

End of AY 2017 Report for SIP – Group 12

Project ID & Title

SIP17-12: Self-Powered Sensor Device for the Elderly

Team

GSDM ID	Name	School	Department	Year	Leader/ Member
16102	SU Meng (CN)	Engineering	Precision Engineering	D1	Leader
16212	HARTWIG Lisa (USA)	Medicine	Community & Global Health	D1	Leader
17212	XU Yang (CN)	Frontier Sciences	Computational Biology & Medical Sciences	D1	Member
17209	WANG Guantong (CN)	Engineering	Mechanical Engineering	D1	Member
17210	GO Yui (JPN)	Frontier Sciences	Computational Biology & Medical Sciences	M1	Member

Objective: Explain what social/global issues that this project tried to address and why the issue is important.

Japan is one of the most rapidly aging societies in the world, with the rest of the world to follow as demographic decline progresses in predominantly developed countries. Japanese society has yet to grapple its greatest problem: how to adequately take care of its ballooning elderly population, which is estimated to comprise 40% of the population by 2040, up from the current 26%. With high demands on younger people at work and the current caretaking provider system that provides for the elderly, the traditional family structure of caretaking has broken down in Japan in recent decades. This means that elderly family members are more likely to live alone than ever before.

The most recent census of Japan (2015) estimates that approximately 6 million elderly live alone in Japan. This would be our target market as opposed to elderly in general. An elderly person living alone without consistent supervision needs a way to alert caretakers or medical personnel if there is a problem. Additionally, there is also a rising precedent for elderly people that have no caretakers and are unable to alert about their passing to anyone.

Thus, our SIP attempted to combat this problem by designing a simple device that can function as an alarm/notification system even if, say, the deceased tenant has no electricity due to ceasing payment of electricity bills. Our device is unique in that it was created with extremely low-cost materials and advanced technology to combat higher-maintenance systems currently in place. We designed and prototyped a self-powered sensor device that can alert families and/or medical personnel about aged people in need.

Method: Explain through what kind of approaches you tried to achieve the objective.

*About the list and details of the interview, add the appendix.

We developed a self-powered sensor system to monitor the movement of the elderly for the purpose of alerting caretakers and medical personnel of any inactivity or trouble. This device and system was low-cost and easy to use in order to allow for accessibility while also respecting privacy concerns.

As a group we discussed how to design the prototype and determined to take two approaches: testing a thin layer of piezoelectric or triboelectric film on the floor or bed and a thermoelectric device approach. Meanwhile, the other half of the group would identify stakeholders and key informants about the social issue and aging society to determine a better prototype design.

The energy-harvesting film could generate electrical signals according to the elder's motions or movement, by which people can learn the activity range of the elderly with collected signals. Thus, if there was no signal, the self-powered system could alert a network of caretaking individuals immediately. The thermoelectric device can collect signals from elderly living alone efficiently by converting heat energy to electricity. These devices can collect signal changes produced by different body temperatures and movements. Thus, it would be easy to find if something happened to elderly living alone, especially in the case of death or high fever. Both devices tested successfully in this prototype stage as shown in the Appendix photos and diagrams.

Five interviews were conducted with stakeholders and experts in aging, community health workers,

government officials, and the private sector. Questions were prepared and target and business research was done in advance to facilitate the interviews and report development. Furthermore, by incorporating feedback from the stakeholder interviews throughout the project, we were able to change the design from an initial small array into considering it to have a floor covering or waterproof/ wearable conception in the shower. Alternatively, connecting the system to a building rather than within the same household, etc.

Outcome: Explain what kind of results you obtained from this project and discuss how it addressed your focal social/global issues.

We had two expected deliverables: (1) an initial prototype of a self-powered sensor system, and (2) a business plan including policy recommendations for designing the prototype once proven successful through our testing processes. The prototype incorporates advanced energy harvesting technologies in order to solve a pressing social problem.

Our vision for this project included an initial prototype and business plan with policy recommendations as producing a full product is out of the scope of our capabilities. We discovered how to produce something like the idea of an “MVP” (Minimum Viable Product) in the start-up world, which is to test early stages in the market and provide feedback for future product development. Therefore, we consider our SIP as successful because we could demonstrate the testing of a prototype alongside a business plan/report with policy recommendations within 6 months. These results addressed our focal social issue by coming up with a prototype that interested both stakeholders and our audience of external practitioners.

This addresses our proposed social issue of taking care of a large elderly population in Japan, but also by extension the world, as many countries are also following an aging pattern as fertility decline progresses worldwide. We targeted the smaller market of Japan to create a business plan and policy recommendations alongside a prototype model. Our report could help other high-level stakeholders understand their issue. By combining each student’s background and seeking out feedback from expert practitioners and if possible, external stakeholders, we created a prototype and recommendations that can effectively solve this problem for some Japanese elderly and the greater Japanese society. While we consider this SIP complete, we would be open to passing on leadership and continuance to other GSDM students for further developing the prototype and meeting additional market testers or stakeholders.

Budget: List the budget this project implemented. *About the details, add the appendix.

Purposes	Expense
Self-powered system’s raw material	
Triboelectric energy harvester	46,848 JPY
Thermoelectric energy harvester	16,449 JPY
Electronic parts (Signal conversion, signal adjustment, circuit assembly)	57,387 JPY
Travel expenses to visit and interview stakeholders	
Round Trip train ticket for 2 people = (3300JPY x 1) + (1380JPY x1)	4,680 JPY
Total	125,364 JPY
(ORIGINALLY REQUESTED BUDGET)	(174,254JPY)

Appendix

1. Final Business Report with Policy Recommendations (Pg.3)
2. List of potential questions for interviews depending on sector (Pg. 10)
3. Email templates in both English and Japanese for reaching out to stakeholders and key informants (Pg. 12)
4. Interview Transcripts (Pg. 13)
 - a) Kyo Takahashi, Aging Expert at Institute of Gerontology (aging) (Pg. 13)
 - b) Social Worker for the Elderly (aging care) (Pg. 14)
 - c) Tatsuya Honda, Young, innovative Forbes “30 under 30” researcher at Fujitsu (start-up) (Pg. 15)
 - d) Yuji Yamamoto, CEO of Healthcare Data Management company Minacare (private sector, data) (Pg.17)
 - e) Tomihara Sayaka, Deputy Director, METI Healthcare Industries Division (government) (Pg. 19)

Business Plan with Policy Recommendations for Prototype of “Self-Powered Sensor Device for the Elderly”

Produced by Student Initiative Project (SIP) Group 12

GSDM Program, University of Tokyo

(**Lisa Hartwig, Meng Su**, Yui Go, Guantong Wang, Yang Xu)

Executive Summary

Japan’s aging society has created a need for innovative ideas to overcome challenges in caretaking and providing services for those over the age of 65 years old. As more elderly people live alone in isolation, there is a need for products to alert caretakers when there is possible injury or early passing. Currently, there are sensor devices and services on the market, but they are high-cost and often require some form of usage or management by the elderly person in question. Our prototype seeks to fill this gap by providing a low-cost alarm sensor device using novel technology that requires no electricity or management once installed.

