A Multidisciplinary Pilot Course on the Internet of Things (IoT): Curriculum Development Using Lean Startup Principles

Dr. Carlotta A. Berry, ECE

Dr. Valerie Galluzzi, CSSE

Dr. Yosi Shibberu, Math

2017 ASEE Annual Conference & Exposition

U108 Computer in Education (CoED) Potpourri

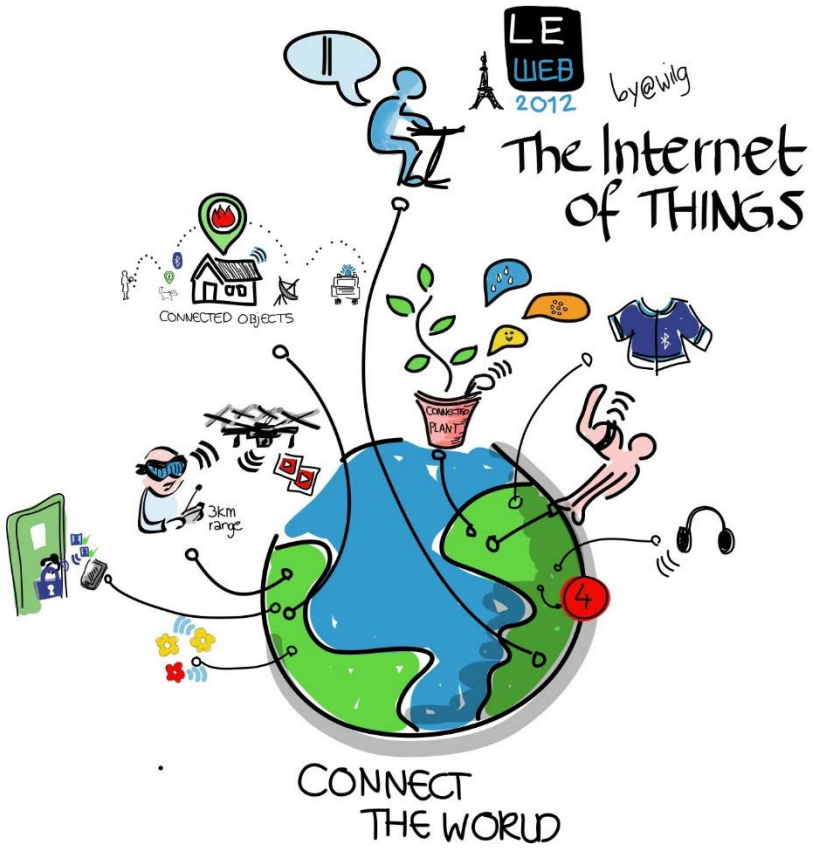
June 25, 2017

Columbus, OH

ROSE-HULMAN INSTITUTE OF TECHNOLOGY

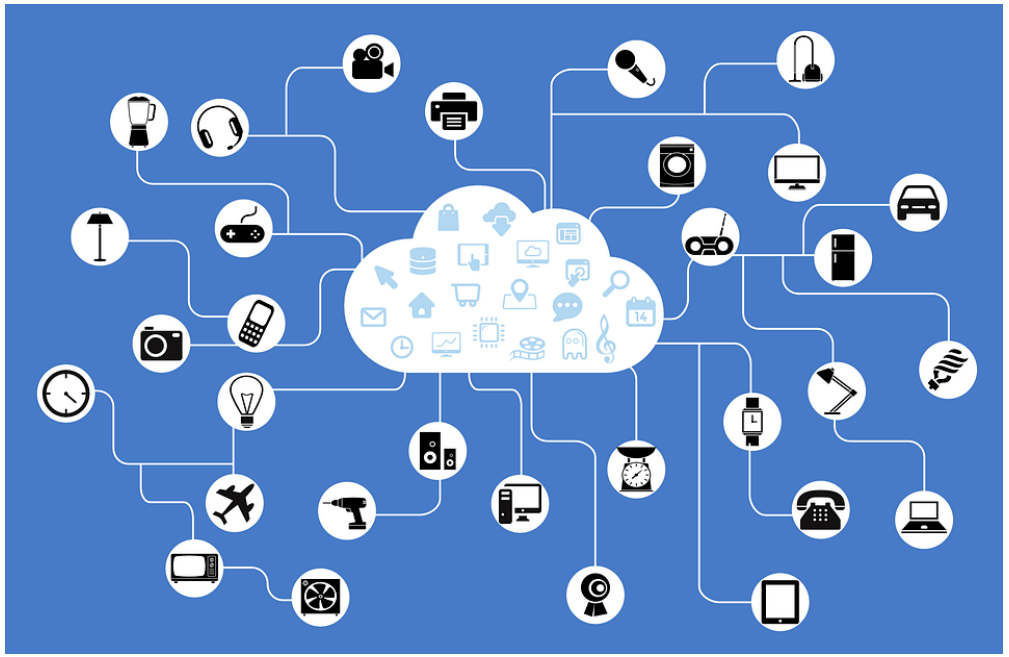
Introduction

- What is IoT?
- Large Growth
- Challenges



IoT Course

