DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING
THE UNIVERSITY OF TEXAS AT ARLINGTON

SYSTEM REQUIREMENTS SPECIFICATION
CSE 4317: SENIOR DESIGN II
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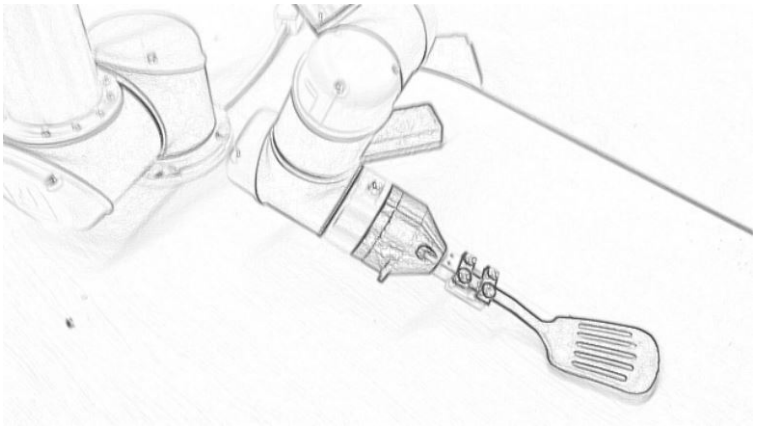

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MASTERCHEF

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Revision History

Revision	Date	Author(s)	Description
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0.1.2	10.29.2017	AT	First draft of contents 5
0.1.3	10.29.2017	TB	First draft of contents 3,4
0.1.3	10.29.2017	JM	First draft of contents 1,2
0.1.4	10.29.2017	JM	Document Pass-Through to Improve Readability
0.1.5	10.29.2017	JM	Entire Document Pass-Through to Add More Content and Image
0.2	5.9.2018	TB	Final Draft

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1 Product Concept

The application of the UR5 known as MasterChef is designed to reduce the cost of owning a business oriented around preparing food. With the increase in demand towards a higher minimum wage, many businesses will be seeking options to save money.

1.1 Purpose and Use

MasterChef will be able to prepare food to serve to a consumer. You will be able to queue up requests and receive the food. Currently the main application is to make grill cheese sandwiches.

1.2 Intended Audience

The target audience for MasterChef are restaurant owners (more specifically ones that run chain restaurants), as MasterChef will allow them to save money on hiring workers.

This will allow owners to save money, worry less about payroll taxes, and serve quality food at a lower cost.

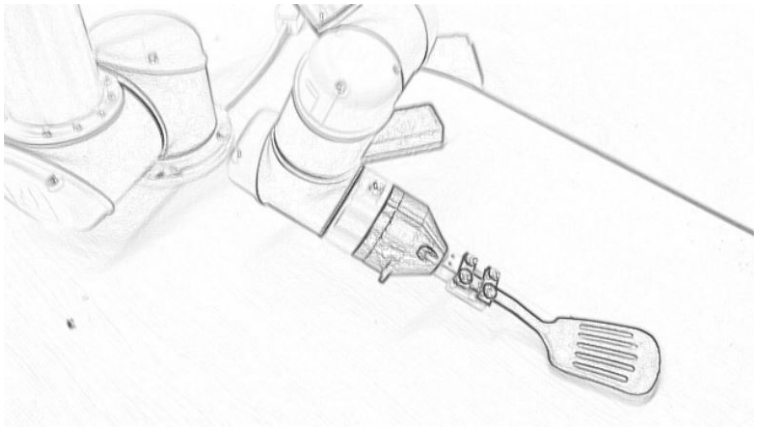

Figure 1: Conceptual drawing

2 Product Description

This section provides the reader with an overview of MasterChef, and the primary operational aspects of the product.

2.1 Features & Functions

This product will cook grill cheese sandwiches on a griddle using vision processing, 3D Printed Mounts, the UR5 Robotic Arm, and a large griddle. You will be able to queue up jobs for the MasterChef for it to know when to start cooking.

It will specifically have a webcam, and various 3D Printed attachments. External equipment may also be designed to make it more convenient for the robot to finish preparing the sandwich.

2.2 External Inputs & Outputs

The product will receive basic instructions from a cashier, and also use a webcam to process where the sandwiches are.

This webcam will allow it to instruct the UR5 to pick up sandwiches and move them onto the griddle. Once it is done cooking, it will move it to a "finished" zone, and display a message that the sandwich is done.

(Currently the webcam is not fully integrated and movement is executed with a GUI.)

2.3 Product Interfaces

There is also a user interface designed to make it easy to queue up different features such as changing the amount of sandwiches to be made at once.

Aside from that, the product will be fairly autonomous.

3 Customer Requirements

It is important for the user to perform a risk assessment when using this product. Refer to the UR5 user manual for additional detailed specifications and requirements of the product's hardware.

