Autonomous RC Car with Lane and Object Detection

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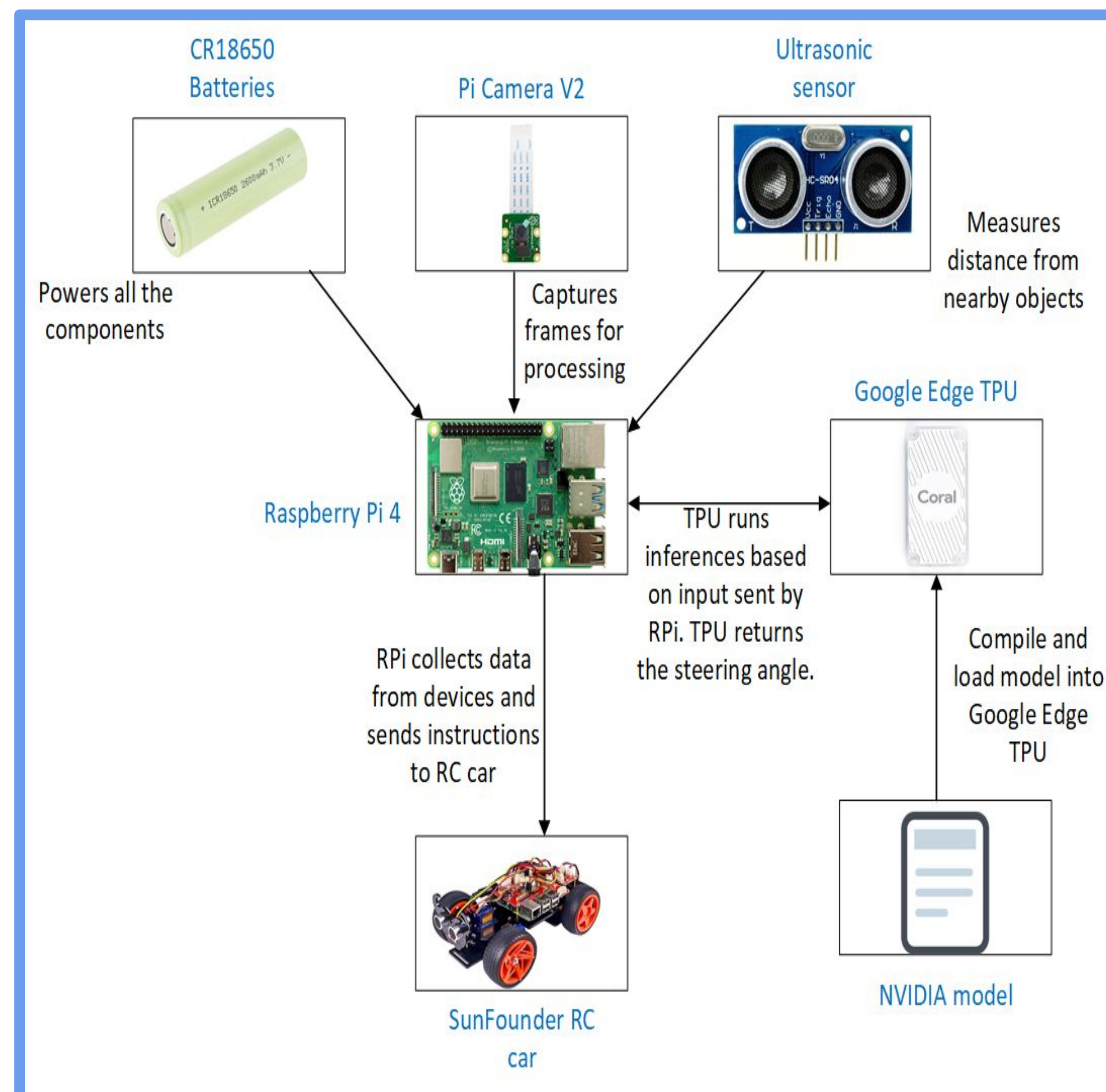
Purpose

Road transportation accidents is one of the major causes of death in the world. One way to mitigate this crisis is through autonomous cars due to their superior reliability and faster reaction time. On the advent of autonomous cars for public use, we can expect fewer transportation accidents, reduced traffic congestion, and parking scarcity to be non-existent (Bimbraw).

Our purpose is to build an autonomous RC car that can do the following: (1) navigate through lanes, (2) detect objects, and (3) respond to those objects with the appropriate action such as stopping at a red light.

Challenges

➤ This quarter we are basing our models around neural networks.
➤ An external TPU will need specific models to run on TFLite
➤ Limited Computing Power

Diagram

CR18650 Batteries — Powers all the components

Pi Camera V2 — Captures frames for processing

Ultrasonic sensor — Measures distance from nearby objects

Raspberry Pi 4 — RPi collects data from devices and sends instructions to RC car

TPU runs inferences based on input sent by RPi. TPU returns the steering angle.

Google Edge TPU

Compile and load model into Google Edge TPU

SunFounder RC car

NVIDIA model

Timeline

➤ **Finished Work**
  ○ Assembly of vehicle (RC car)
  ○ Stop light and stop sign detection using Haar Cascade Classifier.
  ○ Implement collision avoidance.
  ○ Lane Navigation using purely OpenCV

➤ **Future Work**
  ○ Lane Navigation using Behavior Cloning with NVIDIA's model.
  ○ Traffic sign detection using Single Shot Detector framework.
  ○ Design and build a test track for the vehicle
  ○ Further Debug and testing

References

➤ Bimbraw, K. (2015). Autonomous Cars: Past, Present and Future - A Review of the Developments in the Last Century, the Present Scenario and the Expected Future of Autonomous Vehicle Technology. Proceedings of the 12th International Conference on Informatics in Control, Automation and Robotics. doi: 10.5220/0005540501910198
➤ W. Zong, C. Zhang, Z. Wang, J. Zhu and Q. Chen, "Architecture Design and Implementation of an Autonomous Vehicle," in IEEE Access, vol. 6, pp. 21956-21970, 2018.

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