product design project III
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Digital caretaker for elderly

submitted in the partialy fulfilment of the requirements for the degree in **Masters of Design (M.des.), in Product Design.**

Industral Design Center
Indian Institute of Technology
Bombay

ACKNOWLEDGEMENT

This project is the product of the gentle, encouraging support of my academic Guide and the head of the department, honorable Prof. ***Vijay P. Bapat.*** His genuine interest in his students is the gift he offers all who study with him, but I understood it as a trust, and that is what would not let me stop short of my goal. As with all master teachers, he allowed his student to uncover the answers and gladly shared the thrill of those moments.

I would also thank my Co-Guide Prof. Anirudha Joshi without whose support it would not have been possible to complete my project successfully.

Without fail I would like to mention special thanks to the staff from the model shop, Wood workshop, Metal workshop, Painting workshop, Photography staff, and the library whose support have been the back bone for my project. Special thanks to Mr. Pradhan and Mr. Joshi for providing special inputs to my project.

The success credit of this project also goes to those twenty elderly people who have been so kind, cooperative and patient throughout the entire project.

Again I would mention my special thanks to the non teaching staff of IDC and Central library and IIT-Bombay to give me this opportunity to study in this prestigious institute.

Last but not least I would like to thank my parents who have always been my moral support.

CONTENTS

Abstract

The project deals with conceptualizing & designing an electronic product to take care of elderly people's health related problems.
The aim was to design a device for the elderly people that will act as a digital caretaker & help them to solve some of their health related problems based on physiological & psychological requirements.
There are many problems everybody comes across in old age, like health problems communication problems, entertainment problems, relationship problems, memory problems, economical problems, time management problems. These problem rises due to changes in human body, physiological functions, motor ability, sensory & mental change in old age.
The first step was to understand all above problems of elderly people & then select the important one.
A user survey study was done with 20 elderly targeted user to understand the requirement of the product.
The survey was based on contextual inquiries which helped to understand the real problem faced by elderly people.
The data was derived with the help of consolidation of work model & affinity Diagrams. This gave us the list of problems which were carefully segreated in two parts a) problems that can be handled by design & b) problems that can not be handled by design.
Now the problems that can be handled by design were mainly communication, health, motor & memory problems
There are some of the common health problems in elderly people, like blood pressure, cardiac failure, diabetes, & these problems can't be solved completely by medicine but can be controlled by regular check up, regular medicine, food & following the instructions of doctors.
While studing health related problems i derived that the check up process for elderly people gets devided in to 3 parts depanding on the type of disease.
thus the product also got devided in to 3 modules
a) mobile b) stationary c) speaker system.
the refinement of the product went trough 12 alterations & evaluation with 20 users.

Preambles

Chang is the inevitable law of nature. Nothing can remain static in this world. This is equally true of the human body. After birth, the body gradually grows to full bloom and its functions reach their peak at about the age of 30 there after the functions slowly decline over the next five or six decades.

Old age is the closing period on the life span. It is a period when people " move away" from previous, more desirable periods or times of "usefulness".

Age sixty is usually considered the dividing line between middle & old age. Like every other period in the life span, old age is characterized by certain physical & psychological changes. The effects of these changes determine, to a large extent, whether elderly men & women will make good or poor adjustments.

Most of elderly people lives with their family members like their son, spouse or relatives.

but many time elderly doesn't like the feeling of dependence on other.

Some elderly people live alone or in old age home & they have to take care of themselves in these conditions they always need a companionship of caretaker at least to fulfil their medical requirements.

By taking these things in to account I tried to conceptualize a electronic device which will act as caretaker for elderly person.

Approach of the project

- Data collection from books to understand elderly person, their physical & mental state.
- Categorization of elderly on the basis of class, companionship.
- Taking contextual & non contextual interviews of elderly & asking about there ever day life
- Interaction with doctors to get feed back on the physical & mental status of elderly
- Analysis of collected (contextual & no contextual) data by work module
- Understanding elderly person's activities, their requirements & total problems
- Focusing the specific area of problems, like medical area
- Secondary data collection & interviews of elderly person regarding their medical related problem & requirements,
- Interaction with doctor to solve their medical problems,
- Understanding sound therapy & brainwave frequencies
- Studying available medical devices in the market. Understanding it's principle & technology & interface
- Getting dimensions of internals parts of existing products
- primary concepts generation in the form of sketch .
- Secondary concepts generation in the form of phisical model
- refinement of concept
- sketchink of interface concepts
- finalizing concept
- detailing,drawing

Changes in human body

Regulation of Body Chemistry

Life consists of a series of chemical reactions occurring each of the millions of cells of which our body is made. Chemical processes constantly regulate the blood chemistry within narrow limits on a moment-to-moment basis. For example, if a person has eaten too much of sugar and there is danger of inordinate rise of sugar in the blood, the pancreas immediately releases more insulin into circulation if a person has taken too much of fluids, increased urination corrects the situation. The chemistry of blood, which forms the internal environment of all body cells, therefore, remains fixed within narrow limits at all time and under all circumstances with age, the speed of this regulation slows down because all physiological functions, inducing cardio respiratory, digestive and excretory declines The elderly are therefore not able to adapt to changes in food, environment and temperature and to stresses and strains as easily as younger people.

Brain

Consequent to these changes in the chemical milieu at the cellular level, changes occur in various body systems. Alterations of metabolism in the brain and its offshoot cause Certain deficiencies or alterations, which account for changes in, sleep rhythm, sex drive, body temperature regulation and certain degenerative disorders.

Endocrine glands

Changes occur in the endocrine glands, which secrete various hormones. For example diminished production of insulin by the pancreas causes increased incidence of diabetes in the elderly. Ovarian failure occurs at menopause in women, resulting in loss of child bearing capacity and diminished production of female sex hormone. The endocrine changes in the male are less dramatic and include decrease in the production of male sex hormone.

Immune System

The immune system, our bodyguard against infections, slowly and gradually withers away. This has great relevance to certain diseases. Proneness to infections increases, which become more acute and severe, and incidence of cancers are more common in the elderly.

Bones

Bones get depleted of calcium and protein matter (Osteoporosis), and become fragile and liable to fracture easily.

Arterial Obstructions

Heart Attacks and Strokes Significant degenerative changes occur in the arteries of the body especially those supplying blood to the brain, heart, kidneys and legs. A fatty substance, called cholesterol, is deposited in their wails over the years, causing obstruction to the flow of blood. This obstruction, as you will read later, is the cause of heart attacks, strokes, etc.

Other Systems

similarly decrements of function occur in all other systems- digestive, excretory respiratory, etc. This is the natural process of ageing which occurs in every one of us. The body's ability to adapt to aging is truly remarkable. Unfortunately some of us strain or over-tax this ability adopting unhealthy lifestyles- excessive smoking, consumption of intoxicants like alcohol, poor living conditions with atmospheric and environmental pollutants, which invariably hasten the ageing process.

Changes in physiological functions

There are also changes in the functioning of the organs. *Regulation of body temperature* is influenced by impairment of the regulatory devices. Old people cannot tolerate extremes of temperature, either hot or cold, because of the decreased vascularity of the skin. Reduced metabolic rate and lessened muscular vigor also make regulation of body temperature difficult.

When an old person becomes short of breath as a result of unusual exertion, it takes longer to restore breathing and heart action to normal than it did when younger. Pulse rate and oxygen consumption are more varied among the elderly than among younger people *Elevated blood pressure* due to the increased rigidity of the wall of the aorta and central arteries is quite common in old age. Elderly people excrete less urine. And there is less creative in their urine than in that of younger adults.

In old age, there is a *decline in the amount of sleep* needed and in the quality of sleep By age sixty or seventy the daily amount is reduced an hour or two, and brief periods of rest and sleep generally replace the longer periods of sleep of the younger person. Most old people suffer from insomnia especially Women.

Digestive changes are perhaps the most marked of. The changes in the regulatory functions, Difficulties in eating are due partly to loss of teeth, which is fairly universal in old age, and also to the fact that the senses of smell and taste become less acute, making even the best food seem somewhat tasteless

Gradual atrophy of the glands lining the wall of the stomach and bowels results in a decreasein the ferments and juices that aid in digestion.Thus the old person needs more fluids to lubricate and to dissolve food elements.

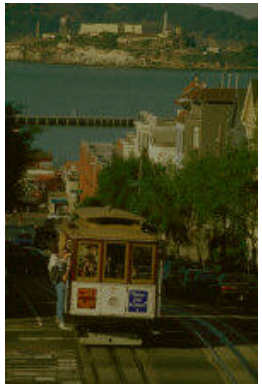
Strength and the ability to work decrease as muscular flabbiness and general weakness make it more difficult for old people to use their muscles. The ability to do strenuous work for a short period of time diminishes with age, while the ability to withstand a long, steady grind increases. It also takes the older person longer to recover from physical fatigue and from fatigue cause by continued mental work or nervous strain. As a result, most old people learn to cut down on any work that requires either strength or speed.

All the send organs function less efficiently in old age than they did when the individual was younger. However, because sensory changes are slow and gradual in most cases, the individual has an opportunity to make adequate adjustments to them. Further more, lasses and hearing aids can almost completely compensate for impaired vision or hearing loss.

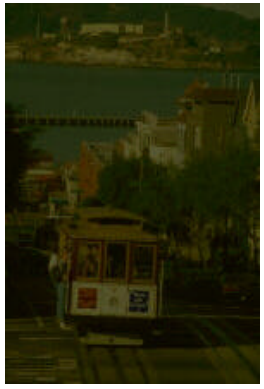
The eyes and ears, which are the most useful of all the sense organs, are also the most seriously affected by old age, although changes occur in the functioning of all the sense organs.

Sensory Changes

Age 20



Age 60



Age 75

These pictures show how much aging changes the relative transmission of light through the optic media for viewers of age 20, 60 and 75.

Vision

Human vision declines with advancing age. Although there are neural losses, the major decline is due to changes in the eye's optics. First, the lens becomes yellowier, making discrimination of blue colors more difficult. More importantly, less light entering the eye reaches the photoreceptors. One problem is that the lens and other optical media become opaque. Further, the pupil shrinks, allowing less light to enter the eye. The following table shows how the pupil size shrinks with age. Note that the pupil's response to dim light also decreases with age and becomes virtually nil by age 80. This means the elderly have especially large vision problems in low light environments.As a result of all these factors, at age 60, the amount of light reaching the photoreceptors is only 33% of the amount seen at age 20. By the late seventies, the amount falls to 12%. Further aging reduces light transmission even more as the effect accelerates.

Contrast Sensitivity

As a result of these factors, contrast sensitivity declines with age. The graph below shows how contrast must be increased with age. Using the sensitivity of a twenty year old as the base line, the graph shows the factor by which contrast must be increased in order to maintain visibility level. Required contrast increases gradually to a factor two in the 60's. The loss of contrast sensitivity then accelerates, reaching a factor of 6 by age 80. These numbers are conservative. First, as already noted, the loss of vision is greater in low light environments.

Color Vision

The yellowing of the eyes' optics changes color vision. The yellow optics block blue light and makes blue objects appear black. Several studies have found, not surprisingly, that older people do not like blue and it should be avoided in design. Colors that contain blue will also look different. Purple and magenta (red + blue), for example, will appear red. Lastly, older people cannot distinguish shades of blue very well.Second, these data include "normal observers." There are a variety of eye diseases, including macular degeneration, glaucoma and diabetic retinopathy, which often further impair vision in the elderly.

Hearing

Old people lose the ability to hear extremely high tones, as a result of atrophy of the nerve and end organs in the basal turn of the cochlea, although most can hear tones below high C as well as younger people. Men tend to experience greater hearing loss in old age than Women.

Taste

Marked changes in taste in old age are due to atrophy of the taste buds in the tongue and the inner surface of the cheeks. This atrophy becomes comes progressively more widespread with advancing age.

Smell

The sense of smell becomes less acute with age, partly as a result of the atrophy of cells in the nose and partly because of the Increased hairiness of the nostrils.

Touch

As the skin becomes drier and harder, the sense of touch becomes less and less acute.

Sensitivity to Pain the decline in the sensitivity to pain occurs at different rates in different parts of the body. There is a greater decline, for example, in the forehead and arms than in the legs.

Mental change in old age

Learning

Older people are more cautious about learning, need more time to integrate their responses, are less capable of dealing with new material that cannot readily. Be integrated with earlier experiences, and are less accurate than younger people.

Reasoning

There is a general reduction in the speed with which the individual reaches a conclusion in both inductive and deductive reasoning. This is partly the result of the tendency to become increasingly cautious with age.

Creativity

Older people tend to lack the capacity for, or interest in, creative thinking. Thus significant creative achievements are less common among older people than among younger ones.

Memory

Old people tend to have poor recent memories but better remote memories. This may be due partly to the fact that they are not always strongly motivated to remember things, partly to lack of attentiveness, and partly to not hearing clearly and distinctly what others say.

Recall

Recall is affected more by age than recognition. Many older people use cues, especially visual, auditory, and kinesthetic ones, to aid their ability to recall.

Reminiscing. The tendency to reminisce about the past becomes increasingly more marked with advancing age. How much the individual reminisces depends mainly on how pleasant or unpleasant the elderly find their living conditions now.

Sense of Humor

A common stereotype of the elderly is that of humorless people. While it is true that their comprehension of the comic tends to decrease with advancing age, their appreciation for the comic that they can comprehend increases.

Vocabulary

Deterioration in vocabulary is very slight in old age because elderly people constantly use words most of which were learned in childhood or adolescence. Learning new words in old age is more infrequent than frequent.

Mental Rigidity

Mental rigidity is far from universal in old age, in contradiction to the stereotype of the elderly as mentally rigid. When mental rigidity sets in during idle age, it tends to become more pronounced with advancing age partly because the elderly learn more slowly and with more difficulty than they did earlier and partly because they believe that old values and ways of doing things are better than new ones. This is not mental rigidity in the strict use of the term but a carefully reasoned decision.

User survey

By contextual & non contextual inquiry

Contextual inquiry workshop was done as a part of 3 days workshop in IDC.
A team of 6 people which are experienced professionals from various fields of human computer interaction were involved and actively participated in the sessions. This helped me to come up with varied approaches for the problem at hand.
various subjects chosen for the CI are one from every category of competency level.

For contextual & non contextual inquiry, first of all I categorized all elderly people.

