**Thesis Project** 

# How Can We Make the Parking Experience More Efficient and Enjoyable





**Oksana Bryhidyr** George Brown College - IMM, 2018

### Introduction

Parking in Downtown Toronto people find hard, boring, time consuming... But it is still a right time, in comparison to European Old Towns with an extremely limited parking spaces, to bring an innovative improvements.

LuckySpot is an on-street parking solution, which provides finding and reservation of the parking spaces, guides drivers to available spot and than gives walking direction to the destination. System includes App and In-Ground Vehicle Detection Sensors to maintain real time parking availability, access rates, hours, addresses, and occupancy. In addition, LuckySpot App benefits with features of voice guidance, online payments, LuckyCoins reward system, parking expiration reminder, parking extention if needed and walking directions back to your car.

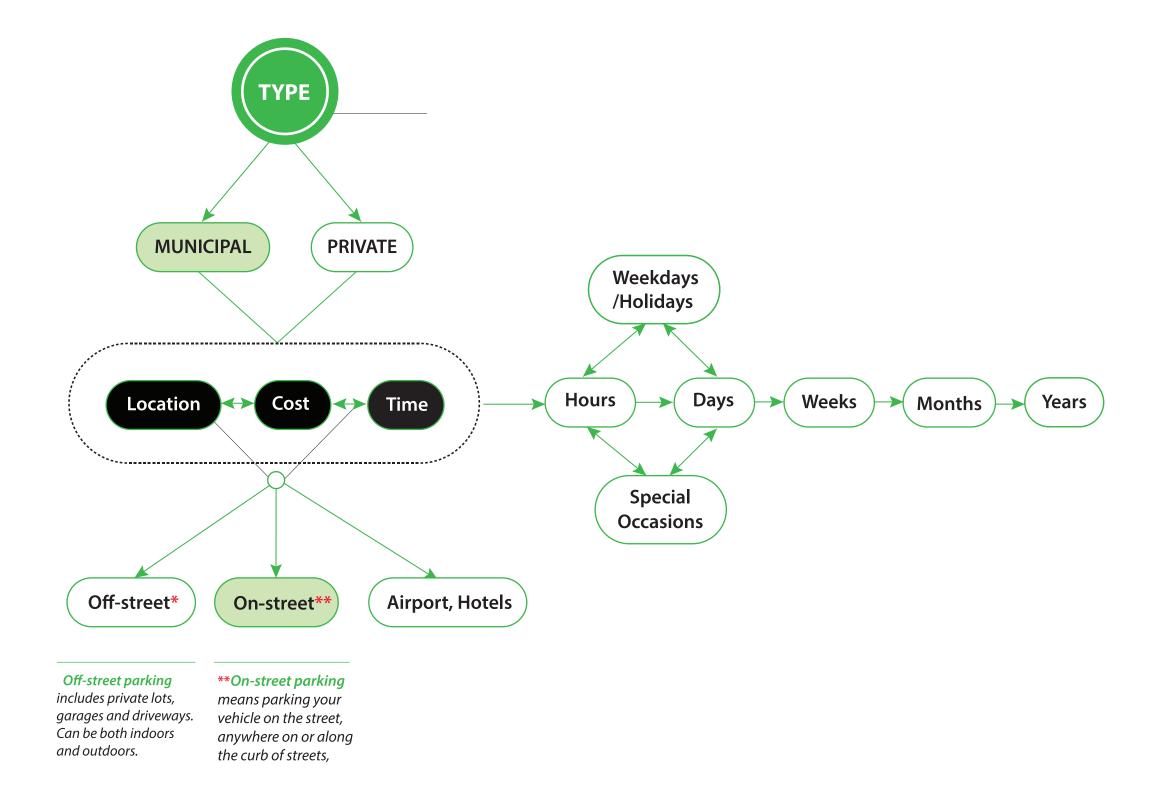


3 hour parking limit in Downtown Toronto

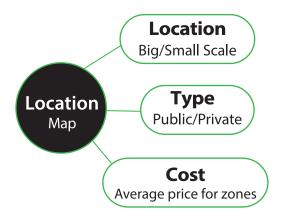


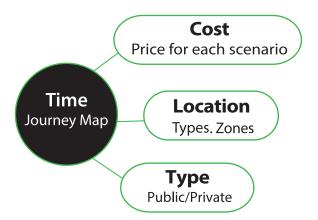


# Diagram 1 Parking Ecosystem in Toronto



How Can We Make the Parking Experience More Efficient and Enjoyable





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# RESEARCH



#### **Toronto Parking Authority (Green P)\***

https://parking.greenp.com

#### **Features**

The Toronto Parking Authority exists to provide safe, attractive, self-sustaining, conveniently located and competitively priced off-street and on-street public parking as an integral component of Toronto's transportation system.

Today provides 20,000 off-street spaces in 150 facilities including 19 parking garages, as well as 17,500 on-street spaces controlled by pay-and-display machines or meters. In addition, the Authority manages, on behalf of the Toronto Transit Commission, 12,500 spaces at their park and ride facilities and parking areas on behalf of the City's Parks and Recreation Department serving the waterfront parks during the summer season. The Toronto Parking Authority is the largest municipal parking operator in North America.

#### Strenghts

- Municipal parking operator

- Covers the most of parking lots in Toronto (20 000 off-street, 17 500 on-street + 12 500 parks in summer)

- Best price (No additional charges besides the parking rate), All existed payments methods available

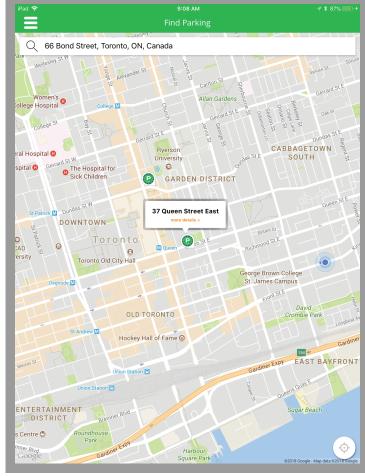
- Convenient parking search tool: by addess, intersection, venue

- Comprehensive information about the spot (Rate, Lot details, Street View, Payment Methods)

- List of he nearest to searched parkings
- Average price for the Street Parking in the searched area
- Mobile App, Website, Mobile Pay

- Convenient payment by Location ID no the meter, possibility to continue parking time

- Easy SignUp with a phone clear interface
- Usable Interface (Monthly Permit uppdate, Paring, History, etc.)
- No needed parking tickets for displayment, enforcement officers checks the licence plate



#### Weaknesses

- Monthly Parking information is not available in App and not easy to obtain trough the phone (although it is present in details)
- No On-street parking spots on the map
- No reservation
- No custom navigation to the parking spot (forwards to Google Map)
- No information about distance from parking spot to your destination

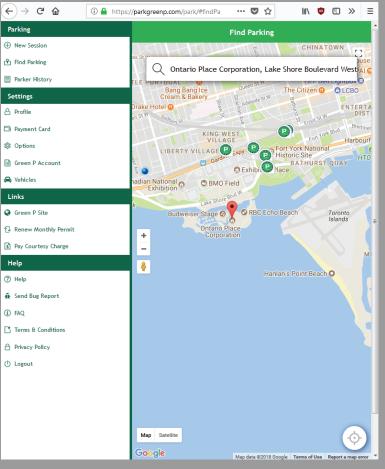
# 37 Queen Street East Address: Toronto, ON ed by: Toronto Parking Authorit Phone number: (416) 393-7275 Location ID: 26 Carpark Information Carpark 26 Address: 37 Queen Street East Facility Type: Garage Capacity: 645 Height Restriction (Approximate): 2.00 Payment Options: Auto Express Pay Stations, Credit Card at Entry & Exit, Cashier Payment Mathade: Bills: Coins, Charge (Visa / Mastercard / American Express Or Rate Informatio \$3.00 / Half Hou Day Maximum until 6 PM - \$28.00 (Entering 7 AM - 10 AM). Day Maximum until 6 PM - \$20.00 (Entering 10 AM - 6 PM) Night Maximum (6 pm - 7 am): \$7.00 Saturday - Sunday & Holidays Day Maximum (7am - 6pm): \$6.00 Night Maximum (6pm - 7am): \$6.00 Unless otherwise posted in a parking facility, regular rates apply on Holid

