TruParking

Smart Parking and the Internet of Things

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Presentation Outline

- Introduction
- Background
- What is TruParking? How does it run?
- Hardware
- Process
- Interfaces
- The X Factor
- Future Work
- Conclusion

Why is parking an issue?

- Drivers wasting money
  - Individuals - **$2,200**
  - United States - **$73 billion**
- Drivers wasting time
  - Individuals - **17 hours**
- Driver stress levels increase
  - Accident rate increases

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Previous Work(s)

- Indect:
  - A similar product that uses optical devices to monitor a set of parking spots.

- RFID:
  - Other products have used RFID chips which add an additional cost that scales with the number of users.

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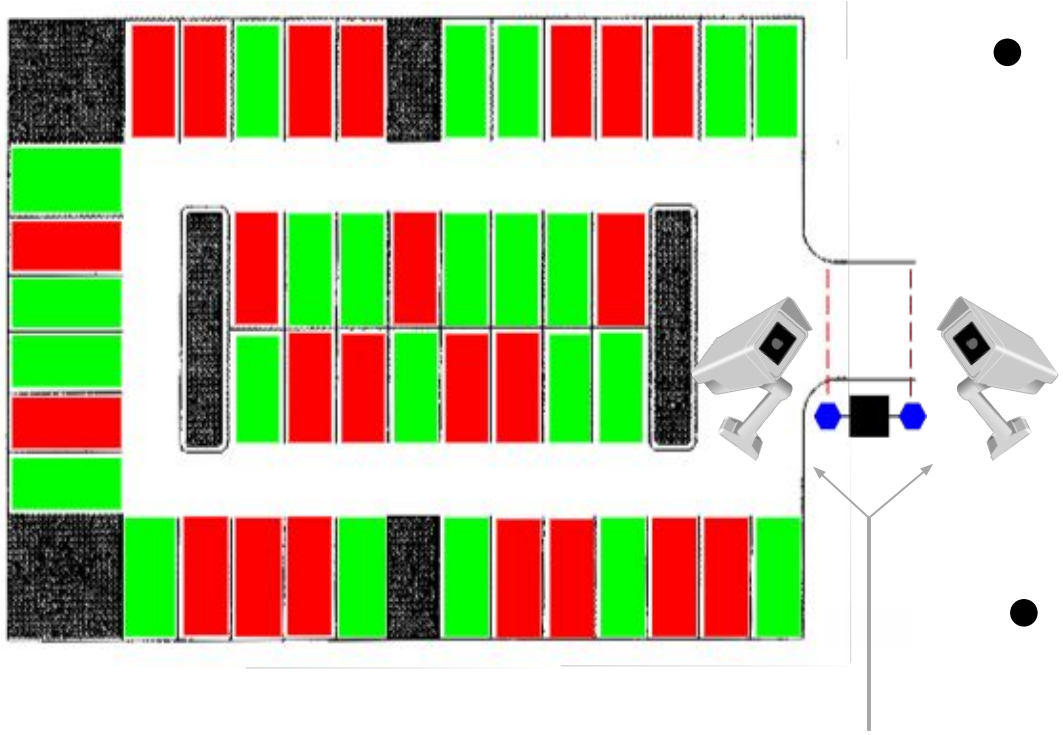
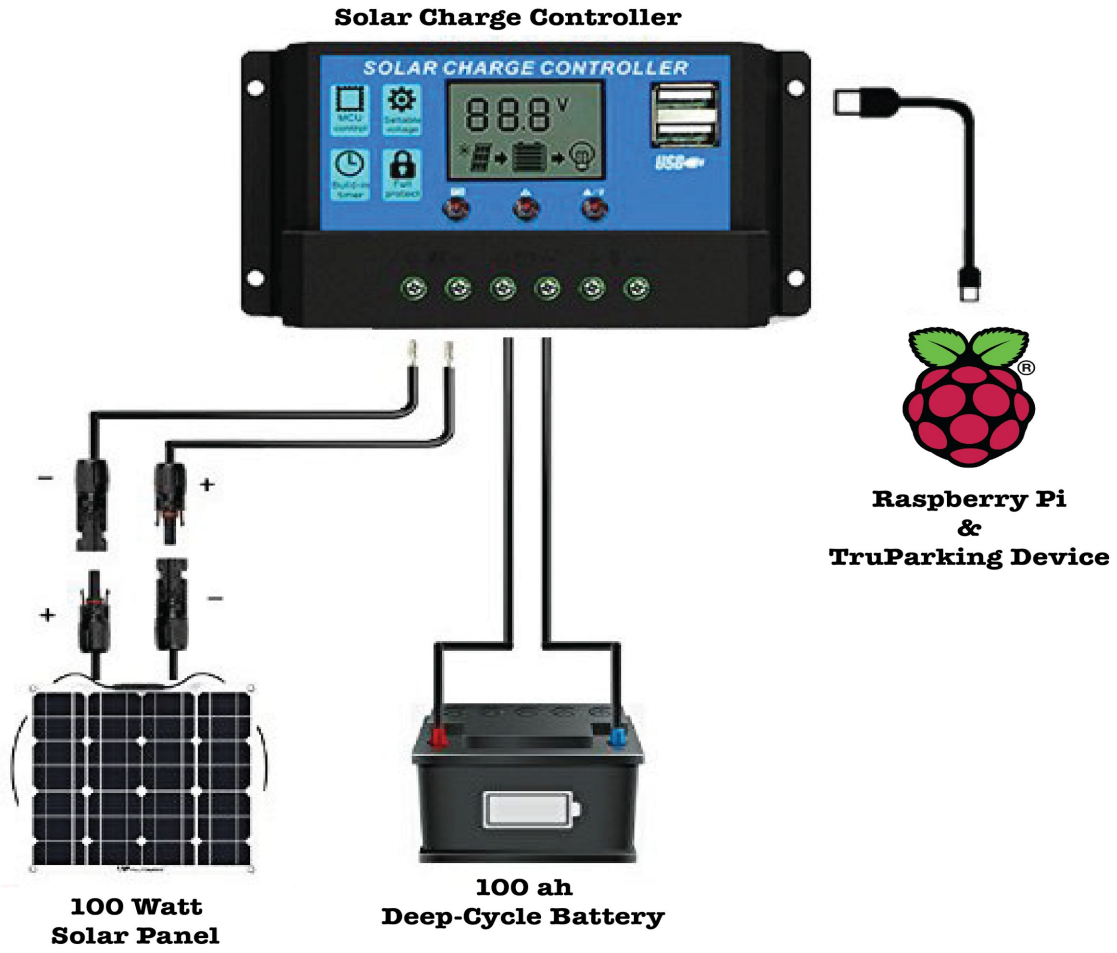
What is TruParking?