Categorizations of elderly people

Upper/upper middle/middle class people (because these people are able to afford the device as well as these people have acceptance towards new technological device like phone, computer and mobile phone)
1) Retired people/ people working after retirement
2) People living alone/ living in old age home/ living with children/ relatives
3) Living with spouse/ other elderly
People with different level of problems & disabilities
* Family of elderly (spouse/child/grand child /caretaker of elderly)

Focus

Every day's life (what an elderly person does through out a day)

How elderly person performs following tasks
Makes daily/ monthly/ yearly schedule
Remembers appointments/ dates/ tasks/ occasions/ medicine timing
Remembers other person/ names/ address/ roads etc.
Keeps & recollects his belongings/passbook/key/personal diary/
Seeks & maintain companionships
Tackles disability in communication (poor eye site/ hearing/ Parkinson's disease

Work modeling

Represent people's work in diagrams
It is useful for finding complex and unfamiliar work domain

Work model constitute
Flow model: It was diagram of communication and co-ordination between different peoples & places
Sequence model: It was diagram of detailed work steps of every work in the elderly person case we draw the sequence model of steps of every day's activity
Artifacts model: It was listing down the artifacts which elderly uses & also observing their interaction with artifacts.
Culture model: this was about factors which influence elderly person and constrains for them.
Physical model: It was all about work environment around elderly

Interpretation session

It is an assignment of meaning to the observations.
Chain of reasoning:
Fact & observable event
Hypothesis (an initial interpretation of the meaning or intent)
Implication of design
Realization of design idea

Affinity Diagrams

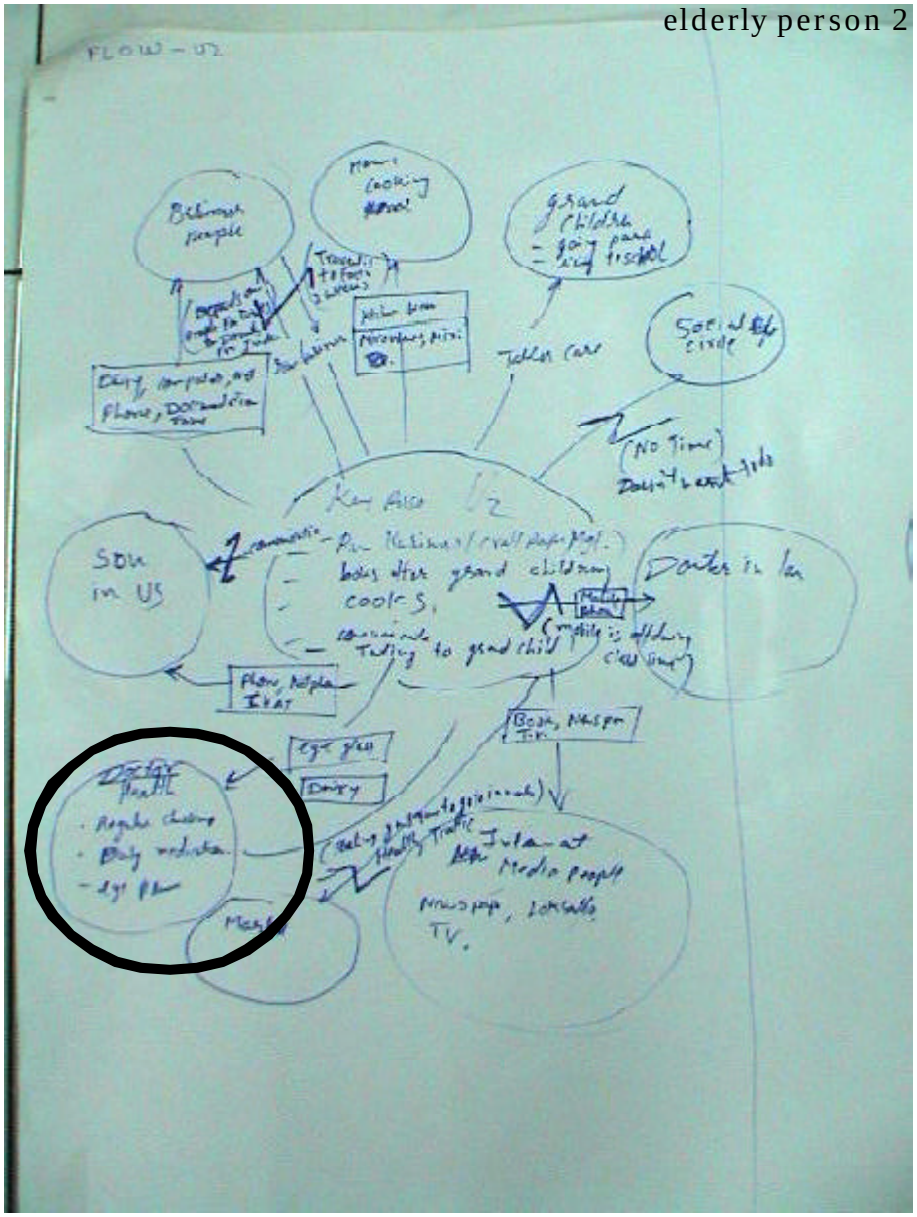
Bottom up hierarchy of notes
Key observations
Insights
Influences from the culture model
Questions and answers
Design ideas
Break down in work

Consolidation of Work Model

And its constituents:
Provides steps and deliverables for the interaction design
optimize the project to smaller bits.
Externalize good design practice.

Start with explicit assumptions and challenge these assumptions.

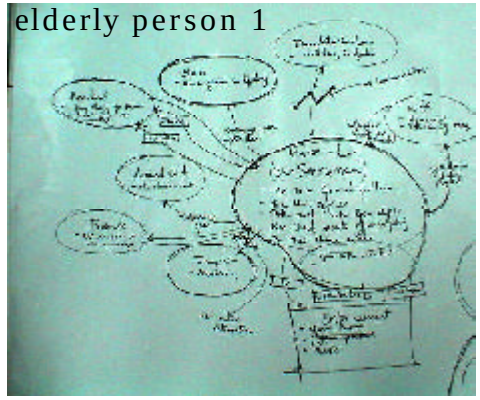
elderly person 2



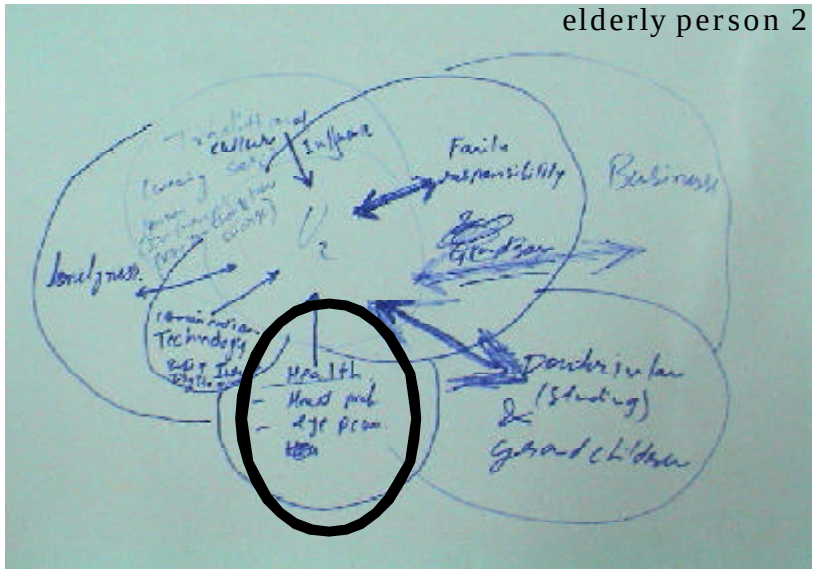
Flow model

elderly person 3

elderly person 1

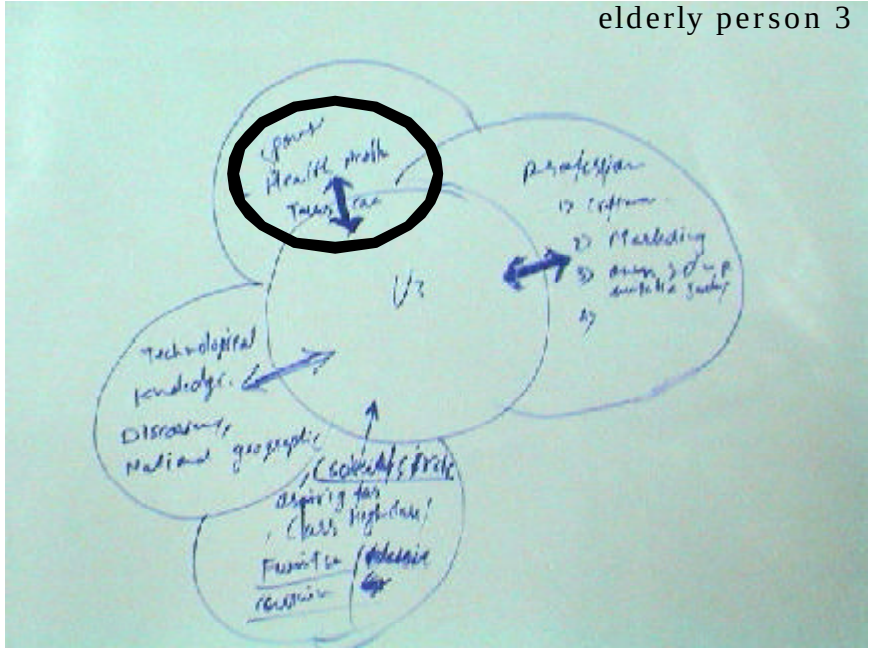


elderly person 2

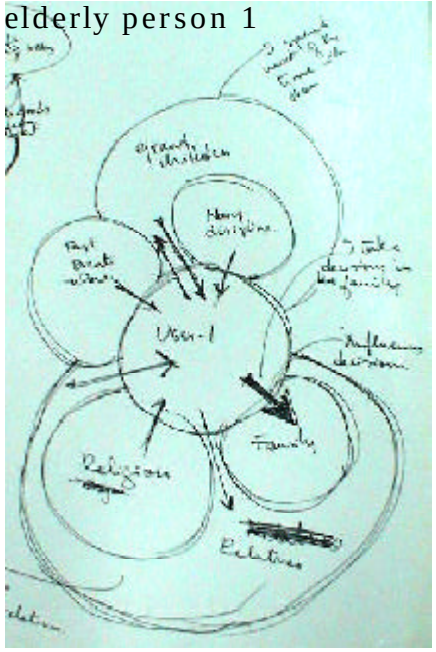


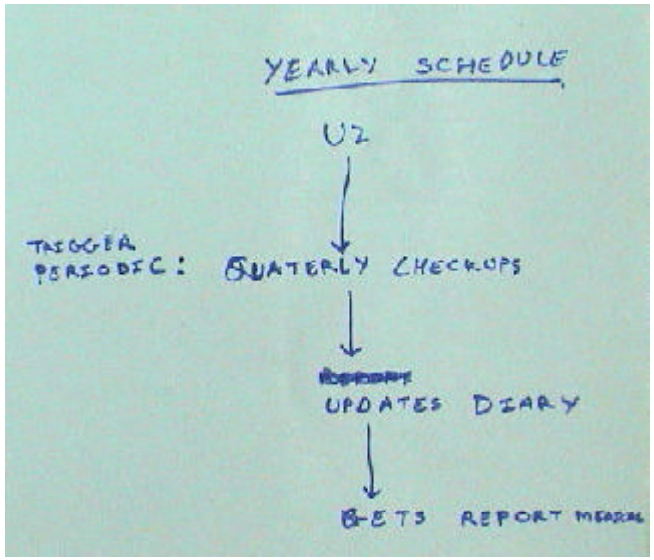
Culture model:

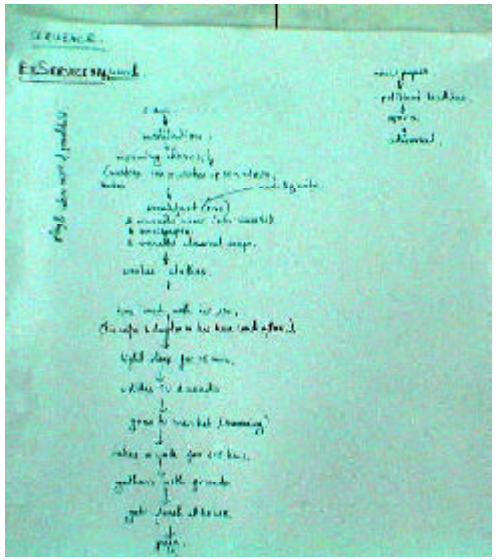
elderly person 3



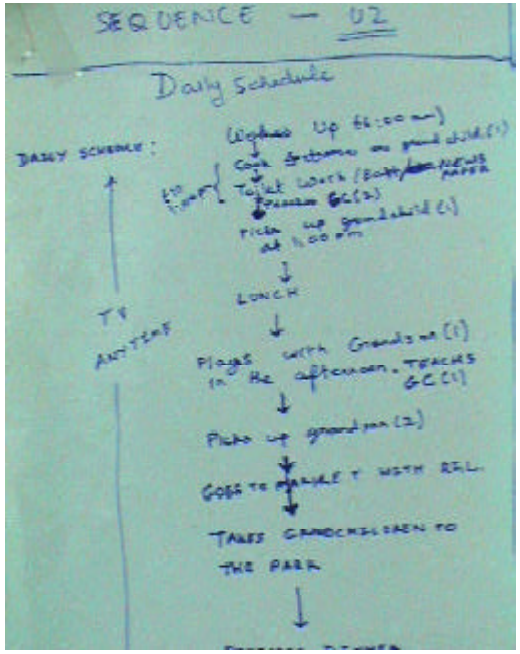
elderly person 1

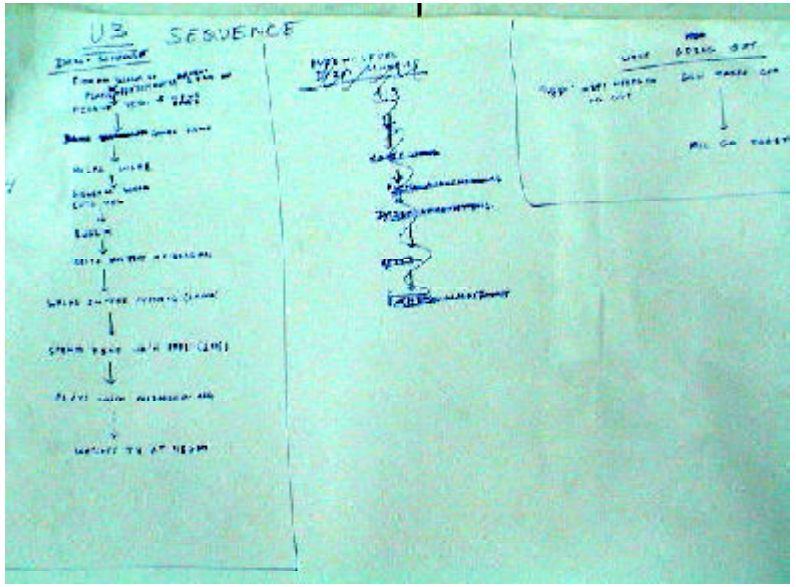






Sequence model





Elderly person activities

Every day's in house activity

Watching television
Taking medicine
Sitting & thinking
Just doing nothing
Sleeping
Reading
Meditation
Playing with grandchild
Work on computer

