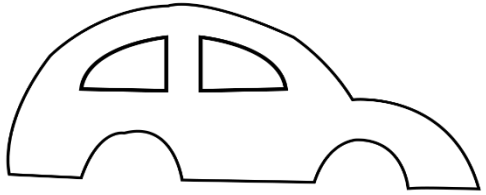
PARKOLITE Ltd



ENSC 440W & ENSC 305W

INTRO

- THE TEAM
- BACKGROUND
- PROBLEM AT HAND
- ECONOMICS
- FINANCING
- COMPETITION
- SCHEDULING
- SOFTWARE DESIGN
- ELECTRICAL DESIGN
- MECHANICAL DESIGN
- SYSTEM OVERVIEW
- FUTURE PROSPECTS
- CONCLUDING REMARKS
- QUESTIONS

THE TEAM

Chief **E**xecutive **O**fficer - RAJ SIDHU, Systems Engineering

Chief **O**perations **O**fficer - OLIVER KRAJCI, Electronics Engineering

Chief **T**echnology **O**fficer - MUBAARAK SANDHU, Electronics Engineering

Chief **F**inancial **O**fficer - SOUDEH MOUSAVI, Electronics Engineering

Chief **M**arketing **O**fficer - AZIN NAVAH, Biomedical Engineering

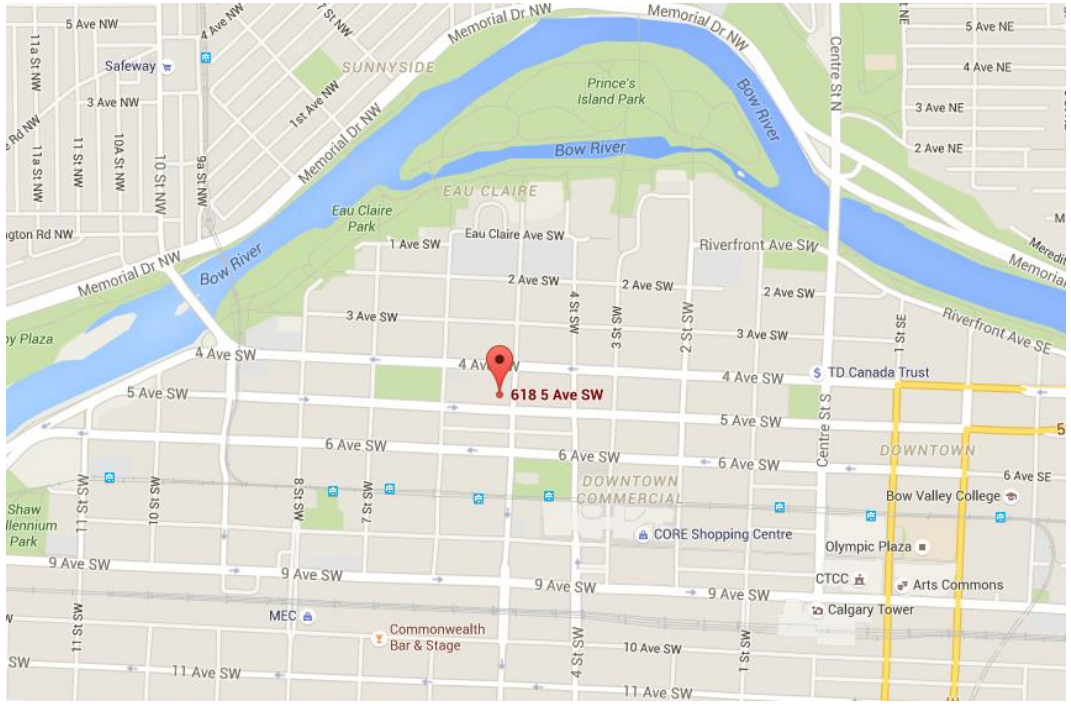
BACKGROUND

GRID 5 Apartments

618 5th Ave SW Calgary,

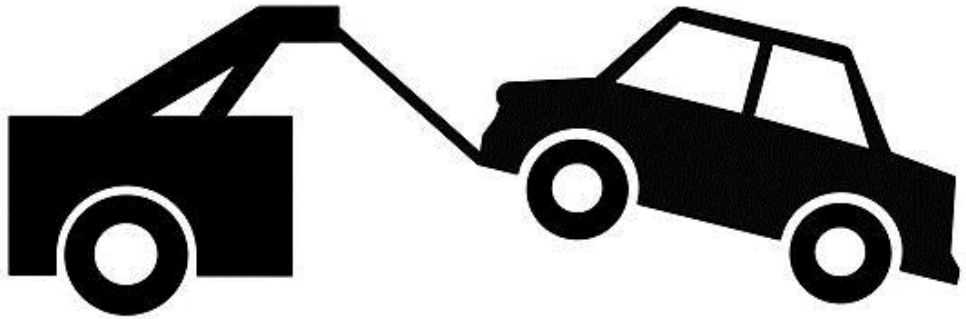
