

Scooter and Bike Sharing aka: Shared-Rideables

IOT Freshman Seminar

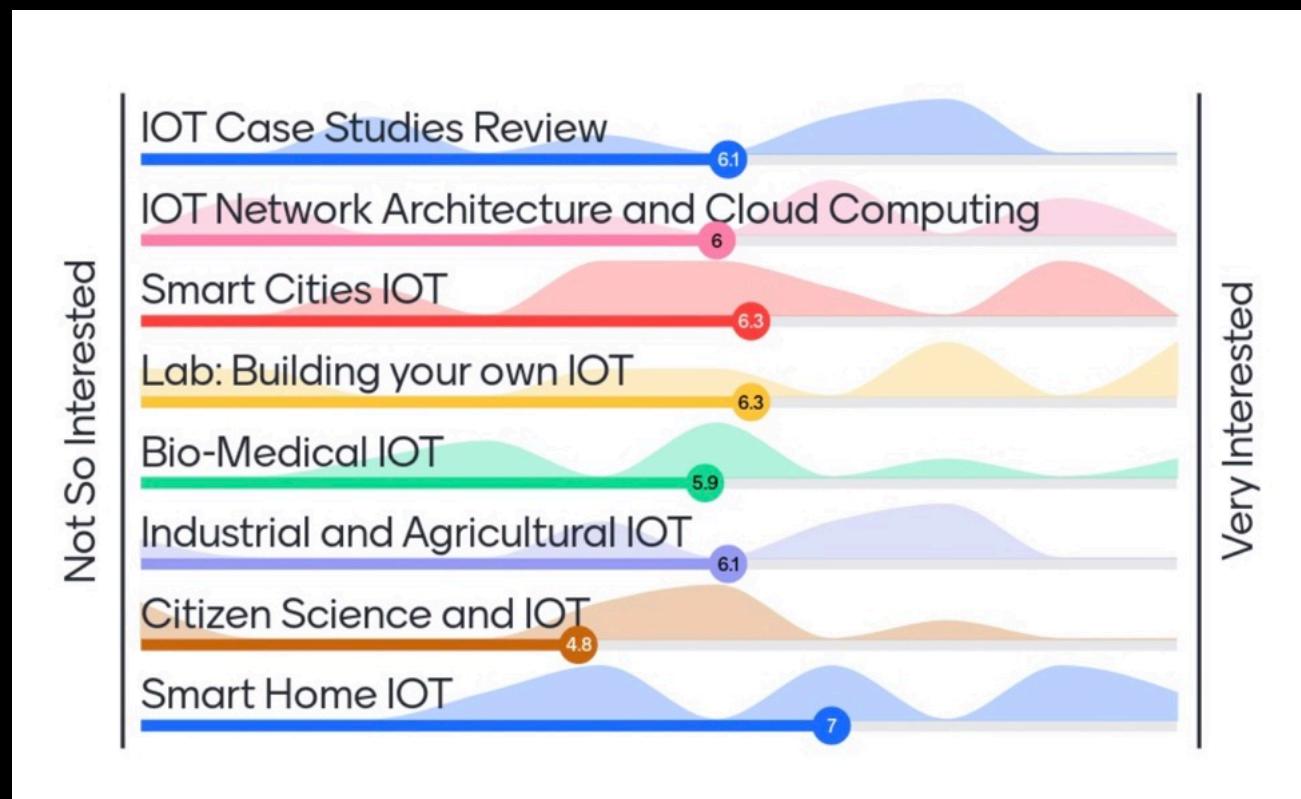
Thr Oct 5, 2022

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What topics do you want covered in class

- 1) Smart Home
- 2) Smart Cities
- 2) *** Lab: Build You Own
- 3) Industrial and Agriculture
- 3) Case Studies



Overview

SHARED-RIDEABLE: Scooter and Bike Sharing

- IOT Network architecture
- Regulations - they are actually regulated!
- Social Impacts
- Economic Impacts

Class Survey

SHARED-RIDEABLE: Scooter and Bike Sharing

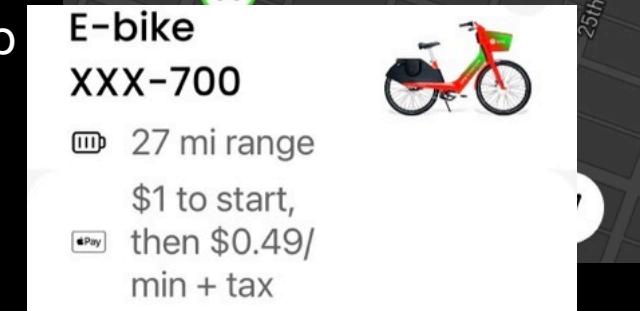
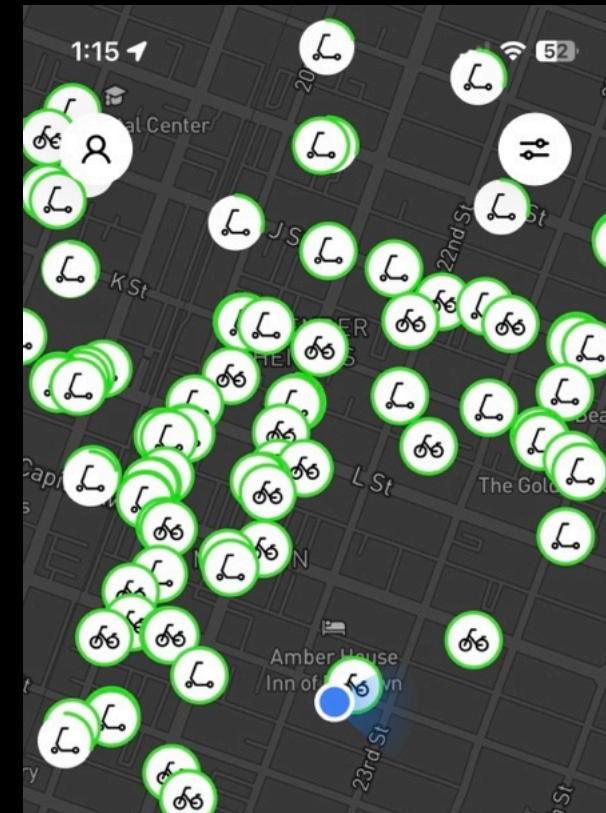
- **Question:** How many times per week do you use a shared rideable?
- Potential answers:

0, 1, 2, 3, 4 ,5

Put up your answer with fingers...

