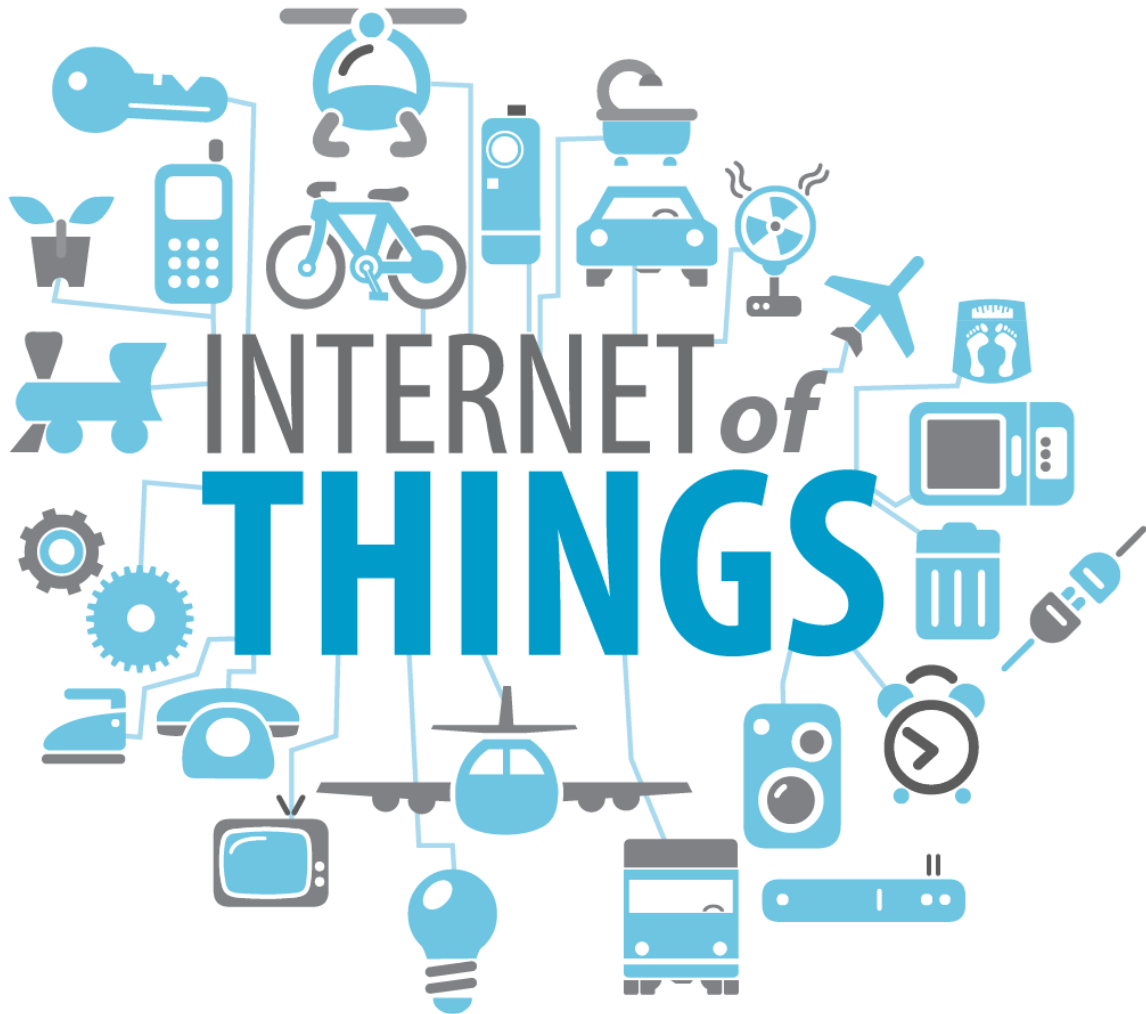KAUFFMAN Louis-Pierre
LESAGE Jean-François
WOLF Etienne
PARIS Thomas

M1- Cloud and Information system

- Smart-trash Project-

Our project is Smart-Trash.

Today, more than 96 % people mention wanting to sort out waste, ecological global warming and the stakes are in the center of the interest of everything and it is important for the large companies to have a low ecological footprint.

Waste sorting is one of the first simple gestures to make and nevertheless only one person out of four is sorting its waste correctly and companies have the duty to invest in the green gestures because they have an impact mattering on the environment in view of the huge quantity of waste which they produce. It is not necessarily a very well represented gesture in the eyes of the population and nevertheless that has a consequent impact.