Alberta Canada

June 12th 2015



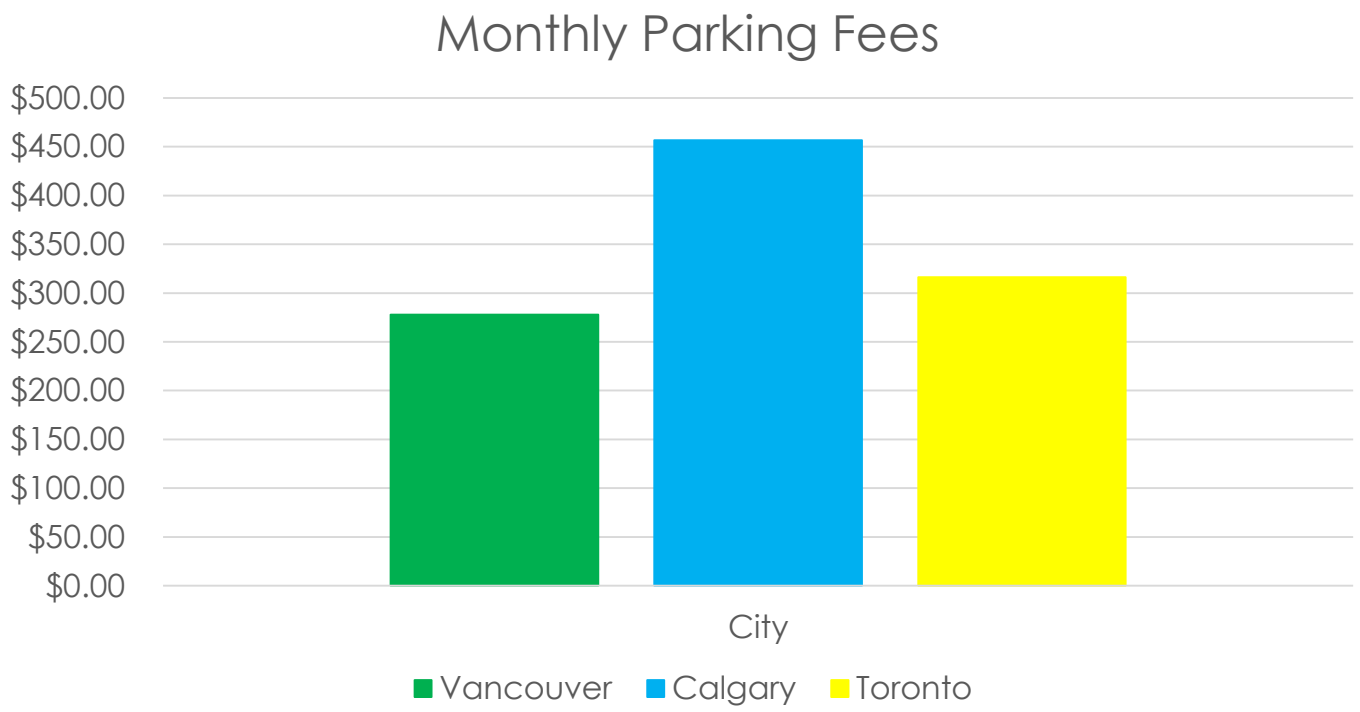
THE PROBLEM

- Parking bylaws can be very difficult to understand, especially while under time pressure!
- In correct parking can lead fines or even being towed



ECONOMICS

- Monthly Parking:
  - Calgary $456.75
  - Toronto $316.40
  - Vancouver $277.82
- Vancouver
  - $65 million parking revenue
- Surrey
  - $2.65 million parking revenue



ECONOMICS

- 25,000 vehicles towed every year in Vancouver
- City of Vancouver in 2015
  - Revenue in Q2 $15.9 million
  - Earnings $53.2 million
- City of Toronto
  - Revenue in 2014 $105.00 million
  - Revenue In 2013 $89.83 million
- We can conclude that the parking payment and ticket revenues of both Vancouver and Toronto combined is approximately a **$175.00 million** market

