EE/CprE/SE 491 - sdmay19-31:
Multi-Purpose Automated Robotic Mixer (mpARM)
Week 14 Report
February 9– February 16
Client: Alexander Stoytchev/Brett Altena
Faculty Advisor: Alexander Stoytchev

Team Members

Drew 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

- **Vision Program-** The main components of the code consist of taking in the input from the command line to identify the quantity required, detecting when a pancake is in view of the GoPro, counting how many bubbles have surfaced on the pancake, and sending signals to the Arduino to flip the pancake. The first step of the code is ensuring that the quantity was sent during the execution of the program. The next step is using Hough Circles to continuously run until a circle is seen on the screen of a certain diameter above 7 cm. Research will need to be done on determining how many pixels in length translate to how many centimeters on the actual griddle. This will help in the computation of determining how many bubbles are required. After that, the background subtraction part blacks out all parts of the image that are still. Work still needs to be done on counting the unique white blobs that appear on the screen. Right now, my computer is not able to execute the code due to issues with Cygwin.
- **Frame-** Measured some of the wood and aluminum pieces of material to lengths specified in the frame design. This was done with a tape measure. The measurement marks were made with a black permanent marker. The materials were removed from their packaging and the packaging was disposed of properly. This included stickers on the aluminum rail and wood, paperboard packaging for the handles, and a plastic and paperboard packaging for each carabiner clip for the handles as well. The materials were cut with a hacksaw at the measured marks. The cutting process made a fair amount of noise, so care was taken to do the cutting at a time of day that would not disturb other people nearby. The cutting was divided across two days so far to avoid making too much noise late at night or early in the morning. The wooden material was easier to cut, being softer. However, there was more material to cut through because it was thicker. The aluminum material was harder by comparison, although much easier to work with than steel channel would have been. In retrospect, this confirms my decision to use aluminum rather than steel. It was noted that cutting the wood would be made easier by using a carpentry hand saw rather than a hacksaw. However, due to cost constraints, a hacksaw is still serviceable, especially considering the limited amount of wood cutting to be done. Care was taken to make the cuts straight and smooth. However, limited precision is possible with hand tools and some cuts are somewhat of an angle relative to what would have been ideal. This should not be an issue for the frame though. The wooden piece was originally an exterior baluster, so the beveled end of it was cut off to allow for more square pieces to be taken from it. After the cuts were made, the sawdust and metal filings were swept up from the floor with a broom. A plastic container was also used to catch some of the waste material and it was emptied as well. The tools and materials were returned to a storage location so as to be out of the way until needed again. The ends of the aluminum pieces were rough from the saw marks, so a

piece of sandpaper was used to smooth them down. This removed the roughness and metal burrs which might otherwise cause harm or disrupt the design. There are aesthetic advantages to this as well.

- **Arm-** The motors in articulation 5 and six kept on moving up towards the gear mechanism causing the belt mechanism to skip as a result of a lack to tension. This was the result of the force the gear system had on the motor mounts which use an inefficient rail system allowing for the motors to slide in a vertical direction. The solution was to place the motors in an appropriate location so as to provide the correct level of tension on the belt system. Then the motors were fixed to their locations with an adhesive product. The belt system has currently operated without slipping after the adhesives were applied.
  Components still not fitting as expected. The solution was to manually machine the parts to fit correctly. While this is time consuming and only works to a limited amount of success it will lead to a more reliable product in the end. The more the arm is assembled the more concerned I am about a large mechanical object which is almost entirely 3D printed. We are really pushing what can be accomplished with hobbyist technology and budget.
- **FPGA-** Coded and I worked on the pipeline for the FPGA for the CPU processes and also set up some of the GPIO ports for outputs to test the FPGA set-up.
  Trying to get a full version of the program for the FPGA set up so that I can use all the testing functions.
  Having trouble with the camera because I can't test the input.
  Waiting for the J-Tag and the power cord to come in.
  Haven't gotten to programming the FPGA yet because I don't have the power cord for the FPGA.
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Pending Issues

- Complete Computer vision code
- Assemble the arm
- Assemble frame

Individual Contributions

Team Member	Contribution	Weekly Hours	Total Hours
Drew Caneff	➢ Worked on assembling the arm	9	201
Amos Hunter	➢ Recorded meeting notes ➢ Measured/cut materials for frame ➢ Planned for additional frame materials ➢ Worked on frame construction	12	152.5
Brett Altena	➢ Started re-write of main program ➢ Directed computer Vision proposal video ➢ Worked with additional member on computer vision code ➢ Researched FPGA alternatives	11	157
Kristian Wadolowski	➢ Worked on computer vision proposal video ➢ Analyzed Arduino Code	6	107

Jase Grant	➢ Worked on FPGA code ➢ Analyzed Arduino Code	6	78

Plans for Upcoming Reporting Period

Team Member	Plans
Drew Caneff	➢ Continue work on arm
Amos Hunter	➢ Continue work on frame
Brett Altena	➢ Debug video file code ➢ Develop FPGA-less program ➢ Simulate test environment
Kristian Wadolowski	➢ Analyze Arduino code ➢ Look for additional 3rd party documentation
Jase Grant	➢ Work more on FPGA pipeline ➢ Integrate camera

Gitlab Activity Summary

Action: joined, Tue Sep 04 2018
Author: dvcaneff
