Chapter 2: State Of The Art.
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In this chapter I will go look though all possible implementations of Sociometric Badge. Before building the realistic solution for this project I need to chop through the Sociometric Badge into several basic principles that will be benefit the target group. Each of these principles will related to whom are this project are meant to. The main target of this project is to create a basic tool that help social scientists to leverage their social experiment, similar to the Sociometric Badge. The hypothetical basic tool mentioned is supposed to carry out only the fundamental functionalities of the Sociometric Badge. From this most basic implementation, the users can then can apply their own requirements to create their own ideal tool that suit their own needs. Specifically for this project, the users will be the social scientists who will be greatly helped to have such a tool like Sociometric Badge and the makers who will help social scientist to build and tweak the tool.

The main principle for state of the art implementation as from the social scientists perspective is the usability. The main concern for social scientists to have Sociometric Badge, is that they cannot find the perfect fit out of the Sociometric Badge. In ideal scenario, let say, when everyone has the same capability to create one, there would be tools similar to Sociometric Badge fitted with with their own requirements for any possible needs. This project sets to create an alternative version to Sociometric Badge that shares the basic usabilities for any given cases so far.

In order to know what kind of propositions are necessary to satisfy most of social scientists, the qualities that this project search for state of the art are the inputs, of the implementations discussed here, the popularity of the technology used to make ones, media of communication, how the data stored, as well as the form itself.

The input that dealt in this chapter are more into which kind of data those are relevant to social experiment. Any input that comes naturally from human will be considered but a basic user experience input like a physical button will not be considered as a details that would affect social experiment, hence such details will not be included. What I meant by "naturally comes from human" is that the input will not be listed in this chapter because the human intentionally make the interaction. If human aware of their action, this should not be considered as an input, since the one of the design goal for this project is to create an ubiquitous wearable social sensor.

The popularity of the technology used and the implementation will determine the impact of each implementations to the world. The more popular the implementation is, the easier it is to get informations. The goal of this project is to create an alternative to the Sociometric Badge. However, the main user group, which is the social scientists, usually will not the one who create the badge, instead it will be someone else with basic expertise of electronics and programming. Hence, the more popular the implementation and the toll used to create it the better it would be for the social scientists to find this someone who will build the badge. This also meant for the social scientists to

make better communication to the makers, as these social scientists are the one who understand the requirements. For this purpose, I will look the popularity based on Google Trends as well as the number of results produced from specific queries related to the components/methods/tools Google search engine. Hence, for this aspect of state of the art, I need to determine what kind of components, methods, and tools are important to create the implementation. And then, I would try identify relevant search keywords to be used within Google Trends and Google search engine to determine the popularity of components, methods, and tools those are used to make the implementation.

Media of communication is how the implementation communicate, to whom it connects into, whether it is one - way or two - way communications, and whether this happens automatically or manually. Analysis on this matter will help to determine to where data is passed into as well as to determine simple communication diagram.

The last part is how the data is stored and how can it be retrieved by the social scientists or general user. In general this parameter will be about the output of each implementations. Anything that shows information in the physical world, for example like web user interface, LEDs blinking, that is related to the input received from the implementation will be considered. This part will also look into how the data is stored, which database is used, or whether or not the implementation used one in the first place.

From the makers perspective, this paper will look into how easy it is to make the implementation if only documentations are available for free. The documentations that this paper are looking for are the part lists, the schematics, the source codes. And for the development in this chapter the main building blocks will be defined. These building blocks are, in bigger picture, the main controller and the programming language used to program the controller.

By the end of this chapter, there will be implementations those are not directly related to Sociometric Badge, but it has features those are nice to have in the Sociometric Badge. These specific state of the arts will have their own specifications but the date of which each implementations known to public will be noted. This will be achieved by searching the earliest possible article within the Internet.

The two main users of this project are the social scientists and the makers. The main end user will be the social scientists those conduct social observation. However, since this paper is intended to be a starting point to create an alternative version of Sociometric Badge as well as due to my own personal experience as a maker, this project will have tendency to look state of the art implementation from technical point of view. And as a whole, these state of the art implementations will look into their simplicity and usability.

Table

Meme Tag

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Meme Tag was first publicly known in 1997. It was made as a wearable device that helps people co - operate with each others. Meme Tag usually used in conference where the homogeneity among its participant is high. Then, Meme Tag tries to group people even further by another topics that independent to the conference topic. Thus, make people with same interest other than what it is in conference meet each others. The usage of Meme Tag is similar to nowadays Twitter, but instead of use tweet online, the wearer of Meme Tag need to meet other people in person to share their message.

