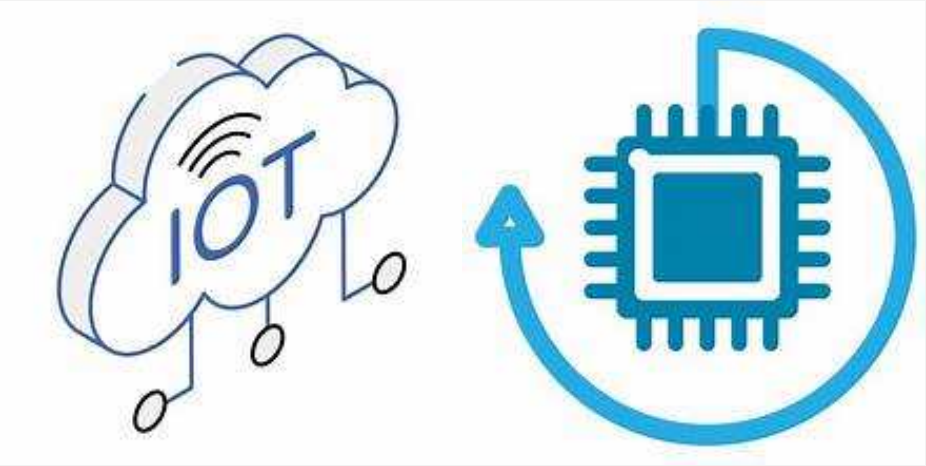
한국외국어대학교
HANKUK UNIVERSITY OF FOREIGN STUDIES

Internet of Things (IoT) Systems



Lecture 01

Course Overview & Introduction to IoT systems

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Hankuk University of Foreign Studies (HUFS)

Spring – 2025

Short Bio (About me!)

- **Ikram Syed**, Associate Professor, Department of Information and Communication Engineering

- **Education:**
  - Ph.D. from Ajou University, South Korea
  - M.Sc. from Incheon National University, South Korea
  - Bachelor from UET Peshawar, Pakistan

- **Experiences:**
  - **Associate Professor** at Hankuk University of Foreign Studies
  - **Assistant Professor** at Gachon University, South Korea
  - **Assistant Professor** at NUST, Islamabad, Pakistan
  - **Assistant Professor** at Superior University, Pakistan
  - **Assistant Professor** at AJK University, Pakistan

- **Office:** Building Eng. Rm#5424-1
- **E-mail:** ikram@hufs.ac.kr
- **Contact: Visit office (or email)**

- **Research Interests:**
  - Wireless Networks, Mobile Communication, and Internet of Things (IoT)

Attendance & Some Rules

Attend/Late/Absence

- Attend: 5 minutes after lect. Start
- Late: 5 ~ 10 minutes after lect. Start
- Absence: Ends in 20 minutes

❑ Following are the class rules:

- ✓ Raise your hand before asking any question
- ✓ Mark your attendance on the App
- ✓ Direct all your problems and queries to me.
- ✓ Always be polite and kind to your classmates and teacher.
- ✓ Listen when someone is speaking and avoid interrupting.
- ✓ Respect different opinions and viewpoints.
- ✓ Arrive on time for every class.
- ✓ Engage in discussions and activities.

Course Organization

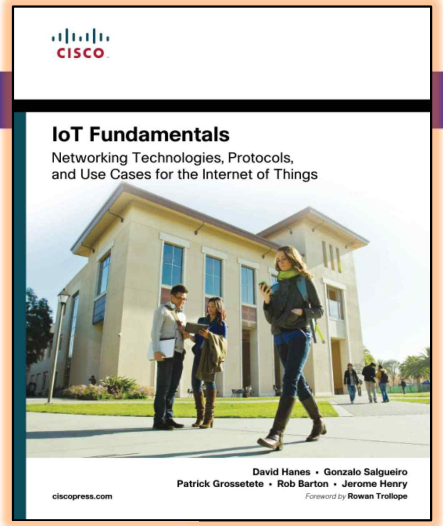
- **Class Schedule:**
  - **Lecture:**
    - **Tuesday→ period 5 (01:00 pm ~ 01:50 pm) & period 6 (02:00 pm ~ 02:50 pm)**
    - **Thursday→ period 5 (01:00 pm ~ 01:50 pm)**
  - **Place:**공학관5301
  - **Offline:** Face-to-Face

