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RIGA TECHNICAL UNIVERSITY

Faculty of Computer Science, Information Technology and Energy

Report Final Project

Study course "Applied System Software"

Team number: ????

Project/code link: https://github.com/arthurlcp/Aldwar

2024/2025 academic year

1. Requirements/Analysis

Project Context and Problem Identification

We are a team of three students working on a project called **MELEC Software**, aimed at supporting electricians in managing materials used on construction sites. Currently, electricians rely on paper records, Excel spreadsheets, or other manual systems to track materials and components. This method is prone to errors, time-consuming, and not optimal for long-term record keeping or updates.

Identified Needs

To better understand the field context, we contacted the owner of an electrical company. He confirmed that although some general-purpose project management or inventory tools exist, none are tailored specifically for the day-to-day material tracking and circuit documentation that electricians require. The key need expressed was a **simple, dedicated software solution** that allows:

- Easy input and storage of materials per site.
- Quick access to stored data for future repairs or inspections.
- A way to design and save circuit diagrams linked to those materials.

Project Scope and Objectives

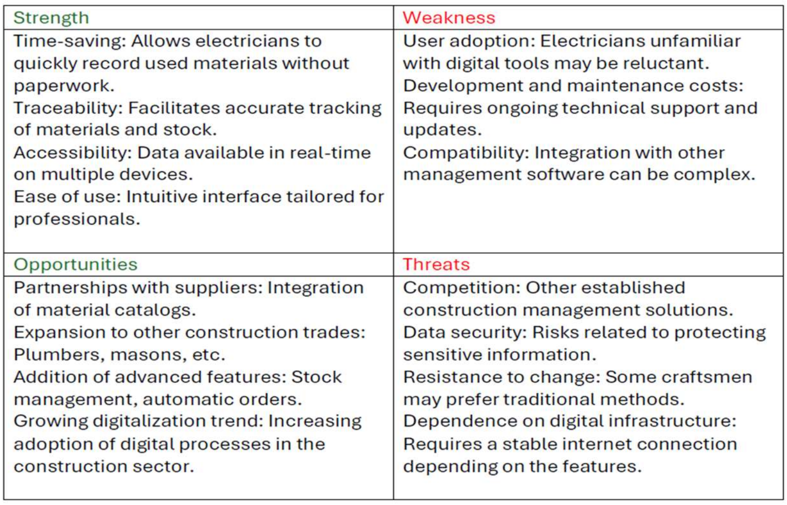
The MELEC software aims to provide:

- A centralized interface for recording materials used on each site.
- A feature to build, store, and retrieve editable circuit plans.
- Export capabilities for archiving and printing (e.g., PDF format).

Feasibility and Constraints

- We chose **Python** due to its flexibility, rich ecosystem of libraries, and our familiarity with the language.
- A **web-based solution** was initially considered but dismissed due to the need for offline and private access.
- Scalability and future updates are considered important, so the architecture is designed with modularity in mind.

SWOT ANALYSIS



Strength	Weakness
Time-saving: Allows electricians to quickly record used materials without paperwork. Traceability: Facilitates accurate tracking of materials and stock. Accessibility: Data available in real-time on multiple devices. Ease of use: Intuitive interface tailored for professionals.	User adoption: Electricians unfamiliar with digital tools may be reluctant. Development and maintenance costs: Requires ongoing technical support and updates. Compatibility: Integration with other management software can be complex.
Opportunities	Threats
Partnerships with suppliers: Integration of material catalogs. Expansion to other construction trades: Plumbers, masons, etc. Addition of advanced features: Stock management, automatic orders. Growing digitalization trend: Increasing adoption of digital processes in the construction sector.	Competition: Other established construction management solutions. Data security: Risks related to protecting sensitive information. Resistance to change: Some craftsmen may prefer traditional methods. Dependence on digital infrastructure: Requires a stable internet connection depending on the features.

2. Journal (W2)

In those first two weeks, we started by drawing up a plan of what we had to do over the duration of the whole project. We also established our project and software requirements and made a 1-month development plan. As there are 3 of us, we each assigned a task. Two people have to start coding and do the basics (file architecture, programming language, etc.). Another will start on the design.

3. Software Requirements

Functional Requirements

The MELEC software must include the following core functionalities:

1. **Material Logging**
   - Users must be able to add, update, and delete materials used on a given construction site.
   - Each material should be associated with a site and have a name, reference code, and quantity.
2. **Circuit Plan Builder**
   - Users can create and visually build simple electrical circuits.
   - Plans can be linked to specific material lists.
   - The circuit editor must allow editing and saving of plans.
3. **Plan Storage and Export**
   - Circuit plans must be stored in an editable format.
   - Users must be able to export plans to PDF for printing or sharing.
4. **Site-Based Material Tracking**
   - The system should organize data by construction site.
   - Users should be able to search and filter material usage by site.
5. **User Interface**
   - The software must offer a clear and intuitive UI, even if aesthetics are not a primary concern.

Non-Functional Requirements

- **Performance**: The application should remain responsive even with a growing number of materials or sites.
- **Portability**: The software should run on standard Windows systems.
- **Scalability**: New materials, components, or plan types should be easily added in future versions.
- **Usability**: The interface should be simple enough for non-technical users (electricians) to use with minimal training.
- **Data Privacy**: All data should be stored locally to avoid security or confidentiality risks.

Technological Choices

- **Language**: Python.
- **Database**: SQLite (or another lightweight SQL database) for easy integration and local storage.
- **Editable Formats**: Potential use of a custom file extension or JSON/XML for storing editable plans.

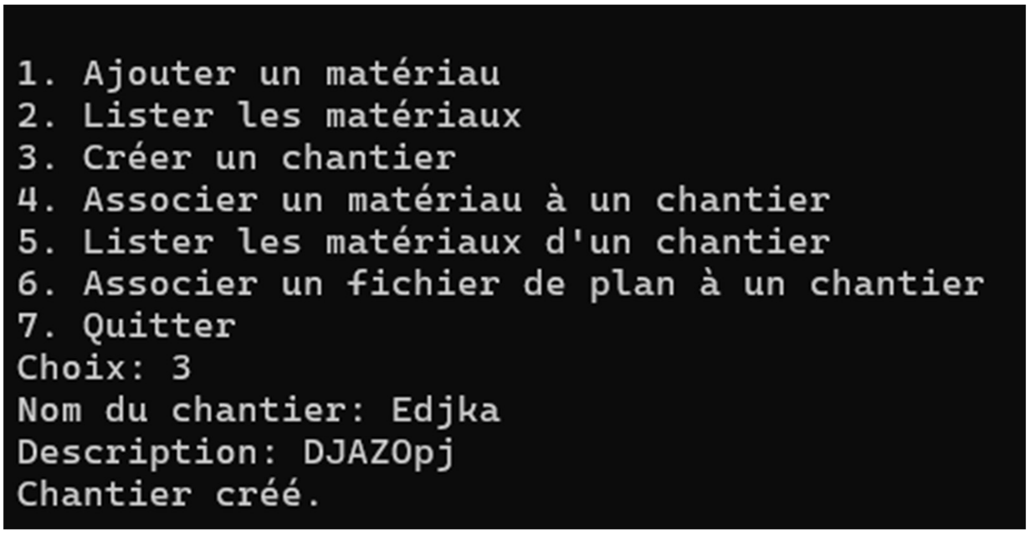
5.Journal (W4)

In week 4, we implemented the first database functions and built the basic interface layout using Tkinter. We also created our initial black-box test cases to check the core functions. Finally, we reviewed the interface to make it easier for users.

6. Black-box Test Cases

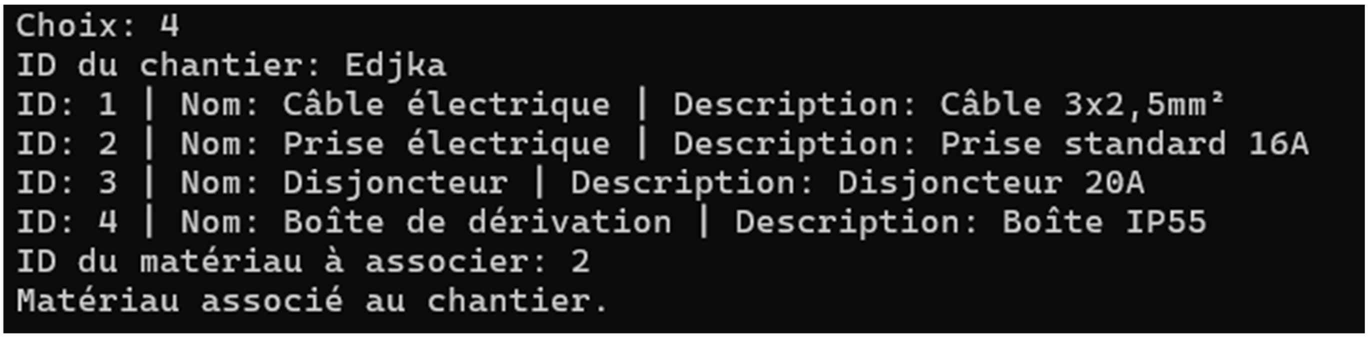
Test ID	Description	Input	Output	Test
TC001	Add Construction Site	Choice « 3 », Name « Edjka », Description « DJAZOpj »	Chantier crée.	Done
TC002	Add material to a Site	Choice « 4 », ID site « Edjka », ID material « 2 »	Matériau associé au chantier	Done
TC003	See all materials available	Choice « 2 »	All materials	Done
TC004	List all materials on a Site	Choice « 5 », ID Site « Edjka »,	Matériaux du chantier :	
TC005				

Test 1



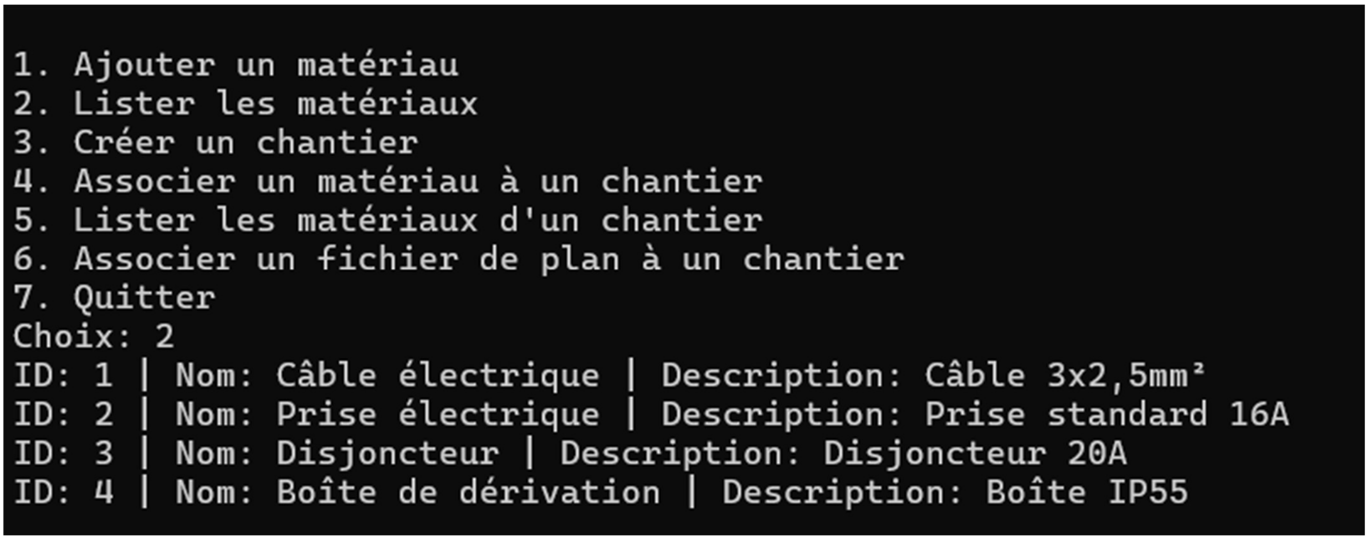
```
1. Ajouter un matériau
2. Lister les matériaux
3. Créer un chantier
4. Associer un matériau à un chantier
5. Lister les matériaux d'un chantier
6. Associer un fichier de plan à un chantier
7. Quitter
Choix: 3
Nom du chantier: Edjka
Description: DJAZOpj
Chantier créé.
```

