MICHIGAN STATE UNIVERSITY

Project Plan Presentation

Deep Oven: Volume & Quantity Estimation in Cooking

The Capstone Experience

Team Whirlpool

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From Students…
…to Professionals

Project Sponsor Overview

- Founded in Benton Harbor, MI in 1911
- Specialize in the design and manufacturing of kitchen and laundry appliances
- Own brands Whirlpool, KitchenAid, Maytag, Consul, Brastemp, Amana, Bauknecht, JennAir, Indesit, Yummly and InSinkErator
- Fortune 500 company with $20 billion in annual sales
- 56 manufacturing and technology research centers

Whirlpool CORPORATION

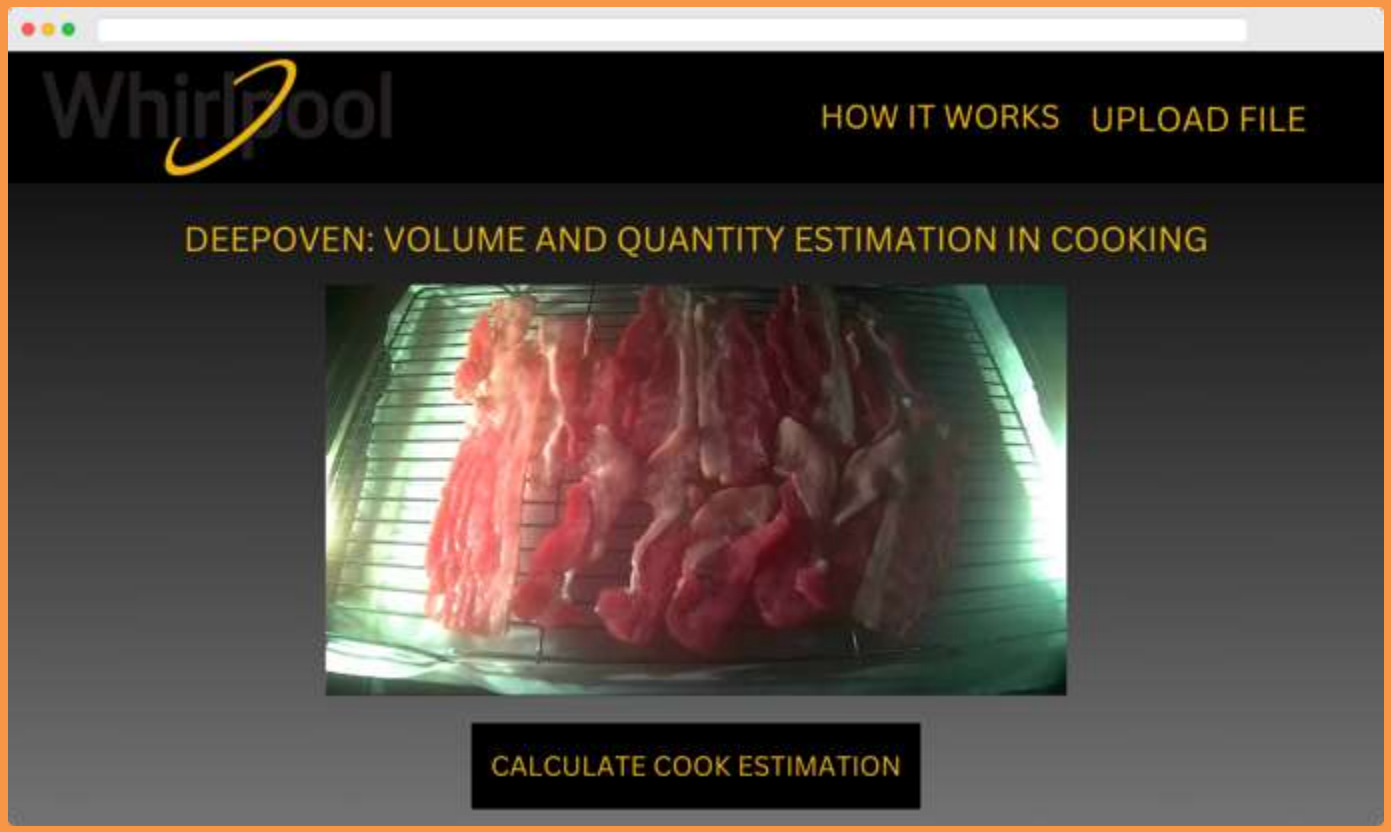
Project Functional Specifications

- DeepOven aims to make cooking easier and more enjoyable for customers by providing an estimated cooking time, livestream oven view, and doneness detection
- Software can detect food volume, quantity, and rack level using a camera inside the oven cavity to calculate cooking time with respect to temperature setting
- Initial estimation factors into end of cooking determination with Whirlpool's food identification and doneness detection technology
- **Visualization of the food volume, quantity, and rack level will be displayed through the web for the Whirlpool development team**