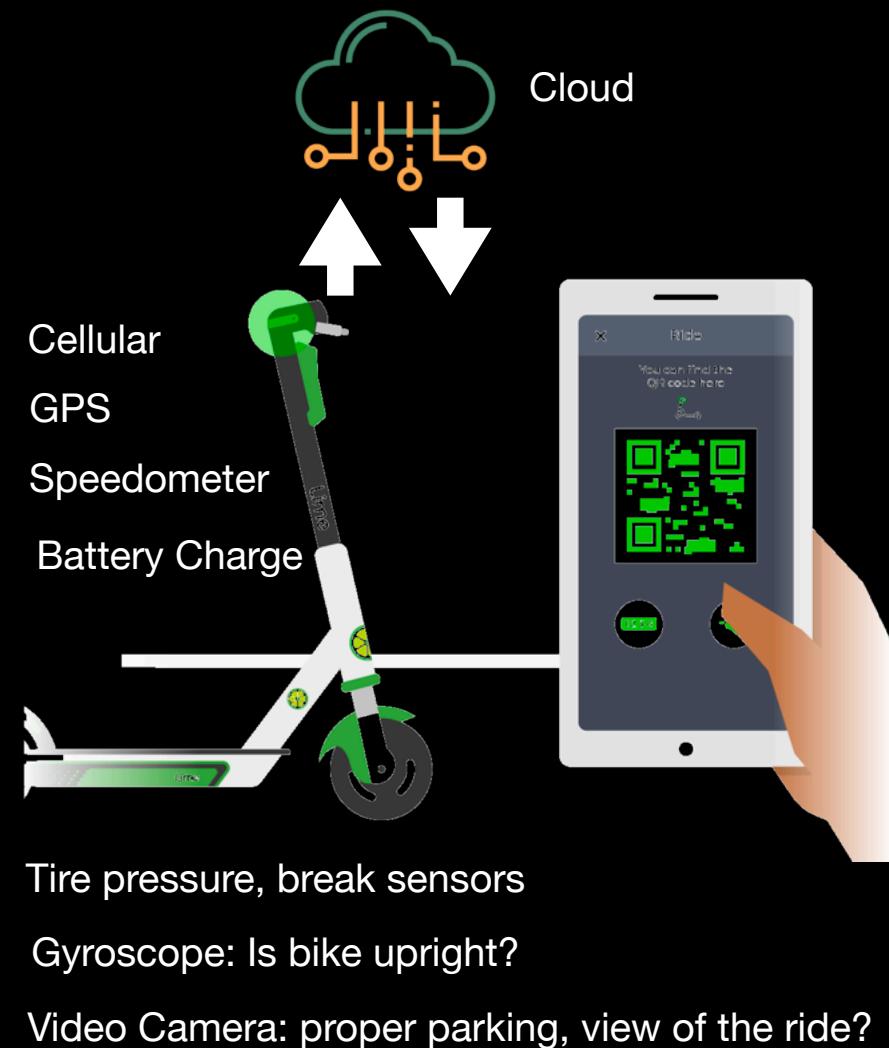
Shared-Rideable Network Architecture

- Rider pays a subscription fee and downloads a cell phone app
- The app (like ride-share) shows the location of available rideables, shows mile range based on battery level
- On arrival, rider unlocks the bike by scanning a QR code
- Unlocking has a fee (\$1) and then every minute of the ride has a fee (\$0.45 \$0.49 per minute)
- Once ride is done, rider terminates ride with cell phone app
- Rider leaves the bike wherever they want (within rules), the rideables are “dockless”



Shared-Rideable Network Architecture

- Company that manages the fleet collects sensor data from each scooter/bike
- Cellular network to transmit all sensor data to the cloud
- Position via GPS so they can find it to service it (also in user App)
- Speedometer, can be used to remotely reduce speed if in “low speed areas”
- Battery level (often in user App)
- Other sensors to predict when maintenance might be necessary: tire pressure, break measurements
- Other feedback like if bike is upright (gyroscope)
- Some are adding video camera to confirm proper parking



Shared-Rideable Network Architecture: Geo-Fencing

Wikipedia: A geofence is a virtual perimeter for a real-world geographic area. A geo-fence could be dynamically generated (as in a radius around a point location) or match a predefined set of boundaries (such as school zones or neighborhood boundaries).

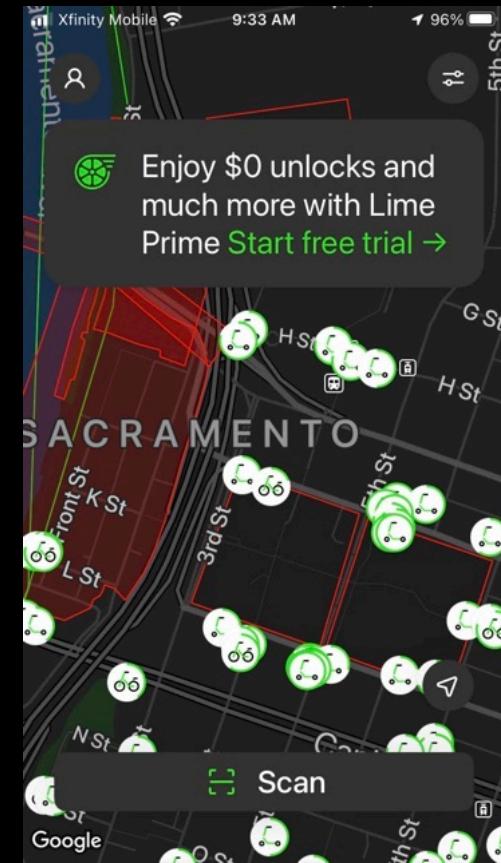


- Motorized vehicles are not allowed on sidewalks or in designated pedestrian areas
- First implemented on the Santa Monica pier. This is easy because it is a large platform surrounded by water
- **Future:** Sidewalks are much harder to detect. Their boundaries are relatively small and complex. GPS is not reliable enough

