

Safety and Security for elderly living alone

Guide: Prof. U. A. Athavankar

About the Project



- To design an interactive security device/**warning system** to make elderly feel secure when they are living alone or as a couple
- Communicate** to the right people about the threat at the hour of need
- Not act as a device or a tool to attack** the attacker

Need of the Project

Every 10 out of 100 persons in the urban cities are in the age group of 60 years or above *

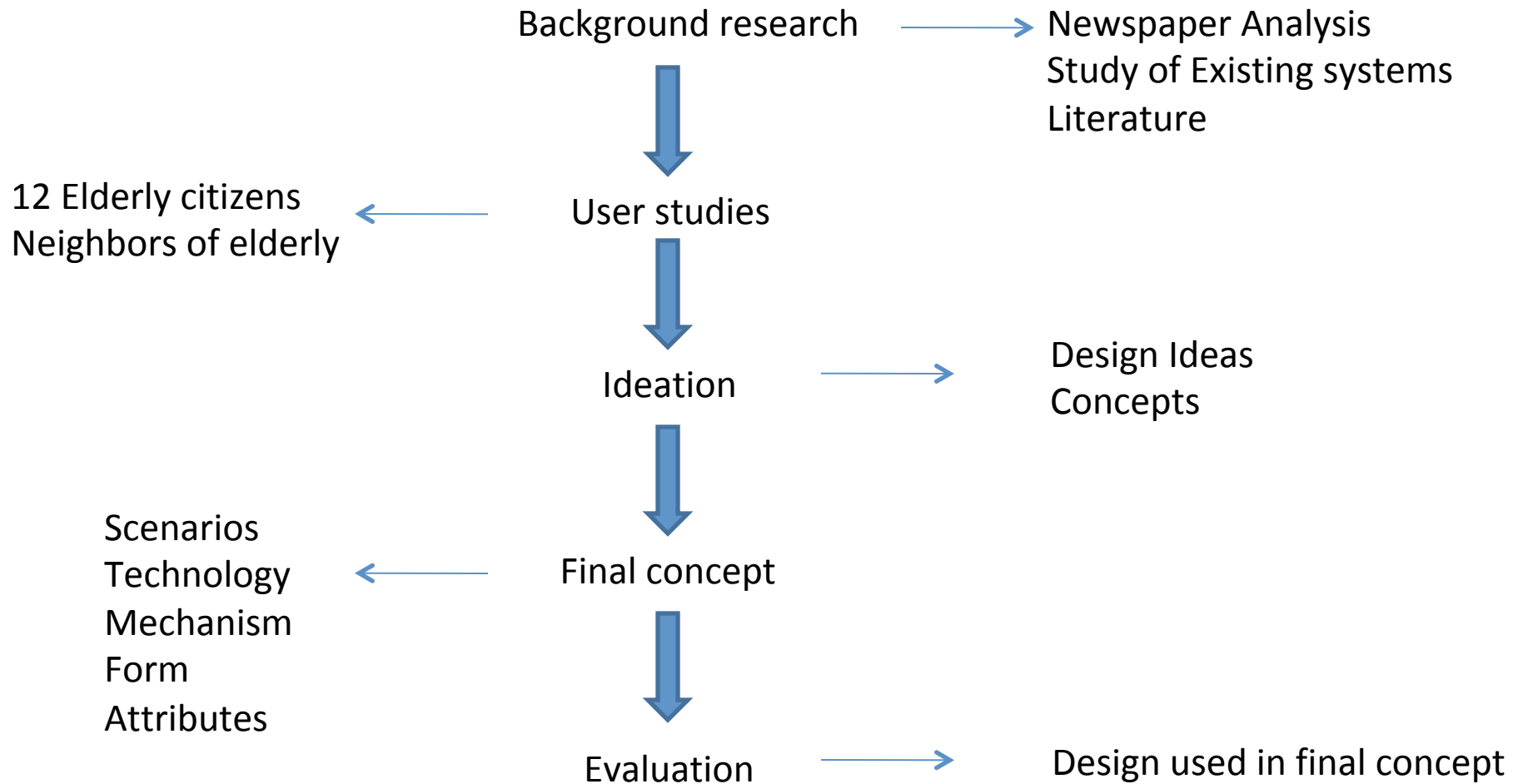
They are the most vulnerable when it comes to crime

The vulnerability of elderly towards crime is reflected from the numbers but more than that, it is the fear towards crime itself that the elderly face (Skogan, 1978).

They take more precautions in their day to day life to avoid potential crime and hence are more likely to stay at home (Brogden M, 2000).

1. Do elderly feel secure being alone in home?
2. Are they indeed secure?

Methodology



What from the background study?

Newspaper Analysis

Printed from
THE TIMES OF INDIA

Elderly once again cry for help

Kapil Dixit, TNN 28 August 2009, 10:02pm IST

ALLAHABAD: The brutal killing of an octogenarian has once again raised the issue of saf
breakers. In fact, this was the second case reported in city after the Handia incident, in v
done to death in a remote

The Lukerganj incident on
have the lone option to se

Officials too claim that the
place to ensure security fi
of relief at their houses wi

Ironically, the khaki-clad s
last eight months, seven e
police into actions.

The senior police authoriti
about security measures :

Apart from heinous cases
officials to save them from
targets for criminals.

Nothing was done till date
from the previous incident

Printed from
THE TIMES OF INDIA

Crime against elderly: Delhi tops list

PTI 16 June 2009, 11:38am IST

NEW DELHI: In some bad news for the elderly, the national capital tops a list of cities as far :

According to a study by HelpAge India, an organisation working for the welfare of senior citize
when it comes to crime against older people.

In Delhi, home to nearly a million senior citizens, crime against elderly people is four times mo
claimed quoting data from the police of the three cities.

The organisation said of the total cases of crime against elderly registered in Delhi last year,
followed by murder and robbery which accounted to 35.5 and 13.3 per cent respectively.

The woes of seniors seem to be basically sourced from their own children and relatives with :

Nearly 50 per cent of perpetrators of such crimes are children and children-in-law, followed b

The maximum number of property-related torture cases have been recorded in South Delhi, k
per cent of such cases have been seen in central Delhi.

The survey found that while one out of eight elderly said "no one cares they exist", about 13 p

"Abuse of senior citizens often starts at one's own home. But fear of family shame, continuou
from going out of the four walls," said Kapil Kaul of HelpAge India.

