




AN APPLICATION THAT SEPARATE RECYCLABLE MATERIALS

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- ▶ The aim of the project is to separate recyclable materials and to enable them to be controlled with a mobile application.
 - ▶ Recyclable materials react differently to some proximity sensors.
 - ▶ These differences can be analyzed and separated according to the results to be drawn.
 - ▶ Through the capacitive proximity sensor and inductive proximity sensor, metal, glass or plastic materials moving on a moving belt can be separated by their different responses.

SEPERATION OF RECYCABLE MATERIALS

- ▶ According to the data obtained by the literature review, in the separation of recyclable materials until today: magnetic separation, separation by barcode reading, object Separation by identification, separation by optical sensors, separation by sound waves and separation by inductive / capacitive sensors are seen.



- **The separation with inductive/capacitive sensors**

- -High accuracy
- -Not affected by noise

- **The separation with barcode reading system**

- - Fast work,
- -Detection with a single camera sensor
- - Describing only a specific brand's products
- - Not working if the barcode on the bottle is worn

- **The separation with optical sensors**

- - Identifying different objects,
- -High efficiency in standard bottles
- - Low yield in non-standard bottles
- - Packaging decreases efficiency

- **The separation with object identification**

- -High flexibility
- - Requires more processor load than other methods
- -A lot of photos need to be collected
- - It causes problems with transparent materials



- ▶ **The separation with sound waves**

- ▶ -High accuracy
- ▶ - Affected by noise
- ▶ -Precision device requirement
- ▶ -High cost

- ▶ **Magnetic separation system**

- ▶ - Suitable for large volumes of waste
- ▶ -High efficiency in separating metals
- ▶ -Cost and volume required for the system is high
- ▶ - Does not offer solutions for plastic, glass and cardboard separation

- ▶ In this project, a fully automatic machine with a production line that can be adapted to automat devices was designed based on the separation system with Inductive / Enclosed Sensors.
- ▶ *What is expected from the system is to classify the incoming recyclable materials according to their raw materials and direct them to the correct box.*
- ▶ *Then, the entry is recorded in the database, and these entries can be controlled with a mobile application.*

- In this direction, recyclable materials are separated by using Arduino physical programming card.
- While the machine is designed, the results of the sensors that ensure the acquisition of data while separating are shown in Table 1 .

Raw Material / Sensor	Inductive Sensor Result	Capacitive Sensor Result
Glass	No	Yes
Metal	Yes	Yes/No
Plastic	No	No

- When the capacitive and inductive sensors detect, the red light on them turns on. Figure 1 shows the reaction of the inductive sensor to a material whose raw material is glass.



Fig. 1. Response of capacitive sensor to glass material

- ▶ Figure 2 shows the reaction of the capacitive sensor to a material whose raw material is glass.



Fig. 2. Response of inductive sensor to glass material

- ▶ Figure 3 shows the reaction of the inductive sensor to a material whose raw material is metal.

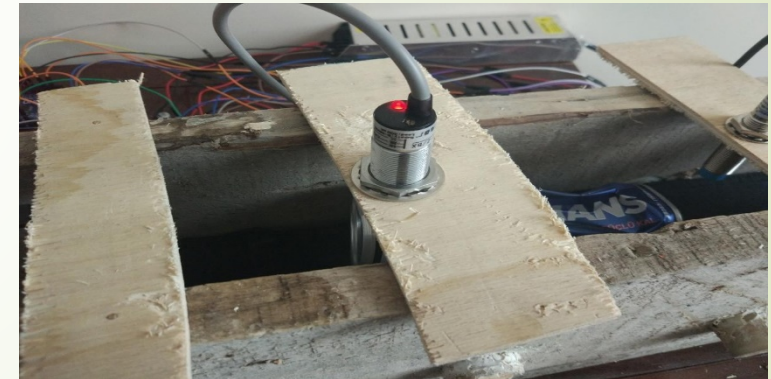


Fig. 3. Response of capacitive sensor to metal material

- ▶ Figure 4 shows the reaction of a capacitive sensor to a material whose raw material is metal.

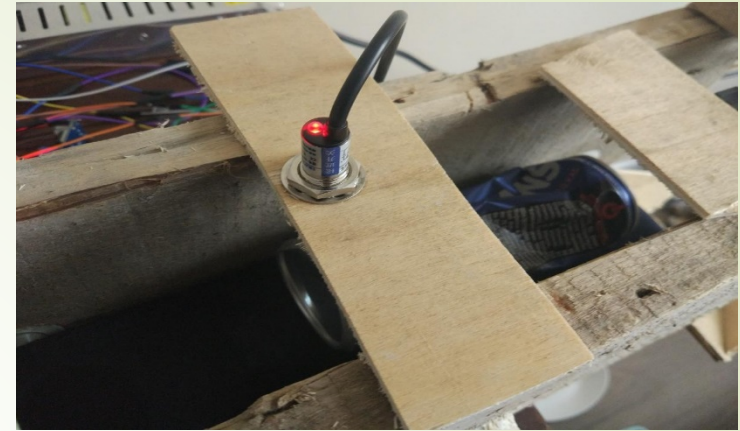


Fig. 4. Response of inductive sensor to metal material

- ▶ Figure 5 shows the reaction of the inductive sensor to a material whose raw material is plastic.



Fig. 5. Response of capacitive sensor to plastic material

- ▶ Figure 6 shows the reaction of a capacitive sensor to a material whose raw material is plastic.



Fig. 6. Response of inductive sensor to plastic material

- ▶ In Figure 7, the state of the system after it is started is shown.



Fig. 7. Android application