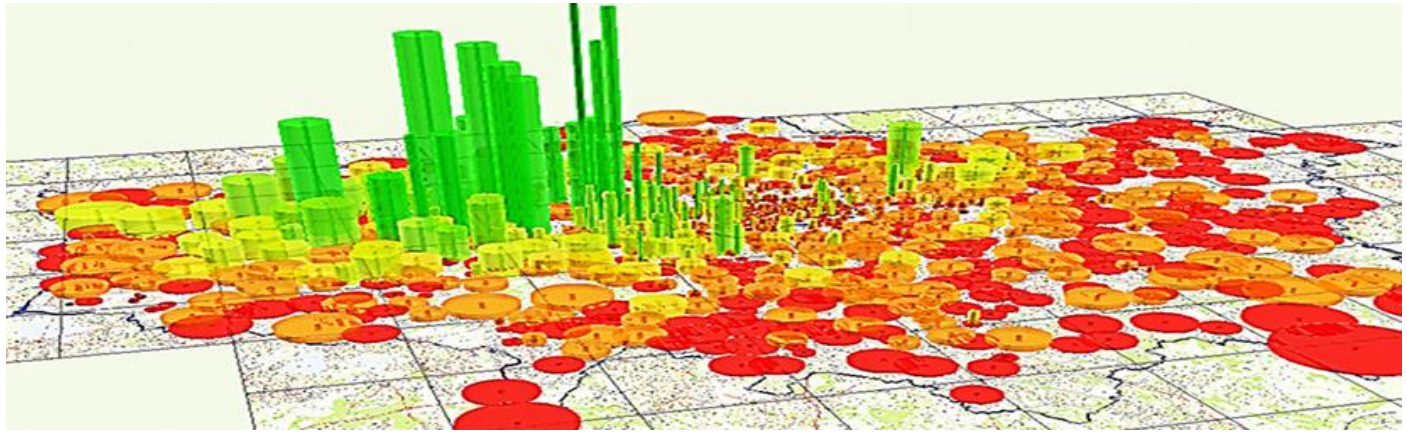
FINANCING

- ENSC440W/ENSC305W
  - Estimated cost **$1,236.00**
  - ESSEF funding **$585.00**
  - Actual Cost **$492.96**
    - Percentage Used **84%**
    - Electronics **57.11%**
    - Mechanical **27.16%**
- Production Ready Prototype **$2000.00**
- Mass production **$350.00 - $500.00**

Source: http://tbmassociates.ca/financing-options.html

COMPETITION

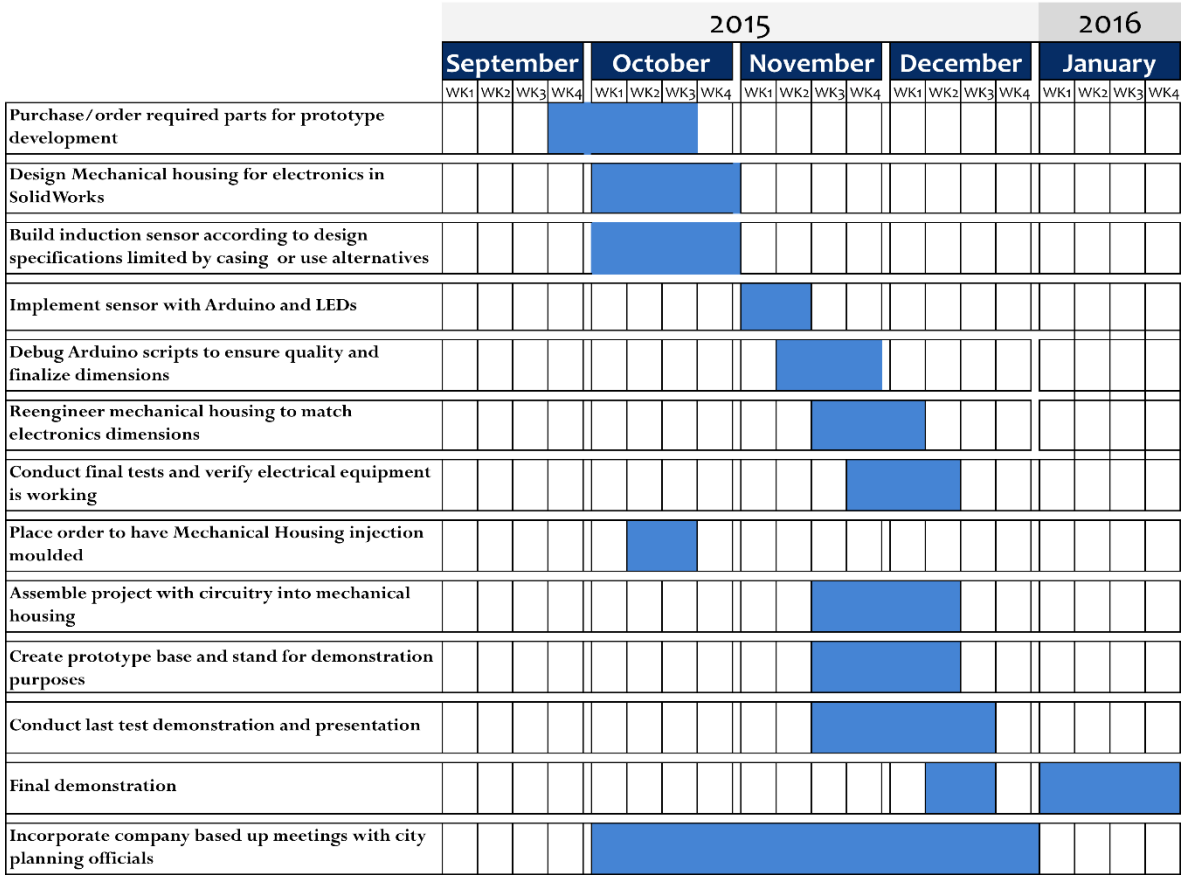
- Currently in the market there is no major competitor that supplies the kind of service that Parkolite has proposed
- Companies with ideas that aid in parking are:
  - Adrriot Technologies
  - Inrix – Use probability methods



Source: http://inrix.com/products/

SCHEDULING

- THE GANTT CHART seen here is what was considered at the beginning of the semester
- There were some scope changes at the beginning of the semester
- The electrical scope had remained the same all throughout with some variations in sensor choices
- There were no major time delays