#### **Opportunities**

- On-street parking information
- Reservation
- Navigation to the parking spot
- Information about the distance from parking spot to your destination

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#### Impark

https://www.impark.com/

#### Features

The Impark group of companies is the largest operator of municipal parking systems in the United States. Impark operates parking facilities on behalf of property owners and asset managers through parking management agreements providing bankable leases. Since 1962, Impark has had a reputation for offering superior service to its customers and clients, and for employing leading edge technology in parking solutions.

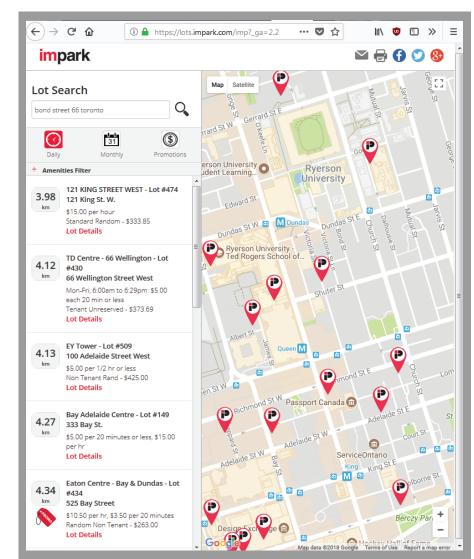
With multiple parking lots and garages of various sizes and both on- and off-street parking — all of which may have different operating methodologies and equipment, staffing, and parking enforcement requirements — municipal parking systems demand a knowledgeable operator with a wealth of experience to draw upon.

#### **Strenghts**

- Good coverage among private operators
- Daily, Hourly, Monthly, Promotions
- Monthly Parking Reservation
- Usable interface
- Information about the distance from parking spot to your destination
- Comprehensive information about the spot (Rate, Lot details, Street View, Payment Methods)
- Payment on the site, Credit cards, cash, deposit 25\$ for day parking, Online Payments

#### **Weaknesses**

- No App, only Website (hangTag App not availabe in Toronto)
- 25\$ deposit for daily parking
- Not enough parking spots



#### - Hourly, Daily Reservation

**Opportunities** 

- Navigation to the parking spot

- Not available online payments for hourly parking

- Expensive hourly parking



Honk https://www.honkmobile.com

#### **Features**

The HonkMobile app allows drivers to search for, pay for and top up parking directly from their smartphone, tablet or computer. Further, Honk now gives access to more people in the Greater Toronto Area (GTA), where demand far exceeds supply, with the integration of the monthly pass feature. Honk users can now purchase a monthly pass for one of the thousands of underground and above ground parking spots using the app. Additionally, Honk is partnering with Toronto Community Housing to offer monthly parking passes. Honk is available at 206 community housing locations around Toronto and the GTA, and the company promises to add more lots in the coming months to accommodate growing demand.

#### Strenghts

- Hourly, Monthly parking
- Promotions
- Monthly parking reservation
- Additional Parking spots in residential area
- Online payments
- App, Website version
- Usable interface

#### Weaknesses

- Not available for older versions than iOS7
- Hourly and daily reservation is not available
- No On-street parking information
- Low coverage

# 66 Bond Street START Today END Toda Parking - H 10

How Can We Make the Parking Experience More Efficient and Enjoyable

# HONK

		HOURLY MONTHLY
Toronto		Q Address -
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y at 12:36pm	Ţ.	Edinton AVE LEASIDE 9 THORNCLIFFE PARK
near 66 Bond Street, Toronto		1 2 Mining and Barrier Mining and American Strength Common Difference Stren
141 Queen St E Zone 9079 🔞 Non-Reservation Enter after: 10:37am Exit before: Jun 13, 12:37pm Book Now	<sup>\$</sup> 20	15 16 16 16 RoseDale RoseDale
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Book Now		
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		Map data @2018 Google Terms of Use Report a map error

#### **Opportunities**

- Hourly, Daily Reservation

- Navigation to the parking spot

#### Parking Cupid

https://www.parkingcupid.com

#### Features

Service matches homeowners who wish to rent out their driveways or parking spots on a weekly or monthly basis with drivers. The cost of using a parking space is entirely up to the parking space owner. Homeowners with parking pads have to pay about \$259 a year to the city. Membership Contribution is the only cost.

#### **Strenghts**

- Good prices for monthly parking rent
- Opportunity for renting for owners

- Realtime offers and inquiries update on the Google Map and through notifications

#### Weaknesses

- no App, only Website
- Confusing interface

- Required registration before using the service

- Limited number of spots

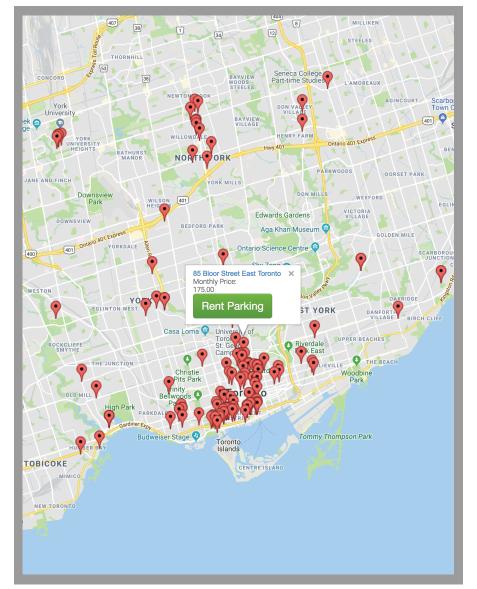
- No daily and hourly parking

#### **Opportunities**

- App

- Hourly, Daily Reservations
- Custom Navigation to the parking spot





#### **WhereiPark**

www.whereipark.com

#### Features

WhereiPark is a marketplace for monthly parking. We are focused on helping companies and commuters find and secure monthly parking spots that are simply not available anywhere else.

For real estate owners, WhereiPark offers a simple solution to unlock ideal parking spots and convert them into a new revenue stream. WhereiPark manages all of the administration on the owner's behalf, including processing payments and managing security deposits.

For commuters and offices, WhereiPark makes it simple to search for monthly parking, compare rates, and book a spot.

