Appendix

Requirements	Verification
Cellphone: 1) The mobile app on the cellphone should get the correct data from Google Maps which should be converted into data which can be read by the microcontroller **6 points**	1) Send test data from the Google Maps and check on a terminal if it can process the data and make it readable for the microcontroller
Ultrasonic Sensor: 1) should be be able to determine the presence of a significant sized object up to 6.5 meters away 95% of the time **5 points**	1) Place an object up to 6.5 meters away from the ultrasonic sensor and check if the the sensors give out a value on the oscilloscope. 2) Connect the sensor to a microcontroller which is hooked up to a computer. Have the microcontroller calculate the distance between the sensor and the object and display the value on the serial monitor
Speedometer: 1. The Speedometer must periodically calculate the the speed at which the bike is moving and pass the information to the microcontroller. Speedometer should give accurate speed 95% of the time **5 points**	1) Spin the bike's wheel and check if the microcontroller detects a change when the magnet on the wheel spokes comes into close contact with the reed sensor on the bike fork
The LEDs: 1) The correct LEDs should light up when a signal is received from the microcontroller 2) The LEDs should catch the biker's attention within 0.5 seconds at least 90% of the time **5 points**	1) When the biker is approaching a right turn the right LEDs on the handlebar should start blinking and similarly for a left turn, the left LEDs should light up. When the biker is too close to the vehicle in front, the corresponding LED should light up. 2) Perform rider tests where the biker uses a stopwatch to measure the reaction time. 3) Create a test application that allows a user to send any random current location and final destination to the

	bike. Observe if the correct LEDs light up when the values input by the user are close to a turn.
The Blinkers 1) The correct blinker should turn on based on which switch is pressed 95% of the time **5 points**	1) Press left/right buttons to ensure that the correct blinker is lighting up
Buzzer: 1) The Buzzer should produce the correct sound of at least 70 dB when a signal is received from the microcontroller 2) The buzzer should catch the biker's attention within 0.5 seconds at least 90% of the time **5 points**	1) When the biker is approaching a turn, the corresponding tone should be played and when the biker is too close to another vehicle, the corresponding tone should be played. 2) Perform rider tests where the biker uses a stopwatch to measure the reaction time. 3) Create a test application that allows a user to send any random current location and final destination to the bike. Observe if the buzzer beeps with the correct frequency when the values input by the user are close to a turn.
Microcontroller 1) Microcontroller should not use more than 200mA current when powered by a 5V source 2) The microcontroller should be able to process information received from the mobile application and ultrasonic sensor and send the required output to LEDs and the beeper 95% of the time. **12 points**	1) Measure correct power and current supply using a voltmeter and multimeter 2) Develop test script and run 100 times to ensure microcontroller is receiving data and then sending it to the appropriate LEDs and beepers
The bluetooth module 1) The bluetooth module should communicate information from the mobile application to the bike in 2 seconds with a tolerance of +/- 0.885s 2) Bluetooth module should be receiving the correct data and sending it to the microcontroller 95% of the time. **5 points**	1) Develop multiple test scripts with varying amounts of data that has to be transmitted via the bluetooth module to the microcontroller to ensure data transmission is done in time 2) Ensure data being sent to microcontroller is accurate by looking at the serial monitor

Power supply 1) It should give a voltage of 5V with enough current to power all devices with a variability of 10% **2 point**	1) Measure the power supply with a multimeter and ensure that both voltage and current stay with intended levels