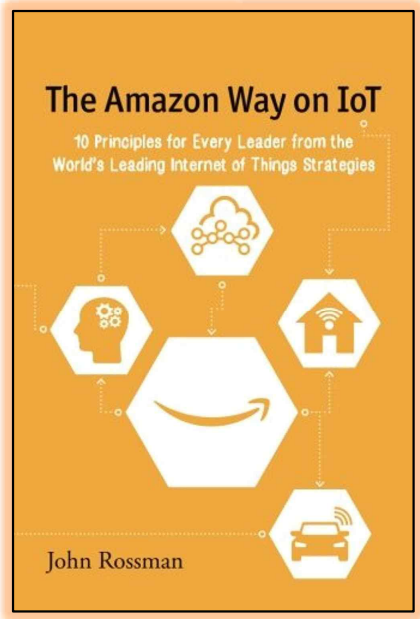
- **Course TA:**
  - **Name: Woo-in Choi**
  - **Email:** chawoa@hufs.ac.kr

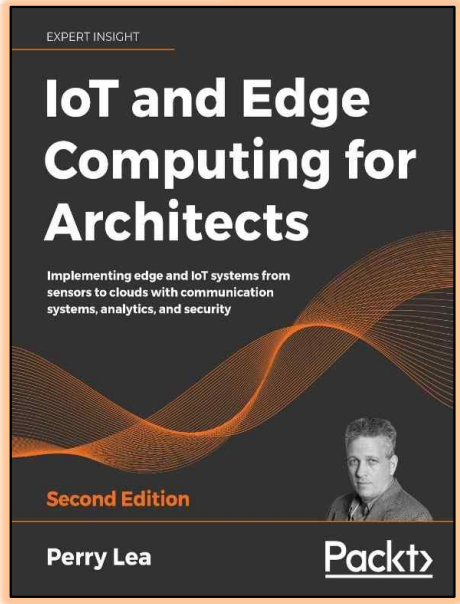
Course Organization

- **Class will be conducted using PPT slides (lectures)**
- **Class will have experiments and programming tasks (You will conduct practical work on real devices!)**
  - The material slides will be uploaded before the class.
  - *Active Learning Strategy: Interactive Questions*!

- **References:**
  - **Build and Utilize Cloud Using IoT Smart Server, Tutorial**
  - **"IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things",** 1st Edition by David Hanes, Gonzalo Salgueiro, Patrick Grossetet, and Robert Barton.
  - **"The Amazon Way on IoT: 10 Principles for Every Leader from the World's Leading Internet of Things Strategies",** by John Rossman.
  - **"IoT and Edge Computing for Architects: Implementing edge and IoT systems from sensors to clouds with communication systems, analytics, and security",** 2nd Edition. by Perry Lea







About You

- Why are you taking this course?
- What background knowledge do you have related to this course subject?
- What are your expectations?
- This is an English class!

Course Objectives

- This course offers a comprehensive introduction to C/Python language programming. It focuses on the following main objectives:
  - What IoT is and how it works today!
  - Understand IoT fundamentals, platforms, and its applications.
  - Learn the basics of IoT concepts and familiarize yourself with the IoT layers Architecture.
  - Learn about IoT hardware tools (Raspberry Pi) and use them in lab experiments.
  - Design and program IoT devices using sensors and actuators.
  - Study IoT protocols for communication and IoT networks.
  - Gain insights Cloud Computing infrastructure and how to transfer data to the cloud.
  - Web server for IoT (IoT and Http server)

Course Contents (1/2)