Test 2



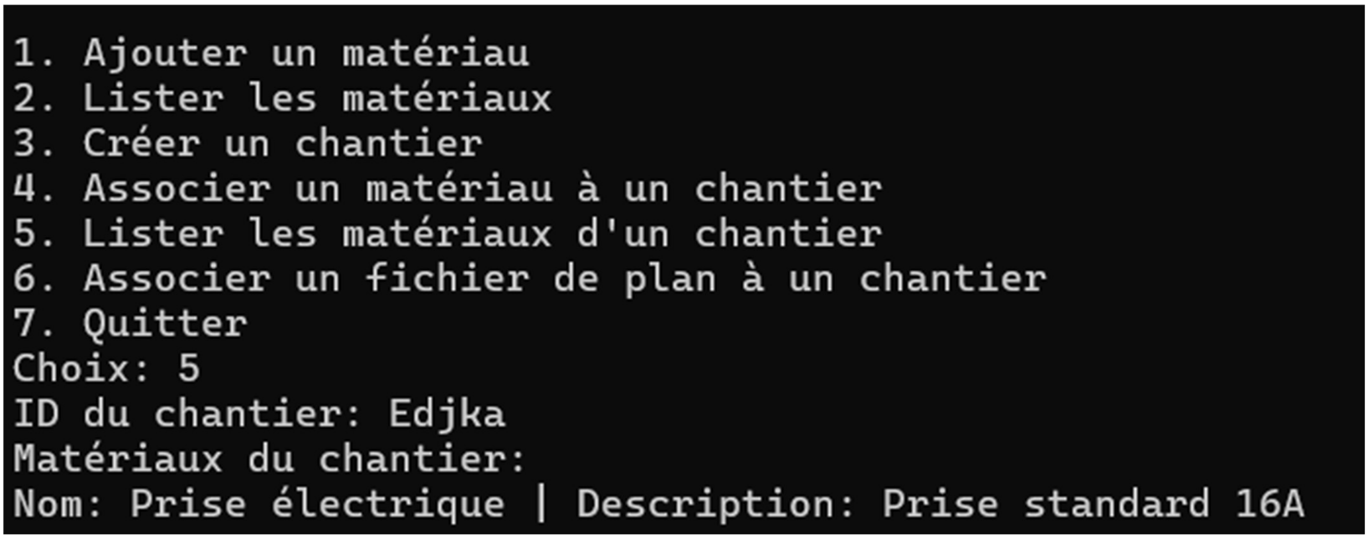
```
Choix: 4
ID du chantier: Edjka
ID: 1 | Nom: Câble électrique | Description: Câble 3x2,5mm²
ID: 2 | Nom: Prise électrique | Description: Prise standard 16A
ID: 3 | Nom: Disjoncteur | Description: Disjoncteur 20A
ID: 4 | Nom: Boîte de dérivation | Description: Boîte IP55
ID du matériau à associer: 2
Matériau associé au chantier.
```

Test 3



```
1. Ajouter un matériau
2. Lister les matériaux
3. Créer un chantier
4. Associer un matériau à un chantier
5. Lister les matériaux d'un chantier
6. Associer un fichier de plan à un chantier
7. Quitter
Choix: 2
ID: 1 | Nom: Câble électrique | Description: Câble 3x2,5mm²
ID: 2 | Nom: Prise électrique | Description: Prise standard 16A
ID: 3 | Nom: Disjoncteur | Description: Disjoncteur 20A
ID: 4 | Nom: Boîte de dérivation | Description: Boîte IP55
```

Test 4

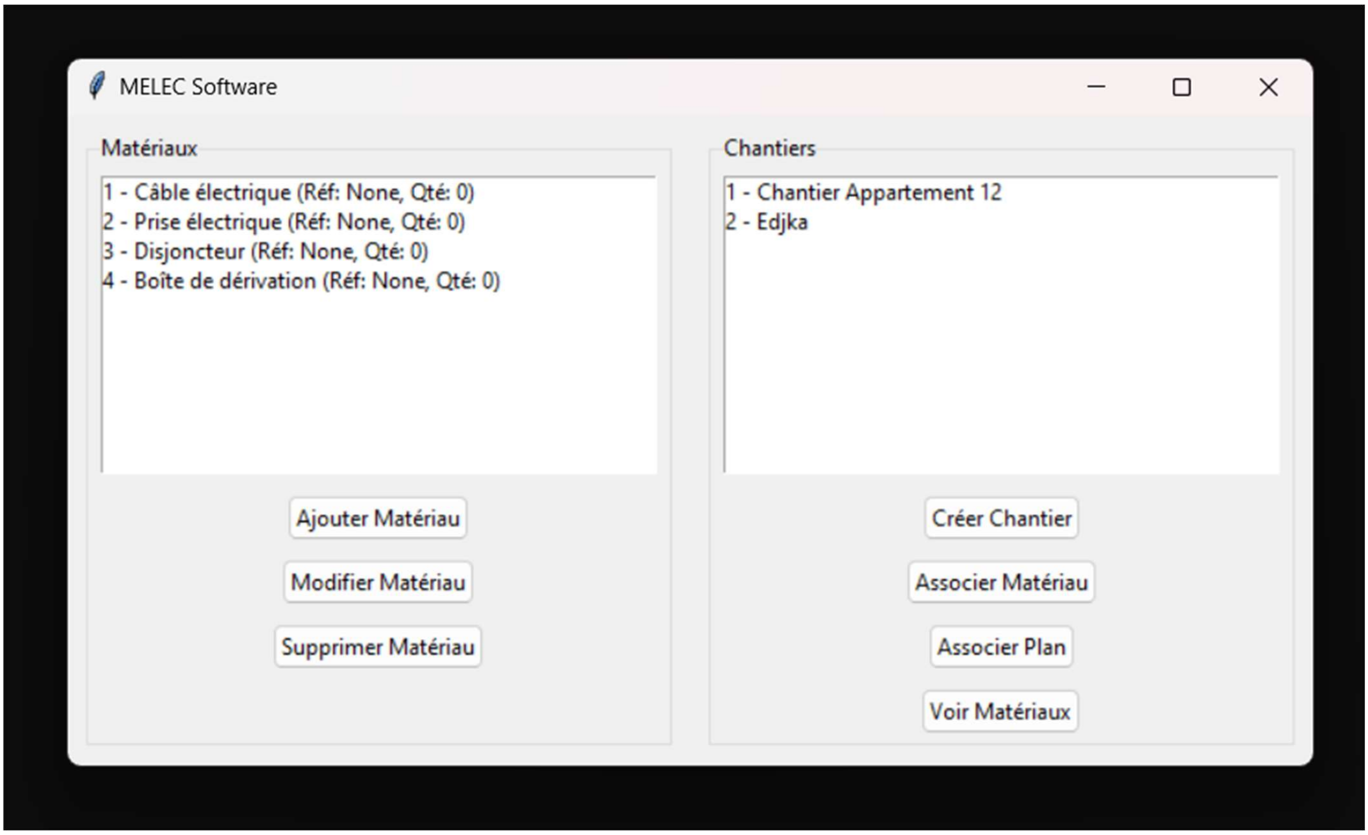


```
1. Ajouter un matériau
2. Lister les matériaux
3. Créer un chantier
4. Associer un matériau à un chantier
5. Lister les matériaux d'un chantier
6. Associer un fichier de plan à un chantier
7. Quitter
Choix: 5
ID du chantier: Edjka
Matériaux du chantier:
Nom: Prise électrique | Description: Prise standard 16A
```

7. Design

For the design of the software we wanted to make something efficient, that can be used in the field or even in the office. The site is honestly not designed to look good, but to be fun, informative and clear, rather than having multiple buttons that would restrict clarity.

Start Screen



MELEC Software

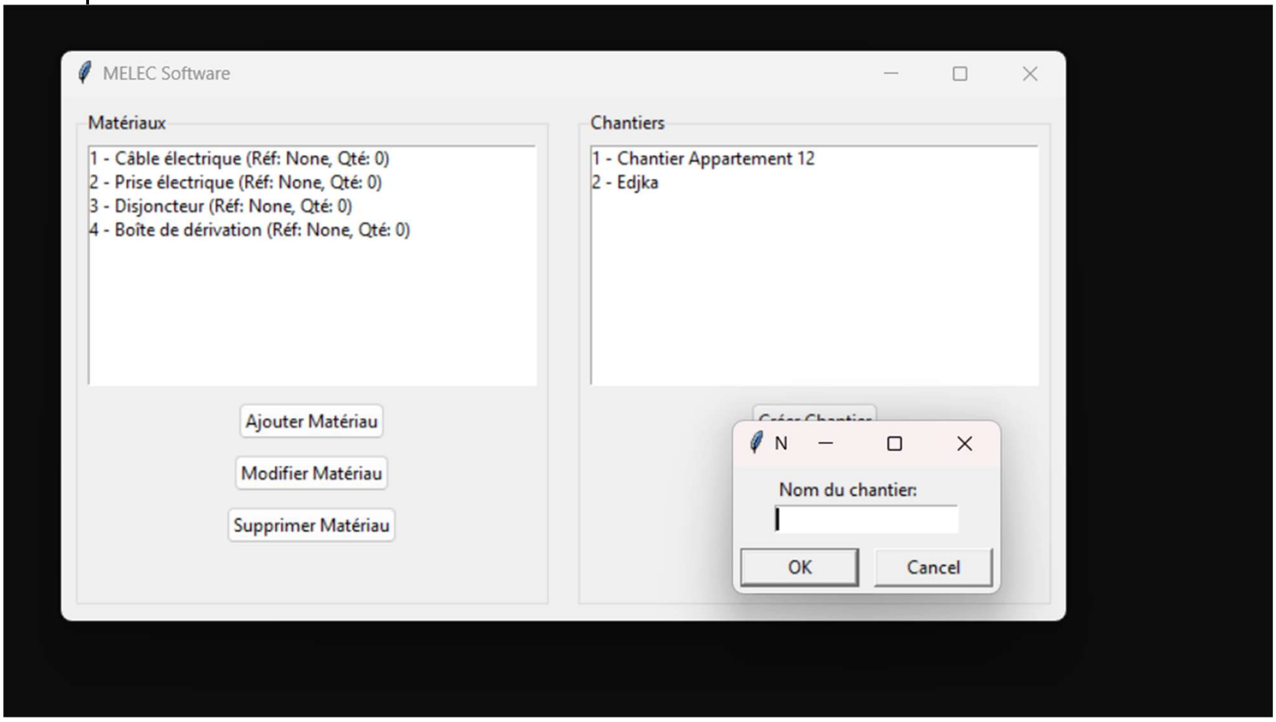
Matériaux

1 - Câble électrique (Réf: None, Qté: 0)
2 - Prise électrique (Réf: None, Qté: 0)
3 - Disjoncteur (Réf: None, Qté: 0)
4 - Boîte de dérivation (Réf: None, Qté: 0)

