



Google Car

Team 7

Mikael La Ferla & Alex Fritz



WAYMO

Google Car → Waymo

Waymo (FKA Google Car) is a product of Google that fits its overall portfolio of offerings because it encompasses a plethora of Google's intangible assets it has mastered since its inception in 1997.

Intangible Technology Used:

- Google Maps
- Google Earth
- Data from user navigation and GPS data collection

The overall shift from intangible products like Maps and Earth, to tangible products in the transportation sector such as WAYMO, can affect users positively because Google can combine its collected data and assets and streamline it into a consumer product that will utilize Google's technologies and engineering to create the safest self-driving car.

Sebastian Thrun

- Stanford University professor who led a team of students, engineers, and programmers to victory in the DARPA challenge after successfully producing a vehicle that runs on complete autonomy.
- Became co-founder of Google X in 2010
- Helped to develop the robots that which had the potential to collect mass data for Google Earth and Maps.
- Thrun's main concept behind the Google Car was to reduce automotive accidents and to allow people to free up people's time.



Waymo's Technologies

- Lidar: Lasers are emitted to help measure distance between objects and is used to help create high-resolution maps.
- Radar Sensors: Used to measure speed of objects that surround the car (ie. Other vehicles)
- GPS and IMU (Inertial Measurement Units): Used to give the Google Car the capability to navigate routes and use data from Google Maps and Street View.
- Cameras: Used to gather data on pedestrians, traffic, traffic signals, etc.



Waymo's Problems

Technical Challenges:

- Weather: The lidar and camera systems did not function properly in bad weather conditions.
- Unpredictability in large cities: Due to many moving variables (crossing guards directing traffic, pedestrians, road closures, etc.) it adds difficulty to the efficacy of the car.

Societal Challenges:

- People are skeptical of an autonomous vehicle making critical decisions that are better made by a human (Avoiding a car that is stopped, hitting other cars, or causing accidents inadvertently).

Regulation Challenges:

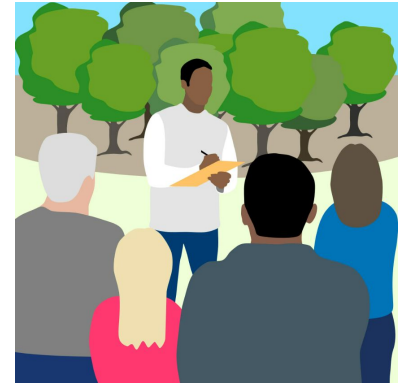
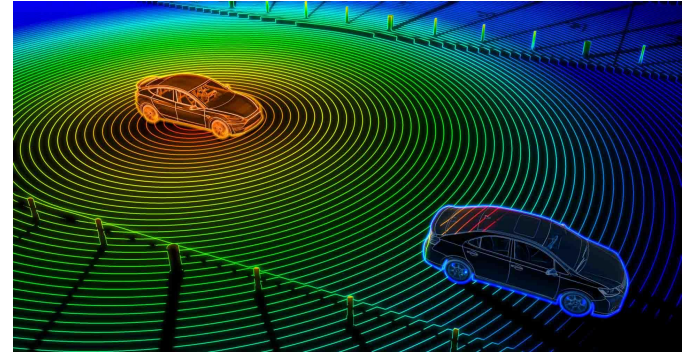
- Making sure the vehicle adheres to all laws on the municipal, state and federal levels

Improvement Challenges:

- Making sure that all technology is used ethically and up to proper standards.
- Making use of more advanced algorithms and newer softwares.

Waymo's Answers

- Technical
 - LIDAR cost reduced from \$75,000 to \$7,500
 - Integrates necessary Google technologies
- Societal
 - Transparency with public
 - Community engagement
- Regulatory
 - Compliance with rules and laws
- Continuous Innovation
 - Waymo → Waymo One (with Uber)
 - Luxury SUVs, sedans, minivans



Resolving the Problems

- Enhance Sensor and Software Efficacy
 - **Pros:** Better performance in adverse weather conditions
 - **Cons:** Increased cost = less accessible to public
- Public Engagement and Education Programs
 - **Pros:** Leverage constructive feedback in operations
 - **Cons:** Takes time, patience, and solid evidence
- Collaborative Regulatory Department
 - **Pros:** Significantly reduce chances of legal issues
 - **Cons:** Regulatory capture, slow decision-making
- Improving/Creating Technologies
 - **Pros:** Expand to public transit
 - **Cons:** Rushed expansion = drop in public confidence



SWOT Analysis

Strengths

- In-house LIDAR sensors and algorithms
- Leverage Google's technologies
- Current partnerships

Weaknesses

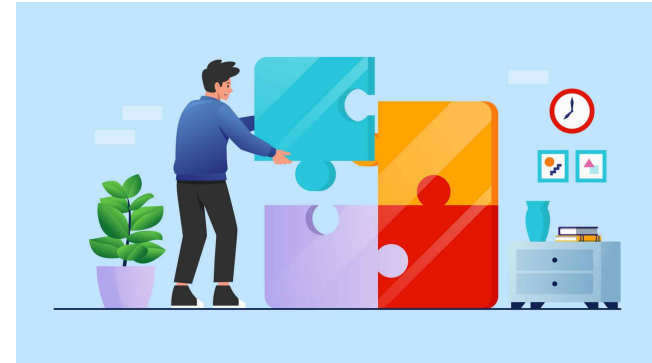
- High costs, risky investments
- Public and Regulatory Uncertainty

Opportunities

- Expand to Silicon Valley, Singapore, Dubai, Tokyo
- Areas of higher socioeconomic and technological status

Threats

- Competition from other high-tech vehicle manufacturers



Waymo's Approach

R&D Investment

- **Problem:** Subpar performance in bad weather and urban areas
- **Solution:** Conduct research through simulations

Partnership Expansion

- **Problem:** Waymo/Uber is only operational in three cities
- **Solution:** Expand to target areas, leverage Uber's transit data

Educational Campaigns and Feedback Groups

- **Problem:** Public's skepticism = difficult to expand
- **Solution:** Host events in communities, share the Waymo experience



Preferred Option

Waymo/Uber Partnership: Ride Before You Buy

- First-hand experience
- Increase in market share
- Cost efficiency
- Increased Public Acceptance



Uber

Works Cited

Allen, Heather. "Activists in San Francisco Demand Governor Shut Down Self-Driving Cars." *NBC Bay Area*, NBC Bay Area, 19 Feb. 2024, www.nbcbayarea.com/news/local/san-francisco-protest-waymo-cruise-cars/3458525/.

Hawkins, Andrew J. "Waymo Will No Longer Sell Its 'Laser Bear Honeycomb' LIDAR Sensors to Other Companies." *The Verge*, The Verge, 27 Aug. 2021, www.theverge.com/2021/8/27/22644370/waymo-lidar-stop-selling-autonomous-cars-laser-bear.

Khosrowshahi, Dara. "Autonomous Rides Are Arriving on Uber with Waymo." *Uber Newsroom*, Uber Technologies Inc., 26 Oct. 2023, www.uber.com/newsroom/waymo-on-uber/

Lakhani, Karim R., James Weber, and Christine Snively. "Google Car." Harvard Business School Case 614-022, January 2014. (Revised March 2015.)