Thus, our multidisciplinary team of University of Tokyo students in engineering, global health, and frontier sciences designed an innovative prototype for a device that can function as a self-powered alarm/notification system for elderly people living alone. Our device is unique in that it was created with extremely low-cost materials and advanced technology to combat higher-maintenance systems currently in place. We designed and prototyped a self-powered sensor device that can alert families and/or medical personnel about aged people in need.

Background

Japan is one of the most rapidly aging societies in the world, with the rest of the world to follow as demographic decline progresses in predominantly developed countries. Japanese society has yet to grapple its greatest problem: how to adequately take care of its ballooning elderly population, which is estimated to comprise 40% of the population by 2040, up from the current 26%. With high demands on younger people at work and the current caretaking provider system that provides for the elderly, the traditional family structure of caretaking has broken down in Japan in recent decades. This means that elderly family members are more likely to live alone than ever before.

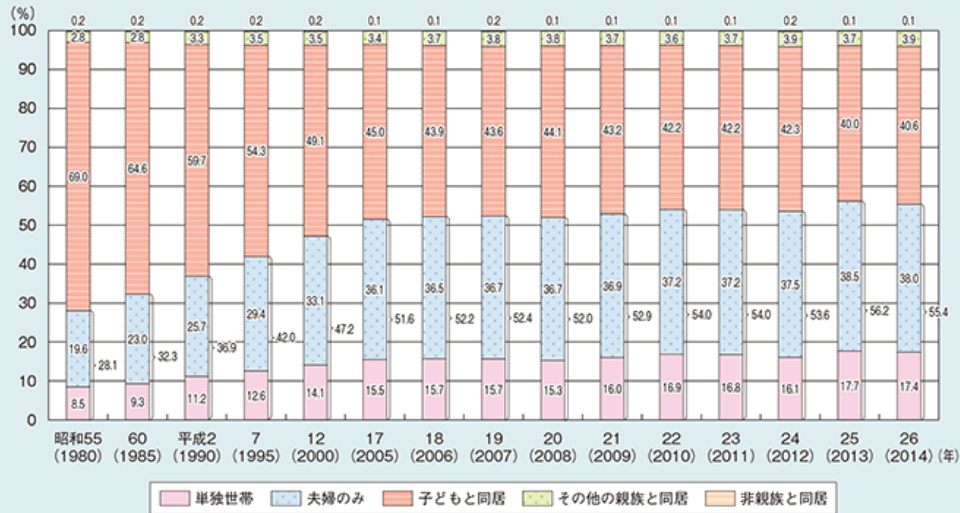
The most recent census of Japan (2015) estimates that approximately 6 million elderly live alone in Japan. This would be our target market as opposed to elderly in general. An elderly person living alone without consistent supervision needs a way to alert caretakers or medical personnel if there is a problem. Additionally, there is also a rising precedent for elderly people that have no caretakers and are unable to alert about their passing to anyone.

Target Market

After researching the situation of the elderly people living in Japan, we determined that our final user would be an elderly person living alone and their caretakers. First of all, the number of elderly people not living with their children is clearly increasing in current years if we look at the below chart (Cabinet Office of Japan, 2016). The orange color shows the decrease over time from 70% in 1980 to 40% today for those who live with their children. The pink and blue colors show an increase in living alone or only with a partner, respectively.

The division of families that include 65 years or older family members

図1-2-1-2 家族形態別にみた65歳以上の高齢者の割合

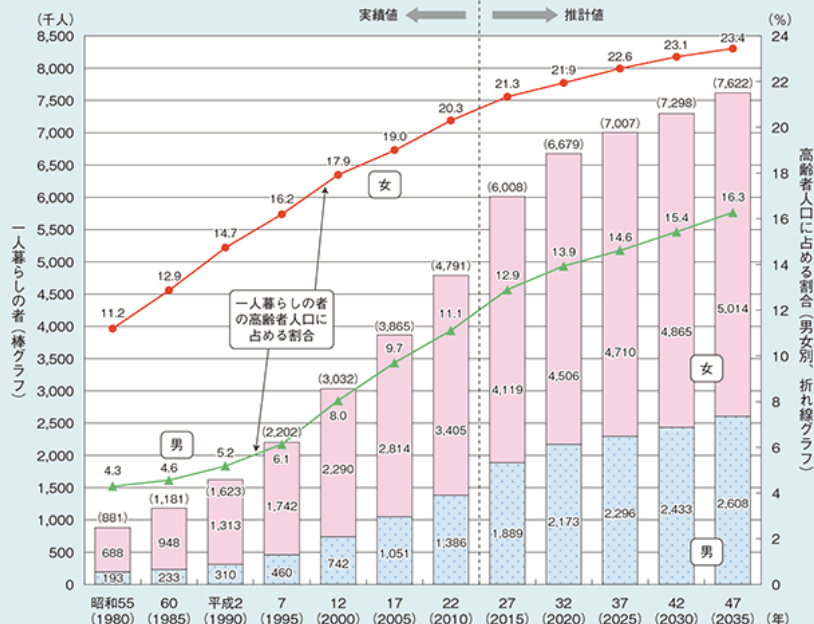


資料：昭和60年以前は厚生省「厚生行政基礎調査」、昭和61年以降は厚生労働省「国民生活基礎調査」
 (注) 平成7年の数値は兵庫県を除いたもの、平成23年の数値は岩手県、宮城県及び福島県を除いたもの、平成24年の数値は福島県を除いたものである。

If we consider the growth and change of elderly people living alone, there is a strong projection for growth in this target group in the coming years. The below chart from the Cabinet Office of Japan (2016) indicates the current growth projections through 2035. Both men (blue) and women's (pink) growth is increasing significantly in projections, with a higher proportion for females due to the life expectancy of women being longer than men.

Movement in Elderly People Living Alone

図1-2-1-3 一人暮らし高齢者の動向



資料：平成22年までは総務省「国勢調査」、平成27年以降は国立社会保障・人口問題研究所「日本の世帯数の将来推計（平成25（2013）年1月推計）」、「日本の将来推計人口（平成24（2012）年1月推計）」
 (注1) 「一人暮らし」とは、上記の調査・推計における「単独世帯」のことを指す。
 (注2) 棒グラフ上の（ ）内は65歳以上の一人暮らし高齢者の男女計
 (注3) 四捨五入のため合計は必ずしも一致しない。

Thus, the above charts show that there is and will be a significant outlook for this target segment and a greater need for caretaking services.

Competitive Analysis: Public Sector

At this time, there are different initiatives for the public sector in providing services for elderly people. For example, there are “minseiiin” who provide consultation and support for elderly people’s welfare in a given caretaking area.

Finally, a volunteer welfare committee through local civil servants commissioned by the Ministry of Health, Labour and Welfare also provides support. However, because the activities are provided on a volunteer basis, there is a shortage and high demand. Those who meet the requirements of working more than three years with high enthusiasm and specific knowledge of welfare and circumstances of the area can qualify.

Social welfare councils work in cooperation with commerce members of citizens to check the households with only elderly people in the area, in particular the bedridden elderly. They check the security situation and confirm safety during disasters. The “regional comprehensive support center” includes specialized staff members for providing nursing care and welfare. There is a need for connecting the centers and residents, which our device could provide if we cooperated with the public sector.