Chantiers

1 - Chantier Appartement 12
2 - Edjka

Set Up of a construction site screen



MELEC Software

Matériaux

1 - Câble électrique (Réf: None, Qté: 0)
2 - Prise électrique (Réf: None, Qté: 0)
3 - Disjoncteur (Réf: None, Qté: 0)
4 - Boîte de dérivation (Réf: None, Qté: 0)

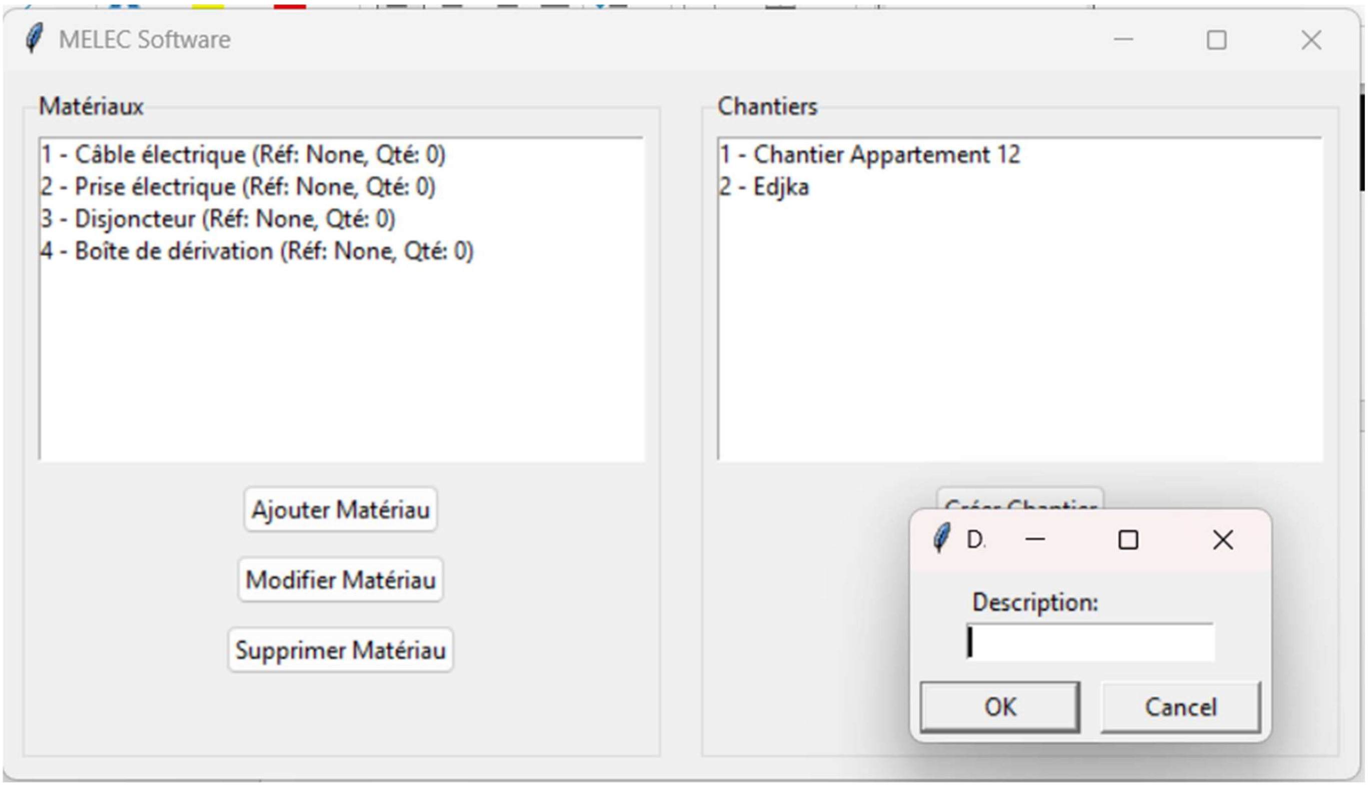
Chantiers

1 - Chantier Appartement 12
2 - Edjka

N

Nom du chantier:

Software ask for description of the site



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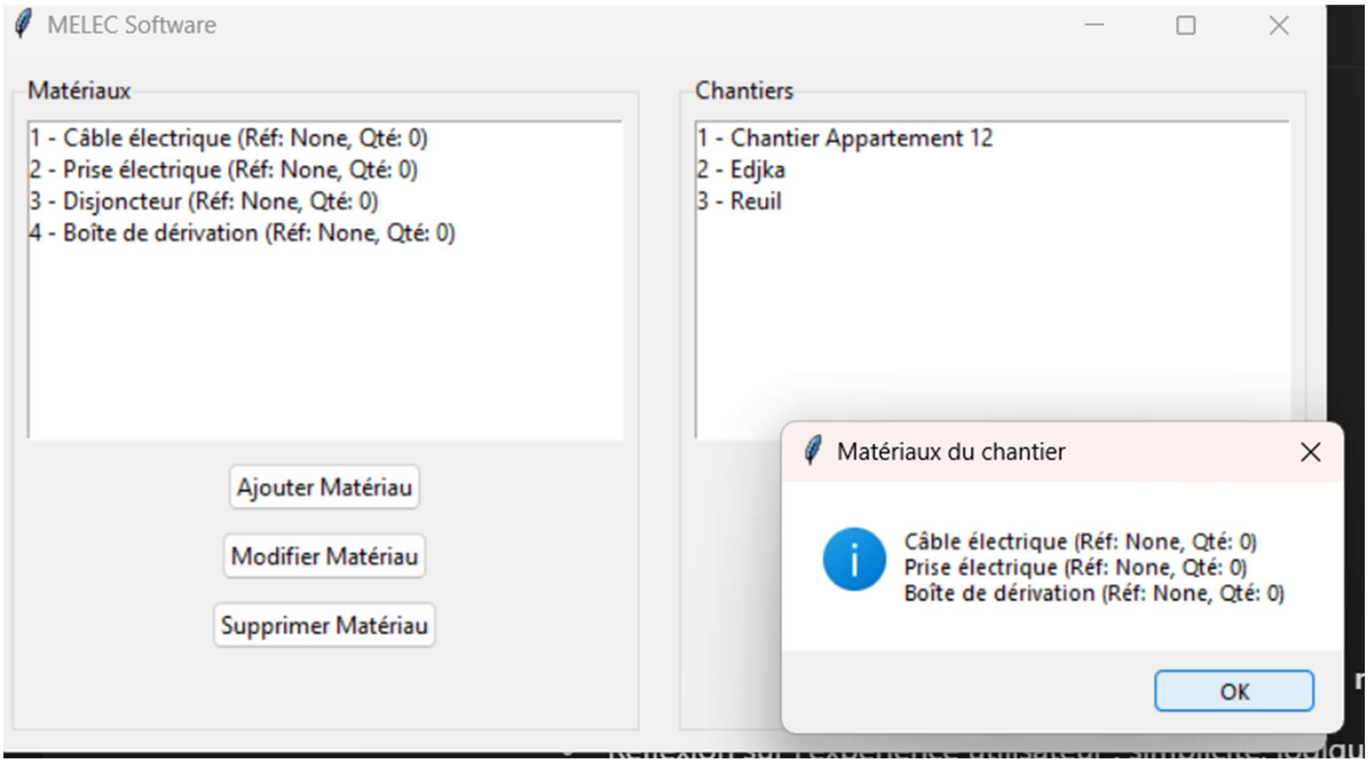
2 - Prise électrique (Réf: None, Qté: 0)
3 - Disjoncteur (Réf: None, Qté: 0)
4 - Boîte de dérivation (Réf: None, Qté: 0)

1 - Chantier Appartement 12
2 - Edjka

Description:

How you can see all materials available



1 - Câble électrique (Réf: None, Qté: 0)
2 - Prise électrique (Réf: None, Qté: 0)
3 - Disjoncteur (Réf: None, Qté: 0)
4 - Boîte de dérivation (Réf: None, Qté: 0)

1 - Chantier Appartement 12
2 - Edjka
3 - Reuil

Câble électrique (Réf: None, Qté: 0)
Prise électrique (Réf: None, Qté: 0)
Boîte de dérivation (Réf: None, Qté: 0)

8. Journal (W6)

In week 6, we finalized the interface structure and improved the database interaction. We also added more black-box test cases and prepared simple diagrams of the interface layout and database tables.

9. Software Design

The application is built with a **modular architecture**, structured into three main layers:

- **User Interface (UI)**: Developed with Tkinter, it allows users to interact with the system through menus, input dialogs, and message boxes.
- **Application Logic**: Contains the core functionality for managing materials, construction sites, and associated plan files, coordinating directly with the database.
- **Database**: A SQLite database is used for persistent storage of materials, construction sites, and their associations.

The application is designed to be **standalone and offline**, requiring no internet connection or external server. So it can be used for example in a construction site.

File organisation :

Our File structure is organized in four parts

File	Role
main_console.py	Console interface to test and validate core functionality
gui_app.py	Graphical user interface (Tkinter) for end users
materiaux.db	SQLite database file
plans/	Directory used to store uploaded plan files

DATABASE :

```
TABLE materiaux (
   id INTEGER PRIMARY KEY AUTOINCREMENT,
   nom TEXT NOT NULL,
   reference TEXT,
   quantite INTEGER,
   description TEXT
);

TABLE chantiers (
   id INTEGER PRIMARY KEY AUTOINCREMENT,
   nom TEXT NOT NULL,
   description TEXT,
   plan_path TEXT
);

TABLE chantier_materiaux (
   chantier_id INTEGER,
   materiau_id INTEGER,
   FOREIGN KEY (chantier_id) REFERENCES chantiers(id),
   FOREIGN KEY (materiau_id) REFERENCES materiaux(id)
);
```

UI Components :

The graphical interface is divided into two main sections:

a) Materials Section:

- Add, update, and delete materials
- List displayed using a Listbox with name, reference, and quantity
- Input handled through simpledialog pop-ups

b) Construction Sites Section:

- Create new construction sites
- Link selected materials to a site
- Attach a plan file (automatically stored in /plans)
- Display materials associated with a specific site

10. Implementation

To implement our software we used several technologies directly linked to the python programming language, which saved us time and enabled us to make a solid software package that doesn't depend on several systems and is therefore somehow more independent, especially when the user is on a building site and can't afford to have software problems on top of potential real-life problems.

Technologies :

- Python 3.x – main programming language
- Tkinter – for the graphical user interface (GUI)
- SQLite3 – lightweight embedded database
- OS, shutil modules – for file and directory operations

These technologies were chosen for their simplicity, portability, and native Python support, allowing the application to run without external dependencies.

The implementation is divided into two main entry points:

- main_console.py: used during early development and testing, provides a CLI to interact with the database and features.
- gui_app.py: full-featured GUI version designed for end-users.

