FoodWise

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Description:

The problem:

Inefficiency and lack of intelligent management in traditional refrigerators.

- Conventional refrigerators do not provide real-time monitoring, inventory management, or personalized user assistance.

- Current high cost of smart refrigerators presents a significant barrier to widespread adoption which limits accessibility for a broader demographic.

Our solution:

Our Smart Refrigerator project introduces an innovative and cost-effective IoT scanning device, designed to revolutionize how users manage their kitchen inventory, by seamlessly integrating with their conventional refrigerators.

Placed near or on the refrigerator, the IoT device seamlessly integrates with a user-friendly mobile app named “FoodWise”.

This system aims to not only streamline inventory management, but also enhance the overall kitchen experience by providing features such as: half-automated shopping list creation, track in real-time more than just one refrigerator, get recipe suggestions, view consumption reports and get expiration alerts for products to reduce food waste.

Use cases:

1. **IoT Scanning and Real-time Inventory**
    - A user wants to effortlessly scan items using the IoT device when placing them in/out of the refrigerator and being able to manage and track his food inventory.
    - The app will have to facilitate seamless item scanning through the IoT device and update the real-time inventory list accordingly, allowing the user to view and modify the list through the app.
2. **Half-Automated Shopping List:**
    - A user wants to rely on the system to analyze his scanned inventory and generate a shopping list based on the parameterized list he created before and the products he already have at his refrigerator.
    - The app will have to analyze scanned inventory data and generate a shopping list relying on his current inventory products.
3. **User Refrigerators:**
    - A user wants to track all of his refrigerators, he may have more than one major refrigerator, add new refrigerators to track and change their nicknames.
    - The app will have to track all the user linked refrigerators, allow the user to add new refrigerators by scanning with the refrigerator IoT scanner the user uniq app barcode, and let the user seamlessly update his refrigerators nicknames.
4. **Recipe Suggestions:**
    - A user wants to benefit from the system leveraging scanned inventory data to suggest personalized recipes based on his available ingredients.
    - The app will have to utilize scanned inventory information to offer personalized recipe suggestions and display them to the user in a convenient way.
5. **Consumption Reports:**
    - A user wants to get reports about his refrigerator added and removes habits during a chosen period time by his choice.
    - The app will allow the user to configure start date and end date by his configure and show him in convenient diagrams graphs about his added and removed habits for each refrigerator.
6. **Expiration Alerts to Food Waste Reduction:**
    - A user wants to receive timely notifications for upcoming expiration of scanned items at his inventory.
    - The app will have to send notifications that alert users about expiring items, by alerting dates that the user needs to update on products in his inventory.

The user will notify about the alerts he configures and can search for recipe suggestions to reduce food waste through recipe ideas.

Application Programming Interfaces:

Embedded endpoints:

1. **Get** `'/request_refrigerator_id'` : Create a new IoT device uniq refrigerator id, only at the first time it starts to work.

   Example of a request: `/request_refrigerator_id`

2. **Post** `'/link'`: Link between a user to his refrigerator.

   Example of a request: `/link , json={"user_id": 1, "refrigerator_id": 1}`

3. **Post** `'/scan'` : get product barcode, scanning mode and a refrigerator id and add/remove the product with this barcode to the specific refrigerator.

   Example of a request: `/scan , json={"barcode": 7290008757034, "mode": "add", "refrigerator_id": 1}`

Frontend endpoints:

1. **Post** `'/add_product_with_app'`: get product barcode and refrigerator id and add one product to the specific refrigerator. For products without barcodes like vegetables we create internal “fake” barcodes and by their picture and name at the app the user can add them to his inventory.

   Example of a request: `/add_product_with_app , json={"barcode": "7290008757034", "refrigerator_id": 1}`

2. **POST** `'/register'` : Register a new user to the system by email, password, first name and last name.

   Example of a request: `/register , json={"email": "liorbaa@mta.ac.il", "password": "12345678", "first_name": "Lior", "last_name": "Barak"}`

3. **Post** `'/user_login'` : Authenticate users within the system by using their email and password.

