

Robotics in Cloud and IOT

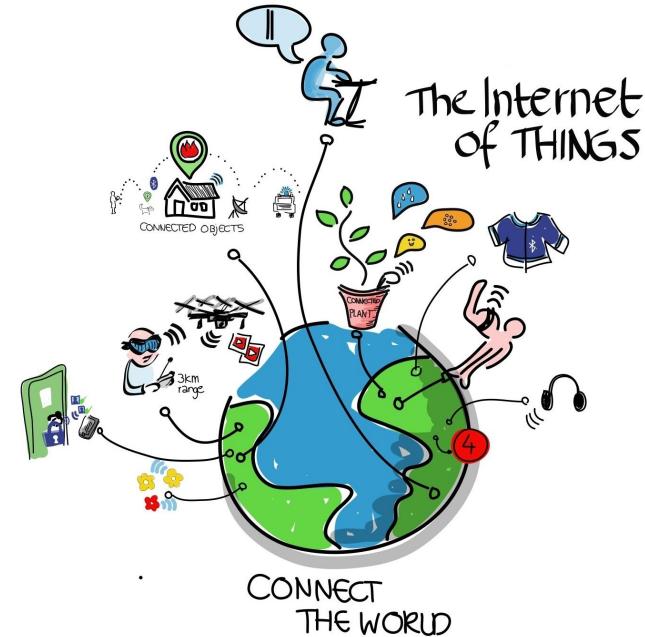
Jihoon Lee, YujinRobot

IT Trend?



Mobile

Cloud



Internet of Things

What's the next?

What's the next?



Image ref: <http://polive.deviantart.com/art/GIANT-CITY-EATING-ROBOTS-11564995>

Why Robot?



Money Keywords

- Google
 - Autonomous car
 - Company acquisition
- Amazon
 - Kiva
 - Drone delivery
 - Picup Challenge
- DARPA
 - Robot Chanllenge

Technology Keywords

- Cloud
- IOT

Contents

- Benefits of Robotics in Cloud with example projects
 - Rapyuta - Roboearth
 - Robot Web Tools
- Crowdsourcing for Robots
 - Project Heaphy
 - Crowd accelerated ML researches
- IOT and Robotics

Jihoon Lee



ROS(Robot Operating System)

- Open Source framework
- Main Contributor
 - Turtlebot + Kobuki
 - Robot Web Tools
 - Multi robot framework
- ROS Consultant
 - KITECH, KARI, OROCA and etc