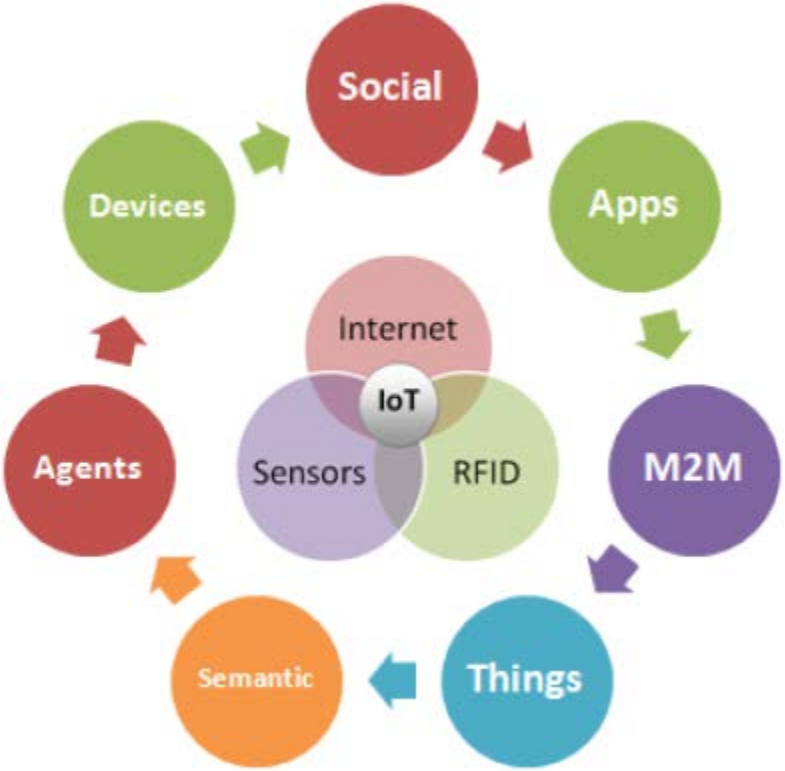
- project-based
- Pilot
- 8 students
- Just-in-time problem-based learning
- Student Recreation Center Treadmills



ROSE-HULMAN INSTITUTE OF TECHNOLOGY

Course Challenges

- When? Where? Context?
- Multidisciplinary
- Breadth versus depth
- Requires a holistic view
- Varied implementations
- No standard learning objectives or course outcomes



Lean Startup

- Weeks from inception to deployment
- Students involved in early stage
- Just In Time teaching
- Minimum Viable Product (MVP)

