EE/CprE/SE 491 - sdmay19-31:
Multi-Purpose Automated Robotic Mixer (mpARM)
Week 12 Report
February 2– February 8
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

- **Thor arm-** There is a concern with articulation five and six with the THOR Robot Arm. While assembling I noticed that much of the provided information on this articulation varies greatly from the provided material given by those who designed the system. Some models include some parts and leave out others and there even appears to be spots for sensors which are not listed in the BOM or any of the other materials. The only sign they exist is in old animation videos and the mounting holes on the physical prints. Additionally, it has come to my attention that with the low quality prints of some of the components, the somewhat poor design of this articulation piece and the nonexistent material on how it should be assembled a weak articulation is most likely guaranteed. While I have been taking time to sure up the structure as best as I can, there is still a concern that this specific articulation is most prone to breaking. What is also concerning is that this is one of the most vital articulations and most complicated to manufacture and assemble. Another concern is with the admittance of the sensor from the BOM there is nothing to tell the system when the joint is at its limit; as a result it is likely that at some point the motor will over rotate resulting in the machine in breaking itself. With an increase in 3D printing quality as well as plans to search back component lists for missing sensors and previous experience in assembling this section of the robot plans have been made to make a duplicate of this articulation. The components we would need to replace which could not be salvaged from the older model are relatively cheap and easy to make. The original model will be used so as to get the arm to the programmers for testing purposes. The second articulation will be made as a backup in the event the first version breaks which is likely. The second version should be of much higher quality and as such should be capable of functioning without breaking. Whichever model of articulation five/six isn't on the robot will be used in the final presentation as a prop as it is by far the most interesting articulation on the robot arm on a mechanical level. Here the cost to make a backup to increase the chance of a fully functional robot for the final presentation is well worth the cost as the necessary material will most likely not exceed more than $20.
- **Testing board-** The testing board was completed and demonstrated in a meeting with Stoytchev. The initial design was altered slightly, allowing for the use of a single debouncing capacitor. Also, the order of the series components was switched a little bit to more conveniently hook up the FPGA. The board is mostly made of salvaged parts, excepting the perfboard, saving the team money. It was soldered together and then tested with a multimeter. It has indicator LED lights for each normally-open switch. When a switch is pressed, the circuit is completed and a voltage of roughly 3 volts is present across whatever load is connected. The board is available for use in testing the input-output behavior of our

subsystems.

- **Pseudo code-** Developed a proposal for the computer vision aspect of the project for the class CPR E 575. In the process, recruited a member of the class to join the group to help with the programming. The pseudo-code for the main program will be followed as closely as possible using C. The code was written off the assumption that there will be methods made for controlling the arm such as the following: pourBatter, flipPancake, and servePancake. The methods will send specific commands to the Arduino in serial bit to send to the arm. The pseodo-code receives instructions from the user interface and the camera. Some stretch goals for the main program is to send a signal to a buzzer when all the pancakes are done cooking and keeping track of progress via a timer on display until the program is done.
- **Thor code analysis-** I continued my research on the arduino code I was given. I decided to follow the advice of the group and looked for 3rd party documentation on the code, as the provided documentation was lacking. After some google searching I was forced to give up on finding 3rd party documentation, as there did not appear to be any postings I could find. After this I continued to study the arduino code, and mapped out the connections between several more functions.
- **FPGA-** Coded and 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
  Ran into issues when trying to compile the FPGA set up. Some of the clocks are messed up and are sending signals wrong. made a lot more progress
  Trying to get a full version of the program for the FPGA set up so that I can use all the testing functions.
  Some issues with the cameras version and I am trying to find a way around it because the version is newer and is harder to interface and hack
  Have some issues setting up the project for the FPGA code at first because of the new board.
  Might need to borrow a J-Tag for the FPGA from the school and a power cord.
  Haven't gotten to programming the FPGA yet trying to get the code to compile and to code it a bit.

Pending Issues

- Batter issues (Splashing, feeding, mixing, type, etc...)
- Complete Computer vision code
- Assemble the arm

Individual Contributions

Team Member	Contribution	Weekly Hours	Total Hours
Drew Caneff	➢ Set up robot assembly station ➢ Assembled articulations 3,5,6 of Thor arm ➢ Adjusted 3D printing ➢ Made plans for minor arm improvements	23	192
Amos Hunter	➢ Finished test board ➢ Planned various aspects, and provided council	14	142.5
Brett Altena	➢ Researched motion detection ➢ Wrote pseudo code for computer vision ➢ Recruited new member for additional computer vision work	7	146
Kristian Wadolowski	➢ Compiled and edited reports ➢ Continued research on Arduino Code ➢ Researched computer vision approaches	6	101

Jase Grant	➢ Worked on code for FPGA ➢ Did more indepth research on ports and integration ➢ Researched pipeline acceleration	5	72

Plans for Upcoming Reporting Period

Team Member	Plans
Drew Caneff	➢ Continue work on arm
Amos Hunter	➢ Continue work on frame
Brett Altena	➢ Debug motion tracking code ➢ Test motion code on FPGA
Kristian Wadolowski	➢ Continue to analyze the arduino code
Jase Grant	➢ Work on code and pipeline ➢ Start integrating camera ➢ Compile code and start FPGA C code

Gitlab Activity Summary

Action: joined, Tue Sep 04 2018
Author: dvcaneff
