



APPLICATION AREA







- A convoy system with a lead car and trail car with the goal of navigating from one location to another
- RC Vehicles will coordinate task by sending messages to each other to aid in perception and prediction



COMPLETE SOLUTION

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4 motor system controlled by Arduino connected to Jetson



OBJECT --- DETECTION + PATH PLANNING

> Intel Realsense provides locations of obstacles which is used to update A* path finder

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- COMMUNICATION

Lead car communicates via bluetooth to aid following car navigate course



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MOTOR CONTROLLER

L298N Shield vs. TB6612 Breakout Board

ODOMETRY IMU + Open Loop vs. Wheel Encoding



POWER SUPPLY

Non-Unified Power vs. Unified LiPo Battery Solution

WHEEL MECHANICS

Standard Wheels vs. Mecanum (Omni-directional) Wheels

OBJECT DETECTION & PATH PLANNING

Intel RealSense \rightarrow RGB + Depth imageRGB Image + MobileNet v1 \rightarrow Obstacle bounding boxAligned depth frame + bounding box \rightarrow obstacle (x, y) locationObstacle (x,y) \rightarrow update vehicle mapFind new path through map using A* \rightarrow update path for vehicle





V2V COMMUNICATION

The obstacles found from object detection are relayed to the trailing vehicle and a path towards our indicated goal is computed using an A*Star search algorithm.



SYSTEM SPECIFICATION - LEAD CAR

Autovot: Lead Vehicle System



Autovot: Lead Vehicle System





TESTING, METRICS AND VALIDATION

Metric	Required	Achieved
Vehicle Speed	1m/s	0.5m/s
Object Detection Latency	100ms	~30ms
Path Planning Latency	10ms	~100ms
Communication Latency (64 bytes)	100±40ms	~80ms
Detection recall @ (r= 0.2m, up to 5 objects)	95%	98%
Detection precision @ (r = 0.2m, up to 5 objects)	90%	99%
Course Length	30m	10m
Obstacle type and number	15, 2 classes	5, 1 class





DESIGN TRADEOFFS

Vehicle Mechanics

- L298N Motor Shield to Adafruit Motor shield
- Separate 9V, 5V power to 7.4V LiPo Battery + UBEC circuit
- IR optical Optocoupler for Odometry
- Standard Wheels to Mecanum Wheels

Object Detection & Path Planning

- MobileNet v2 to MobileNet v1
- Angle Heuristic to A* for planning







PROJECT MANAGEMENT STUFF

		PHASE ONE											PHASE TWO												PHASE THREE												PHASE FOUR														
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