

PROTOTYPE

A. Prototype Overview

The prototype consisted of three main modules. One is the Jetson Nano with the IMX219-160 Camera Module for computer vision purposes. The camera faces in the rear direction of the bicycle in order to

classify and draw bounding boxes and objects. Objects like humans, cars, trucks, and other vehicles specifically have their distances to the camera estimated by the Jetson Nano using the methods mentioned above specifically in Python.

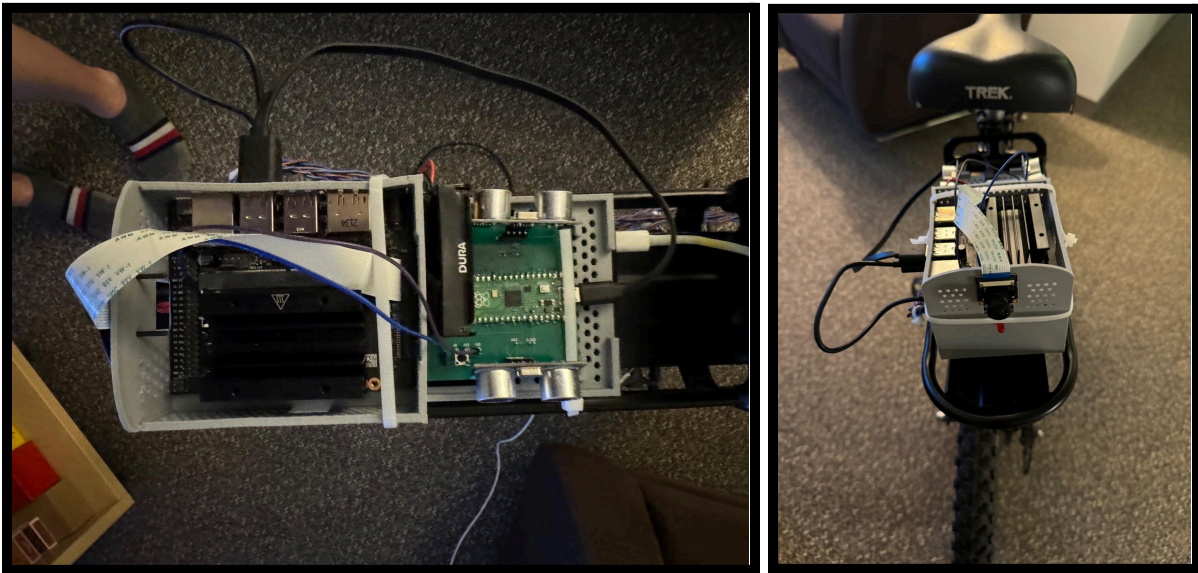


Figure 1. Jetson Nano with Camera

The next module is the ultrasonic measuring module. This module employs two ultrasonic sensors which are controlled and read by the Raspberry Pi Pico. These face the left and right sides of the bicycle in order to capture quickly moving objects on the sides of the bike which are not captured by the camera with little latency. This module is shown in Figure 2.

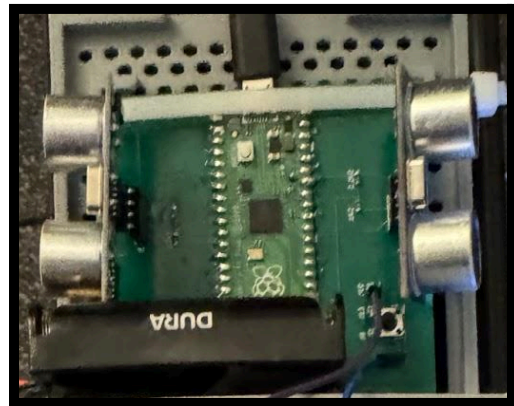


Figure 2. Ultrasonic Sensor Pico Module

The final main module is the Raspberry Pi Pico which controls the vibration motors and the rear red LED light. This can be seen in Figure 3. It uses two double A batteries and the ULN2803A

integrated circuit for the vibration motors. Figure 4 also shows how the vibration motors are mounted onto the bicycle.