The program starts by initializing the GUI through a Tk() root object and launching the MELECApp class, which handles all UI events and logic.

4.3. Key Functionalities Implemented

a) Material Management

- Add, update, and delete materials
- Store additional metadata: reference code, quantity, description
- GUI updates in real time using Listbox and refresh functions

b) Construction Site Management

- Create new construction sites
- Associate multiple materials to a site (many-to-many relationship)
- List materials linked to a specific site

Structure overview :

The main implementation class MELECApp contains methods grouped by feature:

Feature Area	Methods
Materials	ajouter_materiau, modifier_materiau, supprimer_materiau, load_materiaux
Construction Sites	ajouter_chantier, load_chantiers, associer_materiau, voir_materiaux_chantier
Plan Management	associer_plan

All database connections are opened and closed within each method, ensuring data safety and avoiding concurrency issues.

Limitations we know about our software :

- No undo functionality after deletion
- No user authentication or multi-user support
- File paths are stored as-is (no validation of file type or naming)

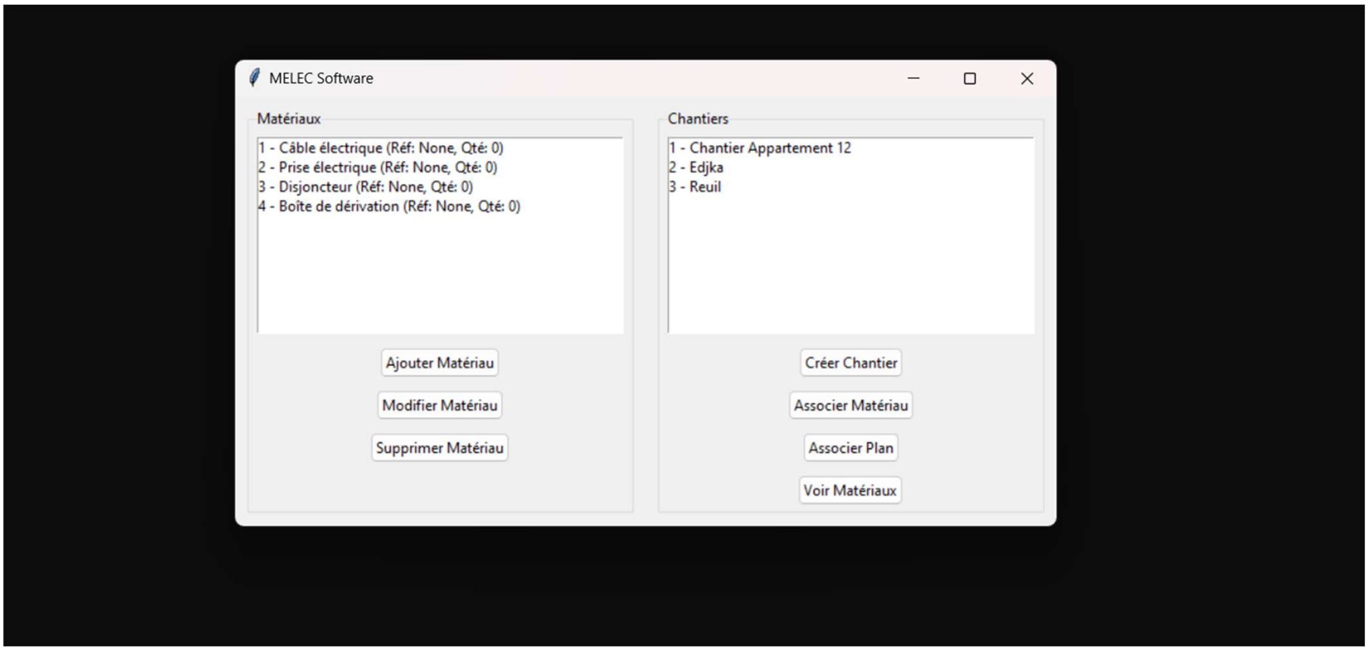
These limitations were accepted for a local single-user prototype and a student project, but they could be addressed in future versions.

11. Journal (W8)

In week 8, we completed most of the implementation: materials can be added, listed, and stored in the database. We also fixed some bugs, like input validation for the quantity field, and discussed the final adjustments for testing.

12. Testing

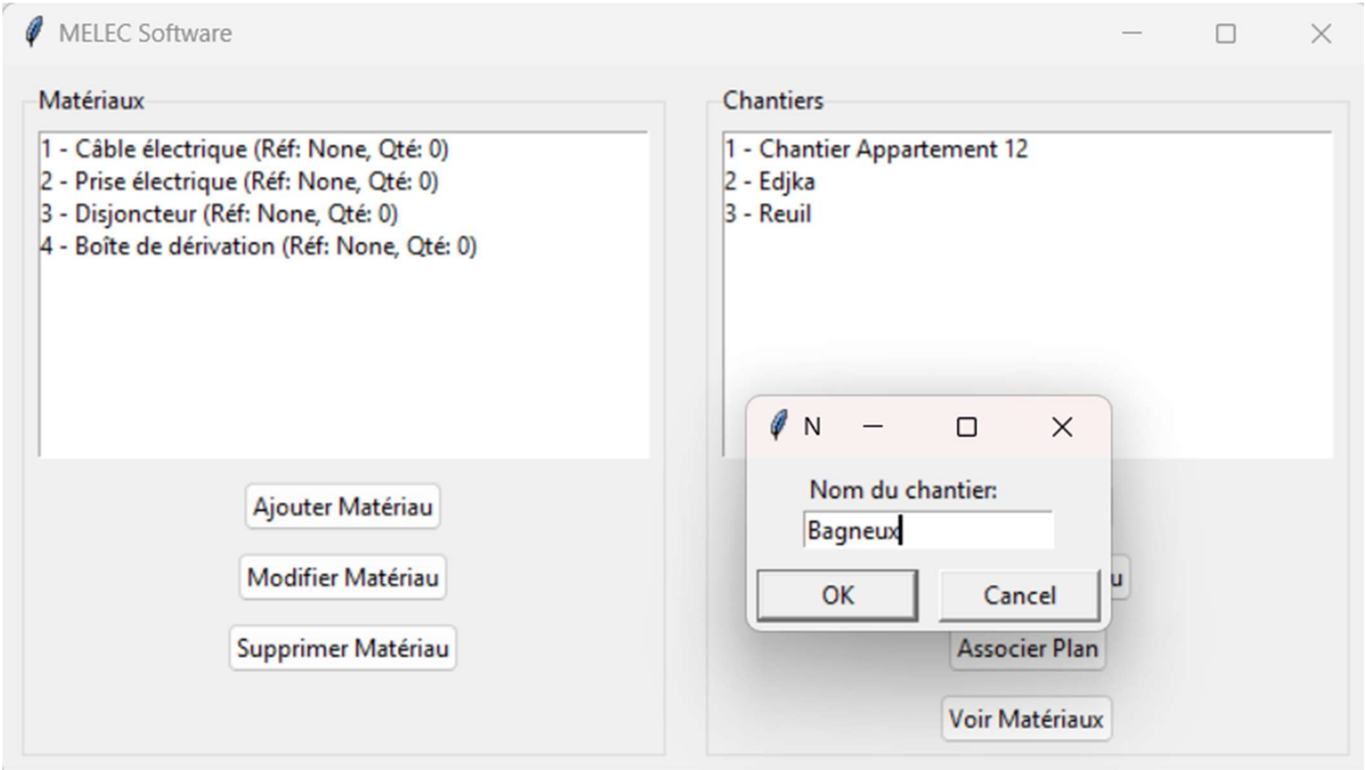
Start screen of the software



1 - Câble électrique (Réf: None, Qté: 0)
2 - Prise électrique (Réf: None, Qté: 0)
3 - Disjoncteur (Réf: None, Qté: 0)
4 - Boîte de dérivation (Réf: None, Qté: 0)

1 - Chantier Appartement 12
2 - Edjka
3 - Reuil

Select button « Ajouter un chantier » and put a name of a construction site :

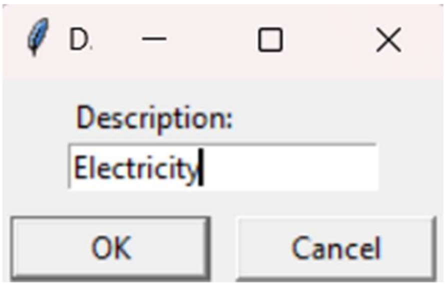


1 - Câble électrique (Réf: None, Qté: 0)
2 - Prise électrique (Réf: None, Qté: 0)
3 - Disjoncteur (Réf: None, Qté: 0)
4 - Boîte de dérivation (Réf: None, Qté: 0)

1 - Chantier Appartement 12
2 - Edjka
3 - Reuil

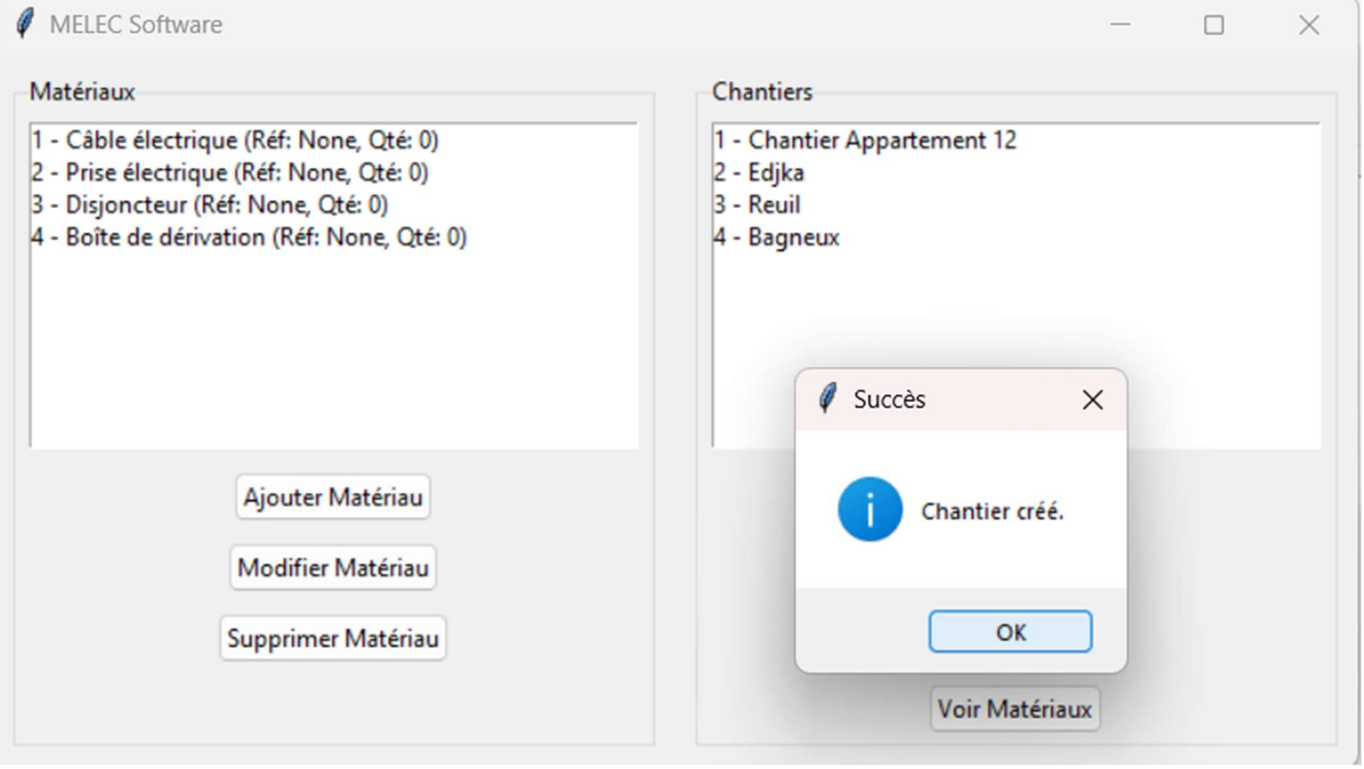
Nom du chantier: Bagneux

Description :