Everyday out door activity

Socializing with friends
Gardening
Going for walk
Working full time or part time
Caring younger or older members of family
Participating in sports (golf/swimming tennis)

Occasionally out door activity

Participating in recently activities & hobbies
Participating in community organization
Doing volunteer work
Participating in political activities
Routine health checkup

Over all Old age problems

Health related problems
Communication related problems
Entertainment related problems
Relationship related problems
Memory related problems
Economical related problems
Time management related problems

Total Design Insights from data collection

Health

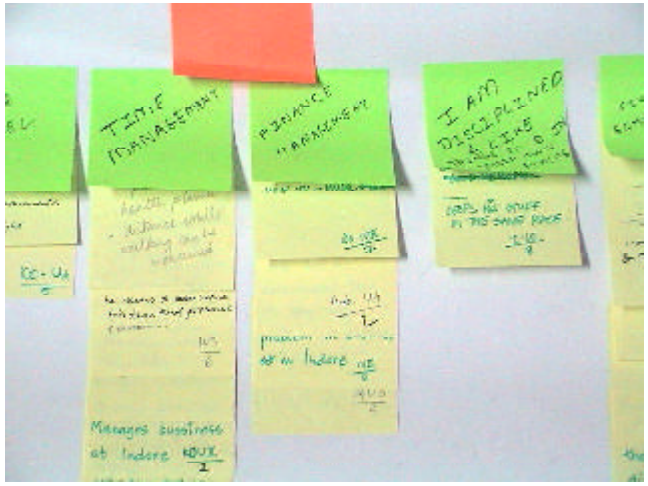
Incorporation of medical instruments showing blood pressure heart beats rate & blood sugar so that elderly can take it's testing regularly at his/her house
Online data transmission to the respective doctor
Updating medical instruction coming from doctor
Auto audio instruction according to the blood pressure & irregular heart beats
Auto emergency call/ alarm, to near by person/ family member /doctor
Place to keep of emergency medicine
Sound therapy for better sleep

Communication

with child/grandchild/relatives/ friends/ employee/ car driver doctor/ market person/ travel agent/ banker/
Audio dial up system to dial required phone(by name/ number)
Video phone to communicate distant child/grandson/
Internet for information.
GPS to locate position.
Road maps/city maps.
Update social programs
Online money transaction

Entertainment: music/ jokes/ news/ puzzles/ games/ religious songs/ religious lecture

Music system(mp3)/ radio.
Chat with friends.
Voice based games.
Small video clippings.
Displaying Good quotations & thoughts
Diary to write about his day/feeling/poems/thoughts
Internet for information
Incorporate photo album/ video/ sound
Display his work & creativity
Shearing information



Relationship:

A device which will improve relationship by giving expressive symbolic messages like, I'm sorry/ i forgive you /I'm happy.
Making new friends by auto information transmission.
If the person is alone it must act as a companion, like virtual pet/
virtual grandson/ virtual friend.

Memory problems:

Help to Remember important dates/time in advance
Help to remember medicine timing, change in medicine, doctors date, regular checkup
Reminder for FD/insurance/bank work/or other policies
Calendar & date of festivals

Time management:
Help to manage time to perform some tasks in given time & destination.
Help to find some time for himself, & his hobbies

These design ideas are the possible solutions for a digital care taker for elderly person, but the area is becoming very vast to take care of all the things they required.

Health problems is more prior to the elderly people so the project direction is focused towards health related problems

communication & memory is also related with the health

my second survey was concentrate on health problem of elderly people.

The most common health problems of elderly are

1) Blood Pressure
2) Cardiac failure
3) Diabetes

Health problems

Hypertension (High Blood Pressure):

Categories for Blood Pressure Levels in Adults *

	Blood Pressure Level (mm Hg)	
Category	Systolic	Diastolic
Optimal**	< 120	< 80
Normal	< 130	< 85
High Normal	130–139	85–89
High Blood Pressure		
Stage 1	140–159	90–99
Stage 2	160–179	100–109
Stage 3	=> 180	=>110

When systolic and diastolic blood pressures fall into different categories, the higher category should be used to classify blood pressure level. For example, 160/80 mm Hg would be stage 2 hypertension (high blood pressure).

Causes of High Blood Pressure

The causes of high blood pressure vary. According to National Institutes of Health, the causes for high blood pressure may include narrowing of the arteries, a greater than normal volume of blood, or the heart beating faster or more forcefully than it should. Any of these conditions will cause increased pressure against the artery walls. High blood pressure might also be caused by another medical problem. Most of the time, the cause is not known. Diet, definitely, plays a crucial role in the development of hypertension along with stress.

Symptoms of High Blood Pressure (Hypertension)

One of the cruel facts of hypertension is that it exhibits no distinctive symptoms. Usually, when you see any symptoms, it is usually too late. This is why hypertension is called the silent killer. The best way to find out if you have high blood pressure is to test for it, which is rather

simple especially since many inexpensive home testing units are now available.

Possible symptoms of high blood pressure vary from person to person. These symptoms could also be symptoms of other health problems. Most doctors say that if you're having symptoms such as:

Headaches

Heart palpitations

Fatigue

A flushed face,Blurry vision,Nosebleeds

A strong need to urinate often (especially during the night)

Tinnitus (a ringing or buzzing in the ears)

Vertigo (feelings that you or the world is spinning dizzily)

Orthostatic hypotension (low blood pressure)

Definition
Orthostatic hypotension is low blood pressure that occurs when a person stands up. It results in decreased blood flow to the brain.

When a person goes from sitting or lying to a standing position, gravity can cause blood to pool in the lower half of the body. This can lower the blood pressure. However, the body has many ways to prevent this from happening, such as the heart pumping harder. In various conditions, the body is unable to prevent abnormally low blood pressure from happening when a person stands up. This can lead to symptoms and is called orthostatic hypotension.

Symptoms of orthostatic hypotension occur when a person stands up. They may include:
headache,neck pain or shoulder pain,dimming, blurring, or loss of vision,
dizziness,weakness,lightheadedness,confusion,falling down,fainting, also called syncope

Orthostatic hypotension has many possible causes, including: dehydration, often from excessive vomiting, or severe diarrhea decreased blood volume, which can occur with excessive bleeding drugs or medications, such as alcohol, the blood pressure medication prazosin, or the diuretic called furosemide prolonged bed rest
old age, which can decrease the body's natural ability to maintain the blood pressure when a person stands updamage to the nervous system, such as that from diabetes, Parkinson's disease, and spinal cord injury
heart conditions, such as a heart attack, congestive heart failure, or a problem with a valve in the heart called aortic stenosis, anemia, or a low red blood cell count, blood vessel problems, such as severe varicose veins, low adrenal hormone levels, also called adrenal insufficiency

first hour of a heart attack is known as the “golden hour.” If you get help during that first hour, your chances of recovery are greatly improved. Yet many people hesitate to get help when they first experience symptoms. They’re afraid of the embarrassment of going to the emergency room and finding that nothing is wrong. So, it is important that you know the symptoms that may indicate that a heart attack is in progress.

Many of the symptoms of heart attack can be brought on by digestive disturbances or other less serious conditions. But only sophisticated medical tests can determine for sure if you’re having a heart attack. Heart attacks may vary from person to person, and from heart attack to heart attack. Women, for example, may experience “atypical’ symptoms such as pain between the shoulder blades rather than crushing chest pain. This may result in them delaying seeking treatment. That is a great mistake.

Heart attack is one instance where getting treatment promptly can mean the difference between life and death. If you are in doubt, err on the side of being more cautious and go to the emergency room and get yourself checked. We will try to describe some of the most common characteristics of heart attack here. Before that we will introduce the other pain called angina which is often precursor to a heart attack.

Angina Pectoris or Angina

Angina pectoris is a precursor to a heart attack. Usually, what happens is this: During physical exertion, during stress or an emotionally charged situation, in cold weather or after a big meal, the heart beats faster. Heart requires more oxygenated blood flow to the heart muscle to maintain the beating. But if the channels by which the blood and oxygen flow to the heart are narrowed, not enough nutrients get to the heart muscle tissue. It suffers oxygen deficiency, and the heart tells you about this with a pain called angina pectoris.The pain is quite distinct. It is described as: “a heavy, strangulating, suffocating experience-far more intense than anything like indigestion, chest wall injuries, pleurisy or spasms of the esophagus that you are familiar with. The pain may seem to start under the breastbone, on the left side of the chest, and sometimes radiates out to other places: throat, neck, jaw, left shoulder and arm and, occasionally, on to the right side.

Angina is an intense, scary episode. But with rest and calm (or by placing nitroglycerin or another kind of nitrate under the tongue), angina attacks usually go away in about 15 minutes or so. If they last longer than that, go to the hospital and have a thorough check up. Long-lasting angina attacks may be the prelude to heart attacks.

Diabetes:

diabetes is a disease in which the body does not produce or properly use insulin. Insulin is a hormone that is needed to convert sugar, starches and other food into energy needed for daily life. The cause of diabetes continues to be a mystery, although both genetics and environmental factors such as obesity and lack of exercise appear to play roles.

Type 1 diabetes: is usually diagnosed in children and young adults, and was previously known as juvenile diabetes. In type 1 diabetes, the body does not produce insulin. Insulin is necessary for the body to be able to use sugar. Sugar is the basic fuel for the cells in the body, and insulin takes the sugar from the blood into the cells.

Type 2 diabetes: is the most common form of diabetes. In type 2 diabetes, either the body does not produce enough insulin or the cells ignore the insulin. Insulin is necessary for the body to be able to use sugar. Sugar is the basic fuel for the cells in the body, and insulin takes the sugar from the blood into the cells. When glucose builds up in the blood instead of going into cells, it can cause two problems:

1) Right away, your cells may be starved for energy.
2) Over time, high blood glucose levels may hurt your eyes, kidneys, nerves or heart.

These elderly health problems doesn't have permanent solution but we can reduce the risk factor by regular health check up, regular medicine, good diet, light exercise, good sleep & stress free life.

The factors need to be checkup regularly

Everyday check up
Heart rate
Blood pressure

Weekly to monthly check up
Cholesterol
Blood glucose

Stresses: Mental & physical stresses are the important factors causes the Hypertension & cardiac failure.

Stresses reduction:

Good & sufficient sleep:

Sleeping pills

- Light therapy
- Vibration & beats therapy
- Music & brain wave therapy

Meditation exercise:

- Yoga
- Tai chi

Aging and the Body Clock:

The nature of the internal body clock can be seen in the changing sleep and activity patterns over the course of human life. As people get older, many tend to get tired earlier and wake up earlier. For some this adjustment can become extreme as they get into their sixties and seventies, so that they find themselves going to bed at 7:00 p.m. or 8:00 p.m. in the evening and waking at 3:00 a.m. or 4:00 a.m. in the morning.

When humans reach their seventies and eighties the amplitude of their circadian rhythms can diminish. This can result in the loss of their ability to maintain a functional sleep-wake cycle. This phenomenon is most notable in elderly care facilities, where residents may sleep at any hour of the day or night, often sleeping for a portion of every hour

Sound wave therapy

Brainwave frequencies

Dr. Jeffrey Thompson.

Combining natural brainwave frequencies with ambient music and nature sounds, Dr. Jeffrey Thompson has discovered a way to let you orchestrate your state of mind to Stimulate concentration and productivity to:

• Promote insight and intuition

• Release physical tension and trigger the “relaxation response”

• Quiet your mind so you can drift into deep, restful sleep

• Heighten your sensitivity and foster communication and intimacy

• Enhance artistic inspiration and creativity.

Every state of mind has a unique pattern of brainwaves - composed of alpha, beta, delta and theta waves - which can be measured and mapped. BRAINWAVE SUITE blends subtle pulses of sound into the musical soundtrack, to stimulate your brain to produce waves with a pattern that matches the state you want to experience.

Using three-dimensional recording techniques, BRAINWAVE SUITE combines synthesizers, shakuhachi flutes, Tibetan bells, and acoustic guitar with actual sounds of nature to produce soothing, relaxing music which enhances the effect.

By listening through stereo headphones to slightly detuned tones (i.e., two sound frequencies that differ by a small number of Hz), the brain hears the “difference” between the tones and will naturally speed up or slow down to match it. This is sonic brainwave entrainment in action. Facilitating a specific range of brainwave states may assist in many areas, including pain reduction, enhanced creativity, stress reduction, or accelerated learning.The term binaural beat frequencies describes a neuroacoustical phenomenon that takes place when the brain perceives one tone in one ear with a slightly detuned tone in the other. As a means of measuring the difference between these two tones, the brain creates a third “phantom” tone, unheard elsewhere. This is known as a binaural (two-ears) auditory beat.The use of BBFs is an ancient sonic technology. A few thousand years ago, someone discovered that two minutely
detuned sounds create a third sound in the brain, and that our brainwaves slow down or speed up to match this natural third sound. The technology of modern computers allows us to become extremely precise in the application of these tones.

