenge.Gov. The community of Lafayette has formed this collaborative out of existing relationships among stakeholders to create a sustainable partnership to meet EPA's challenge of creating a Smart City Air Quality Sensor Network. LEaRN is intended to create a foundation for continued learning and innovation related to smart cities, civic engagement and digital transformation for Lafayette and for other communities interested in these topics. We understand that the intent of the Challenge is to help communities share knowledge of new approaches to managing big data collected from large quantities of environmental sensors of varying quality, the development of best practices around data management, discovery and analytics, and identification of new approaches for cross-disciplinary integration and community engagement to foster sustainable citizen engagement. **The LEaRN Collaborative offers an existing and active partnership that is already working together on issues critical to Lafayette, proven resources and expertise related to data/sensor management, and broad community engagement to ensure project sustainability.**

1.1 Why this Challenge is Relevant to Lafayette

For many years ground-level ozone and particle matter pollutant concentrations in the Lafayette community have been rated mostly "Good" on the Air Quality Index (AQI) according to data from LDEQ. To most citizens, it may seem like we should have little to be concerned with regarding local air quality. For this reason, awareness around air quality issues and the potential health risks of poor air quality are not fully appreciated. However, Lafayette's AQI values are not always "Good." Since 2012, data show that a minimum of 18% of days per year were in the "Moderate" zone for Ozone. One third or more of days were not "Good" for air quality from 2013-2015, with 111, 141, and 119 days respectively, being considered "Moderate" on the AQI. Further, with new companies opening in the Downtown and Research Park areas, more people are commuting in a dense area of the city. Additionally, the population of Lafayette is projected to increase by approximately 90,000 in the next 20-years. Unless we increase awareness of air quality issues and health concerns and motivate more citizens to start to adopt cleaner transportation methods such as car-pooling, walking, biking, or public transit, traffic congestion and related air quality issues could be more expensive to address in the future. The deployment of ~300 air quality sensors through this project will expand the geographic reach of air quality data and allow for the synthesis of readings across the community. This project will help Lafayette discern fine spatial- and temporal-scale variations in air quality and to use this data, combined with traffic congestion data fed to the same network via existing sensors deployed in the community, to inform analyses of alternate transportation management solutions.

1.2 LEaRN: An Existing and Active Partnership Focused on Sustainability

The LEaRN Collaborative is a network that is founded on the existing core partnerships across Lafayette Consolidated Government (LCG), the University of Louisiana at Lafayette (UL) and CGI. This core team is working together within the Lafayette community to build a diverse economy that includes information technology anchored by LCG and UL investments as an official US Ignite community, CGI's commitment to create 400 new technology jobs and UL's commitment to triple the number of IT graduates, resulting in a \$93 million annual impact and creation of \$36.6 million in annual income. The LEaRN Collaborative consists of broad community engagement across public education, private business and government sectors to ensure sustainable community involvement. We have created an expert advisory council that will help Lafayette learn from concurrent Smart City initiatives.

TEAM MEMBER	COMMITMENT	EXPERTISE AND RESOURCES
Core Solution Development		
Lafayette Consolidated Government (LCG) POC: Carlee Alm-LaBar, Director, PZD; 337.291.8013	<ul style="list-style-type: none"> ▪ Infrastructure for sensor deployment across community ▪ Will establish an Open Data Portal via existing Esri Enterprise License 	<ul style="list-style-type: none"> ▪ Has implemented IoT sensors for traffic congestion; will be cross referenced with air quality data ▪ The Lafayette Comprehensive Plan

TEAM MEMBER	COMMITMENT	EXPERTISE AND RESOURCES
calmlabar@LafayetteLA.gov	<ul style="list-style-type: none"> ▪ Will utilize this effort to inform and launch an Open Data Policy for LCG 	sets forth objectives that lessons learned around Smart Cities will inform and accelerate
University of Louisiana at Lafayette POC: Dr. Ramesh Kolluru, VP for Research, ULL Phone: 337.482.6541 rjk6962@louisiana.edu	<ul style="list-style-type: none"> ▪ Incorporating LEaRN projects into School of Engineering, School of Geosciences and School of Computing and Informatics ▪ Professors and students will assist in sensor development, calibration, O&M, outreach 	<ul style="list-style-type: none"> ▪ UL specialization in IoT/Big Data ▪ NSF funded data analytics and research center ▪ US Ignite Community partner
CGI Technology and Solutions POC: William LaBar, VP Consulting Services, Phone: 337.281.2066 william.labar@cgifederal.com	<ul style="list-style-type: none"> ▪ Supplemental funding for up to 400 sensors ▪ Providing IoT data management solution ▪ Technical data management and system integration consulting for LEaRN solution ▪ Members will assist in community outreach 	<ul style="list-style-type: none"> ▪ Global IT solutions provider with proven experience in Smart Cities, IoT and complex data management ▪ Existing partner with Lafayette with over 300 members in community
Sensor Deployment	Commitment	
Lafayette Public School System	<ul style="list-style-type: none"> ▪ Deployment across the 40 LPSS facilities within the community ▪ Educational sessions with LPSS students from K-12 to engage in LEaRN Collaborative activities related to Air Quality ▪ POC: Dr. Donald Aguillard, Superintendent, 337.521.7000,daguillard@lpsonline.com 	
Lafayette Public Library	<ul style="list-style-type: none"> ▪ Deployment across the public library network; Educational/outreach sessions with general public hosted across the library network. ▪ Pre-established Indoor Air Quality Speck monitoring program ▪ POC: Beth Chiasson, Community Services Coordinator, (337) 261-5783, beth.chiasson@lafayetepubliclibrary.org 	
Lafayette Downtown Development Authority	<ul style="list-style-type: none"> ▪ Deployment sites for downtown business community district ▪ POC: Nathan R. Norris, CEO, DDA 337.291.5566, nathan@downtownlafayette.org 	
One Acadiana	<ul style="list-style-type: none"> ▪ Regional Chamber of Commerce that will recruit at least 20 business deployment sites ▪ POC: Jason El Koubi, President & CEO; (337) 408-3650, jason@oneacadiana.org 	
South Louisiana Community College	<ul style="list-style-type: none"> ▪ Deployment sites across all campus locations ▪ Student engagement activities on project topics such as sensor assembly, software/application development, data visualization and citizen science. ▪ POC: Natalie J. Harder, PhD, Chancellor, 337.521.9000, Natalie.Harder@solacc.edu 	
Lafayette Economic Development Authority	<ul style="list-style-type: none"> ▪ Business recruiting for at least 20 business deployment sites ▪ POC: Gregg Gothreaux, President & CEO, 337.654.0934, gregg@lafayette.org 	
LEaRN Advisory Board: Providing subject matter expertise, best practices and project guidance		
Center for Neighborhood Technology, Chicago	<ul style="list-style-type: none"> ▪ Nonprofit research and advocacy organization committed to improving urban economies and environments across the United States; IoT Research expertise ▪ POC: Scott Bernstein, President, 773-269-4035, scott@cnt.org 	
The Enterprise Center,	<ul style="list-style-type: none"> ▪ Focused on establishing Chattanooga as a hub of innovation by leveraging the city's 	