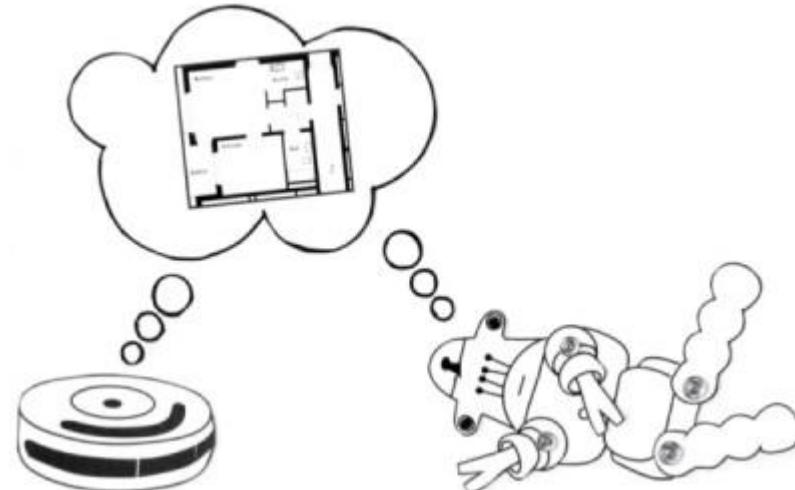
Yujin Robot

- Research Engineer
- Robotics in Concert
 - Multi Robot + IOT framework

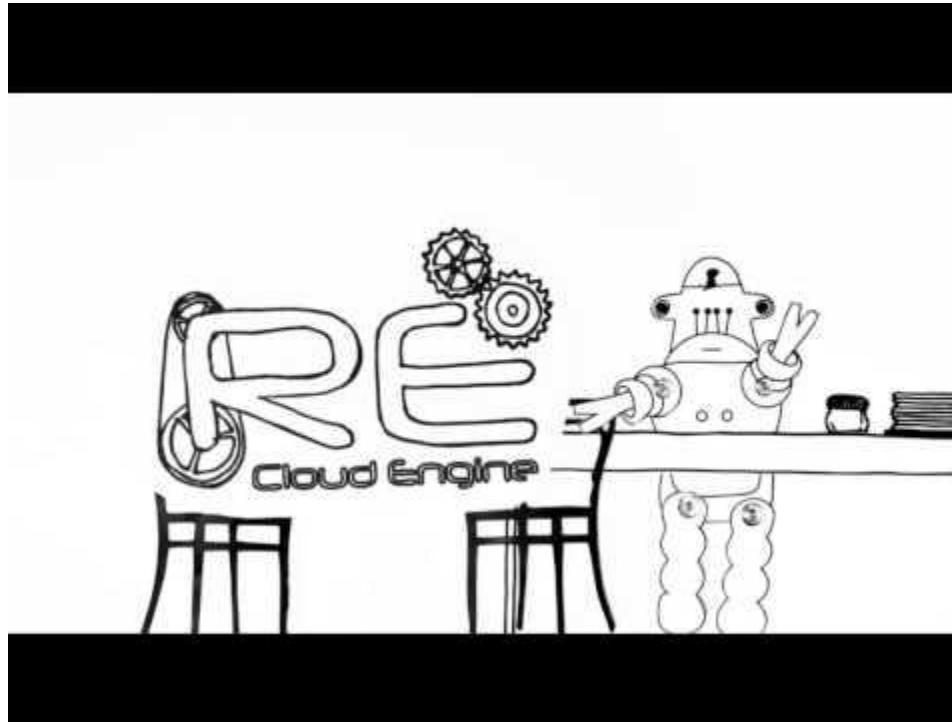
Rapyuta - Roboearth



Rapyuta Robotics



Rapyuta - Roboearth



Rapyuta - Roboearth

- Started by ETHZ Roboearth team
- Introduced in 2013. Spin off in 2014
- Open source project
- Features
 - Offloading robot's computation power
 - Multi-robot system in cloud

Computation offloading - Meaning

- Less in-robot computing power -> Cheaper robot
- Lower power consumption -> Improve battery
- Data(e.g object) sharing among multi robot
 - > Easy to reproduce using different robot

Computation offloading - example



Robot Web Tools



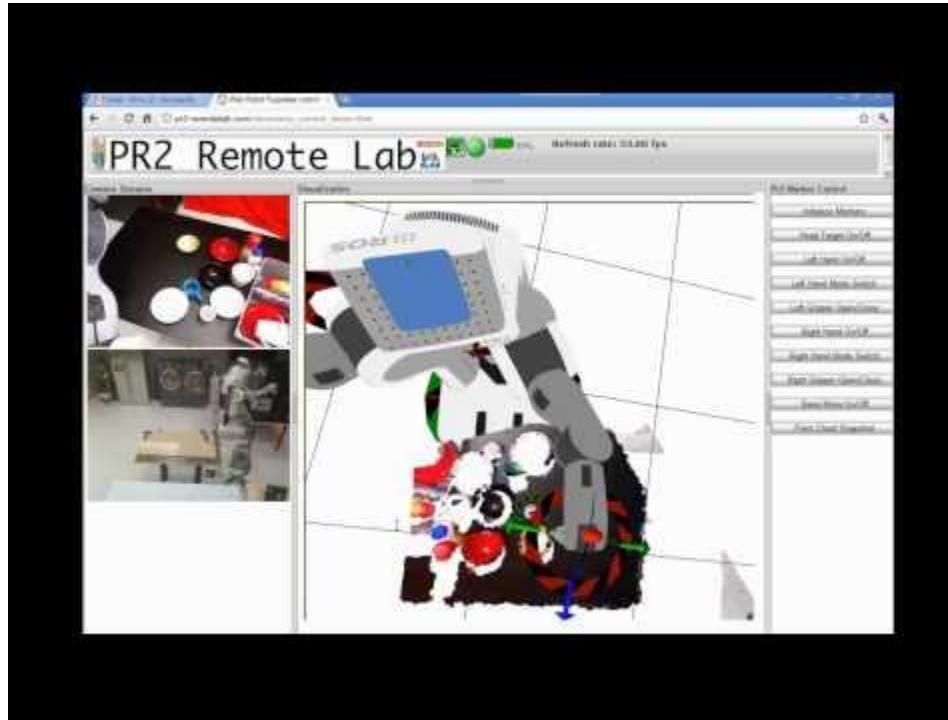
The screenshot shows the homepage of the Robot Web Tools website. At the top, there is a navigation bar with the logo "ROBOTWEBTOOLS" on the left and links for "HOME", "TOOLS", "DEMONSTRATIONS", "NEWS", and "COMMUNITY" on the right. The background of the page features a collage of various robot heads and bodies in shades of blue and grey. In the center, a large white text box contains the following text:
ROBOT WEB TOOLS IS A COLLECTION OF OPEN-SOURCE MODULES AND TOOLS FOR BUILDING WEB-BASED ROBOT APPS.
Below this text, there are two calls to action: "WANT TO SEE ROBOT WEB TOOLS IN ACTION?" on the left and a blue button with a checkmark icon and the text "VIEW DEMOS" on the right.

