Roux-Bot Home Cooker
UC Santa Cruz, Baskin Engineering
Senior Design Project 2015

Group Information:
Dustin Le - Computer Engineering, Robotics Focus
dutale@ucsc.edu

Justin Boals - Electrical Engineering
jboals@ucsc.edu

Tuan Tran - Computer Engineering, Systems Focus
tuhtran@ucsc.edu

Joe Riggs - Computer Engineering, Robotics Focus
jriggs@ucsc.edu

Abstract:
The Roux-Bot team is striving to create an automated cooking robot that can assist with and teach the preparation of complex dishes for amateur and intermediate home chefs. Through a mobile app, a home chef can upload new recipes into their bot and activate it remotely with Wifi. Roux-Bot will attempt to engage in a new kind of home cooking automation.

Project Description:
The goal of Roux-Bot is to create a smart electronic device that can perform time consuming culinary tasks, starting with the production of a french roux. It will be able to slowly add correct amounts flour and butter into a cooking pot while stirring the mixture. Additional dispensing compartments will allow for more complex dishes to be programmed after the basic roux is perfected.

The basic design elements that will be used to accomplish this are an electric cooking component and a mixing component. The heating component will be monitored with temperature sensors to ensure a consistent result, and will be powered by a variable PWM signal to produce a varying but consistent temperature. The mixing component will be powered by a motor, and will need to be designed as to mix a roux with a consistent smooth texture.

After these basic functions are implemented, three types of dispensers will be implemented. A mechanically designed flour dispenser will need to be created that can
distribute an accurate amount of flour at the command of the microcontroller. A second dispenser will be designed to distribute butter or oil, depending on the feasibility of a butter dispenser. One or two more general dispensers will allow the ability for custom ingredients to be added automatically at a programmable time, which will be needed for additional recipes. The whole design will need to be ergonomically friendly and washable, as it is designed for a home cook.

It will have a manual user interface that can accept input through buttons and provide output on an LCD display, starting with the ability to select between the four defined types of roux. After this level of sophistication is reached with the machine then the team add the ability to cook additional programmed recipes and potentially make the device programmable for custom recipes, all using a mobile app. The app will interact with the Roux-Bot through a Wifi chip, which can be activated remotely wherever Wifi is present. The aesthetic and functional design of the app will be refined, as it will be the main interface to use the Roux-Bot.

**What is a roux:**

A roux is a traditionally French sauce made by slowly incorporating flour into a fat such as butter, oil, or animal fat, and is the base for many culinary applications. By cooking the mixture more or less, four distinct color definitions of roux can be made: white, golden, brown, and dark brown. The white roux provides the most thickening power to sauces, but the least flavor. Conversely, a dark brown roux provides the least thickening power but a richer and more developed flavor. Some examples of dishes that use roux in American cuisine and could be made in part in the Roux-Bot are mac and cheese, gravies, gumbos, curries, and souffles.

**Why is Roux-Bot useful:**

A machine that automates cooking processes could save time and energy in the kitchen, and could help beginning cooks learn simplified recipes. A cook wouldn’t have to stir the pot almost constantly for 20 minutes to create a dark brown roux for gumbo, for instance, but could let Roux-Bot do that part while they prepped other dishes. An amateur cook could simultaneously learn a new recipe while helping Roux-Bot cook the dish.

As a design project, the creation of Roux-Bot is a complex task because it needs to incorporate elements of hardware design, mechanical design, software coding, and sensor implementation. It requires creative thinking to solve the dispensing of ingredients with different material properties. When finished, Roux-Bot will be a mechanical, software and electrical feat while creating an edible product that could potentially be consumed by the class.
Minimum Specifications

Winter 2015:

- Implemented hot plate with consistently variable temperatures
- Cooking bowl and stirring mechanism implemented together
- Power regulation board providing system power from wall supply
- All mechanisms interacting with microcontroller
- Sending/receiving data with microcontroller through wifi
- Mobile app skeleton in place *(REMOVED 2/26)*
- *(AMMENDMENT - 2/26)* Instead of mobile app skeleton, a local network webpage skeleton will be in place instead
- Outline drawn up of culinary recipes we will be using
- Prototype user interface in place using push buttons & LCD screen

Spring 2015:

- Dispensing mechanisms for flour, fat, and extra ingredients implemented
- Full automation of cooking through microcontroller
- Complete mobile app up and functional
- Wall drawn power board controlling all functions and working efficiently
- Encase the electronics of the bot in a protective shell

Division of Labor

Tuan Tran
- Wifi to microcontroller integration
- Mobile app design and implementation

Justin Boals
- Power supply design
- Circuit design and electrical analysis
- Soldering and PCB production
- Manual input & LCD implementation

Dustin Le
- Lead microcontroller design
- Cooking element design and electrical implementation
- Dispenser mechanism design and implementation

Joe Riggs
- Project overseer
- Mixing element design and implementation
- Dispenser mechanism design and implementation
- Microcontroller assistance
<table>
<thead>
<tr>
<th></th>
<th>Fall '14</th>
<th>Winter '15</th>
<th>Spring '15</th>
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<tbody>
<tr>
<td>Dustin</td>
<td>Research cooking stove &amp; sensors</td>
<td>Assemble cooking base and circuitry</td>
<td>uC controlled cooking w/ variable temp.</td>
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<tr>
<td>Dustin &amp; Joe</td>
<td>Design dispensing methods</td>
<td>Build flour dispenser</td>
<td>Build extra ingredient dispensers</td>
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<tr>
<td>Joe</td>
<td>Research motors, bowl, and mixers</td>
<td>Assemble mixers and circuitry</td>
<td>uC controlled mixers</td>
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<td>Justin</td>
<td>Research power supply</td>
<td>Power budget</td>
<td>Build power distribution board</td>
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<tr>
<td>Tuan</td>
<td>Plan mobile app design and Wifi interaction</td>
<td>Implement preliminary mobile app</td>
<td>Communicate between app &amp; uC with Wifi</td>
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<tr>
<td>Group</td>
<td>Research and choose microcontroller</td>
<td>Research and plan specific recipes</td>
<td>Automate all processes in sequence</td>
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