Shared-Rideable Network Architecture: Geo-Fencing

Lime is doing the following geo-fencing

- **No Locking Zones:** Riders cannot end or pause a ride in this zone. Locking is disabled.
- **Low Speed Zones:** The scooter's top speed is restricted in this zone and riders can tap on the zone to see the top speed.
- **No Scooter Zones:** Riders cannot ride in this zone. The vehicle will safely stop and locking will be disabled. Riders must walk the scooter out of this zone to resume riding or stop the ride.
- **No Parking Zones:** Riders cannot park their scooter in this zone. Riders should confirm that their vehicle is not in a 'No Parking Zone' to avoid potential fines.



Sacramento: Old Town, DOCO, Cit Parks

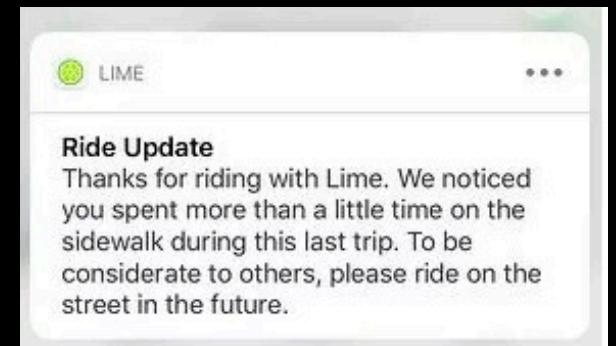
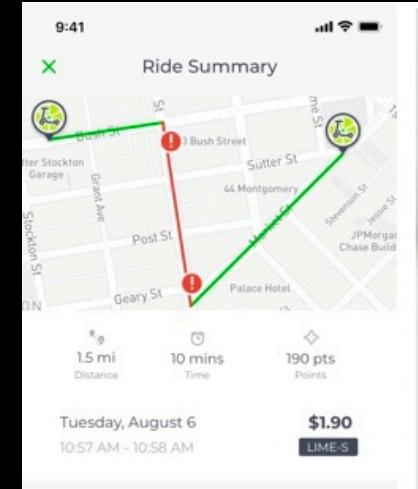
Shared-Rideable

Can they detect if rider is on a sidewalk?

- Lime is trying to use sensor data to determine if scooter is on road versus sidewalk
- Pilot program is monitoring every ride in downtown San Jose
- 2022, Lime is trying to understand the vibration of the underlying surface using a “sophisticated statistical model” it designed in-house. This should enable it to distinguish between sidewalks and roads.
- Lime says, “With this functionality, Lime is able to discern with up to 95% accuracy when a rider is riding on a sidewalk instead of the street”.

2023 update: Advanced rider assistance system (ARAS), will use camera to detect the sidewalk.

Allow city to choose if rider is alerted or scooter slows/stop

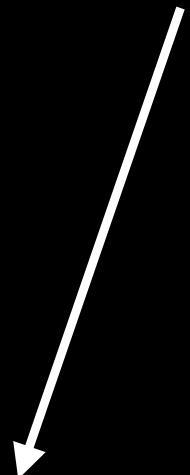


Rider will get feedback in the App

Shared-Rideable Network Architecture

- This is an incredibly rich IOT
- Once rider is on shareable
- Sensor data is sent to the cloud and analyzed
- The cloud can then command the rideable to change its behavior
- This closes the loop from rideable to cloud and back again
- Once implemented, can operate with just “things” no human decision making (except for the behavior of the rider)

One measure of a successful IOT is when it “streamlines a process”



Shared-Rideable

Network Architecture: Geo-Fencing

- Shared-Rideables have implemented:
 - No Lock Zones
 - Low Speed Zones
 - No Scooter Zones
 - No Parking Zones
- Wow, this simple IOT is becoming increasingly complicated!
- Do we really need all this technology?
 - Why don't we do this for ride-share drivers?
 - Why don't we do this for all automobiles?
 - Enforce speed-limits? On the I-80 causeway for example.
 - Unlikely to happen in the near future
 - People are super obsessed with their cars, they represent “individual freedom”

Shared Rideables

IOT Fail

What is this a picture of?

A garden?

A park?

An art installation?

An overgrown field?



Shared Rideables

IOT Fail



Shared Rideables

IOT Fail



Shared Rideables

IOT Fail



Shared Rideables

IOT Fail

- Around 2018 in China, the market was unregulated and became saturated with bikes
- Dozens of bike-share companies quickly flooding city streets with **millions** of brightly colored rental bicycles
- However, the rapid growth vastly outpaced immediate demand and overwhelmed Chinese cities, where infrastructure and regulations were not prepared to handle a sudden flood of millions of shared bicycles
- Companies who jumped in too big and too early began to fold, their huge surplus of bicycles can be found collecting dust in vast vacant lots
- Example where some regulation helps reduce company failure (when venture capital tries to flood the market)



- A photo of 1000's of discarded bikes!