Fee for successful renting

#### **Strenghts**

- 100% free to list your spot on WhereiPark
- Guaranteed space for parking
- No additional charges for renting
- Alerts for new available spots
- Online payments

#### **Weaknesses**

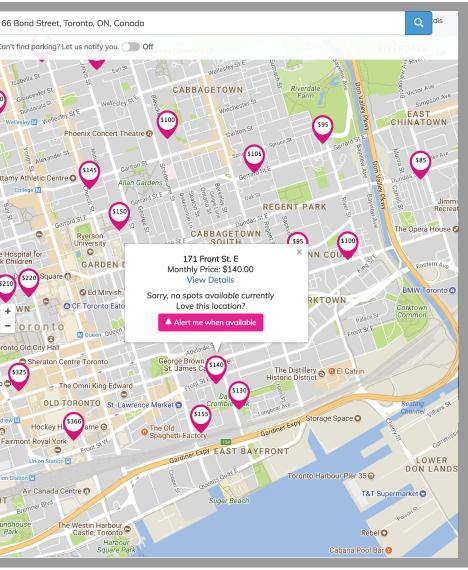
- Low coverage
- No hourly and daily parking
- No On-street parking

# \$325 Air Canada Centre 🙃

- Hourly and Daily parking

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#### **Opportunities**

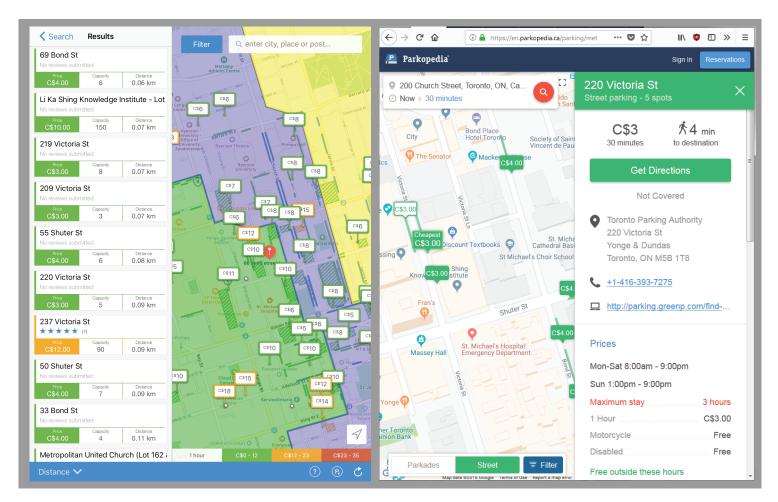
- Expanding the coverage
- On-street parking

Parkopedia

https://en.parkopedia.ca

#### Features

Since 2007 Parkopedia has become the world's leading parking service provider used by millions of drivers and organizations such as Apple, Audi, BMW, Coyote, Ford, Garmin, GM, HERE, Honda, Jaguar, Land Rover, Mazda, Mercedes-Benz, Peugeot, Porsche, Skoda, Sygic, TomTom, Toyota, Volkswagen, Volvo and others. Parkopedia allows drivers to find the closest parking to their destination, tells them how much it will cost and whether the space is available. Real-time parking availability The ability to pay for parking online, through a mobile app and in-car. Parking reservation online and through a mobile app. Hourly, Daily parking. Points system



#### **Strenghts**

- Parking reservation
- Online payment
- Good coverage
- Usable Interface (Price Range Zonning, full information about parking lot)
- On-Street and Off-Street parking information
- Feedbacks

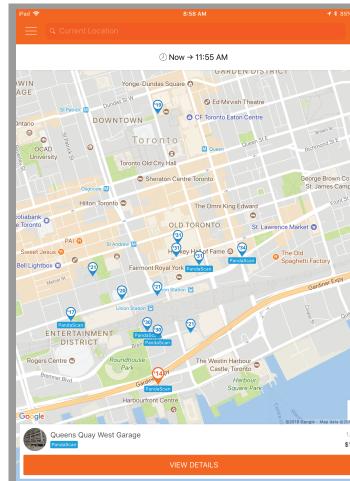
#### Weaknesses

- Inaccurate information on street parking
- Reservation is not available for the most locations
- No guaranteed availability
- No monthly parking reservation

#### **Parking Panda** https://www.parkingpanda.com/

#### **Features**

Partership with a parking locations facilitate reservatns directly. Guaranteed space ahead of sports games, events, and trips to the city, real-time prices for thousands of lots and garages in over 40 cities. Dedicated customer service available by chat, call, or e-mail with a real, live person, always. Instantly access and redeem your parking confirmation from the app for an easier, stress-free parking experience. Price depends from location. Flat rate pass sent on email



#### **Strenghts**

**Opportunities** 

- Update with a more recent

- Reservation improvement

information On-street parking

- Desktop and App versions
- Hourly, Daily, Monthly parking
- Guaranteed space for parking
  - Promo codes (Goupon) acceptable
  - Cancelation available
  - Usable Interface (Monthly Permit
  - uppdate, Parking History, etc.)
  - Customer support system
  - No additional fees for reservation

#### **Weaknesses**

- (no mobile confirmations) - Low coverage

How Can We Make the Parking Experience More Efficient and Enjoyable



iPad 🗢 Cancel	в:10 РМ Eaton Centre - Bay & Dundas Parkade	<b>1</b> ≵ 51% <b>□</b> )
Eaton Centre -	Bay & Dundas Parkade	0.4 km \$11.00
	⑦ Now → 9:05 PM	
PHOTOS		
IMPORTANT INFORMATIO	N	
🗭 No re-entry	Max height: 6'7"	
AMENITIES		
Accessible	G Covered Parking	
Electric Vehicle Charg	ging On-Site Staff	
ABOUT THE PARKING SPA	ACE	
	eed to park on levels P1-P3 (do not park in stalls ma e the attendant at the exit on P1 BEFORE returning t	
	anada's most visited tourist destination. It is served l ocated on the east side of Bay St. in the middle of I	
HOURS OF OPERATION		
Sunday: 7:00 AM - 12: Monday: 6:00 AM - 11: Tuesday: 6:00 AM - 11 Wednsday: 6:00 AM - 1 Thursday: 6:00 AM - 1 Friday: 6:00 AM - 11:0	00 PM :00 PM 11:00 PM :00 PM	
	RESERVE FOR \$11.00	

- Some locations need printed pass
- No On-street parking information

#### **Opportunities**

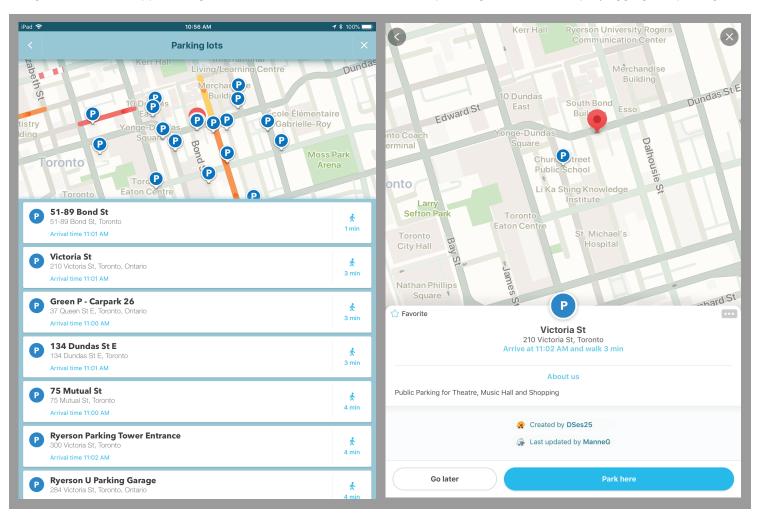
- On-street parking
- Coverage growth
- Electronic passes

Waze

https://www.waze.com/

#### **Features**

Waze, the real-time traffic app owned by Google, is teaming up with transportation data firm INRIX to help drivers find the best parking spot close to their destination. "Where to park" feature, which suggests parking lots closest to a destination and allows users to navigate there directly. Additionally, if a user doesn't select a parking lot prior to arrival, Waze will give the option to select and navigate to one when approaching a final destination. That feature will be supercharged thanks to uniquely aggregated parking data.



