Projects: IoT based on Cloud

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Internet-of-Things

- Things (Devices)
  - Many of them
    - Different Types
    - Isolated Systems
  - Data and Command
    - Sensing the world
    - Give Response

- Challenge
  - United: Connected + Communication
  - Smart: Data Analytics + Strategy

Source: https://aws.amazon.com/iot-platform/
http://www.brain-smart.net/smart-brain-health-blog/page/2/#axzz4W4oSp8a6
AWS IoT platform

United: Connect + Communication
Stated: “Thing Shadow”

Smart: Other Cloud Service
Data Storage
Machine Learning

Source: https://aws.amazon.com/iot-platform/
Recap: Hello AWS IoT!

Temperature sensor
Period: 5s (0.2Hz)

Sensing

Publish

Connecting

Forward

AWS IoT

Amazon SNS

Smart

Source: https://aws.amazon.com/iot-platform/
Some IoT system projects in our lab
Timed Up and Go @ Home

Timed Up and Go (TUG) Test

- A test of **mobility** and **fall risk** in community-dwelling, frail older adults

- Widely used in **hospital**
  - Test before surgery
  - Predict Falls

- **Only measure the total time by the doctor**

Can we do TUG @ home with more measurements?
Smartwatch TUG systems

- A cloud-based Smartwatch TUG system
  - Send reminders to the subjects
  - Automatically collect and analyze the motion data
  - Doctors can see the results in real time.
TUG test Result

The analysis is on cloud with AWS Lambda

Raw Motion data

2020-01-27 10_33_08_112_692_685_T01.txt Using: Gyroscope, confidence: 0.99

Yaw Angle 2020-01-27 10_33_08_112_692_685_T01.txt

- total time(s): 11.17
- sit-stand(s): 1.64
- turn1(s): 1.93
- turn2(s): 1.79
- stand-sit(s): 2.00
- cadence(steps/s): 1.48
- stepDetector: Gyroscope
- Detector confidence: 0.99
Smartwatch TUG System Architecture

Cloud based IoT system

- Sensing
  - Smartwatch motion sensors

- Connection
  - Auto upload the sensor data to AWS S3
  - S3 triggers an event to AWS Lambda

- Smart
  - AWS Lambda does the smart analysis
  - Give the feedback to the doctors
Alexa Voice-Agent for mental health

- A smart voice-agent based Amazon Alexa
  - An “App” in Alexa is called as a skill
  - Guided Breath exercise to help soothe the patients
    - Mindfulness is reported to be able to relief stress[1]

Mindfulness Skill Architecture

- Echo device as frontend (Sensor and actuator)
  - Get patients’ feelings; help the patient relaxed.
- Alexa Skill platform (Middleware)
- AWS Lambda (Analysis)
  - Build a database for each patient (AWS DynamoDB)
Recap: IoT concepts

- **Sensor & actuator**
  - Smartwatch, Raspberry Pi (with Camera, mic), motion sensors…
  - Stepping motor, Light bulb, A/C

- **Connection**
  - AWS IoT…
    - You don’t need to use AWS IoT, but you need to connect your devices to other devices or cloud.

- **Smart**
  - AWS Machine learning
    - Analyze the big data from the sensors, then make a smart decision
Thanks!

- Feel free to email me about any questions.
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