Description:
Electricity

And you create a new construction site :



Matériaux

1 - Câble électrique (Réf: None, Qté: 0)
2 - Prise électrique (Réf: None, Qté: 0)
3 - Disjoncteur (Réf: None, Qté: 0)
4 - Boîte de dérivation (Réf: None, Qté: 0)

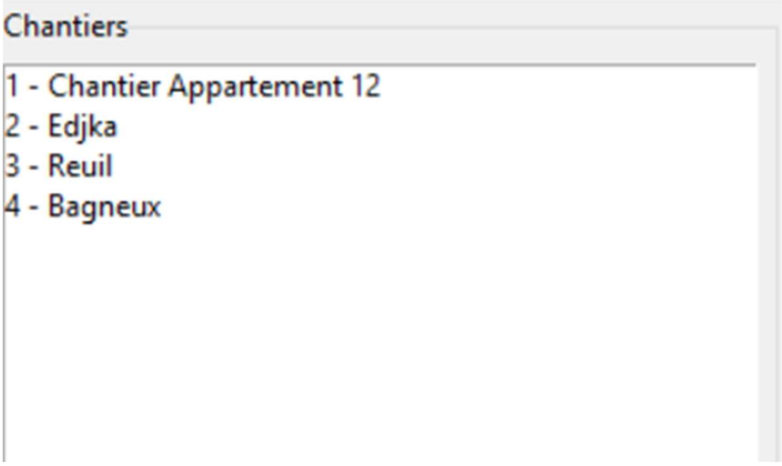
Chantiers

1 - Chantier Appartement 12
2 - Edjka
3 - Reuil
4 - Bagneux

Succès

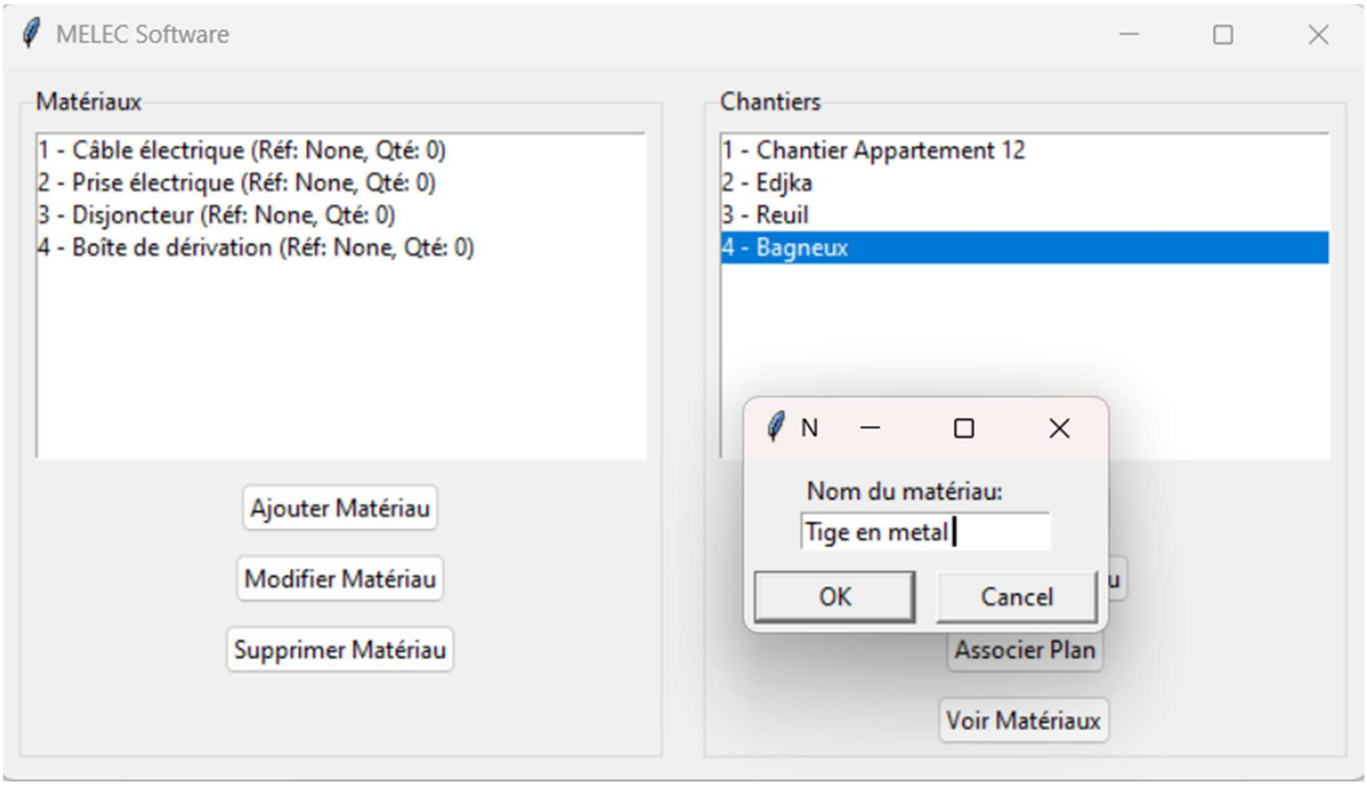
Chantier créé.

You can see that the new construction site is here :


Chantiers

1 - Chantier Appartement 12
2 - Edjka
3 - Reuil
4 - Bagneux

Here it is the window to add a new materials at the list :



MELEC Software

Matériaux

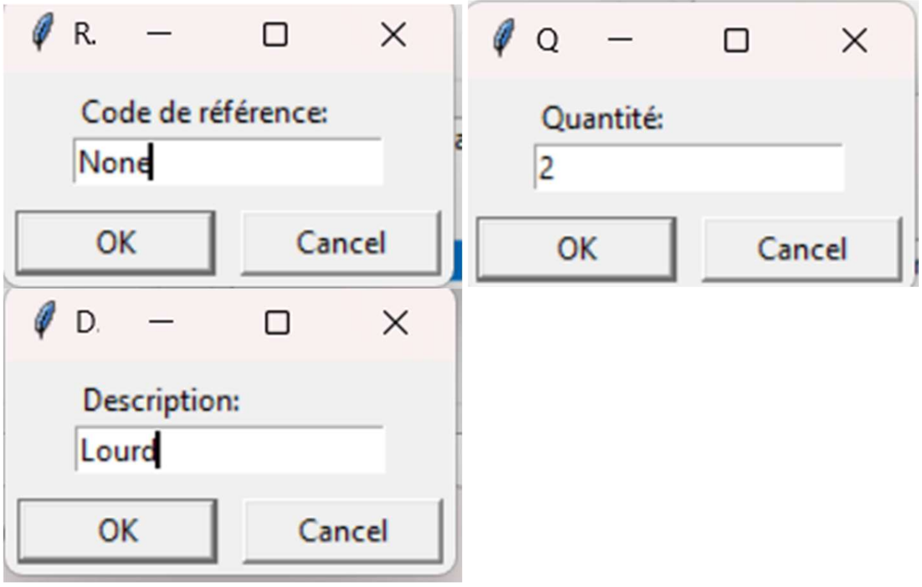
1 - Câble électrique (Réf: None, Qté: 0)
2 - Prise électrique (Réf: None, Qté: 0)
3 - Disjoncteur (Réf: None, Qté: 0)
4 - Boîte de dérivation (Réf: None, Qté: 0)

Chantiers

1 - Chantier Appartement 12
2 - Edjka
3 - Reuil
4 - Bagneux

Nom du matériau: Tige en metal

All needs for materials (Ref, Quantity, Description)

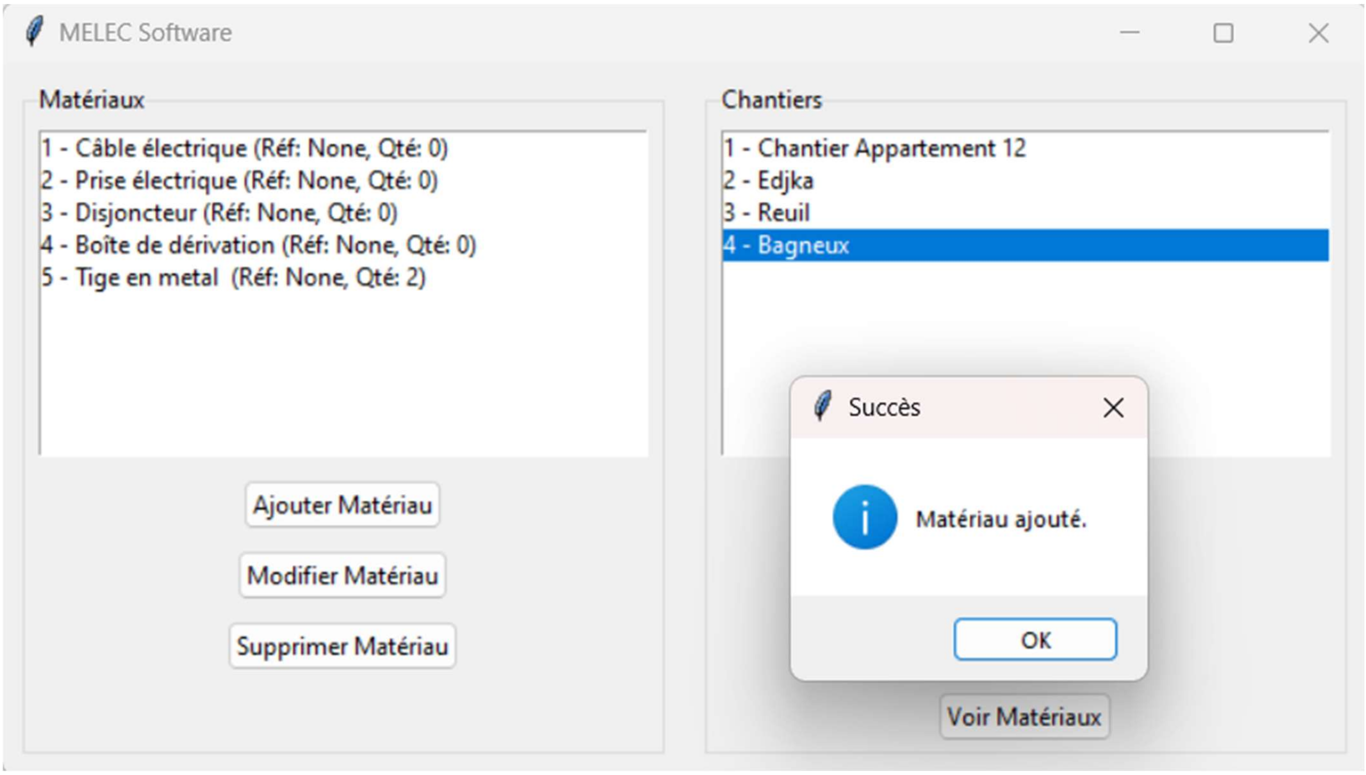


Code de référence: None

Quantité: 2

Description: Lourd

The new material is added



Matériaux

1 - Câble électrique (Réf: None, Qté: 0)
2 - Prise électrique (Réf: None, Qté: 0)
3 - Disjoncteur (Réf: None, Qté: 0)
4 - Boîte de dérivation (Réf: None, Qté: 0)
5 - Tige en metal (Réf: None, Qté: 2)