PARKOLITE Ltd

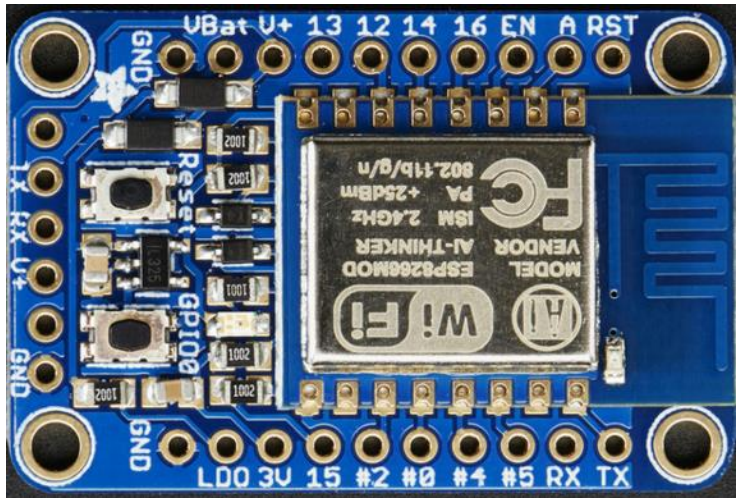
SCHEDULING

- Near mid November 2015 Parkolite decided to develop an app for the API
- This idea was something that was thought of in more depth near the end of October and was decided that it would be a “nice to have” addition

  if time permitted
- The last two weeks of the November were dedicated to bringing the app online and connecting it to our electric circuit unfortunately we were unable to create a connection that give us the feedback that we had expected
- It should be noted that application development and integration were not a part of the original scope of work. The original SOW was dedicated to creating the API only
- Reliability testing was done on the API as the project progressed stage by stage thereby avoiding “bioaccumulation” with regards to bugs and other issues

SOFTWARE

Wi-Fi Module - ESP8266



Source: https://learn.adafruit.com/adafruit-huzzah-esp8266-breakout/using-arduino-ide

- A Wi-Fi module is used to pass the parking state (RGB state) to a cloud, where it can be accessed via a mobile app
- The Wi-Fi module is programmed once with Arduino IDE, and then operates freely
- The module uses GPIO pins to read the state of the RGB LEDs
- The RGB state is transmitted to a cloud, where it becomes available on the internet
- The module is FCC approved which means its can be used in final production

SOFTWARE

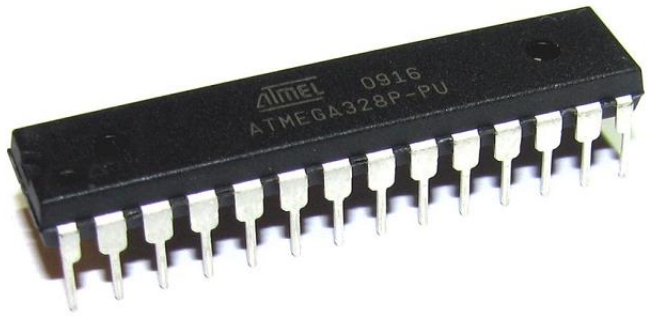
Application programming

Source: http://opendatakosovo.org/training/android-development-with-restful-web-services/

- The app communicates with the Wi-Fi module
- It takes the RGB state from the Wi-Fi module as an input and outputs the colour on the application screen
- Alternatively, the app also gives you push notifications on your phone when the light changes colours
- This allows the user to be aware of his/her parking situation at all times
- The user receives real-time feedback

SOFTWARE

ATMEGA 328P

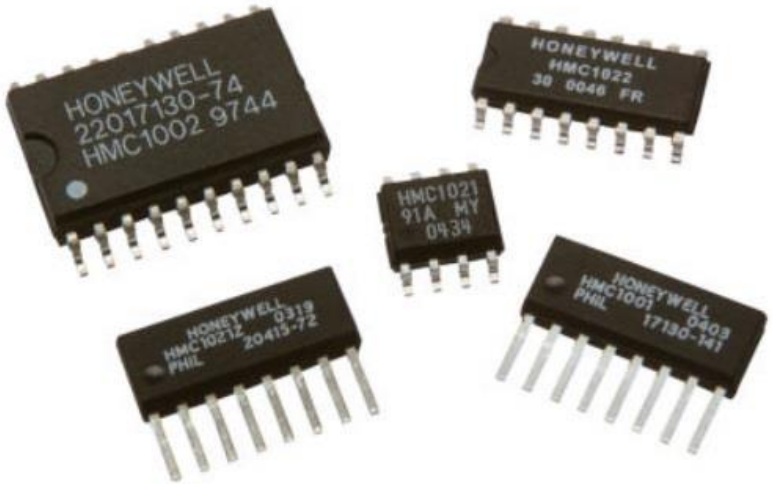


Source: http://www.nkcelectronics.com/arduino-uno-ready-avr-atmega328p-microcontrol328.html

- The brain of the whole system ATMEGA328P, which was programmed the Arduino IDE using the Arduino UNO board for rapid prototyping
  There is one sensor input (AMR sensor)
- There are three sets of outputs:
  - Three PWM outputs for controlling the RGB LEDs
  - One output for degaussing, or resetting, the sensor
  - Three outputs for setting a digital potentiometer to calibrate the sensor

ELECTRICAL

Honeywell AMR Sensors



Source:
http://www51.honeywell.com/aero/common/documents/myaerospacecatalog-documents/Missiles-Munitions/HMC_1001-1002-1021-1022_Data_Sheet.pdf

