Project name: Sanitation Solutions 360

NTx App Challenge Submission to: 1) Waste & Recycling and 2) The Internet Of Things using the Gemalto Cinterion board for proof of concept/prototying

Sanitation Solutions 360 is focused on a holistic approach to improving sanitation. Our approach is to limit the items that go to the landfill, therefore we provide recycling training and solutions to encorage recycling and composting. Lastly the items that cannot be recycled or used in compost, then must be dumped. The IoT solution proposes a more efficient and greener way of managing waste.

1. In our video you will see how we will change human behavior by providing an Interactive 3D Recycling game.
2. Next we use technology to make waste management more efficient and green.
3. We believe that data talks; so we have incorporated metrics to measure the impact our solutions have and will make this data available via the Dallas Open Data website.

Solution 1: Just In Time Dumping
Solution 2: Diversion Scoreboard - Automated Diversion Calculations Posted on the Dallas Open Data site
Solution 3: 3D Interactive Recycling Game

Solutions 1 and 2 use a system of integrated wireless sensors connected to the "cloud" via the Gemalto Cinterion board for our entry to the Internet of Things horizontal as well as Waste & Recycling. Solution 3 is a 3D interactive recycling game and is our entry for Recycling. Since CollabFinder has limited bandwidth, please check our gitHub site for our proposal package!

Solution 1: Just In Time Dumping

Problem: the City of Dallas (CoD) has customers that use dumpsters, however, there is currently no automated way to detect if these dumpsters need servicing. This causes **waste** in the form of:

1. Human Resource Waste - Sending people out to these specific dumpsters that may not need immediate servicing,
2. Wasting $expensive, Diesel fuel, these trucks get only 5 miles per gallon!
3. Therefore, it's also a waste of Energy!
4. as well as **adding more traffic congestion, and wear & tear to our roads**,

5. Adding more miles, wear & tear/maintenance costs to the dump trucks,
6. Creating more risk and costs for insuring these expensive vehicles,
7. **adding unnecessary pollution to the air**

Solution:
Implement & Integrate a **Level Detecting sensor** [Sensor 1] in all of the City of Dallas's dumpsters that can detect when the dumpster is at 80% (or other specified amount) full and send a notification/alert in the form of a 1) SMS message, 2) Email message and 3) real-time visual monitoring dashboard running on the Internet. These notifications will also specify a time stamp of when this event occurred, the physical location of this dumpster, and the level value that this dumpster is set to trigger these notifications / alarms. This information will also be saved in a database for Key Performance Indicators (KPIs) to track how long it takes the sanitation crew to respond, as well as record which locations need more frequent servicing than other locations.

Implement & Integrate a wireless **GPS/location sensor for all the dumpsters**, this will tell the sanitation dispatcher and dump truck drivers where the dumpsters are located; also useful if these dumpsters are ever moved or stolen. [Sensor 2]

Implement & Integrate a wireless **GPS sensor in the dump trucks**, the Sanitation truck dispatcher can determine which dump truck currently out in the field, is closest to that Alamed Dumpster location. [Sensor 3]

The dump trucks used by the CoD have a lever that the operator pulls to compact the contents of the trash receptacle. When the range of motion of this lever becomes less, this indicates that the trash receptacle is becoming fuller. There can be a **range of motion sensor on this lever** that can detect if the CoD dump truck has enough room available to hold the contents of another alarming dumpster. [Sensor 4]

If the range of motion sensor indicates that the dump truck has room, and that dump truck is closest to the dumpster, then the dispatcher can contact that crew and tell them to go to that dumpster for emptying.

If the closest CoD dump truck is too full to accommodate another dumpster load, then the CoD dispatcher can check the next nearest dump truck.

Benefits:

1) This will save the CoD money and help them to better utilize their sanitation staff.

2) This will also save energy (in the form of fuel) by not dispatching trucks to dumpsters until they're ready for dumping.

3) It will reduce maintenance on the CoD dump trucks, by keeping them from making trips to dumpsters that are not that full.

4) It will reduce maintenance on the CoD roads where these heavy, large trucks travel.

5) It could reduce the cost of insuring these dump trucks if they are driven less.

6) The people living in Dallas, will see less incidences of when excess trash is overflowing out of the dumpsters, this will provide a more sanitary situation and a better quality of life for the City of Dallas residences.

Solution 2: Diversion Scoreboard

Diversion is a sanitation term that means how much weight of "stuff to be disposed of" will be diverted from the land fill. Earth has limited space for landfills and they have to be used consciously without any negative impacts to the land, air and water there, and in the surrounding area of the landfills. Sanitation Solutions 360 will automate collecting this information, then post this to the City of Dallas open Data web site so that everyone can see which business "walk the walk" of being green! Consumers can then decide which business they intend to support based upon how truthful they are to making efforts towards being green.

The City of Dallas plans to have two types of diversion calculations here in Dallas, one will be for recyclables, and the other will be for "organics" used to create compost. We will have three types of dumpsters, one will be for things that the city of Dallas can recycle, one will be for organic waste such as spent coffee grounds, and parts of veggies you remove before you eat them and the last dumpster will be for items that truly need to go to the landfill for disposal. Here is how the diversion rates will be calculated:

Add the weight of all three types of dumpsters, notice the load sensors on the bottom corners.

TotalDisposedWeight = Recyclables + Organics + Trash

Recycle Diversion % = (Weight of Recyclables ÷ TotalDisposedWeight) x 100
Compost Diversion % = (Organic Waste ÷ TotalDisposedWeight) x 100

Each specific dumpster will have four load sensors located at the bottom, near each corner. This information will be used to calculate the weight of the contents of this dumpster.

Each dumpster will be identified by its latitude and longitude and associated with a business or manager of the dumpster.

The final weight reading will be saved and the diversion calculations completed before the dumpster contents are taken. To detect this event we can use the fact that the weight measurement within 5 minutes of this emptying time will be much lower than the previous weight reading 5 minutes earlier. Also these dumpsters can be fitted with the Just in Time Dumping solution.

These calculated diversion rates and their associated dumpster owners will then be automatically uploaded to the Dallas Open Data portal, https://www.dallasopendata.com Companies that do say they're green and want to show users confirmation of this can link to this site.

Since Diversion calculations are based on percentage, a small company, like Dialexa, can have better recycling and organics recycling numbers than a big company like Walmart store #123. This shows that the management and employees care about the city that they're located in and want to do the right thing for Mother Earth!

Consumers base their buying decisions on many things like good customer service, and if companies do embrace keeping our environment as healthy as possible, as well as taking action towards that goal (not just rhetoric). When this information is posted to the Dallas Open Data portal, consumers view this and can decide which shops and businesses they want to support. Businesses and organizations who participate in this Open Data Diversion calculations postings can use it in their marketing to attract more business, funding and win awards.