REMOTE SERVICE PROVIDER

AUTONOMOUS LEVEL 3-4 VEHICLE

PROVIDER

WE STAY IN THE LOOP, SO YOU DON'T HAVE TO

AV onDemand

1.

Challenge

DEFINING OUR PROBLEM SPACE

Questions we asked ourselves in the beginning:

➔ How can we improve the experience in AVs to make them feel more safe, reliable, and accessible for all types of riders?
➔ How can we take into consideration the jobs of professional drivers?
➔ How do we ease the transition from semi-autonomous to fully-autonomous vehicles?

D4SD CHALLENGE & TOPIC

Problem: AVs aren't completely reliable – they still expect the rider to takeover in certain difficult conditions. How can we allow all types of riders to travel freely in AVs without having to worry about a possible takeover event?

2.

Research, Observations, and Solution

DISABILITY IN AMERICA

★ 1 in 7 people in the US (57 million) have a disability, and for a large subset of the disabled community, transportation remains inaccessible and unreliable for their needs.

★ AV legislation is being discussed, but not so much as to how AVs can accommodate riders with disabilities.

★ Ride-sharing companies are not completely reliable for riders with disabilities.

# INTERVIEWING AT PB, MISSION VALLEY, VA HOSPITAL

Norman, 56

Marty, 31

Joy, 23

OUR SOLUTION

Solution: AV onDemand eliminates all rider takeover responsibilities and improves accessibility within autonomous vehicles by connecting each vehicle to a service provider to remotely handle the AV whenever the situation arises.

THE
REMOTE A.V. SERVICE PROVIDER PROCESS

AV onDemand connects a service provider to an AV that operates on existing ride-sharing infrastructures and acts as a facilitator when the vehicle experiences technical difficulties in dynamic environments.
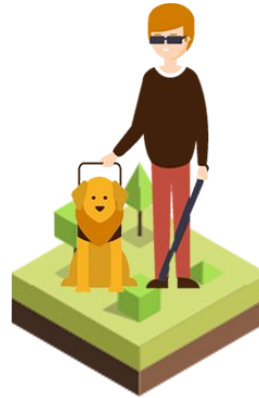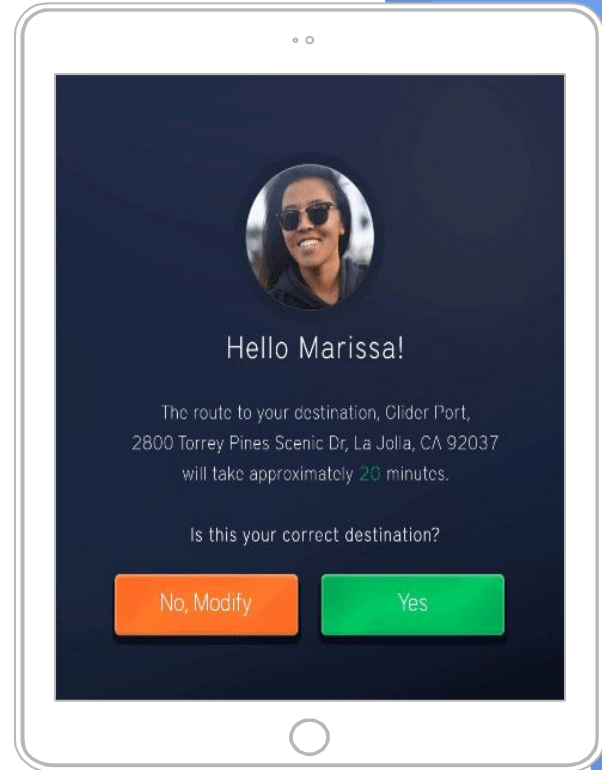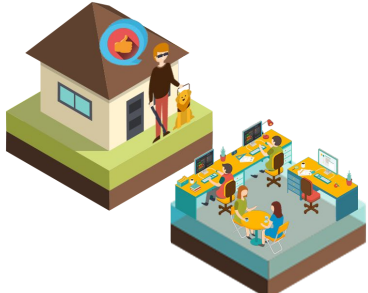

CARRIED OUT BY PASSENGER

CARRIED OUT BY SERVICE PROVIDER

3.