Delta: 0.1-3 Hz deep sleep, lucid dreaming, increased immune functions, hypnosis

Theta: 3-8 Hzdeep relaxation, meditation, increased memory, focus, creativity, lucid dreaming, hypnagogic state

Alpha: 8-12 Hz light relaxation, “super learning”, positive thinking

*Low Beta:*12-15 Hz relaxed focus, improved attentive abilities

*Midrange Beta:*15-18 Hz increase mental ability, focus, alertness, IQ

High Beta: above 18 Hz fully awake, normal state of alertness, stress and anxiety

*Gamma:*40 Hz associated with information-rich task processing and high-level information processing

he question becomes: What predominant brainwave state is most conducive to a desired activity? Beta, Alpha, Theta, or Delta?Whereas filtration is the process of subtracting specific sonic frequencies from a soundtrack, creating the BBF effect is an additive process. De-tuned sine-wave tones are mixed into a soundtrack of music, nature, or white noise. Sometimes the two tones can be heard, other times they are sub-audio. This is a subjective decision on the part of the producer. For the greatest effect, headphones or stereo speakers placed in proximity to each ear are recommended.The phenomenon known as binaural beats was discovered by the German researcher H. W. Dove in 1839. He found that binaural beating (an actual wah-wah effect similar to vibrato) took place when separate frequencies were introduced into each ear, for example, a tone of 100 Hz in the right ear and a tone of 108 Hz in the left. The brain strives to bridge the gap by creating a third tone that is the actual difference between the two; in this example, 8 Hz.According to the biophysics authority Dr. Gerald Oster, the binaural beat exists only as a consequence of the interaction of auditory signals occurring within the brain. The sound of the binaural beat will only be heard with the participation of both ears. If one ear is covered and only one tone is heard, the brain will use normal auditory measurement senses to determine tone, amplitude, timbre, etc. The phenomenon of BBFs is a consequence of measurement.This natural process of sonic measurement takes place not only in humans but in other animals as well.

Simply put, as a sound wave passes around the skull, each ear gets a different portion of the wave. When the wave length of a sound signal is longer than the diameter of the skull, the brain hears the inputs from the ears as out of phase with each other. Binaural beat expert F. Holmes Atwater states that “it is this innate ability of the brain to detect phase differences between the ears that enables the perception of binaural beats.
For optimal results, headphones are recommended.

Second survey

Questioner for elderly

1) Name, age, gender, location?
2) Occupation/ before retirement?
3) About family members
4) Social background?
5) What you do through out any / daily schedule?
6) How you make your daily/ monthly / yearly schedule?
7) What are the things you include in to your schedule?
8) What are the most important things in your schedule?
9) How do you remember your appointments important dates, tasks, occasions?
10) Do you have any problem with communication with others?
11) Do you have your personal belongings?
12) How/where do you keep your belongings & how do you recollect it?
13) Any health related problem?
14) When / how did you came to know about your health problem & how did u tackled it first time?
15) Which kind of medicine are you taking for your health problem?
16) What are the timings of your medicine?
17) How many types of medicine you take every time?
18) How many times you take medicine in day?
19) How do you remember medicine timings?
20) Do you take medicine yourself or somebody helps to take it?
21) How do you keep your medicines?
22) Do you have emergency medicines?
23) Did you encounter any emergency situation?
24) How did you react in that situation?
25) How did you called for help?

26) How many times you go for your regular check up
27) How do you communicate with doctors
28) What kind of artifacts you are using
29) Is there any other person who is taking care of all your

Questioner for elderly care taker

Name, age, gender, location

1) Are you a member of this family or hired?
2) Are you professionally trained for this job?
3) Relationship with elderly person
4) How much time a day you spend with elderly person?
5) What are his/her activities throughout day?
6) What are his needs?
7) Do you help him to remember his medicine timing?
8) How do you remember his medicine timing?
9) How frequently you take him for regular check up?
10) Did you face any of his health emergency situations?
11) How did you act in that situation?

Data analysis of second user survey

Health problems identify Problems identified with 23 users
the most common health problems of elderly are

Health problems	% Quantity
• cardiac problems	75%
• sleep disorder	72%
• blood pressure	68%
• Diabetes	45%
• Arthritis	28%
• asthma	10%

According to the priority the importance is given to

- Communication
- memory
- cardiac problems
- sleep disorder
- blood pressure
- diabetes

physical problems

- Poor hand grip
- Muscular fatigue
- Shaking hands
- Poor hearing ability
- Poor eye site

Other problems

- Limited communication (family/relatives/ friends/ doctors)
- Do not like to talk more on phone
- Weak memory to remember medicine timing & other things
- Discontinue in thoughts & behaviors
- Doesn’t like to learn new complicated things
- Doesn’t know medical terminology & related statistical things
- Does ’t like to know that they are ill
- Avoiding regular health checkup & meeting with doctor

Regular health checkup timing

Sr. no.	Health problems	Health checkup	normal health elderly person	critical health elderly person
1	cardiac problems	Pulse / heart rate	Whenever feel uncomfortable	Whenever feel uncomfortable
		Cholesterol , HDL cholesterol	15 day - 3 months	15 days
2	blood pressure	blood pressure	Once in a day – week	Thrice a day
		Blood sugar	Once a week	
3	diabetes	Blood ketone triglycerides	15 day-2 months 15day-2 months	

For regular health check up some products are available in the market:

blood pressure checkup

HEM-629

- 14 memory storage
- Measures blood pressure and pulse from the wrist
- Completely automatic inflation and deflation
- Large, easy to read LCD digital display
- Portable - great for travel
- Operates on 2 “AAA” batteries (included) - approximately 1 year battery life when used once/ day

HEM-637

- IntelliSense™ technology offers personalized inflation for maximum comfort
- 90 memory recall
- Graphing capabilities with date and time stamp
- Cuff fits wrists 5 1/4'' to 8 1/2''
- 5 year warranty

http://www.healthchecksystems.com/bpwrist.htm

Fingertip Blood Pressure Monitor

- Simple to use
- Cuff inflates with the push of a button
- Compact, lightweight and portable
- Finger cuff fits left index fingers 2" to 3" in circumference
- Clear digital panel measures approximately 1/2 x 1-3/4"
- Includes illustrated instructions and 2 “AA” Batteries

http://www.healthchecksystems.com/bpwrist.htm

Mio Wristwatch Monitor:

Count calories and measure heart rate The Mio from Physi-Cal is a heart rate monitor wristwatch without the chest strap.

It measures your heart rate, calculates your calories burned, and allows you to track your calories in and out throughout the day.

Features

- No chest strap.
- Measure your heart rate by placing two fingers on the two MioSensors on the front of the watch.
- The heart rate monitor also displays the percentage of your maximum heart rate, which helps you keep your workout in your desired zone.
- Watch with date and day.
- Chronometer - with the chronometer running, the Mio tracks how many calories you are burning during the activity
- Running tally of calories consumed and burned, with a signal when you exceed your goals.
- Track your progress with an online diary.
- The Mio Sense booklet has calorie listings for home prepared foods and fast foods to help you track your calories.
- Backlight

http://www.mm-inet.com/fitness/mio-watch.htm

BioScanner Glucose Monitor and Cholesterol Tester:

More than a glucose monitor, more than a cholesterol tester...

The BioScanner 2000™ home health test kit may reduce your risk from the complications of diabetes and heart disease. Most important is good glycemic control through diet, exercise, blood monitoring and medication. The BioScanner 2000™ glucose monitor and cholesterol tester is the first and only complete health management product that can perform multiple tests on one device. Color-coded strips and MEMo chips provide easy identification and correct calibration. As new tests become approved, the device is easily upgraded to include new test chemistries.

The BioScanner 2000™

1. Multiple blood chemistry testing.
2. One-step testing.
3. Average for previous ten tests, past fourteen and thirty day.
4. Storage of up to 250 glucose and 30 of each other test.
5. Automatic shut-off in two minutes from non-use of instrument.
6. Automatic calibration with inserted MEMo chip
7. Results in about one minute and future test upgradeable.

Continues task

(Every day 24 hours)

- Communication
- memory
- Heart rate measurement
- Emergency

Intermediate task

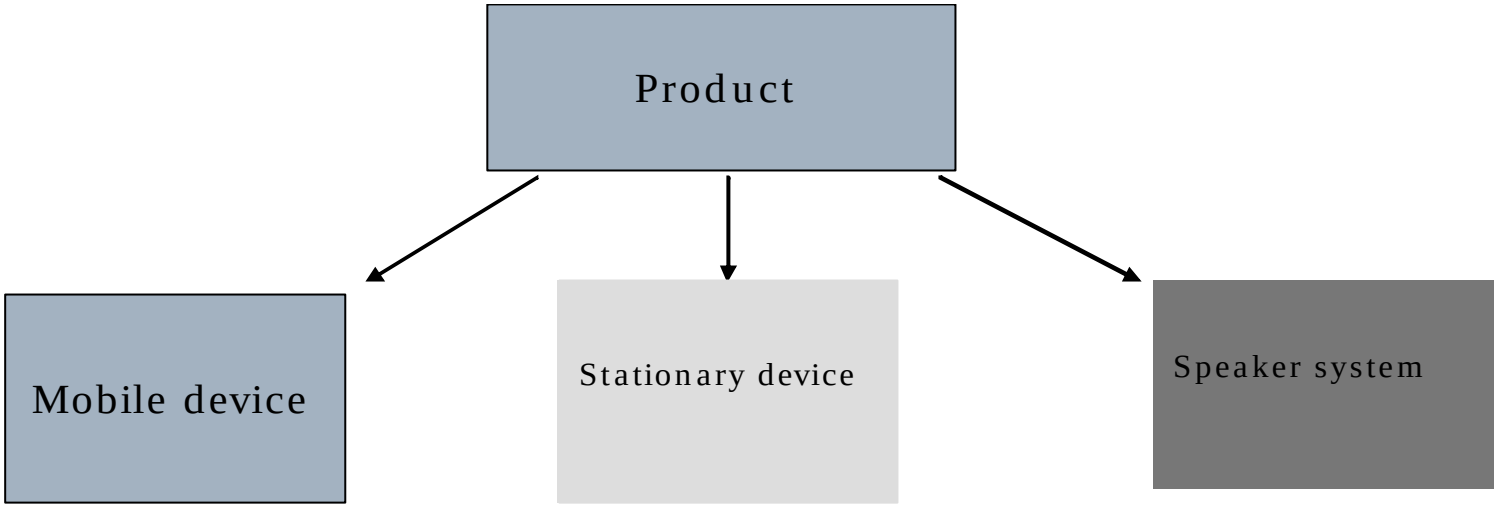
(Once in a day -3 months)

- blood pressure checking
- Blood test

Regular intermediate task

(every day at bed time)

- Taking Sound therapy



Communication device
Task reminder
Heart rate
Emergency call

Blood pressure
Blood glucose
Cholesterol test
Test timing Scheduler
Timer
Sending test report to doctor

Sound therapy

Total measurement tasks
1) BP
2) heart rate
3) Blood factors

Emergency tasks
1) Medicine
2) Call to emergency service
3) instruction

Audio tasks
1) Music therapy
2) Wakeup call

Other tasks
1) Test timing Scheduler
2) Timer
3) Sending test report to doctor

Product brief

- The aim of this project is to conceptualize an electronic device to take care health related problems of elderly parson.

- The product should solve basic communication problems
- The product should contain minimum keys to avoid fatigue
- The product should be design by considering elderly problems like
  - Poor hand grip
  - Shaking hands
  - Poor hearing ability
  - Poor eye site

- The product should contain of regular health checkup kit for
  - Everyday check up: Heart rate, Blood pressure ;Weekly to monthly check up: Cholesterol, Blood glucose.

- The product should be design by considering dimensions of inside sensors with the study of available “regular health checkup” product in the market.

- The product or a part of product should be able to give sound therapy for good& stress free sleep to elderly person.

- The interface of product should be design by considering his visual ability(color/ contras/ readability)
- The interface of product should be design by considering his metal state to avoid mental fatigue.
- The product should have a personal touch in interaction

Design ideas

- Muscular fatigue
- Provide minimum key for minimum figure movements
- Voice activated to avoid hand movement
- Give touch screen

- Poor hand grip
- Ergonomically design grip
- Device should be hang in neck
- Provide shock proof pads inside the device
- Other good place to keep device safe like (hand mounted /wrist mounted/ body mounted/ pocket/ belt

- Shaking hands
- Provide bigger keys
- Difficult to locate key, give some distance between two keys
- Give minimum keys
- The key should have finger grip
- The device should hold by two hands

- Poor eye site
- Give bigger screen
- Make text bigger (or at least adjustable)
- use only very high contrast colors.
- Avoid script, decorative or other fonts with fine lines and detail.
- Use fluorescent screen
- Avoid abrupt luminance transitions.