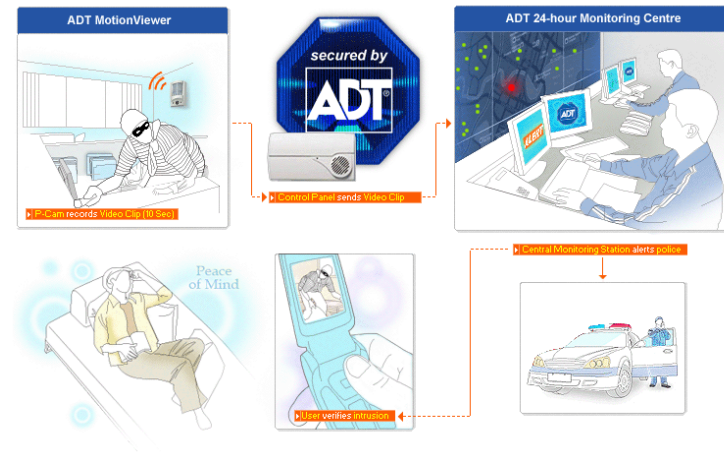
He said such abuse also comes in various forms -- physical, emotional psychological and fina

1. The crime is being committed by the family cook or servant himself.
2. Thieves overpower and tie up the elderly and then commit the crime
3. Foundations like Dignity and Help Age India help in creating awareness (promise to visit once in a week) and providing helpline facilities (which elderly scribble in a telephone book kept in the hall)

What from the background study?

Existing Security systems

Many systems exist to help prevent crime from happening when people are not in their homes, few systems are available to help people fight the crime or defend themselves or communicate when they are inside the homes.



Video monitoring systems help in knowing the identity of the person at the door step but what if the crime is committed by a house member or their servant itself?



There are personal gadgets to be worn or used by elderly frequently available in the market but they have been to provide specific functionalities like monitoring the heart, Blood Pressure, sugar levels or keeping track of grandchild, pets etc.

User Studies

Insights & Observations

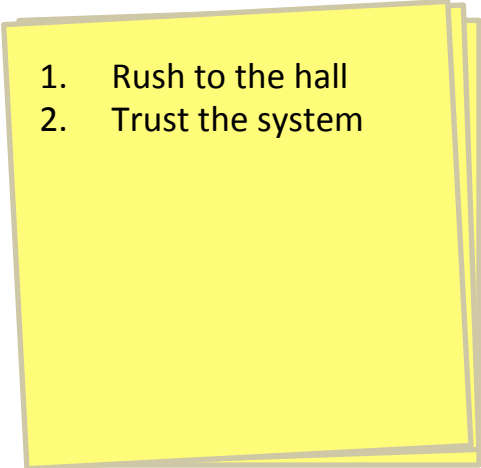
1. Since phone book is kept in the hall, in case of emergencies they have to always **rush to the hall** to call someone, as all contacts are not known by heart.
2. Elderly people being religious visit temples (long trips) and pilgrimages often, then there is a high chance of their house being burgled.
3. Elderly citizens need a system to monitor the activity of the guards to **trust** them.
4. Safety door is a must when living in an apartment.
5. Social contact with the neighbors' and other people from the colony is very important for an elderly citizen.

Key points

User Studies

Insights & Observations

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- 
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 2. Trust the system

User Studies



Breakdowns

They sometimes **forget** things – like removing key from the lock.

Elderly need a contact-list which shares information that can be **easily retrieved**

Neighbors want to help the elderly but are busy with their day to day routine that they lose track of time

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User Studies



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2. Trust the system
3. Forget things
4. Easily retrieve info

Design Brief

The aim of this project is to design a security device, for elderly people, which would trigger a warning system and alert nearby neighbours and security guard for timely help.

Essential:

1. The device must be able to **call for help within 5 seconds** when activated.
2. The device must be **easy to use** in extreme circumstances (elderly being hit by someone, elderly falls down, elderly unable to see, elderly unable to move).
3. The device **must be inconspicuous** and must not reveal its identity of a security device.
4. The device must alert the elderly or the system **about its existence**.

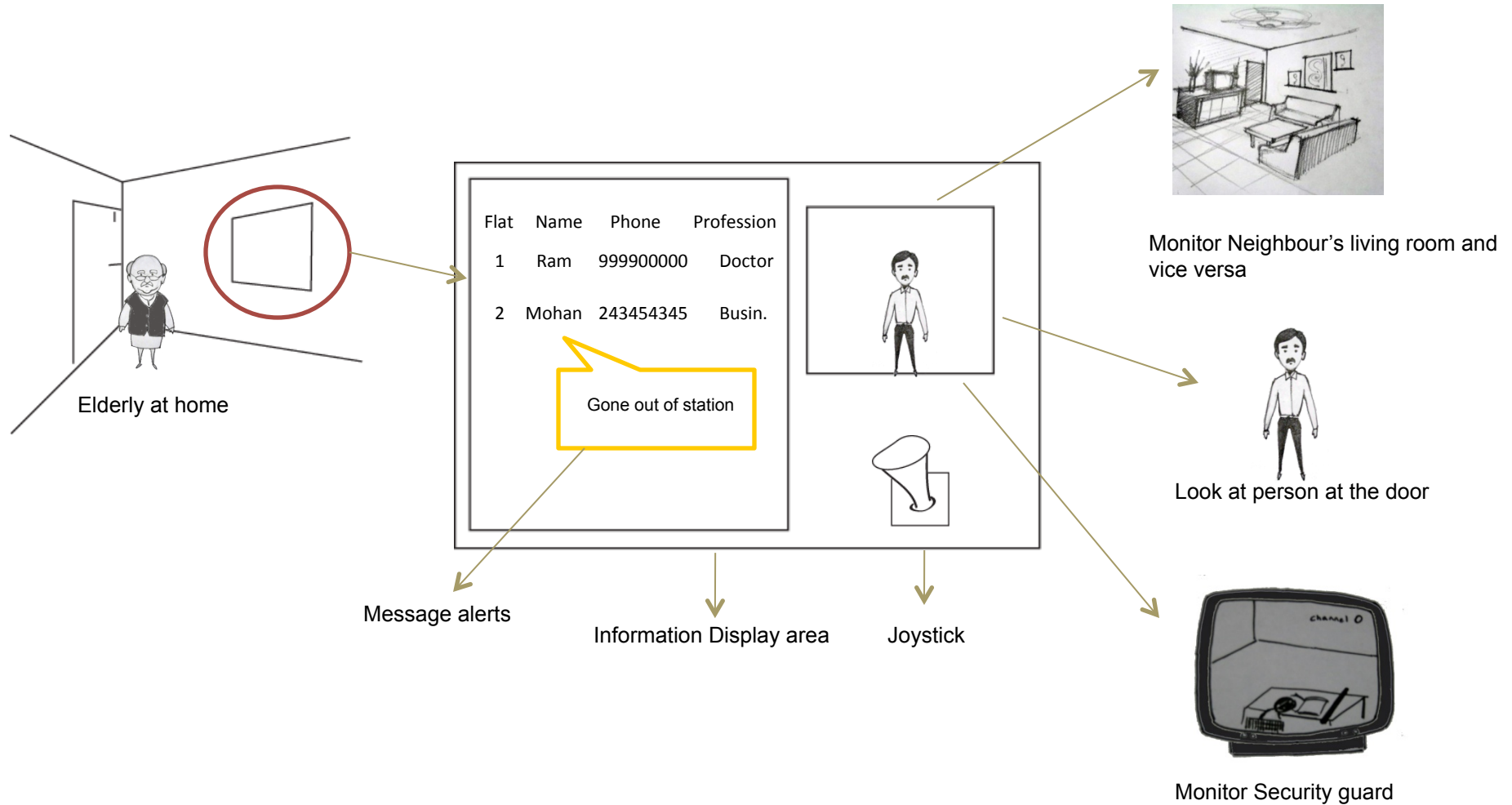
Desirable:

1. The device must be always **within the users reach**.
2. The device must help in **authenticating a person** and monitoring his activities.
3. If it is a wearable device, then it is desirable that it is independent of a power source, to **avoid being bulky**.

