CDAN™

City-Wide Distributed Audio Network

Executive Summary

  CDAN^{TM} – City-Wide Distributed Audio Network – is a revolutionary concept that allows cities with installed CityIQ networks of IoT smart, sensor-laden street light systems to realize potentially massive revenue through audio advertising. Using the already-installed CityIQ infrastructure, the smart street lights are modified to include speakers so that 30-second audio advertising spots can be played at each streetlight. Streetlights can be targeted for audio spots individually, based on a geographic region selected by the advertiser, or city-wide. When two advertisers want their spots to play on a specific streetlight at a specific time, a Google-style auction is employed to determine the winner.

  Using advertising revenue projections from both radio and internet audio advertising and based on a 50-50 split of advertising revenue with the city, CDAN^{TM} supports an installation payback period of 9-12 months. Due to the highly automated nature of the system post-installation and the short installation payback period, we project a 5 year return on invested equity in excess of 30% annualized.

CDAN^{TM} – City-Wide Distributed Audio Network

CityIQ

The Internet-of-Things (IoT) is upon us! Current[1], a subsidiary of General Electric, has developed an IoT smart, sensor-laden street light system that is calls CityIQ. Each CityIQ streetlight monitors an oval area of roughly 36 by 54 meters (120 to 180 feet) and includes video cameras for video, still images, and computer vision analytics; two acoustical sensors; and environmental sensors that monitor temperature, pressure, humidity, vibration, and magnetic fields. The streetlights are connected via the cellular telephone infrastructure to a centralized data center where data can be reviewed and further transmitted to others. The network's first job will be pointing out vacant parking spots to drivers and alerting traffic enforcement officers to illegally parked cars.

Already more than 2,000 CityIQ streetlights have been installed in San Diego[2] [3]– and the total is scheduled to rise to 3,200 by May, which represents a coverage area of substantially the entire city. Additional installations are currently planned for Atlanta and Singapore.

The CityIQ platform is sensor-agnostic and device-agnostic, so we can connect pretty much any device we want to the streetlight and have a data channel all the way back to the central data center. Also, each streetlight includes 500Gb of memory that can be used to store data.

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[1] https://www.currentbyge.com/cities

[2] https://spectrum.ieee.org/computing/it/san-diego-installs-smart-streetlights-to-monitor-the-metropolis

[3] https://spectrum.ieee.org/view-from-the-valley/computing/networks/san-diegos-smart-streetlight-network-yielding-a-firehose-of-data?utm_source=circuitsandsensors&utm_campaign=circuitsandsensors-01-22-19&utm_medium=email
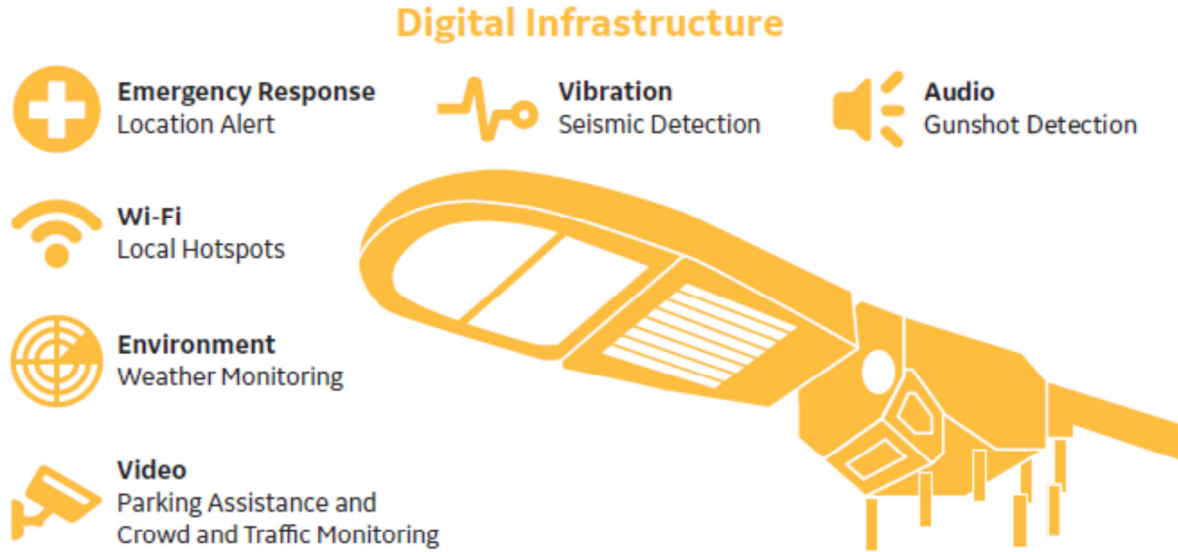
Figure 1. CityIQ™ intelligent nodes fit any street light, enabling existing infrastructure to provide new and expanded capabilities for cities, such as environmental sensors, crime detection tools and traffic monitors.