At the bottom of the page, there is a section titled "BRINGING ROBOTS TO YOUR FAVORITE BROWSER" followed by a descriptive paragraph:
ROBOT WEB TOOLS ALLOWS WEB APPLICATIONS TO INTERFACE WITH A VARIETY OF ROBOTS RUNNING MIDDLEWARE LIKE THE POPULAR ROBOT OPERATING SYSTEM (ROS) USING THE LATEST IN HTML5 AND JAVASCRIPT.

BRINGING ROBOTS TO YOUR FAVORITE BROWSER

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Robot Web Tools



Robot Web Tools

- Started as PR2 Remote lab by Bosch and Brown in 2010
- Currently maintained by Bosch, Brown, WPI, and YujinRobot
- Open source project
- Helps to develop robot web applications to visualise robot data and interaction tool.
- Features:
 - Provides modules and tools for building web applications.
 - Real time robot data streaming
 - Video/Pointcloud streaming
 - 2D/3D visualisation and Interaction

Robot Web Tools

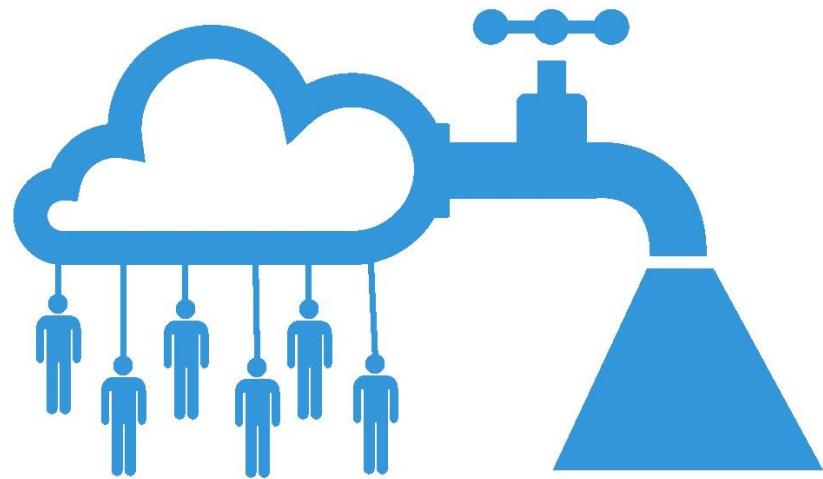
Meaning

- Control robot through web browser
 - > No installation for robot operator
 - > Remote Access from anywhere from any devices
- Websocket and javascript modules
 - > Robotics for web developers
 - > Easy integration with any web based services

Benefits of Robot with Cloud

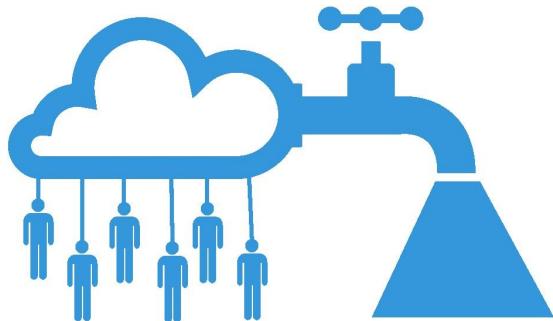
- Reduces robot's computation burden
- Allows remote access from anywhere

