Circuit and Shape Design for Wearable Computing

Group 5 Tianyi Wang 5140309214

1 Background

Nowadays, wearable computing becomes more and more popular. As Google Glass and Apple Watch, we can also use wearable computing in medical field. Facioplegia is a common symptom in our daily life, patients cannot control their facial muscle. Most of them could not blink, it may injure their eyes, even lead to blindness. So we can use wearable devices to help them exercise their facial muscle to avoid other disease caused by facioplegia.

The project I engaged in is about design a glasses controlled by cell phone and simple stimulating circuits to help patients relieve facioplegia. The first generation glasses has got great success and our team finished test in a hospital last year. On the basis, we want to ameliorate the appearance and redesign a smaller circuit to reduce the weight, the second generation glasses will have better performance.

2 Target

There are three targets for us to redesign the glasses.

The first one is we need to redesign a smaller circuit. Our program is run in Raspberry Pi, it need a source which can provide 5V operating voltage and 2A operating current. To help patients exercise their facial muscle, we want to use a 7.5V or 12.5V pulse voltage to stimulate their facial nerve. However, we can only carry a 3.7V battery pack, it cannot provide two different voltage levels at the same time, so we need to generate the voltages by aided circuits. In the first generation, we use two XL6009 modules to raise 3.7V to 5V or 12.5V directly, because

their input ports are in parallel, the currents in the two modules are different and the circuit's size is a little large (the PCB board is shown in Figure 1). We need to select a new structure to solve these problem and design a new module to replace the function of XL6009 module.

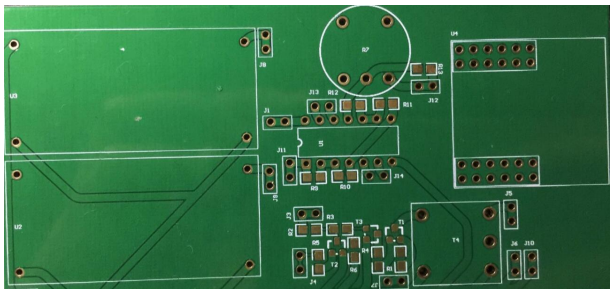

Figure 1: first generation source circuit

Our second target is to select a suitable camera. Our program needs to catch and compare two eyes' activities on a whole patient's face to judge if he want to nictate, if so, it can transmit a signal to the circuit to generate an irritative voltage. But now, our team has improved the program, it only needs to catch one eye and demarcate the boundary, so we need to find a new camera to adapt the new algorithm.

The last one is to design a new appearance for the second generation glasses. According to the size of new circuit and the requirement of image capture position, we have to rebuild a new 3D model and print it by 3D printer.

3 Progress

We have finished a part of our target yet. At first, we constructed a test platform based on Raspberry Pi Z0, we used the platform to test the performances of different cameras, the result is shown in Figure 2.

Then, we designed a new source circuit by XL6009 and LM2596 chips. The new structure is based on a series circuit, the input voltage

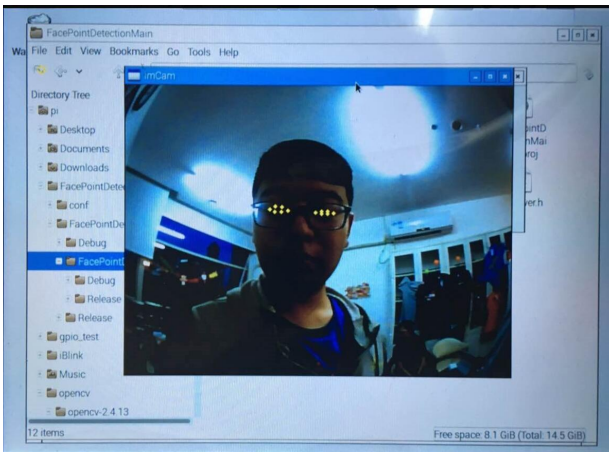

Figure 2: test result on Raspberry Pi

is 3.7V, we use XL6009 to raise the first part's output voltage to 12.5V and use LM2596 to bring the second output voltage down to 5V. We alsp removed the extra part to shrink the size. The new PCB is shown in Figure 3, its size is $36.8mm \times 30.8mm$, and smaller than before.

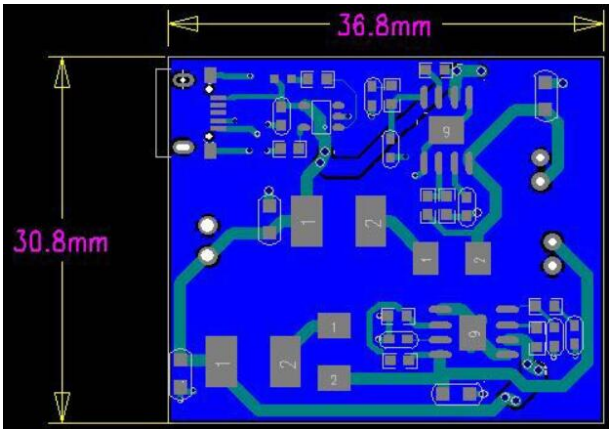

Figure 3: new source circuit's PCB

Now, we are designing the new 3D model for the glasses by AutoDesk's 123D Design, this model will be finish in one week or two weeks later.