Bike Buddy

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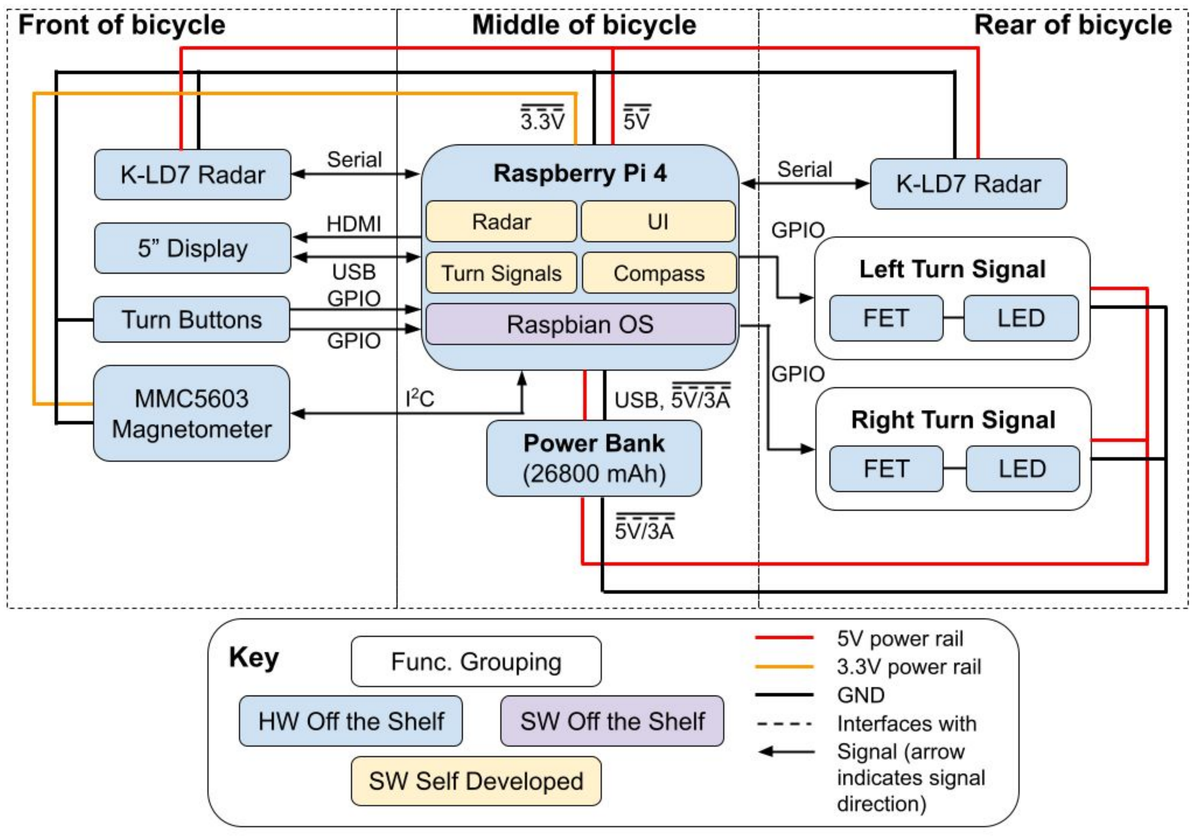
Product Pitch

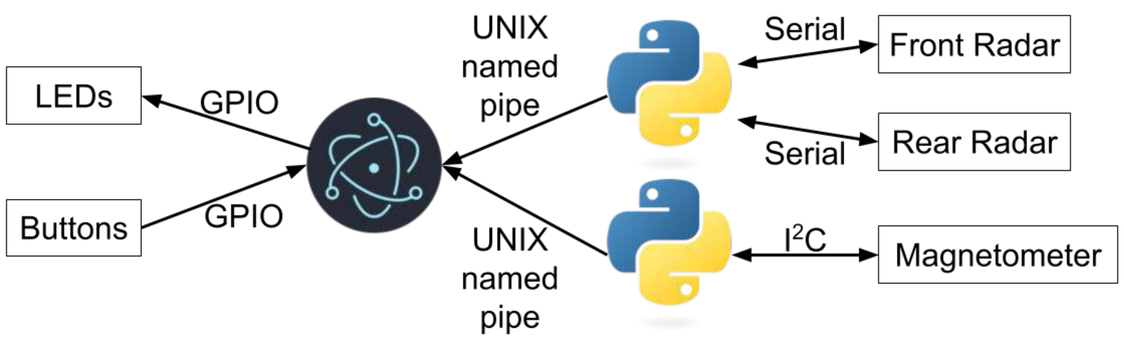
Bike Buddy is a system that is intended to improve safety for bicyclists by allowing them to have better situational awareness and giving other road users a better understanding of cyclists' intentions. This is accomplished through a system incorporating microwave *radars* that detect vehicles located behind and in front of the bicycle, along with *turn signals* mounted on the rear and front of the bicycle. An embedded computer integrates information from the radars and provides *visual alerts* to the bicyclist on a centrally mounted display. The radar achieves **~95% distance detection accuracy** with a **max range of around 24 meters**.