Benefits of Robot with Cloud



Crowdsourcing through web

Crowdsourcing

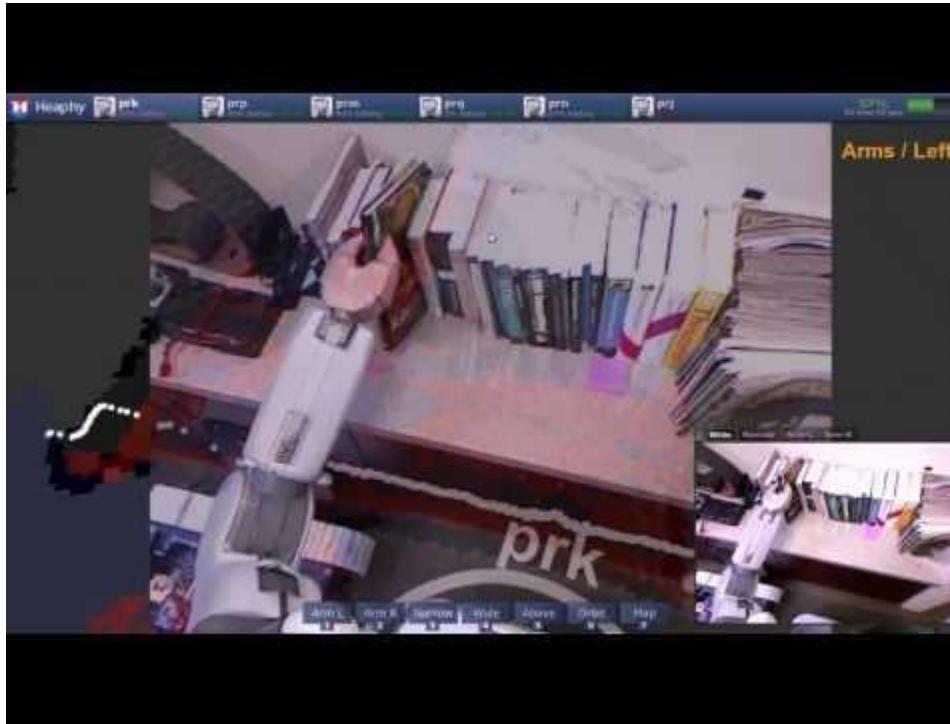


Crowdsourcing is the process of obtaining needed services, ideas, or content by soliciting contributions from a large group of people, and especially from an online community, rather than from traditional employees or suppliers.

Examples

- Quirky
 - crowdsourcing people's idea
- Wikipedia
 - crowdsourcing people's brain
- reCapcha
 - crowdsourcing for text recognition

Heaphy



Heaphy

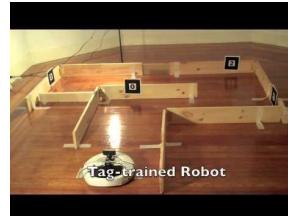
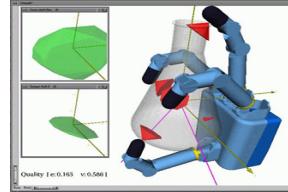
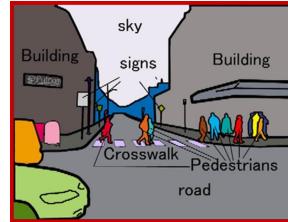
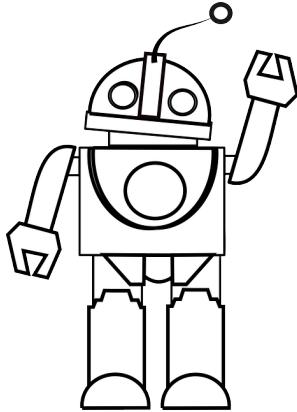
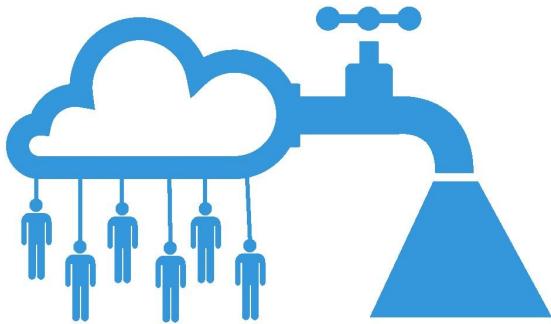
- Started by Willow Garage
- Closed project.
- Currently dead...:(
- Features
 - Remote robot operation
 - Crowdsourcing using Amazon Mechanical Turk

Mechanical Turk



- Amazon Crowdsourcing Platform
 - Logo design survey
 - Image annotation
 - Translation

