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| JCU |
| CC2511 Final Product Report |
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# System Working Principle

## Introduction

This part will demonstrate how group 3 designed PCB as well as the thoughts of software design for milling machine GUI and its function.

## Hardware

Hardware design began with knowing the usage of hardware. Members need to get together to take comprehensive knowledge of what kind of hardware need to be designed.

### Preparation

There were several meetings for the preparation of design. In the first meeting, whole working circuits were separated into several parts, for instances, power supply, stepper motor and etc. Under instruction of task sheet, a general actual working circuit which wouldn’t be in detail should be drawn. With several modification and correction in the following meeting, final proper circuit which everyone agree on was presented.

### Schematic

On the basis of prepared circuit, main components were added to Altium schematic. Several component sheets need to be referenced. unoccupied pins were listed waiting for use. In several components sheet, some calculations are required to provide enough voltage for milling machine. The availability of components was significant as well. Several stores were there for customers to choose. Having put all available components into schematic and run several compilations to correct circuit, it was time to step into PCB.

### PCB

This step needs good space management ability to sort all components on one small board. The size of PCB was fixed. Thus, it took time to arrange everything on board.

## Software

## GUI

Although it was troublesome, GUI part was the easiest part for coding. Several options were need to be listed. The cursor needs to jump around in GUI. So, to find the location of cursor was the troublesome thing that programmer need to do.

## Function

Excluded code sheets were added to this project to improve its readability.

### Utility

In this part, functions that are control milling machine manually and GUI control were placed in this file as well. From Group 3’s perspective, the function ‘manual movement’ is the core function in this part. In ‘manual movement’ function, 3 motor drivers and PWM for drill were controlled. What’s need to be mentioned for controlling the milling machine is that the delay time between to operation is significant. Without that function, the CPU cannot accept the command so quickly and it will be stuck.

### Shape

For drawing different shape, what needs to put emphasis on is the circle. Math library was imported for the usage of express circle. With circle’s expression as well the function that move spindle smoothly, the proper circle will be drawn easily. For the Olympic Rings, the point is to find 5 start point and then measure the distance for each point. Having applied moving function to move the spindle, circle drawing function is called to draw 5 rings.

# Problem and Troubleshooting

## Introduction

In this part several problems are listed and the solutions will be provided.

## Problem

In the process of designing PCB and programming, lots of problems occurred. During the PCB design, we calculated the voltage of several components and need certain value of resistants. We checked all store. However, there is no resistants that can satisfied our requirement directly.

During First soldering process. I mistakenly solder one motor drive chip in the wrong way. And we overheat the board in the reflow oven as well. We tried to use hot airgun to remove it and resolder it. However, there were some pins short. To improve the quality of the product, we remade our board. Fortunately, the brand new board seems pretty and can be practical to use

For the software part, circle was hard to be drawn. We tried to use lots of way to make it like circle, but failed. And I was lack of the knowledge for the circuit. Sometimes could not understand what I am doing for the design. We put one motor drive chip in the wrong way. When we tried remove and replace it with new one. We almost destroyed it.

## Troubleshooting

Fortunately, we’ve got lots of recourse to use. Online resources and senior student resources were the most helpful resources we used a lot. Sometimes, we turned to Bronson and Ben as well. We use the combination and similar resistance to substitute the resistance that we want. For the board, we re-make it again. I tried to use graphic library to draw circle, but it seems Kinetic didn’t allow me to use advanced library directly in my project. Consequently, I turned to use Math library and use circle expression to present y in the function. And finally, circle can be drawn.

# Hindsight for Product

## Introduction

This part will critical assess the product we made. Suggestions are provided for engineers that will modify the product in the future to improve the qualification of the product.

## Design Critical Assessment

### Pros

1. Power protection to protect circuit in case power supply plugin in the wrong way
2. Provide different mode for motor to choose.
3. The reset button on the board to substitute the reset button which was blocked by upper board on K22FN board.
4. We made progress bar for drawing to make progress of program visible.
5. Trim points are set to adjust current of motors and test point make troubleshooting easier.

### Cons

1. Step motor moves noisily and lag.
2. Only the semicircle can be drawn for the first trial.
3. Z and Y pin on the schematic are inverse
4. The circle function we use is not accurate.
5. The GUI works well on my laptop, but not on Uni’s. The resolution of screen is different

## Revising Recommendation

1. It’s the code problem. We put some prompt within loop of driving motor. Don’t put unrelated code inside motor driving code.
2. It’s mathematic problem. Do carefully calculate the loop times when program circle function.
3. Re-check the pin on schematic before submitting. Or you will spend lots of time debug the code.
4. The progress bar we made reduce the moving speed of motor driver. Consider to adapt it.
5. Float numbers should be used in circle function for accurate shape.

# Teamwork Issues

## Introduction

This part will state the contribution of each teammate and problem that we team met and how to figure it out.

## Contribution

Kim: schematic and PCB design. GUI and motor-driving function. Board Solder

Peng: schematic and PCB design. GUI and shapes-drawing function. Board Solder

Fuzhen: Triangle-drawing function. Put components on the PCB board.

## Problem Statement and Solutions

At the beginning, we’ve got 4 people in our group. But Levi transferred major to IT. Task was increased much more than we thought before. However, Kim was helpful to discuss with. And senior students are always in the lab to talk with. We learned a lot from them. However, one of our teammates is too busy to attend almost all meeting. Things become more difficult though, we still try to figure all things out. Having spent more time and message the conclusion for the meeting to the teammate absent helped us to finish the task on time.