Incentives:

1. The device must **retain the cultural identity** of the system that elderly live in; thereby making the elderly to use it regularly.

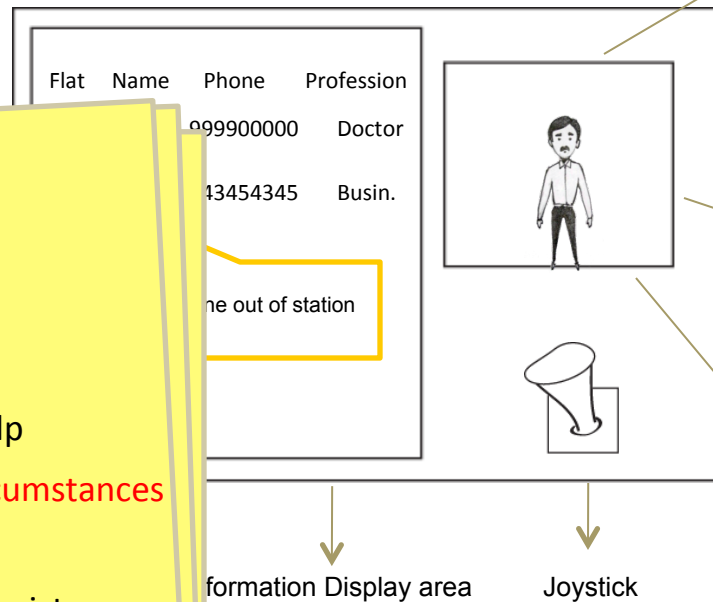
Ideation – Concept 1



Key Points

Ideation – Concept 1

1. Must not rush to the hall
2. Trust the system
3. Forget things
4. Easily retrieve info
5. Must be able to call for help
6. Easy to use in extreme circumstances
7. Must be inconspicuous
8. Alert the elderly about its existence
9. Must be within the users reach
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11. Must not be bulky
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Monitor Neighbour's living room and vice versa



Look at person at the door



Monitor Security guard

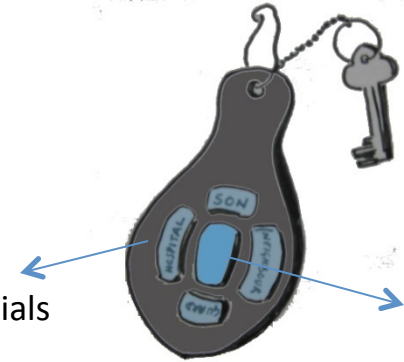
Ideation – Concept 2



Key chain



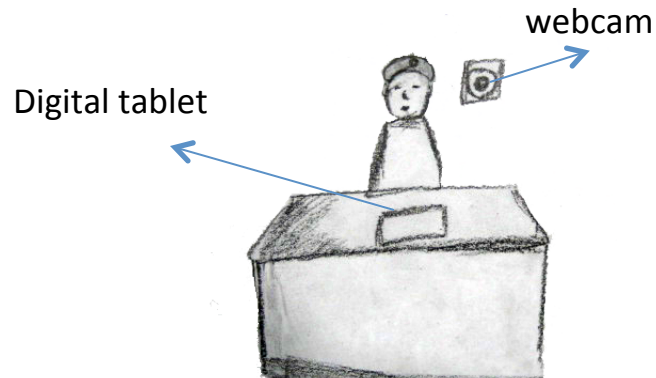
Watch



Speed dials

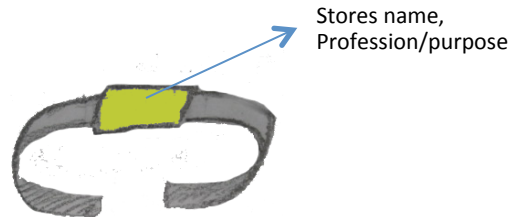
Door alert

Multipurpose Key chain



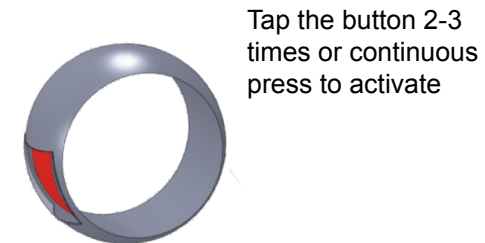
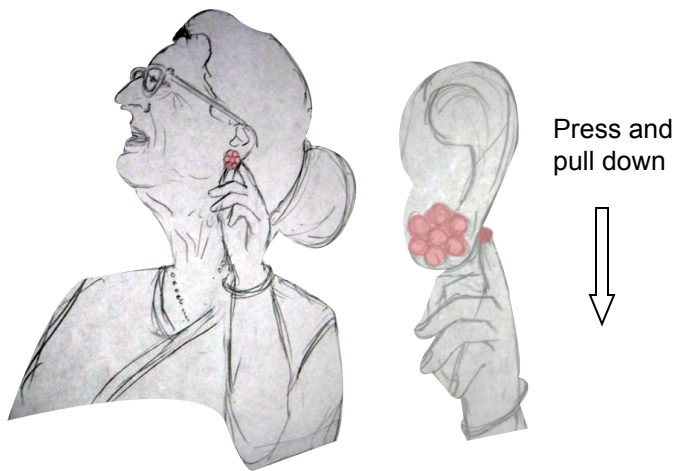
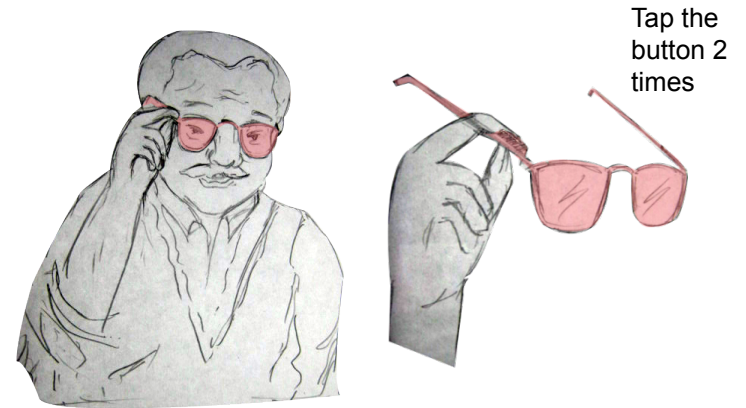
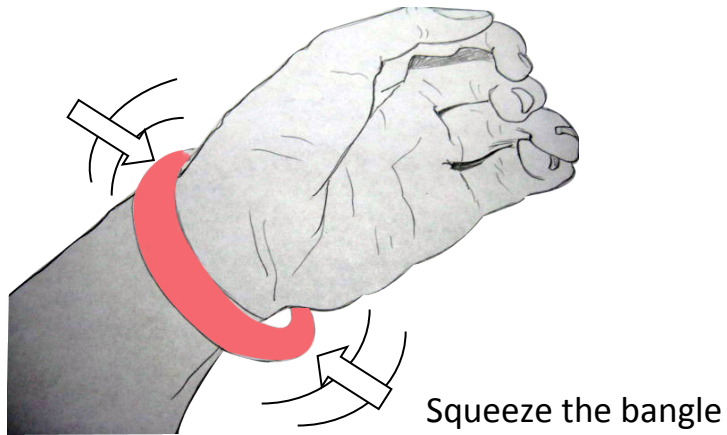
Digital tablet

