Major Studio 1

Final Design Project
When IoT talks

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I. Introduction

This paper outlines a design project focused on redefining the relationship between human and non-human things. The project “When IoT talks” is an Internet of Things project and an interactive installation device that uses physical computing, NodeJS, Python, ImageNet and Raspberry Pi.

It is a response to the trend that this relationship has been transformed in many aspects with the continuous development of the Internet of Things technologies. It is a design experiment of adding human behavior to non-human things. It sets up an interactive object theatre where the audience can react in everyday places. It simulates a speculative scenario that when Internet equips the household objects, an object can communicate with the environment, with another object, and with the human in a different way than nowadays.

II. Background

2.1 Significance of design

Why Internet of Things? The concept Internet of things refers to a network of physical devices. In the past ten years, it quickly picked up multiple technologies like machine learning, embedded system, sensor networks, and wireless communications. By 2015, the number of connected devices worldwide has reached 15.41 billion [1].

The consequence is that, it enables a large scale of objects to connect and exchange data, alter human’s ability to interact with objects, equip all objects in the world with identifiers, and therefore, transform our lives.

The changes are around the corner.

2.2 Design philosophy

The design of this project is to reflect a small scenario out of hundreds of ones arising from the topic above. Having a form of interaction reinforces this reflection process. The audience will be able to see, to hear, and to experience. It is accessible to both single audience and multiple ones. The way it presents itself may not be expected but deliberate. It forces the audience to think. Is it funny? Is it scary? Will the audience feel emotionally engaged or be indifferent? What is it going to be like if the same idea is presented in different forms?

2.3 Human-centered design

We need to rethink the idea “human as the only kind of user” in the age of Internet of Things, while “getting things done” is still significant [2].

2.4 Speculation

Although the execution form is using current technologies, this project aims to speculate through design and think of the system in a less constrained way. This includes:

- No capability restriction. Any existing object can be easily revamped to be a qualified IoT.

- No usage restriction. The number of objects has grown to the point that objects are developed for both functional use and emotional use.

- No bias. All design projects will be evaluated at a planetary level like “universe”-centered design.

III. Research

3.1 What happens to the future

Five years from now, there will be 50 billion data-spouting devices [3] connected to the Internet: commuting tools, household objects, public space installations, sporting goods, even food.

Because of IoT, the form, function, and feeling of future objects may encounter a fundamental change, so does the producing process, maintenance, and recycling. Right now we have the smart object (smartphone) and non-smart object. In the future, to classify an object, there may be more specific metrics like the volume of knowledge (intelligence), whether it has the human characteristic or not, and the usage. To make the communication more smooth, we may design a language that both machine and human understand, and not just for programming. Objects may be encouraged to develop its characteristics, similar to human's personality, now that they all have digital identifiers. The relationship between human and objects can be colleagues, agents, or companions [4].

3.2 Levels of Intelligence

Artificial Intelligence has also made tremendous progress in the past ten years. It is leveraging human intelligence and waving towards surpassing human intelligence.

Nonetheless in a cyber-physical system [5], from connection to the configuration, artificial intelligence is not all required. There exist levels of intelligence in the middle between merely allowing the object to sense and communicate to the level of automated decision making.

3.3 Human vs. Non-human

Smithsonian [6] listed several human characteristics including walking upright, tools & food, body shapes, human brains, social life, language & symbols, and human's impact on the world. Non-humans usually share some of the characteristics above but not all of them.

This research can be extended to design experiments in multiple ways: human with missing human characteristics, non-human things with human characteristics, human interacting with non-human things, and the other way around.

3.4 Machine communication

- WiFi, Bluetooth, 2G/3G/4G cellular, Thread

- Assembly language, binary

- Morse code

3.5 Digital identity

Digital identity is the identity claimed in a network environment. It is linked to digital identifiers like username, email, and online activity.

IV. Execution

4.1 Overview

This project uses two robotic objects, embedded with raspberry pi and a camera module, all set up within an acrylic box. With the python file and an image database, the raspberry pi can recognize contents from surroundings. For example, it can recognize a reflex camera and a dining table. This recognition provides the robotic object capability to generate a conversation starting with “I see a camera”. The other object will echo this topic by picking up the topic and search with a dictionary API. The conversation is seen by robotic arm movement. Short pause represents a dot in the Morse code, and long pause represents a line. I also configured an audio module to allow the conversation to be broadcasted through either a headphone or audio speaker.

There are three layers of communication represented. Firstly, object communicates with another object by machine language. I used Morse code as it is the best bridge connecting human language and machine movements. Secondly, objects communicate with the environment through camera and image recognition. Finally, the audience (human) can communicate with the objects by audio and human language.

4.2 Audience

This project targets the following types of audience:

- Household owners who usually ignore everyday objects

- People who are interested in the Internet of Things future

- People who are interested in non-human things

- People who are interested in a different way of communication

4.3 Precedents

Many precedents are discussing the relationships between human and IoT devices.

Manas Mudbari once posted a twitter with a comic describing how IoT devices like Nest, iRobot, oven and pendant lights are gossiping about the household owners. [7] There were two Google Home assistants having a dialogue debating the existence of God in a streaming from Twitch user Seebotschat. [8] In one of the demo from Watson, Watson became a co-pilot for driving and Watson can understand your entries and respond accordingly. [9] Lastly, say hi to Brad, a needy toaster in a design experiment “Addicted Products”, it threatens to sell itself if neglected. [4]

4.4 Iterations

In the first round of prototype test

- A web interface with an illustration of the kitchen and a conversational script about the conversation between a toaster and a trashcan was presented.

- The audience thinks that if IoT objects can talk to each other in the future home, the conversation could be "funny" or "scary" or "boring".

- Two of the audience prefer physical interaction.

- People like the part when the toaster sends out a gif.

In the second round of prototype test

- Two physical objects are presented with the servo motor and LED communicating with Morse code was presented.

- It is not very clear to the audience that the objects are using Morse code.

- The size may still be a problem. Also if using Arduino, then it is going to be all wire connected.

- It needs to be more like a conversation, i.e., when one of the objects is "talking", then maybe the other should be waiting.

- A camera module can be added to detect what is happening around and trigger further reactions.

4.5 Results

The final execution as stated in the overview was left at the center of the D12 workspace as an instruction set. The word “I see” was proved powerful, so does the way that it looks like a decoration for the workspace plus a music box using servo movements make its point. The fact that the object is both speaking and moving slowly makes the live demo much harder. I can see that the audience often lose the interest after they wear the headphone but nothing happened. A better syncing tempo or a better significance should help.

Reference

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