Pilot Course

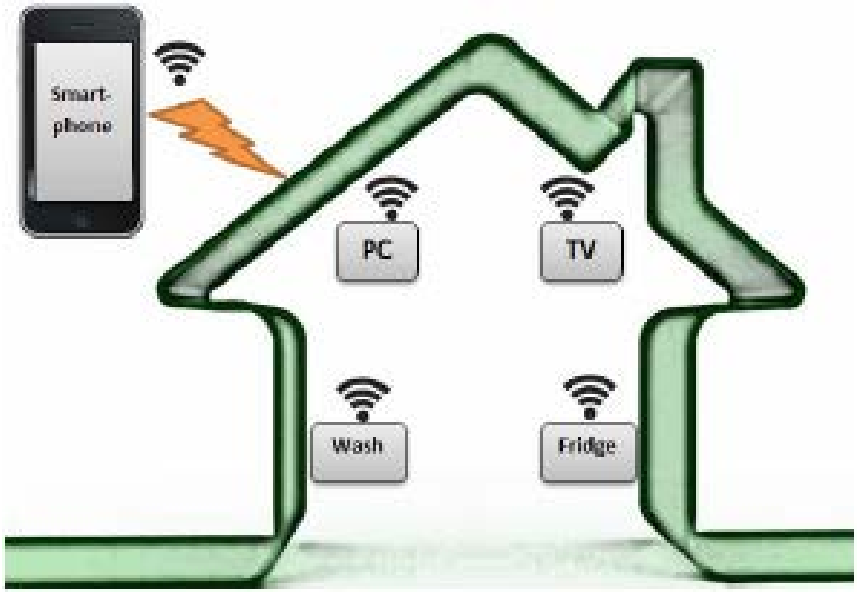
- Course content versus student learning
- Top-down, linear versus dynamic and unstructured
- More creative
- Make connections
- Ask more questions

ROSE-HULMAN INSTITUTE OF TECHNOLOGY

Pilot Course

- Off the shelf hardware
- Multidisciplinary
- Novel content
- Machine learning
- Distributed computing
- Multiple sensor
- Sensor to sensor communication
- Single project

Project Characteristics



- Wireless transfer of data
- Limited power
- Large amounts of data
- Machine Learning
- Feature Selection
- Signal Processing
- Distributed Information

Project

- Put Shimmer 3 IMU sensors with gyroscope on treadmills
- 4 mtgs per week
- Hardware (ECE)
  - Radio communication
  - Compressed sensing
- Software (Math, CS)
  - Bluetooth communication
  - Machine Learning

Results

- Data features – mean, maximum, standard deviation of accelerometer, magnetometer, frequency and power spectra
- Created machine learning classifiers
- Used cross-validation

- Able to classify treadmill activity as no activity, running or walking at 98% positive rate
- This was done in real time on the treadmill

ROSE-HULMAN INSTITUTE OF TECHNOLOGY

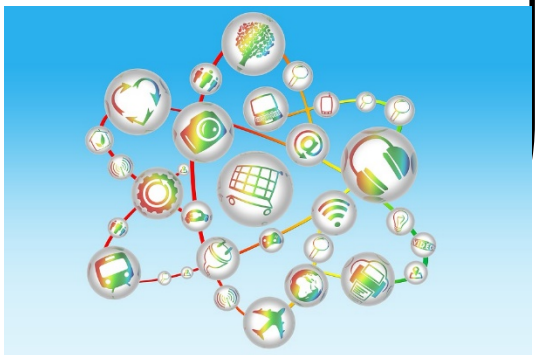
Challenges

- Importance of Power consumption
- Challenging creating a ground truth data set
- Danger of overfitting data
- Assessing technical mastery may be difficult

Conclusions

- Team teaching greatly reduced course burden
- Create more strategic framework for expectations
- Submit weekly progress memos
- Time log of activities

- Literature review
- Documentation of team communications
- Add data and device security
- Invited lectures
- Voice of the customer



ROSE-HULMAN INSTITUTE OF TECHNOLOGY

Questions

www.rose-hulman.edu/~berry123
berry123@rose-hulman.edu

ROSE-HULMAN
INSTITUTE OF TECHNOLOGY