#### Strenghts

- Real-time information about parking from a variety of sources

- Automatic parking pin adding to the map apon arriving

#### Weaknesses

- No information about the price
- No reservations
- No guarantees about availability



BestParking https://www.bestparking.com

#### Features

BestParking arranges parking reservations on behalf of independently owned and operated parking facilities. BestParking does not set the parking prices, operate the parking lots, or determine parking availability. When your reservation is submitted online, the rate is secured. For this reason, your reservation rate may not be combined with any additional coupons, special offers or other promotion when you exit the parking lot. Special discounts will not apply.

iPad 🔶

66 Bond Street

22 min walk

5\$ fee commission for the reservation

Price for paking set by owner.

#### **Strenghts**

- Parking reservation
- Online payment
- Good coverage
- No guaranteed availability

- Usable Interface (Monthly Permit uppdate, Paring, History, etc.)

#### **Opportunities**

**Opportunities** 

- Prices Information

- Reservations

- Complicated procedure of receipt displayment

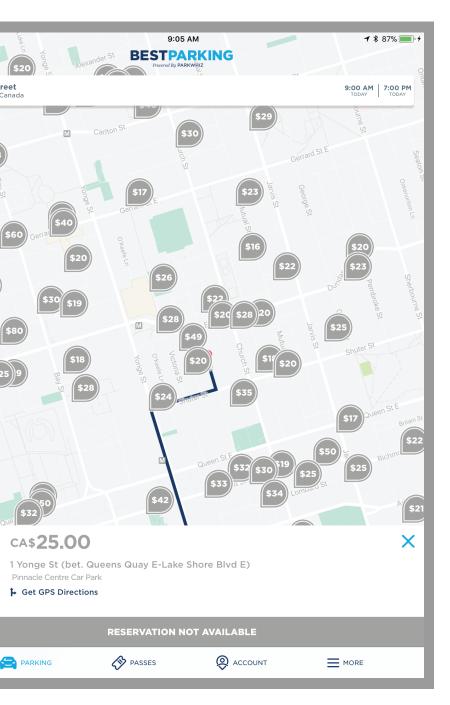
- BestParking is not resposible for inaccurate information or other issues

- Reservation is not available often
- No On-Street Parking information

- Free

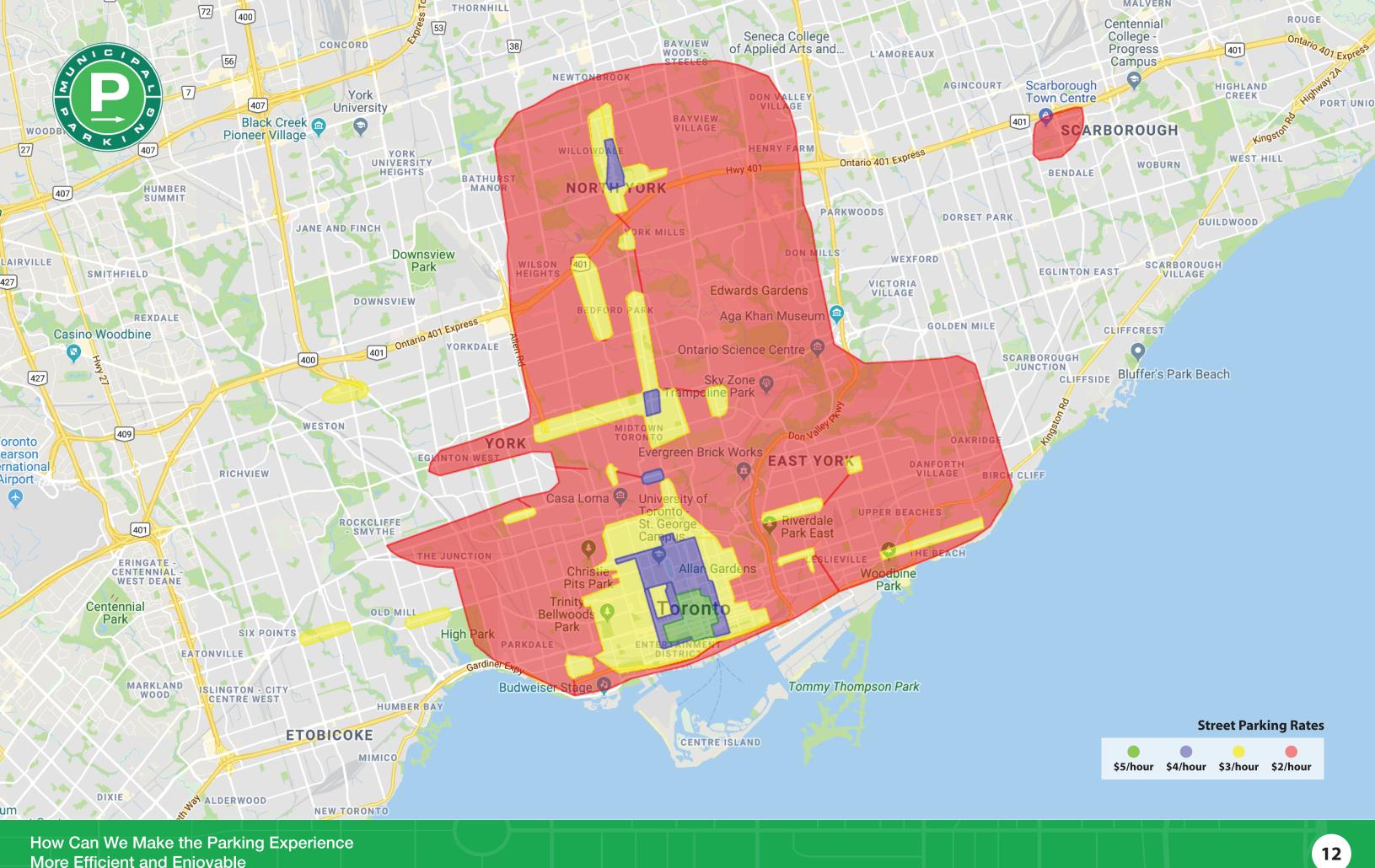
How Can We Make the Parking Experience More Efficient and Enjoyable