Competitive Analysis: Private Sector

A competitor’s analysis was done on other existing products in the market and summarized by the table below.

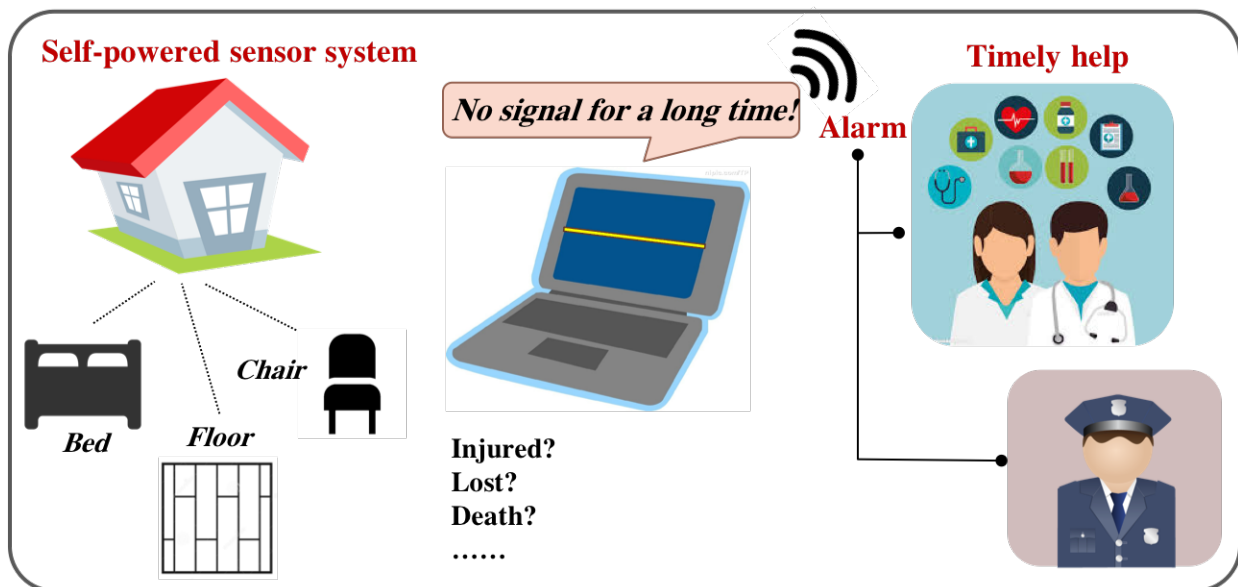
Who to alarm	Company Category	Company name	Device	Price
Security workers	Security	SECOM	Portable Alarm	¥4,700/month
			sensor	
			medical watch	option + ¥900/month
		ALSOK	controller	device ¥47,200
			door motion sensor	construction ¥15,800
				¥2,000/month
Family member	Home electric appliances	Panasonic	Camera	¥20,740
			infrared sensor	¥4,320
			regulation device	¥12,960
	Internet service	iTSCOM	IP camera	¥3,380/month
			infrared sensor	
		solk seeds	sensor	52,910(device)
			regulator	¥2,980/month

		chiba tusin system	door sensor	¥53,000
			regulator	
		aito system	door sensor	¥37,500
			regulator	
		art data	sensors	¥101,600
			regulators	

Other successful competitors are primarily designing devices that are hooked to the door or an invasive camera that is constantly monitoring a person who may wish to have some privacy. Furthermore, the cheapest device is approximately 3,000JPY per month, which could add up to over 36,000JPY per year, and for many years of monitoring would become costly for a family. Otherwise, the device could be purchased outright but then costs much more, as indicated by the table.

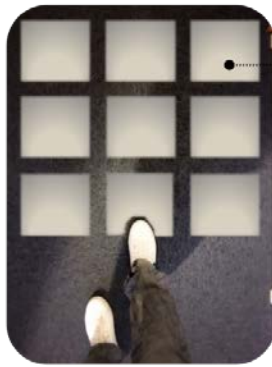
Furthermore, if we consider the usage of such devices that invade privacy or require electricity to maintain, the elderly person may not wish to cause such a burden on their caretakers for managing it. If the elderly person is suffering from dementia or other conditions that cause memory loss, there could also be a false alarm if they do not trigger the door or the placement of the sensor, etc. Therefore, our device fills a need in the market in that it does not invade privacy through videos while not consuming electricity or requiring the elderly person to manage their own movement in order to remind the sensor not to trigger an alarm.

Prototype Design and Explanation of Service



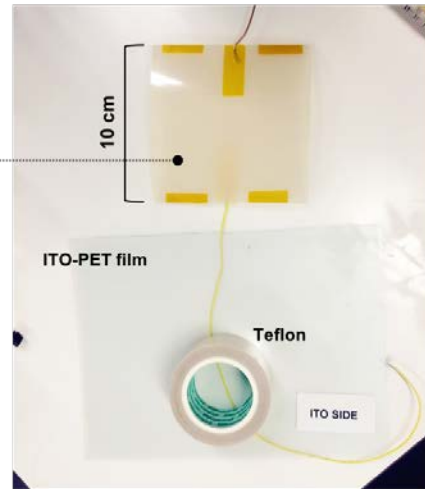
Develop a prototype of a self-powered sensor system to monitor the movement of the elderly in order to alert caretakers and medical personnel of any inactivity or trouble.

Unit array



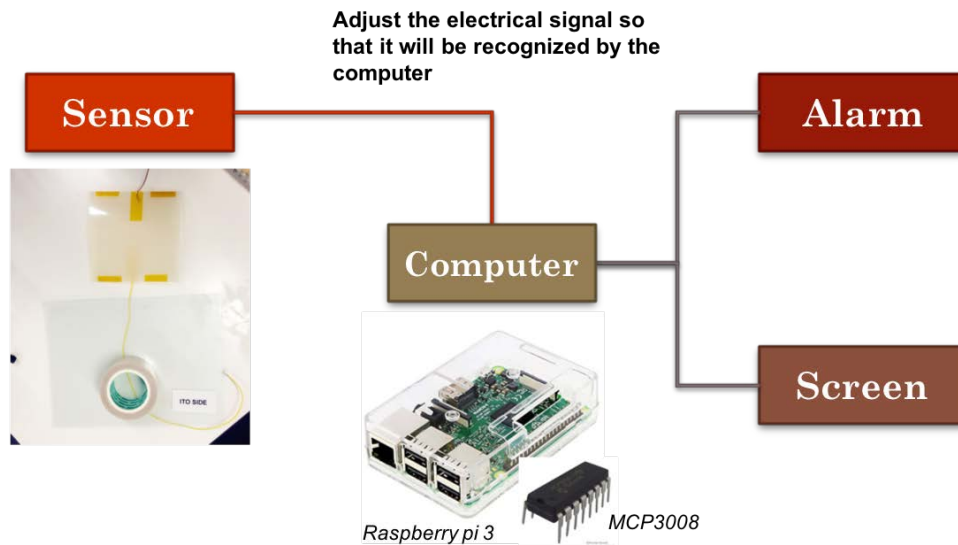
By tapping the arrays, signals could be collected from corresponding positions.