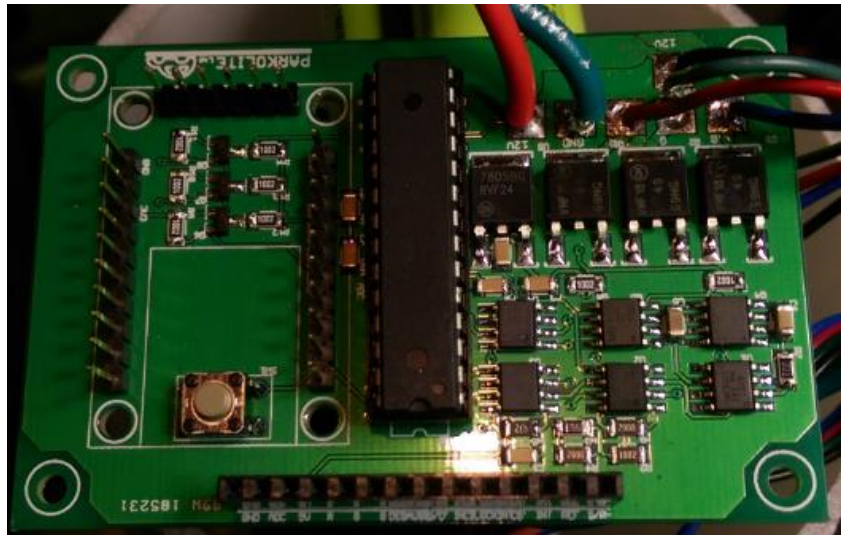
SENSORS

- Some considered sensor types:
  - AMR/Hall effect, Ultrasonic, Infrared, Radar, Loop induction, Inductive
- Why did we choose AMR?
  - Ultrasonic/Infrared would be blocked by the plastic enclosure
  - Radar was too bulky
  - Loop-induction was relatively expensive and complex
  - Inductive was very expensive
  - AMR is a simple, cheap solution with little supporting circuitry

ELECTRICAL

Full Electronic Circuit

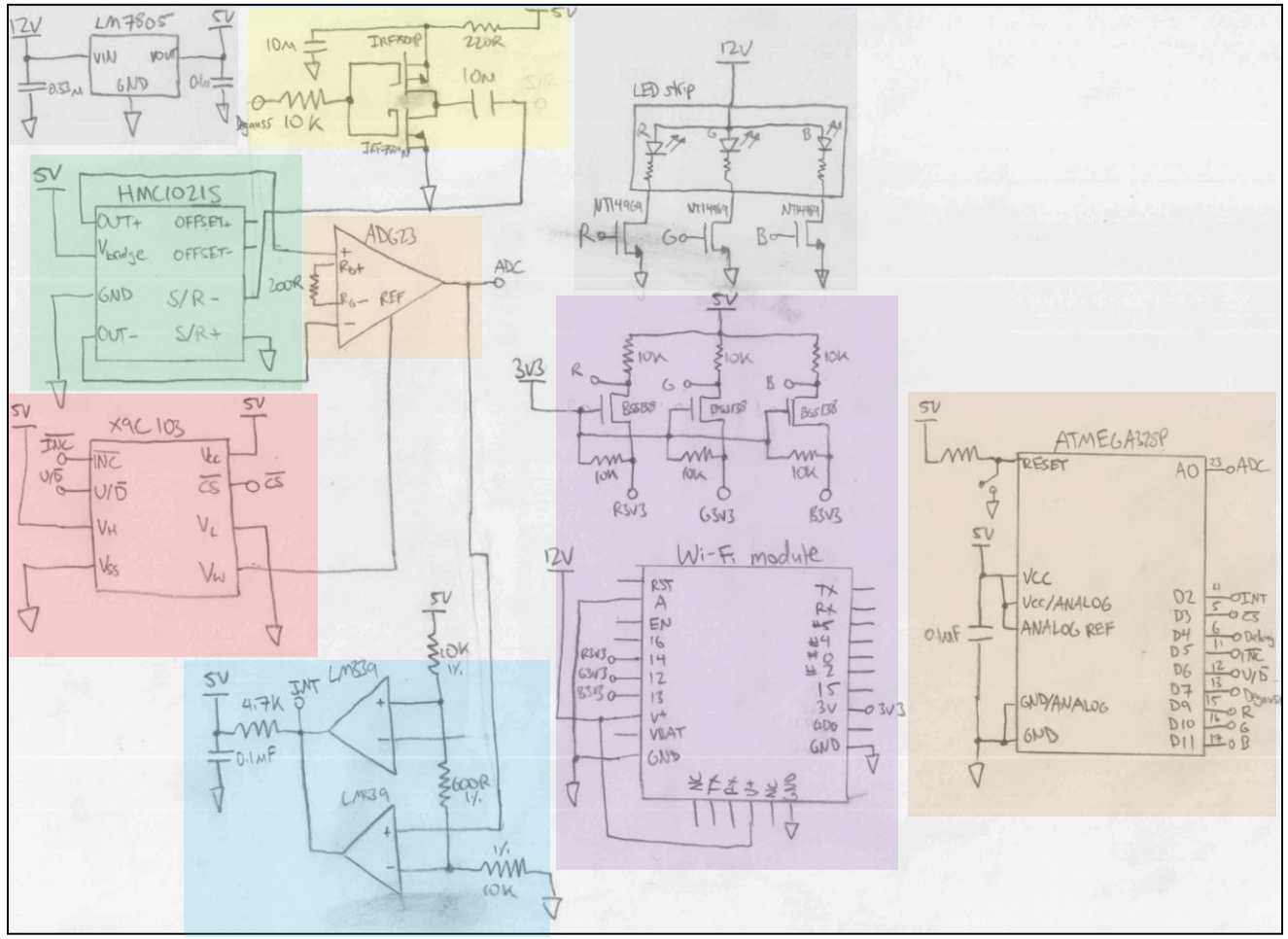
(Schematic on next slide)