webcam



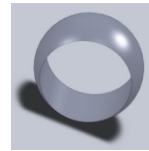
Stores name,
Profession/purpose

Ideation – Concept 2 | Wearable Technology



Ideation – Concept 2 | Wearable Technology

1) The elderly activates the wearable device, which has an RFID tag in it. The RFID reader detects the distress signal and video camera inside the house switches on automatically

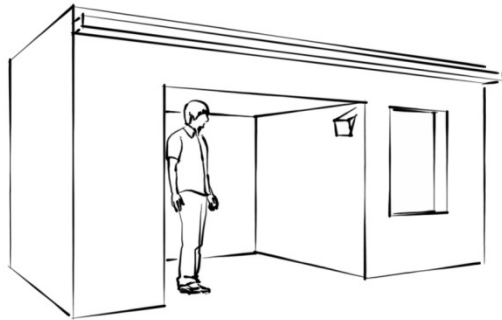


Ring



RFID tag

3) The guard verifies whether it is a security or safety related issue or just a false alarm through his video interface and immediately rushes for help



RFID reader

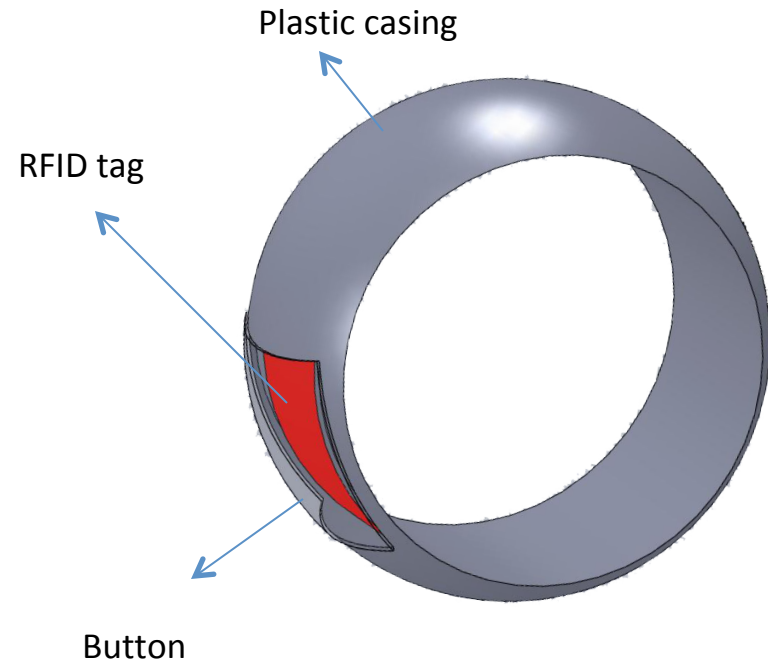
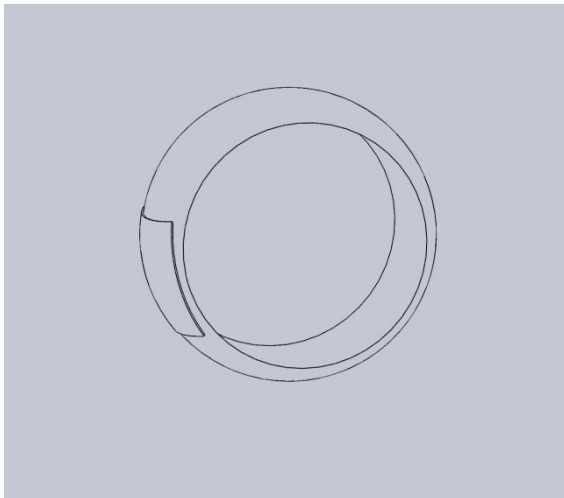
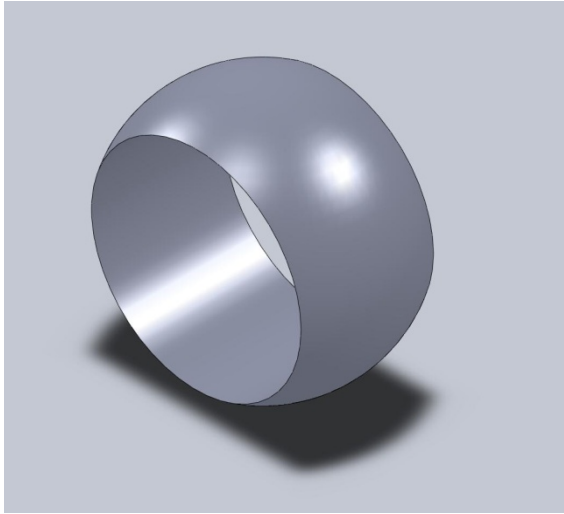
Surveillance camera

2) The video is relayed to the security guards interface which has quick dial options to intimate the elderly's nearby neighbors and also has emergency numbers