Triboelectric Energy Harvester



Cheap and safe materials

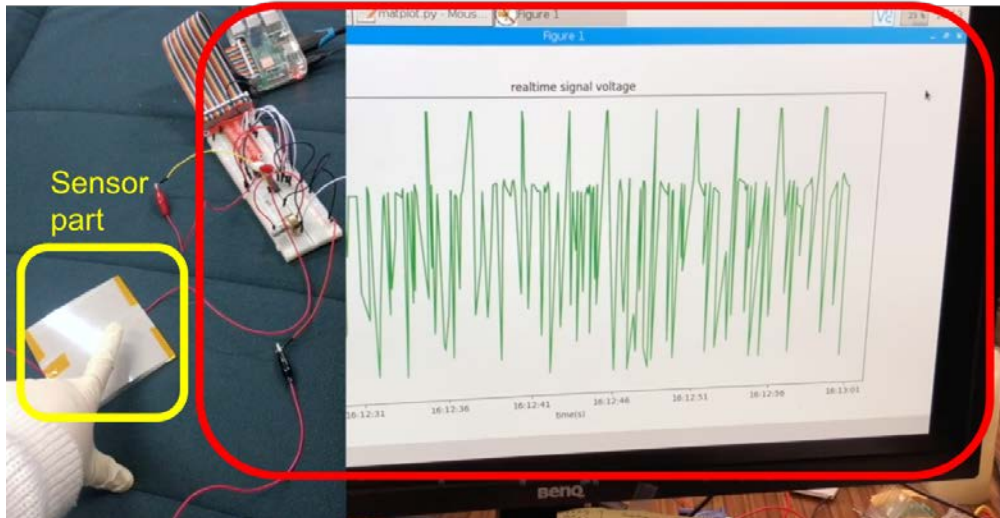
We made use of a novel technology called triboelectric energy harvester. Each sensor unit can convert external mechanical power into electricity.



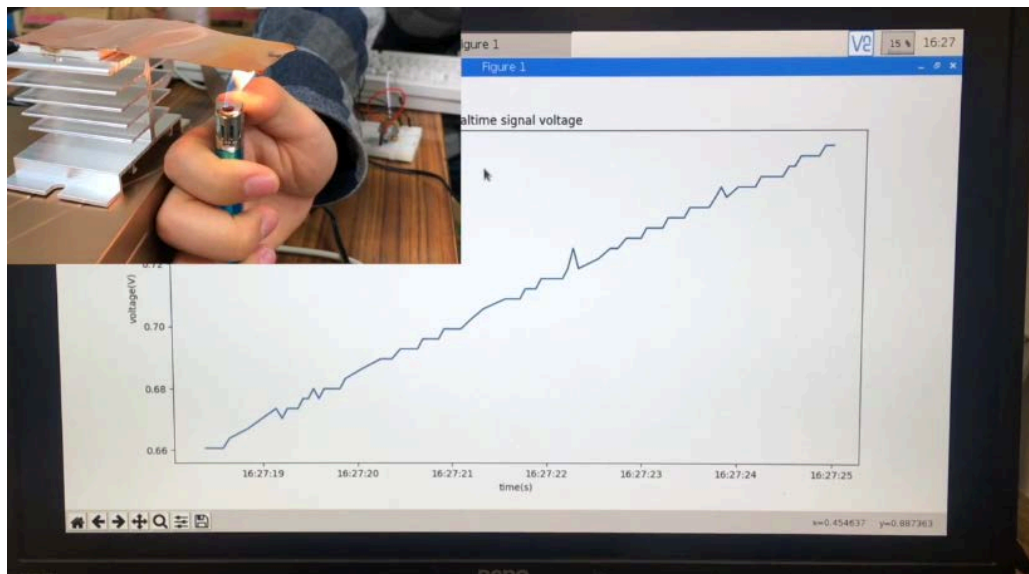
Convert the collected electrical signals into digital signals

Our system could be divided into three parts. The sensor part generates electric signals. The signals must be adjusted by external circuit in order to be recognized by the computer part. Computer part's task is to convert the collected electrical signals into digital signals. Then digital signals will be sent to the alarm and screen of monitor part.

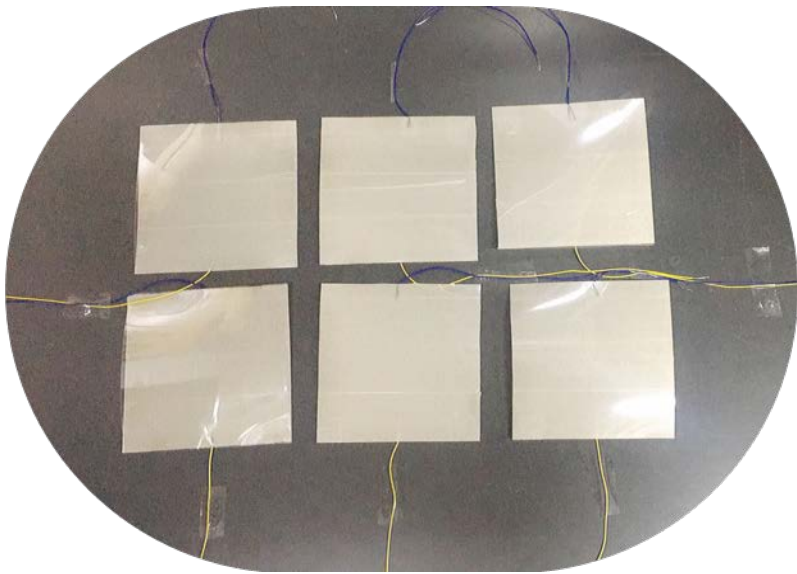
Monitor part



The sensor part is set in the living space of elderly people, and needs no external power supply. Just by tapping the unit, electricity is generated. The monitor part is for doctors and police. The whole monitor part is just a simple computer. It needs external power supply.



In addition to triboelectricity, we have also created a thermoelectric model. With its help, we can more precisely monitor the action of elderly people. We want to make the process fast, so we used very high temperature to show you its performance. Actually, human body temperature can also help generate signals, but cost longer time. This is an assistive technology to help us accurately grasp the information.



Sensor array will be integrated into a carpet. When volunteers walk on it, it is easy to gather information such as where the volunteer is or how often the volunteer steps here, etc.

Policy Recommendations

After completing stakeholder interviews and research on the target market, this team proposes several policy recommendations for society to address the issue of elderly living alone.

- (1) **Incorporate more innovative policies and/or devices to assist the elderly:** Much like the prototype that this project team designed, there is a need for more R&D for providing services and products for our identified target market of elderly people, in particular those who live alone.
- (2) **Partner cross-sector for initiatives such as private-public partnerships or social impact bonds for funding:** Through our target market analysis and competitive analysis, it became clear that there are two sectors working separately on covering the issue of caretaking for the elderly. If there is more collaboration between the sectors, there could be more innovative ideas that could serve our suggestion in (1). It is clear through the demographic analysis that the target market will only grow in coming years, providing a lucrative opportunity for private sector companies.
- (3) **Consider more applications of this technology if it is further developed:** As the elderly people living alone market grows, there will be a higher demand for electricity in general, not only for caretaking. While this technology now can power a low-electricity sensor, by implementing more of this technology it could power more apartments without electricity costs or fossil fuel usage.
- (4) **Build more family-oriented dwellings:** The high cost of housing in urban areas is a barrier for those who may wish to create a family and increase the native fertility rate of Japan. By providing better housing options and incentives for building providers, a long-term approach for combatting a low fertility rate could be devised.