At the point when Meme Tag was used, the process to set one is straight forward. After user register at the conference in - site, they will be guided into a computer booth where they can set their first meme (message). Then, they can share their meme by touching other Meme Tag face to face. The connection between Meme Tag to the computer booth is unknown but the peer - to - peer communication between Meme Tag to share meme is done using infrared. I would suggest that the connection between Meme Tag to the booth computer is done using infrared communication as well, since at that point USB is not yet popular and there is no cable socket found in Meme Tag part list. Moreover, there was a web server as well to hold the captured memes.

Meme Tag formed as bare as it was. There was no case used to cover, wearer could see the LCD display directly, as well as other electronics components behind it.

What this project can learn from Meme Tag is its easiness to be setup during conference where there are a lot of people in queue to get their Meme Tag setup.

Meme Tag has a decent documentations. These are including the main documentation page itself, tutorial, part list, PCB design, but there are no source codes.

The Sociometer

The Sociometer described as a wearable sensor packages. It was made in 2002 for helping researcher measuring interaction between people. The development of The Sociometer not only focused on its hardware but it also took ergonomics design as its main concern. The result is a shoulder pad packed with a lot of sensors for social data gathering, that, although it is not as ubiquitous as the previous implementations, it is easy and can be comfortably worn through day. The result was that users are very happy to use it, thus its presence was neglected by the users.

It was equipped by microphone, accelerometer, and infrared. There are other sensor as well that can be easily attached, like for example gyroscope. The microphone was used to capture incoming sound and then has its features extracted (pitch and volume). The Sociometer used low - powered infrared to detect if face - to - face communication between its wearer happened. The accelerometer was used to know if the body language between participant in a conversation synced or nearly the same.

As for this project, the usage of low - powered infrared could help to determine whether face - to - face communication is currently happened. Normal infrared would detect any incoming signal as far

as 5 meters. But, the low - powered one will only be detected in 1 meter range. This would ensure that only valid face - to - face communication happens. The study of form factor is a good example on how to setup less - presented wearable device. Although the size is big for a wearable electronics device, due to its ergonomics and form - factor the user will not be worn out after long time use. This technique presents another dimension of ubiquitousness, of which, device not only blend to the environment but also to its user.

There are no documentations available to make Sociometer aside from the initial research paper and other related research paper.

UbER Badge

UbER Badge is the best implementation for this project. As it is in its description, it was intended to be a development platform that can be extended to satisfy any possible cases. At its most basic setup, when it was introduced in 2003, it has microphone and infrared transceiver for social data gathering as well as local positioning system using RFID. It communicate to each other with hopping transmission between other UbER Badge.

Form wise UbER Badge has noticeable LED matrices as a display instead of LCD screen that Meme Tag uses. The basic design offers a simple casing to cover its innards.

This project could learn from how UbER Badge make everything to be easily extensible. The use of modular circuitry enabled other people to adjust UbER Badge to meet personal needs.

Due to the nature of open source development platform the UbER Badge has the most documentations from any other implementations listed in here.

nTag

nTag was first known in 2003 and it went commercial until ~2008. This wearable device was used to manage a lot of people within the same place. Although there is not specific input for social data gathering, it packed with applications to regulate people. It is mainly used in conference,

nTag was first known in 2003 and it went commercial until ~2008. This wearable device was used to manage a lot of people within the same place, especially conference. In my opinion nTag was the Meme Tag that went commercial. It has the same sociometric principle that was also in Meme Tag, which is to exchange message within participants as well as stimulating conversation for like - minded people. On top of that nTag was packed with a applications to help conference organizers to manage a lot of people. For example is has a functionality for the organizer to throw a questionnaire that the nTag wearer can just answer right away within the badge and then display the results in real time as the wearer finished answering the questionnaire. All in all, nTag offered control for the conference organizer and networking for its wearer.

Form wise, nTag build like a regular badge. The distinction is that it has an LCD display that can handle at least a small (~7 words) sentence. There are input buttons that I suggest these were meant

as answer buttons in case of questionnaire and polling from the conference organizer. Also, there is a connection from the badge to database. The database is used to store values from questionnaires as well as other important information like the whoever had meet the wearer during the conference along with information on which room the wearer currently in. It is equipped with infrared transceiver to exchange message and RFID for local positioning system.

nTag offers flexibility that none other implementations in this state of the art has. This is due to it has the most basic input and output, the LCD and push buttons. With these basic components the amount of things it can do is so many.

Because nTag is a commercial product there are no documentations on how to make one.

Sociometric Badge

Sociometric Badge is what the Sociometer has become. It is a wearable electronics device to do sociometric data gathering. It packed with a inputs such as, microphone, Bluetooth, accelerometer, and RFID. The first iteration of the Sociometric Badge came in 2007, up until the latest version which came in as an IP to a company named Humanyze. Unfortunately, since this went commercial, there are little to no information on the current development of the Sociometric Badge.

