Autonomous People Mover
P15241

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Project Guild: Dr. Rick Lux

Project Customer: Dr. Raymond Ptucha

Overview

- Customer Needs
- Project Definition
- Engineering Requirements
- System Architecture
- Design Summary
- System Testing
- Project Evaluation
- Suggestions for Future Work

Project Description

- Modify an electrical golf cart to be controlled remotely.
- The created vehicle will be used as a base for an autonomous vehicle.

Customer Requirements

Importance	Customer Need
9	Self Steering
9	Able to drive forward and reverse
9	Communicates speed
9	Focused on passenger and bystander safety
9	Controller can stop cart remotely
9	Passenger can stop cart with brake
9	Cart will stop out of range
9	Moves when controlled remotely
9	Allows the passenger to take over steering
9	Robust
9	Ready for Imagine RIT
9	Within budget
6	Able to communicate GPS location
6	Protects passengers from impact of rapid braking
6	Indicates driving mode
6	Weatherproof
3	Clear documentation
3	Simple design
3	Space for future projects
3	Holds 2 Passengers
1	All-Weather Driving
1	Able to identify surroundings to avoid collision
1	Noticeable Appearance

- Vehicle safety top priority for both passengers and bystanders.
- Focused on expandability for future projects.

Green	Achieved
Yellow	Partial Success
Red	Failed
Grey	Future Project Goal

Engineering Requirements & Results

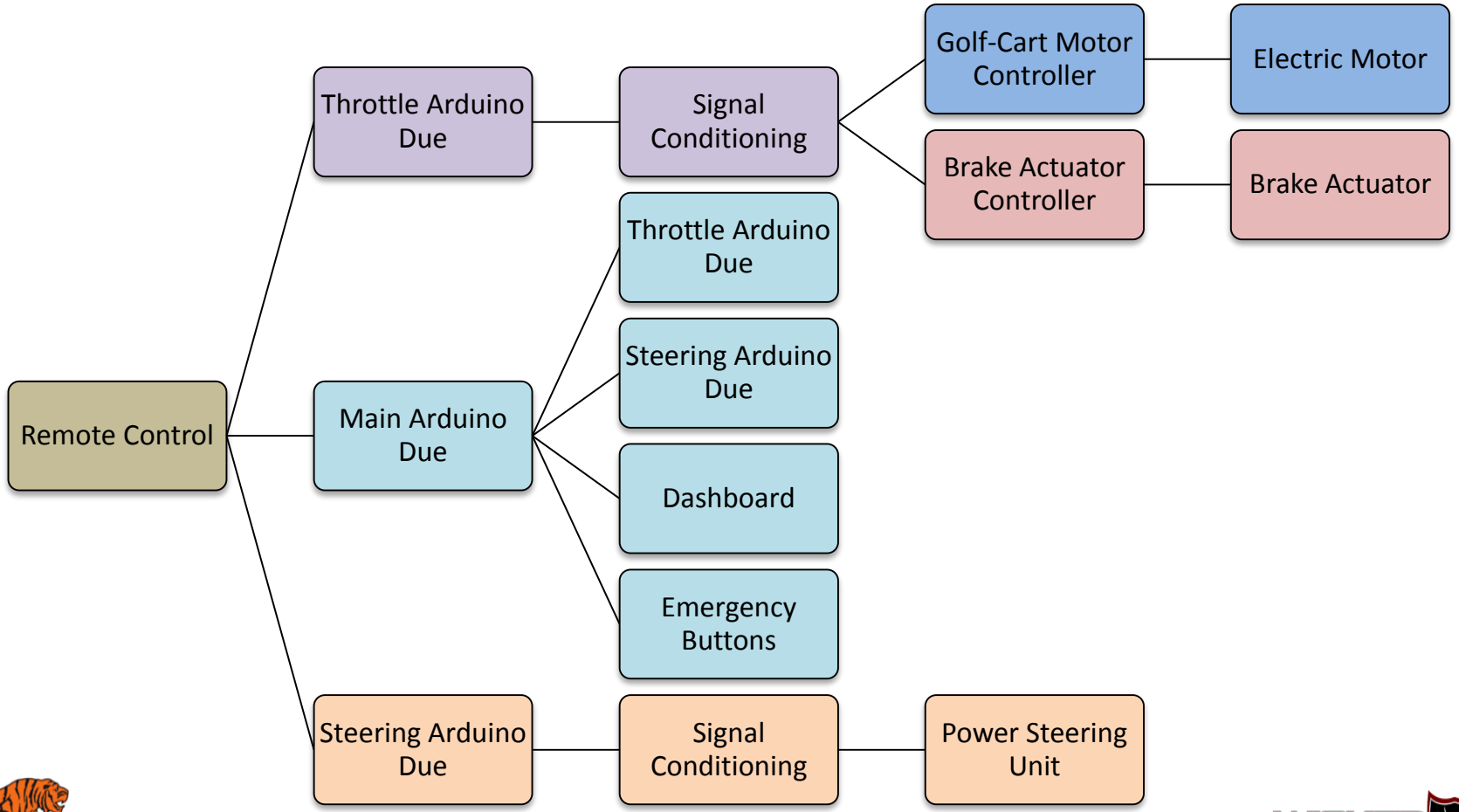
- Emergency stopping time critical to ensure safety.
- Imagine RIT deadline.
- Remote range and response time.