Appendix 3. List of potential questions for interviews depending on sector

*Note: This is a list of all questions for all stakeholders. Some may be more relevant to others (for example, directly to caretakers or elderly versus policymakers, etc). **We may also add questions at the interview depending on how the stakeholder answers the questions, which may lead to additional insights, etc.*

Introduction: Briefly introduce the following and explain the objective of the interview below.

1. The interviewers and role in the group: name, year, department, etc.
2. The GSDM program and its goals: the Global Leader Program for Social Design and Management (GSDM) is an interdisciplinary doctoral program to train top leader's for today's global society. 21 departments are involved in an effort to develop students' talents in solving complex societal problems with innovative science, technology, and public policy.
3. The goal of this Student Initiative Project (SIP): our Student Initiative Program (SIP) is to create an innovative, low-cost, no electricity sensor alarm that can be left inside an elderly person's home and alert a caretaker if there is no activity sensed within a predetermined amount of time. With more and more elderly living alone in Japan, there needs to be an innovative way to combat the problem of untimely death or injury. (Draw a picture of the sensor prototype concept to explain our idea to the stakeholder).

Objective of the Interview: To gain more information about the business of creating a sensor device for the elderly, the situation for elderly living alone, and the needs of the market. Possibly also find out more about technological or policy constraints.

INTERVIEW: POTENTIAL QUESTIONS

Japanese Society, Government Health Officials, Caretakers of elderly etc. (understand the business & technological constraints)

1. How much of a problem is the issue of elderly people living alone for society? What are the main challenges?
 - a. Suggestions: death, no caretakers, doing daily tasks, etc.
2. What are the main concerns of elderly who live alone for caring for themselves on an individual level (not as much for society)?
 - a. Is there really a need for this kind of sensor application in their life?
3. How can we improve our project and sensor device so that it is useful to an elderly person living alone?
 - a. Suggestions: low-cost, free through subsidies from government, donation program, volunteer support, no device option, etc.
4. What are the limitations of the current market?
 - a. Why haven't other sensors or similar alert devices been successful so far?
5. What do you see as the barriers for this device being implemented in an elderly person's home? Are any related to government policy or fear of technology by users?
 - a. What policies are in place that could create limitations for this device to be implemented in all of society?
6. Is there any other advice or a future you could imagine for this kind of product?
7. If we designed the best product possible, how would you imagine it would function?
 - a. What kind of policy recommendations would you make?
 - b. How involved would you want the government to be (national, local)?

Elderly Living Alone (Understand our customers)

1. What are your main concerns about living alone?
2. Would you feel relieved if there was this kind of system in your home?
 - a. How could we improve the device to better serve your needs?
3. What would worry you if you had to keep this product in your home?
 - a. Suggestions: risk of device malfunction, obstructive, lack of privacy, technology implementation, etc.
4. Who do you prefer to be notified if you passed away (death)?
 - a. Suggestions: family member, caretaker, volunteer, apartment complex manager, hospital, etc.
5. Is there any other advice or a future you could imagine for this kind of product?
6. If we designed the best product possible, how would you imagine it would function?
7. What is your vision for a society that has more than 40% elderly?

For Private Sector Companies/ Technology Companies (Understand the business & technological constraints)

1. What kind of business plan and specifications would be necessary for a company to adopt this product?
2. What do you think are the main issues and target areas for elderly living alone in Japan?
3. What would a company expect the profit margin to be if they were to develop and market this product?
4. What are the expectations for a “minimum viable product” (MVP) in the electronics and/or sensor market?
5. Why haven't companies already created this product? (There are cleaning and caretaking services, volunteers who manually check on the elderly, etc.)
 - a. Is a no-electricity, low-cost one enough of a “value proposition” to attract customers or governments to implement this device?
6. What is the budget and schedule you would expect if you were designing and creating this product within your company?
7. What are some success criteria we could use for our prototype design?
8. Can you think of any competitors we could research for our project?
9. What advice would you give to start-up entrepreneurs designing a product like ours?
10. Is there any other advice or a future you could imagine for this kind of product?
11. If we designed the best product possible, how would you imagine it to function?

Appendix 4. Email templates in both English and Japanese for reaching out to stakeholders and key informants

ENGLISH VERSION OF OUTREACH EMAIL

My name is _____, and I am currently a global health student at the University of Tokyo. I am reaching out to you to inquire whether it would be possible to interview you for 30-60 minutes as a key-informant and stakeholder in an innovative project I am currently working on.

To introduce the project briefly, a group of University of Tokyo students in engineering, frontier sciences, and global health are designing an innovative self-powered sensor device for elderly people living alone.

In Japan, an increasing number of elderly have few or no relatives to take care of them, and there needs to be a private and low-cost solution to alert caretakers when the elderly person living alone has not moved recently within their home due to either a problem or death. We hope to solve this problem with our self-powered sensor device.

Our group is gathering information through key-informant interviews by reaching out to stakeholders and experts in the field to ensure we design a device that meets the needs of our target group, elderly people living alone in Japan.

Might you be able to help us by allowing us to interview you for approximately 30-60 minutes one day next week or before December 15?

If you are unavailable before Dec. 15, we would also be grateful if could interview you after the new year.

Thank you for your time and support. We would be honored if you would be able to support our ambitious endeavors in successfully completing a prototype design suitable for our target group for the betterment of Japanese society.

JAPANESE VERSION

東京大学国際保健学科博士課程の_____と申します。

〇〇先生に、現在私たちが取り組んでいる革新的なプロジェクトの鍵となる情報収集のため、30-60分ほどの簡単なインタビューをさせて頂きたく、今回連絡させていただきました。

プロジェクトの概要を説明させていただきます。

私たちが取り組んでいるのは現在大きな社会問題となっています高齢者の孤独死を防ぐための革新的な自己充電式警報センサーデバイスの開発です。このプロジェクトには、東京大学の工学部、薬学部、医学部などの専門の異なる修士、博士の学生が関わっています。

日本では現在少子高齢化に伴い、高齢者のお世話をする余裕のある若者が減少しています。そのため高齢者が一人で暮らすケースが増えています。この際に必要不可欠となってくるのが家族や近くの親戚に高齢者の突然の転倒や病気による行動の異常を知らせるデバイスです。安価で高性能な警報アラームセンサ

ーが求められている今、私たちは最先端技術を用いた効率的で高性能なセンサーの開発を目指しています。

そこで、_____の専門家であります〇〇先生に貴重なご意見いただくことで、日本の一人暮らしの高齢者というターゲットに相応しい製品のデザインにつなげることができればと考えております。

大変お忙しいところ恐縮ですが、来週の12/15までの期間で先生のご都合のよろしい時にインタビューに伺わせていただいてもよろしいでしょうか。

もし12/15までの日程でご都合が合わなければ、年明けにインタビューさせていただきたいです。

長文のメール失礼いたしました。ご貴重なお時間を私たちに割いてくださり、ありがとうございます。先生のお力をお借りして、日本の社会問題を改善できるような素晴らしい製品のデザインを目指します。ご検討のほどよろしく願いいたします。

Appendix 5. INTERVIEW TRANSCRIPTS

a. Interview with Professor Kyo Takahashi, Institute of Gerontology, Aging Specialist December 13, 2017.