Course Content
Introduction to IoT systems
IoT Platform and Architecture
Electronics for the Internet of Things Introduction on Raspberry Pi Raspberry Pi Instillation and Setup Python review
Software for the Internet of Things Linux (overview and Commands)
Sensors and Peripherals sensors experiments
IoT devices Programming with Streams
IoT sensor control Sensors and Dashboard Connect and use an LCD

Grading

- **Attendance:** 10%
- **Assignments:** 10% (can be!)
  - Practical IoT projects
- **Midterm Exam: 25%** (Project 1)
- **Final Exam: 25%**
- **Term project: 30%** (Project 2)

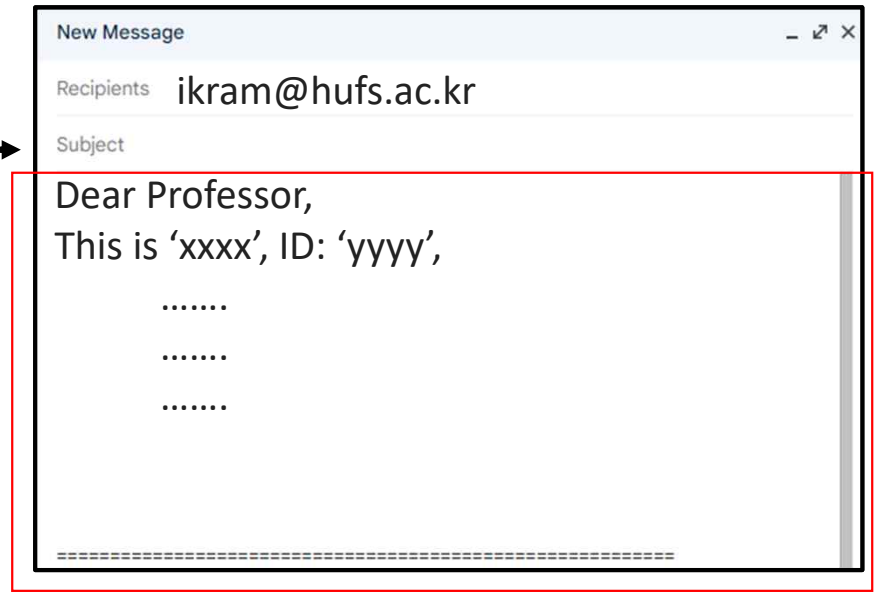
Assignments

1. Deadlines are always final
2. No credit for late submissions
3. Only latest version will be considered

Anybody involved in any kind of cheating in any type of assignments or exams will get zero marks.

Contact Method

- **E-mail (**ikram@hufs.ac.kr)
  - **Subject:**
    - [IoT_system] Your Query Title
  - **Message Body:**
    - Mention your Name and ID



Prerequisites

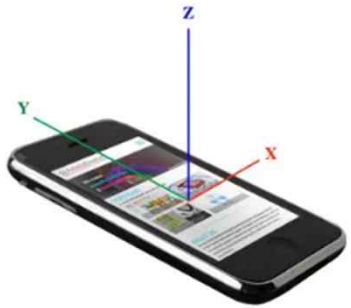
- **The prerequisites for studying this course:**
  - Basics of computer science and some knowledge of networks concepts are assumed for this course.
  - Ability of programming language (such as Python) are required!
  - Basics of electric circuits and electronics circuits are also preferable!
  - If you have never heard before about IoT and are a complete beginner, you have come to the right place ☺
  - Therefore, let's get started and enjoy with learning IoT system!

Introduction to IoT

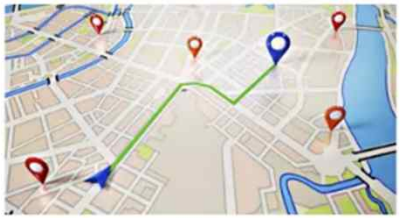
What is Internet of Things (IoT)?