Table 1: Requirements and Verification

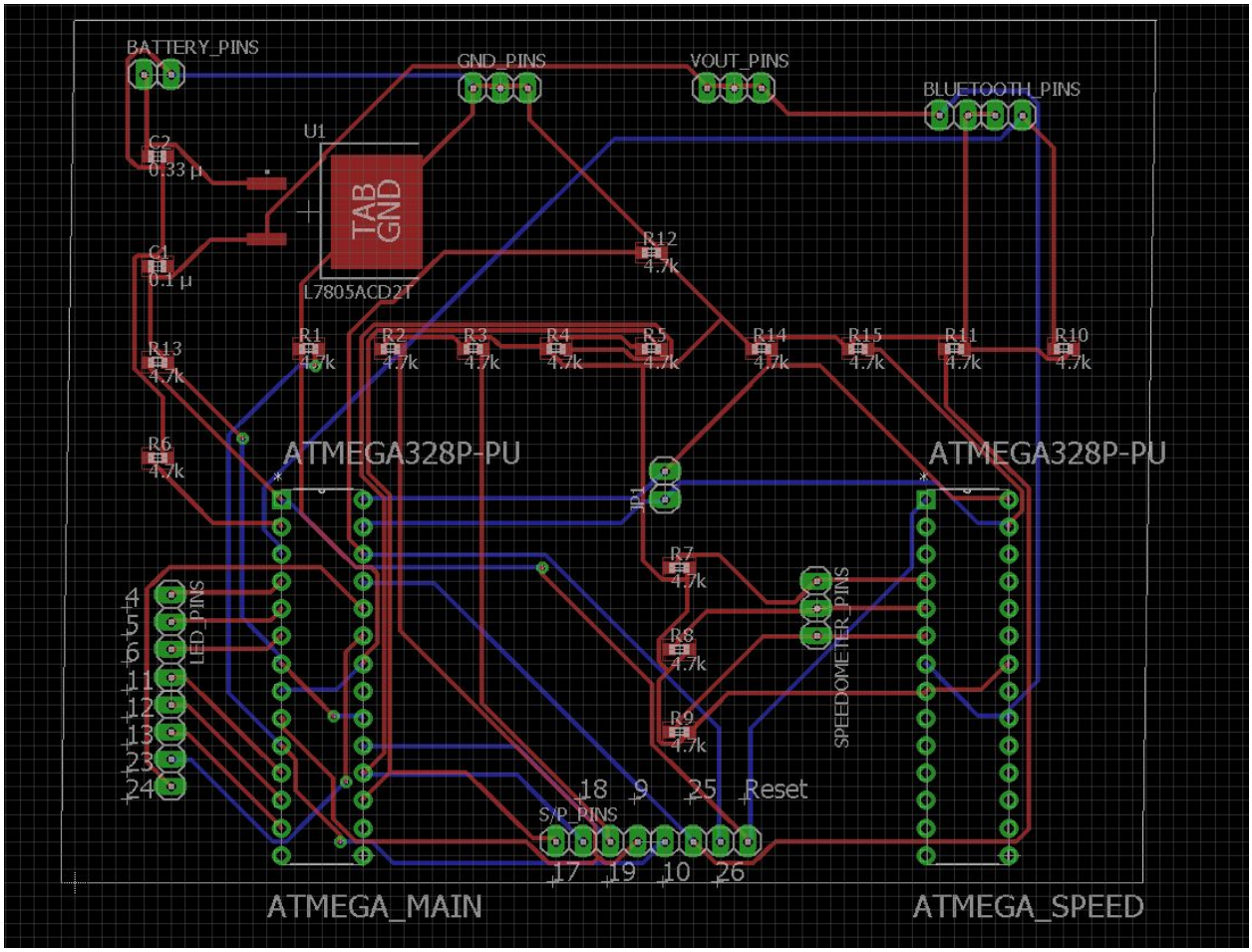

Figure 1: PCB Board