   Example of a request: `/user_login , json={"email": "liorbaa@mta.ac.il", "password": "12345678"}`

4. **Post** `'/update_user_email'` : Update the email for a logged in authenticated user by entering a new uniq email.

Example of a request: `/update_user_email , json={"email": "liorbarak99@gmail.com"}`

5. **Post** `'/update_user_password'` : Update the password for a logged in authenticated user by entering a new password.

   Example of a request: `/update_user_password , json={"password": "12345678"}`

6. **Get** `'/linked_refrigerators'` : Get all the linked refrigerators of a logged in authenticated user.

   Example of a request: `/linked_refrigerators`

7. **Get** `'/refrigerator_contents'` : Get the refrigerator content of a logged in authenticated user by a refrigerator id.

   Example of a request: `/refrigerator_contents?refrigerator_id=1,`

8. **Get** `'/number_linked_refrigerators'` : Get the number of the linked refrigerators that the user linked to for logged in authenticated user by a refrigerator id.

   Example of a request: `/number_linked_refrigerators?user_id=1`

9. **Post** `'/update_refrigerator_name'` : Change the nickname of the relevant refrigerator for the given user for logged in authenticated user by a refrigerator id and new name.

   Example of a request: `/update_refrigerator_name?user_id=1 , json={"refrigerator_id": 1, "new_name": "Main Refrigerator"}`

10. **Get** `'/search_products'` : Get up to 10 products that include substring of the product name, if all == 1 for products with barcodes and else for products without barcodes, for an authenticated user.

    Example of a request: `/search_products?product_name=C&all=1`

11. **Post** `'/update_refrigerator_parameters'` : Update the list of products that always needs to be in the refrigerator, by refrigerator id and the list of the parameters products, for an authenticated user.

    Example of a request: `/update_refrigerator_parameters?refrigerator_id=1 , json=[{"barcode": 7290004131074, "amount" : 3}]`

12. **Post** `'/save_shopping_list'` : Save the current shopping list for the relevant refrigerator, by refrigerator id and the list of the shopping products, for an authenticated user.

    Example of a request: `/save_shopping_list?refrigerator_id=1 , json=[{"barcode": 7290004131074, "amount" : 3}, {"barcode": 7290004127329, "amount": 2}]`

13. **Get** `'/generate_initial_shopping_list'` : Get initial shopping list for the relevant refrigerator, that contains all the products that need to be in the refrigerator with their amounts and currently are not in the inventory or their amount less than in the shopping list, for an authenticated user.

    Example of a request: `/generate_initial_shopping_list?refrigerator_id=1`

14. **Get** `'/get_refrigerator_parameters'` : Get the last inserted list of the products that always need to be in the refrigerator, for an authenticated user.

    Example of a request: `/get_refrigerator_parameters?refrigerator_id=1`

15. **Get** `'/fetch_saved_shopping_list'` : Get the last saved shopping list that was created by the user, that is linked to the relevant refrigerator, for an authenticated user.

    Example of a request: `/fetch_saved_shopping_list?refrigerator_id=1`

16. **Get** `'/get_product_alert_date'` : Get a product alert date for a logged in authenticated user, by a refrigerator id and product name.

    Example of a request: `/get_product_alert_date?refrigerator_id=1&product_name=Eggs pack 12L free organic`

17. **Get** `'/get_refrigerator_content_expired'` : Get all the products whose alert date expired for a specific refrigerator of a logged in authenticated user by a refrigerator id.

    Example of a request: `/get_refrigerator_content_expired?refrigerator_id=1`

18. **Post** `'/update_alert_date_and_quantity'` : Update product alert date and quantity of a logged in authenticated user by a refrigerator id, product name, alert date and product quantity.