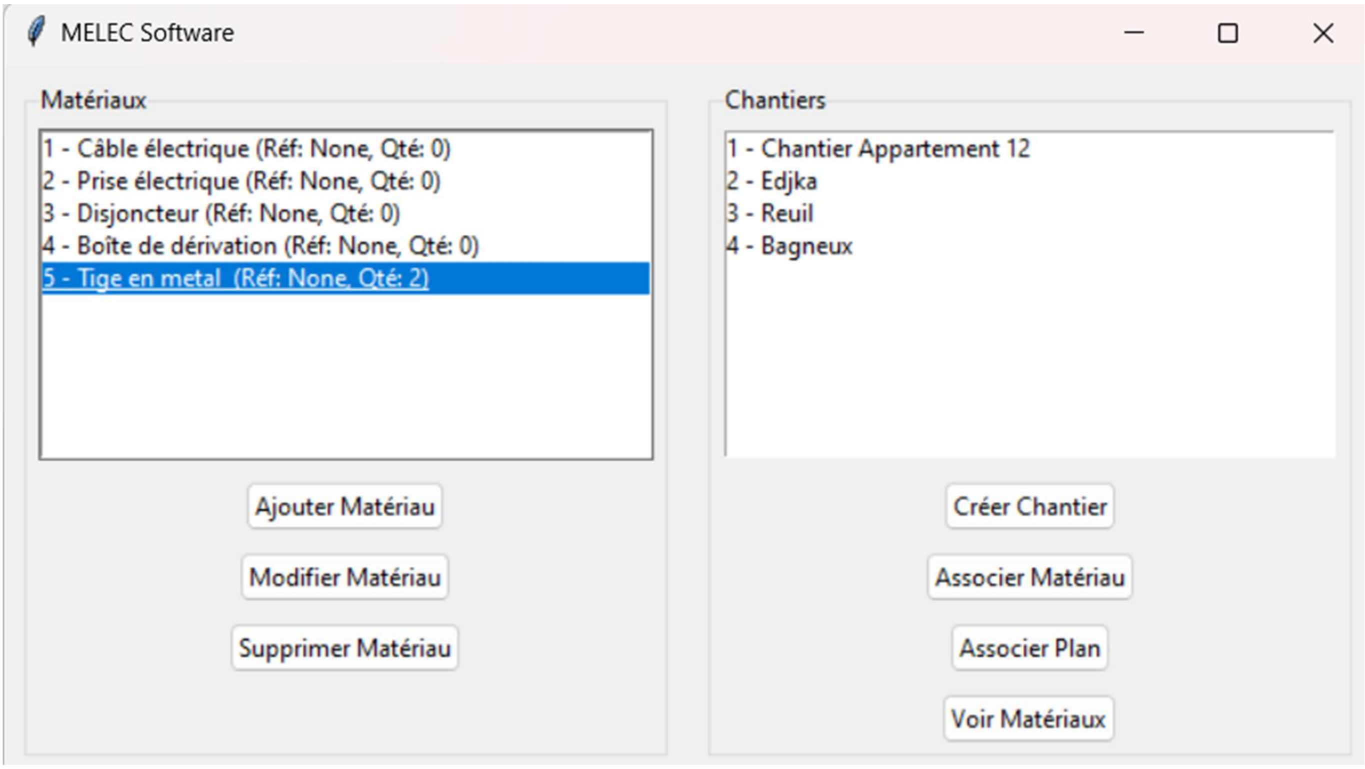
Chantiers

1 - Chantier Appartement 12
2 - Edjka
3 - Reuil
4 - Bagneux

Succès

Matériau ajouté.

You can also select a material in the list :



```
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2 - Prise électrique (Réf: None, Qté: 0)
3 - Disjoncteur (Réf: None, Qté: 0)
4 - Boîte de dérivation (Réf: None, Qté: 0)
5 - Tige en metal  (Réf: None, Qté: 2)
```
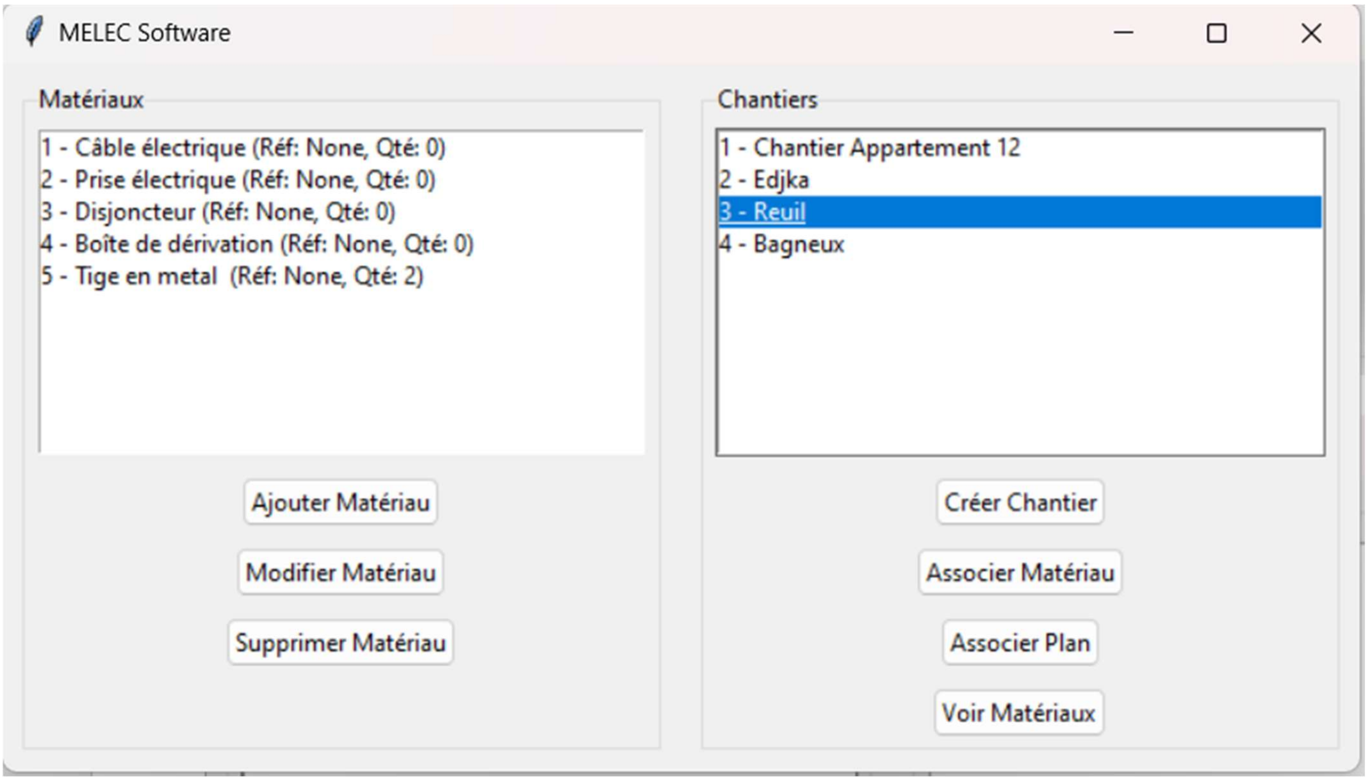

```
1 - Chantier Appartement 12
2 - Edjka
3 - Reuil
4 - Bagneux
```

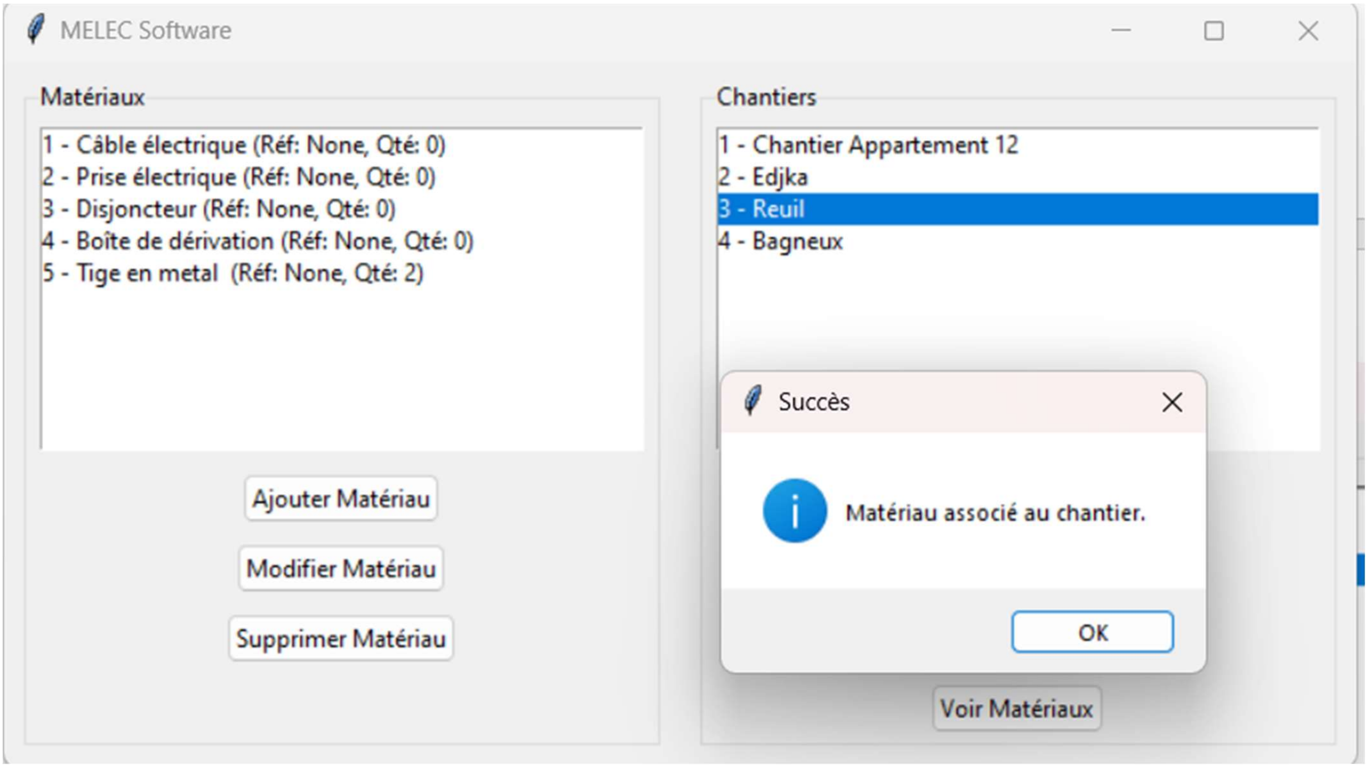
After select a construction site in the list :