System Architecture

Overall System Block Diagram

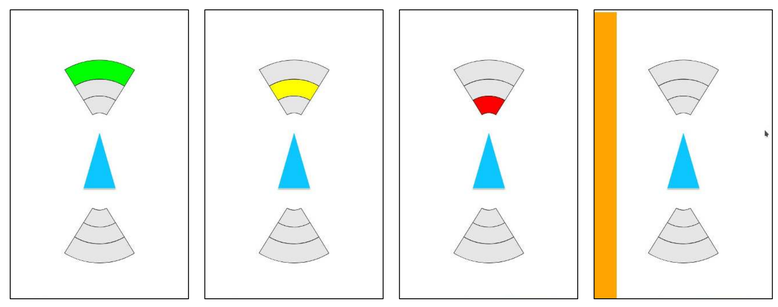


Software Block Diagram



System Description

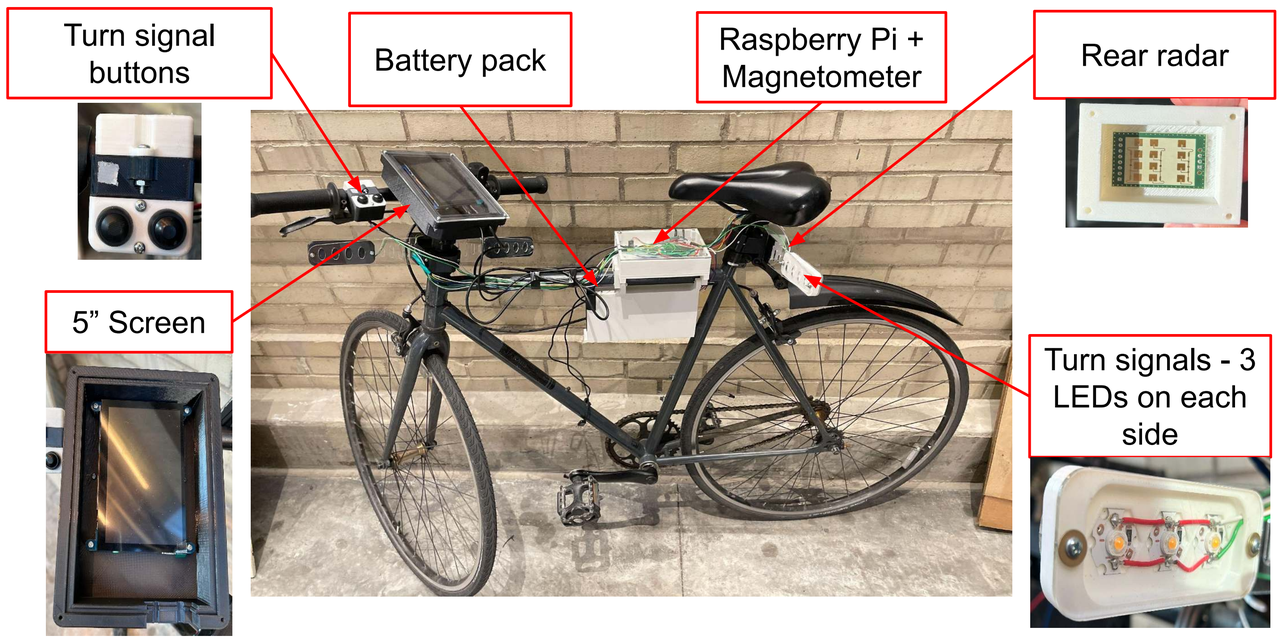
User Interface
The screen displays the distance to vehicles in front and behind you, along with orange bars to indicate a vehicle on your side. Internally, the UI is built using the same tech that websites are built in!



UI screenshots: from left to right, it shows a car in front at (1) far distance (2) medium distance (3) close distance (4) a car on the left side behind

Vehicle Sensing
2 microwave radars, one mounted in front and one in the back, perform detections for blind spot indication and forward/rear range detection.

Turn Signals
Turn signals are activated by pressing buttons mounted on the handlebar and will flash LEDs both in front and on the back of the bicycle. They can be deactivated by pressing the buttons again or turning the entire bicycle in either direction. Changes in the bicycle's direction are picked up by the magnetometer, which functions as a compass.



System Evaluation

Use-Case Requirements:

Metric	Target	Actual
Battery Life	≥ 2 hours	≥ 2 hours
Detection Lead Time	≥ 1.5 seconds	* Varied
Turn Signal Brightness (night/day)	≥ 500 / 100 ft.	–/ ≥ 104 ft

Design Requirements:

Metric	Target	Actual
Max Detection Range	≥ 14m	25.13 m (Rear) 11.84 m (Side)
Distance Accuracy	≤ ±10% deviation	5.44%
Velocity Accuracy	≤ ±10% deviation	7%
Power Consumption	≤ 13.4 A	≤ 1.64 A

** Test results continue to be updated. Please see our website for the most recent results.

Embedded System Tradeoff Factors:
- Performance
- Power draw
- Heat
- USB max current

Conclusions & Additional Information

More Info? Scan Me!

https://course.ece.cmu.edu/~ece500/projects/s24-teama3/

What Worked:
- A system that has blind spot detection, range display, and auto-deactivating turn signals was built

Logistical
- Slack time & parallelization are important

Technical
- Using a magnetometer as a compass is not trivial - IMU would be a good alternative

Potential Improvements:
- Incorporate GPS map data into detection, so the system knows the road

Compromise:
- The system that alerts the rider when at risk of colliding with a vehicle based on the distance and velocity were unable to work reliably enough, so it was disabled

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