In the interest of ecology, and to make sorting less tedious, we offer you the Smart-Trash. It will take care of your waste itself! The principle is simple, we offer a connected object and software. In the first time the connected object will allow to detect when the trash is full and will send a message directly to the dumpster manager. The product is intended to be used by companies or either in cities. However, it is also possible that the detector is used for residences with the large collective garbage cans (yellow, green and blue)

As a reminder, companies pay loads depending on the weight of the garbage, which is why the smart strass sensor can be a very good element to save money. Indeed, you will receive a message directly on your phone that will indicate when a trash is full. In addition, we provide a software with which will allow companies especially to the garbage trucks to use the shortest road in town to reach the collection places, so they will save fuel, and this will reduce traffic congestion in the cities, the traffic will be more fluid.

The smart trash package is designed to save money, but also to influence companies towards the ecological path, it is above all a tool, a help to manage its waste more easily in order to make businesses more autonomous and cities cleaner.

STATE OF ART

Our first issue was to determinate what were the solutions already implemented on the market, so we can know if first of all our idea was already taken and if it was really interesting to develop it.

There are many connected bins today because environmental issues are more and more important, and connected objects are more and more present on the market.

However, the other projects and designs are mainly bins for individual use (at the family level). Our project diverges initially from other competitors since it mainly affects large companies, cities or residences using dumpsters, large containers etc. In a second step, our project diverges by the fact that our device does not directly sort the waste, but it makes possible to limit the environmental pollution by limiting the displacements of the garbage collectors, and by reducing the congestion in the cities. We can therefore say that there is no project like ours today. The only connected boxes that exist for garbage cans are barcode scanners which are used for example by Amazon Pantry to facilitate shopping.

We found some interesting example of connected bins and innovative project:

- R3D3 makes it possible to recognize the waste and to compact it but only for the plastic waste (cans, plastic bottles, goblet ...). It does not include organic waste or glass waste. The price is quite high: indeed, it is around 4000 €. For individual use only.

- Bruno, the smart bin makes it possible to pick up garbage on the ground thanks to an integrated vacuum cleaner. However, the amount of storage is very limited and not suitable for companies that require tools with larger containers.

- The Eugene device only allows to scan the barcodes of the products to know how to recycle them, there is no trash as such. It allows to know if the waste is organic, glass or plastic. The price is around 100 €.

- The Genican device is the same as Eugene, with a scan of the product barcodes. The primary goal is not to recycle but to add the product to be scanned on the shopping list. The price is about $ 150. The system is connected to amazon to directly order online purchases.


Our system can cling to any corporate trash. This is a completely new product since it indicates when the trash needs to be emptied thanks to a sensor system. Everything is automatic.

We have conducted a survey for more precision on the desires of people to participate in a project like ours:

Market research with a population made up of school students on sustainable development and their interest in our project. (41 participants)
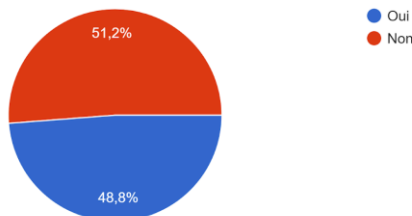
Vous sentez-vous concernés par le développement durable?
41 réponses
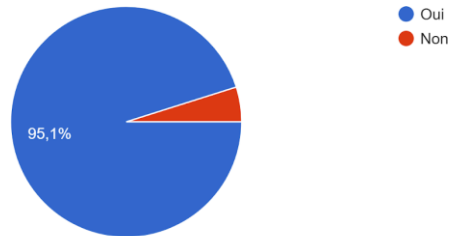
Do you feel concerned by the sustainable development?

- Oui
- Non

95,1%

A votre échelle, réalisez-vous des actions qui s'inscrivent dans une optique de développement durable? (triage des déchets par exemple)
41 réponses

At your scale, do you realize actions that are part of a sustainable development perspective?
If your city provided you with the means to act, for example using smart and connected municipal garbage cans, would you be more involved?