- Poor hearing ability
- Provide earphones & microphone for interaction with device
- Provide audio & visual information

House environment

Artifacts

chair

cupboard

Wrist watch

Diary

Leather bag

Telephone

Cell phone

Leather purse

Television

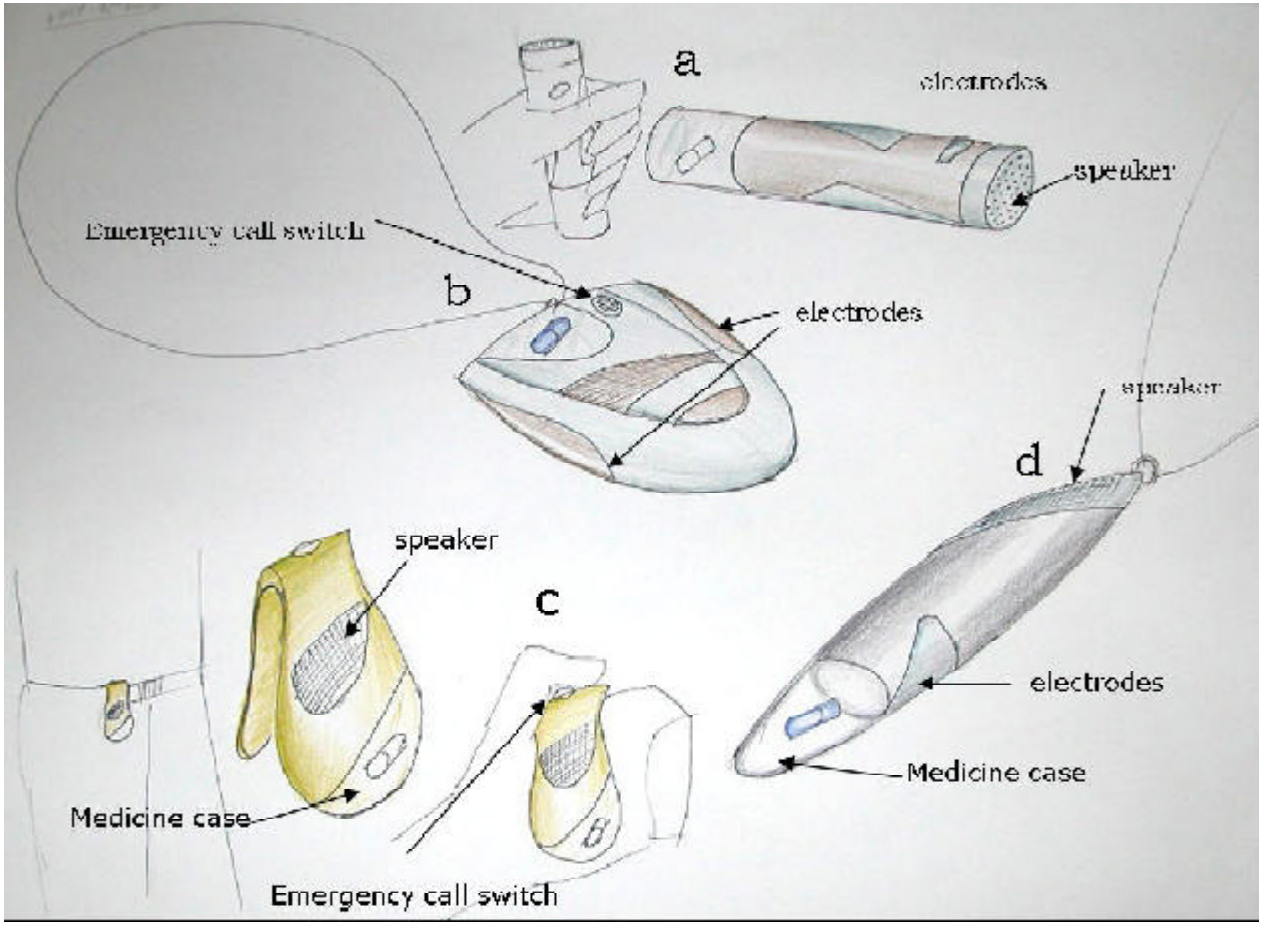
Table top calendar

Concept 1.1

This concept is based on the minimizing keys

Voice activated Mobile device

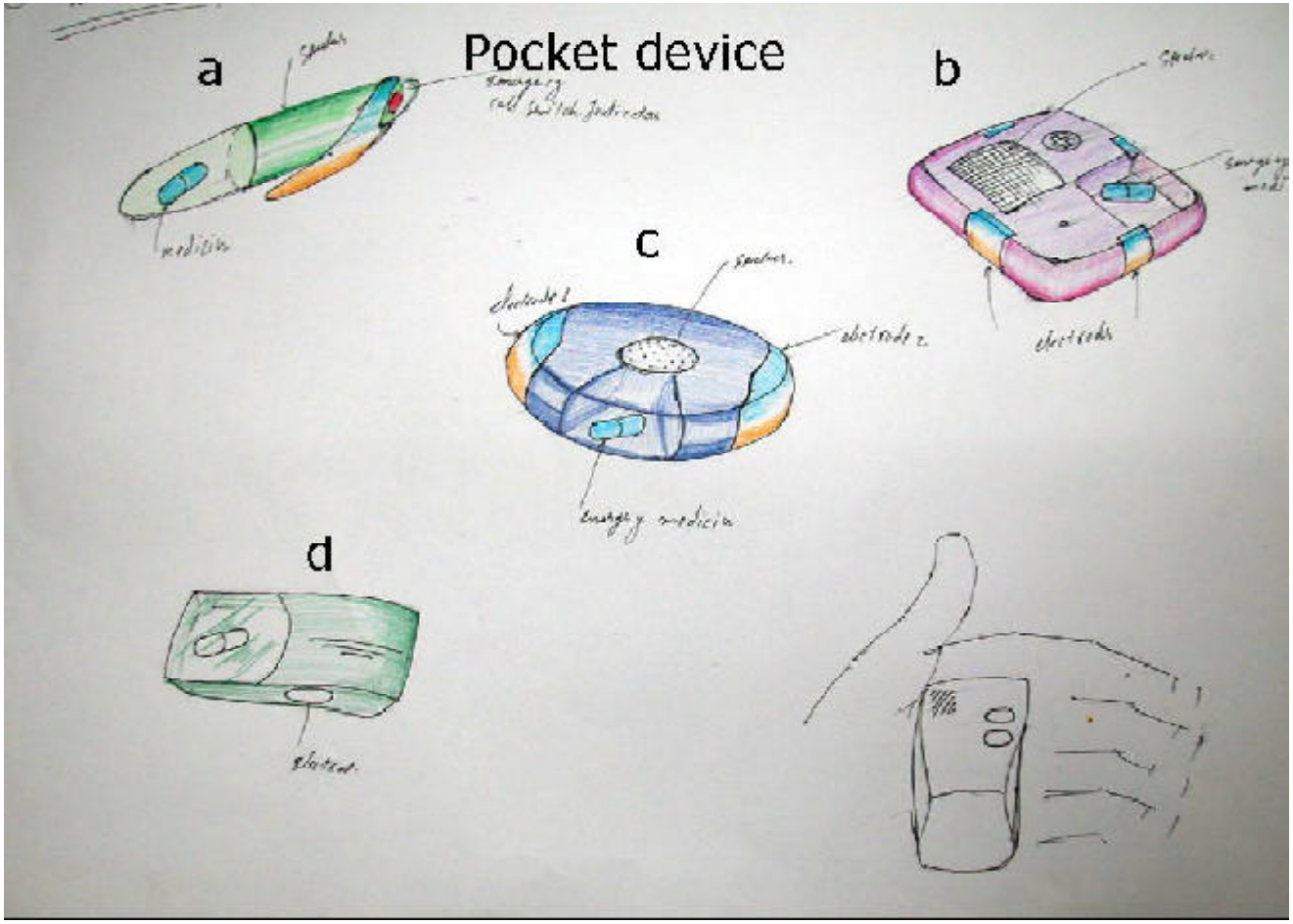
Features
1 Total audio interaction
Single key to avoid hand &finger fatigue
2 No screen
3 Voice activated
4 good hand grip



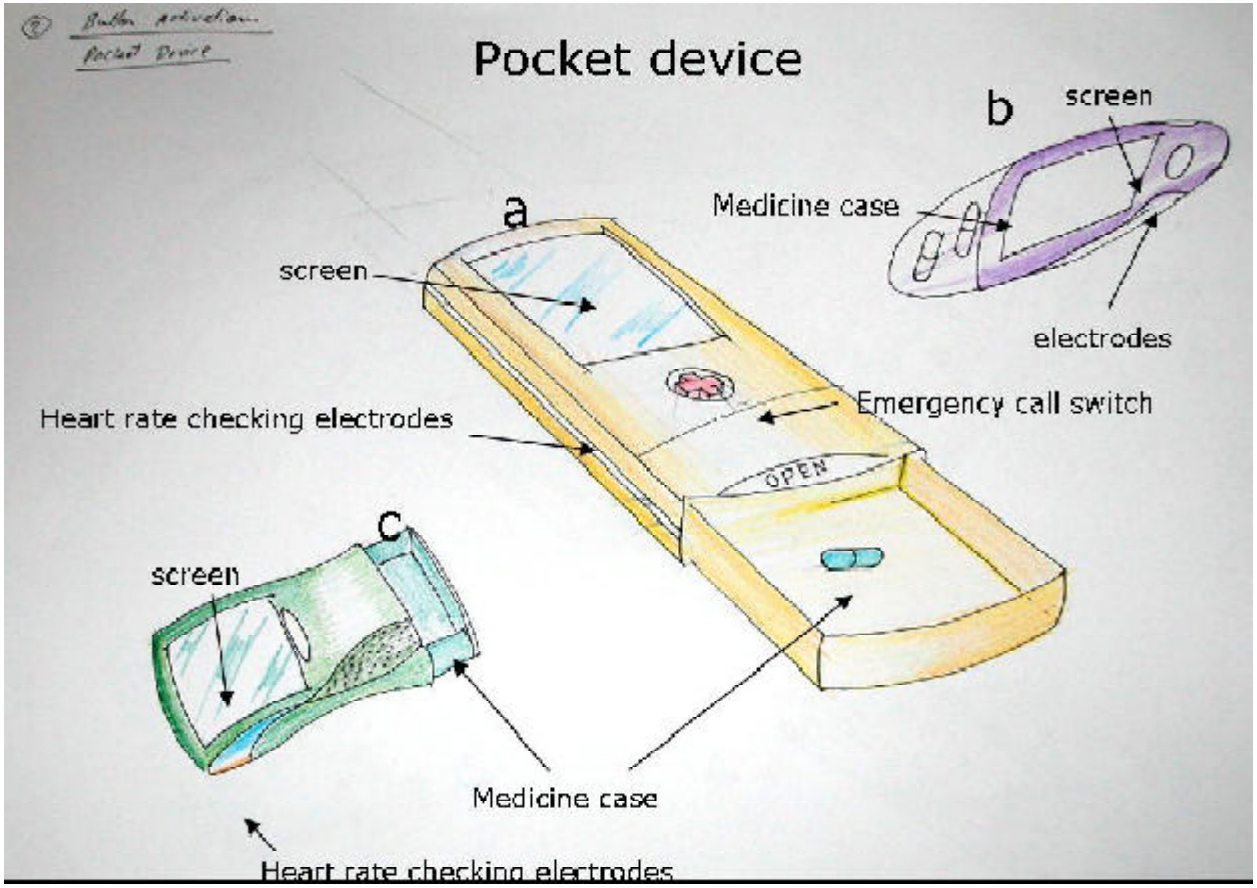
Concept 1.1

This concept is based on the minimizing keys

Voice activated Mobile device



Features
1 Total audio interaction
Single key to avoid hand &finger fatigue
2 No screen
3 Voice activated
4 good hand grip



Concept 1.2

This concept is based on the

minimizing keys

Voice activated Mobile device

Features
1 Total audio interaction
2 Single key to avoid hand &finger fatigue
2 Voice activated
3 display screen

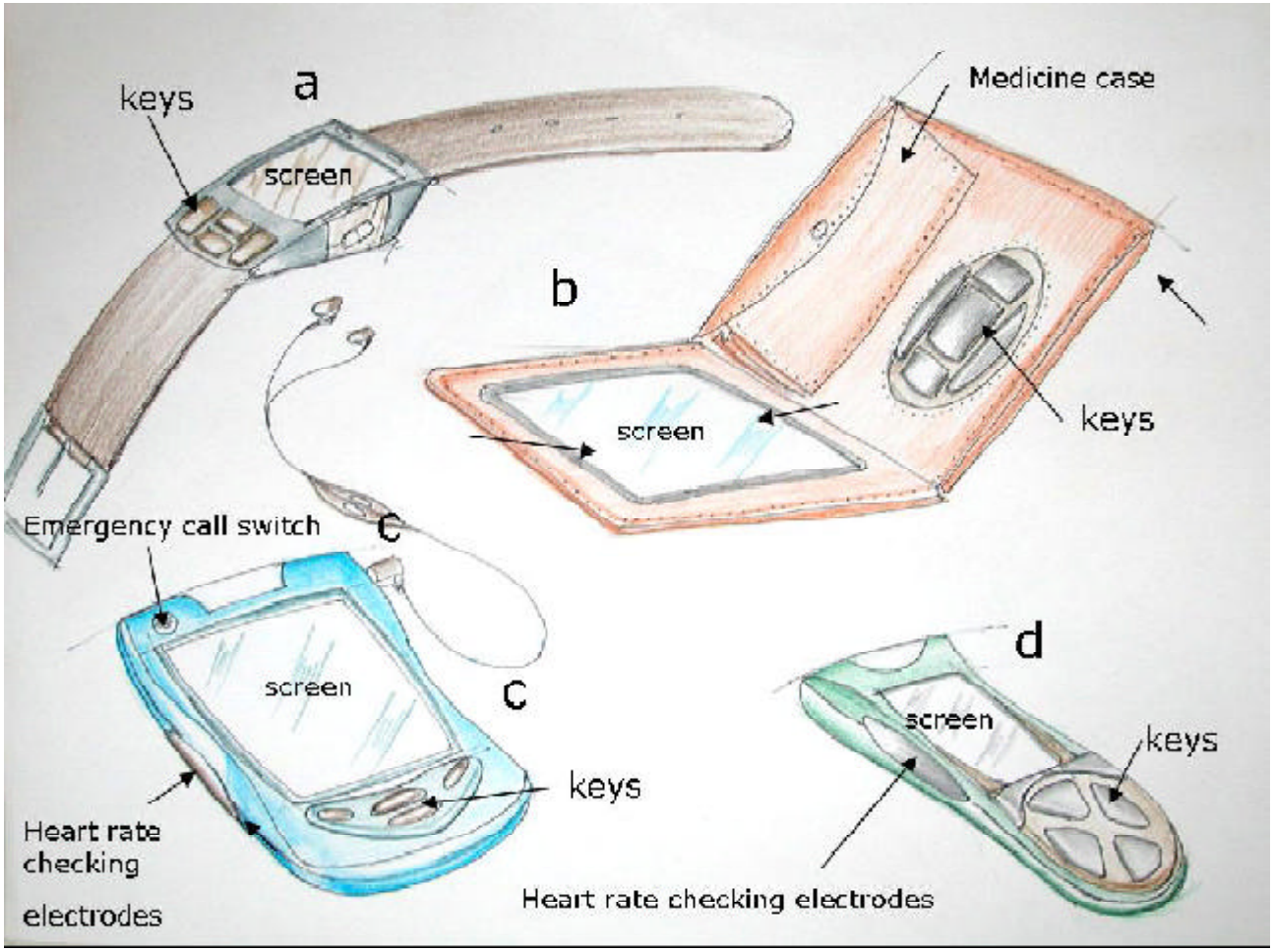
4 good hand grip

Concept 2.1

This concept is based on the

minimizing keys

Voice + key activated Mobile device



Features
1 audio + visual interaction
2 min key to avoid hand &finger fatigue
3 big keys
4 big screen
5 Voice + key activated