Let's first look at our mobile phones!
They have the following features and devices

Voice Detection



Mobile Gyroscope



GPS Tracking

Adaptive Brightness

Face Detection

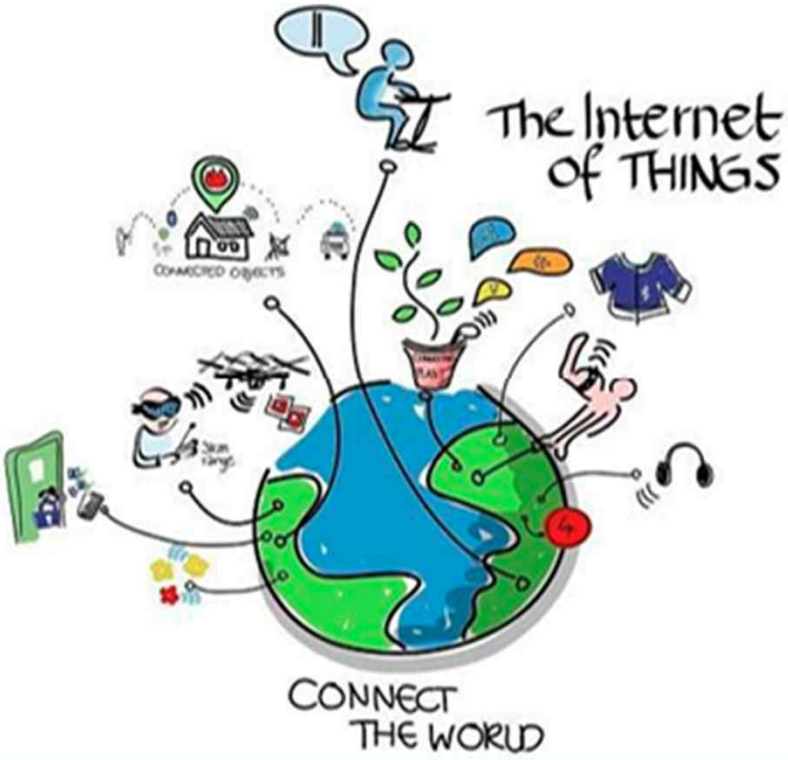
Introduction to IoT

- Most of these features (**or Things**) are pre-built in the smartphones (Android-based, and iPhone-based, …)
- All of these features have interaction between them, maybe one application can use all some of them at one!
- For example: Fitness App (GPS Sensor, Accelerometer & Gyroscope, Heart Rate Sensor)
- That means these features can be **interconnected** together to provide a better system!

The Internet of Things

- IoT is simply a concept wherein machines and everyday objects are connected via Internet
- The *thing* refers to all the things that can be connected to Internet
  - Door locks
  - Lights
  - Household appliances
  - Car
  - Clothes

IoT refer broadly to extension of network connectivity and computing capability to objects, devices, sensors, and items not ordinarily considered to be computers