Security guards interface

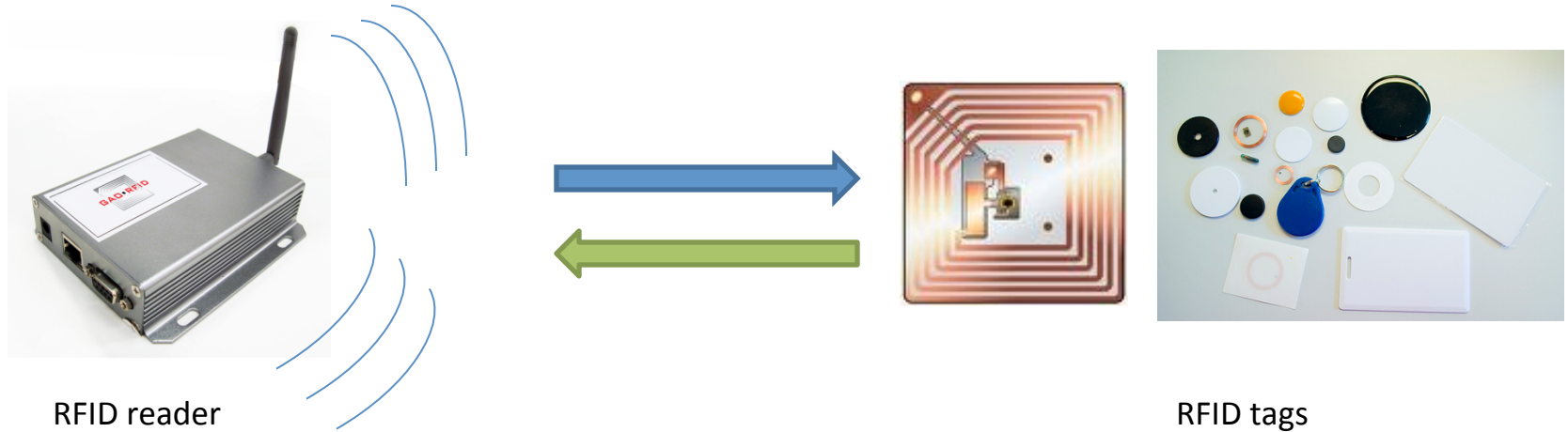
Components of the ring



Security Guards interface



Technology



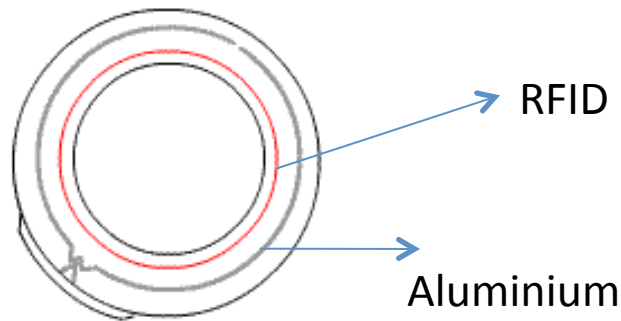
RFID (Radio Frequency Identification)

Active and Passive RFID tags

Passive Low Frequency tags (125-135 kHz) can be read up to 30 cm away,
High Frequency tags (13.56 MHz) up to 3 m away,
Ultra High Frequency tags (2.45 GHz) up to 7 m away,
and active tags up to 100 m away or more

Mechanism

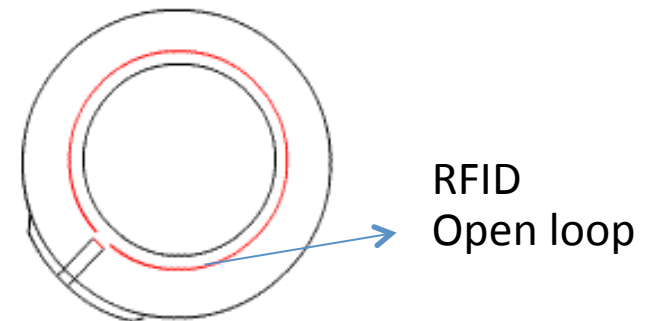
Mechanism - A



Aluminum

Mechanism A: A thin layer of aluminium surrounds the RFID tag. As metals rebound radio waves, by default the ring will be in the de activated state. When the button is pressed, the aluminium layer opens up allowing the radio frequency waves to get in.

Mechanism - B



Close the loop/spring loaded

Mechanism B: A part of the circuit of the RFID tag is kept open and when the button is pressed it completes the circuit and gets activated.

Scenarios



Invisible Security

1. Doesn't let the person know about the alert.
2. Doesn't embarrass a regular guy.
3. The elderly can alert guard of any suspicious moving guy
4. (A person going up and down the stairs, standing in front of a door for a long time etc.).
5. The elderly can alert guard even while sitting and chatting with a person inside the house.

Scenarios



Easiest to reach

1. The ring is the easiest to reach especially in a scenario where the elderly is being tied up and is unable to move.
2. It is difficult to forcefully pull out the ring, by the intruder unlike a necklace or keychain or watch.
3. In case the intruder tries to pull out the ring, the button will get pressed, as it is difficult to remove a ring from a finger. So the force applied will cause the button to be pressed.

Scenarios



Easiest to activate

1. The ring is easiest to activate especially in an unexpected scenario.
2. Recording of identity is helpful only to a certain extent, if the servant (or cook) decide to commit the crime; the elderly has to save himself.

Scenarios



Easily reachable when elderly is temporarily disabled

1. The ring is helpful especially in a state of total confusion where the elderly doesn't know about what is happening around.
2. In that state it is best to hold on to a device that is very near to you and activate it (or press or hold it tightly, squeeze etc.).
3. In this case the RFID reader will detect the presence of the ring continuously for 2-3 seconds and then alert the guard.

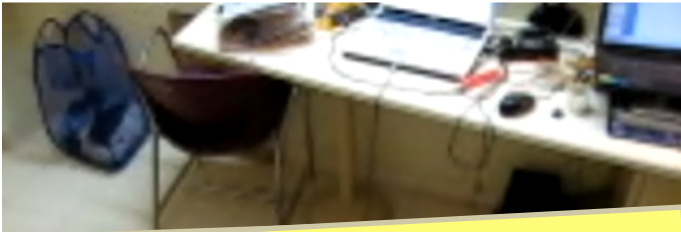
Scenarios



Can be combined with other forms of electronic safety devices

1. The RFID reader can be programmed to open the front door, and also alert the security guard etc.
2. Other systems like the heart monitoring systems can be synched with the ring to help in sending out an alert signal to the security guard even in the case the elderly forgets to press the button. For instance due to the sudden rise in the heartbeat the heart monitoring system may cause the ring to vibrate which will remind the elderly of the button.