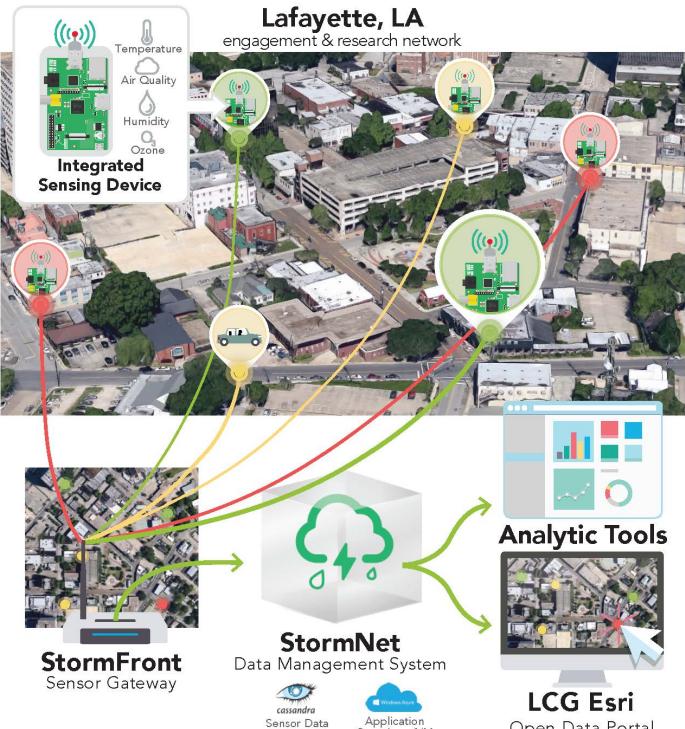
TEAM MEMBER	COMMITMENT	EXPERTISE AND RESOURCES
Chattanooga	<p>digital technology; Geolocated Allergen Sensing Platform (GASP) expertise</p> <ul style="list-style-type: none"> ▪ POC: Ken Hays, President and CEO, (423) 661-3300, ken@theenterprisectr.org 	
US Ignite	<ul style="list-style-type: none"> ▪ Independent, 501(c)(3) nonprofit; US Ignite fosters the creation of next-generation Internet applications that provide transformative public benefit. ▪ Smart Gigabit Communities best practices and lessons learned ▪ POC: Scott Turnbull, National Technology Leader, scott.turnbull@us-ignite.org 	
Louisiana Department of Environmental Quality (LDEQ)	<ul style="list-style-type: none"> ▪ Small Business/Community Assistance Program provides environmental regulatory assistance and information to small businesses and communities such as Lafayette ▪ Providing resources for public outreach and education on air quality issues and topics across the community ▪ POC: Jeff Jackson- Environmental Scientist Supervisor, jeff.jackson@la.gov 	
Microsoft	<ul style="list-style-type: none"> ▪ Expertise in Smart Cities and Internet of Things Data Management cloud architecture ▪ POC: Tim Turitto, Worldwide General Manager, Government, 425.706.1039, tturitto@microsoft.com 	

1.3 Technical Solution Overview

LEaRN is comprised of the following components: (1) Air Quality Sensors representing multiple tiers of quality, combining build and buy strategies; (2) LEaRN Data Management Platform based on CGI's StormNet software; (3)

Esri Open Data Portal for LCG; (4) Azure virtual machines, web applications, storage, and messaging; (5) Open Data Application Programming Interface (API); and (6) Context-sensitive Data Visualization that will include sensor based traffic congestion data (already in place). Figure 1 provides a conceptual overview of the LEaRN sensor and data management approach.

The LEaRN platform will collect data using custom-designed integrated sensing devices. These devices will consist of a data logger based on a Raspberry Pi single-board computers with modular sensors for measuring air quality and meteorological data which will be used to ensure data accuracy and quality. The sensor devices will be deployed on existing infrastructure within the Lafayette community (e.g. utility poles, schools) to take advantage of existing integration points for power and Wi-Fi connectivity. Sensor data will be streamed to the StormFront gateway, which will be a Java-based implementation of the OGC SensorThings API. This gateway will be developed by CGI and made available as an open-source project. As part



of the implementation, a plug-in will be developed for connecting StormFront to StormNet, which is CGI's data management platform for real-time sensor data. StormNet, which runs in Microsoft's Azure cloud, offers centralized storage using Cassandra as a repository, as well as REST APIs for accessing data. Existing StormNet-based data visualization tools can be applied to LEaRN. These tools will provide customizable web dashboards built on top of the StormNet API, and allow visualization of real-time data, and identify trends and anomalies for multiple sensors at the same time. Similarly, third-party tools such as Tableau and Qlik can be used for visualization by stakeholders, and

access will be made available through LCG's new Open Data Portal which will be launched with this project.

1.4 Challenge Constraints

Our team understands the core constraints put forth by EPA for this Challenge and presents a solution that meets and exceeds these core constraints in order to maximize the impact of EPA's seed funding and benefit other communities by providing lessons learned and best practices for similar Smart City solutions elsewhere.