- Dual simulated break beams
  - The order in which the beams break determines the direction the car is travelling
    - We then collect the data accordingly
  - Manipulation of SPOTS log file (AWS)
- Entrance we subtract vs. Exit we add

Image Processing - Work in Progress

What is TruParking?



- Normal vs. Efficient
- How our solar power works
- Self Sustaining

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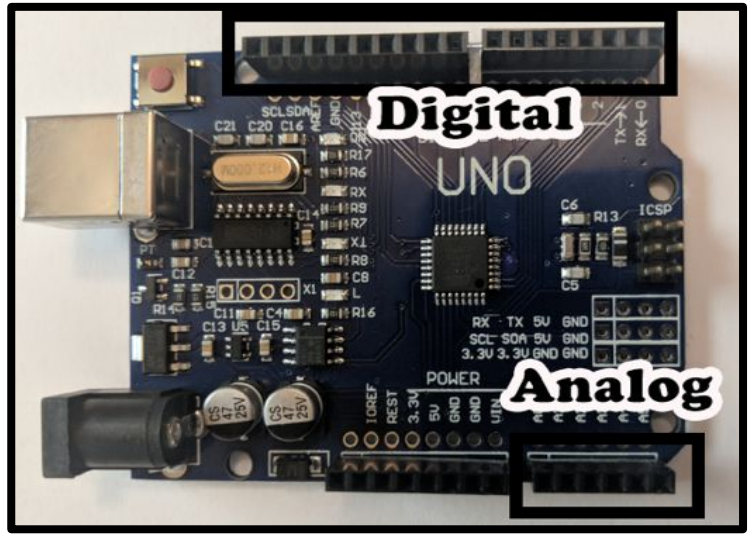
Hardware

- Infrared Rangefinder (1)
- Arduino Uno (2)
- Raspberry Pi 3 (3)