# PARKING ZONES

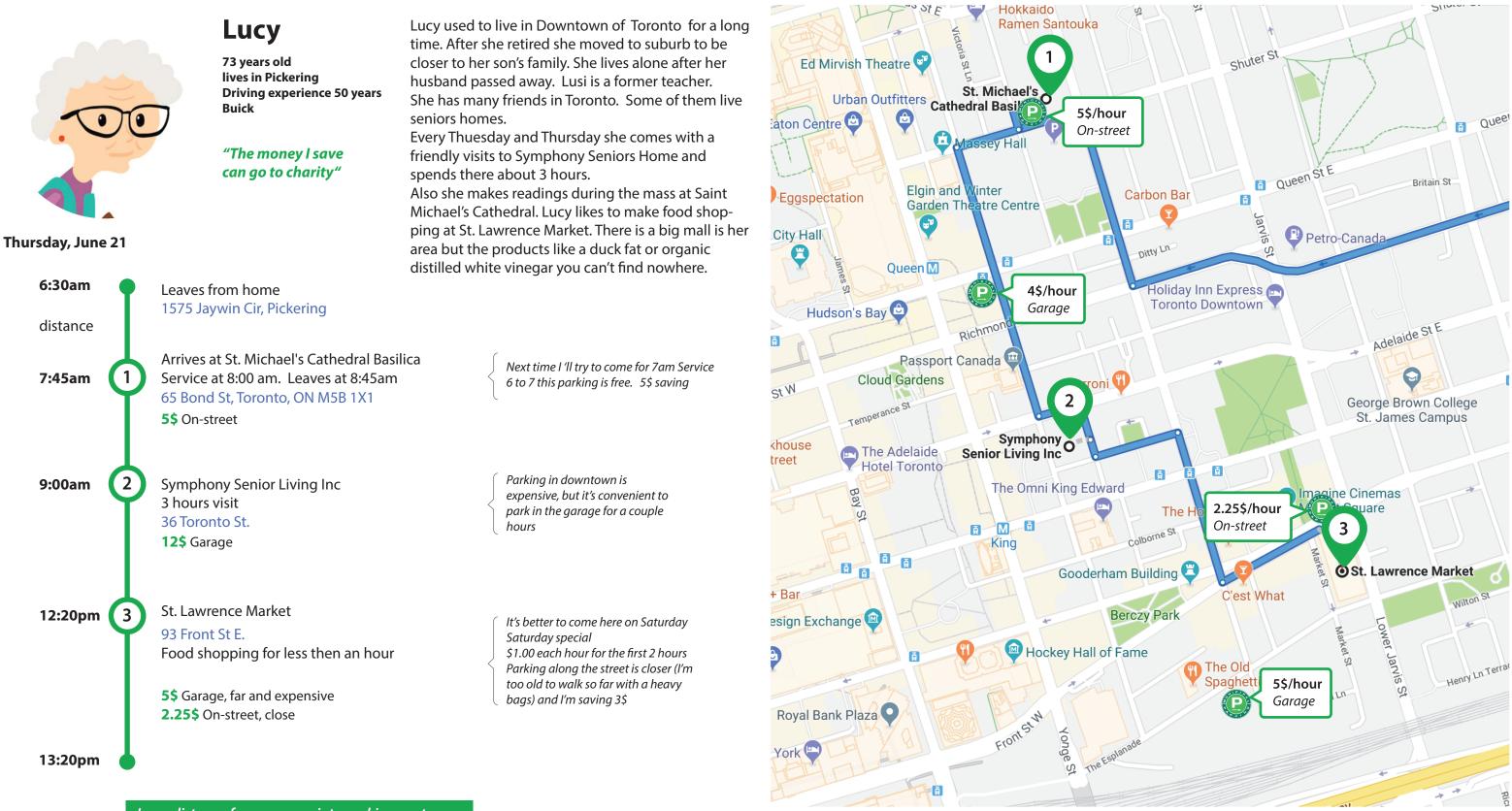




More Efficient and Enjoyable

# USER PERSONAS' JOURNEY ON PARKING ZONES





**Insights:** Long distance from appropriate parking spot. Price depends from location, type, time of parking.

How Can We Make the Parking Experience More Efficient and Enjoyable



#### Thursday, June 21

Josef

48 years old lives in Nort York **Driving experience 30 years** Maserati, Ferrari on weekend

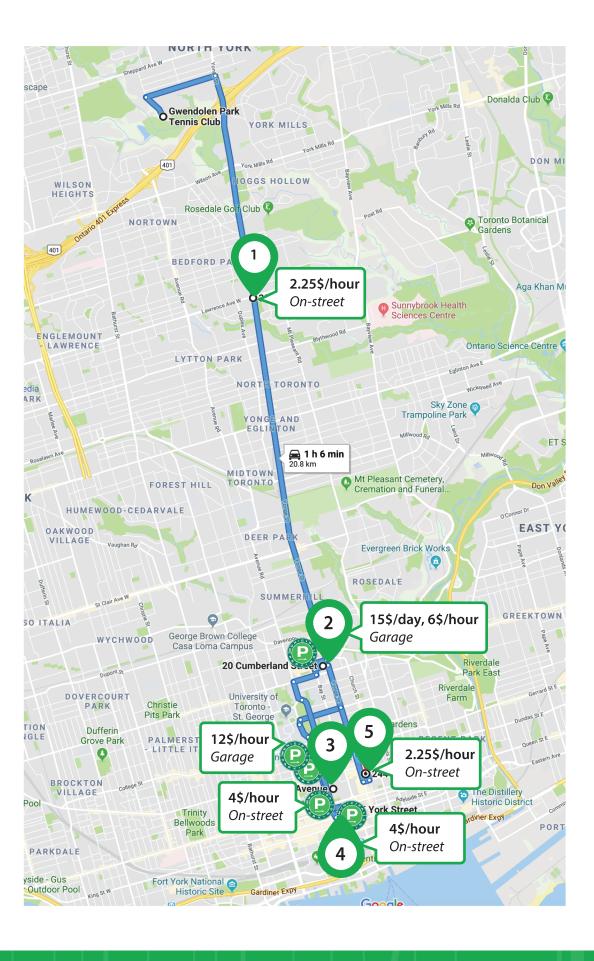
*"Time is money. I don't look"* at the price, I park whenever I see an open spot. "

Josef is a lawyer. He owns his lawyer firm, which is located in downtown. Although work takes much time he is realy devoted to his family: wife Sarah, daughter Ann (14), son Alen (18).

He lives in a luxury house with a view on the Gwendolen Park. His family often play tenis together having a tenis court in 5 min walk. He is a member at Don Valley Golf Course where he spends weekends together with his family.









### Nick

Leaves from home

Arrives in the Marylin

Arrives to office

14\$ Surfice

135 Liberty St #300

George Brown College

341 King Street E

70 Distillery Ln

free On-street

**Ontarion Place** 

711 Lakeshore Blvd W

6,75\$ Street parking

Arrives to Distillery District

1275 Lake Shore Blvd W

Bell Park

Free

2

3

4

15 Cronin Dr, Etobicoke, ON

29 years old lives in Etobicoke **Driving experience 11 years** Honda Civic

*"Parking in Toronto costs"* a lot of money but it is more flexible than the TTC "

#### Thursday, June 21

7:00am

8:00am

9:30am

6:00pm

9:10pm

10:40pm 【 5

I play tenis with my colegue before our work sometimes. Parking is free before 5pm on weekdays

While I'm finding less expensive monthly parking, I spend 12-14\$ a day...

I was lucky to get my spot before others.

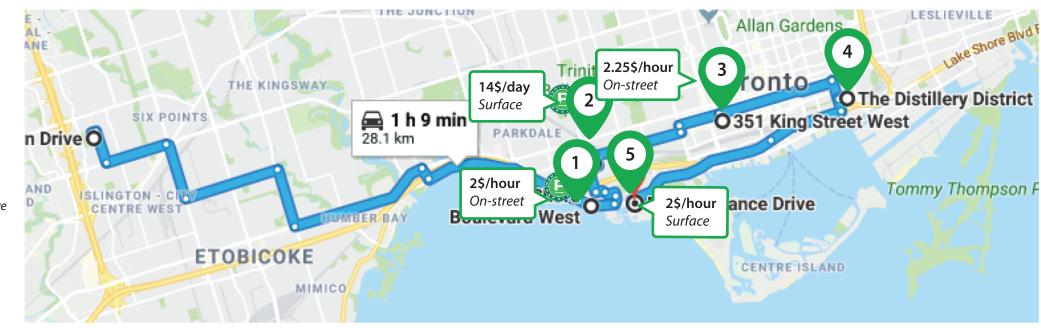
There is Garage at 5\$ per hour but on our way we found free (it was 9pm) on-street parking

This place is beautiful at night, so I'm not surprised it is not free

11:30pm They left to Mississauga

2\$ Surface

Nick is a talanted media designer. He has just got anew job at Forge Media + Design (Liberty Village). He lives with his parents in Etobicoke. He was thinking about moving into his own apartment but he doesn't want to live alone. However, maybe everything will have changed soon. He met Jenna at George Brown College, where he is taking french classes. And it seems she is a girl of his dream. She lives in Mississauga and gets to college on TTC. Today Nick is going to invite her somewhere after the class.