CONSTRAINT	APPROACH	BENEFITS
Deploy 250 to 500 sensors in a community	<ul style="list-style-type: none"> ▪ We will deploy roughly 300 sensors ▪ Combined build and buy strategy for heterogeneous data set comparisons 	<ul style="list-style-type: none"> ▪ Build strategy engages community and university from day 1 ▪ Varying data quality of sensors will mirror long term data management challenges
Community involvement in purchasing and using the sensors	<ul style="list-style-type: none"> ▪ Eight community partners committed to education, outreach, deployment ▪ CGI providing resources to cover system integration and consulting 	<ul style="list-style-type: none"> ▪ ULL, SLCC and LPSS engagement will reinforce community education and stakeholder buy in
Identification of partners and project sustainability	<ul style="list-style-type: none"> ▪ Eight community partners and LEaRN Advisory Board provide in depth expertise ▪ Significant in kind donations from LCG, UL and IoT/Data Management practice within CGI 	<ul style="list-style-type: none"> ▪ Pre-established air quality monitoring project with CGI, UL and LCG already provides foundation for long term sustainability ▪ Existing Library indoor sensor network, traffic congestion IoT projects show proven foundation
Be transparent in terms of making the data open and describing the data management plans	<ul style="list-style-type: none"> ▪ LCG committing to launch of Open Data Portal ▪ StormNet provides publicly accessible API for data use 	<ul style="list-style-type: none"> ▪ LCG policy to be set in place to create transparency culture ▪ Future hackathons sponsored by UL, CGI and the LEaRN Collaborative to build value from this data access

1.4.1 Solution Details (Challenge Criteria)

The following sections detail the LEaRN Collaborative's solution for the Challenge Criteria.

1.4.2 Data Management

The LEaRN Collaborative understands the complexity involved in ingesting, storing, publishing, and assuring the quality of high-volume and high-frequency sensor data. To that end, the solution presented uses CGI's StormNet platform, which relies on the Microsoft Azure Cloud and the Apache Cassandra distributed database management system. Azure provides a foundation for low-cost scalability, while Cassandra's distributed architecture provides the foundation for the fault-tolerant storage and rapid querying of high-volume sensor data.

1.4.2.1 Data Storage

Sensor data, which is comprised of device identifier, sample date, criteria pollutants, and associated meteorological data, will be stored using a table per query pattern in Cassandra to meet the needs for efficient data retrieval. Storage will be optimized for anticipated queries such as daily analysis, yearly trends, and prediction. Both raw data and down-sampled summary data will be retained indefinitely to meet the needs for visualization and analysis. Historical data will be archived using lower cost storage, such as Azure Blob storage, should the need arise.

1.4.2.2 Metadata

In addition to the actual sensor measurements, metadata about sensor devices will be collected and made available.

Metadata will include: location, last calibration, raw voltage readings, battery and/or power levels, and installation details. Metadata will be used as input to data quality control, assurance functions to preclude the use of invalid data.

1.4.2.3 Data Transmission

Sensor data and metadata will securely enter the StormNet platform from the StormFront sensor gateway via Advanced Message Queuing Protocol (AMQP) messages sent to an Azure EventHub service bus, which is deployed as part of the StormNet system. Messages will be processed asynchronously and data will be stored in Cassandra.

StormFront – a Java-based implementation of the OGC SensorThings API which will be developed as part of this effort – will receive data from sensors and aggregate these data for efficient delivery to the StormNet data store. Both AMQP and the OGC SensorThings API are relevant standards that will allow for the inclusion of other data sources and integration patterns as the solution evolves.

1.4.2.4 Data Availability

Raw and summary data will be made available to stakeholders in multiple formats, such as JSON, CSV, XML and others as needed, via a REST API implemented within StormNet. A REST API will serve as the lowest common denominator for stakeholder integration, and can support mobile, browser-based, and machine-to-machine integration.

1.4.2.5 Data Sensitivity

All data and metadata will be streamed from fixed monitor locations, and therefore will not require any human intervention that might inadvertently capture personal information. Therefore, the solution presented does not require controls for Personally Identifiable Information (PII).

1.4.3 Data Use

1.4.3.1 Pollutant data to be collected

LEaRN will collect data about ground-level ozone (O_3) and particulate matter (PM), as well as meteorological variables relative humidity and air temperature. Ozone and PM are of interest because of their effects on human health where exposure can increase morbidity of heart and lung disease (e.g. asthma, decreased lung function). Relative humidity and air temperature data are useful for improving correlation between smaller, cheaper O_3 and PM sensors and more expensive mid- and high-quality sensor systems, such as those employed by EPA and LDEQ. Air temperature is of interest for studying urban heat island, which can co-occur with higher concentrations of air pollutants and cause compounding acute health effects (e.g. heat stroke, asthma attacks). All data will be collected at a one-minute temporal resolution over each of the ~300 sensors distributed throughout the community.

1.4.3.2 Problems to address with the data

LEaRN will address the following problems by collecting air quality data: (1) lack of awareness in the Lafayette community about air quality issues; (2) air quality problems due to traffic congestion; (3) air quality problems due to landscaping maintenance practices. It should be noted that these are initial points of departure for analyses of air quality data. Other community problems related to air quality will likely emerge as the project unfolds.

1.4.3.3 How the data will be used

Air quality data collected and made publicly available via web-based geospatial visualization tools will help to reduce the lack of awareness among the general public regarding air quality issues in Lafayette; the data and visualization tools will be an integral part of a comprehensive air quality outreach campaign publicized via press releases and promotional materials, local media coverage, and social media. To address air quality problems due to traffic congestion, the Collaborative will use air quality data from sensors mounted on utility poles along arterial roads and highways of Lafayette. These data will make it possible to compare air quality degradation to traffic congestion. In conjunction with traffic study data, air quality data can help provide the fact base needed to improve traffic management by improving signal timing and redesigning intersections while managing for congestion and air quality. These data can also be used together with our public outreach campaign to develop policies aimed at reducing single occupancy vehicle trips, and increasing use of mass transit, biking, and walking. Lastly, air quality data collected in residential neighborhoods and near schools and commercial property would allow for assessment of the role of gas-

powered landscaping equipment in contributing to poor air quality. These data will inform our outreach campaign and will allow policies to be crafted to encourage the use of electric or other alternate landscaping tools and methods.

