

INTRODUCTION

This is the project for ECE 362. Our team focuses on designing, building, and testing LED POV on a bicycle wheel. One LED strip is attached onto a bicycle wheel along with STM32F0-Discovery Microcontroller, an 18650 battery and a DC step-up module. The LED strip displays characters or patterns when the wheel rotates.

METHODOLOGY

Hardware

- STM32F0-Discovery development board
- WS2812B LED strip
- 18650 battery
- DC step-up module
- Hall effect sensor
- 3D printed mold components
- Bicycle

Software

The open-source Eclipse IDE is used, alongside the “System Workbench for STM32” Eclipse plugin (supported by STMicroelectronics).

Overall Approach

A strip of LED lights and a Hall sensor are connected to the STM32F0-Discovery board. The 3D printed mold fixes the components onto the bicycle axle. The Hall effect sensor sends the current velocity to the microcontroller to align the display speed with the current velocity.

A PWM waveform with a period of 1.25 us is generated on timer 1 to drive the LED strip. DMA is used to feed the preprogrammed characters in flash memory to the capture/compare register to update the duty cycle of the PWM waveform.

A magnet is attached to the wheel hub to produce external magnetic field so that whenever the Hall effect sensor passes through the magnet. A timer configured to be input capture mode captures the current value of free running counter to represent the time of one lap of wheel rotation thus the hold time of each state can be calculated by subtracting the data transfer time.