AV onDemand Process

1. PASSENGER ORDERS SERVICE

▸ Rider enters and confirms destination
▸ A service provider can be summoned throughout the entire trip

To the right: example of rider UI

Hello Marissa!

The route to your destination, Glider Port, 2800 Torrey Pines Scenic Dr, La Jolla, CA 92037 will take approximately 20 minutes.

Is this your correct destination?

No, Modify   Yes

Day in the Life:
Service Provider

▸ Service providers given 360 view of surrounding environment
▸ System status indicates AVs confidence to maneuver through environment
▸ Service providers work from a remote location and view a system status for all autonomous vehicles currently dispatched on rides with ride sharing companies.

HAZARD ZONE
DETECTION

Machine learning helps perform comparative analysis that calculates hazard zone percentage to determine whether vehicle may be in danger

i.e. construction zone or dirt roads

To the right: example of service provider UI showing different cars that have increasing hazard zone percentages over time

AV & SERVICE PROVIDER
COLLABORATION

Upcoming Obstacle Detected

System has detected potential paths for bypass.

Route History

Left turn on Scholars Dr S onto Scholars Ln
300 feet

Make a U-Turn on Scholars Ln
200 feet

Turn right on Scholars Dr S

250 feet

System Generated Alternate Routes

1. Drive past road lines on shoulder to bypass obstacle.
Approximate time estimate: ~12 minutes

Modify   Select Path

2. Perform U-Turn when conditions are safe and drive alternate route.
Approximate time estimate: ~10 minutes

Modify   Select Path

Manual Override Option

Set Restrictions   Set Boundaries   Set Path Trajectory

Front Perspective

Blind Spot Front Left Perspective

Back Perspective

Blind Spot Front Right Perspective

AV & SERVICE PROVIDER COLLABORATION (CLOSEUP)

Upcoming Obstacle Detected

System has detected potential paths for bypass.

Manual Override Option

Set Restrictions   Set Boundaries   Set Path Trajectory

Front Perspective

Blind Spot Front Left Perspective

Back Perspective

Blind Spot Front Right Perspective

Closeup of Manual Override

Setting paths, boundaries, and restrictions for the AV to safely follow

MANUAL OVERRIDE MODE - FAQ

Why not create a driving simulator?

1. Requires precise calibration
2. Capture-to-Display Latency
3. Different model cars handle uniquely
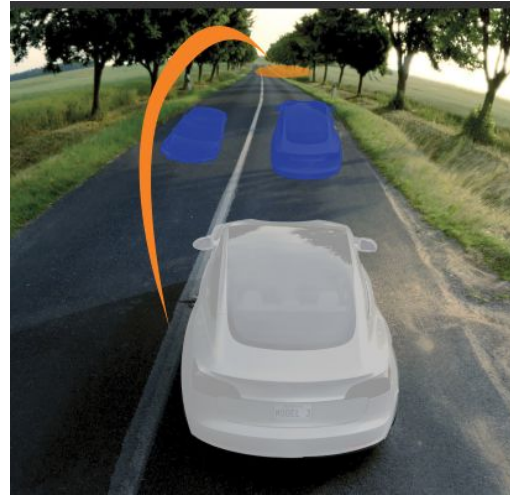
Why trajectory arrows?

1. Reduce takeover responsibilities
2. UI is uniform for all cars
3. Increased depth perception

4.

Testing and Feedback

Testing and Feedback

Testing Rider UX

AV gives audio notifications to alert "blind" passenger of its arrival

Approximately 5 minute trip with construction zone detected

Findings for Rider Experience

Riders were comfortable and relaxed

Communication mostly helpful but one rider described it as "extra"

Problems:

- Blindfolded passengers had difficulty finding vehicle
- Riders were not rushed which could explain why they were relaxed

Testing and Feedback

Testing Service Provider UX

Tested to see if service providers could provide smart choice in short amount of time

Easiest way we could think of to test UI

Problems:

- Could make quick and safe decisions but difficult to place stickers in the correct spot as video moves

Testing and Feedback

Service Provider Ratio

Honda service help line took 7 minutes to answer one of us

Same person answered the five of us successively

Pointed out that SP ratio should be 1:1

5.