<https://www.theatlantic.com/photo/2018/03/bike-share-oversupply-in-china-huge-piles-of-abandoned-and-broken-bicycles/556268/>

Shared Rideables

Scaling up at a dizzying pace

- **Blitzscaling:** The Lightning-Fast Path to Building Massively Valuable Companies. Book by Hoffman and Yeh (2018).
- It argues that the secret to starting and scaling massively valuable companies is “blitzscaling”
- A set of techniques for “scaling up at a dizzying pace that blows competitors out of the water.”
- We saw this with many venture capital backed companies like: Amazon, Uber, Lyft, Jump, Lime. And even Airbnb !
- They could burn money and make little profit on speculation it would become HUGE.
- In the case of shared-rideables, it led to business failure, annoyed communities, and governments

Shared-Rideable Government Regulations

- Because **blitzscaling** can overwhelm cities and neighborhood with shared rideables
- 2018 scooter companies were using gorilla tactics and then cities kicked them out.
- They were eventually allowed back in but regulated (in some cities)
- Require a permit from the city, the permit comes with some rules

Puts limits on the number of rideables

The distribution (to promote equity for low-income and under-represented populations)

Requires data to be provided on rides (start, stop, duration)

Shared-Rideable

Outcome of no government regulations

- Jan 8, 2022
- Ford's e-scooter company Spin (acquired in 2018) is leaving markets and laying off staff.
- To improve profitability, is pulling out of all "open permit markets"
- "Open permit markets" are places where multiple scooter companies can run businesses, with no caps on fleet sizes
- <https://www.engadget.com/ford-e-scooter-company-spin-leaving-markets-laying-off-staff-154545440.html>
- Because Ford is a traditional business (not venture capital), they just can not profit in unregulated regions. They make 2x profit in regulated areas.



Shared Rideables

Government Regulations - Still Big Money

BUSINESS \ TECH \ TRANSPORTATION

Lime raises over \$500 million, confirms plans to take its electric scooter company public

The latest e-scooter company to try its hand at the public market

By Andrew J. Hawkins | @andyjayhawk | Nov 5, 2021, 10:00am EDT

Shared-Rideable Government Regulations In San Fran

- The SFMTA has granted powered scooter share permits

2021 permit cycle.

Lime up to 2,000

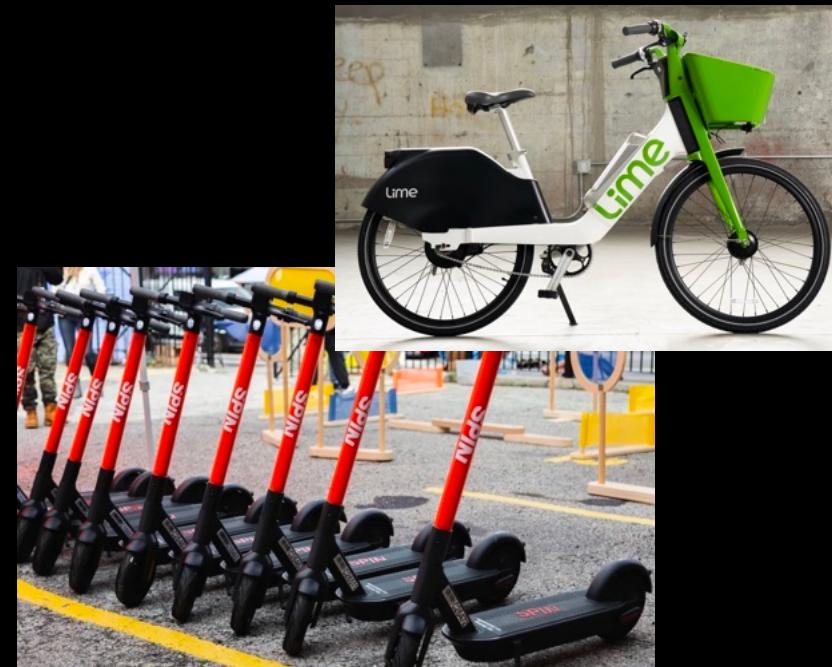
Spin up to 2,000

Scoot up to 1,500

2023 permit cycle.

Lime up to 2,750

Spin up to 2,750

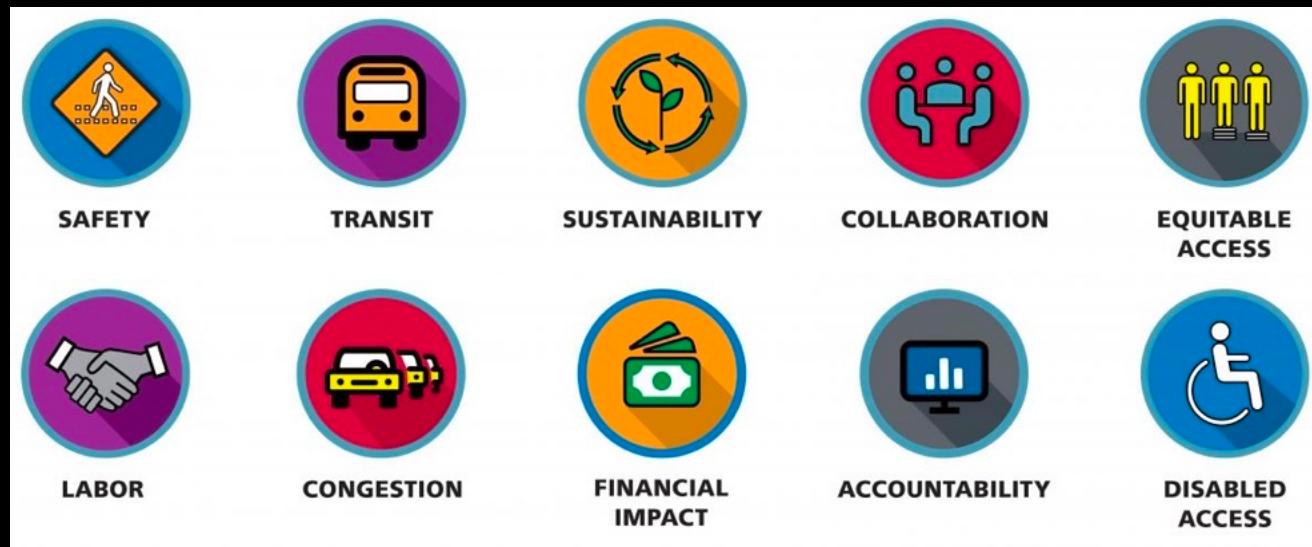


- Parking citations to share companies for devices not parked according to the parking requirements
- Biweekly meetings with the Scooter Share permittees and SFMTA staff and extensive reporting requirements
- Community engagement
- Must share their rider data!

