Facial Paralysis Smart Glasses

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May 17, 2017

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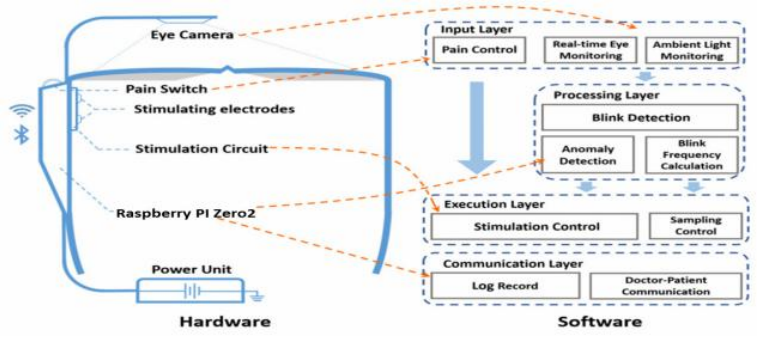
1 Abstract

Facial paralysis makes patients lose their facial movements.The problem usually occurs on just one side of the face. In this condition,we design a pair of smart glasses.Its mainly to catch the normal side of the face

2 Design

The architecture design is shown as follows which includes hardware and software function modules.



2.1 Hardware

A camera is installed in front of the eyes to get blinks. The eye camera captures images of both eyes and send them to the Raspberry PI Zero platform, which also monitors the ambient lighting condition. The Raspberry PI Zero and stimulation circuits are located on the patient's paralyzed side of the face. In particular, the Raspberry PI Zero and stimulation circuits are in the outer side of the glass frame, and two stimulating electrodes are in the inner side of the frame pressing on the patient's facial skin. The Raspberry PI Zero has Wi-Fi and Blue-tooth interfaces which can be utilized for communication with smartphones. A power unit supports both the process-ing platform and the stimulation circuits. Our circuits also contain a potentiometer as the pain switch, which could ne-tuning the automatic stimulation level control scheme. This is to accommodate individual diversity in case of discomfort.

2.2 software

The software consists of four layers: input layer, processing layer, execution layer and communication layer. The input layer receives the input images and ambient illumination data from the camera and pain control action from the pain switch. The images and illumination data are sent to the processing layer for operation model selec-tion, blink detection, anomaly detection and blink frequency calculation. The execution layer contains stimulation con-trol and

sampling control. The stimulation control takes in the result of detections and calculations from the processing layer to adjust the electric stimulation parameters for the pa-tient automatically. It also responds to patients' actions on the pain switch. The sampling control takes in results from the processing layer and adjusts the sampling frequency of the camera. When a doctor needs to acquire the patient's pathology data or the patient needs to report the pathol-ogy records, they can transmit data via the communication layer. The communication layer can support both Wi-Fi and Bluetooth transmissions.

3 My solution of the hardware:

This work is mainly about the hardware implementation of smart eye glasses.We focus on the realization of capture of the dynamic picture and the feasibility to wear. What we do is about facial paralysis.We create a smart eye glasses to get the dynamic picture, analysis and process the behavior from other device,which is connected by wi-fi or bluetooth.Finally we make sure it can help the patient.

3.1 Project work

3.1.1 The core computer

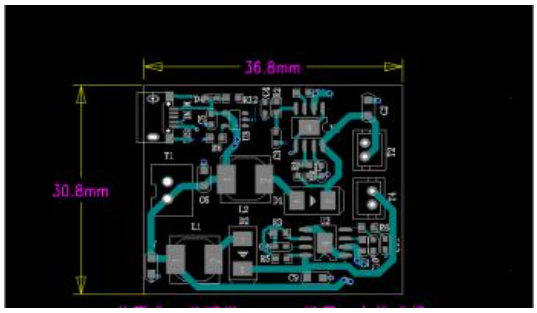
There were a lot of try of handling devices.On the basis of their predecessors,the small single-board computers Raspberry Pi was chosen to do the job.It has a wi-fi and bluetooth modules ,which can connect to the cell phone and other control device.We configured the system with the necessary software like opencv and others.After that the previous program can be run.Next step I will focus on the pi and program debugging of the camera.

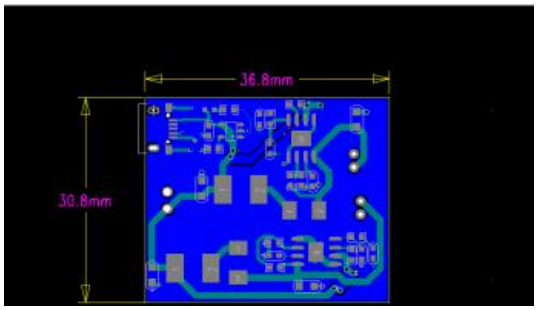
3.1.2 The camera

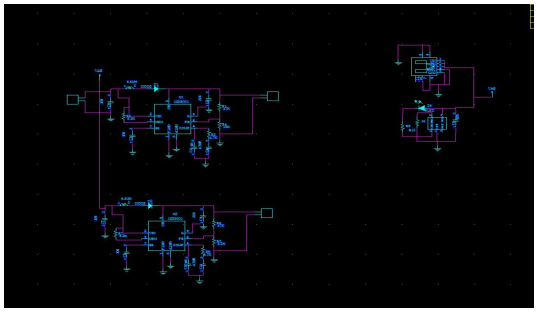
As a wearable device,the camera can calibrate ones face.So it should be as small as it could.We make a suitable camera,which has a 50mm*50mm*5mm size.The camera can connect to respberry directly.We try to match the camera and program,finally it can calibrate eyes in a suitable position.

3.1.3 The circuit

As we use Raspberry pi,the power supply becomes a big problem.We works much on the problem.At the beginning,we supply power by computer or power bank,which is obviously cant be wearable.Then we use the 3.7v lithium battery and DC-DC booster.But the stimulating circuit needs another booster.Both of boosters which can buy online is not so little.So we design a circuit to realize the two function.The schematic diagram and the PCB are as follows.







3.2 Future work

make the one eyes Calibration instead of the two eyes calibration.

Direct the Raspberry pi

3DP a suitable glasses