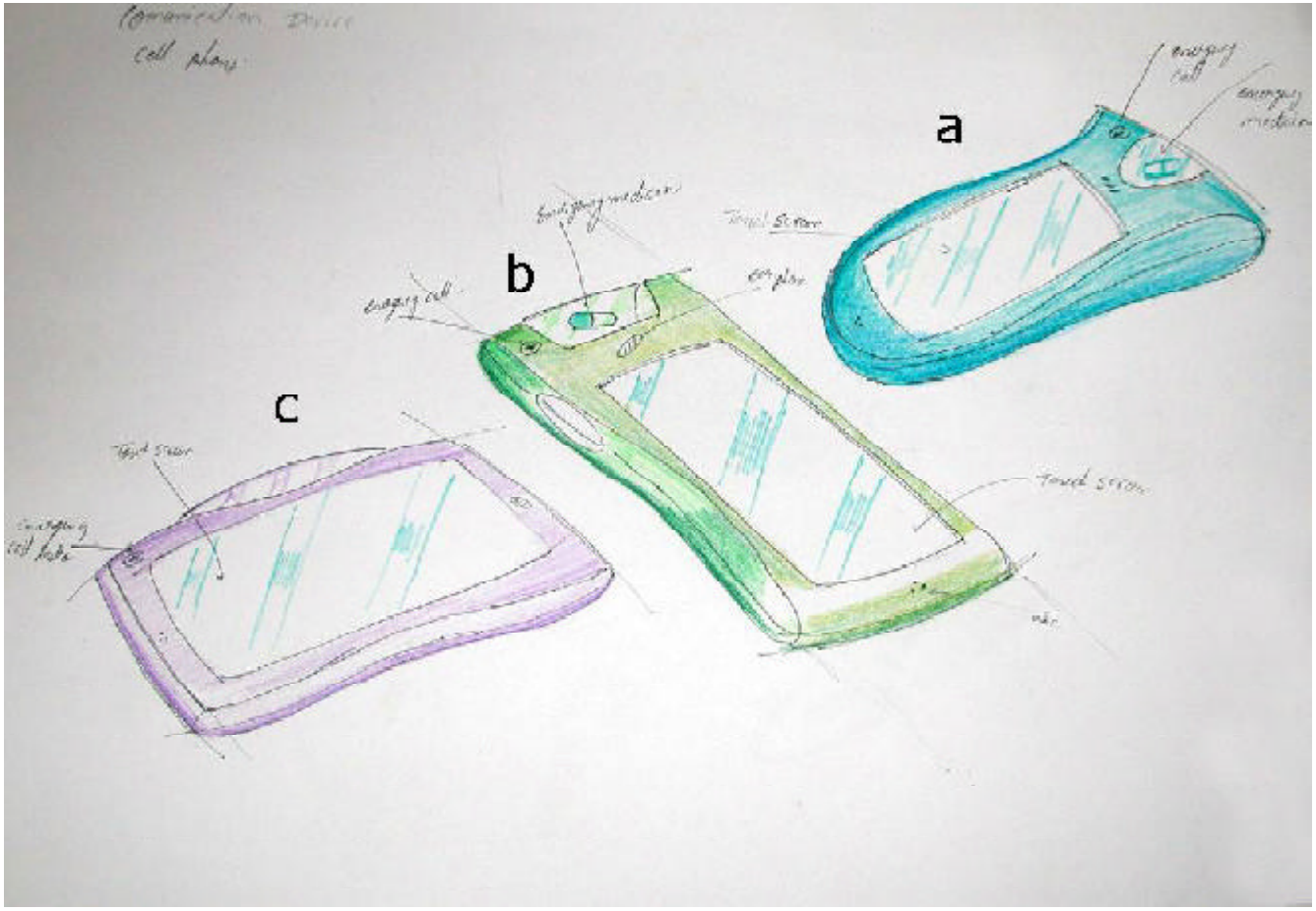
Concept 2.2

This concept is based on the

minimizing keys

Voice + touch screen

Mobile device



Features
1 audio + visual interaction
Touch screen
2 big screen
3 Voice + touch activated

Concept 2.3

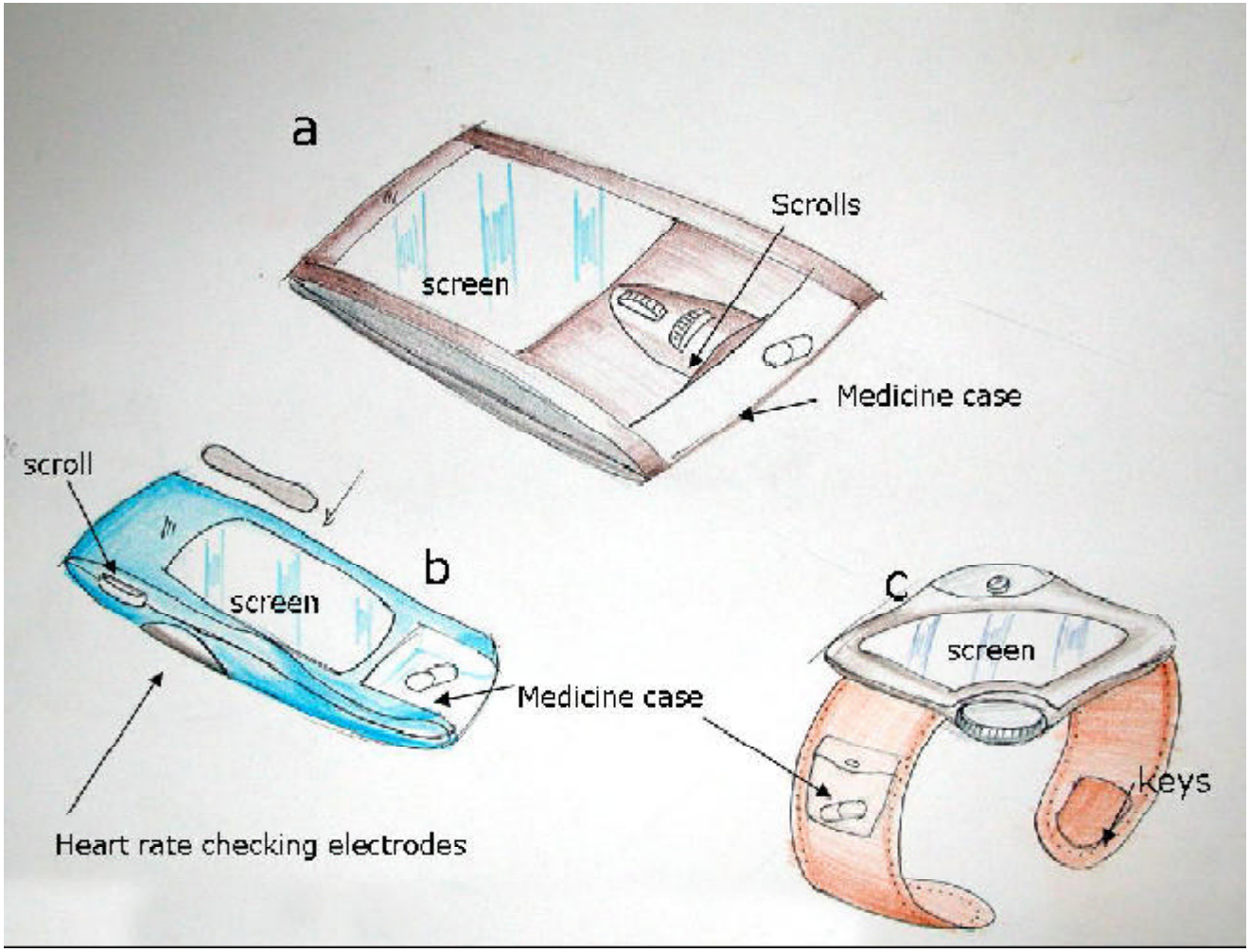
This concept is based on the

minimizing keys

Voice + scroll operated

Mobile device

Features
1 audio + visual interaction
2 scroll
3 big screen
4 Voice + scroll activated



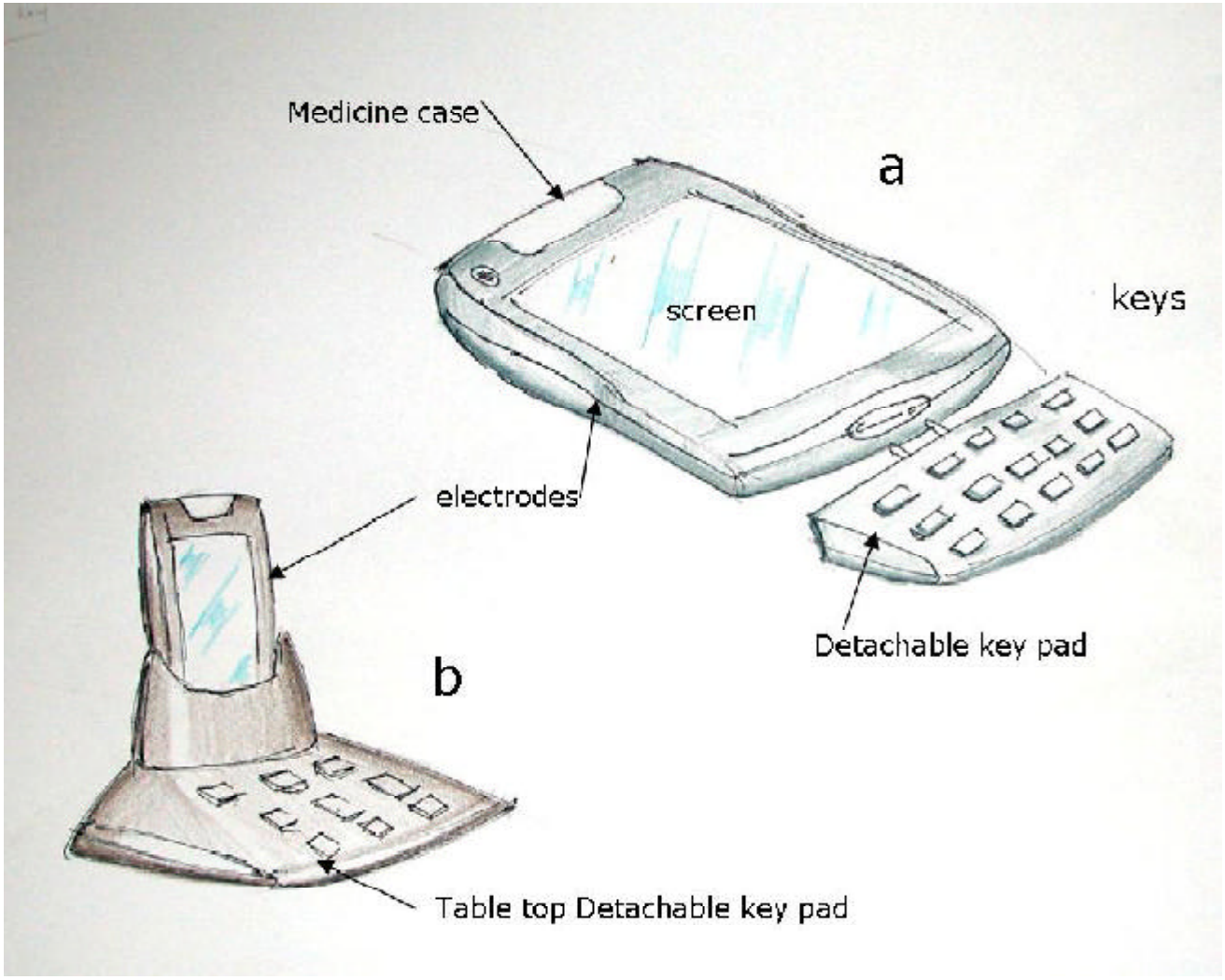
Concept 3

This concept is based on the

minimizing keys

key operated Mobile device

Features
1 keys
2 big screen
3 keys activated



first stage Evaluation (qualitative test)

7 grades method by 10 users

		C1.1	C1.2	C2.1	C2.2	C2.3	C3	
	Easy to operate	7	7	6	6	5	5	C1.1, C1.2
	Poor hearing condition	1	1	5	5	5	5	C2.1-C3
	Emergency situation	0	3	7	7	7	4	C2.1-C2.3
	Shacking hands	6	6	6	1	4	2	C1.1-C2.1
	Visual Interaction with device	0	3	5	2	5	3	C2.1,C2.3
	Activation feed back of device	1	6	7	6	6	7	C2.1,C3
	Addition	15	26	36	27	32	26	C2.1 key+ voice activated