1.4.3.4 How the data will be analyzed and visualized

The data will be analyzed with state-of-the-art visualization and analyses tools to gather insights into the spatiotemporal distribution of air pollutants throughout Lafayette. For example, we will leverage StormNet components for visualization as well as predictive modeling frameworks, including machine learning. Raw data along with the various summaries will be stored in Apache Cassandra. With the data in the Cassandra data store, analyses can be performed using tools such as Apache Spark, Apache Drill, Apache Hive, R, and Python. After using data analytics to extract insights on the data, the spatiotemporal air quality data will be visualized in a real-time map viewer web application, which will allow users to discover further insights into patterns of the data. The results of the analyses will be downloadable by the public at via the human-readable web interface or machine-readable REST API.

1.4.3.5 Who will use the data

The following stakeholders will be the primary institutional users of the data collected by LEaRN Collaborative: (1) Lafayette Consolidated Government (LCG) Environmental Quality Division, (2) LCG Planning Department; (3) LCG Traffic and Transit, (4) UL Office of Sustainability; (5) UL Environmental Health and Safety. In addition, we anticipate the data collected will be used in STEM education at both UL Colleges of Engineering and Science as well as in K-12 settings at the Lafayette Parish School System. Finally, we will encourage the general public to make use of the data for novel, unanticipated applications. These could be facilitated by holding hackathon events in cooperation with LCG, UL and CGI.

1.4.3.6 Anticipated community cost savings by use the data

We anticipate several opportunities for the Lafayette community to save money or reduce costs by using the air quality data collected by LEaRN. First, citizens who learn about transportation impacts on local air quality may be motivated to use low-cost, active transportation methods such as biking and walking. Second, these data may be useful in the short term to provide high spatial resolution warnings of poor air quality, and in the long term to shape development and transportation policies to improve air quality. In both cases, reduced exposure to poor air quality can reduce health threats to vulnerable populations (e.g. children, elderly, those with heart and lung disease, etc.), reducing time lost from school and work. Third, the health benefits of active transportation and improving air quality may lower medical expenses and reduce lost wages from taking medical leave to care for oneself or family. Fourth, increased ridership on Lafayette Transit System busses may reduce the level of local government subsidy needed. Lastly, reduced traffic congestion due to awareness of air quality impacts of transportation and decisions to use alternate modes may reduce maintenance costs on roads and could reduce commute times.

1.4.4 Sensor Procurement and Deployment

1.4.4.1 Sensor Selection

We utilized the EPA Air Sensor Toolbox and our past experience with similar sensor technology to select sensors with the best combination of cost, accuracy, ease of calibration, and long-term reliability. CGI has extensive experience with temperature and humidity sensors from multiple vendors and have performed performance testing to evaluate field operations, temperature extremes, and long-term reliability through our Sensor R&D lab in Huntsville, AL. Building on this experience, we selected the following air quality sensors: (1) MQ-131 semiconductor O₃ sensor; (2) SensorTech MiCS-2614; and (3) Alphasense OPC-N2. The MQ-131 and MiCS-2614 are O₃ sensors selected for their response range, ease of integration, and sensing method. The PM sensor OPC-N2 was selected based on EPA research and shows one of the highest correlations to FEM monitors. To collect and transmit the sensor data we will utilize Raspberry Pi microcontroller boards mounted in ruggedized enclosures and powered at the installation points with existing infrastructure.

1.4.4.2 Sensor Procurement

Our team works directly with suppliers and OEMs to procure, assemble, calibrate, and test sensor solutions and has established the contacts needed for the procurement of the sensors planned for LEaRN. Our past performance in

procuring and delivering complete sensor solutions for the U.S. Army for Remote Corrosion Monitoring and Marines Prepositioned ship inventory management are two examples of procuring and providing end-to-end sensor solutions and backend data processing for management and visualization. We utilized proven industry standard sensors from OEMs and incorporated them into our network and data system, creating dedicated low-cost sensor solutions.

1.4.4.3 Sensor Deployment

In coordination with our teammates, in particular the LCG Department of Public Works, we have selected several key areas to distribute the sensors around the City. Most sensors will be mounted on ~200 traffic signal poles, utilizing existing power and communication present. We have also identified ~100 locations near public schools to install sensors. An additional ~100 sensors will be placed in public parks, recreation centers, fire stations, all of which provide sites that are well-maintained, routinely monitored, secure and well-distributed around the community. Altogether we have identified over 400 sites that provide the necessary resources and access to deploy sensors. We plan to deploy 300 sensors at a subset of these sites.

1.4.4.4 Monitoring sensors operational status

Each data logger (a data logger may be connected to one or more sets of air quality, humidity, and air temperature sensors) is designed to report on a scheduled interval to our database ensuring continued operation and easy identification of faulty units. Our sensor solution also provides bi-directional communication between data loggers and the StormNet data management platform to allow remote checks, internal self-test initiation, and software updates. The system will also be able to send email notifications to personnel responsible for maintaining sensors to initiate repair or recalibration. In addition to the on-board self-test and remote database management, our partnership with UL provides us with student help to inspect, field verify, and laboratory recalibrate sensors. Our environmental enclosure and sample input filters will help to minimize in field failures but our team understands and is ready to address those events that foul the sensor or otherwise disrupt the operation of the sensor suite.

1.4.4.5 Ensuring physical security, accuracy and precision of the sensors

The LEaRN team will perform design, assembly, and calibration of the initial sensor solution to understand the complete sensor suite accuracy and precision expected during reporting. We also plan to conduct quarterly in-field inspections of sensors with the help of our partners at LCG (e.g. utility workers doing routine traffic system maintenance) and UL (e.g. students in engineering and environmental science programs). The in-field inspection will include inspection of the housing, sampling ports, power, self-test, and sample gas or zero flow test for sensor response. On an annual basis the sensors will be taken down and laboratory inspected (at UL laboratory facilities) and calibrated, this data will be critical in evaluating the system robustness and sensor life expectancy in the field. Our selection of sensors is based on the testing performed by the EPA in evaluation of low cost sensor options. The high correlation of low cost O₃ sensors provides us confidence our system will provide broader coverage with high accuracy across the city. However, low-cost PM solutions do not offer as good a correlation with high-quality sensors and we will test alternate solutions such as calibration offset, humidity monitoring and conditioning, along with placement near FEM sites for long-term precision comparisons. The physical security of each sensor installation will be maintained by mounting sensors in difficult-to-reach places such as the tops of traffic signal poles. The placement, small size, and environmental enclosure will protect installations from the elements and make them unlikely targets for vandalism.