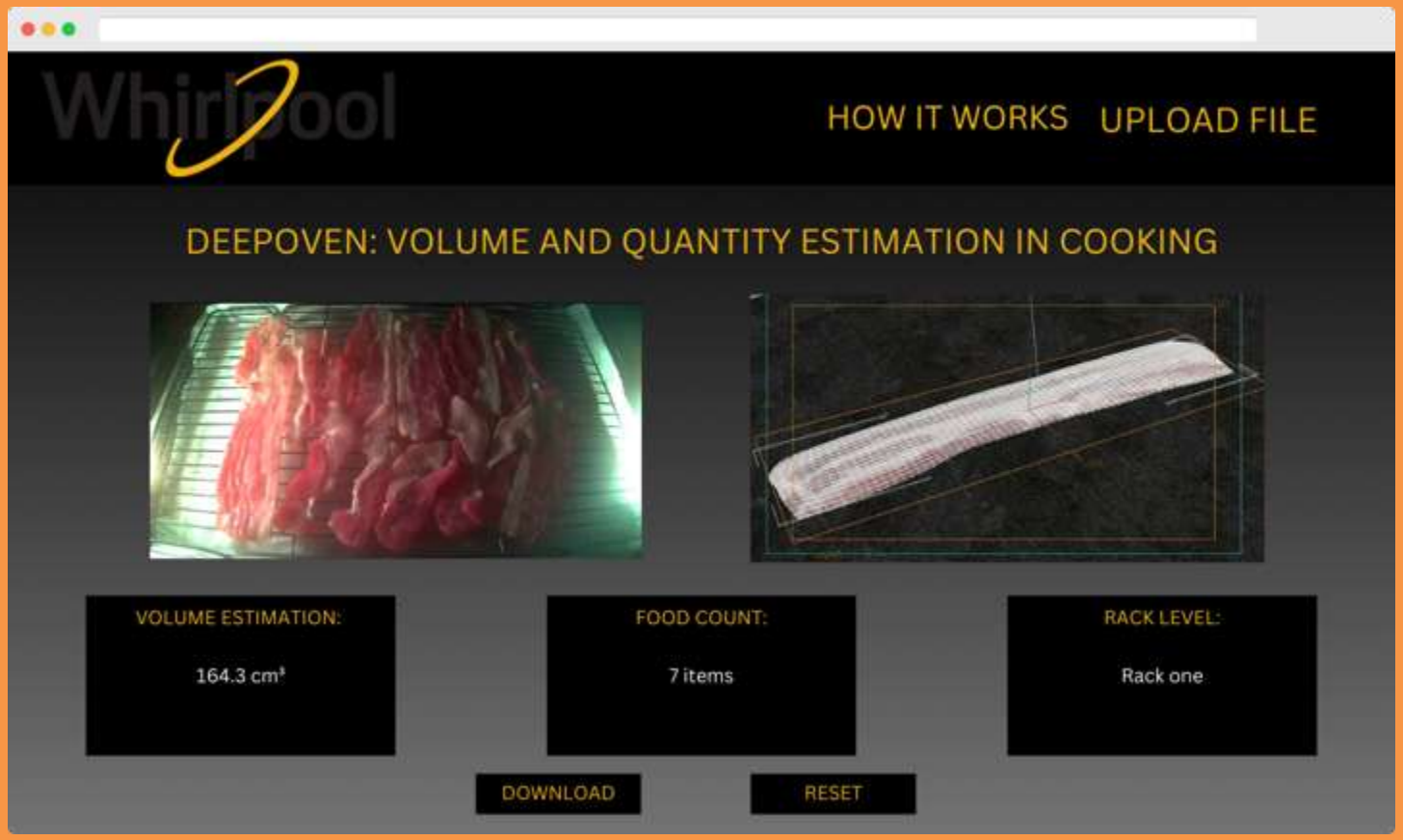
Project Design Specifications

- Web application aimed to visualize essential cooking data for employees at Whirlpool
- Uploading an image file system
- Preview each data set for more in-depth analysis about the 3D reconstruction and how the data was achieved
- Download the data gathered
- Reset feature to clear current data set