Crowdsourcing



Provides nice ways for robot-hard but human-easy tasks

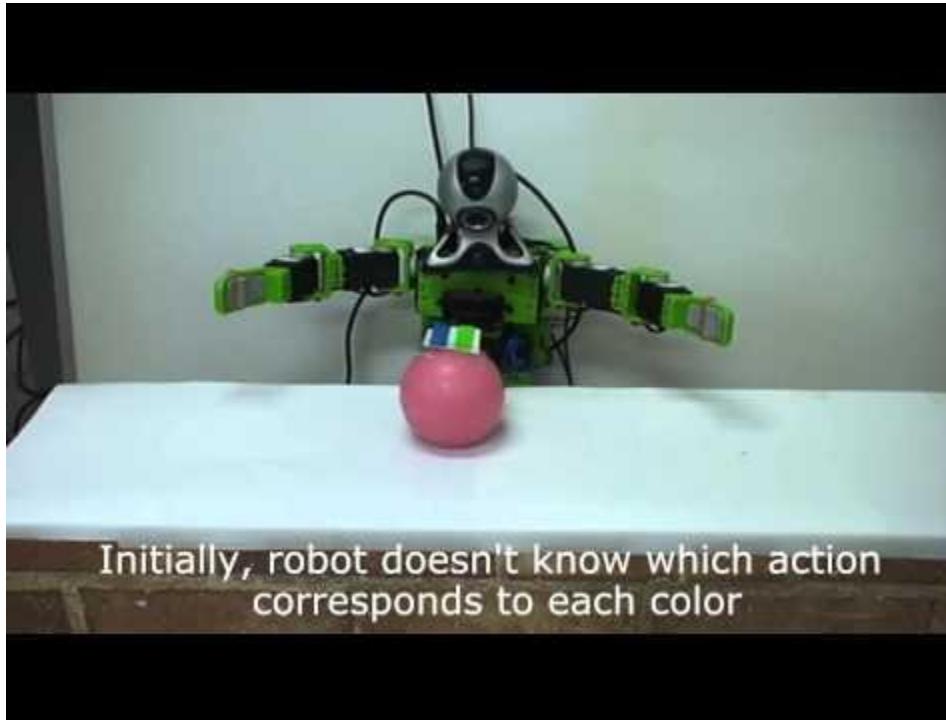
- Human-in-the-loop
- Data collection for machine learning

Crowdsourcing - example1



...but these actions sometimes fail.

Crowdsourcing - example2

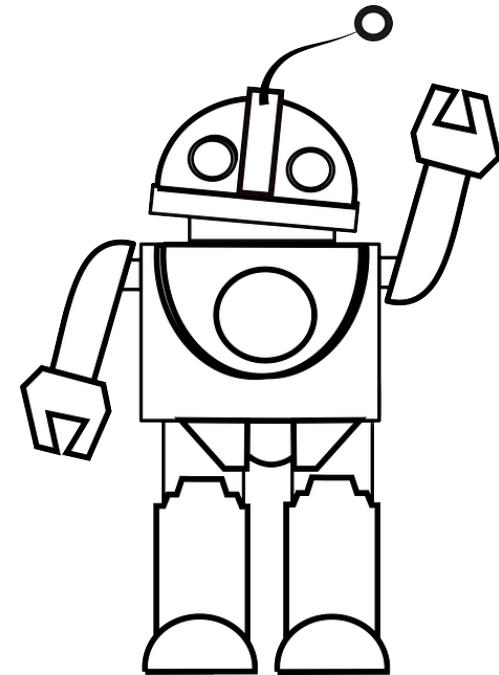
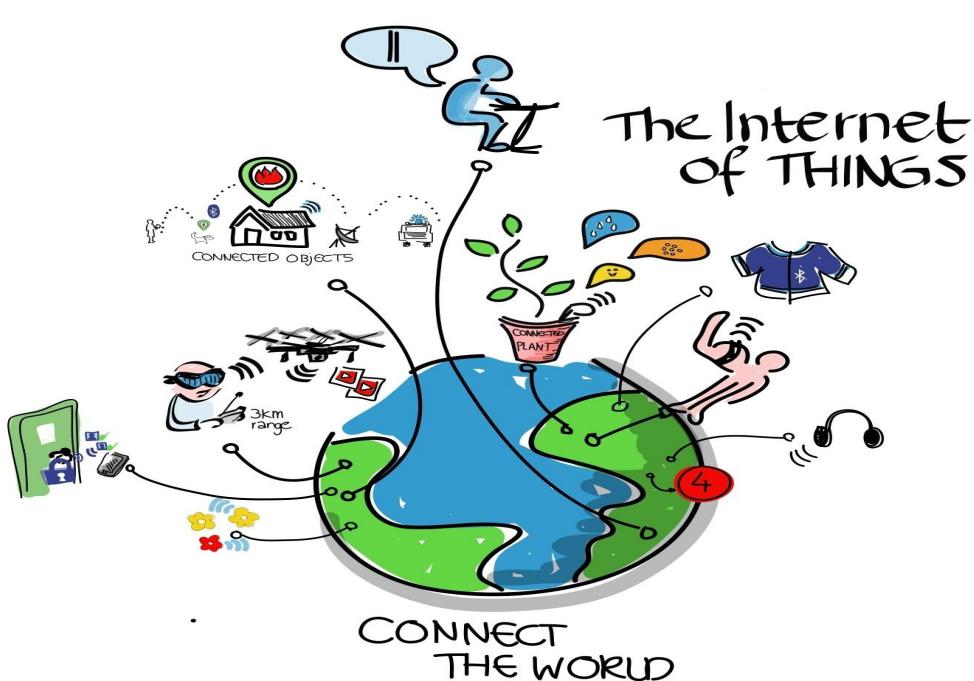