Engr. Requirement (metric)	Unit of Measure	Marginal Value	Ideal Value	Results
Digital angle measure of front wheels	degrees	±1	±.5	0.5
Maximum reverse speed	mph	3	5	5
Maximum forward speed	mph	10	12	12-5 remotely
Accuracy of physical location	meters	6	2	3
Emergency stop response breaking time from full speed	s	3	1.5	1.85
Remote control range	meters	15	25	1000+
Maximum weight	kg	375	350	340
Passengers	persons	1	2	2
Percentage of documents easily accessible	%	90	100	95
Predicted mean time between maintenance	days	7	10	15/4
Available space for future projects	m^3	0.05	0.1	8
Factor of safety for mechanical parts		2	2	2+
Measurement of rear wheel speed	m/s	±1	±.5	1
Number of driving modes	#	2	2	2
Cart response time to remote control	s	1	0.5	0.1
Parts for solution within budget	$	2000	2000	1900+donations
Operational during Imagine RIT	date	5/2/14	4/24/14	Morning Only
Light showing mode visibility	m	20	30	40+
Moisture resistance	Pass/Fail	IPX1	IPX1	Fail

Green	Achieved
Yellow	Partial Success
Red	Failed

Note: times include human error (±.3seconds)

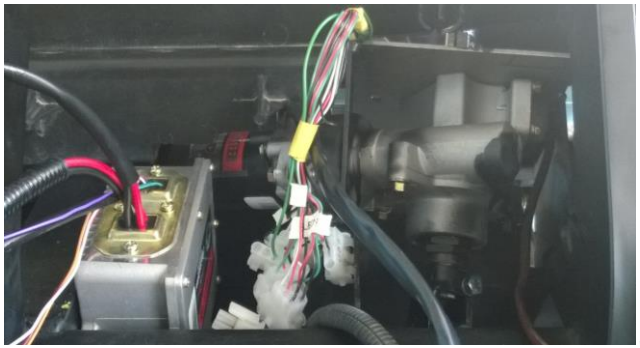
System Architecture



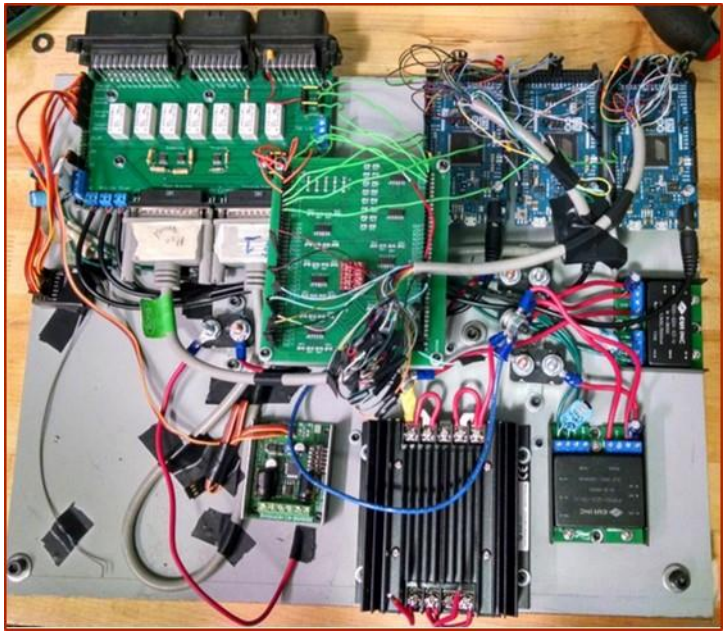
Design Summary

Mechanical

- Braking:
  - Actuator used to pull the brake cable.
  - Actuator uses cable and pulley wheel to align cable with brake pedal.
- Steering:
  - WickedBilt power steering unit installed in-line with steering column.
- Throttle:
  - Stock golf-cart motor assembly used.



Design Summary Continued



Electrical

- Braking:
  - 12 V Current controller used for actuator.
  - Actuator built-in potentiometer used for feedback.
- Steering:
  - 0 – 5 V Differential signal used as input into wicked bilt system.
- Throttle:
  - 0 – 3.3 V signal injected into the stock golf cart motor controller.

Project Evaluation

- Provided a good base prototype of remote control vehicle
- Future revisions are required to provide reliable platform for autonomy
- Important experience in multidisciplinary engineering environment

Future Work

- Design revision of electrical systems to ensure robustness.
- Additional weather proofing.
- Sensor Installation.
- Autonomy development.

Questions?