- Oui
- Non

51,2%

48,8%

Si votre ville vous fournissait les moyens d'agir, par exemple à travers l'usage de poubelles municipales conn..., seriez-vous davantage impliqué(e)s?
41 réponses
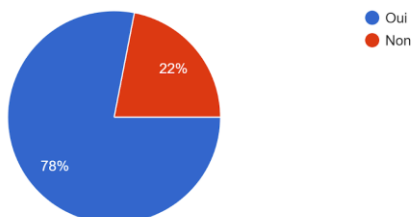
If your city provided you with the means to act, for example through the use of connected municipal garbage cans, would you be more involved?

- Oui
- Non

22%

78%

And the results are pretty convincing, it enlights the fact that sustainable development is something that talks to the population : Everyone wants to act, with the means provided for them. Those means needs to be intuitive so he doesn't drastically change the user's lifestyle.

However, in a population that remains relatively small, it is clear that an innovation such as our Smart-Trash would push young people to become more involved in sustainable development than today, which is due for the most part to a lack of means.

ADVERTISING and HOW TO HAVE CUSTOMERS

The goal as a young startup is to have as many customers as possible quickly, there are several possibilities:

- telephone prospecting, mailing, phoning to contact customers directly at the source, and selected the most suitable customers to buy our product.

- advertising on networks, with the influence of social networks it is possible to have a greater visibility on the internet, more by using google AdWords or Facebook ads, our offer can appear directly in search engines. Moreover, our smart-trash offer is also usable for residences so indirectly to individuals.
While developing our business, we'll have to create our social networks so we can have visibility thanks to them and use those as our main communication resource.

A web site that presents our device is also important because we'll link it to our social networks and it will be the first thing people see when they search about us on the web.

The goal is also to have partnerships with the cities, to contact the townhalls so we can act together to focus the garbage collectors of each city and have full-time clients.

Or the "bouche à Oreille "which remains the most effective sales technique since it is directly the customer who praises our product, it is free and assured.

General analyze

the general vision will allow us to establish the strengths and weaknesses of our project so that we can focus our research and target the real needs, we made a

vision of a young startup (like smart-trash), with a SWOT matrix that is essential for any business.

STRENGTH	WEAKNESS
- Connaissance technologique - Connaissance tendances (jeune entreprise) - Aucune concurrence qui ressemble exactement au produit	- Manque d'expérience - En phase de test
OPPORTUNITY	THREAT
- Réseau - Viser plus de personne - Étendre notre programme - Assembler produit et logiciel	- Logiciel qui peut se hacker - Produit défaillant si la benne à une forme différente

Our weaknesses and threats are mainly dependant of the fact that this is still a first prototype. While evolving our product we'll design it more carefully, securitizing it so it becomes a product that we can sell to the companies and present to the investors.

Product Specification

As there are currently no real tools to identify the different type of wastes and sort it in a single machine, we decided to change some aspects of our project. In fact today it is complicated to sort the wastes simply by analyzing their composition (glass/ plastic/ cardboard), what exists today are devices that scan bar-codes and recognize products through them.

But there is no scanner that could recognize organic waste from recyclable waste (plastics, paper, etc.) or glass, especially since in our everyday waste, sometimes paper can be crumpled, a nibbled apple, a dented can... In short, the recognition being far too complex, we chose to remove the sorting part of our project, and finally to keep the idea of limiting garbage collection in businesses and residences.

Our current project would be to create a little device that would detect when a garbage can is filled, beyond a certain threshold, in order to send a signal to the garbage collectors so they know that they have to pick it up.

For detection in case of a full bin and sending a signal, we will need infrared obstacle detection sensors (because a bin being closed there is no light inside). We

plan to put 3 sensors, one on each side of the trash, so that the signal is sent only if the 3 sensors are triggered at the same time for a certain time, for two main reasons:

- so that the signal does not send each time an object passes in front of a sensor
- so that the signal does not send while the trash is filled by an object taking up a lot of space on one side of the bin but not completely filling the trash.

For sending a signal we will use a card using a sim card that can send text messages. We will therefore also have to provide a sim card. For the power supply we will use a medium size battery system (50,000 mAh) which should be largely sufficient. It will surely be necessary to provide cables, and various other adapters or resistors in order to realize an operational housing.

For the code/implementation part of our package we will use the latest version of Arduino (v1.8.8) and the different libraries it offers. In particular, we will need the GSM library included since version 1.0.4, for the GSM SHIELD card
.