Example of a request: `/update_alert_date_and_quantity ,json={"refrigerator_id": 1, "product_name": "Milk 1% 1L Tnuva", "alert_date": "2024-09-25", "product_quantity": 3}`

19. **Get** `'/get_statistics'` : Get refrigerator consumption statistics of added and removed products of a logged in authenticated user, by a refrigerator id, product name, alert date and product quantity.

    Example of a request: `/get_statistics?refrigerator_id=1&start_date=2024-07-20&end_date=2024-08-09`

Managers endpoints:

1. **Post** `'/add_new_product_to_DB'` : End point that is intended for managers to add new products to the 'Product' database by product barcode and product name.

   Example of a request: `/add_new_product_to_DB , json={"barcode": "#027", "product_name": "Tahini"}`

Server dependencies:

Flask

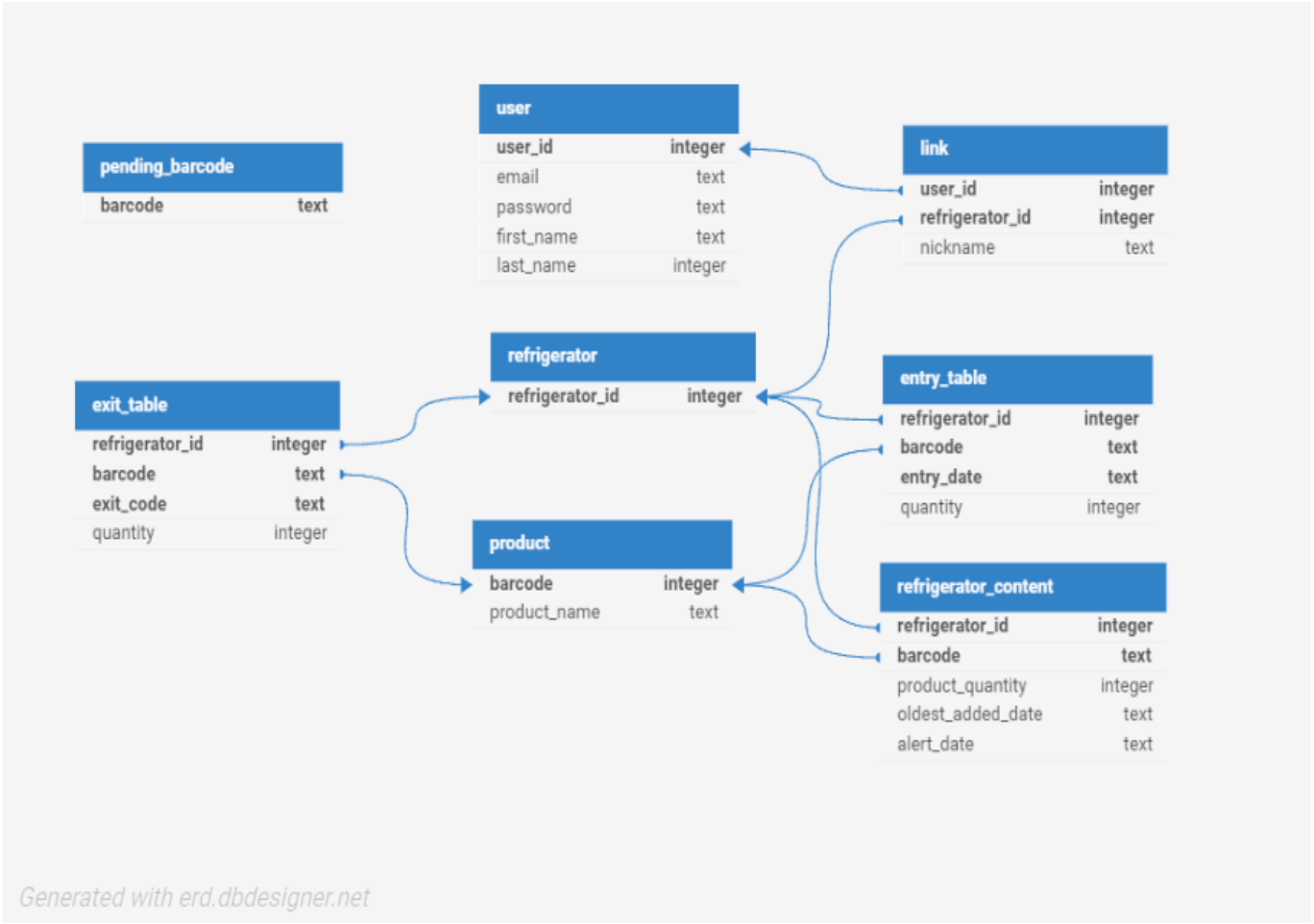
Werkzeug

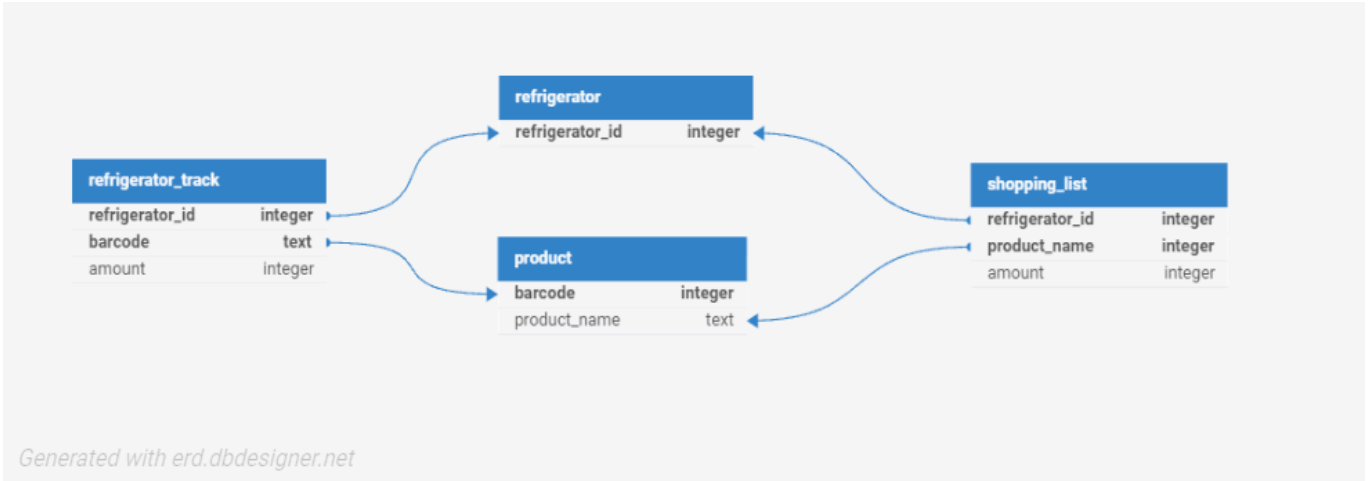
Flask-Bcrypt

Flask-JWT-Extended

Flask-Mail

Database schemes





DataBase tables:

1. product: stores information about each product.

2. user: stores information about each user.

3. refrigerator: stores id of each refrigerator.

4. refrigerator_content: stores the products that are available in each refrigerator.

5. refrigerator_track: stores information on parameters that the user always wants to have in his inventory with their amount.

6. shoppint_list: stores the latest shopping list that was created by one of the linked users per refrigerator.

7. link: stores the links and nicknames between each user to each refrigerator.

8. pending_barcode: stores barcodes of new products that a user scans and we don't have them yet in our 'product' table at the database.

9. entry_table: stores information on every product that enters a refrigerator.

10. exit_table: stores information on every product that is removed from a refrigerator.

Explanation on how to deploy the Flask app to GCP (GOOGLE CLOUD):

First, we need to build a Docker image containing the Flask app and then upload the image to Docker Hub and then upload the Docker to the google cloud.

In the `Server` directory, there is already a `Dockerfile` with all the necessary instructions to create the image.

Now the following steps need to be done.