Scenarios

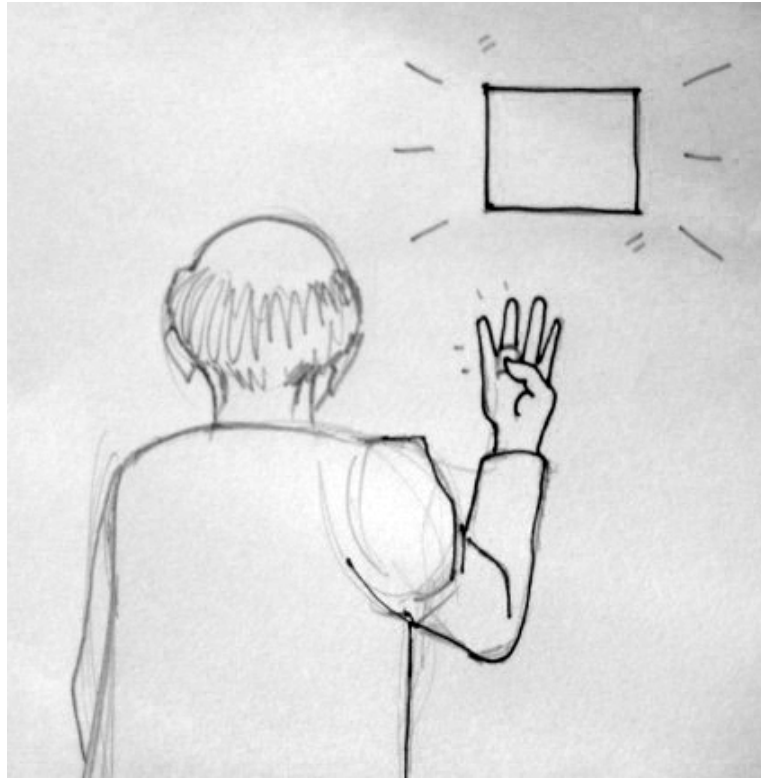


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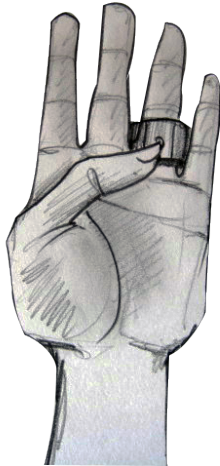
1. Must not rush to the hall
2. Trust the system.....???????
3. Forget things.....???????
4. Easily retrieve info
5. Must be able to call for help
6. Easy to use in extreme circumstances
7. Must be inconspicuous
8. Alert the elderly about its existence.....???
9. Must be within the users reach
10. Help in authenticating a person
11. Must not be bulky
12. Retain the cultural identity.....???????

Will the elderly remember to activate ring?



Drill conducted every week where elderly has to activate the ring to switch off the beeps from the reader

Interactions



Triple press or continuous press for activation of the button



Groove on right side to help elderly tighten ring onto any finger



Photo of God on the top of ring to help him align the ring properly so that the button side of the ring faces the thumb

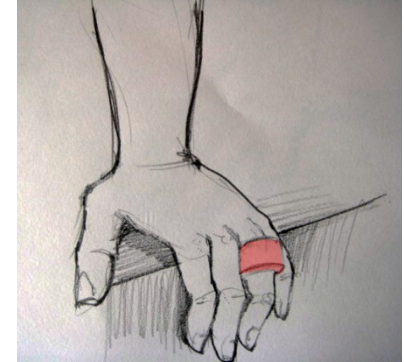
Interactions



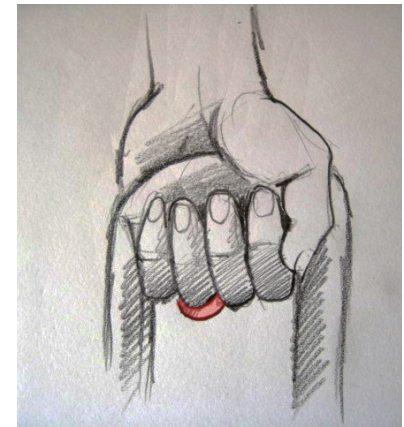
Countersunk to help avoid false alarms



Tapping on the floor

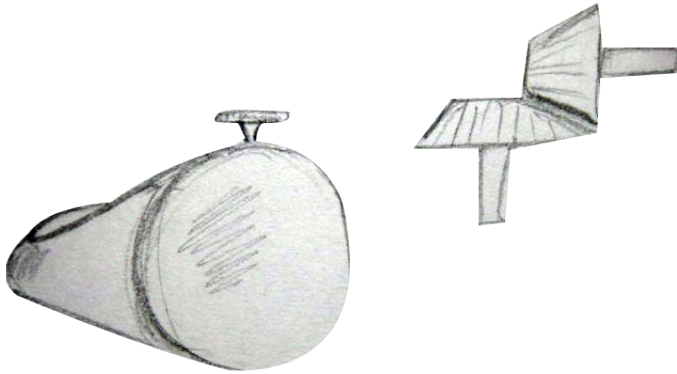


Holding surface for support



Holding a bag with weight inside

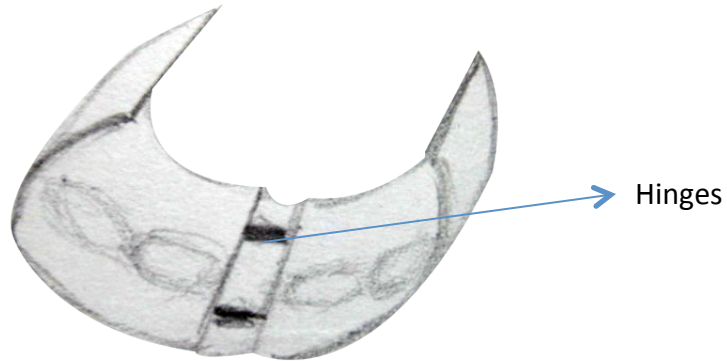
Form explorations



Mechanism to adjust the diameter of the ring using bevel gears



Mechanism to adjust the diameter of the ring using flanges (left) and screw (right)



Hinge type ring for easy fit

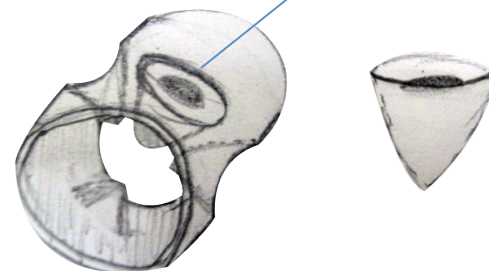
Form explorations



Shapeable ring using flexible materials



Broad ring with buttons all around the circumference



Buttons in form of cones

Broad ring with countersunk buttons in form of cone extrusions on the inside

Attributes

Simple and cheap look



Copper rings

Attributes

Simple and cheap look

Devotional



Images, symbols, inscriptions of God

Attributes

Simple and cheap look

Devotional

Health



Copper rings



Magnetic rings



Tungsten with gold
Multiple metals

Attributes

Simple and cheap look

Devotional

Health

Superstition



Rings with gemstones

Attributes

Simple and cheap look

Devotional

Health

Superstition

Memorable



Wedding rings



Favorite rings

Form

Tightening of the ring



Ring must not rotate, so that the position of the button doesn't change



Evaluation

A certain set of qualitative and quantitative experiments were conducted to ascertain the type of interactions that is being associated with the ring.

Two types of rings were used in this case –

- 1) Button as an extrusion outside the ring and
- 2) Button is countersunk on the surface of the ring.



A LED (light emitting diode) was connected to the ring and a 3 volt micro lithium cell. So each time the button gets pressed a visual confirmation is got from the LED glow that is strapped to the user's wrist for experimentation.



User (age:72)



3V battery

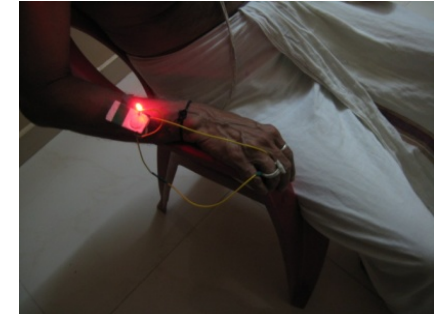


LED

Evaluation

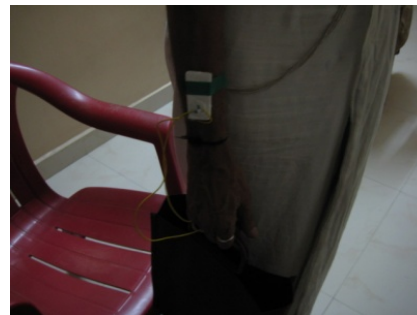
Experiment 1: Which ring in which finger is more comfortable for the user?