<https://www.sfmta.com/projects/powerd-scooter-share-permit-program>

Shared-Rideable Government Regulations In San Fran

- Guiding Principles for Emerging Mobility Services and Technologies



Shared Rideables

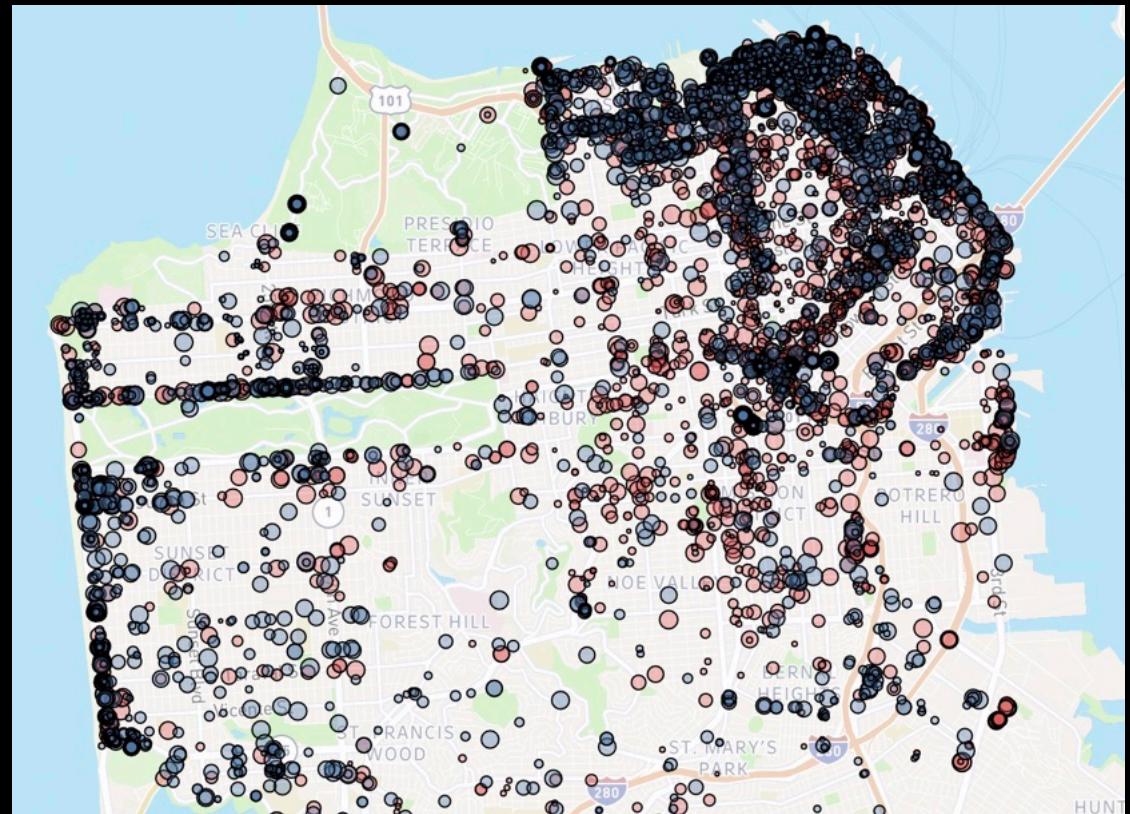
Regulations: Open Data

- Because the shared-rideables are through a contract with the city, the city imposes a set of regulations.
- One regulation is that the contract companies provides rider data including start/stop time, location duration of ride complaints of bikes parked that block pedestrians, cars, private property log reported injuries and accidents

Shared Rideables

Regulations: Open Data

- [https://www.sfmta.com/
shared-mobility-dashboards](https://www.sfmta.com/shared-mobility-dashboards)
- Real-time map of citations in
San Fran