1) Ensure that the `docker` variable at the beginning of the `server.py` file (line 25 at the time of writing this document) is set to `True`.

2) Ensure that all libraries not included in Python's standard library are listed in the `requirements.txt` file, located in the `Server` directory, in the following format: `<library_name> == <version_number>`.

3) Make sure Docker Engine is installed on your computer and is connect to your Dockerhub account

4) Open cmd and run the following commands:

- docker build -t my-flask-app .
- docker tag my-flask-app username/my-flask-app:<version_tag>
- docker push username/my-flask-app:<same_version>

5) Now, go to Google Cloud Console, then to Cloud Run, and click on the Create Service Button.

6) In the `Container image URL` field, enter the following URL (after making the necessary adjustments):

`docker.io/username/my-flask-app:<version_tag>`

7) In the `Service name` field, enter `foodwise`.

8) In the `Authentication` section,
check the box for `Allow unauthenticated invocations`.

9) In the `Minimum number of instances` section, select `1`.

10) In the Container section, ensure that the Container port is set to 12345

Technical Explanations and Important Notes for the IoT Device:

The device is a Raspberry Pi 4 running the following operating system: Raspbian GNU/Linux 11 (Bullseye).

The device also has a touchscreen connected via HDMI and a scanner connected via USB.

To give the device access to Wi-Fi, you need to connect it to the local Wi-Fi network through its operating system.

To do this, you need to connect a keyboard and mouse to the device. After that, turn on the device, and once the operating system has started, click on the Wi-Fi icon and select the Wi-Fi network you want to connect to.

After the device is connected to Wi-Fi, you can access it remotely using a program called VNC Viewer. You'll need the local IP address that the device received from the local Wi-Fi network.
You can find the local IP address by running the command `hostname -I` in the terminal of the operating system running on the device.

When connecting, you will be prompted to enter a username and password. The username is `codeCrafters` and the password is `12345`.

On the device's operating system desktop, there is a file named `app.py`, which is the program running on the device

To ensure that the program runs automatically when the operating system starts, you need to make sure that there is a file named `autorunmyfile.desktop` in the file system at `/home/codeCrafters/.config/autostart`.

The file should contain the following content:

[Desktop Entry]

Exec = bash -c "cd /home/codeCrafters/Desktop && sudo python3 app.py > /home/codeCrafters/Desktop/app.log 2>&1"

This file runs automatically when the operating system starts, giving the operating system the instruction to navigate to the directory where the `app.py` file is located, run it with full permissions, and direct all the program's output, including logs, to a file named `app.log` on the desktop.

Details on the Software Running on the Device:

The software has two threads running as part of the program.

The **main thread** is responsible for interacting with the GUI displayed on the touchscreen, which includes three buttons for switching between modes: Add Mode, Remove Mode, and Link Mode. In Add Mode, every scan attempts to add the scanned barcode. In Remove Mode, every scan attempts to remove the scanned barcode. In Link Mode, every scan attempts to link a user to the device. The main thread is also responsible for communication with the server using the `requests` library.

The **secondary thread** is responsible for handling scans from the scanner and processing the scanned data.

Both threads use a shared memory space, which is a queue. The secondary thread adds processed scan tasks to this queue, while the main thread retrieves these tasks and sends them to the backend server. The system is designed to be thread-safe, ensuring proper synchronization to handle concurrent access to the queue safely.

When the operating system starts, the software also automatically launches (as explained in the technical notes above). At this point, the main thread imports its identifier. If this is the first time the device has been powered on, it will send a request to the server to obtain a new identifier. Otherwise, it will retrieve the identifier from the device's local memory.

Additionally, if the communication with the server is temporarily lost, the device will manage the situation as follows:

During scanning, it will store all unsent scans in a queue and continue to add new scans to this queue. Once communication is restored, it will immediately send all the queued scans to the server one by one.

If the loss of communication occurs while retrieving the identifier, the device will keep attempting to send requests to obtain a new identifier until the connection is reestablished.