(introduction of GSDM, SIP, our project concept, etc.)

His questions for us to consider: What kind of technologies already exist? He has heard of sensors in the light? Or family/ housekeeping machines. What's new?

Important to show newness if we develop an idea for social design.

- clarify our strengthen value proposition.
- Panasonic maybe makes one?

People may want to buy this product in the context of security. In this sense, public officers may want to grasp this situation more than the individuals themselves. It depends on the final design of the product and its purpose.

Example: disaster preparedness. The public sector wants to know where those at most risk (children, elderly, disabled) are. Geographic information. The system would help.

Also, care managers could benefit from using this kind of technology if the elderly is under long term care system (health coverage type in Japan). To know the user's life and lifestyle.

(How many elderly are covered by this system?) Maybe the younger elderly in their 60s – less than 20%. So the majority are not using this system.

The majority are taken care of by their family members even if not living together. Or do you know *Minnseiiinn* 民生委員. Community security? Community supporters.

Major problem: cost of long term health care insurance. The trend is increasing as more people age and we need to reduce the burden of it. There is no stopping the increasing trend, but instead we can try to address better living in the long term. Try to minimize the costs or effects.

In my opinion living alone is not the serious problem. It is a natural phenomenon because people live longer than before and a spouse or family member could die. Those living alone will increase. We don't need to see that situation as a problem. But the cost of long term care is.

For example: insurance. Some older people are likely willing to be found by this sensor in case of an emergency. Some have an emergency switch to call 911. Willing to have that kind of technology. But maybe they cannot reach the button for some reason.

(Are there limitations in getting elderly to accept this kind of device in their home?) Yes, maybe it can be that we have to convince them. It is definitely useful for the watchers, family members, public officers, etc. It could be that we tell them about security management (of solitary death).

Organ donation example. → Japanese people must fill in when getting drivers license if they wish to be a donor or not. Maybe it can be implemented through the 民生委員? The care managers, they could do it on behalf of the public sector and could watch.

There is also a concern about managing the information itself. A lot of information on movement will be gathered and will be expensive to maintain and manage it. Who will do that? Maybe only store the information or only detects something strange and alerts? The signal could simply be 0 or 1. It depends on the final purpose and design of the device.

Limitations of current devices: elderly and family members can easily access each other via telephone or skype. If they cannot reach them, then the family member would check.

Maybe an application could solve this. They could know when the elderly used electricity or hot water etc. Is this market too small or too much transmitted information?

A major barrier at the policy level if trying to implement this through an organization or public institution: privacy of the caretaker and elderly. If they disagree to provide information, nobody can get it. However, disaster preparation doesn't respect the privacy law. Those groups can collect information of those at risk for disaster. No privacy in a

disaster context. Even so if someone wants, they don't want to disclose information to public sector or third party. In this case they are not on the disaster risk list.

(What would your ideal design to help elderly be?) Some machine to help their toileting procedures would change their quality of life. It affects their day to day. For those who cannot move, some kind of vacuum system in the bed to deal with toilet procedures.

Also, we must consider the social context. We are social animals. Older people tend to lose network. Friends and family members die. Generation gap between grand children. Social assistance technology. Could increase quality of life.

(Is there a barrier to relying on one another as elderly for peer support or social systems? Or for checking on each other for this solitary death?)

Peer education could be good for helping with new technology or quality of life. But other times it can be a poison because those in the same generation, especially the elderly Japanese, do not want to share or trust others around them. They do not open to just anyone. However, if the other person is younger or from a different generation, they are not in the same field and could accept help or being open with them.

Setouchi jakucho – monk woman? (90 something) Published a book for daily living. There is a book about how this older female monk accepts this younger Japanese secretary and her directness because she is of a different generation. It could be that Japanese culture of the elderly limits reliance on one another for social support.

Another aspect of lack of trusting others in elderly is that to be older means to be cognitively impaired and depressed. These are age dependent factors.

What is your vision for being part 40% of the elderly society?

“sustainability” key word. We probably need more immigrants if we pursue the productivity. If we change mindset from productivity to happiness or some other measure, the activity would be different and maybe don't need as much productivity.

Also that 40% of elderly in overall society will be my generation once we grow old!

How about AI helping with productivity or taking jobs, affecting mental health of the world? Well, technology is important if we look at productivity. But happiness is not made by only that aspect. If the technology compensates for our losses in aging, it could be welcoming.

If he needed this device in his home as an elderly, who would he want to contact or how would it work? Honestly, for him after he dies it doesn't matter. Some elderly prepare more and want organization. For him it won't matter.

b. Interview with Ishihara Kana San, Social worker for elderly(社会福祉士), December 13, 2017. 地域包括支援センター、横浜市新羽ケアプラザ

(introduction of GSDM, SIP, our project concept, etc.)

<The situation of the elderly people>

300 people out of 3000 are now living alone around Nippa region. Some of them live alone in their home because they don't want to leave their own home. But many are willing to get into the Nursing home but cannot because so many people are waiting for the vacant and only rich people can get into the private Nursing home.

They also afraid of falling down when they are alone. No need to say that good sensors are in demand.

<The situation of sensors used>

Often the sensors used in elderly's home is just a emergency button. When they are in real danger and cannot reach to the button it is useless.

Nursing home or hospitals use nurse call for the emergency. And they also use sensor mat. When patients topped over, it will alarm the care takers.

Ishihara san have never heard nor seen of other kinds of (high technology) sensors before.

<What kind of product is needed?>

1. Easy to use (No need to operate by elderly people)
2. Cheap
3. Alarm family member or guardian in the case of emergency

(There is a high possibility of getting hooked up by the law of privacy if you alert the police officer. It's better to contact family members through the sensor.)

<Problems>

- It is difficult for the community center to catch up all the data of the elderly people living in their district.
- The pension of the Middle class people is too low. (There is no subsidy for the middle class people.)
- The number of Nursing home is insufficient.
- The manpower taking care of the elderly people is insufficient.

<Ways to solve the issue of aged society>

- Let healthy elderly people to take care of the neighbors who need help.
- Prevent ourselves from being various disease and becoming a healthy elderly people who don't need any medical treatment or care.

→the community center has already tried to execute these counter measures, however the real situation is not that easy.

c. Tatsuya Honda, Fujitsu Researcher and “Forbes 30 Under 30” interview (January 28, 2018)

He designed a small vibrating device that transmits sound vibrations through hair follicles for feeling sound for Deaf people. Called “Ontenna” and conceptualized during his university studies.

How did you come up with the original device concept?

Designed “ontenna” device during university. He often worked with Deaf students and created a circle and NPO to support them when studying sign language. Then thought was there another way he could use his design and engineering skills to help them?

These people cannot know if animal barks nearby or if a phone or alarm sounds, etc.