We ordered an Arduino r3 kit containing about fifty pieces. The price is about 39 €. In the kit we used these parts:
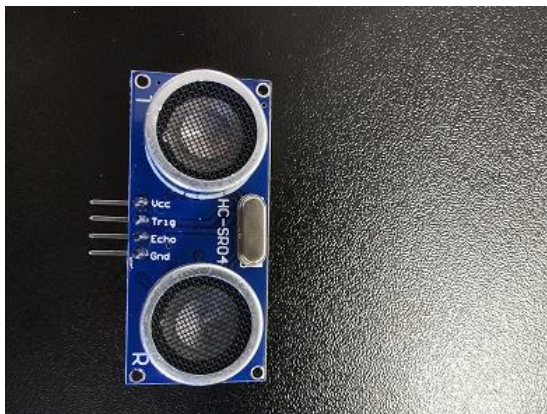

An ultrasonic distance sensor
We used this sensor to detect the presence of an object in front of the detector. Indeed, it is an ultrasonic sensor that can calculate a distance. The advantage of taking an ultrasonic sensor is that it can work even in the dark (which is the case in a trash). The calculated distance makes it possible to know if there is an object or not in front of the sensor, so if the trash is filled or not.
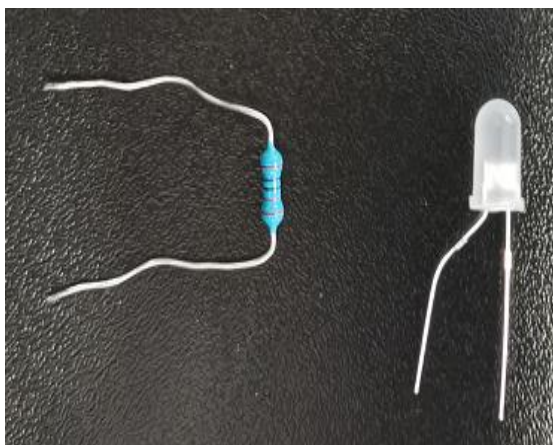
A resistance and a white LED
the resistor and the LED are used to know when the trash is full, the LED flashes when it is.
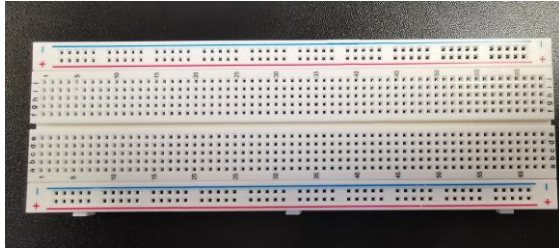
A test plate

The test plate is used to connect all the components. We used this test plate because for the moment the project is a beta and we did not do any welding.


Arduino UNO R3

The Arduino UNO R3 is the main component of our case, it is the one that allows to connect all our components and execute the code.

We also ordered a SIM 900 GPRS/GSM Shield that cost approximately 25€
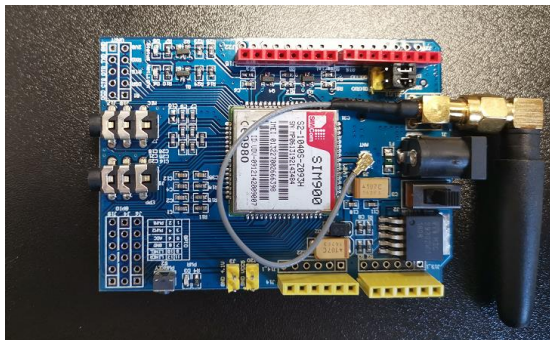
This component allows you to send and receive text messages or calls. We use it to send text message to garbage collectors once the garbage is full.