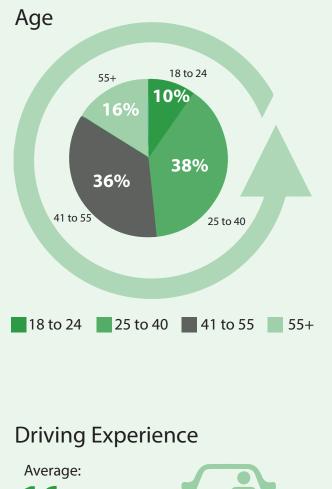
On-street parking is more convenient and less expensive **Insights:** 

How Can We Make the Parking Experience More Efficient and Enjoyable



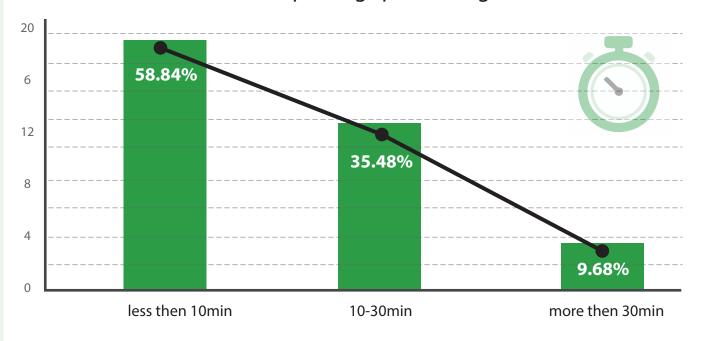
# **Statistic**

# 90% of respodents drive to downtown 1-2 times a week

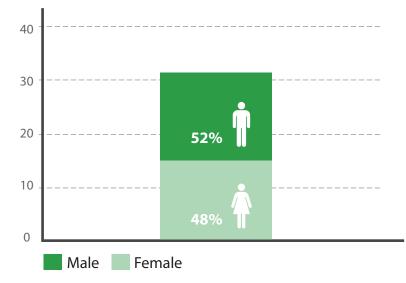




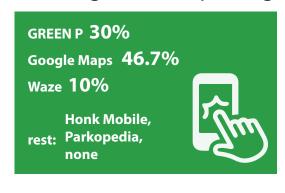
### Time drivers reserve for the parking spot finding



#### Gender



### **Most Used Apps** for Navigation and parking



How Can We Make the Parking Experience More Efficient and Enjoyable

# **Research Insights**



- Parking needs are growing every year  $\checkmark$
- Still a good time for parking regulations in comparison to European cities
- On-street parking in residential area face  $\checkmark$ lack of space, law regulations difficulties
- Transit parking lots: not enough spots  $\checkmark$ after 9am
- On-street parking is not supported by apps  $\checkmark$
- Lack of on-street parking spots  $\checkmark$
- ✓ Prices are extremely high in some locations
- On-street parking is more convenient in term of the distance to the destination and less expensive.

Through real-time data and analytics, cities are finding that they generally don't have a lack of available parking; drivers instead have the perception of scarcity due to a lack of information.

# TECHNOLOGY



# **Existing Parking Sensors**

#### \*nedap

#### SENSIT IR Wireless vehicle detection sensors

http://www.nedapidentification.com

Nedap's wireless vehicle detection sensors efficiently measure occupancy of individual parking spaces without complex or time consuming installation. The wireless vehicle detection sensors are installed in each parking space. The system is based on a self healing wireless mesh network of vehicle detection sensors designed to detect vehicle presence in individual parking bays.

- Wireless detection and communication

- Flexible integration with parking applications

- Dual detection (infrared and earth magnetic field)

- Easy installation without wiring





Netherlands, Dubai, Italy, Spain, Singapore and the USA

#### **SENSIT Gateway**



The SENSIT Gateway is the interface between the SENSIT sensors, the Relay Node and the SENSIT Software.



#### SmartPark' solution

https://www.smartparking.com

#### **In-Ground Vehicle Detection Sensors**



Individual parking space sensors that gather and transmits information for management, payment and compliance monitoring

#### **Features**

- Both infrared and magnetic technology in every in-ground vehicle detection sen
- Wireless for ease of installation and minimal costs by eliminating civil works.
- Powered by long-life batteries for low maintenance.
- Independently certified for accuracy and compliance.
- Robust construction to resist both vandalism and accidental damage.
- No impact on existing IT infrastructure.
- Integrates with SmartRep for unsurpassed information and analysis.
- Wireless for ease of installation and minimal costs by eliminating civil works.

libelium

**Features** 

- Vandal resistant.

#### **Smart Cities Sensor Platform**

#### http://www.libelium.com/

Smart Parking allows to detect available parking spots by placing the node under the pavement. It works with a magnetic sensor which detects when a vehicle is present or not. Waspmote Plug & Sense! can act as a repeater for a Smart Parking node.

#### Magnetic sensor

- Efficient car park occupancy measurement and overstay detection



#### Final pavement hole



SAN MATEO, Calif., ZARAGOZA, Spain

#### **Internet Gateway**

Battery can be recharged using the internal or external solar panel options. The external solar panel is mounted on a 45° holder which ensures the maximum performance of each outdoor installation.



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Westminster City Council - London, UK Town of Claremont - Perth, Western Australia New Plymouth District Council, New Zealand

#### SmartSpot Gateway

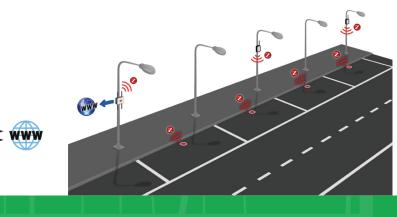
Mounted on a pole, wall or ceiling it acts as the central communication unit that collects data from In-Ground Vehicle Detection Sensors via wireless communication and transmits it to the SmartCloud parking services system.

Installation is easy and can be done in minutes.

Three methods of power: mains power, rechargeable battery and external solar panels.







# **Existing Parking Sensors**



**Banner Wireless Solutions for Smart Parking** https://www.bannerengineering.com/

#### **M-GAGE** Parking Sensor



#### **Features**

The wireless M-GAGE Parking Sensor is a compact and easy to deploy solution for monitoring single parking spaces, allowing cities to better manage the parking challenges of today and tomorrow.

- Reliably detects large ferromagnetic objects using a three-axis magneto-resistive technology

- Automatically communicates parking space status by radio to the closest Gateway

- Parking space availability information can be sent to a remote supervision system for real-time visualization and statistics or enforcement via GSM/Cellular, RS-485 or Ethernet using a DXM100 Wireless Controller

#### **R-GAGE Radar Sensors**

R-GAGE radar sensors are capable of solving a more diverse range of vehicle detection applications than other sensing technologies, including inductive loops.



#### **Features**

Detects moving and stationary targets up to 24 m away

10

- Frequency modulated continuous wave (FMCW) radar ensures reliable detection in all weather conditions

Extended Connectivity to Smart Devices

- Operating Temperature from -40 °C to +65 °C (-40 °F to +149 °F)

- Non-intrusive, easy-to-install and easy-to-use solution that does not require any specific maintenance

- Higher sensitivity and shorter range

- Adjustable sensing field - ignores objects beyond setpoint.