The idea was also based on cat fur and how they can feel sound around them through their fur.

How did you move from prototype in college to a new design?

He won a small grant for young students to design innovative products and managed to then move beyond the original wired device to a wireless device.

The vibrations were first on the clothes or skin. But “kimochiwarui” (didn't feel good”) or “mahi” (numb) etc, and on clothes was “wakarinkui” (hard to feel/know).

Then they decided the hair could be appropriately sensitive but still enough to know when it vibrates.

When you came up with the hair concept, did the test user tell you directly or did you think of it? How did you make the connection?

They designed several prototypes and tested and remade it over and over. Eventually as they eliminated options they could come up with this idea.

For example, people who can't hear at all or use any cochlear implant, they need vibrations for feedback. Originally they made a visual light bar that is low for small sounds and bright for big sounds. But because Deaf people use so much visual input for information, they are stressed when they see these lights abruptly and would rather have tactile feedback.

Then they had to decide where to then have the vibrations.

Was it a large group of testers? Someone different every time? Or the same one tester?

Actually, it was one tester. Sometimes after a round we would ask a few others, but generally we would only have one or two same testers try and give feedback each time.

For example, they tried it with a vacuum cleaner (it would unplug and Deaf person did not know and would continue vacuuming. As long as it was vibrating they know it is working.), a doorbell and others – it vibrates along with the sound pattern of the original sound.

How about trying to include others outside of the Deaf community?

So we worked in schools and could watch the students actually try speaking to feel the vibrations. Usually they don't use their voices much.

They did a tap dancing event in Shibuya to allow the public to try wearing them and experience watching tap dance with the device in their hair, both Deaf and hearing people.

So how did you move from the original basic prototype to the next iteration?

He was close to the final users and need to know exactly who is using it and what kind of environment. Then he had these testers try it many times.

How did you choose your original target group then?

An exclusive group or only that group. For example, we originally marketed for Deaf people who really love technology OR do not use technology at all. So in the beginning really try to focus on the target. Then you can expand to another group.

Something else we considered was there are many devices to kind of help them in emergency situations or safety reasons, but nothing that simply enhances their quality of life, such as being able to listen to music. This product could help them do that – and conversely, the product can then move beyond only this market to hearing people as well.

So how did you then get picked up by Fujitsu? Did you have a specific business plan or a pitch? What materials did you need?

So we simply pitched it by meeting a connection. Honestly, there was no business plan or anything else needed. All they wanted was the passion. It has been a 2 year project and will have final judgment in June. Fortunately the Mito grant helped the initial prototype to show how it could be a reality. That probably changed everything. I quit Canon when they wouldn't try my project and Fujitsu said they would try to help me.

So at Fujitsu now, do you feel they are accepting of this passion only or are looking for business profitability and other aspects?

Interesting you ask that because now we are building a schedule for final milestones. There have been a few shut downs regarding how the target segment is too limited and how this technology can be expanded to other groups who can purchase it.

(After introducing our SIP project)

I like the idea of trying to use the advanced technology in its current applicability now rather than continuing to wait for the research of tomorrow and wearable chargers for phones, etc. Could there also be more way to expand it to those who truly have no electricity? I could also try to introduce you to someone 65+ living alone in Japan to test it.

Make sure to have the prototype first and continue testing it as you go with the target segment rather than finish the prototype then test it. Do it as you go.

Something we are trying to do now is rather than have the people test it for only one day, they use the device for awhile and give feedback. They could take a picture with a polaroid camera and write notes of their feedback in that moment. Then they collect the pictures and consider how to update it. This may be too difficult to explain to an elderly person to do. Maybe just taking notes for ideas.

I want to know how to connect the sensor – doesn't it require electricity to transmit the data? Skeptical as to its true no-electricity possibility.

So back to Fujitsu – were there ever blocks to your ideas? How did you expand further with your idea when this happened?

Sometimes with Fujitsu – how to expand further when blocked because of money. We decided to try to make it more like an accessory rather than some limited use. We also go to the field and test it directly with the deaf schools or maybe working with the NPO to reach target market.

He is also working on ALS patients for new project. Moving eyes with tracking eyes.

Welfare products – always the negative point. The customer or patients will tell you what they don't like about life and you try to focus on that one point. You can't resolve all the problems.

(for example, sound is loudness and frequency, but antenna only focuses on loudness)

When it comes to implementing or distributing the product, have you ever had to try working with the government service to use it? Or only the private sector?

trying to do it only through private sector – and then maybe if not then do public sector.

Because it is an accessory. Trying to avoid working with the government because all of the paperwork and bureaucracy holds the ideas back.

What are some of your ideas for milestones or targets along the way?

Marketing strategies are at the deaf schools or events instead and then spread it out to the schools. Even for Fujitsu now it is an original case. Welfare product.

We had the Prototype, vision, user's face – showing them actually using it and that convinced them. How they experienced it.

They're in the planning stage now for future ideas. Trying to do something by the Olympics to be more inclusive.

They want to sell one real set of the current device to a school by June, in addition to collaborating with 4DX movie theaters for a cheaper better experience.

What happens if Fujitsu doesn't approve the project beyond June?

Then I probably quit and find another job! But there has been a bit of press about this innovative helpful product with the Fujitsu name. I doubt that would happen. But it has been 2 years and 6 months. It took longer than I expected to get to this phase with many barriers such as approval of testers and other issues. It may be easier to do these initial studies in a university environment. Such as liability if they get injured while testing your device, etc.

What would you be doing if you didn't have Ontenna project?

Probably still designing user interface for printers at Canon.

How do you define success along the way?

I take pictures of my user using the product to show its value in the market. Choose the target market exactly. Try to have them test it while you're still prototyping it.

Any other advice for our project?

Maybe you could check out Todai Hospital or some government housing area.

How does this compete with a motion sensor? Be prepared to fight other good and/or existing ideas.

Maybe you can track the level of pressure for a fall compared to a step.

Or during the earthquake there were electricity blackouts. Could this contribute?

d. Yamamoto Yuji interview, CEO of Minacare, Jan 30 2018

(Brief introduction of the project and asking for business advice especially as it relates to healthcare management)

Main things you need to consider are what man power, technology, resources within existing company do you have now?

It is your own property? Get a patent? If not engineers. If it is someone's property, you need to get license and pay the license fees.**

Who is actually paying for the product for profit? Who is happy using this product? Not only "iine" or that's nice. Think of who would think if you didn't have this would probably die and want it, etc. Then try to design it for this person.

(Go-san: the old person is still worried about self. So family does it for them. But because nennkinn is not enough, can't get device).

How do you approach them for this marketing? Who and which channel for how much?

Cost vs price are totally different – the in between is more important for profit margin. WTP.

Strategic price? How is it that your team knows why it's your product low price and if others can quickly imitate it then it'll get repeated. The core technology must be yours for patent.

You could be supplier for existing sensor companies. Instead we are trying to sell a service through multiple stakeholders.

Say if others don't feel we need the alarm all the way to the police or other groups. Even if it is just through the health care providers. Try to scale up once you try with nurse or human capital.

