FUNDING PROPOSAL
Smart outdoor trash can network
By
Luis Rodriguez & Alvaro Clemente & Jorge Tordera

Abstract
In residential areas, most single houses have their own trash can or dumpster in the front waiting to be emptied every night. However, not every day the trash can is full, so garbage trucks operate in a very inefficient way by checking every container. We want to create a wireless device that will be placed in the trash can and will notify the central garbage collecting system that the unit needs to be emptied. Then, using an ad-hoc algorithm, the most efficient route to gather all the garbage will be calculated and sent to the driver every night. The device will run on batteries and will be extremely cheap to discourage thieves from stealing it. Also, the device will have a protective case to lock it in the trash can.

Project description
The Chicago garbage collection system collects around 1.1 million tons of residential garbage and recyclables annually. While the average number of living units daily collected has been increased, there is still room for further improvement by optimizing the process. Most of the dumpsters are not full by the end of the day, but the garbageman needs to approach the container, open it and the realize that it is almost empty. This represents a huge waste of time and fuel in the trucks because it makes necessary to check every single dumpster manually.
To reduce the time that it takes, we propose the creation of a network that would point out which dumpsters need to be emptied and that will suggest the best route to accomplish the task.
for that. we have developed a wireless device that can be placed inside the dumpster. This device incorporates an infrared sensor that is able to detect if the dumpster is full or not. On a daily basis this sensor will send the state of the dumpster to a centralized monitoring center, where all the data from the different sensors will be collected. A special algorithm that integrates the Google API will decide what is the best route for the garbage truck to visit all the full dumpsters, and will export it as a Google Maps itinerary. Finally, the garbage truck’s driver will only have to confirm the route and pick all the waste. If there is any variation during the journey, the algorithm will dynamically adjust the route.
Team

Our team is mainly composed by three experienced and internationally recognized engineers.

- Luis Rodriguez: senior ECE of UIUC, ICAI (Madrid): he is proficient in the current technologies involved in the development of the Internet of Things (IOT), and he has been awarded with the Web platform infrastructure Chicago 2016 award by his work in an app to get Chicagoans involved in the city’s issue reporting.

- Alvaro Clemente: senior ECE of UIUC, ICAI (Madrid): He is a telecommunications expert with more than three years of current work in the sensor development field. He is also a wireless network’s (RSS based systems) back-end expert, and deeply knows the ins and outs of a distributed system like the one proposed.

- Jorge Tordera: senior ECE of UIUC, UPV (Valencia): he is a machine-learning algorithms expert (LDA, QDA, SVM) and has worked in the integrations of smart sensors in the automotive sector, successfully developing smart-car assistance devices.

Each member of the team provides their own experience in order to fulfil the high-level requirements we set in our design review. They will leave their current duties to work full time to meet the deadlines of the project, so their commitment and ability are guaranteed.

The “ask”

In order to pursue this project, we are asking for $100,000 in exchange for 10% of equity in our company. With this money, we will produce our first 10,000 units and star a pilot program in a smart city. If you invest on us, you will get a 25% discount on the first 10,000 units.

With the pilot program, we want to prove our concept, and start refining our idea to be ready for mass production. This first program will also serve as a marketing tool, so other trash collection companies and public administration get to know our product and its benefits.

Budget and timeline

The money will be assigned as follows:

- With a salary of 28$/hour for each member of the team, and an expected duration of 230 hours, the total labor cost will be $48,300 (including the overhead).
• The remaining $51,700 will be used to pay for the parts and lab equipment necessary to manufacture the device. The cost of the parts estimation is explained in figure 1.

<table>
<thead>
<tr>
<th>Part</th>
<th>Part Number</th>
<th>Unit Cost</th>
<th>Quantity</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Board with USB interface</td>
<td>Arduino UNO</td>
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<td>$5</td>
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<tr>
<td>Wifi adapter</td>
<td>ESP826</td>
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<tr>
<td>Battery Cell</td>
<td>1860 Li-Ion battery</td>
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<tr>
<td>Power Supply (includes AC/DC converter)</td>
<td>5V DC, 2A, 1 Output, Micro USB Plug In Power Supply</td>
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<tr>
<td>Infrared sensor with distance controller built-in</td>
<td>IR Infrared Obstacle Avoidance Sensor Module for Arduino</td>
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<td><strong>Total</strong></td>
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</table>

Figure 1: Part cost estimation

**Long term impact / Conclusion**

Waste of time, budget and resources within garbage collection will no longer be a problem, specially in big cities. This project will optimize the garbage collection of many smart cities around the world, it opens a wide range of possibilities, not only efficiency in the process of collection but also the possibility to contribute to one of the most challenging problems that our society is facing: global warming, by reducing the amount of greenhouse gases that garbage trucks produce. These lead into money saving and the option to invest in other areas. Moreover, reducing fuel consumption is another point which shows our deep commitment with natural resources.

The smart outdoor trash can network is a perfect indicator that the future of smart cities and the new type of welfare that citizens want to experience can now be achieved,