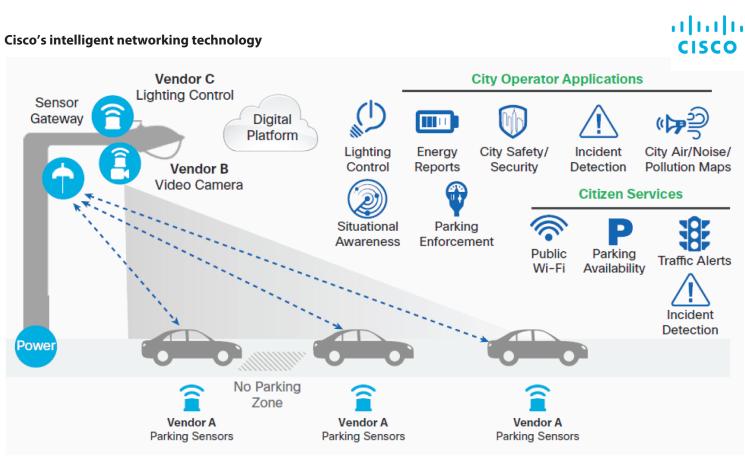


#### Hybrid parking solution https://www.streetline.com

The new system is a culmination of sensors, free Parker smartphone app from Streetline and an intelligent networking platform from Cisco. **In-Ground Sensors** 



A single in-pavement sensor per block-face combined with Streetline's proprietary analytics, provides continuous real-time parking occupancy data for the entire block. Whether it's a Streetline sensor or an existing sensor in your city, a single sensor per block face is the ONLY infrastructure required for our Smart Parking solution.



How Can We Make the Parking Experience More Efficient and Enjoyable



Minneapolis, MN, USA

San Carlos, San Mateo, Calif (Silicon Valley), USA The Washington Metropolitan Area, USA Oregon State University, USA

#### Camera

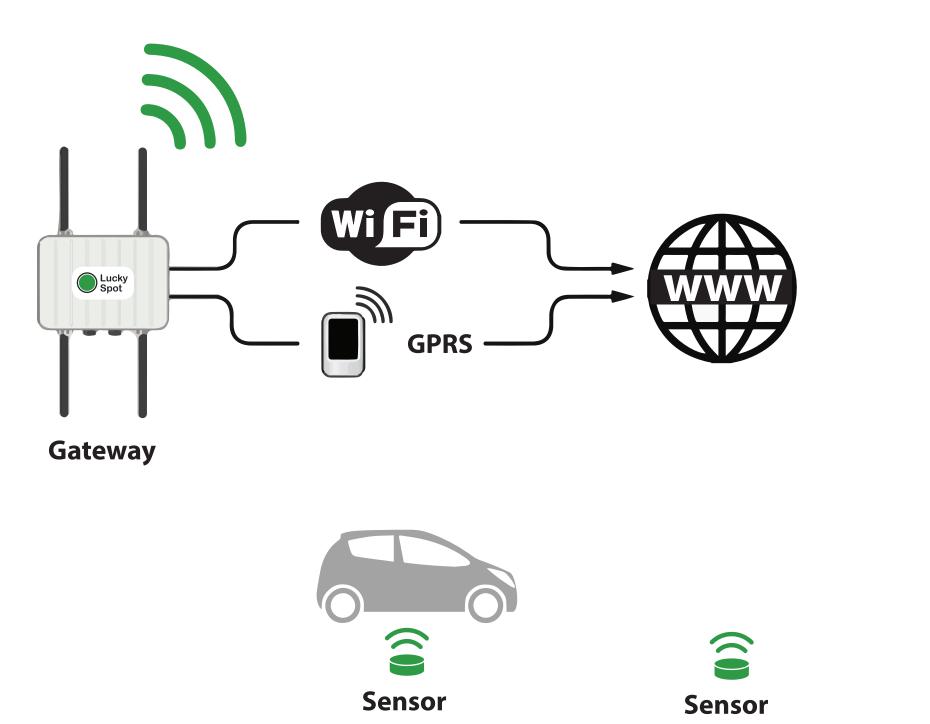


With recent advances in imaging technology, cameras are now able to scan further and in greater detail than ever before. Streetline realized that with the right software, the average camera could provide real-time data on up to 100 parking spaces and effectively improve enforcement also.

# LUCKYSPOT PARKING SOLUTION



### LuckySpot Parking System



How Can We Make the Parking Experience More Efficient and Enjoyable

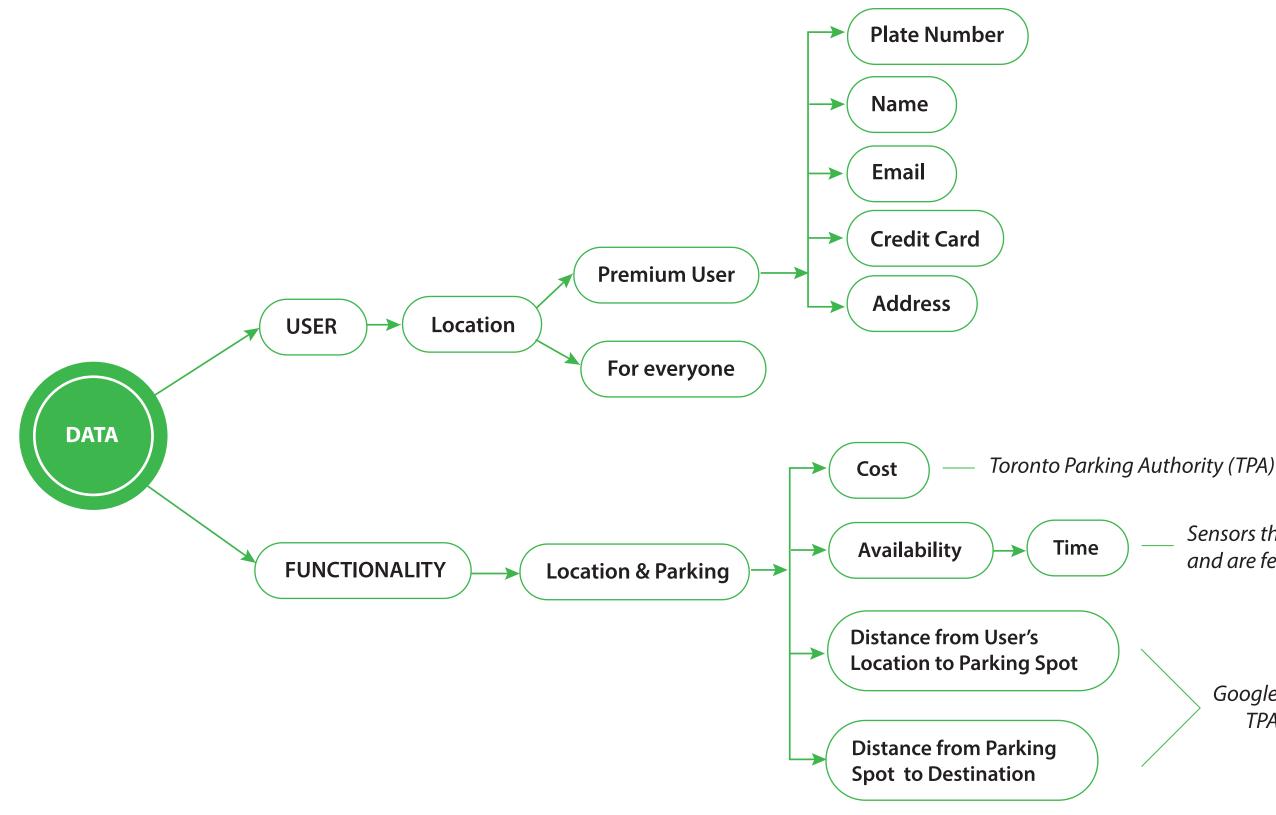


# LuckySpot App

· · ·
●●●○○ InVision 중 8:00 PM 100% -
Lucky Spot
Enjoyable Street Parking in Toronto
and Are
Temple Are
Typened 2
Thorborn Arre S
5 Sprindbards Are
Home
Spinduent Are
R.
Gardiner Extry
* Medieval Times 🕤
Dinner & Tournament
50 A
V Allow LuckySpot to use your location