- The electronic circuit consists of four primary modules:
  - Sensor and supporting circuitry
    - Sensor
    - Signal amplification
    - Threshold detection
    - Degaussing charge pump circuit
    - Digital potentiometer
  - Power circuitry
    - Regulators
    - Pass transistors
  - Microcontroller
  - Wi-Fi module
    - Level-shifting circuitry

ELECTRICAL

Full Schematic



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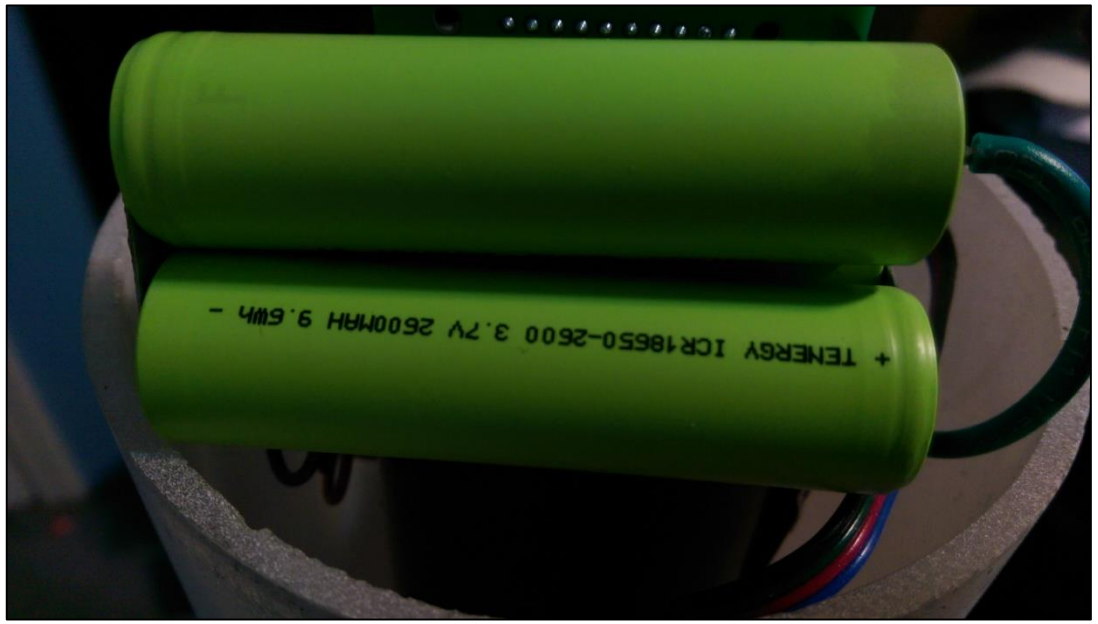
    - Level-shifting circuitry

ELECTRICAL

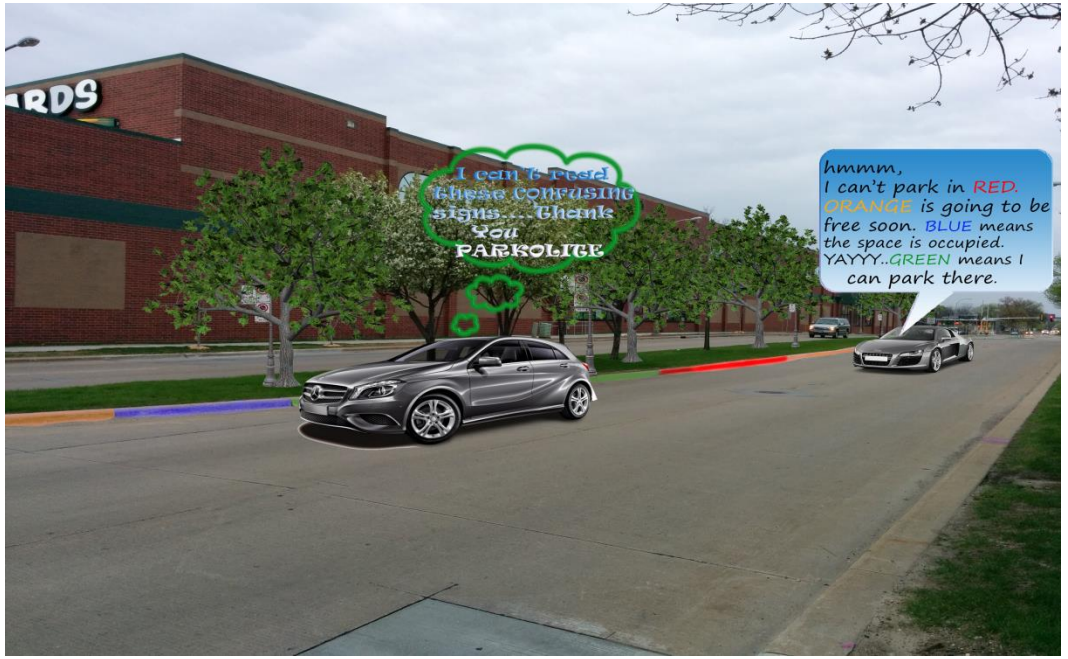
Power



- Long term, power will come from the city infrastructure's 120VAC
- We are currently powering this system using Li-ion 18650 batteries
  - Why?