Introduction to IoT

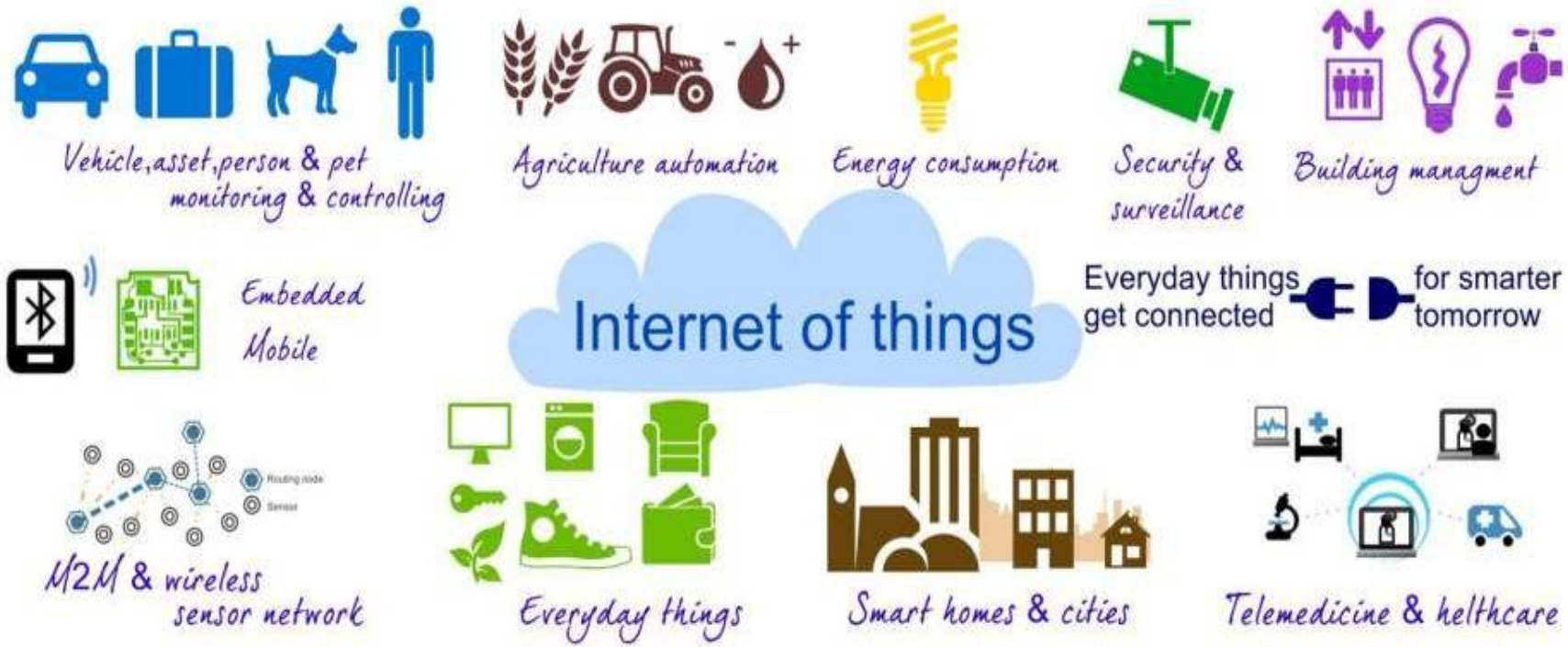
- **Internet of Things (IoT):** Connecting *everyday things* embedded with *electronics, software, and sensors* to the Internet enabling them to *collect and exchange data*. **Example:**

- A platform is needed to control things of home and car, give you continuous alarms via phone, and keep you updated!
- How about locking your home remotely using your phone? A platform connects your phone and smart door lock is needed!
- How about warming your home using AC air-condition while you are back from work to home in winter! Do you like it? IoT can do it for you!

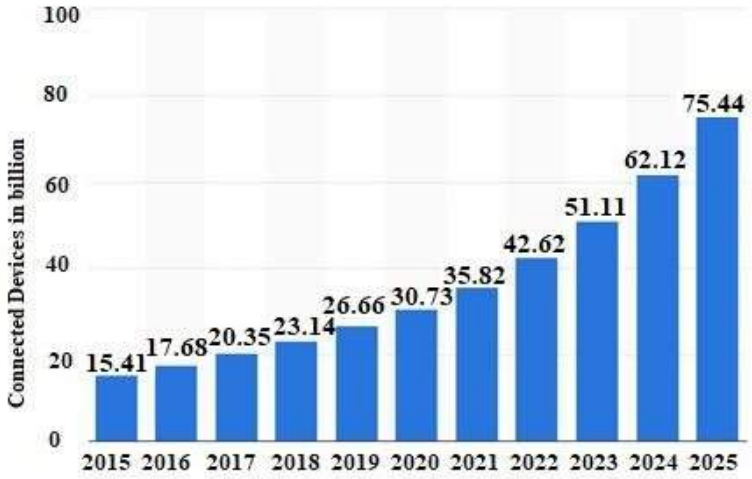
Introduction to IoT

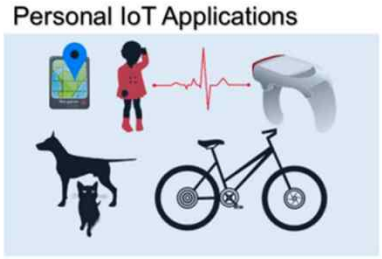
What is Internet of Things (IoT)?