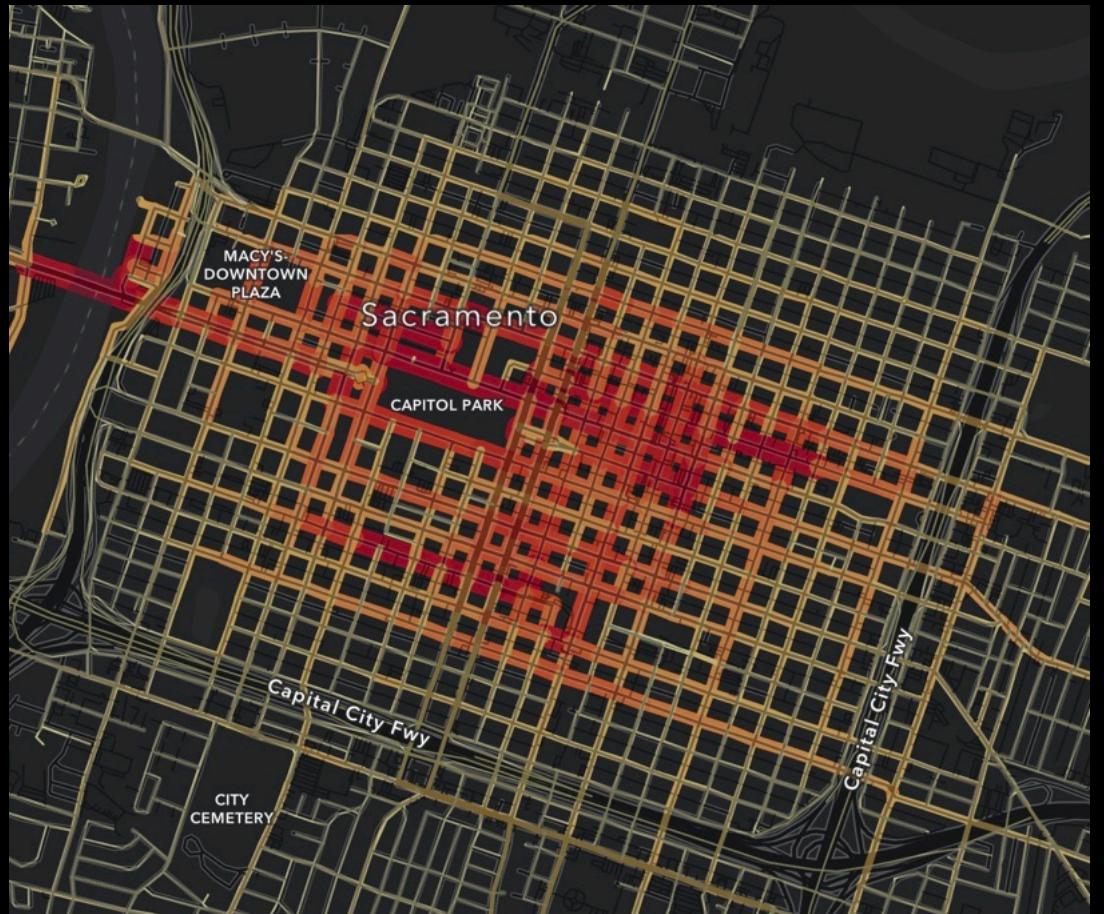
Shared Rideables

Regulations: Open Data

- Trips by block in Sacramento
- What does this visually convey?

Map of Sacramento

<https://public.ridereport.com/sacramento>



- <https://storymaps.arcgis.com/stories/bc51f7b0500f4dd195d1eb0594ace24a>

Shared Rideables

Open Data

- The City uses **anonymized** device data to better plan for:
 - Parking
 - Understand bikeway needs (adding more bike lanes)
 - Respond to community concerns
 - Ensure operators (Lime/Spine) meet cities equity requirements
- Still in its early stages, excited to see how this might transform our cities

Shared Rideables

Regulations: Open Data

- This is “meta” IOT
- These violation reports are presumably an IOT system themselves
- City is charging company who in turn could charge the rider

▼ Penalty Details

Case Number	342850	Device Type	Scooter
Issue Date	3/21/2021	Violation Type	Parking
Status		Citation	
Penalty Applied		Improper Parking	
Serial Number	SPTJVB	Citation Description	Locked to muni shelter on a narrow sidewalk. Corner street is Duboce. Please remedy immediately.



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What about Ride-Share?

Is their data public?

- Uber/Lyft generally **do not** give up their rider/driver data but sometimes they are required to
- In NYC they are part of the Taxi and Limousine Commission (TLC) and are required by law to submit data on every ride that occurs
- Data is not easy to use and cities are not making dashboards comparable to rideables
- Uber calls it "Uber Movement" **No longer available as of Oct 2023?**

Shared Rideables

Social/Economic Impact

- Are used for short commutes to work
- Are used for the “last mile” of a commute, to get to/from public transportation hubs
- Are used for leisure, just ride around (especially scooters)
- Are used to get to entertainment destinations like bars, restaurants, and cafes
- The entertainment aspect is known to increase local spending, supporting local businesses
- What about impact on cars and other public transportation?
 - Generally, decreases the number of cars (60% of car rides are less than 6 miles, maybe 3)
 - 2021, 52% of all trips, including all modes of transportation, were less than three miles
 - Generally, decreases the number of riders on traditional public transport (bus, commuter train)
 - Aren’t shared rideables part of public transport?

Shared Rideables

Why aren't shared rideables part of the municipal transportation system?

- Like buses, subways, and commuter trains?
- I am not sure
- Many cities have free buses along popular tourist routes. For example, "Charm City Circulator" bus is free in Baltimore.
- One possibility is cities can't compete with venture capital **Blitzscaling**
- But, some cities do manage their own shared-rideables



Shared Rideables

Some are managed by municipalities

- San Fran
- Portland
- Boston
- New York City

Shared Rideables

- Boston - BlueBikes - <https://www.bluebikes.com/>
- 4,000+ bikes. 400+ stations. 11 municipalities
- Compare with San Fran: Lime up to 2,750, Spin up to 2,750, Scoot up to 1,500
- Because it is a tax based service, it comes with a lot of equity features you normally don't see with for-profit companies

Free 90 day pass for essential workers (including employees of restaurants, retail shops, grocery stores, and pharmacies)

Income-Eligible Program. \$50 per year (\$5 month) gets you unlimited 60-minute trips

With \$13/month (was \$11 in 2022) membership riders get unlimited 45 minute rides

One time use: \$2.95 for the first 30 minutes

City distributes bikes into low-income neighborhoods (not just tourist destinations)

City ensures bikes are useful for commutes, placing them within 1-mile of commuting corridors

- I would argue that if this kind of easy/cheap/accessible bikes and scooters was common, we could transform our cities

Sacramento Region

Sacramento Regional Bike Share - Partner with Lime

- <https://www.sacog.org/bike-share>
- Launched in the cities of Davis, Sacramento, and West Sacramento on May 15, 2018
- Membership based system that allows people to pick up a bike, ride to their destination, and leave it at a new location for a small fee
- Now partnered with Lime (acquired from Uber/Jump).
- Lime began with 200 bikes across the two cities and will ramp up to 600 bikes based on rider demand.
- **LimeAccess** program – \$5 a year (for qualifying low-income users) for free 30 minutes up to five times a day.
- **LimeAid** program – Free 30-minute rides up to five times a day for healthcare workers, public safety workers, and other essential workers (must sign up to qualify).

Maps Are Everywhere Because of IOT

- Mapping Apps (Google, Apple, Wave)
- Ride share (To some extent)
- Shared Rideables (massive map data)
- Weather maps
- Etc etc etc
- But how could they be useful?

Shared Rideables

Why aren't shared rideables part of the municipal transportation system?