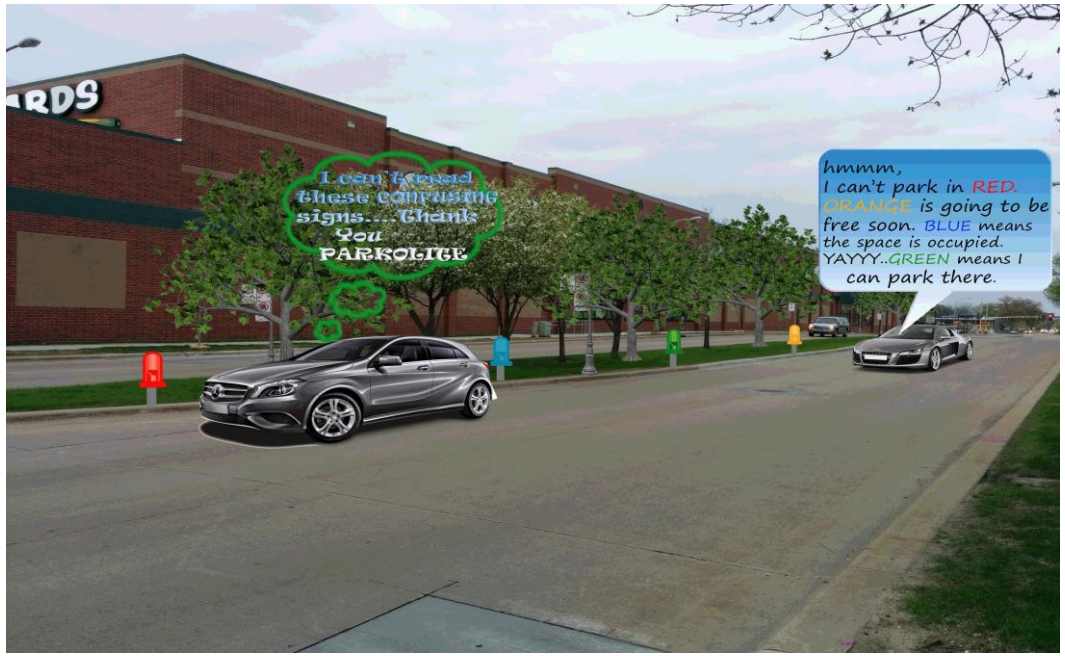
MECHANICAL

- Over the span of 4 months the project was changed mechanically after realizing the original design flaws
  - The first design proposed the following as it can be seen from the illustration below:



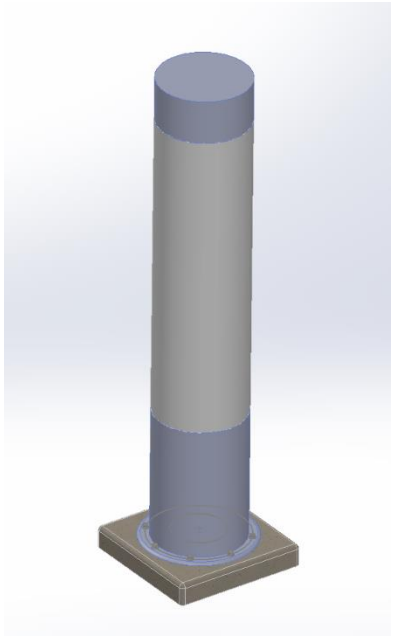
MECHANICAL

- It can be noted that now we have decided to implement an upright design as opposed to a flat design
- Therefore the new design would appear something like the representation seen here:

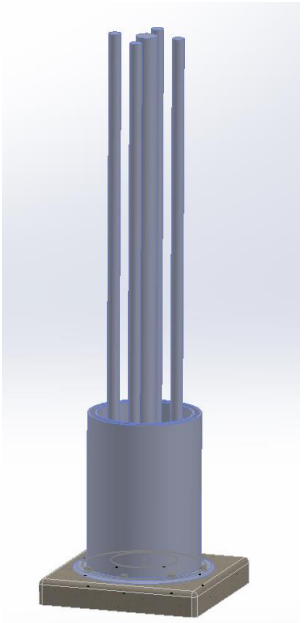


MECHANICAL

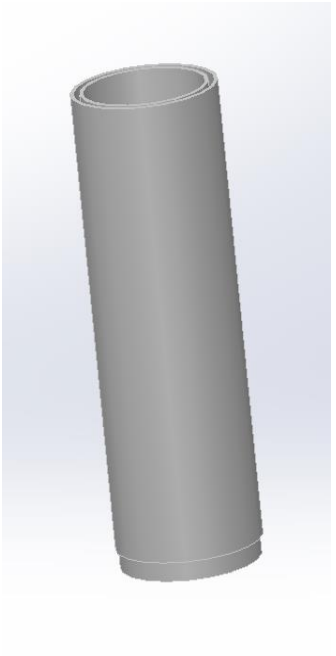
- Instead of a flat design where the indicator latched onto the curb we decided to pursue a more cylindrical up right design as seen here:



