The original purpose of our project was to create a Scara based robot arm that could quickly and accurately use G Code based commands from a GUI element. On top of this, our group added the extra conditions that it needed to also be able to take an input image, whether it was an image already on the computer or if it was taken with the webcam, and generate G Code from that image to draw a rough version of it, and for it to have the option to allow the user to draw in a canvas and then have the arm produce a similar drawing. To accomplish these requirements, we decided that the project would be broken down into several core blocks: the GUI block, the computer vision block, the Arduino block, the servo block, the arm apparatus block, and the drawing tool holder block.

When designing, we considered two main options for what to use to control the servos, an Arduino or a Raspberry Pi. With the Raspberry Pi we could have the system be all-in-one that would allow a user to simply connect a monitor and a mouse, minimizing the need for a computer, but unfortunately we found that this was not an option as running computer vision on a Raspberry Pi was very difficult with its limited specifications. Therefore we decided to have a two-part system where we run the computer vision and GUI on a base computer that then sends the commands to an Arduino that then translates the commands and controls the servos.

For the Arduino firmware, we went with an implementation of an open-source G Code interpreter called GRBL. GRBL is often used in 3D printer projects and has full support with G Code and can be used in a large array of build formats. Normally GRBL only supports linear movement of axises, this lead us to use an implementation that converts the Cartesian coordinates in the command into angles for the servos to move to.

Another design problem we ran into was that the servos required at least 6 volts to function properly. We tossed back and forth between whether we should create a whole new block for a power supply or if we should just try to step up the output voltage of the Arduino to reach 6 volts. In the end we decided to just use an external power supply as we were already too far into the project to consider building a separate block for it.

From this project we learned several lessons. The first that we learned is that if we are going to use open-source code that it needs to be thoroughly tested for our needs and that we need to make sure that it supports the hardware that we are using. We realized far too late that the software that we used does not fully work and caused us to have to modify the implementation for it to be semi-successful since we could not swap to another firmware as it did not support our hardware. Another thing that we learned is that the sooner that we can put things together and start testing, the better. We put things together far too late and scrambled to sort out the last couple of issues.

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PROJECT TITLE:	Arm 1
PROJECT MEMBERS:	Craig Brod, Joseph Borisch, Austin Gusewelle
DATE DUE:	6/1/22
Legend:	Course Due Date / Group Due Date

WBS NUMBER	TASK TITLE	START DATE	DUE DATE	COMPLETED BY	PCT OF TASK COMPLETE
1	**Plan**				
1.1	Engineering Requirement	4/6/22	4/7/22	Team	100
1.2	Block Diagram 1	4/6/22	4/10/22	Team	100
1.3	Project Timeline	4/6/22	4/11/18	Austin	100
2	**Design**				
2.1	List of Parts Draft	4/13/22	4/17/22	Craig	100
2.2	Block Check Off 1	4/15/22	4/22/22	Team	100
2.3	CAD Overview	4/15/22	4/24/22	Austin	100
2.4	Pseudocode	4/15/22	4/24/22	Craig / Joe	100
2.5	Order Parts	4/20/22	4/24/22	Joe / Austin	100
3	**Build/Test**				
3.1	Design Feedback Session	4/25/22	4/25/22	Team	100
3.2	Rough Draft Build	4/22/22	4/27/22	Team	100
3.3	Design Feedback Submission	4/25/22	4/29/22	Team	100
3.4	Revised Build 1	4/27/22	5/4/22	Team	100
3.5	Test 1	4/27/22	5/4/22	Team	100
3.6	Block Check Off 2	4/29/22	5/6/22	Team	100
3.7	Revised Build 2	5/4/22	5/11/22	Team	100
3.8	Test 2	5/4/22	5/11/22	Team	100
3.9	Final Test	5/11/22	5/18/22	Team	100
3.1.1	Backup Test & Build	5/18/22	5/25/22	Team	100
4	**Project Presentation**				
4.1	Poster Draft	5/13/22	5/19/22	Team	100
4.2	System Verification	5/20/22	5/27/22	Team	100
4.3	Expo	6/1/22	6/1/22	Team	100
4.4	Showcase Assignment	5/27/22	6/3/22	Team	100