

Autonomous Racecar

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Abstract

The autonomous racecar being produced re-engineers a standard RC car by implementing a NVIDIA Jetson Xavier NX development kit and designing a power distribution system for all of the components. When powering the system, 2 separate power supplies will be incorporated for the powertrain motor with various components and computing board respectively. The Jetson will use data collected in the form of frames to train a Convolutional Neural Network model. The car's Autonomous Control mode will be created by utilizing the Neural Network to predict values for the car's throttle and wheel direction based on real-time video comparison. The autonomous car control will be programmed using Python and the Neural Network implementation will be done by applying the TensorFlow library. The car will also have a manual control mode in which a user can control the car using an Android Application built using Android Studio.

Project Goals

- Have the racecar be able to go through a predetermined course and progressively learn its path
- Ability to be remotely controlled by a user

Detail Specifications

- Go through the loop of TCNJ's Track and Field
- Minimum speed: 15mph
- Run time: 10 min
- Dimensions: 18in x 12in x 10in
- Maximum Weight: 8lbs
- Minimum Communication Distance: 200m
- IP 31 Rating for electrical components



Figure 3: TCNJ's Track and Field

System Architecture

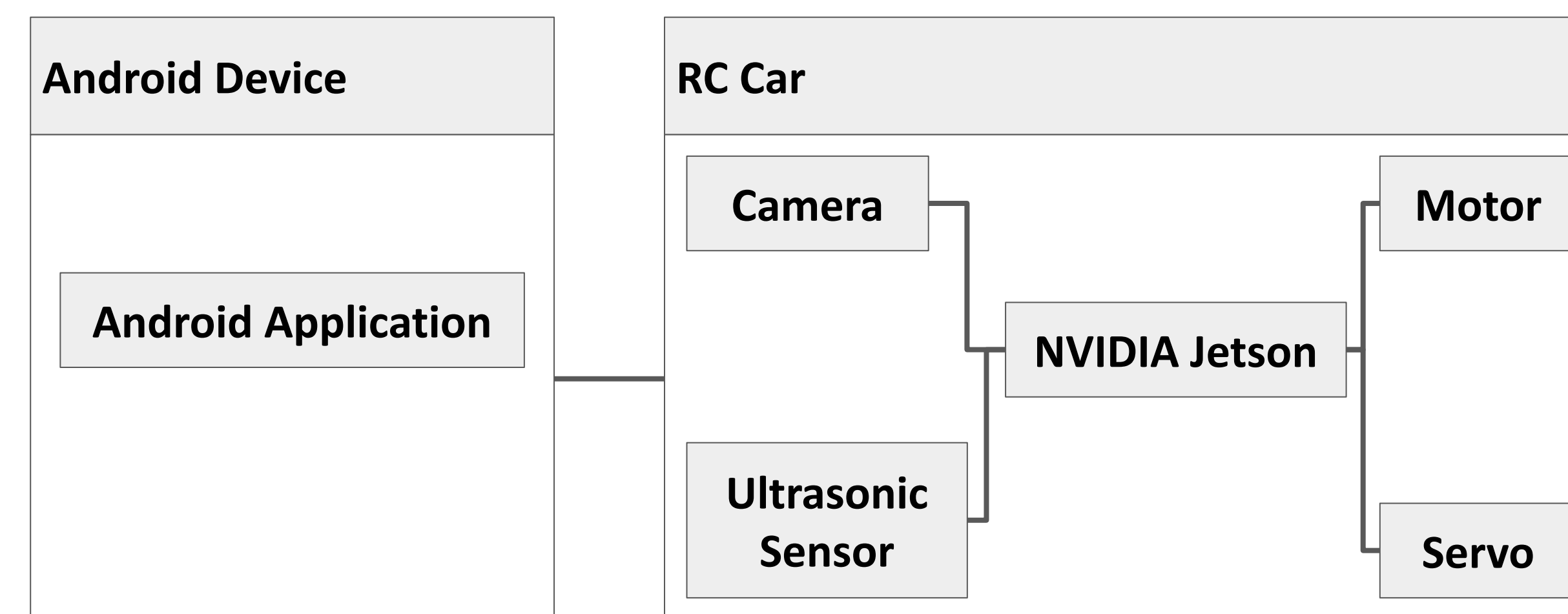


Figure 2: System Architecture

- The system of the autonomous racecar consists of 2 main components: Android Device & RC Car
- In the android device system, it consists of an android application that will be able to control the RC car
- In the RC Car system, it contains the computing board, NVIDIA Jetson, which will control the camera, ultrasonic sensor, drivetrain motor, and servo

Future Work

- A neural network will be implemented and tested Spring of 2022 to autonomously control the car
- The car will be trained on TCNJ's track and field and will be debugged when applicable

Components

- Appropriate programming language: Python
- Use of a camera and ultrasonic sensor will be implemented to meet the project requirements
- A pre-built car chassis will be used due to being cost effective than buying parts individually
- A PWM (pulse width modulation) will be used to control the drive train motor and steering of the car
- Machine learning will be implemented to control the car autonomously
- 2 separate power supplies will be used. One will power the computing board while the other will power the drivetrain motor and various hardware
- A DC-DC step-up converter and 12 volt regulator will be used to increase the output voltage of the power supply for the computing board.