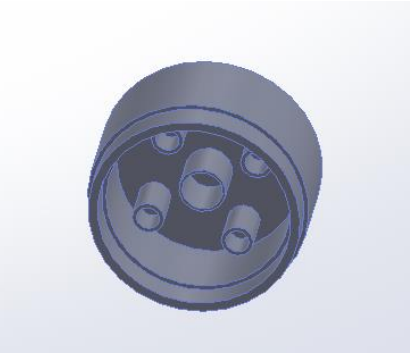
Production Design



Internal Core



Outer Shell



API Lid

MECHANICAL

- From the original design Parkolite decided to pursue a cylindrical design
- There were more pros then cons when pursuing the new design for example:
  - There is greater visibility
  - You don't risk severe equipment damage if the car parks incorrectly
  - New design requires less road space
  - There are less weather deterrents for example snow and hail
  - The design is more modular and can be easily accessed for maintenance and part replacement
  - Creating a production ready product is more feasible due to readily available parts
  - It is easier to make it waterproof so internal electronics stay dry and short circuit free

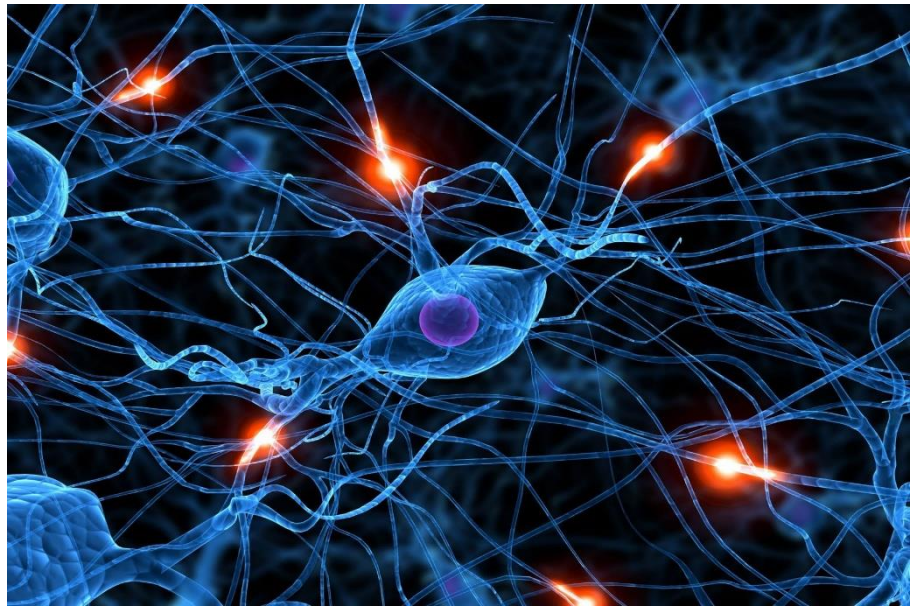
MECHANICAL

- A More simplified version of the final design was created
  - Proof of concept API is 95% plastic
  - The outer shell is clear acrylic plastic
  - Internal/external fittings are ABS plastic.
- Outer shell for prototype API went through:
  - Sanding twice
  - Frost coating two layers
  - White spray coating one layer
- The internal pipes and fittings are readily available
- They are typical ABS plumbing pipes
- These pipes were used because of size constraints

SYSTEM OVERVIEW

FUTURE

- City of Surrey has expressed interest
  - Active correspondence
- End users
- Mobile application
- Integration with payment systems
- Database/cloud system
- Neural network



Source: http://www.extremetech.com/computing/167179-facebook-is-working-on-deep-learning-neural-networks-to-learn-even-more-about-your-personal-life

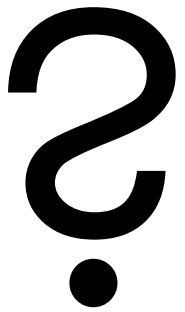
FUTURE

- By creating a neural network, parking will effectively be considered "on demand"
- Real time updates through App
  - This will only be achievable by creating city wide infrastructure for parking through the use of API's
- Work with existing payment infrastructure to alert users on usage
- API – a multi-faceted product
- Future expansions may also include the addition of bike racks on strategically selected API's

CONCLUSION

- What did we learn from this experience?
- How we could have done the project differently?
- Project Summary
- Thank You Steve Whitmore and Dr. Andrew Rawicz
- Thank you Lukas for update meeting
- Thank you ESSEF for funding the idea

QUESTIONS



THE END

THANK YOU

REFERENCES

- [1]http://tbmassociates.ca/financing-options.html
- [2]http://inrix.com/products/
- [3]https://learn.adafruit.com/adafruit-huzzah-esp8266-breakout/using-arduino-ide
- [4]http://opendatakosovo.org/training/android-development-with-restful-web-services/
- [5]http://www.nkcelectronics.com/arduino-uno-ready-avr-atmega328p-microcontrol328.html
- [6]http://www51.honeywell.com/aero/common/documents/myaerospacecatalog-documents/Missiles-Munitions/HMC_1001-1002-1021-1022_Data_Sheet.pdf
- [7]http://www.extremetech.com/computing/167179-facebook-is-working-on-deep-learning-neural-networks-to-learn-even-more-about-your-personal-life