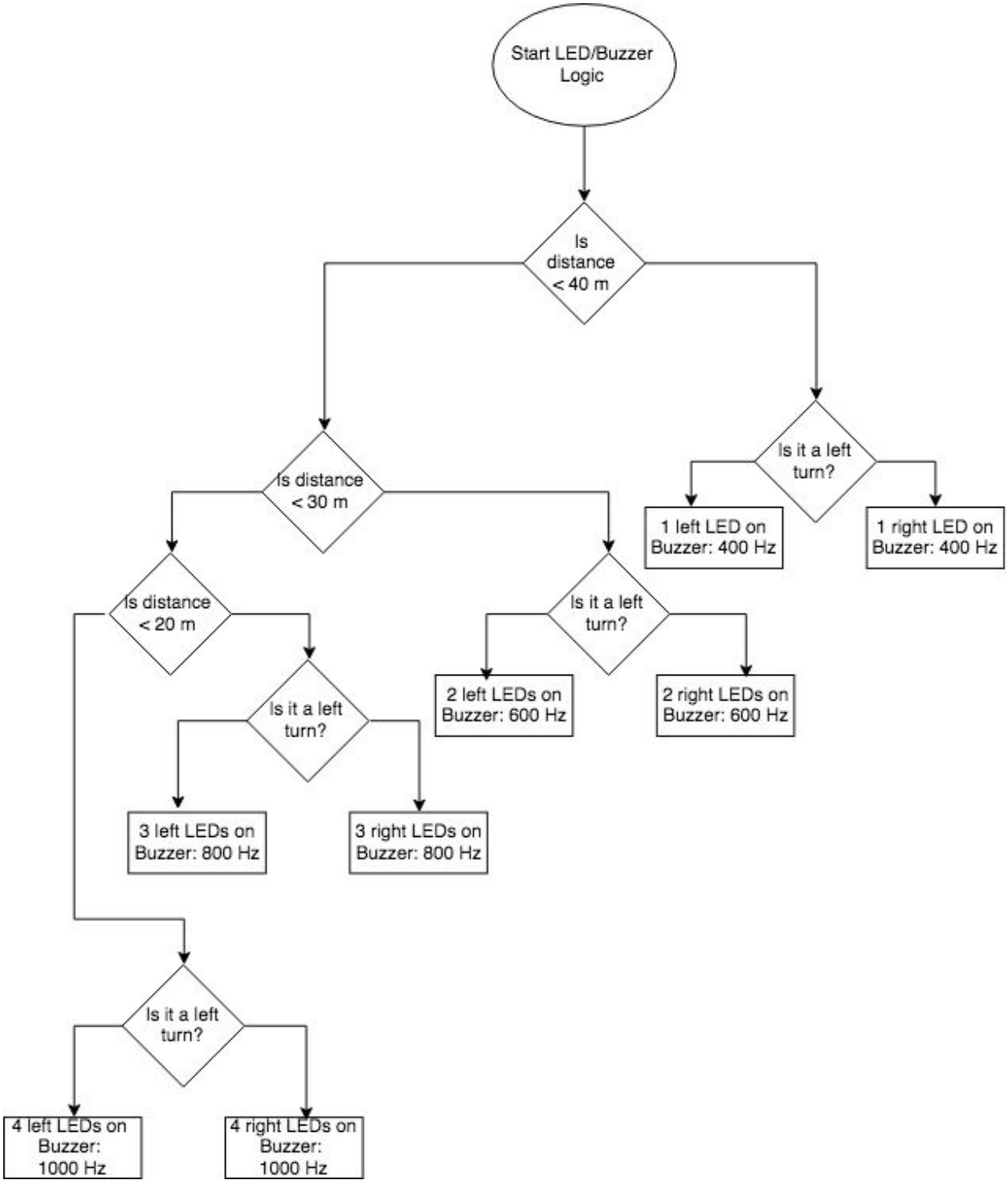

Figure 2. LED/Buzzer Logic

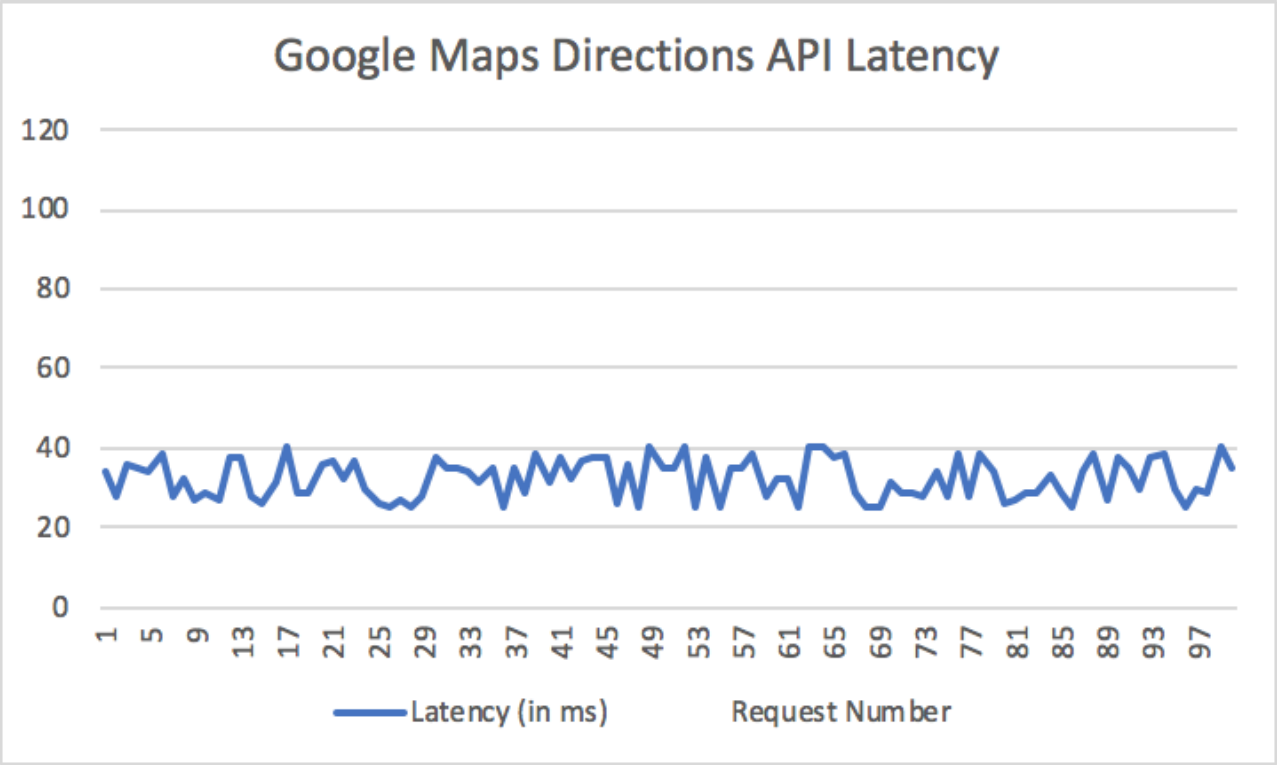