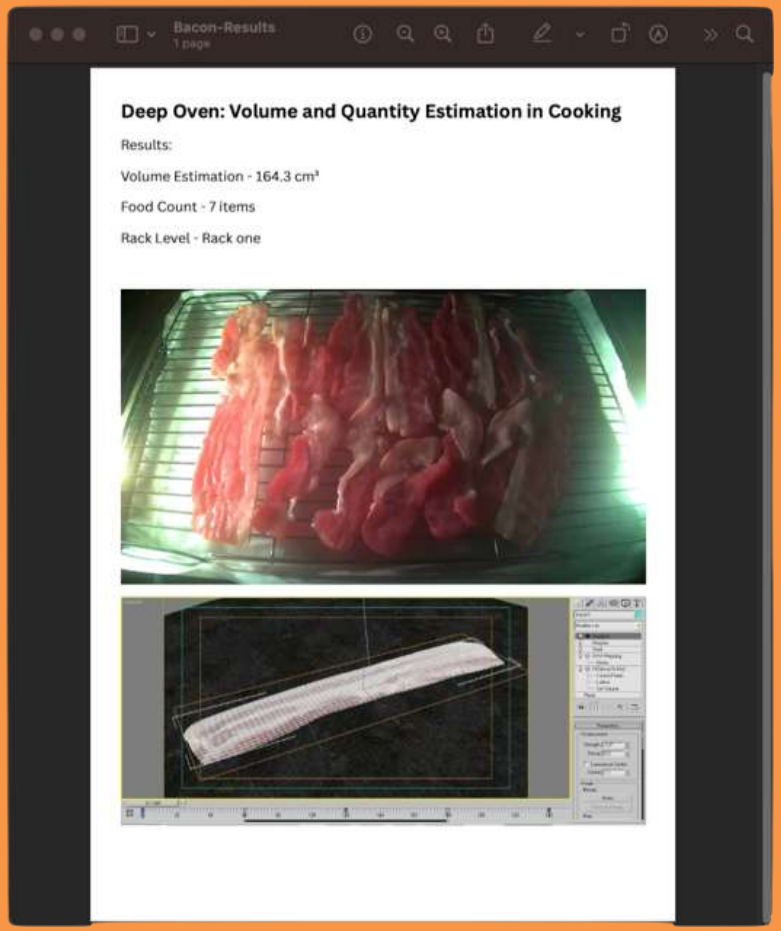
Screen Mockup: Homepage



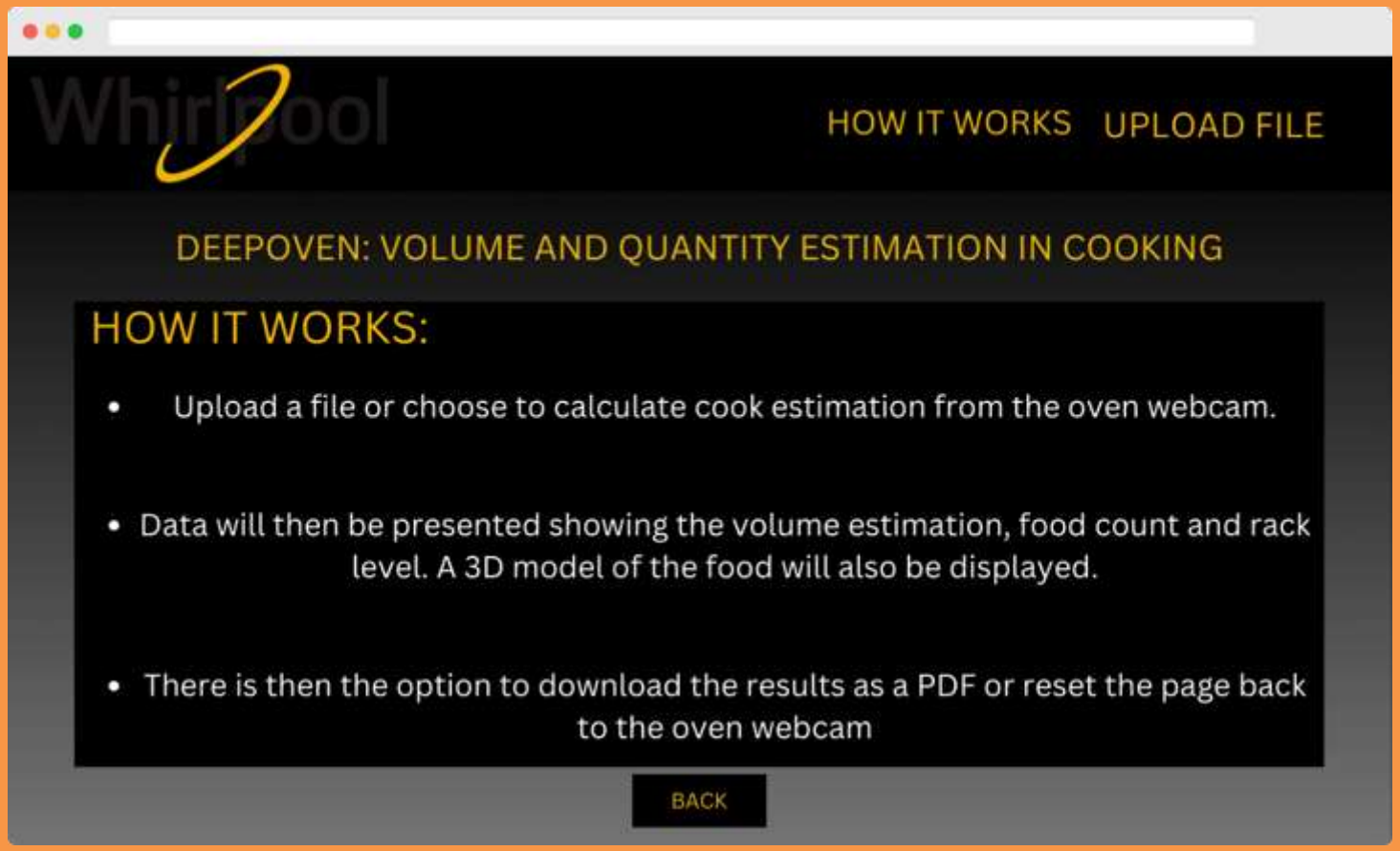
Screen Mockup: Data visualization page



Screen Mockup: PDF Download



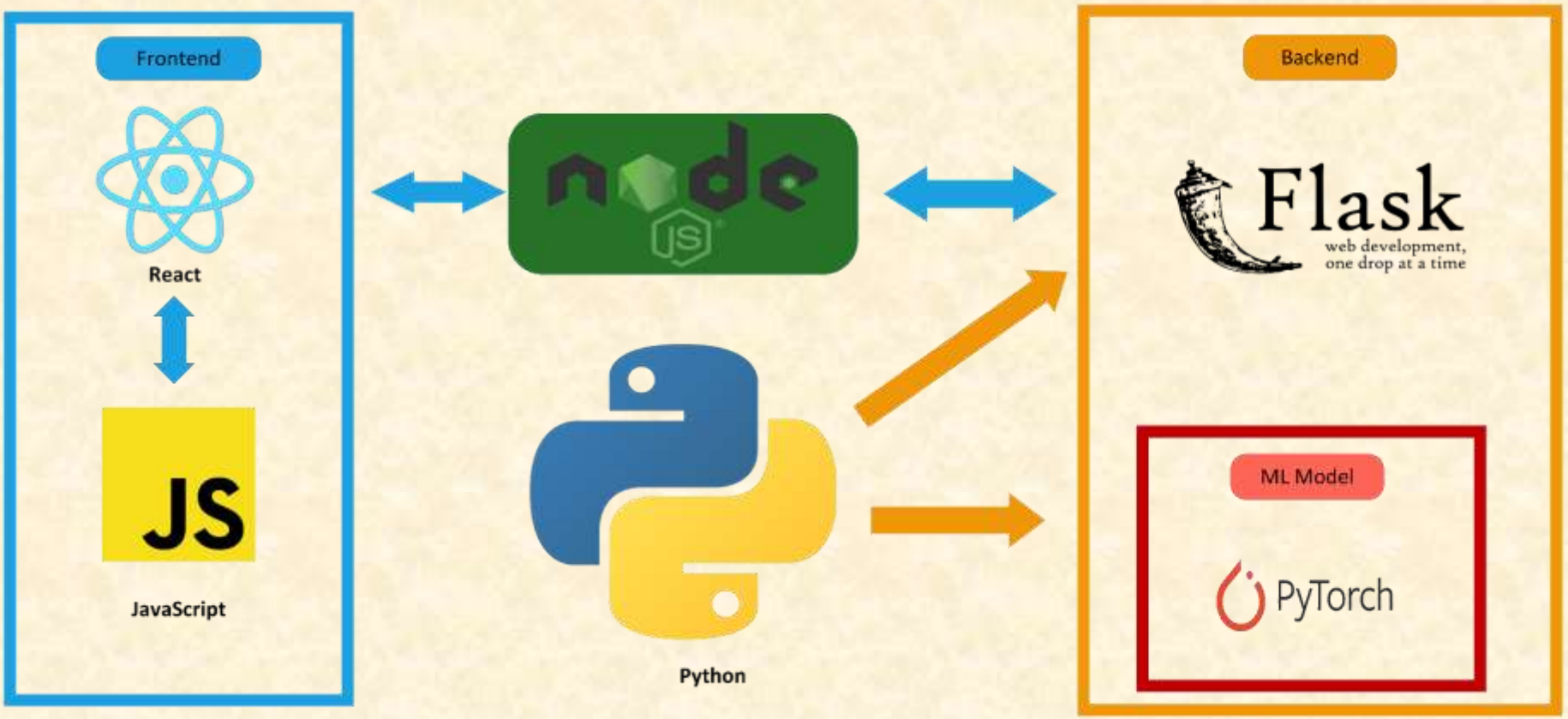
Screen Mockup: How it works page



Project Technical Specifications

- The frontend is constructed using React, JavaScript enabling the creation of dynamic and responsive web pages
- The backend utilizes Python, with PyTorch for machine learning and deep learning tasks
- Use Flask to transmit the results to the frontend, ensuring users receive accurate and timely feedback on their inputs

Project System Architecture



Project System Components

- Hardware Platforms
  - Camera
- Software Platforms / Technologies
  - Front-end: JavaScript, React
  - Back-end: Python, PyTorch, Flask
  - Server: Node.js

Project Risks

- Find and train a 3D reconstruction model to generate the volume of food from a 2D image.
  - Description: Our Client suggested using existing 3D reconstruction open source, currently struggling to find one that's usable
  - Mitigation: Consult the issue with clients, and conduct research to fix problems related to the required package version being too outdated
- Create a weighting for the relationship between rack distance from the camera and perceived volume.
  - Description: When the food is closer, the 3D image will be larger and produce a larger volume.
  - Mitigation: Find the relation by using the distance of each rack from the camera to create a weight to add to the volume calculation
- Determine the distance to the camera
  - Description: How do we determine how far something is from the camera
  - Mitigation: Find the rack level height and angle of the camera for calculation
- Identify rack levels and food quantity.
  - Description: How to use ML model to identify rack levels and food quantity?
  - Mitigation: Using the result of 3d reconstruction to determine possible solution.

Questions?