RESULTS



Figure 1. Characters displayed

Figure 2. Connection

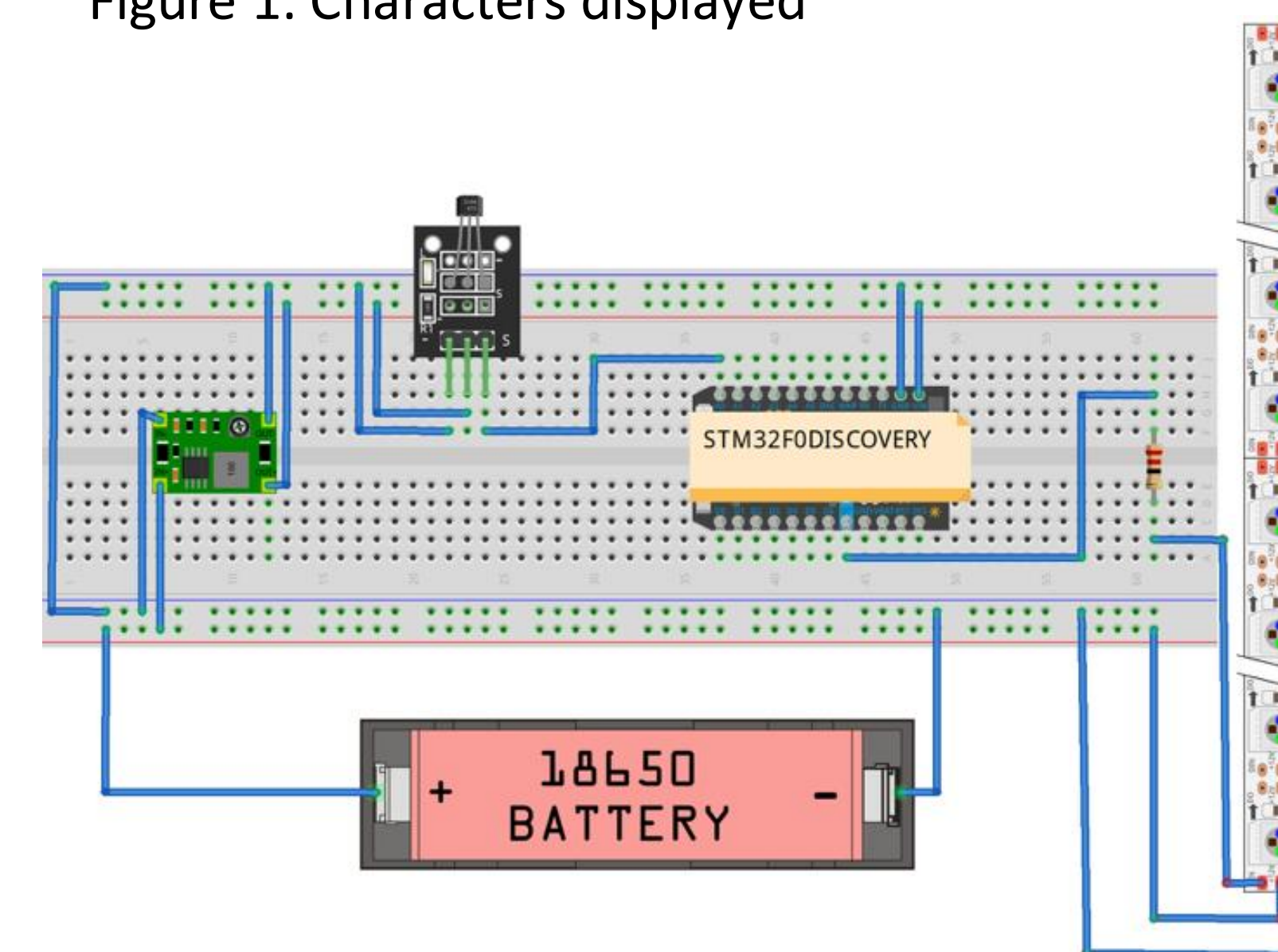


Figure 3. Wheel set-up



Figure 4. Real POV

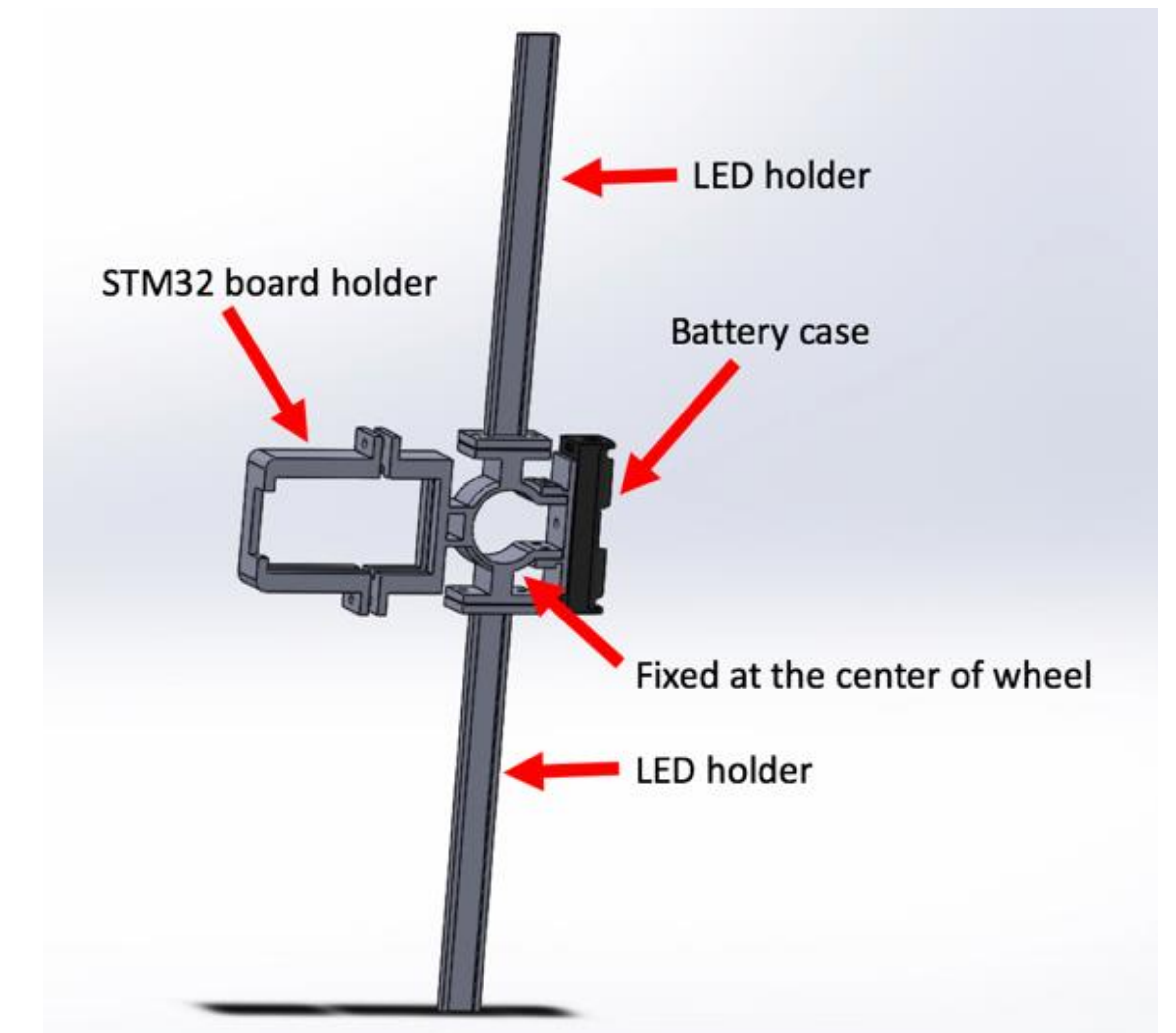