Figure 3. Google Maps API Latency

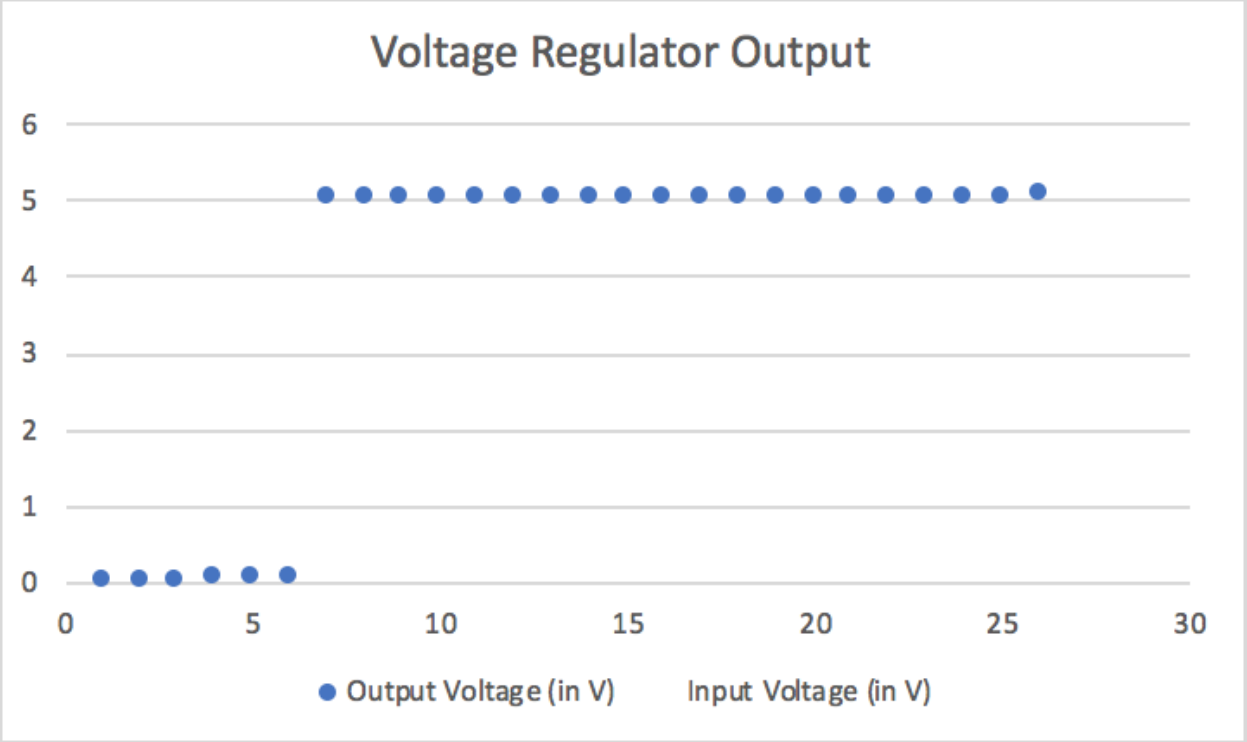

Figure 4. Voltage Regulator Output Voltage