1.4.4.6 Time to project operation

Our project plan calls for an agile approach with three months to design, test and calibrate the sensor solution, with two months for building the first 50 sensors ready and one month to deploy and connect these sensors to the network. Based on lessons learned from this initial deployment, an additional 250 sensors will be procured, built and deployed over the following six months. Our understanding of sensors, data networks, and the availability of sensor modules enables this fast turnaround to a deployed systems. Our database system StormNet also provides the needed backend structure for capturing, processing, and displaying the data, further shortening our time to full operation. During this

ramp up period, the LEaRN Collaborative will engage in multiple public outreach and stakeholder sessions to engage the community as well as begin planning with LCG for the launch of the new LCG Open Data Portal that will provide additional access to data collected as part of this project.

1.5 Project Sustainability

1.5.1 Resource investment by community and individuals and sensor users

LCG will provide staff time for project management as well as sensor deployment and maintenance. UL will provide staff and student time (as part of service-learning activities) to assemble, deploy, and maintain sensors, and will use sensor data as part of existing STEM-related courses. CGI will provide ~\$30,000 for the purchase of sensors and sensor components (including back-up sensor components used for training and maintenance), as well as staff time to advise and assist with sensor assembly, deployment, and maintenance. Additionally, CGI will provide software development resources to apply and host the StormNet Platform, which will be licensed to LCG for use in the LEaRN Collaborative air quality monitoring project. Lafayette Public School System and Lafayette Public Library will use air quality data collected as part of STEM education activities. Please refer to Exhibit 1 in section 1.2 (pp. 1-3) for a detailed listing of our partners, their role in the LEaRN Collaborative and their relevant expertise and contribution to our solution.

1.5.2 Partnerships to be established to implement the project

Please refer to Exhibit 1 in section 1.2 (pp. 1-3) for a detailed listing of our partners, their role in the LEaRN Collaborative and their relevant expertise and contribution to our solution.

1.5.3 Economic viability and replicability

Our build and buy strategy for sensor procurement maximizes the use of EPA's seed funding. We are leveraging existing LCG and private infrastructure for power and data connectivity in order to defray costs (a replicable approach across many communities). Through the use of Open Source standards, existing LCG software licenses for leading industry software, and an existing partnership between LCG, UL and CGI, that includes a symbiotic relationship across education and long-term O&M, LEaRN Collaborative provides for a sustainable project. The collaborative will publish a white paper summarizing our approach to help other communities to adopt a similar approach.

1.5.4 Overcoming possible barriers to success

Barriers to project success include: (1) loss of sensors due to damage or theft; (2) lack of engagement among citizens to use the sensor data; and (3) lack of interest among the general public in the goals and outcomes of the project. To mitigate loss of sensors, we will purchase (using funds from CGI) materials sufficient to deploy a total of 400 sensors, but will only deploy 300 sensors at any one time, leaving the remaining sensors to be used to replace deployed sensors as needed. This will allow us to maintain at least 250 deployed sensors for a period of three to five years. Lack of citizen engagement and interest will be overcome by persistent outreach activities through local media coverage, social media, and through in-person demonstrations at Lafayette's many cultural festivals throughout the year.

1.5.5 Relevant team member expertise and resources available to carry out proposed work

Please refer to Exhibit 1 in section 1.2 (pp. 1-3) for a detailed listing of our partners, their role in the LEaRN Collaborative and their relevant expertise and contribution to our solution.

1.5.6 Eco-friendliness of project

The LEaRN Collaborative air quality data collection project will encourage citizens to adopt cleaner, high-occupancy transportation methods such as car-pooling or public transit that would reduce congestion and produce less air pollution than single occupancy vehicle trips. Additionally, the proposed project will encourage citizens to choose active transportation methods such as walking or biking that do not produce direct emissions of criteria pollutants. Above all, the project will increase awareness about local air quality issues that affect our health and wellness, and may motivate citizens to make other behavioral and consumption changes, such as changing landscape maintenance tools and practices, that could further reduce air quality pollution.



Lafayette Engagement
& Research Network

Appendix A: Letters of Support for the LEaRN Collaborative



804 E St. Mary Blvd. Lafayette, Louisiana 70503 // o 337.233.2705 // f 337.234.8671 // OneAcadiana.org

October 26, 2016

Environmental Protections Agency
1200 Pennsylvania Avenue, N.W.
Washington, DC 20460

To Whom It May Concern:

As the President and CEO of One Acadiana, I write this letter of support for the proposed Lafayette Engagement and Research Network (LEaRN) presented by Lafayette Consolidated Government. The community of Lafayette has formed the LEaRN Collaborative to create a sustainable partnership to meet EPA's challenge to create a Smart City Air Sensor Network. LEaRN creates a foundation for continued learning and innovation related to smart cities, civic engagement and digital transformation for Lafayette and for other communities interested in these topics. This collaborative, formed for Lafayette, offers an active, sustainable partnership to EPA that is already working together on issues critical to the Lafayette community, proven resources and expertise to enable project success, and broad community engagement to ensure project sustainability.

One Acadiana is a business-led, privately-funded economic development organization serving a nine-parish (county) area in South Louisiana. Our vision is to make our region one of the most sought-after places in the South for emerging businesses and professional talent. This collaborative effort in innovation between the public and private sector supports One Acadiana's vision to make our region one of the most sought-after places in the South for emerging businesses and professional talent.

Representing more than 1,200 businesses throughout the area, One Acadiana has the ability to support the project through a network of resources. As such, we are committing to leveraging our network to:

- Identify up to at least 20 local businesses across the Lafayette community to be participants in the LEaRN network for air quality.
- Provide resources to research and support the overall LEaRN Collaborative as Lafayette continues to embark on this and additional smart city initiatives across our community.