CityIQ Streetlights

Each streetlight incorporates a package of hardware that Current calls CityIQ. It includes an Intel Atom processor and half a terabyte of memory; Cellular communication; Bluetooth and Wi-Fi radios; two 1080p video cameras for video, still images, and computer vision analytics; two acoustical sensors; and environmental sensors that monitor temperature, pressure, humidity, vibration, and magnetic fields. Each streetlight monitors an oval area of roughly 36 by 54 meters (120 to 180 feet). The streetlights themselves are positioned on average about 125 feet apart.

Additionally, although Current mentions that the CityIQ streetlights are expandable to include other sensors that may be connected to the CityIQ streetlights post-installation, we have determined that the data communication channel between the CityIQ processor and any potential later-installed component is high speed and actually bi-directional. The CityIQ streetlight has been specifically designed to be sensor-agnostic so it offers a great deal of flexibility as to what devices can be connected.
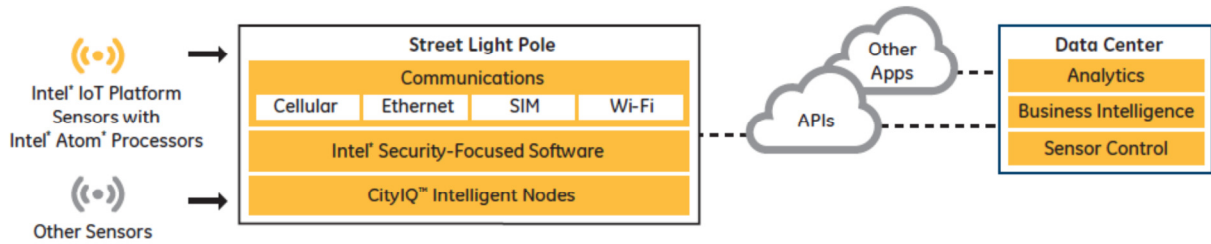
Predix Cloud Server

Much of the sensor data gathered is processed on board, with selected events or streams of data uploaded to GE's Predix cloud through AT&T's LTE network. The choice of AT&T's network for the San Diego installation was chosen as part of the contract process. Any cellular data provider can be used.

The Predix cloud servers manage communication with specific CityIQ Streetlights, store data from the streetlights, and provide secure access to streetlight data to third parties. Additionally, the Predix cloud manages periodic updates and diagnostics of the CityIQ Streetlights by communicating with the CityIQ Streetlights over the cellular network. That is, the communication channel between the Predix cloud and the CityIQ Streetlights is also bi-directional. Also, because the communication channel is the cellular LTE network, it is high speed.

CDAN^{TM}

Our invention turns the typical use of the CityIQ Streetlights on its head. Instead of receiving data from the CityIQ Streetlight sensors, we are primarily transmitting audio data to them. Basically, instead of a sensor, we install a speaker at the streetlight. The speaker communicates with the Predix cloud through the processor on board the streetlight. Thus, if we want a specific streetlight speaker to play a specific audio clip, we can identify the streetlight at the Predix cloud and then download the audio to the specific streetlight.