# Diagram 2 Sources of the information



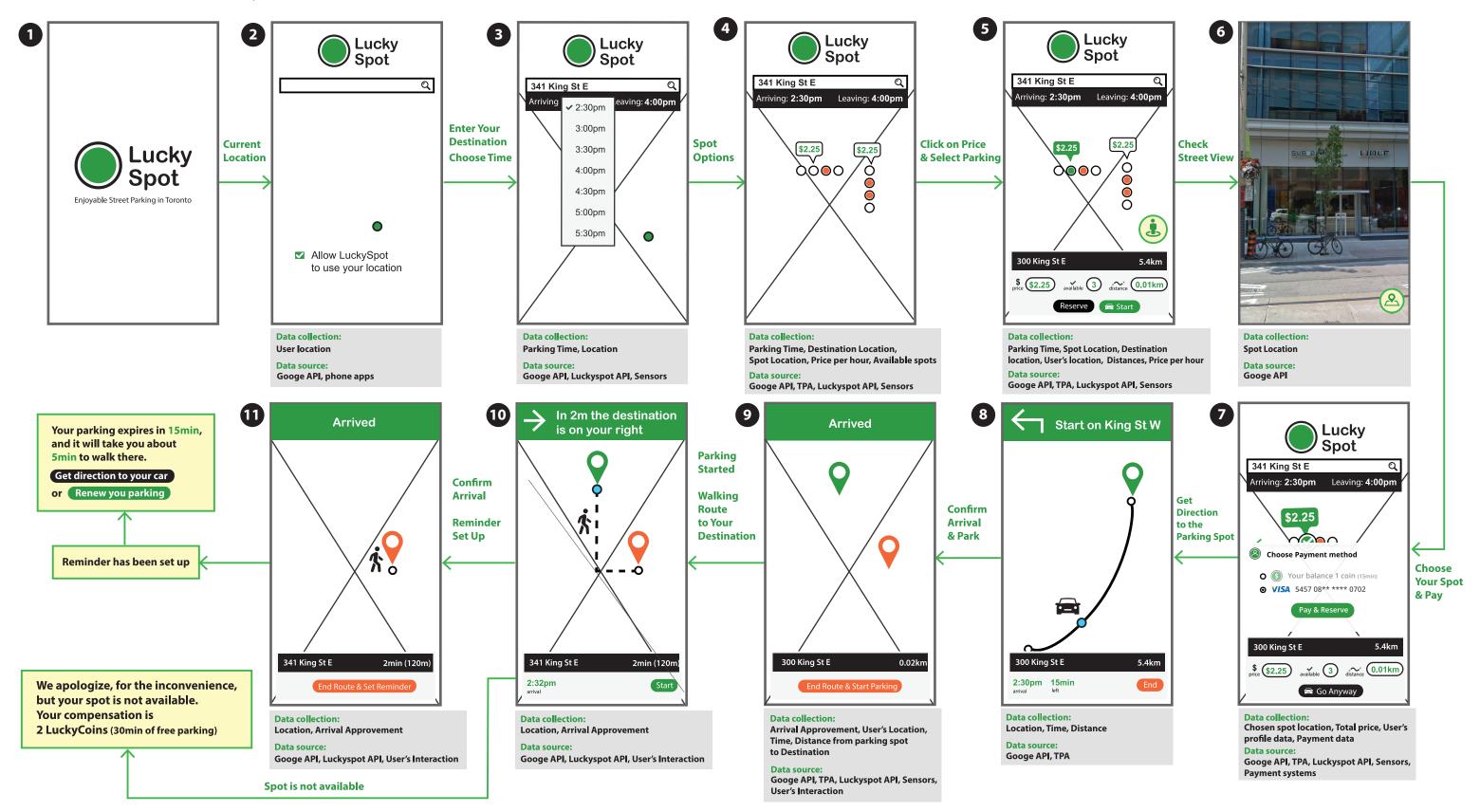
How Can We Make the Parking Experience More Efficient and Enjoyable

Sensors that Connect to AR and are fed into the APP

22

Google API TPA

# Diagram 3 Data types and sources

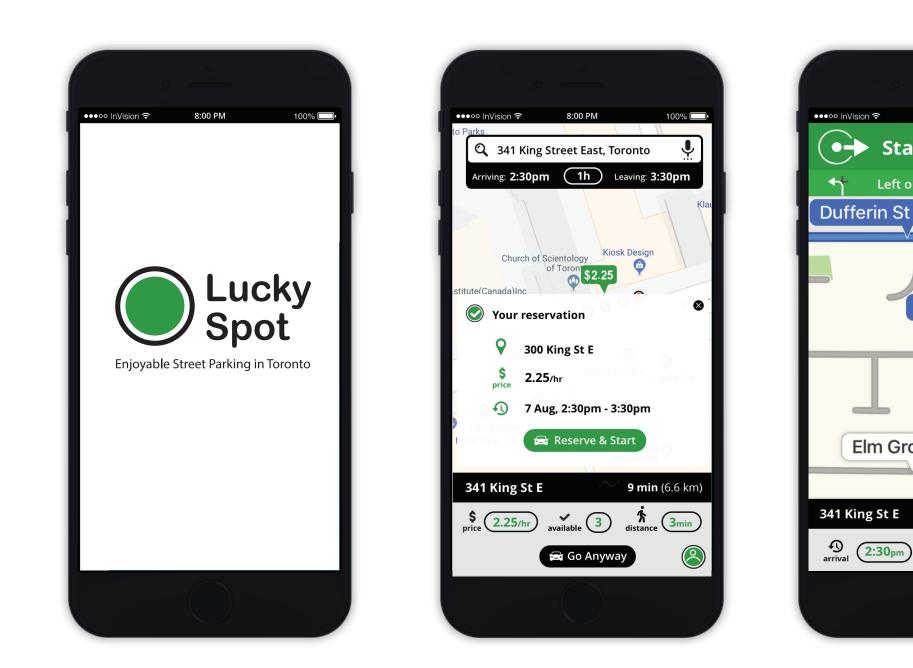


How Can We Make the Parking Experience More Efficient and Enjoyable

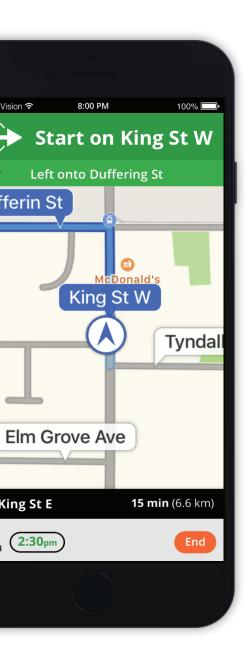
# LuckySpot App



LuckySpot is an on-street parking solution, which provides finding and reservation of the parking spaces, guides drivers to available spot and than gives walking direction to the destination. System includes App and In-Ground Vehicle Detection Sensors to maintain real time parking availability, access rates, hours, addresses, and occupancy. In addition, LuckySpot App benefits with features of voice guidance, online payments, LuckyCoins reward system, parking expiration reminder, parking extention if needed and walking directions back to your car.







8:00 PM