We are committed to working with LCG and the rest of the LEaRN Collaborative and will devote applicable time, expertise, and resources to fulfill the strategies outlined in the attached application. Please do not hesitate to contact us with any questions.

Sincerely,

A handwritten signature in black ink, appearing to read 'Jason El Koubi'.

Jason El Koubi
President and CEO
One Acadiana



CGI Federal
538 Cajundome Blvd
Lafayette, LA 70506 USA
Tel. 337-484-1699

cgifederal.com

10/27/2016

Dear EPA Smart City Challenge Committee Members,

It is my pleasure to write in support of the Lafayette Engagement and Research Network (LEaRN) collaborative being submitted to the Smart City Air Challenge by the Lafayette Consolidated Government (LCG) and University of Louisiana at Lafayette (UL).

The LEaRN Collaborative will create a sustainable partnership to meet EPA's challenge to create a Smart City Air Sensor Network. LEaRN is intended to create a foundation for continued learning and innovation related to smart cities, civic engagement and digital transformation for Lafayette and for other communities interested in these topics. This collaborative formed for Lafayette offers an active sustainable partnership to EPA that is already working together on issues critical to the Lafayette community, proven resources and expertise to enable project success, and broad community engagement to ensure project sustainability.

CGI is a strategic partner to LCG and UL and is already working within Lafayette to bring 400 IT jobs to help diversify the local economy, build a Smart City "living lab" and assist in STEM education and environmental sustainability initiatives across the community. As a core team member of the LEaRN Collaborative, our support will be focused on providing system integration and consulting support, cloud hosting and access to our IoT/sensor data management platform to support data management and access. In addition, we will support LCG in launching its first Open Data Portal for the city.

We are committed to working with LCG, UL Lafayette and the rest of the LEaRN Collaborative and will devote applicable time, expertise, and resources to fulfill the strategies outlined in the attached application. Please do not hesitate to contact us with any questions.

Sincerely,

William LaBar
Vice President, CGI Federal

October 27, 2016

USEPA, 1200 Pennsylvania Avenue, N.W.

Washington, DC 20460

Colleagues,

I write to support the Lafayette Engagement and Research Network (LEaRN) presented by the Lafayette Consolidated Government and the University of Louisiana. Lafayette has formed the LEaRN Collaborative that will meet EPA's challenge to create a Smart City Air Sensor Network. LEaRN is intended to create a foundation for continued learning and innovation related to smart cities, civic engagement and digital transformation in Lafayette and for other communities interested in these topics. This collaborative offers an already-active and effective partnership, proven resources and expertise to enable project success, and broad community engagement to ensure project sustainability.

CNT is a research and leadership organization committed to improving urban economies and environments across the US. We do this through analysis, testing and place-based demonstration, and then helping craft implementation at scale. Our support includes providing lessons subject matter expertise from our work in Chicago and other communities across the US to assist Lafayette in launching this collaborative, creating a sustainable framework for the future related to this Air Quality Network, and targeted problem solving to maximize Return on Investment upon award of the Challenge.

We are committed to supporting the Collaborative and helping fulfill the strategies outlined in the attached application. Please do not hesitate to contact me with any questions.

Sincerely,



Scott Bernstein, President, Center for Neighborhood Technology

2125 W. North Avenue, Chicago, IL. 60647

773 269 4035, scott@cnt.org, www.cnt.org

**CNT is a winner of the MacArthur Foundation Award for
Creative and Effective Institutions**





October 26, 2016

Environmental Protection Agency
1200 Pennsylvania Avenue, N.W.
Washington, DC 20460

As the CEO of Lafayette's Downtown Development Authority (DDA), I support the proposed Lafayette Engagement and Research Network (LEaRN) presented by Lafayette Consolidated Government. Lafayette formed the LEaRN Collaborative to create a sustainable partnership to meet EPA's challenge to create a Smart City Air Sensor Network. LEaRN creates a foundation for continued learning and innovation related to smart cities, civic engagement and digital transformation for both Lafayette and other communities. This collaborative offers an active sustainable partnership to EPA that is already working together on issues critical to the Lafayette community, with proven resources and expertise to enable project success, and broad community engagement to ensure project sustainability.

DDA's mission is the physical, economic and cultural development of the downtown Lafayette district—preserving and enhancing its important place as the heart of Lafayette and Acadiana. The LEaRN Collaborative offers an exciting opportunity for downtown businesses to participate in, understand and learn from Smart City initiatives and will serve as a foundation for continued Smart City initiatives that align with the [Downtown Lafayette Action Plan](#). As such, we are committed to leverage our downtown network to:

1. Identify and recruit downtown businesses to be participants in the LEaRN network for air quality.
2. Provide resources to support outreach, education and general awareness regarding air quality and smart city initiatives that align with the objectives of our community.

We are committed to working with LCG and the rest of the LEaRN Collaborative and will devote applicable time, expertise, and resources to fulfill the strategies outlined in the attached application. Please do not hesitate to contact us with any questions.

Cheers,

Nathan R. Norris
CEO, Downtown Development Authority



October 27, 2016

Environmental Protection Agency
1200 Pennsylvania Avenue, N.W.
Washington, DC 20460

Re: Smart City Air Challenge

To whom it may concern,

As the President of The Enterprise Center in Chattanooga, I write this letter of support for the proposed Lafayette Engagement and Research Network (LEaRN) presented by Lafayette Consolidated Government and the University of Louisiana at Lafayette. The community of Lafayette has formed the LEaRN Collaborative to create a sustainable partnership to meet EPA's challenge to create a Smart City Air Sensor Network. LEaRN is intended to create a foundation for continued learning and innovation related to smart cities, civic engagement and digital transformation for Lafayette and for other communities interested in these topics. This collaborative formed for Lafayette offers an active sustainable partnership to EPA that is already working together on issues critical to the Lafayette community, proven resources and expertise to enable project success, and broad community engagement to ensure project sustainability.

The Enterprise Center is focused on establishing Chattanooga as a hub of innovation, improving people's lives by leveraging the city's digital technology to create demonstrate, test and apply solutions for the 21st Century including Smart City solutions like the Geolocated Allergen Sensing Platform (GASP). As a participant on the LEaRN Collaborative Advisory Board, our support will be focused on providing best practice insights and subject matter expertise from our global partnerships to assist Lafayette in launching this collaborative, creating a sustainable framework for the future related to this Air Quality Network, and targeted problem solving to maximize Return On Investment upon award of the Challenge.