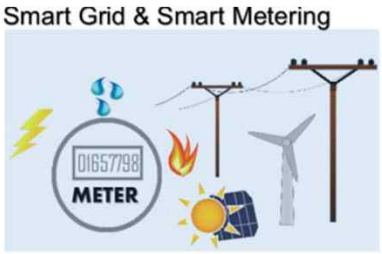
The Internet of Things (IoT) refers to a vast number of “things” that are connected to the internet so they can share data with other things.

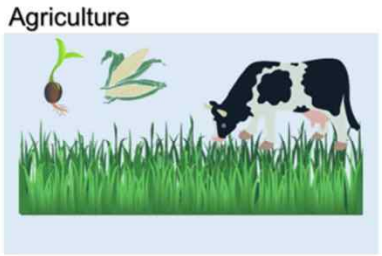


Rise of the Internet of Things (IoT)









Introduction to IoT

- IoT applications such as Internet-connected devices and industrial machines use built-in sensors to collect data and, in some cases, act on it.
- IoT connected devices and machines can improve how we work and live.

Have you used IoT? Can you give some examples where you used the IoT in your life?

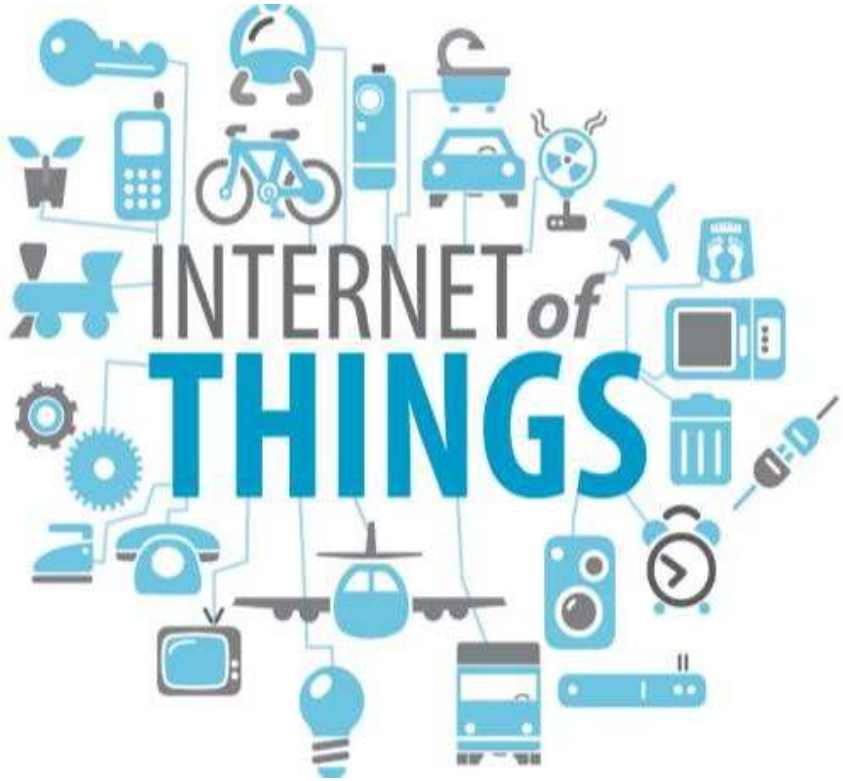
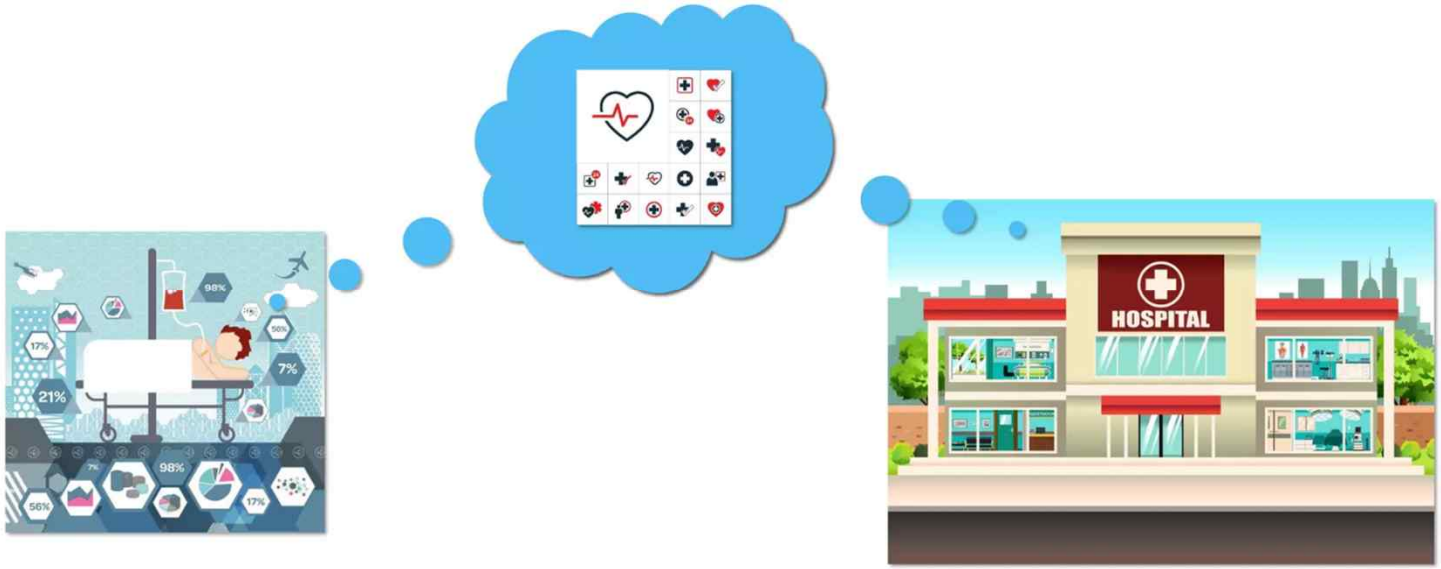


Image from http://smartdatacollective.com/rick-delgado/285576/scary-security-concerns-internet-things

Why do we need IoT?

- To understand why do we need IoT, let's take this example in healthcare!



- IoT continuously monitoring this patient by sending data records (e.g., heartbeat, blood pressure, or ……
- A complete reports are sent periodically to the cloud.

Why do we need IoT?

- In case of emergency, the system notify the hospital and an imbalance immediately to bring the patient to the hospital.

- At hospital, the doctors are already having complete history about the patient from the system.
- The doctors, all prescriptions, medicines, and operation theater are on standby!

Does this reduce a lot of efforts and time? Do you know why do we need IoT?

Why do we need IoT?

- If we can expand the interdependence of humans to interact, contribute, and collaborate with respect to different of things around us, then we will be builder of a proper Internet of things environment.
- This would be much safer, secure, effortless, and time-saving environment.

Why do we need IoT?

Examples (Not limited to)

- Without parking sensors, parking a car quickly and safely becomes difficult.
- Without checking real-time weather updates on a phone, going outside unprepared can be risky.
- Without a GPS-enabled map on my phone, tracking my route while driving is challenging.
- Without a ride-hailing app (e.g., KakaoTaxi), finding and booking a taxi quickly is inconvenient.
- Without IoT-enabled industrial monitoring, factories struggle to detect machine failures early.

Any Questions!

THANK YOU