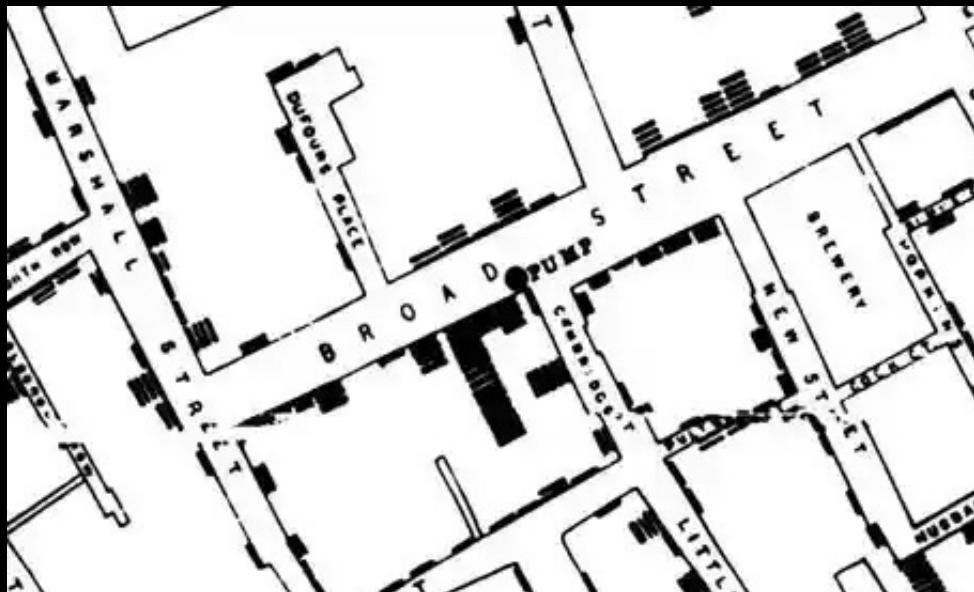


Some Historic Maps With A Huge Impact

The cholera map that changed the world

John Snow's 1854 London Cholera Outbreak

- Mapped Cholera outbreak in London (1854)

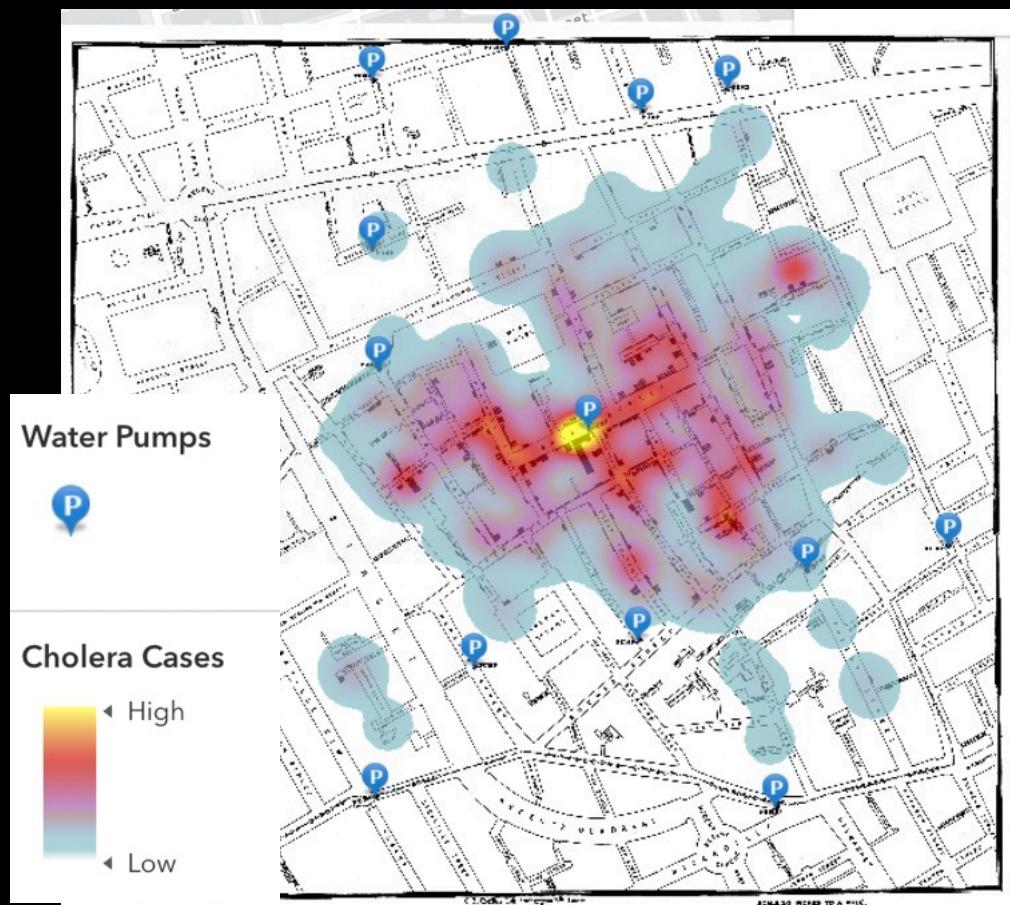


<https://learn.arcgis.com/en/projects/map-a-historic-cholera-outbreak/>
<https://www.theguardian.com/news/datablog/2013/mar/15/john-snow-cholera-map>