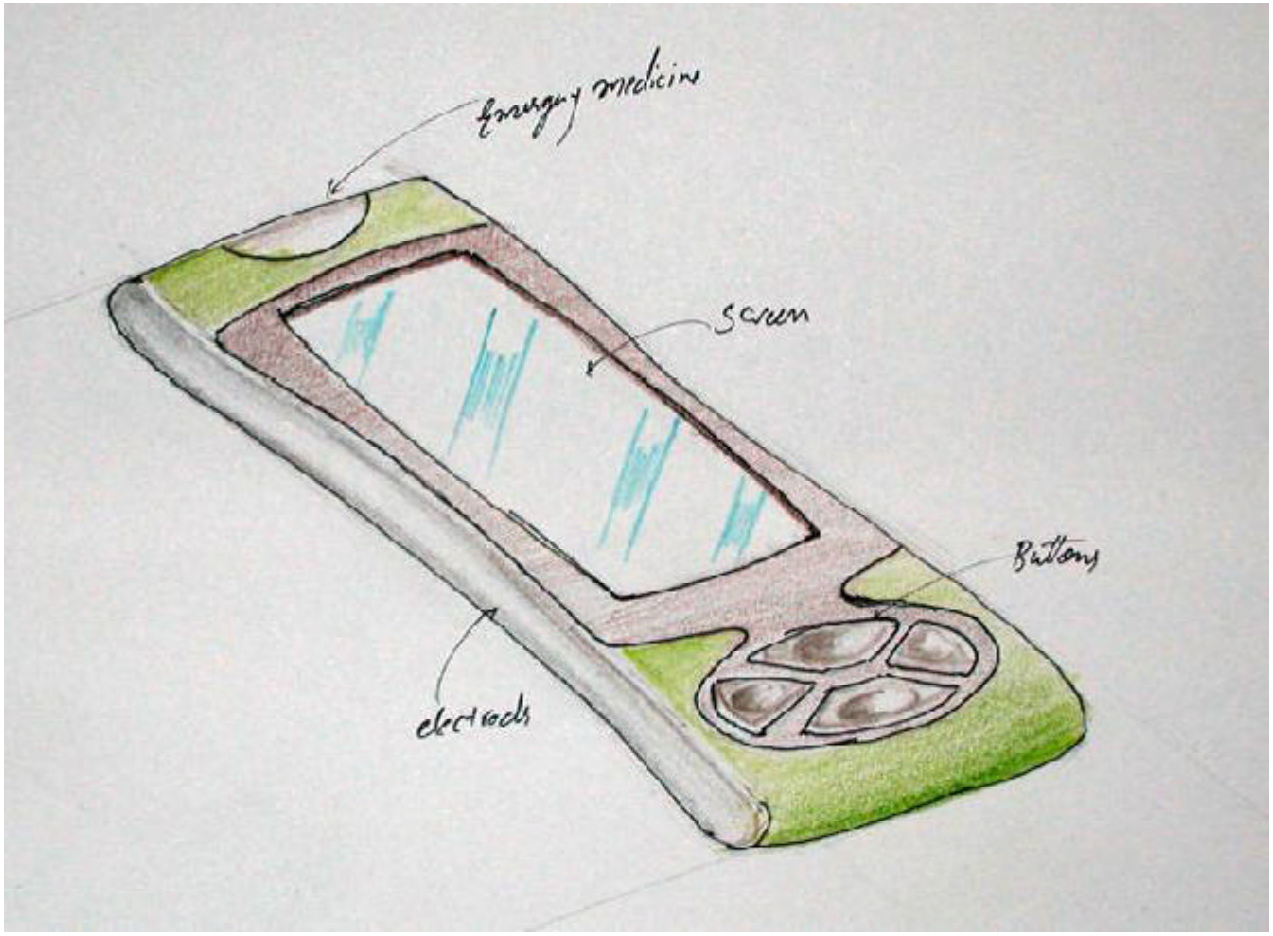
first stage Evaluation of product placement (quantitative test)

	Wrist mounted	In pocket	Hanging around neck	Belt mounted
User comfort 40%	20	30	30	35
Accessibility 30%	25	20	23	19
Safety of device 30%	25	15	24	28
Average	70	65	77	82

Second stage concept generation

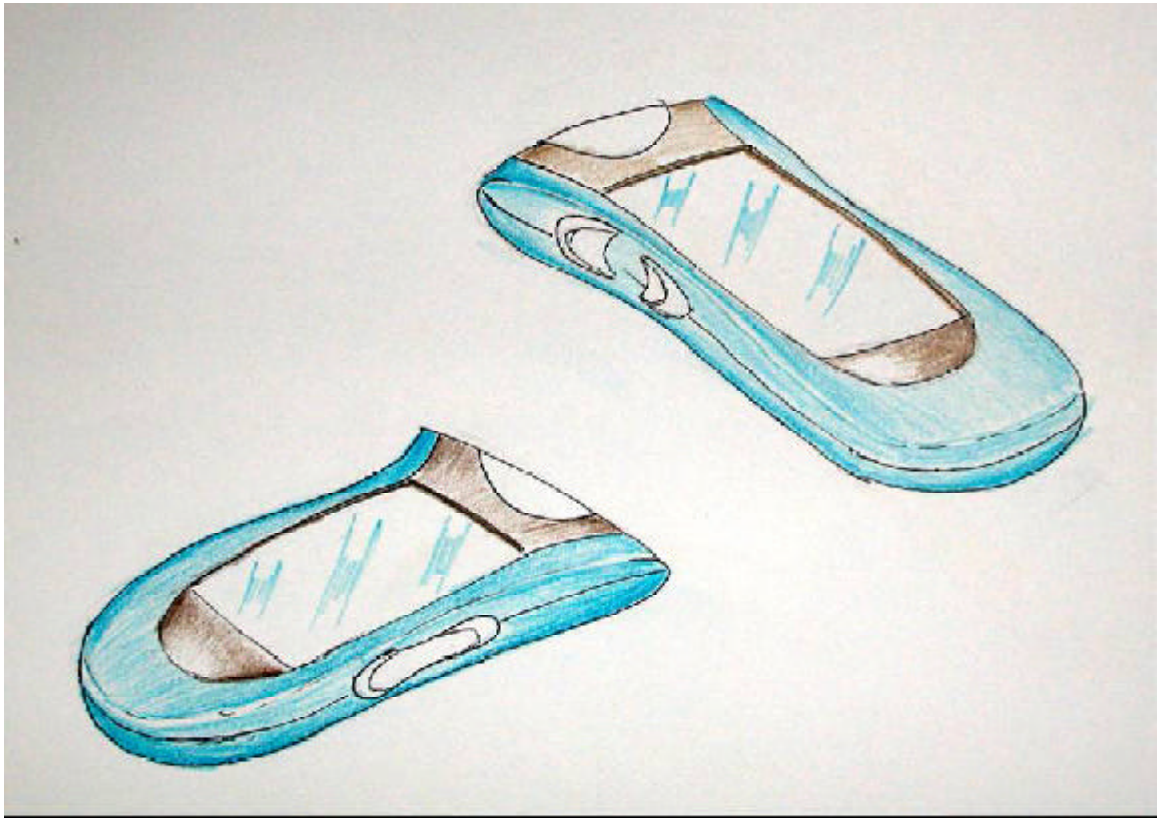
Concept1

- Voice + key activated
- 4 key operation easy to operate
- Good grip of one hand
- Big screen
- Good grip of fingers on hand



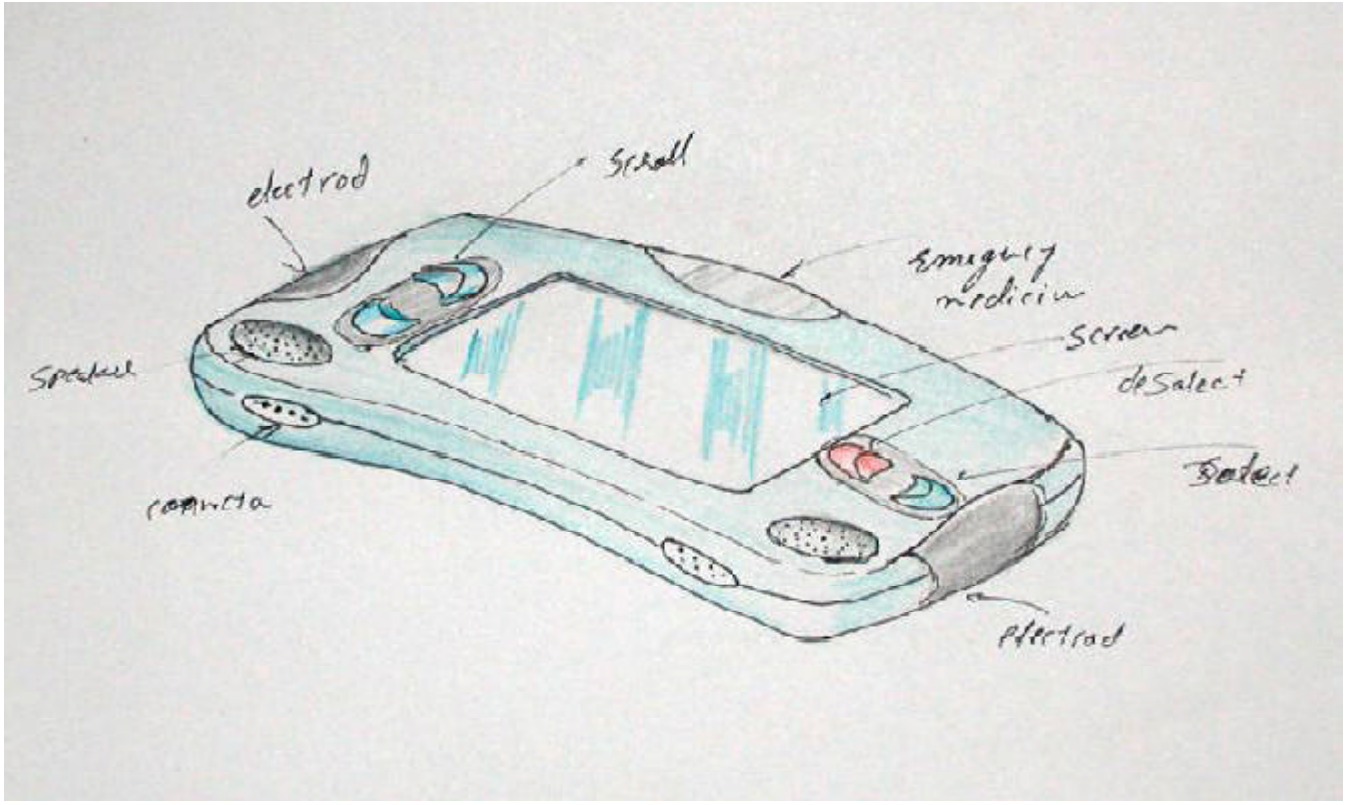
Concept 2

- Voice + key activated
- 4 key operation easy to operate
- Good grip of one hand
- Big screen
- Buttons location at natural position of fingers as you grip on device
- Good grip of fingers on buttons

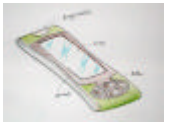


Concept 3

- Voice + key activated
- 4 key operation easy to operate
- Good grip by two hands
- Big screen
- Buttons location at natural position of fingers as you grip on device
- Good grip of fingers on buttons