Countersunk – ring finger



Experiment 2: How often the ring gets pressed while performing daily tasks?

1. Lifting a bag with weight inside
2. Holding the chair handle for grip when getting up
3. Taking support of the wall while walking
4. Shaking hands with another person
5. Clutching the fingers tightly



Countersunk button

Normal button

Evaluation

Experiment 3: Which ring gets pressed unintentionally while performing user specific activities?

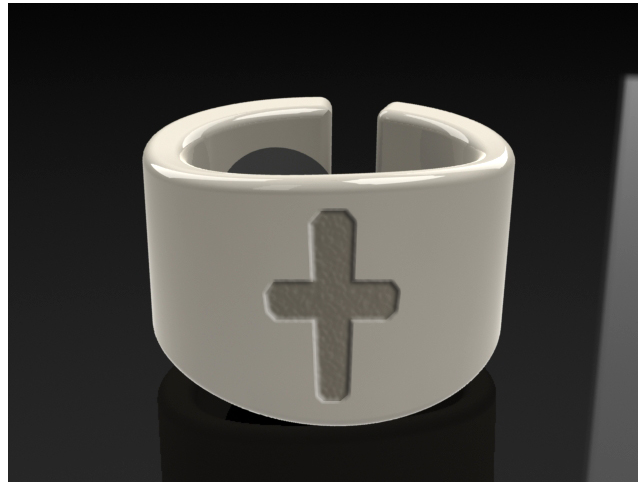
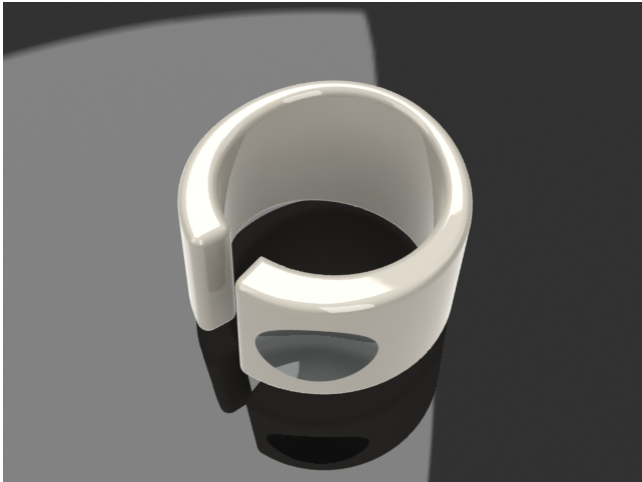
1. Playing with the ring
2. Rotating the ring

Countersunk is much more effective than normal button in not getting pressed



User 2 (age:69) using a Normal button

Final Design

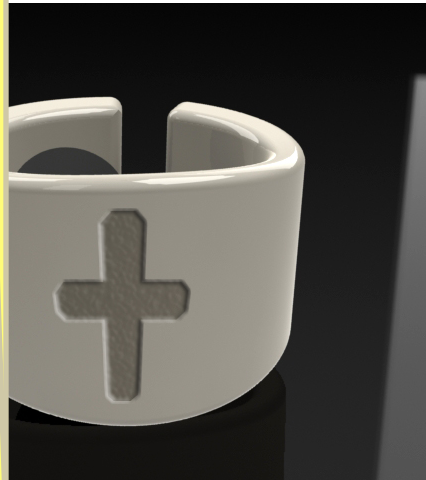


Key Points

Final Design



1. Must not rush to the hall
2. Trust the system
3. Forget things
4. Easily retrieve info
5. Must be able to call for help
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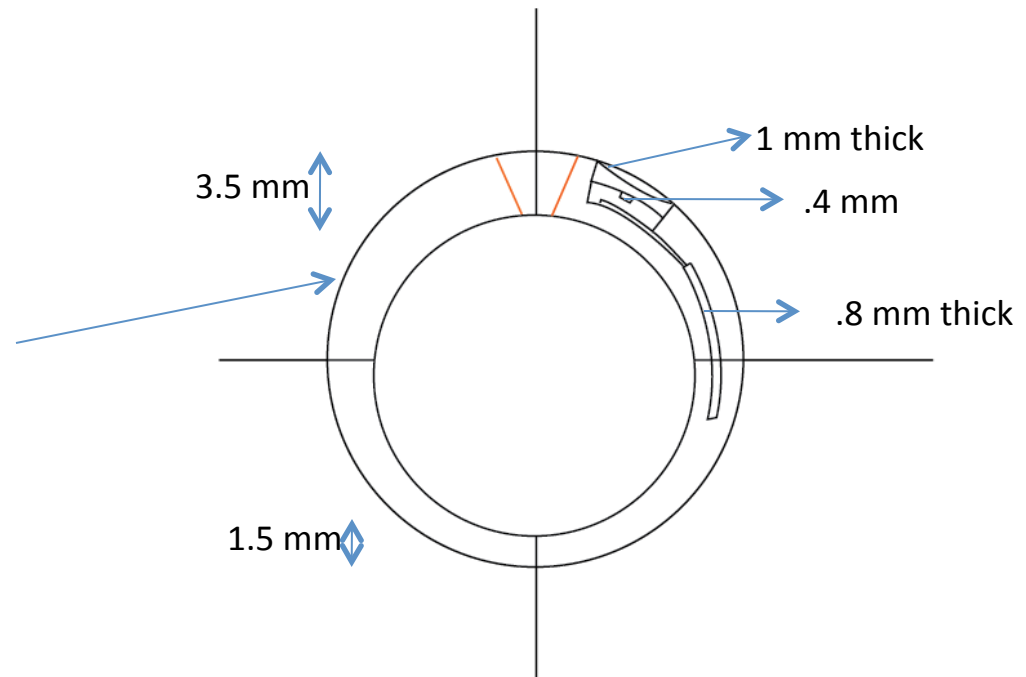


Material

1. While taking food, must not react to chemicals
2. Must not be reactive to skin
3. Must be resistive to hot temperatures (while taking bath with hot water)
4. Must not wear out, if a part of it gets consumed, it must be harmless to body.