3.1 Workspace Assessment

3.1.1 Description

The UR5 must be used in a workspace within a radius of 850mm of the base. For all required functions, the tools and and attachments can only be used within this space.

The UR5 has a maximum payload of 11 pounds so we must keep that in mind when assigning tasks.

The griddle work area must be clear and all attached equipment (namely the tool contacting the griddle) must be able to tolerate high temperature heat (upwards of 400Â°F)

3.1.2 Priority

Medium

3.2 Tool and Attachment Bindings

3.2.1 Description

Any tool or removable attachment secured to the mount of the UR5 must go through a safety check to ensure that the tool is secured and will not move within the mount while in use. This is to ensure the integrity and safety of the system. The tool and all attached components must also be able to handle the high temperatures mentioned above.

3.2.2 Priority

High

3.3 Ability to Prepare a Grill Cheese Sandwich

3.3.1 Description

The MasterChef should be able to prepare an edible grill cheese sandwich to completion.

3.3.2 Standards

- The bread must be properly toasted. - The finished sandwich must be properly placed on the "finished" by the UR5.

3.3.3 Priority

High

4 Packaging Requirements

Complete product is handled as is. No additional packaging protocol or concerns are needed for the product.

However, we could package our sub-components.

4.1 Tools and Mounts

4.1.1 Description

Our 3D Printed mounts could be applied to many scenarios. We could release this in two says.

We could either release open-source files to allow people to freely print our mounts, or we could sell the individual parts cheaply.

4.1.2 Standards

- Decent build quality.

4.1.3 Priority

Low

5 Performance Requirements

MasterChef is a technology based on the UR5 platform developed to cook food. Speed and performance is a concern.

5.1 Speediness of Food Preparation

5.1.1 Description

Our technology must be able to cook a sandwich to completion within a reasonable amount of time within safety constraints.

5.1.2 Constraints

- How is the throughput required? sandwiches/hr?
- Human interaction constraints and safety?
- Reliability?
- Productivity goals?

5.1.3 Standards

- Health/Safety standards

5.1.4 Priority

High

6 Safety Requirements

The MasterChef involves use of heat and moving components. Safety must be taken into consideration during the development of this project.

6.1 Proximity Sensors

6.1.1 Description

With moving components at play, it might be wise to install proximity sensors or at least a barrier to prevent a person from being struck with a moving component.

6.1.2 Standards

- Must prevent a person from being hit with the moving UR5.

6.1.3 Priority

Low. The UR5 moves slowly in its current state.

6.2 Heat Safety

6.2.1 Description

The UR5 and its attached components will interact with a griddle. We will need to ensure that our equipment is not damaged by the heat, and that we wear proper equipment to handle the heated components.

6.2.2 Standards

- Oven mitts or protective gloves must be worn when interacting with the grill. - The equipment must not be in close proximity to any heat sources, at least not for very long.

6.2.3 Priority

High

7 Maintenance & Support Requirements

The user of the product will be responsible for maintaining the product by troubleshooting with the manuals. If it is a hardware failures, the customer should contact the manufacturer (UR5). Any such requirement will be describe here in this section in details.

7.1 Tools

7.1.1 Description

Tools and work space should be keep clean.

7.1.2 Priority

Moderate

7.2 Software updates

7.2.1 Description

Software updates are planned to be fully integrated at a later date. (The final prototype currently does not have this functionality working) This will be performed on the Raspberry Pi Controller and will ping against our website for future updates.

7.2.2 Priority

Moderate

7.3 User manual/support

7.3.1 Description

There will be hard copy of the manual/support.

7.3.2 Standards

- Must be easy to read.

7.3.3 Priority

Moderate

8 Other Requirements

Items and tools that will be use in the final product will be describe here in this requirement section.

8.1 Tool Rack

Tool rack setup

8.1.1 Description

Placement of the tool rack will be place at a specified position of the UR5.

8.1.2 Priority

Low

8.2 Camera Placement

8.2.1 Description

Placement of a camera will be facing the UR5 at an angle and height for maximum visual.

8.2.2 Standards

- Must be at a position where it can examine the sandwich positions.

8.2.3 Priority

High

9 Other Requirements

All priority 5 in the previous section will be describe here in this section.

9.1 Vision Processing

Vision Processing

9.1.1 Description

Inclusion of a camera and software for processing the position of sandwiches in realtime.

9.1.2 Source

N/A

9.1.3 Constraints

Camera must be able to visualize where each individual sandwich is on the griddle.

9.1.4 Standards

N/A

9.1.5 Priority

Low

9.2 Software Updates via Website

Software Update Routine

9.2.1 Description

Inclusion of a website that the Raspberry Pi can ping to in order to update the software.

9.2.2 Source

N/A

9.2.3 Constraints

Routine must be able to reliably update the software without causing bugs that can break the system.

9.2.4 Standards

N/A

9.2.5 Priority

Low

REFERENCES