Real Time Lane Tracking, Collision Avoidance, & Object Recognition (s18-47)

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Goal

- Our project's aim is to accomplish lane tracking, collision avoidance, and object recognition capabilities via a camera and an ultrasonic sensor and implement them on a miniature car.

Motivations and Objectives

- Motivations
  - Over the past several years it has become apparent that self-driving cars will lead the future. Technology and car companies are conducting crucial research into this field and concluded that full autonomy is only achievable through a combination of systems and sensors.
- Objectives
  - Lane Tracking and Object Recognition
    - The systems employ a computer vision technique in which real-time data is collected by a single calibrated camera and inputted into a neural network
  - Collision Avoidance
    - An ultrasonic detection system which can measure the distances to a nearby object using sound waves

Research Challenges

- Installing/compiling all OpenCV packages correctly on a Raspberry Pi
- Developing, training, and optimizing vision software
- Integrating all three systems to achieve seamless autonomous driving

Acknowledgement

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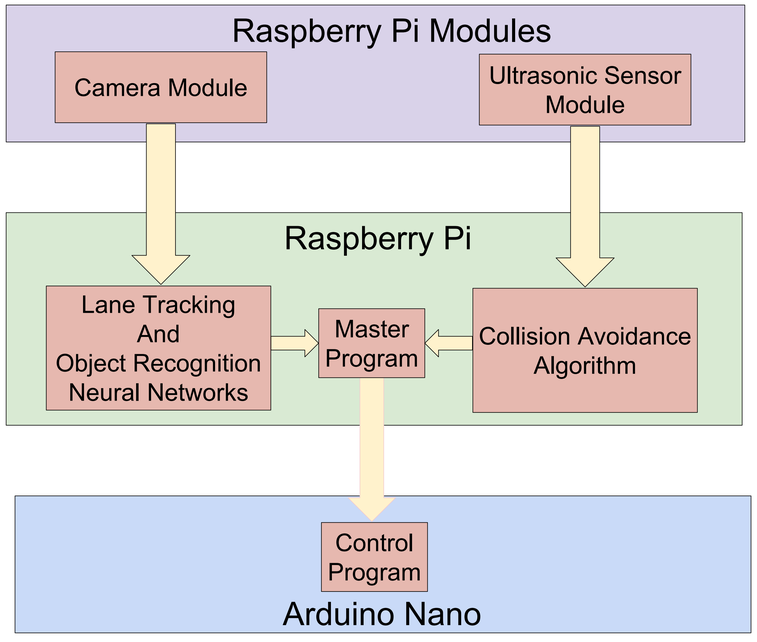
References

[1] Eprints.utar.edu.my. (2018). [online] Available at: http://eprints.utar.edu.my/2666/1/CT-2017-1406719-1.pdf [Accessed 19 Apr. 2018].

Methodology



- The camera feeds live images into the Raspberry Pi which uses OpenCV libraries injunction with a neural network to provide Lane Tracking and Object Recognition capabilities
- The ultrasonic sensor supplies data of surrounding objects to the Raspberry Pi which will use a distance algorithm to decide if and when the RC car should come to a stop
- The Raspberry Pi master program will give control instruction to that Arduino which will regulate the speed of each wheel via PWM (Pulse Width Modulation)

Results

- **Lane Tracking**
  - We were able to achieve autonomous driving. However, due to the limited computing power of the Raspberry Pi approximately one (1) to two (2) frames were able to be processed through the neural network per second. This resulted in delayed reaction time.
- **Object Recognition**
  - We were able to successfully create an object recognition system for detection of stop signs. Training lasted 28 hours on a rented server. The camera module inputs an image into a custom object detection algorithm. When a stop sign is detected the vehicle comes to a stop for a short period of time. Stop sign detection is also disabled to avoid multiple detections of the same stop sign. An image of object detection is shown on the right.

- **Collision Avoidance**
  - We were able to successfully create a collision avoidance system. The ultrasonic sensor module gave input to a collision avoidance algorithm which detects any objects within fifteen (15) centimeters. When a nearby object is detected the car will come to a stop until the obstruction is cleared. The collision avoidance algorithm is given top priority in the master program.