Sociometric Badge packed with a lot of sensors, there are voice input from microphone, presence detection using infrared, Bluetooth to determine the proximity of the badge with other similar badge, RFID for local positioning, and accelerometer to determine body language. These all then packed into nice looking form factor that looks no different than other office badge. There are administration control panel as well control panel for regular wearer as well. The first iteration of the Sociometric Badge in 2008 has a Java based cell phone application that used to display real - time data visualization directly from the badge. However, the recent Sociometric Badge, that I have looked, needs to have its data manually moved from the badge into the main computer using Bluetooth.

Sociometric Badge is the main inspiration for this project. The goal of this project is to create the flexible development platform that was once UbER Badge with recent technologies to make an alternative to Sociometric Badge.

Although the first initial version of the Sociometric Badge has research papers but since it went into a commercial company there are no research papers that directly about the Sociometric Badge. And it has no documentation aside from these research papers.

Rhythm Open Badge

Rhythm Open Badge is the newest approach to the Sociometric Badge since it went commercial. The project's first commit into its GitHub repository was on 21st January 2016. The project is still going up until this moment and it has two stable version to be used. At first, before the shutdown, Rhythm Open Badge has a Google Hangout plug - in to simulate the similar functionality of the

Sociometric Badge but with online interaction in mind. Additionally, it also has an Android application to make an Android phone to be the Rhythm Open Badge itself despite some limitations.

Although the project is open source, currently, it has little documentations. There are source codes available, there are Eagle CAD PCB file as well as very simple part list. But there is no way for a commoners to know how to build one by looking at the documentation that it currently has. It uses nRF51-DK a low powered Bluetooth development kit to make the device, but it does not mention to which functionalities the Bluetooth serves.

The form factor is very small and what could inspire related project is the usage of low powered Bluetooth micro controller that can be powered with only a coin battery.

Unrelated Implementations

- **Hackaday Super Con Badge** is an electronics badge for Hackaday annual conference. Hackaday itself is a tech heavy conference filled with like – minded people who are interested in hacking. This badge is simple, it has 2 AA batteries as its main power source, a set of directional button (up, down, right, and left) and as a display it has LED matrices. The main purpose is to let its wearer hack the badge from the firmware into its kernel and it has a pre – installed Tetris video game. The concept that can be learned is how the badge can be set within the badge itself. The user can, obviously, use computer to hack the device and re – compile back codes into the device. But, with the directional buttons and LED matrices, it is enough to explore, navigate, and set some basic settings within the device.
- **AND!XOR DEFCON Badge** is a badge from DEFCON conference. Similar to Hackaday annual conference, DEFCON also has an annual conference for people who are interested in cyber security. AND!XOR badge is similar to Hackaday Super Con Badge, it has a screen and buttons. What makes it different is that the ability to set the whole program using Serial communication. Serial communication is what is used to put codes into Arduino board. So, instead of compiling the whole codes to change parameters, this AND!XOR Badge can be set just using Serial communication via USB connector in the bottom of this badge. This will make sure that the end user will not change anything important from what is already compiled in the device.

With regard of social scientists as the main end user for this project. Having an ability to set parameters from the device itself, like it is in Hackaday Super Con Badge, is great. Social scientists will set the parameter before hand. Then the respondents will wear the badge like it is not a data gathering tools. Since the alternative Sociometric Badge this project is trying to make will be wore by the respondents and not for the social scientist itself, having an on – board setting is not necessary. Perhaps a simple indicator like LCD display or LEDs to display informations would be the solution for this project.

From the social scientists itself, it would be the best solution if there is a method to set the alternative Sociometric Badge without having to compile back the codes into the device. AND!

XOR Badge provides its user by simple command line interface to set some parameters by connecting it into any computer with its provided USB connector.

Conclusion

There are two main principles when I was looking for possible state of the art implementation: usability and simplicity. Both can stand on its own, but it can also be combined. The usability is the what each of the implementation has to offers to social scientists. Whether it is relevant for social data gathering or not as well as any other features around the implementation that supports social data gathering. The simplicity is the main quality for the makers. The simplicity comes as how simple it is for makers to build and tweak the implementations. This quality comes as whether there is a documentation, schematics or PCB design, part list, as well as the source codes. The more of these elements are available the simpler it is to make and to tweak.

As from defining on what is the most hypothetical basic Sociometric Badge, based on the table, it is known that these implementations has at least three inputs each. The common inputs are, audio, local positioning system, as well as face to face detection for any other wearer nearby. Since, local positioning system need to be tested in more established environment and I do not have access to one, I concluded that the most basic inputs for device similar to the Sociometric Badge are audio input and face – to – face detection between peers.