1 - Câble électrique (Réf: None, Qté: 0)
2 - Prise électrique (Réf: None, Qté: 0)
3 - Disjoncteur (Réf: None, Qté: 0)
4 - Boîte de dérivation (Réf: None, Qté: 0)
5 - Tige en metal (Réf: None, Qté: 2)

1 - Chantier Appartement 12
2 - Edjka
3 - Reuil
4 - Bagneux

And press the button « ajouter le matériau au chantier »

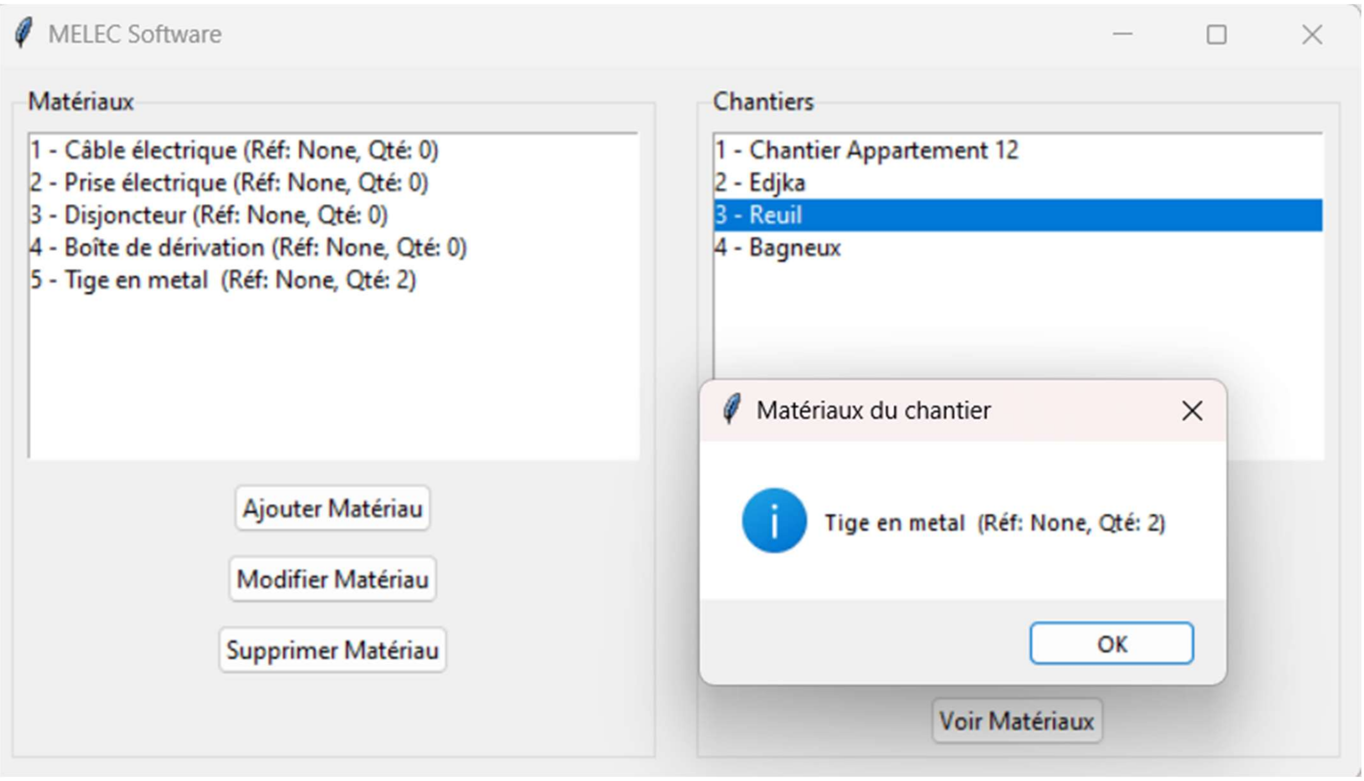


1 - Câble électrique (Réf: None, Qté: 0)
2 - Prise électrique (Réf: None, Qté: 0)
3 - Disjoncteur (Réf: None, Qté: 0)
4 - Boîte de dérivation (Réf: None, Qté: 0)
5 - Tige en metal (Réf: None, Qté: 2)

1 - Chantier Appartement 12
2 - Edjka
3 - Reuil
4 - Bagneux

Matériau associé au chantier.

And then the material will be added to the list of materials of the site.

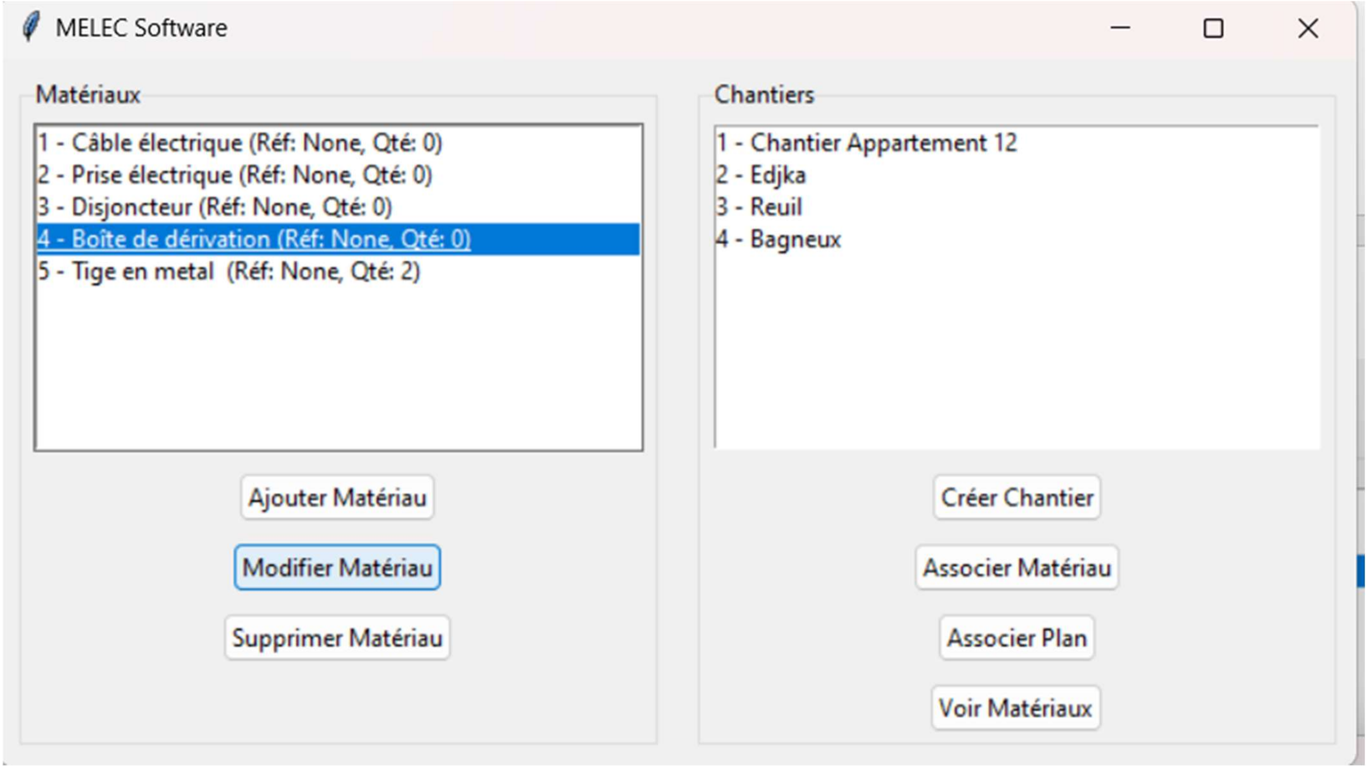


1 - Câble électrique (Réf: None, Qté: 0)
2 - Prise électrique (Réf: None, Qté: 0)
3 - Disjoncteur (Réf: None, Qté: 0)
4 - Boîte de dérivation (Réf: None, Qté: 0)
5 - Tige en metal (Réf: None, Qté: 2)

1 - Chantier Appartement 12
2 - Edjka
3 - Reuil
4 - Bagneux

Tige en metal (Réf: None, Qté: 2)

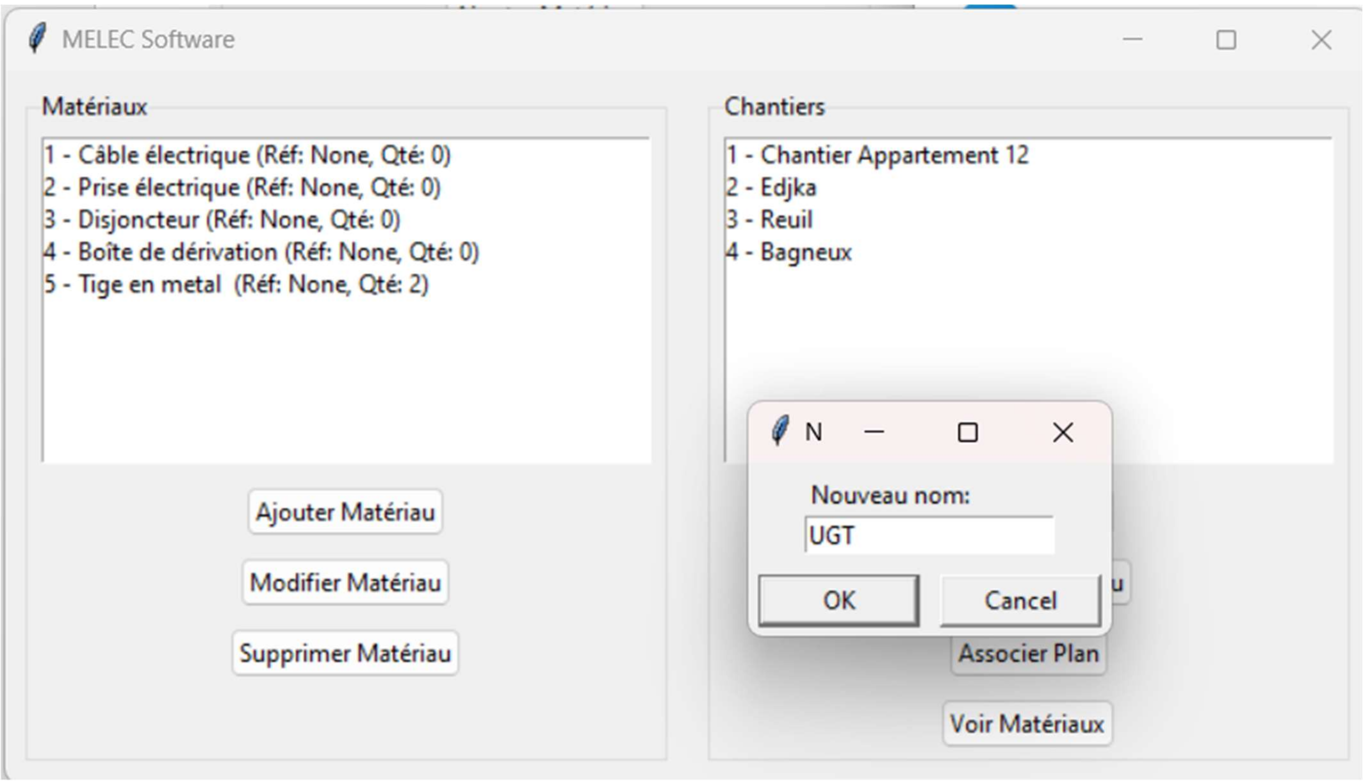
You can also modify a material by select it in the list :