We don't want too much alarming or low alarming. → what is the threshold? Need to really change it to needs to work**

Instant business model? Could be that you are only a supplier to a service provider that already exists in this context. Then work with engineers to get exclusive licensing contract.

No incentive → who really worries about it? *Lisa: Building manager when people pass away unnoticed is a large one.*

Target customer should be property manager or construction? You could argue that the cost is lower if we find them earlier.

You could also consider the "Job to be done" – not just want to do. They want a tool to do the task that no one wants to do. Not just nice to have, but it is needed.

So if it is a service or supplier: How many sensors or elderly people can this person watching them through the software manage?

Does the customer pay for the person managing it, their hourly rate? etc.

How much does each customer pay for this watch person?

Is there a place that has enough to cover the costs of the watcher?

When does the service come? After the alarm goes off – the minutes. Is it a 2 minute delay, 10 minute delay, etc. Maybe doesn't actually help enough.

Lisa: Yes, in USA everyone likes to sue each other at the slightest problem. What if someone did not respond to the alarm in time?

Could do simulation to see if everyone falls down/ sets off alarm too much and how response time with caretaker.

Also think bigger picture for the market. How many times in one year do these phenomena happen? How many die or have to find this data? Not just die but fall down and then hospital? How much frequency? Not so low risk? Then becomes capital intensive.

Be a device supplier first.

(maybe cut the people who do programming etc. branding)

Not only find possible customer but have to find some partners for scaling up and testing phase. Even if we did want to implement it.

Something else to consider: is it acceptable to you if only the company profit goes up? Etc. For example, you give them a lower price so that the elderly people can access it – but if the company doesn't change the price and only gains a larger profit margin, then maybe you did not meet your goal to truly help people. This must be built into the contract.

The time gap of operating costs/ cash – when you have to pay suppliers or manufacturers before you get paid for your product. Cash is always king in business. Even if you make profit on profit/loss (PL) if your cash flow you will be bankrupt because people don't wait.

If only device supplier and payment interval.

Maybe if only MVP and licensing. Then if they're interested in your patent or license, then they will pay you in advance and could be lighter. Instant profit. Just give away the patent license instead?

Whose patent is it?

If it becomes team's property, who can divide up? Why can you be a team member of the patent? What's your value to the patent?

What if a company comes and offers more salary for the patent, and you fire the non-essential person. Build a contract in the beginning for mutual commitment or agreement. Team building essence. (*Lisa: this is like marriage.*) Haha! Yes.

Any other advice for us?

Why not talk to service places? What are the needed service parts for that idea? How many years can you use it and then replace it?

Not the end user. Industry side who is struggling to make the right market or product? Often the problem with this "mimamori" products is no one can sell them. No one actually buys them. Find out who will actually hand over cash for this technology. As you meet more stakeholders, you can try to also identify potential business partners for if you do produce the product.

Lisa: what about if AI reads the data instead of a human watch? The government would definitely be more on board with this concept.

e. Tomihara Sayaka interview, Deputy Director, METI healthcare industries division, January 31, 2018

(briefly describe our project and goal of interview)

So the first thing to consider is who is benefitting from the device itself? Of course the elderly but also nursing homes or children who live far away. It may be easier for the staff who work for elderly people.

The local government may have a benefit. But there is a concern – is it actually cost saving or not? Yes, it can be good to do preventive measures that allow them to live more actively and longer. However in this case it is only an alert system.

We are using SIB (social impact bonds) as a funding mechanism for some new innovative technologies in this area. The way to use this is to see if you gain more later or somehow now, etc.

****Something she wants to know: Is it waterproof? Could it work in the bathroom? Most elderly people don't fall down in the middle of the apartment as much as in the toilet when sitting and getting back up, or in the shower or bath tub.**

We have some feedback that they want a wearable device that is also water proof.

Lisa: Yes, and if they are elderly maybe they forget to charge existing waterproof wearable devices. Something unique about our device is that it requires no charging or battery operation. And for maybe elderly people who have dementia.

Yes, this is certainly a concern. Maybe in the bathroom they also have increased blood pressure from the temperature of the water.

Something else to consider may be what does this replace if we use the device? For example, maybe have it alarm more during the testing phase to be sure you don't miss any problems, then as it is optimized and improved from feedback can know what the alarm threshold may be.

As for this – is it a service or a supplier? May want to consider only supplying rather than a whole system as this costs more and more confusing who to apply to. Some businesses have an option where they add this security feature on to home security services in general. This helps elderly feel safer.

SIB schemes are interesting but take a lot of time. Local government fairly large scale not just five or ten homes. Need larger scale. Building managers may be a good idea.

What are some of your main concerns as you work on active aging and other policy areas?

Medical issues and elderly nursing issues. For the latter, several issues not addressed. As you mentioned, they are very lonely. To have them continue to work or connect to the community. Some academic work shows that those who are involved in community do not fall ill like those who are lonely. So now there is evidence that community involvement prevents illness which helps the cost of caring for illnesses.

This is especially the case for men and women. Women are better getting into community to be more involved. For men, it is hard for them to find a new role in new context after retiring at 65. How to empower active senior people.

Another concern is the payment and incentive system of health care workers. Payment system for elderly care in nursing home, if they get sick, the health care worker gets paid more because time and expertise. So now there is no incentive for elderly to make the individual get better. It is not a good business model.

On the ground level. Compare to medical issues for a disease, if you prescribe a medicine it makes you better. We are wondering what kind of nursing care will make them get better? Misplacement of incentives, good stories of nursing homes that empower and improve their illness. But these are only stories. Only stories is not enough to change all of nursing in Japan.

Lisa: (positive deviance of which ones that are good?)(what is the measurement of good?)(involvement in community during working age years?)

Lacking workforce to care for elderly people. How to improve elderly's condition. Now is only taking care of them and watching them go down. Hard job. If we could show them somehow that their efforts improve the conditions, more people may be motivated to help.

Disincentives for workers, plus lack of workers. Evidence-based good methods is not enough.

Change the work style of Japanese population so they can stay connected to the community even if they get ill. As your model shows, lonely elderly will increase.

Finding a role for themselves – women can do this. Men when working for 50 years cannot find a new life. No big hobby or volunteer activities. There is a hierarchy where people listen to you at work once senior but in real world it is more flat.

Lisa: (private sector elderly alumni association?)

Continuous care retirement communities – in USA ? ** check.

They create them near universities. Senior place next door. Another department is trying to start a new initiative like this. Borrowing idea from US. Didn't go well because went out to rural areas branding. She still thinks this idea could be successful if rebranded.

Lisa: Do men cost more as well? She hasn't looked into it. But she does believe that most business workers sharply cut off involvement once retiring around 65 and go downhill from there. If it could be more gradual, they may be healthier long term.

Women 10% have steep decline and die or bedridden, 90% slow deterioration. Versus 20% of men are steep decline or die/etc, 70% slow decline, and 10% are actually genki. (*Who are these 10% genki men?*) She says they are mostly leaders or worked many extra years in high-level positions, shachou, etc.

Is declining fertility is in the same issue but very separate?

After 2042 the elderly also decrease too. Not having enough children is the bigger problem. If parents have to be cared for it affects lifestyle of children. Certainly fertility is the larger issue in this problem.