1



2

3

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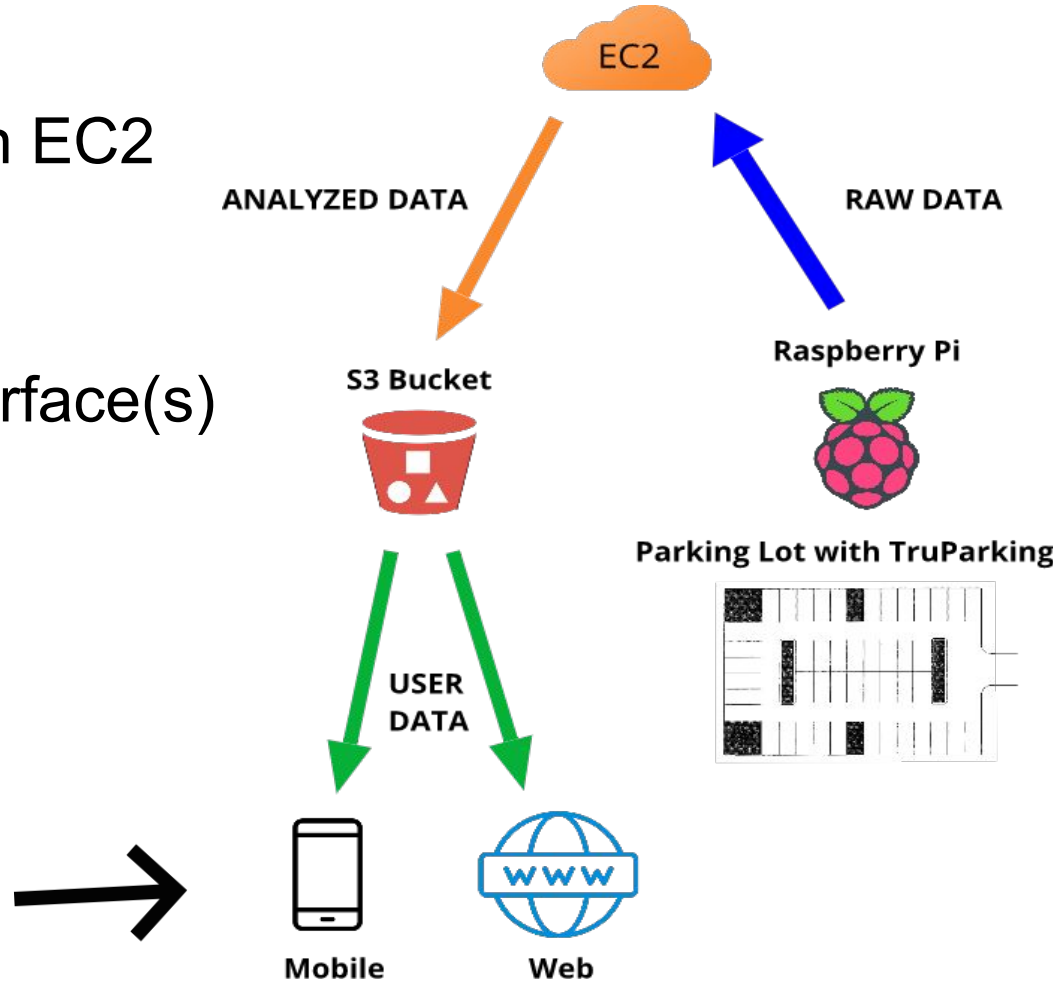
Our Process

1. TruParking device collects data
2. TruParking device then transfers data to Amazon EC2
3. Amazon EC2 relays data to Amazon S3 Bucket
4. Data inside S3 Bucket can be pulled by user interface(s)



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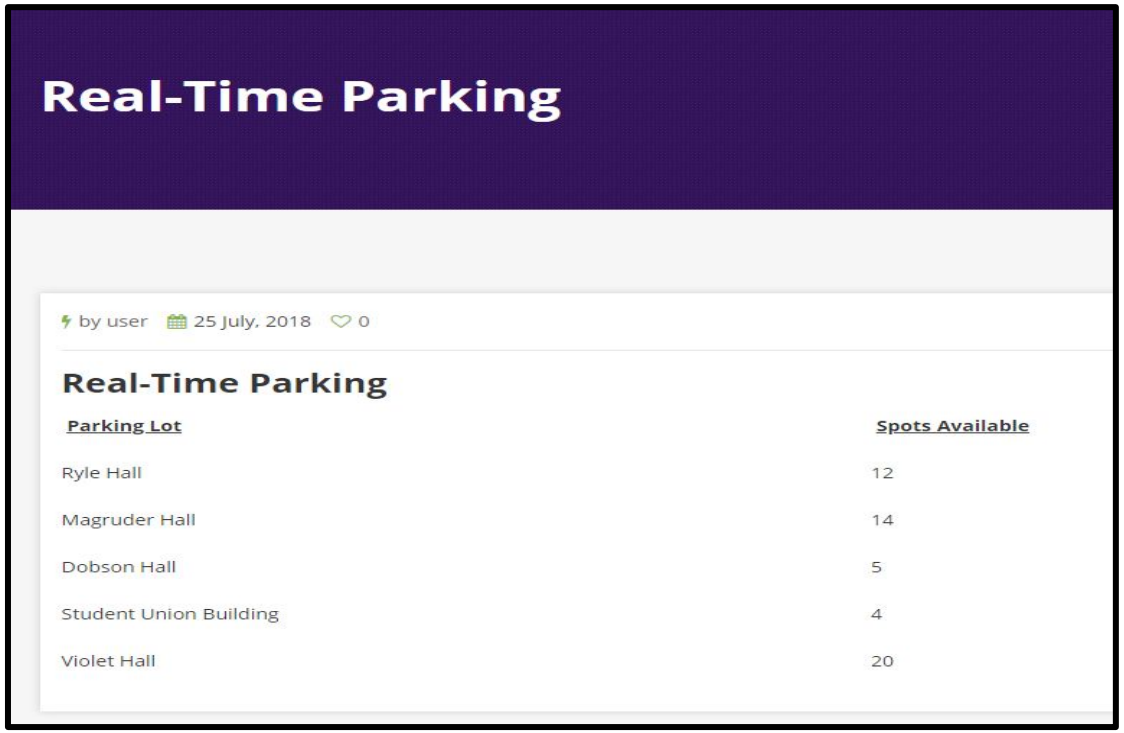
Interfaces