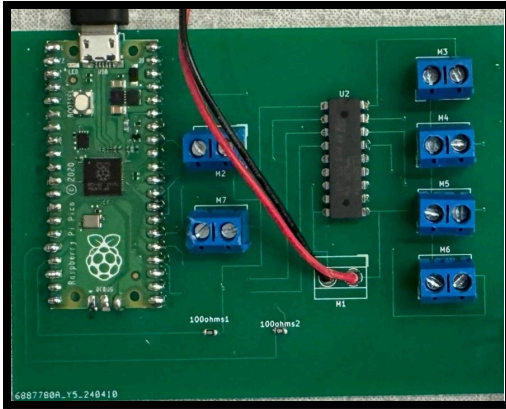


Figure 3. Vibration and LED Feedback Pico Module

Figure 4. Vibration Motor Mounting

The three modules mentioned above are mounted onto a rear bicycle rack that connects to the bicycle seat and is above the rear tire. A view of the modules on the rack are shown in Figure 5.

From the bike rack, the battery power bank which supplies 5V and 3A of power to the NVIDIA Jetson Nano Developer Kit is mounted as shown in Figure 5 in an enclosure depicted in Figure 6.

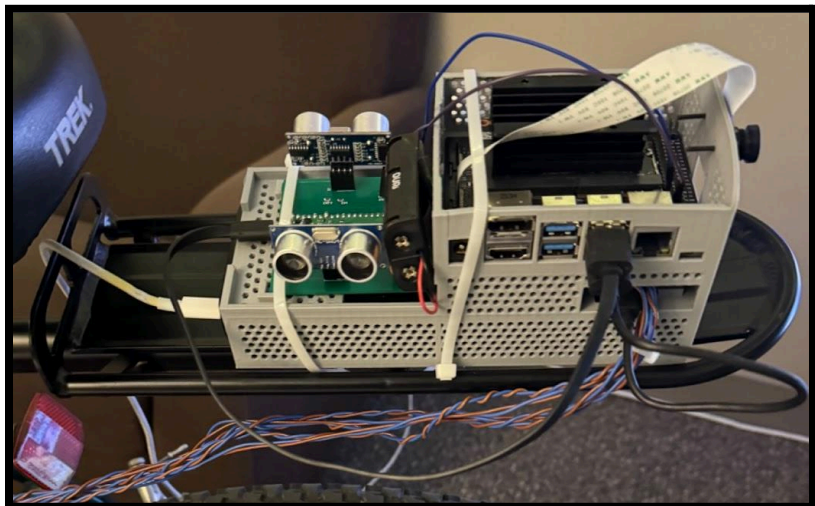
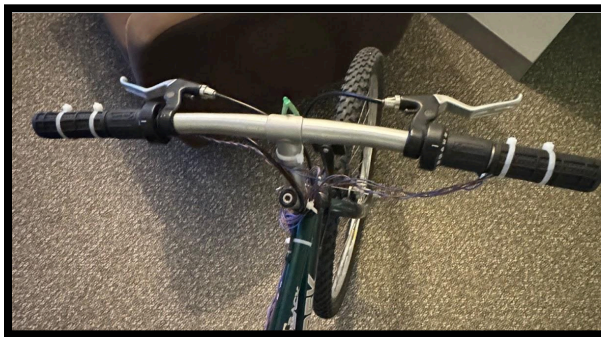


Figure 5. Rear Bike Rack Modules

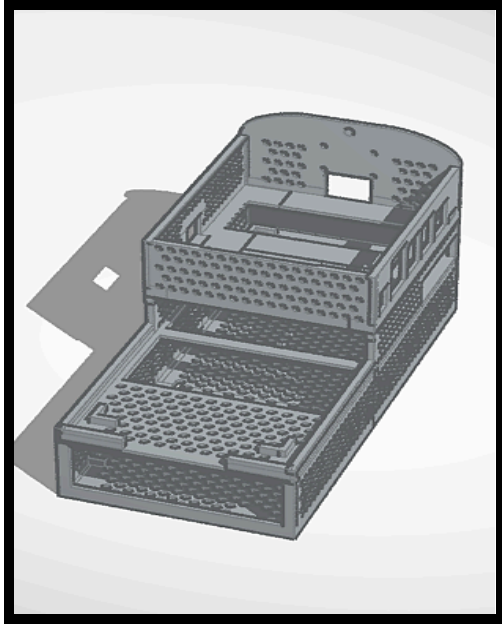


Figure 6. BikeVision Enclosure

The complete system on the Bicycle is shown in Figure 7. The main size of the modules on the rear bicycle rack is 8.15in x 3.64in x 3.7in. The weight of the device including the power supply is about 2.29 lbs. The boot time of the device is about 1.5 minutes and the estimated battery life is 6-10 hours of use.



Figure 7. BikeVision on Bicycle