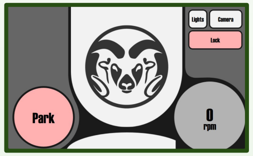
WALTER SCOTT, JR. COLLEGE OF ENGINEERING
COLORADO STATE UNIVERSITY

Electric Go-Kart
ECE Senior Design Project 2022

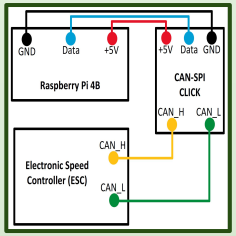
APD and EKartUI

- Both run on Raspberry Pi 4B
- **Autonomous Pedestrian Detection (APD)**:
  - Created with Andrew Helmreich for ECE528 project
  - Performs real-time object detection on webcam feed using a Coral USB Accelerator
  - Recognizes pedestrians, cars, cyclists, and other vehicle-related classes
  - Runs inside of EKartUI to provide a seamless user experience
- **EKartUI**:
  - New interactive user interface for the kart shown on 7” touchscreen
  - Designed using PyQt 6.2
  - Provides readout for important kart information
  - Serves as a hub for other features, such as APD



CAN Communication

- Following issues with I2C communication last year, we decided to change to the CAN protocol
- Our electronic speed controllers (ESCs) support CAN natively
- The Raspberry Pi 4B running the UI doesn’t support CAN, so we used SPI to CAN converter boards to send and receive info from the Pi
- The ESC’s CAN data output allows us to receive information such as the RPM of the kart’s motors, battery statistics, and ESC temperatures
- This data can then be displayed on EKartUI for the driver



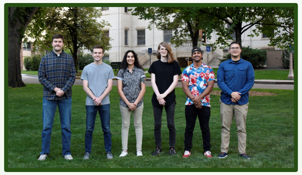
Electrical Engineering:
Rico Barela
Nikola Durand
Vani Kapoor
David Neitenbach

Computer Engineering:
Ryan Guidice
Andie Groeling

VIP Student:
Matt Gilmore

Advisors:
Olivera Notaros
Doug Bartlett

KART TEAM
FOLLOW THE SIGNAL



Purpose

- Demonstrate a highly-modular fully-electric vehicle
- Demonstrate important engineering topics to all level of students, especially at the middle and high school level
- Showcase the different skills and expertise of a group of students through the application of their schoolwork

Design Objectives

Design Goals	*Measurable Objectives*	*Completed*
Demonstrate a fully-electric highly-modular vehicle	Developed a Go-Kart that showcases features from an array of ECE disciplines	✓
Improve user interface and experience with the Go-Kart	Designed a fully-functional touchscreen user interface	✓
Two separate power systems for motor control and front control systems	Obtains solar measurement readouts such as current, voltage, and battery charge level	✓
Demonstration of real-time object detection	APD system is integrated into the user interface	✓
Convert Go-Kart communication to CAN protocol	Displays RPM and speed from ESCs in the user interface via CAN	✓

Future Work

- Fabricate new chassis with functioning mechanical brakes
- Further software integration
  - Automated configuration of ESC software on start-up
- Addition of more sensors for further data collection and ML development
- Increased user interface integration with drivetrain, LED, and radio control systems

3D Printing and Mechanical Changes

- Created in-house CAD designs using Fusion 360 and Creo Parametric
- 3D printed parts were used for their versatility and quick test fitment during development
- The STL file designs will be transferred to future teams to continue development. The ease at which STL files can be converted into GCODE for various printers makes this method versatile.
- 3D printed parts:
  - Tubular chassis mounting brackets that secure the 3D printed camera mount which houses the front camera
  - ESC module mounts
  - Housing for the Raspberry Pi, LCD screen, and cooling fan
- Steering Adjustment:
  - Faster response from steering wheel to front wheels
  - More stable steering column

Power Systems

- Power systems have been split into a front Control Power System and a rear Motor Drive Power System
  - Eliminates the need for a large voltage conversion and decreases noise
  - Organized for showcasing and easier comprehension
- Control Power System
  - Solar charged battery system
  - Powers Raspberry Pi
  - Powers SPI-CAN Click
- Motor Drive Power System
  - Powered with 6 Lithium Polymer battery packs
  - Powers 2 Electronic Speed Controllers (ESCs) that convert power to 3-phase for motors
  - Key switch to turn on the power