Here is our mounting for the Smart-Trash box, we did it with Fritzing Software that allow us to create our mounting:
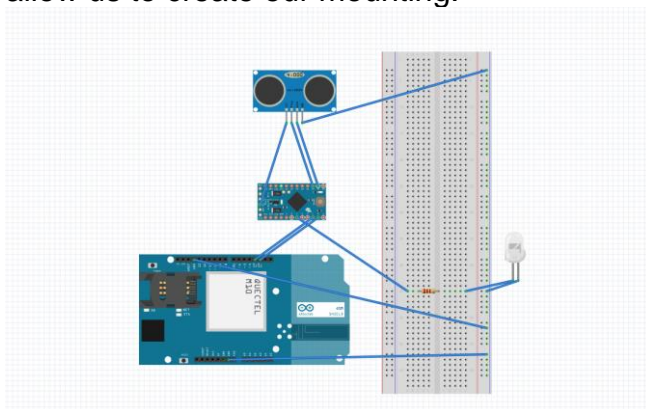
You can see on the next photo a screenshot of an example of a route management software for garbage collectors (Trash Mapper). We can imagine through this software that the vertices represent the bins (with full, or empty for value), the arcs represent the streets of the city (with the distance as value). This software was made with QT in C ++ but it's only a beta version of the software that could be implemented if our project works on a small scale.
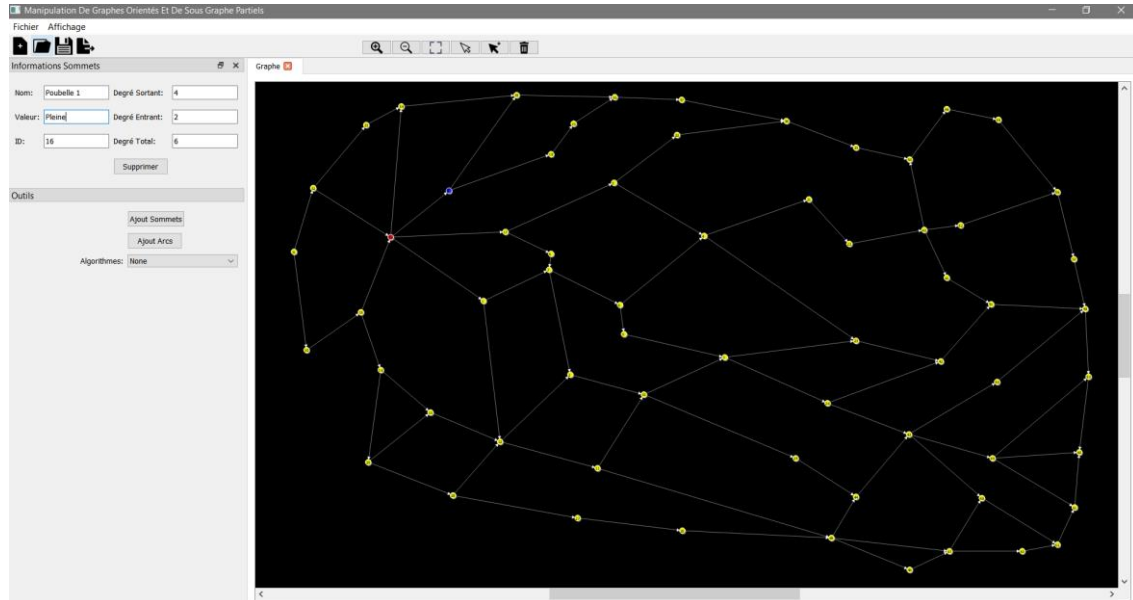
UML DIAGRAM