1 - Câble électrique (Réf: None, Qté: 0)
2 - Prise électrique (Réf: None, Qté: 0)
3 - Disjoncteur (Réf: None, Qté: 0)
4 - Boîte de dérivation (Réf: None, Qté: 0)
5 - Tige en metal (Réf: None, Qté: 2)

1 - Chantier Appartement 12
2 - Edjka
3 - Reuil
4 - Bagneux

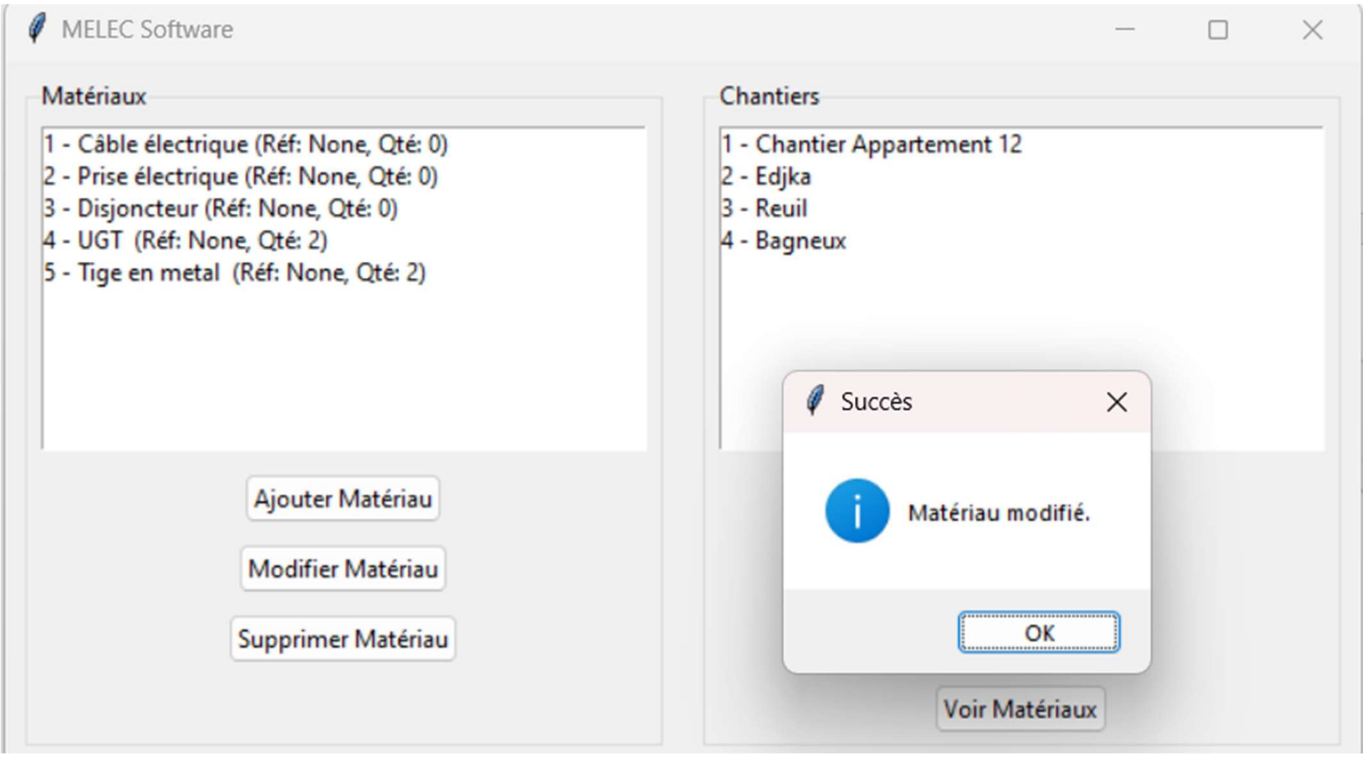
Put informations :



1 - Câble électrique (Réf: None, Qté: 0)
2 - Prise électrique (Réf: None, Qté: 0)
3 - Disjoncteur (Réf: None, Qté: 0)
4 - Boîte de dérivation (Réf: None, Qté: 0)
5 - Tige en metal (Réf: None, Qté: 2)

1 - Chantier Appartement 12
2 - Edjka
3 - Reuil
4 - Bagneux

Nouveau nom: UGT



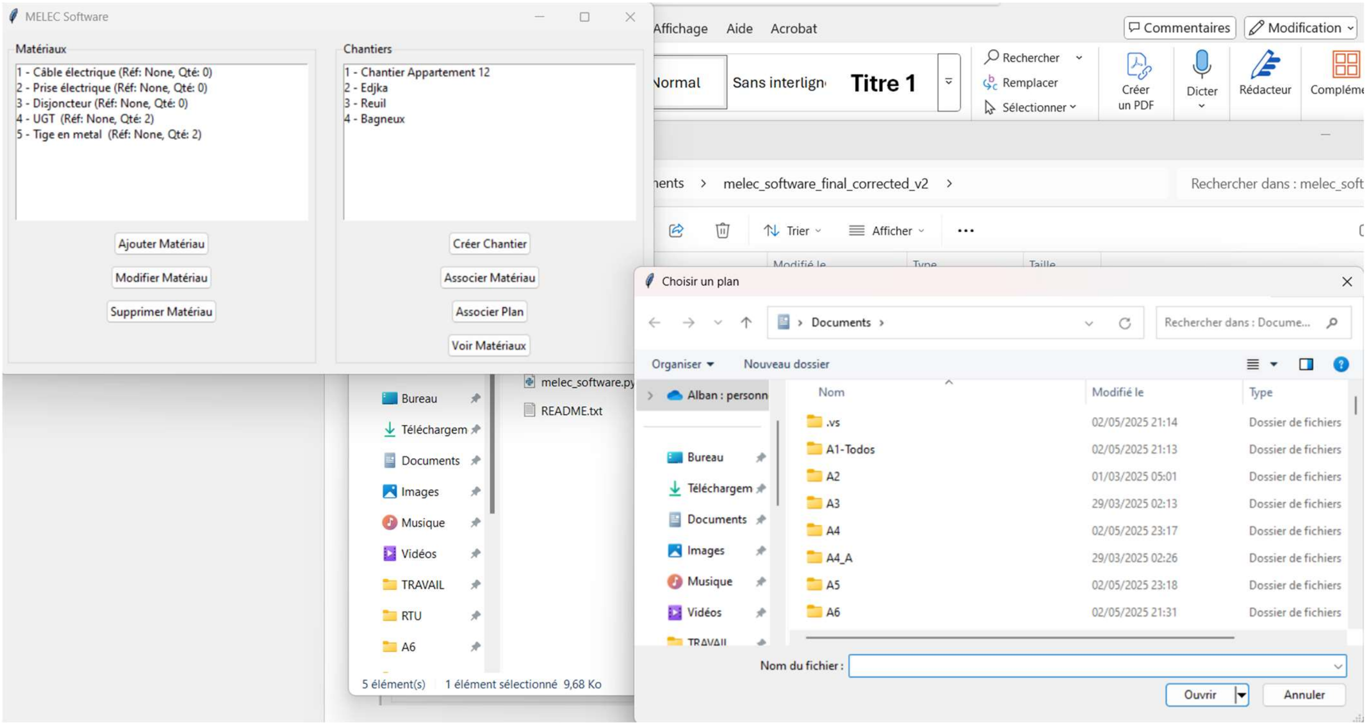
1 - Câble électrique (Réf: None, Qté: 0)
2 - Prise électrique (Réf: None, Qté: 0)
3 - Disjoncteur (Réf: None, Qté: 0)
4 - UGT (Réf: None, Qté: 2)
5 - Tige en metal (Réf: None, Qté: 2)

1 - Chantier Appartement 12
2 - Edjka
3 - Reuil
4 - Bagneux

Matériau modifié.

Here is modify in the list.

And the last possibility, you can add a plan of the site with a pdf. File. with the button « Associer Plan »



MELEC Software

Matériaux

1 - Câble électrique (Réf: None, Qté: 0)
2 - Prise électrique (Réf: None, Qté: 0)
3 - Disjoncteur (Réf: None, Qté: 0)
4 - UGT (Réf: None, Qté: 2)
5 - Tige en metal (Réf: None, Qté: 2)

Chantiers

1 - Chantier Appartement 12
2 - Edjka
3 - Reuil
4 - Bagneux

ents > melec_software_final_corrected_v2 >

Rechercher dans : melec_soft

melec_software.py
README.txt

5 élément(s) 1 élément sélectionné 9,68 Ko

Choisir un plan

Documents >

Rechercher dans : Docume...

Nom	Modifié le	Type
.vs	02/05/2025 21:14	Dossier de fichiers
A1-Todos	02/05/2025 21:13	Dossier de fichiers
A2	01/03/2025 05:01	Dossier de fichiers
A3	29/03/2025 02:13	Dossier de fichiers
A4	02/05/2025 23:17	Dossier de fichiers
A4_A	29/03/2025 02:26	Dossier de fichiers
A5	02/05/2025 23:18	Dossier de fichiers
A6	02/05/2025 21:31	Dossier de fichiers

Nom du fichier :

13. Journal (W10)

We conducted unit and system tests to ensure that each feature worked correctly and integrated smoothly. User acceptance testing was also performed to gather feedback. Any bugs were fixed, and we verified the stability of the final product before deployment.

14. Preparation

We first had a meeting where we drew up a development plan for the software, with the ideas we already had for functionalities to be integrated. Also, we divided up all the tasks and evaluated what would take us the longest on the project, be it the report, the code, the video, etc...

The goal was to develop a system capable of:

- Managing a list of construction materials
- Creating and organizing construction sites (chantiers)
- Associating materials with specific sites
- Attaching blueprint files to projects

This analysis allowed us to determine the essential features and the structure of the database.

Based on simplicity, efficiency, and project constraints, the following technologies were chosen:

- **Python**: for both scripting and GUI development
- **SQLite**: lightweight, file-based relational database
- **Tkinter**: standard Python library for creating graphical user interfaces

Conclusion :

The development of MELEC Software successfully addressed the initial objective: to provide electricians with a tool that simplifies the recording and management of materials used on construction sites. Through a user-friendly interface and efficient database structure, users can now:

- Add, edit, and delete materials
- Create and manage construction sites
- Associate materials with specific sites
- Attach and retrieve blueprint files related to each project

By combining a command-line prototype with a graphical interface, we ensured both functional reliability and improved user experience.

The use of SQLite for storage and Tkinter for the interface offered a lightweight but powerful solution that is easy to deploy.

This project has strengthened our understanding of full-stack development, from planning and requirements gathering to implementation and testing.

15. Grading Rubric

Group Members Name	Appreciations	Grade
Alban du Couedic de Kergoaler 250AEB007		
Dwyane Dufrenot 250AEB009		
Arthur Lacampagne 250AEB055		