WEB



MOBILE

- Real-Time
  - Future Predictions

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How is TruParking *different*?

- TruParking is an independent smart device that completes the tasks of all other previous works mentioned at a fraction of the cost
- You only need one device per entrance/exit

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Future Work

- We would like to incorporate an affordable and simplistic use of RFID or QR scanning.
  - Use for vehicles that do not need to be considered as taking up a spot, for example: campus vehicles that simply pass through the lot all together
- Image Processing
  - Increase accuracy
  - Eliminate possible errors
  - Possible security applications

Data Processing

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Conclusion

- Parking is a prevalent issue in today's world.
- Several attempts at solving this
  - most known solutions are costly and inefficient
- TruParking offers a simple, economic, and efficient solution
  - Only single board computers, Infrared break-beams, and cloud computing
  - Solar powering is inexpensive and will save in the long run

TruParking

Questions?

References

[1]

Federal Highway Asmi, "Highway Finance Data Collection," U.S. Department of Transportation, 7 November 2014. [Online]. Available: https://www.fhwa.dot.gov/policyinformation/pubs/hf/pl11028/chapter4.cfm. [Accessed 8 August 2018].

[2]

Federal Highway Administration, "State Motor-Vehicle Registrations - 2016," 2017 November. [Online]. Available: https://www.fhwa.dot.gov/policyinformation/statistics/2016/mv1.cfm. [Accessed 8 August 2018].

[3]

Statista, "U.S. automobile registrations from 2000 to 2016," 2017. [Online]. Available: https://www.statista.com/statistics/192998/registered-passenger-cars-in-the-united-states-since-1975/. [Accessed 8 August 2018].

[4]

K. McCoy, "Drivers spend an average of 17 hours a year searching for parking spots," 12 July 2017. [Online]. Available: https://www.usatoday.com/story/money/2017/07/12/parking-pain-causes-financial-and-personal-strain/467637001/. [Accessed 8 August 2018].

[5]

INRIX, "Searching for Parking Costs Americans $73 Billion a Year," [Online]. Available: http://inrix.com/press-releases/parking-pain-us/. [Accessed 8 August 2018].

[6]

Indect, "What We Do," Indect, [Online]. Available: http://indect.com/what-we-do/. [Accessed 17 August 2018].

[7]

M. Winter and J. Osterwiel, "Apparatus and method for sensing the occupancy status of aprking spaces in a parking lot". United States of America Patent 7,116,246, 3 October 2006.

[8]

T. N. PHAM and D. B. N. D.-J. D. MING-FONG TSAI, "A Cloud-Based Smart-Parking System Based on Internet-of-Things Technologies," IEEE Access, vol. 3, pp. 1581-1591, 2015.

[9]

A. Khanna and R. Anand, "IoT based Smart Parking System," IEEE, pp. 266-270, 2016.

[10]

J. Geerling, "Raspberry Pi Dramble," [Online]. Available: https://www.pidramble.com/wiki/benchmarks/power-consumption. [Accessed 19 August 2018].

[11]

"ArduinoCC," [Online]. Available: https://store.arduino.cc/arduino-uno-rev3. [Accessed 18 August 2018].

[12]

"Arduino Uno Rev3," Arduino, [Online]. Available: https://store.arduino.cc/usa/arduino-uno-rev3. [Accessed 15 August 2018].

[13]

Raspberry Pi Foundation, "About Us," [Online]. Available: https://www.raspberrypi.org/about/. [Accessed 17 August 2018].

[14]

"Grabserial," 13 January 2017. [Online]. Available: https://elinux.org/Grabserial. [Accessed 12 August 2018].

[15]

Amazon, "What Is AWS," Amazon, [Online]. Available: https://aws.amazon.com/what-is-aws/. [Accessed 18 August 2018].

[16]

"AdaFruit," [Online]. Available: https://www.adafruit.com/product/1568. [Accessed 8 August 2018].