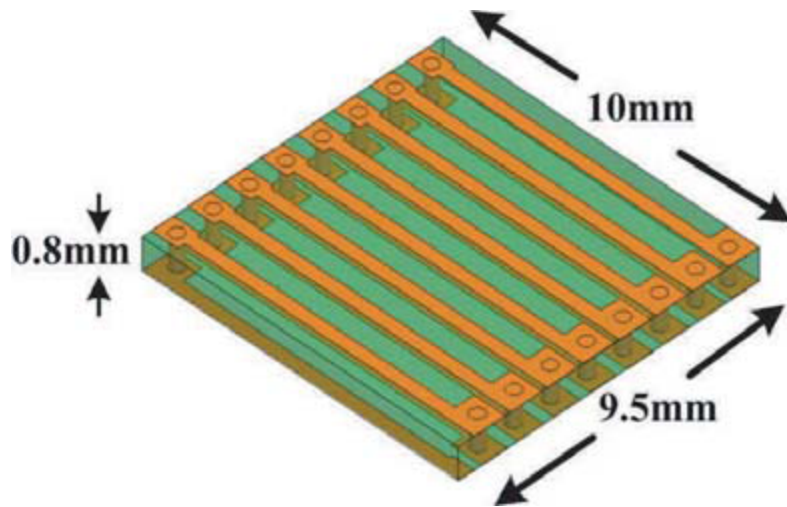
Thermoplastic Elastomer

Flexible Plastic

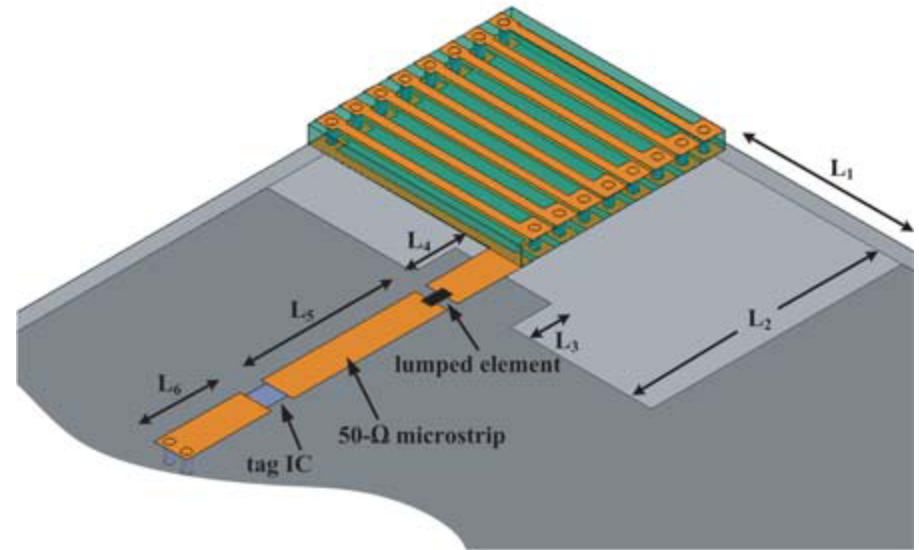


Range of RFID

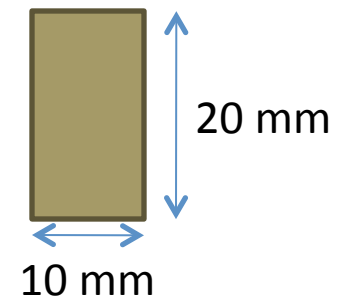
1. Ultra High Frequency tag
2. Larger antenna size



Dimensions of the antenna



Lumped circuit added to chip with antenna to boost range up to 5-6 m

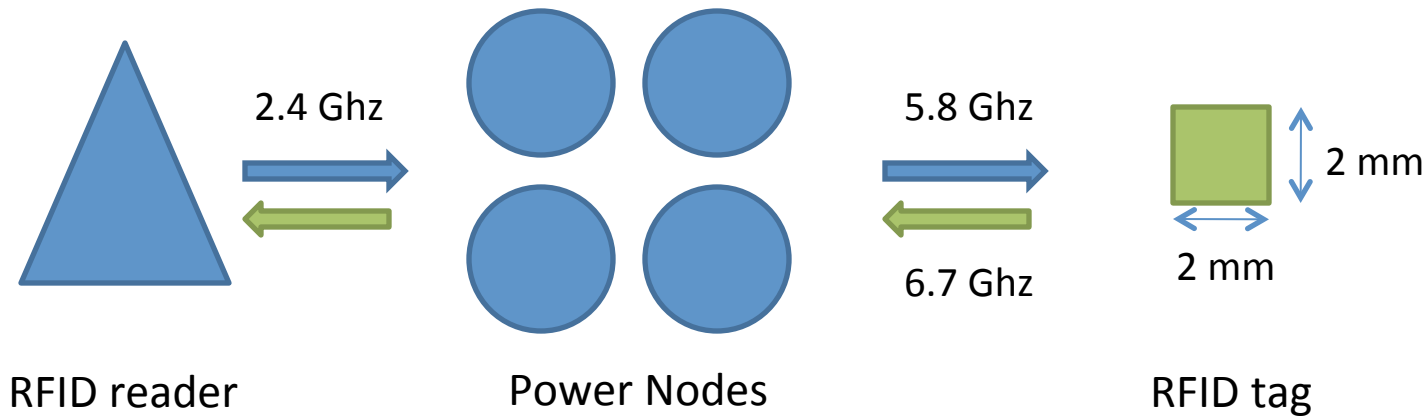


Range of RFID

1. Network of power nodes around the house (2m apart)
2. Ultra wideband passive tag



2mm passive RFID chips



Acknowledgments

My Sincere Thanks to -

My guide Prof. U. A Athavankar for his guidance and support

Prof. Anirudha Joshi , Prof. Ravi Poovaiah and Prof. G.G. Ray for their viewpoints

Keyur Sorathia for his timely help

All my batchmates at IDC

Special Thanks to –

Mandar, Sanket, and Saurabh Srivastava for the video shoot

References

1. Boric-Lubecke O, L. V. (2002). *Wireless house calls using communications technology for health care and monitoring*. IEEE Microw Mag.
2. Brogden M, N. P. (2000). *Crime, abuse and the elderly*. UK: Willan, Devon.
3. *Daily RFID* . (2009). Retrieved from Daily RFID : <http://www.rfid-in-china.com>
4. Doberman. (2005). Retrieved from hautegear: <http://hautegear.com/wearables/category/security/>
5. Hemmert, F., Knörig, A., Joost, G., & Wettach, R. (2009). Stick, Click n' Call: Self-adhesive Pressure-Activated RFID Tags for Mobile Phones. *Proceedings of the Third International Conference on Tangible and Embedded Interaction (TEI'09)*. Cambridge, UK: ACM.
6. Melanie R. Rieback, G. N. (2006). A Platform for RFID Security and Privacy Administration. *Proceedings of LISA '06*, (pp. 89-102). Washington, DC.
7. Skogan, W. (1978). *The Fear of Crime Among the Elderly*. U.S. Department of Justice.
8. Swann. (2008). *Products: view: 389*. Retrieved from swannsecurity Web site: <http://www.swannsecurity.com/s/products/view/?product=389>
9. TimesofIndia. (2001 - 2009). Retrieved July 14, 2009, from indiatimes: www.indiatimes.com/timesofindiaarchive.htm



Thankyou