Initially, robot doesn't know which action corresponds to each color

Benefits of Robot with Cloud

- Reduces robot's computation burden
- Allows remote access from anywhere
- Provides easy way to collect data for robot-hard tasks

IOT and Robotics



Without IOT



Robot cannot ..

- press button for elevator control
- control light for better view
- push doors to open

without human's assists.

Can do nearly nothing unless it equips expensive sensors and actuators.

With IOT



Robots get IOT device assists for...

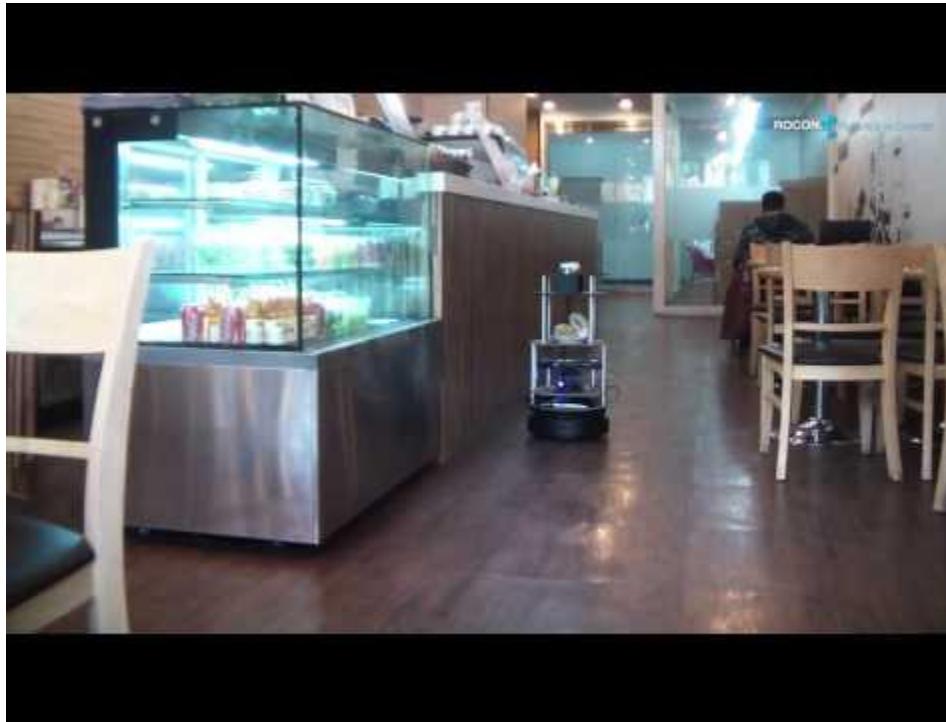
- Environmental control
 - example
 - Elevator control
 - Door opening
 - Lighting

without human's assists

- Human Interaction
 - Tablet UI interaction
 - Speech recognition

IOT extends robot's capabilities to interact with world!

Cafe Dorothy - Rocon



In summary

Robot era is coming..!

With these technologies help

Ref

Image

- Mobiles : <https://jquerymobile.com/>
- Cloud computing : <http://splorg.org/cloud-computing-focusing-canada/>
- IOT : http://commons.wikimedia.org/wiki/File:Internet_of_Things.jpg
- Robot Invasion : <http://polive.deviantart.com/art/GIANT-CITY-EATING-ROBOTS-11564995>
- Crowdsourcing : <http://www.forbes.com/sites/benkerschberg/2015/02/05/how-strategic-cmos-use-crowdsourcing-to-win/>
- Web : http://pixabay.com/p-42584/?no_redirect