The cholera map that changed the world

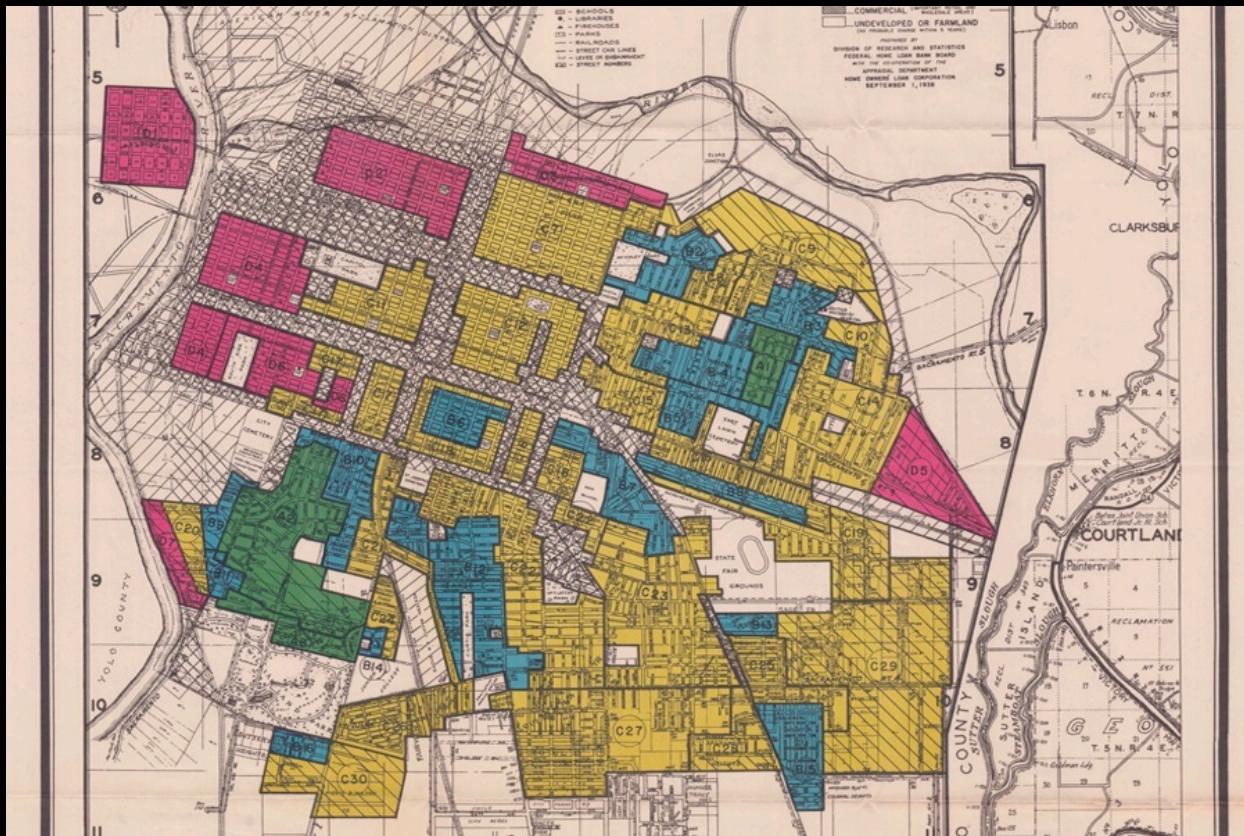
John Snow's 1854 London Cholera Outbreak

- Cholera is an acute, diarrheal illness caused by infection of the intestine with a toxigenic bacterium (e.g a bacterial infection).
- In the 1800's, we did not know about bacteria!
- This map showed us that the spatial distribution of cholera was correlated with **some** water pumps but not others.
- First indication of how it spread (through water contamination).



Redline maps in the 1930's

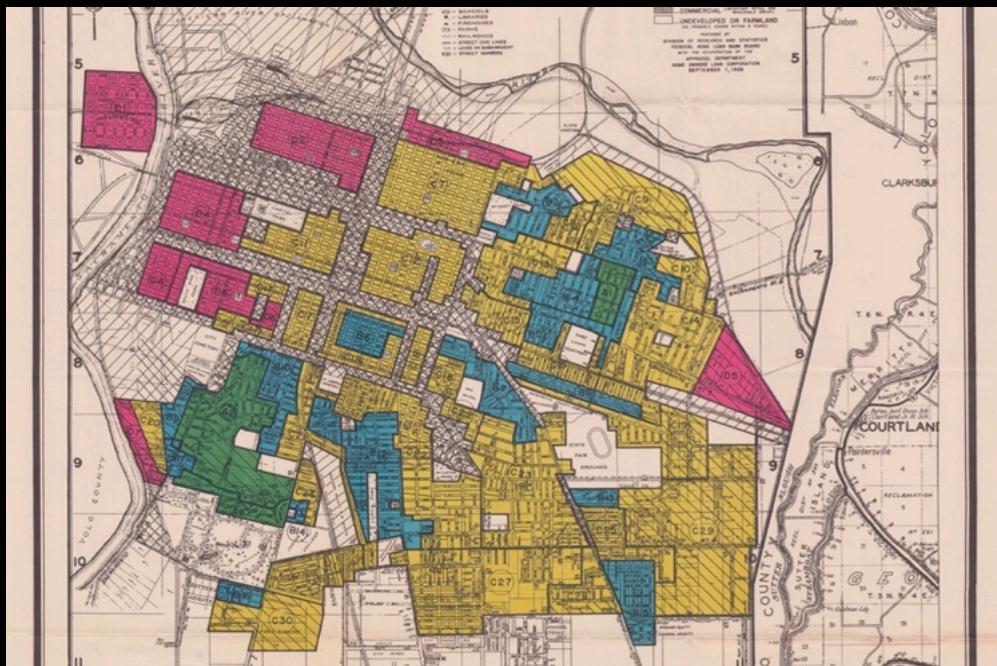
Drawn by government sponsored bank lenders



Redline maps in the 1930's

Drawn by bank lenders

- "A" areas, green, were considered "hot spots," where good mortgage lenders ... are willing to make their maximum loans."
- "B" areas, in blue, were deemed not as desirable, but "still good."
- "C" areas, in yellow, were considered in decline
- "D" areas, in red, were considered to be in full decline, areas lenders should steer clear of.
- This classification method was heavily influenced by a neighborhood's **racial** and economic demographics.
- Private banks quickly adopted the government's identification system, commonly denying home loans to residents in neighborhoods considered risky.
- The color-coding of maps became a verb: to redline a community was to mark it as undesirable and not worthy of investment.



Next Class

- Review of components that make IOT.
- A 6 level framework for thinking about IOT systems.
- Start thinking about the smart home