Architectures, Protocols, and Applications of Internet of Things (IoT)

-- What are the Essential Factors to Create a True IoT System? --

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Agenda

1. Concepts and Examples of IoT
2. Features of IoT
3. Architectures and Algorithms/Protocols of IoT
4. Applications of IoT

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What is IoT?

(What is NOT IoT?)

| Ubiquitous System = IoT? | No, US ≠ IoT |
| Cyber-Physical System = IoT? | CPS ≠ IoT |
| Cloud Computing = IoT? | Cloud ≠ IoT |
| Internet = IoT? | Internet ≠ IoT |

IoT should have ....

Comm. and Coop. between Things, M2M, M2P, P2M, S2S
An Example of IoT system
Support system for elderly persons

Cloud Computing

Smart Home

WSN and Internet

Ubiquitous Computing

Features of IoT (1)

Basicly:
• Sensing function
• Communication
• Smart App. & Services

Specially:
Scalability
Openness
Aware/Finding
Intelligence/Smartness
Conflict free/resolution
Safety

Features of IoT (2)

More about Conflicts and Safety

Requirement
Resources

Time

Monitors with cameras in a smart city
• Traffic control
• Fireman,
• Police
• Service provider

Hot or Cool

Sensors,
• Actuators,
• Physical-Objects
• Equipment
• Persons
Cloud Comp., Transparent Comp., and IoT

Cloud Comp.
- Scale out resources
- SaaS: Software as a Service
- Virtualization

Transparent Comp.
- as simple functions as possible
- OS and applications can be downloaded from servers
- Piece by piece in a flow way

Optimal Downloading the Video Contents to Wearable Devices

App. Example 1: Remote Mutual Situation-Aware Algorithm for Elderly Life Support

3. Privacy-Aware Mediation Algorithm
2. Abnormal situation detection by SIED
1. Situation reasoning

App. Example 2: Magic Ring based Awareness

Control appliance Call for helper,
Ring Type Device
TV

Different Gestures
Show intention
by gestures

MR V1
Magic Ring
MR V2
Hardware and software

- Hardware
  - 3-axis acceleration MMA7361L
  - MCU CC1110 TI 8051 core, RF transceiver 433 MHz
  - Power: 3.7v, 30mAh lithium, 1mA

- Soft (Recognition algorithm)
  - 12 kinds of One-Stroke gestures
  - 50 samples for a gesture
  - SD of X, Y, Z acceleration value
  - 9 features of the values are used

- Results
  - Accuracy: 86.92%, 97.55%
  - Time delay: around 0.1~0.2s
  - 10 kinds of activities can be recognized (walking, eating, cleaning)

App. Example 3: IoT for Rescue Survivors in Disaster

App. Example 4: Transparent Service Selecting and Loading (TSSL) Architecture

Summary

- What is IoT:
  - Global infra. bridging physical and virtual worlds, with features, open, conflict-free, etc.
- What are the Essential Factors for designing IoT
  - Techniques (Integration of various tech)
    - Embedded systems, RF-IDs, sensor networks,
    - Cloud comp. and transparent computing, etc.
  - Designing IoT System
    - Identifying conflict in the problem domain
    - Deciding the architectures and techniques
    - Developing Algorithm and Killer Applications