Here's the good part – our system operates on standard 30-second audio advertisement spots. Each streetlight can be equipped with a "Start" time in the morning and a "stop" time in the evening – and then each 30-second slot between the start and stop times can be sold for audio spots.

This can be a huge advertising revenue opportunity for a city. The city is basically operating thousands of localized audio speakers – and advertising spots on the speakers can be purchased city-wide, based on a selected geographic area, or on an individual speaker basis.

For advertisers, our system is very approachable. Advertisers just upload their spots to our server. We convert the ads to MP3 at 96kbs to reduce bandwidth. Also, higher fidelity audio is wasted in the outdoor environment. For each spot, they can select the geographic area and the time of day for display. They then set the maximum price they will pay to display their spot and the number of instances – or they can just set an ad budget.

Using the Google model, when multiple advertisers want to play their audio spots at a specific streetlight at a specific time, we employ a Google-style auction and play the winning spot. Here is some info on Google auctions. https://www.wordstream.com/articles/what-is-google-adwords

The auction for a specific spot time closes 5 minutes before that time. This gives our system plenty of time to determine the auction winner and transmit their audio spot to the specific streetlight(s). At the streetlights, the audio spot is pre-stored in the on-board memory and we then initiate play of the spot at the chosen spot time. By pre-storing the spot in the on-board memory, we avoid any issues of latency or interruption in the cellular communication channel that might occur with streaming spots.

<u>Speakers</u>

We have two models of speakers that can be installed – a budget option and a high performance model. The budget option is the he LU43PB High Performance speakers from Dual Electronics and the high performance model is The Bose 251 Environmental Outdoor Speaker set. You can see a review of the speakers here:

https://mashable.com/roundup/best-outdoor-speakers/#qn4Nzllh8aq6

<u>Network Details</u>

More specific technical network details can be found at the following links:

https://ie-cities-docs.run.aws-usw02-pr.ice.predix.io/#r_get_situational_awareness_media_api.html
https://developer.currentbyge.com/cityiq

Network Options

We are also exploring three other business models for CDAN^{TM}

1.   Audience-Based Pricing

The CityIQ Streetlights include video cameras that can determine how many people are near the streetlight. The number of prospective listeners can be used as an input to the pricing calculation for playing the spot. For example:

- An advertiser may set an option that a spot will only play if there are a minimum number of people around.

- We can charge advertisers on a per-person basis.

- We can establish "high traffic" surcharges when the audience is a certain size.

2.   Pay For Exclusive

If an advertiser wants to only have their ads play on a specific streetlight, we can accommodate them for a price. They can select any time frame of at least half an hour up to permanent – and for that time only their spots will play. We are not sure whether we will limit exclusives to a specific area or a certain max number of streetlights – or if the entire city will be up for grabs for a price.

3.   Pay To Lock Out Competitor

Each advertiser indicates their business field - and advertisers can pay so that no other business in their field can have a spot play at a specific streetlight. For example, if there is a streetlight near a Burger King, Burger King can pay so that no spots from fast food restaurants like McDonalds will be played on the streetlight. However, Burger King probably does not care if spots for a bank (for example) are played at the streetlight – and might like a mix of spots. It is anticipated that the pricing here will be less than the Exclusive pricing above, but that many more businesses would be willing to pay a reduced fee to lock out a competitor.

Other Patents

The CEO passed on your recommendation to search the PTO's website, so I did. I made a list of the patents below. The CEO says that all of these patents look pretty close to what we came up with. However, the CEO says that you are the best patent attorney around and that you will be able to find a way to get us our patent without infringing on these other patents.

Patents:
US 20190028864 A1
US 20180324486 A1
US 20180266672 A1