We are committed to working with LCG, UL Lafayette and the rest of the LEaRN Collaborative and will devote applicable time, expertise, and resources to fulfill the strategies outlined in the attached application. Please do not hesitate to contact us with any questions.

Sincerely,

A handwritten signature in black ink, appearing to read "Ken Hays".

Ken Hays
President



October 27, 2016

Environmental Protection Agency
1200 Pennsylvania Avenue, N.W.
Washington, DC 20460

To whom it may concern,

As President and CEO of the Lafayette Economic Development Authority (LEDA), I write this letter of support for the proposed Lafayette Engagement and Research Network (LEaRN) presented by Lafayette Consolidated Government. The LEaRN Collaborative is a sustainable partnership of community organizations formed to address the EPA's challenge to create a Smart City Air Sensor Network. LEaRN creates a foundation for continued learning and innovation related to smart cities, civic engagement and digital transformation for Lafayette and for other communities interested in these topics.

LEDA works with businesses as they make decisions to start, expand or relocate to Lafayette, Louisiana, and the surrounding communities. Through innovative collaborations with business, government and education, LEDA strives to grow the community's business base for future development and diversification. The EPA's focus on developing information technology infrastructure and new data streams is especially pertinent to Lafayette—as we have experienced a period of accelerated growth in the technology sector. This challenge will undoubtedly act as a catalyst for further innovation in the area. As such, LEDA is committed to the LEaRN Collaborative and will promote the deployment of sensors to the local business community, as well as to new companies entering the market.

We are committed to working with LCG and the rest of the LEaRN Collaborative and will devote applicable time, expertise, and resources to fulfill the strategies outlined in the attached application. Please do not hesitate to contact us with any questions.

Sincerely,

A handwritten signature in black ink, appearing to read "grieg gothereaux".

Gregg Gothereaux
President & CEO



LAFAYETTE

P A R I S H S C H O O L S Y S T E M

October 25, 2016

Dr. Donald Aguillard
Superintendent
P.O. Drawer 2158
Lafayette, LA 70502
337.521.7000

Environmental Protections Agency
1200 Pennsylvania Avenue, N.W.
Washington, DC 20460
Smart City Air Challenge

To whom it may concern,

As Superintendent of the Lafayette Parish School System, I write this letter of support for the proposed Lafayette Engagement and Research Network (LEaRN) presented by Lafayette Consolidated Government and the University of Louisiana at Lafayette. The community of Lafayette has formed the LEaRN Collaborative to create a sustainable partnership to meet EPA's challenge to create a Smart City Air Sensor Network. LEaRN is intended to create a foundation for continued learning and innovation related to smart cities, civic engagement and digital transformation for Lafayette and for other communities interested in these topics. This collaborative formed for Lafayette offers an active sustainable partnership to EPA that is already working together on issues critical to the Lafayette community, proven resources and expertise to enable project success, and broad community engagement to ensure project sustainability. Ultimately, LEaRN will help identify best practices for managing big data at the local level, engage and inform citizens related to data collection within their community, and help inform Lafayette and others best practices for data usage from sensors to understand environmental condition, human health and smart city topics.

The Lafayette Parish School System's mission, in collaboration with stakeholders, is to develop productive citizens prepared to compete in a global community. We view the LEaRN Collaborative as a strategic opportunity to introduce topics such as Smart Cities, Environmental and Human Health concepts, Citizen Science, the Internet of Things, Big Data, Informatics and Data Visualization into the Lafayette Public School System. We look forward to the educational opportunities this project will result in throughout the community and will achieve this by deploying sensors across our 40 schools and setting up student engagement activities related to the project on topics such as sensor assembly, experience with informatics/data visualization and citizen science.

We are committed to working with LCG, UL Lafayette and the rest of the LEaRN Collaborative and will flex available time, expertise, and resources to fulfill the strategies outlined in the attached application. Please do not hesitate to contact us with any questions.

Sincerely,

Dr. Donald W. Aguillard, Superintendent
Lafayette Parish School System

October 27, 2016

Environmental Protection Agency
1200 Pennsylvania Avenue, N.W.
Washington, DC 20460
Smart City Air Challenge

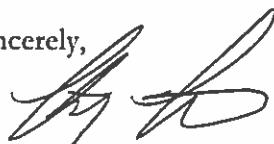
To whom it may concern,

As Microsoft's Worldwide General Manager for Government, I write this letter of support for the proposed Lafayette Engagement and Research Network (LEaRN) presented by Lafayette Consolidated Government and the University of Louisiana at Lafayette. The community of Lafayette has formed the LEaRN Collaborative to create a sustainable partnership to meet EPA's challenge to create a Smart City Air Sensor Network. LEaRN is intended to create a foundation for continued learning and innovation related to smart cities, civic engagement and digital transformation for Lafayette and for other communities interested in these topics. This collaborative formed for Lafayette offers an active sustainable partnership to EPA that is already working together on issues critical to the Lafayette community, proven resources and expertise to enable project success, and broad community engagement to ensure project sustainability. Ultimately, LEaRN will help identify best practices for managing big data at the local level, engage and inform citizens related to data collection within their community, and help inform Lafayette and others best practices for data usage from sensors to understand environmental condition, human health and smart city topics.

Microsoft is a strategic partner to Smart City communities across the globe. Our Smart City approach empowers cities and citizens to unlock their potential by delivering innovative digital services that can help them lead safer and healthier lives, enriched by high-quality education. We help cities engage their citizens, empower city employees, optimize city operations and infrastructure, and transform and accelerate innovation and opportunity. As a participant on the LEaRN Collaborative Advisory Board, our support will be focused on providing best practice insights and subject matter expertise from our global partnerships to assist Lafayette in launching this collaborative, creating a sustainable framework for the future related to this Air Quality Network, and targeted problem solving to maximize Return On Investment upon award of the Challenge.

We are committed to working with LCG, UL Lafayette and the rest of the LEaRN Collaborative and will devote applicable time, expertise, and resources to fulfill the strategies outlined in the attached application. Please do not hesitate to contact us with any questions.