Feasibility

Implementation of Existing Technology

The technology needed to implement AV onDemand
already exists

- ➔ Capture-to-Display technology
  - ◆ Satellite data transfer
- ➔ Machine learning and big data acquisition
- ➔ Lidar detectors

Capture-to-Display Latency

Time it takes to compress, decompress, then display video to remote location

- Empirical testing with skype shows a CTD of 200ms delay
- Skype states their latency can reach a minimum of 150ms
- Car can travel up to 5.5ft in 25mph zone
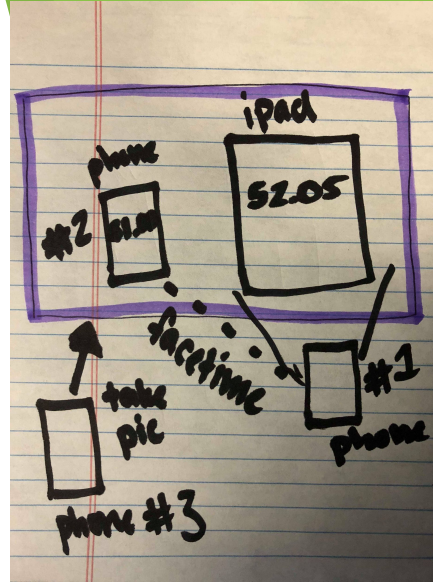
Understanding Big Data

Uber and Lyft test AVs in urban environments to identify where they fail

Data storage can be called upon in real time to verify if an AV is in a predetermined hazard zone

6.

Impact

Mobility for Individuals with Disabilities

AV onDemand eliminates passenger takeover responsibilities required in level 3 to 4 AVs, increasing mobility for the physically, cognitively, and visually disabled.
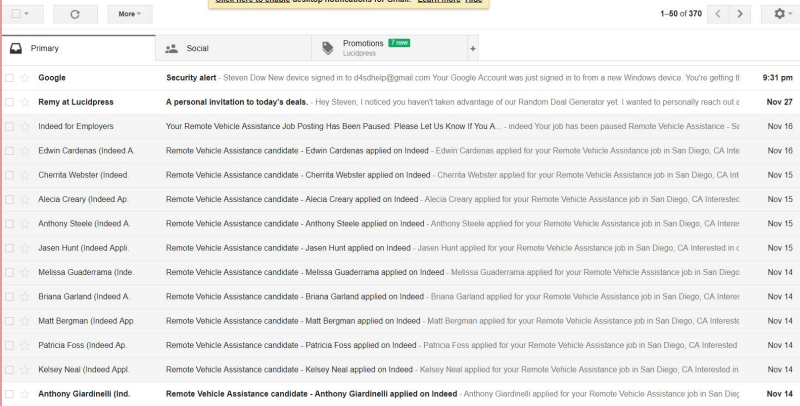
Enhanced Rider Freedom

AV onDemand's service extends to all ride-share customers who don't want to worry about rider responsibility.

New Employment Opportunities

AV onDemand creates a new job market for professional drivers who would be displaced by AVs.

Individuals with disabilities who demonstrate the capacity to perform service provider duties may also be employed.

We put a fake service provider job listing on Indeed.com and received over 300 applications!

7.

Future Steps

Developing a Robust Service Provider UI

What we have:

Alex on roof with phones taped together

Snapchat stickers to indicate boundaries and paths

2D arrow projectiles

Developing a Robust Service Provider UI

What we want:

Camera with 360 view

Drag and drop indicators onto real time video for manual takeover

- 3D arrow projectiles

Computer program that allows the Service Provider to actually control the car

Calculate the perfect ratio of service providers to AVs

How to do:

Access to an AV

Computer programmers and mechanics

Gather data for hazard percentages

More time

More testing

$$$

Thank you!!

References:

http://www.ti.com/lit/wp/spry301/spry301.pdf Calculating Latency

U.S. Census Bureau, American Community Survey

Bureau of Transportation Statistics, "Transportation Difficulties Keep Over Half a Million Disabled at Home," April 2003.