

EE/CprE/SE 491 - sdmay19-31:**Multi-Purpose Automated Robotic Mixer (mpARM)**

Week 5 Report

October 7 - October 13

Client: Alexander Stoytchev/Brett Altena

Faculty Advisor: Alexander Stoytchev

Team MembersDrew Caneff — *3D Printer Specialist/CAD Designer/Accountant*Amos Hunter — *Electromechanical Specialist/Meeting Scribe*Brett Altena — *Meeting Facilitator/ Computer Vision Developer*Kristian Wadolowski — *Report manager/Front-end programmer/Computer vision Developer*Jase Grant — *Embedded Systems/ Assignment Manager***Summary of Progress this Report**

- **Design document has been completed**
- **Many designs and sketches have been released**
- **Team website has seen significant improvements** - These improvements include pictures and bios for all team members and a problem statement for our project.
- **Interface research** – Through research of available options for the user interface we have found three possible options for a user interface.

Direct computer hook-up: *This will likely be used for prototyping anyway, as it allows us to quickly and easily edit and upload code to the machine. On this platform we could use the programming tools to trigger a programmed response, or we could program a menu to act as a more user-friendly interface. It is also technically free, as everyone has a computer we could hook it up to.*

Touch-screen: *In this interface we would buy a touchscreen, and then program a user interface onto it. It isn't as programmer friendly as the computer is, but it certainly is user-friendly. This option is the most expensive, and if our budget is already projected to be tight.*

A simple push button: *Pressing the button sends out an electrical signal to the machine, which can be interpreted a variety of ways (most likely as "make a pancake"). A single button is incredibly cheap. It's completely unambiguous to any user, and it's easy to program.*

- **Thor arm components** – Review was done on every gear, motor mount, pulley, and other 3D parts. This was done to become familiar with the arm for future assembly and use. While data on the arm shows that it is fully capable of lifting the weight of a pancake, it is difficult to know if it is capable of performing the flipping motion we require for the project.
- **Electrical research** – Research was done on viable switches for the project. Prices of switches were compared through online vendors. A rocker switch with built-in LEDs would appear ideal for the project. As the LEDs would allow the user to see clearly if the device is on or off, aiding in troubleshooting. Additional research was conducted on switch debouncing, which is where you attempt to eliminate the high frequency switching effect that happens when you first open or close a switch. The suggested solution to this problem is to connect a shunt capacitor to the switch. The capacitor acts as a high pass filter and passes the higher frequency "signal bouncing" to the ground, but allows the on/off DC voltage to remain. The proposed capacitor would have one lead connected to one side of the switch, and the other lead grounded.

Further research was conducted on the ideal capacitor for this purpose. It was found that an ordinary electrolytic capacitor would work, and that so long as it was connected with proper polarity the

capacitance did not need to be very high. The intended use for this capacitor provides a rather large tolerance for variation in capacitance.

- **Computer vision** – Looked into doing various methods of using OpenCV. The first method researched was utilizing `opencv.blobs`, this method searches for "blobs", contours within images that match a set size determined by the user. This method would be best used for processing the image stream to detect the pancakes because it can track unnatural objects.

The next method that is viable option is utilizing the rough circles library. This library detects circles seen within an image and tracks their attributes. This will be used for the tracking bubbles within the pancakes as they form. We may decide to only track the bubbles within a specified inner circle within the pancake as the inner bubbles form later in the cooking process.

http://ubaa.net/shared/processing/opencv/opencv_blobs.html

[https://opencv-python-](https://opencv-python-tutroals.readthedocs.io/en/latest/py_tutorials/py_imgproc/py_houghcircles/py_houghcircles.html)

[tutroals.readthedocs.io/en/latest/py_tutorials/py_imgproc/py_houghcircles/py_houghcircles.html](https://opencv-python-tutroals.readthedocs.io/en/latest/py_tutorials/py_imgproc/py_houghcircles/py_houghcircles.html)

- **FPGA** - Determined that the university available FPGA's are not suitable for the project, as they would require a long and time-consuming programming process to meet our requirements. Alternative FPGA's are commercially available that can handle the demand of the project's computer vision processing. A rough draft of an IP module for such an FPGA has been set up.

Pending Issues

- Detailed budget of parts
- Complete prototype design
- Figure out the process for 3D printing
- Acquire the materials needed to begin prototyping

Plans for Upcoming Reporting Period

- Create detailed reports needed to begin prototyping.
- Begin prototyping
- Being finalizing shopping list
- Complete project plan v2

Individual Contributions

Team Member	Contribution	Weekly Hours	Total Hours
Drew Caneff	<ul style="list-style-type: none"> ➤ Participated in group meetings ➤ Worked on design document ➤ Created flowcharts for documentation ➤ Reviewed Thor arm components and electric boards 	12	55
Amos Hunter	<ul style="list-style-type: none"> ➤ Participated in group meetings ➤ Worked on design document 	11	34.5

	<ul style="list-style-type: none"> ➤ Completed two design sketches ➤ Created flowcharts for documentation ➤ Researched electrical components 		
Brett Altena	<ul style="list-style-type: none"> ➤ Participated in group meetings ➤ Facilitated meetings ➤ Worked on design document ➤ Focused on implementing and testing computer vision system ➤ Made improvements to team website 	7	30
Kristian Wadolowski	<ul style="list-style-type: none"> ➤ Participated in group meetings ➤ Worked on design document ➤ Researched interface options 	7	24
Jase Grant	<ul style="list-style-type: none"> ➤ Participated in group meetings ➤ Contributed to design document ➤ Created flowcharts for documentation ➤ Continued designing program module for FPGA 	5	21

Gitlab Activity Summary

 Action: joined, Tue Sep 04 2018

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