Figure 5. 3D-printed holder design

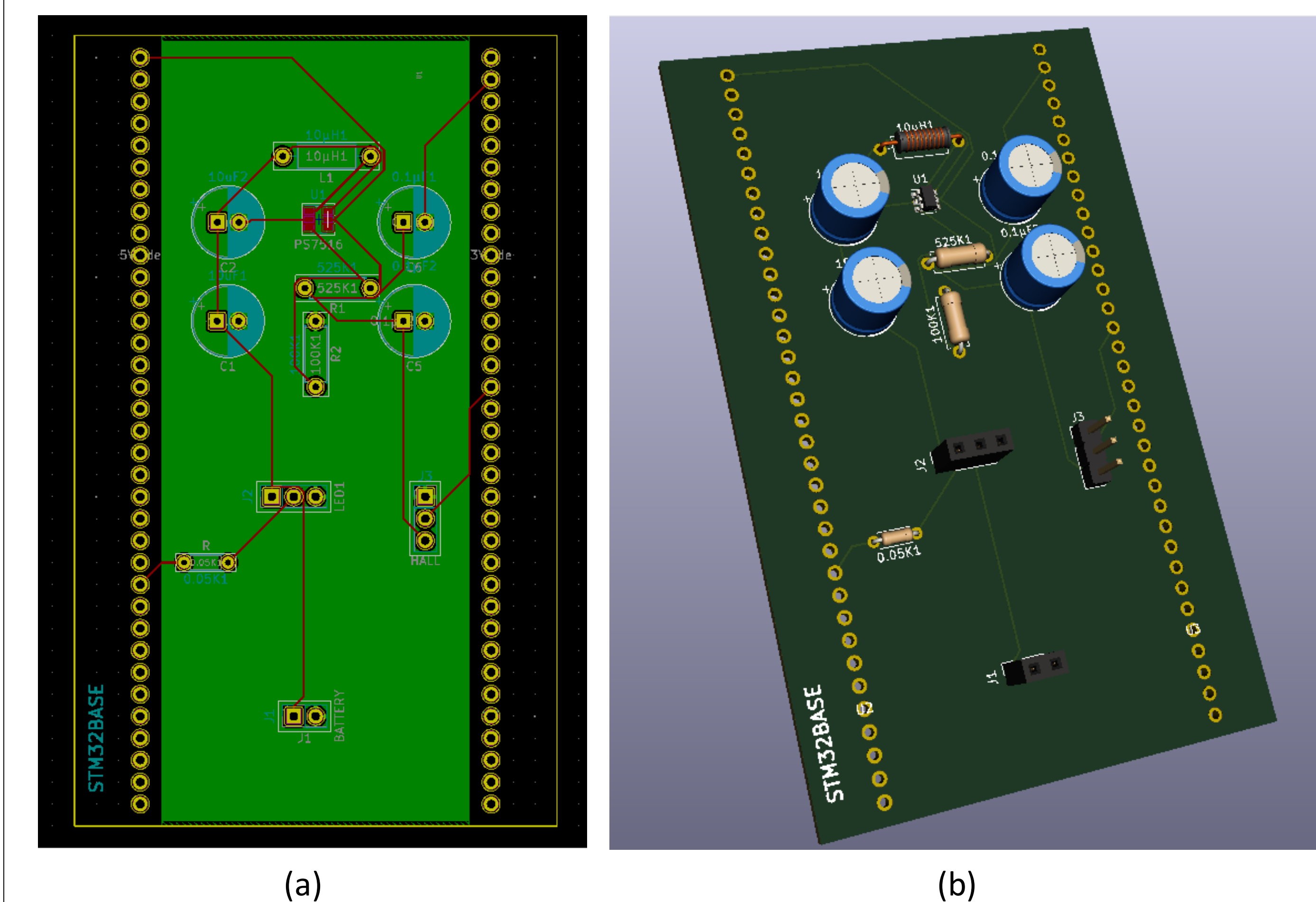


Figure 6. PCB design

ACKNOWLEDGEMENT

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