Sincerely,



Timothy Turitto
Worldwide General Manager
Government
Microsoft Corporation



South Louisiana
Community College

Chancellor's Office
1101 Bertrand Drive
Lafayette, LA 70506
Phone: 337.521.9000

October 27, 2016

Environmental Protection Agency
1200 Pennsylvania Avenue, N.W.
Washington, DC 20460

To whom it may concern,

As the Chancellor of South Louisiana Community College (SLCC), I write this letter of support for the proposed Lafayette Engagement and Research Network (LEaRN) presented by Lafayette Consolidated Government. The community of Lafayette has formed the LEaRN Collaborative to create a sustainable partnership to meet EPA's challenge to create a Smart City Air Sensor Network. LEaRN creates a foundation for continued learning and innovation related to smart cities, civic engagement and digital transformation for Lafayette and for other communities interested in these topics. This collaborative formed for Lafayette offers an active sustainable partnership to EPA that is already working together on issues critical to the Lafayette community, proven resources and expertise to enable project success, and broad community engagement to ensure project sustainability.

SLCC's mission is to transform and enrich the lives of individuals and communities. SLCC commits to providing skills and knowledge through a dynamic learning environment where students realize their potential, compete in today's global economy and perpetuate to solve the complex problems of tomorrow. We look forward to the educational opportunities that LEaRN will bring throughout the community and will support the collaborative by deploying sensors across 3 related sites and by setting up student engagement activities related to the project on topics such as sensor assembly, software/application development, data visualization and citizen science.

We are committed to working with LCG and the rest of the LEaRN Collaborative and will devote applicable time, expertise, and resources to fulfill the strategies outlined in the attached application. Please do not hesitate to contact us with any questions.

Thank you for the consideration.

Sincerely,

A handwritten signature in black ink that reads "Natalie J. Harder". The signature is fluid and cursive, with "Natalie" and "J." being more stylized and "Harder" being more like a standard printed name.

Natalie J. Harder
Chancellor



Office of the Vice President for
Research, Innovation & Economic
Development

P.O. Box 43610
Lafayette, LA 70504-3610
Office: (337) 482-5811
Fax: (337) 482-5102
Université des Acadiens

October 27, 2016

Environmental Protection Agency
1200 Pennsylvania Avenue, N.W.
Washington, DC 20460

To whom it may concern,

As the Vice President for Research, Innovation, and Economic Development at University of Louisiana at Lafayette, I write this letter of support for the proposed Lafayette Engagement and Research Network (LEaRN) presented by Lafayette Consolidated Government (LCG). The community of Lafayette has formed the LEaRN Collaborative to create a sustainable partnership to meet EPA's challenge to create a Smart City Air Sensor Network. LEaRN creates a foundation for continued learning and innovation related to smart cities, civic engagement and digital transformation for Lafayette and for other communities interested in these topics. This collaborative formed for Lafayette offers an active sustainable partnership to EPA that is already working together on issues critical to the Lafayette community, proven resources and expertise to enable project success, and broad community engagement to ensure project sustainability.

UL Lafayette is a place of rich culture, close community and real-world research. We believe firmly in "research for a reason" which has led us to successfully partner with Lafayette Consolidated Government to make Lafayette a US Ignite Community and to create the NSF Center for Visual Decision and Informatics (the nation's only NSF funded big data and analytics center, led by UL). To support the success of LEaRN, UL is committed to:

- Incorporating air quality sensor building and data analytics and visualization project work into the School of Engineering, School of Geosciences and School of Computing and Informatics student activities. The sensors built by students will be deployed throughout the Lafayette community.
- Working with LCG and CGI to hold high school and public sensor building classes to engage with the general public on the goals of the sensor network, issues around air quality and recruit citizens in the community to deploy these sensors at their homes.
- Incentivizing engagement with LEaRN amongst students by providing bike share rental discounts to students who check out air sensors to engage in this citizen science effort.

We are committed to working with LCG and the rest of the LEaRN Collaborative and will devote applicable time, expertise, and resources to fulfill the strategies outlined in the attached application. Please do not hesitate to contact us with any questions.

Sincerely,

A handwritten signature in black ink, appearing to read "Ramesh Kolluru".

Ramesh Kolluru, Ph.D.



October 26, 2016

Environmental Protection Agency
1200 Pennsylvania Avenue, N.W.
Washington, DC 20460

Dear Grant Committee Members,

It is my pleasure to write in support of the Lafayette Engagement and Research Network (LEaRN) collaborative being submitted to the Smart City Air Challenge by the Lafayette Consolidated Government (LCG) and University of Louisiana at Lafayette (UL).

The community in Lafayette has a strong commitment to the development of applications and infrastructure for profound public benefit. As part of a cohort of 15 NSF funded US Ignite Smart Gigabit Communities, LEaRN would build on an already strong track record of development and leadership in the region. Providing a sustainable platform for monitoring and analysis of air quality would intelligently inform civic planning discussions and impact analysis due to Air Quality. The adoption of an innovative data management platform and creation of a public data portal based on open APIs would empower the community by increasing civic engagement and empower entrepreneurs and community advocates to build new generations of tools to further benefit the region.

In my role as the National Technology Leader for US Ignite, I have had the pleasure of working with Lafayette on a number of Smart City initiatives. Their dedication to applied research that has a direct positive impact on the community is a particular strength of the LCG and UL. In support of this project US Ignite is committed to:

- Connecting LEaRN to a large national community of leaders in environmental monitoring and data analysis as part of the broader US Ignite effort.
- Participate, along with other experts, as part of an advisory board or team to provide an innovative and open data platform and portal for sensor data.
- Working with LCG and UL to establish a robust network through the US Ignite Digital Town Square, supporting wide deployment of Internet of Things arrays, increase the range, capacity and responsiveness of the network for monitoring devices.
- Promoting the use of, and engagement with, sensor data by local application developers to create applications for transformative public good.

Sincerely,

A handwritten signature in black ink that reads "Scott Turnbull".

Scott Turnbull
National Technology Leader, US Ignite
Scott.turnbull@us-ignite.org
678-379-9488