Use case diagram
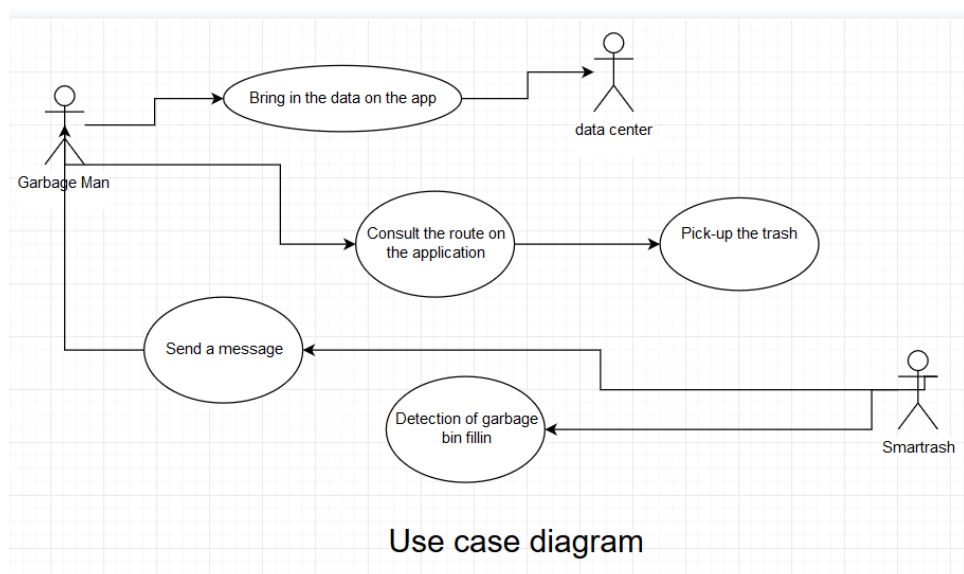
Code for the Arduino

```
#include "SR04.h"
#include <SoftwareSerial.h>

#define TRIG_PIN 12
#define ECHO_PIN 11
#define LED 4

SR04 sr04 = SR04(ECHO_PIN,TRIG_PIN);
SoftwareSerial SIM900(7, 8);

long a;
int i=0;
bool msgsent = false;

void setup() {
  //let the gsm connect to the network
    SIM900.begin(19200);
    delay(20000);

    Serial.begin(9600);
    pinMode(LED, OUTPUT);

    SIM900.print("AT+CMGF=1\r");
    delay(100);

    SIM900.print("AT+CNMI=2,2,0,0,0\r");
}


bool sendSMS() {
  //Set the phone number to send the message
  SIM900.println("AT+CMGS = \"+33630114200\"");
  delay(100);
```

```
    SIM900.println("Ce projet mérite un 20 !");
    delay(100);

    // End AT command with a ^Z, ASCII code 26
    SIM900.println((char)26);
    delay(100);
    SIM900.println();
    // Wait to give module time to send SMS
    delay(5000);
    return true;
}

char receivesms(){
    return SIM900.read();
}

void loop() {
    //Take the disctance from the sensor and display it
    a=sr04.Distance();
    Serial.print(a);
    Serial.println(" cm");


    char incoming_char=0;
    while(a < 15){
        //Make the LED flash
        digitalWrite(LED, HIGH);
        delay(500);
        digitalWrite(LED, LOW);
        delay(500);

        //i contain the number of second
        i++;
        incoming_char=0;
        a=sr04.Distance();

        a=sr04.Distance();
        Serial.print(i);
        Serial.println(" seconde");

        //If we wait more than 5 sec with an obstacle we send a SMS
        if(i >= 5 && msgsent == false){
            //Switch on the LED
            digitalWrite(LED, HIGH);
            //Send a sms
            msgsent = sendSMS();
            if(msgsent == true)
                Serial.println("Message envoyé !");
            digitalWrite(LED, LOW);
        }
    }
    i=0;
    digitalWrite(LED, LOW);
    delay(1000);
}
```

Division of the tasks and deadline

Here is the distribution of roles in our team:

Jean-François Lesage : Technical Authority
Etienne Wolf : Project manager

Louis-Pierre Kauffman : Business Developer
Thomas Paris : Marketing communication

- The month of January was dedicated to the implementation of the tasks of each, to find a group and to define the initial project with the right axes, it was not necessary to put it on the final schedule

People	Mi Février	Fin Février	Mi Mars	Fin Mars	Mi Avril
Louis-Pierre	Définition cahier charge + recherche produit	changement de projet – définition du besoin	Elaboration Produit +State of art	Test du rendu + rapport	Rendu livrable + vidéo
Etienne	State of art + recherche produit	changement projet – définition du besoin	Recherche élément (prix etc.)	Test du rendu + rapport	Rendu livrable + vidéo
Jean-François	Dev logiciel	Changement projet – recherche élément (prix)	Elaboration produit + Dev logiciel	Dev logiciel + mise en place circuit	Rendu livrable + vidéo
Thomas	Elaboration offre + state of art	Changement de projet – recherche élément (prix)	– analyse advertising + Élaboration produit	Test du rendu + rapport	Rendu livrable + vidéo

Conclusion

Our smart trash project taught us how to manage an innovative project from scratch, until it's done. It was essential to get organized and to establish the roles and tasks of everyone at the beginning of the process. Our progress has been slowed down because of a bad start, since from the very beginning we have targeted a project that cannot be done with our own resources. However, in the end we have a functional sensor with an efficient code and software that indicates the best way for the garbage collectors for example. It is also important to locate the needs and draw up specifications. Our goal is to complete the project in the future and add a database to assemble the software we have and the sensor. Make a uniform

software that would be connected to all sorting centers to simplify the handling of smart-trash and to optimize their displacement.

We also plan on connecting our device to a mobile application that could show the map presented on the software and the bins that have to be picked up in real time. This is something we haven't done because of a lack of time and resources, but for a future development it's an important aspect of our project. We can also think about the same thing on a web interface.

We enjoyed a lot working on this project, and it was a real interesting challenge to realize it.