7 grades method by 10 users

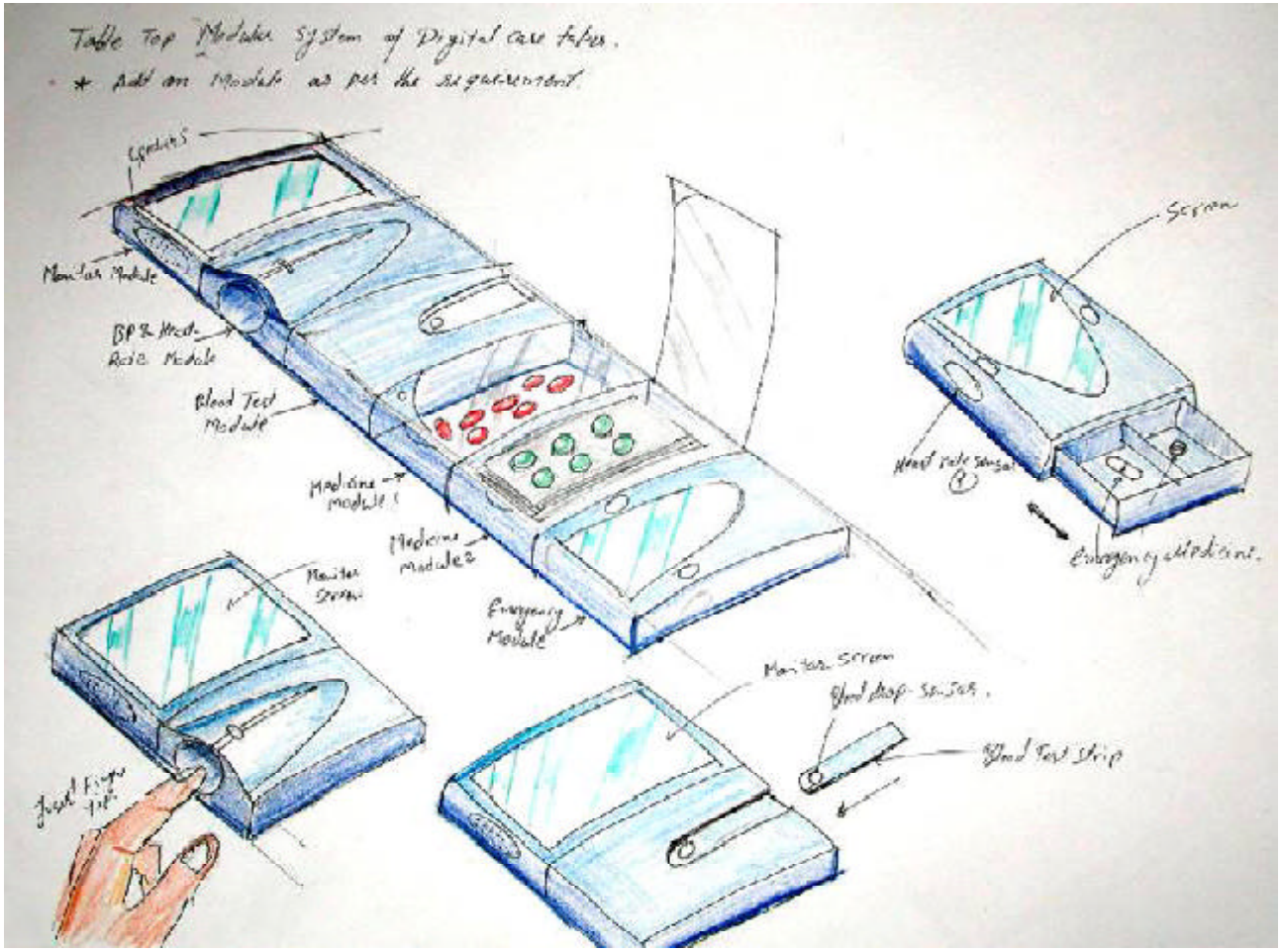
				
	Ergo grip	6	6	7
	Shaking hand	3	3	7
	Finger fatigue	5	3	6
	Visibility	4	4	7

Second stationary part of device

concept 1.1

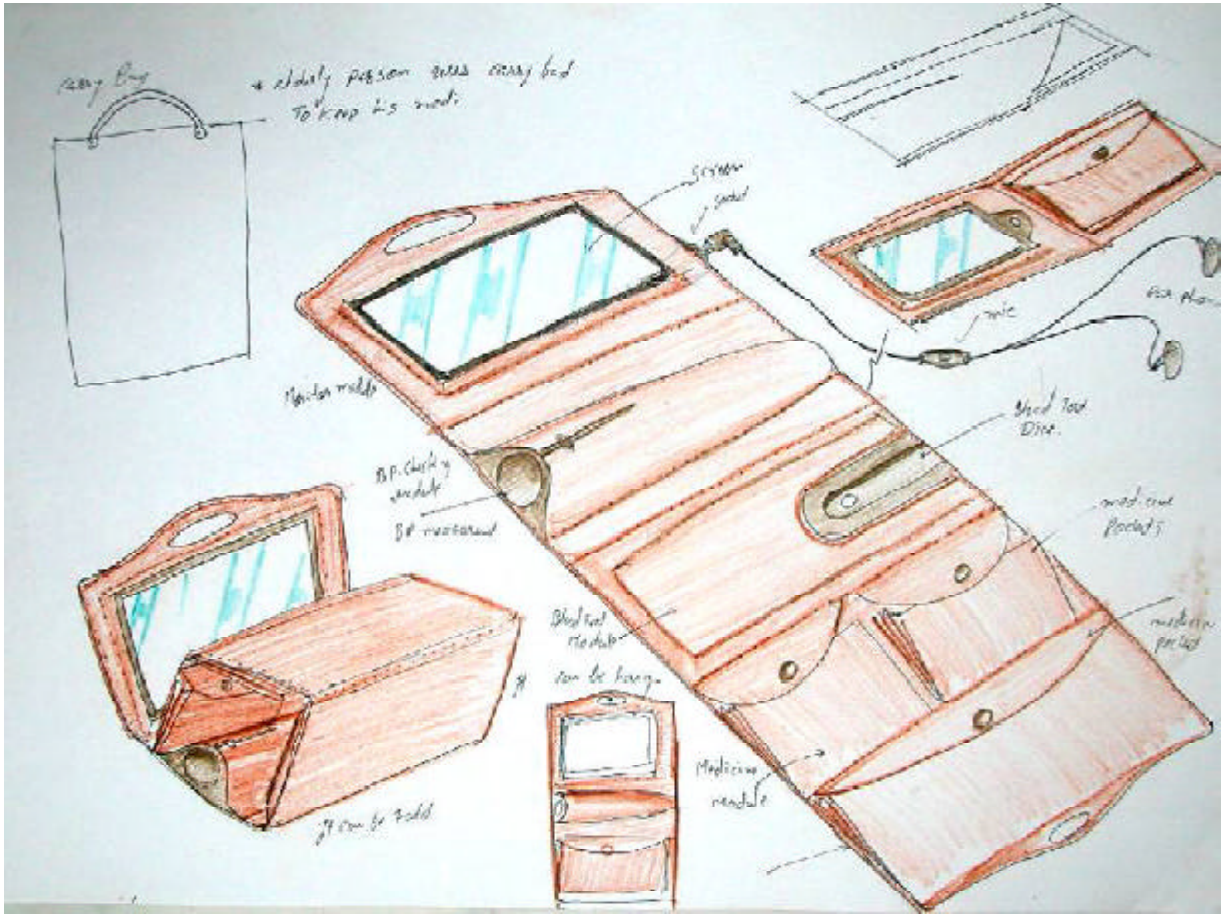
Modular system

it givesflexibility of add on as per the requirement



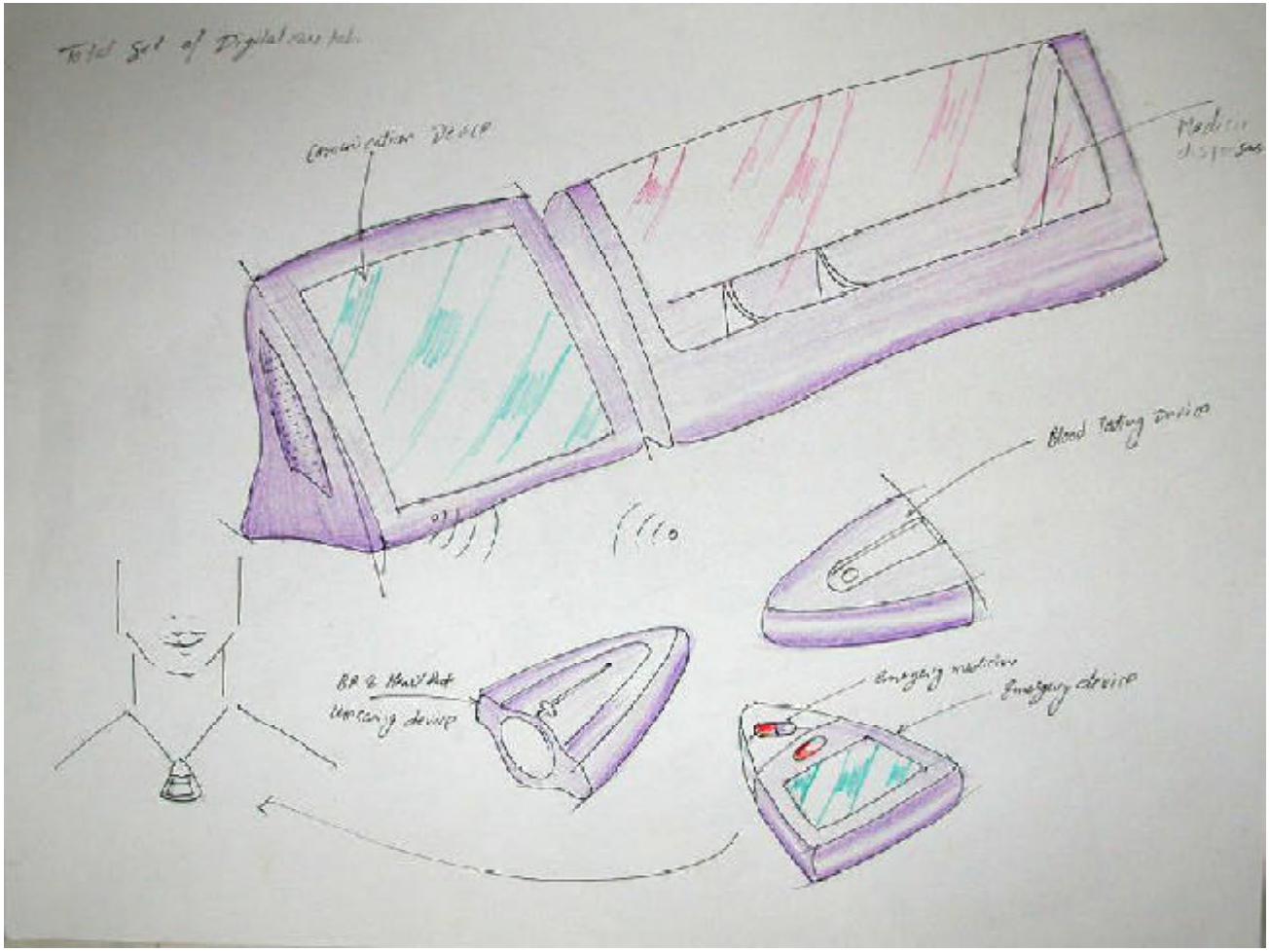
concept 1.2

Modular system
Modular systemBy using leather material
This modular components is staying together with single case



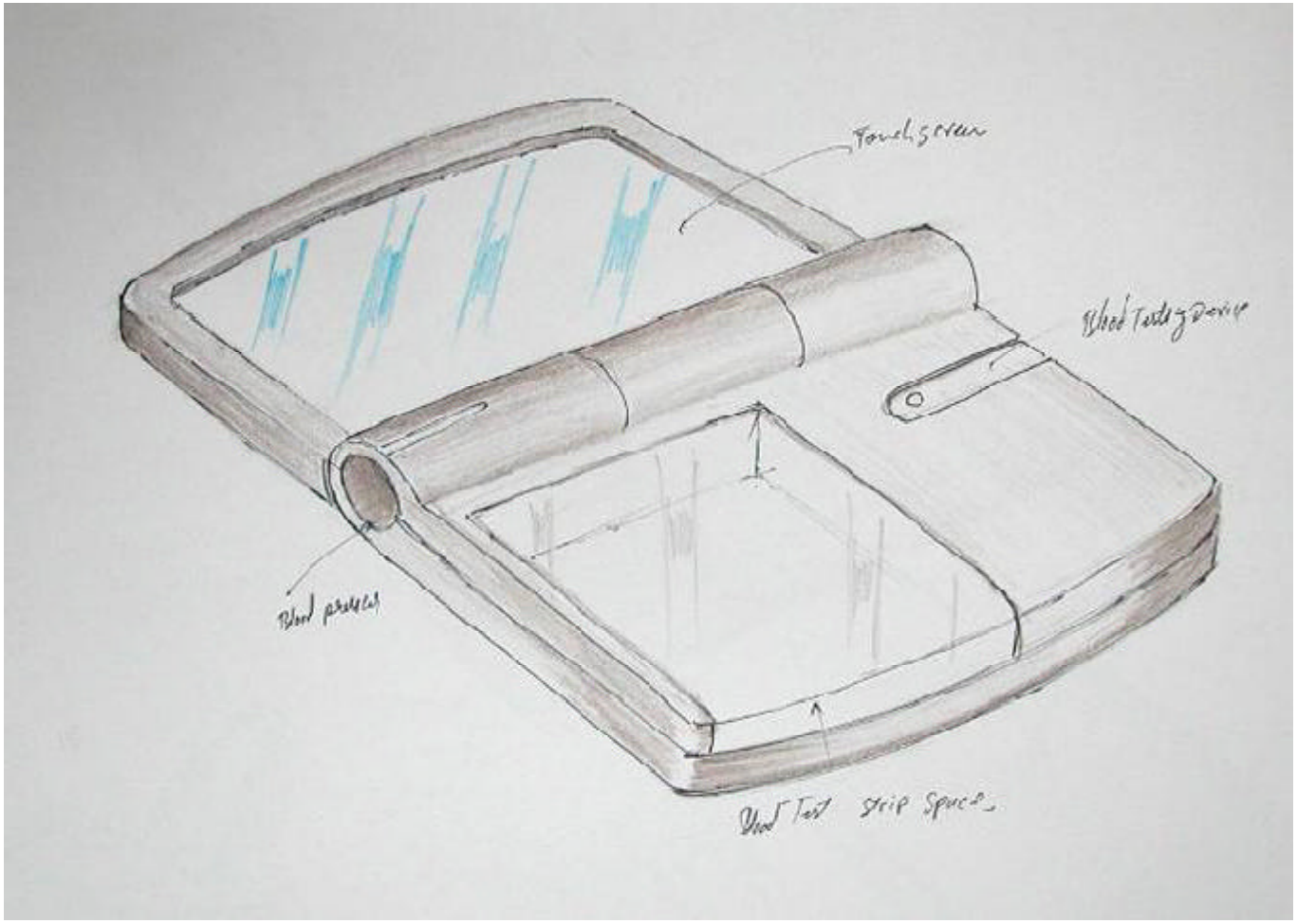
concept 1.3

Modular system as a Table top device



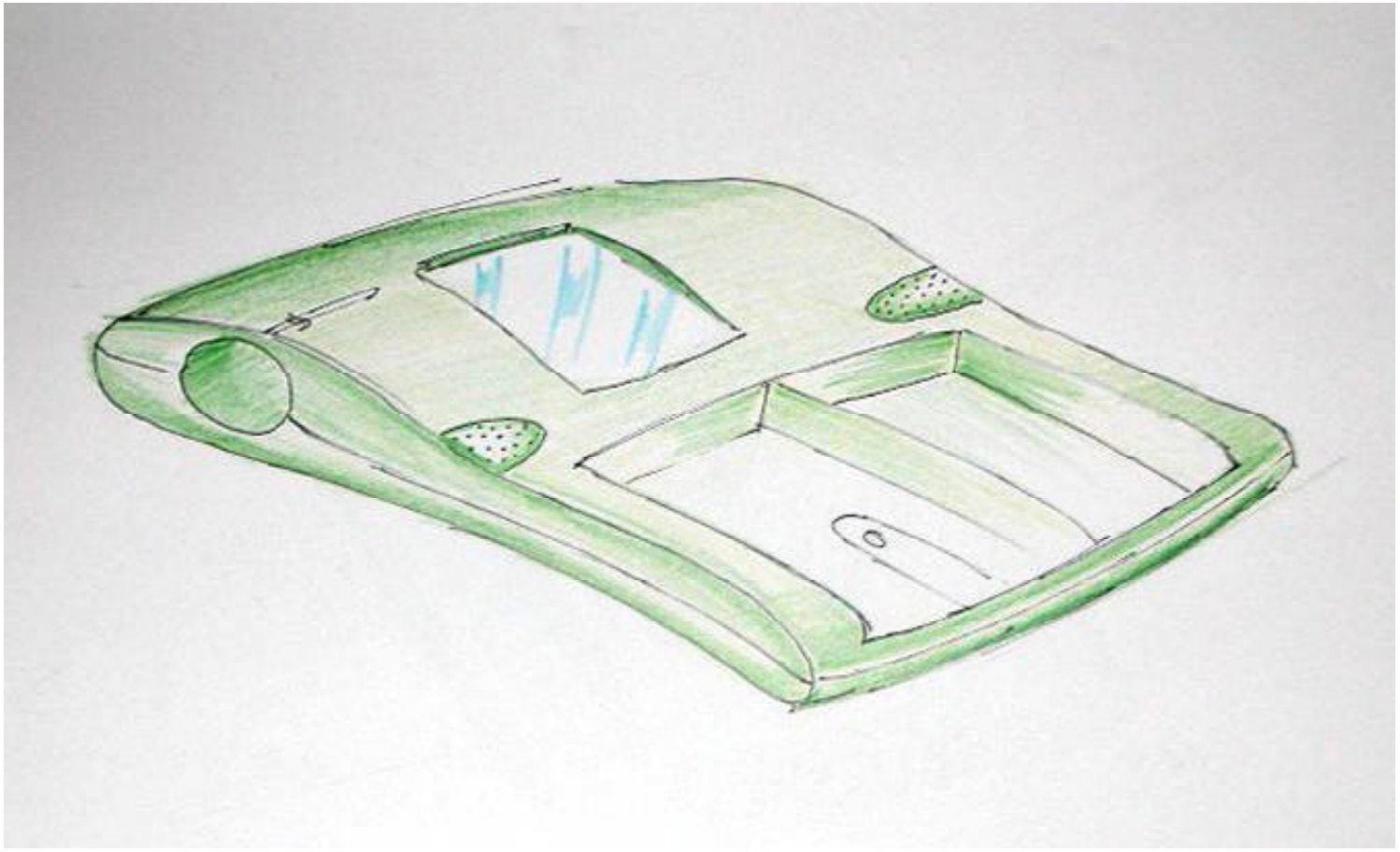
concept 2.1

Non modular system system



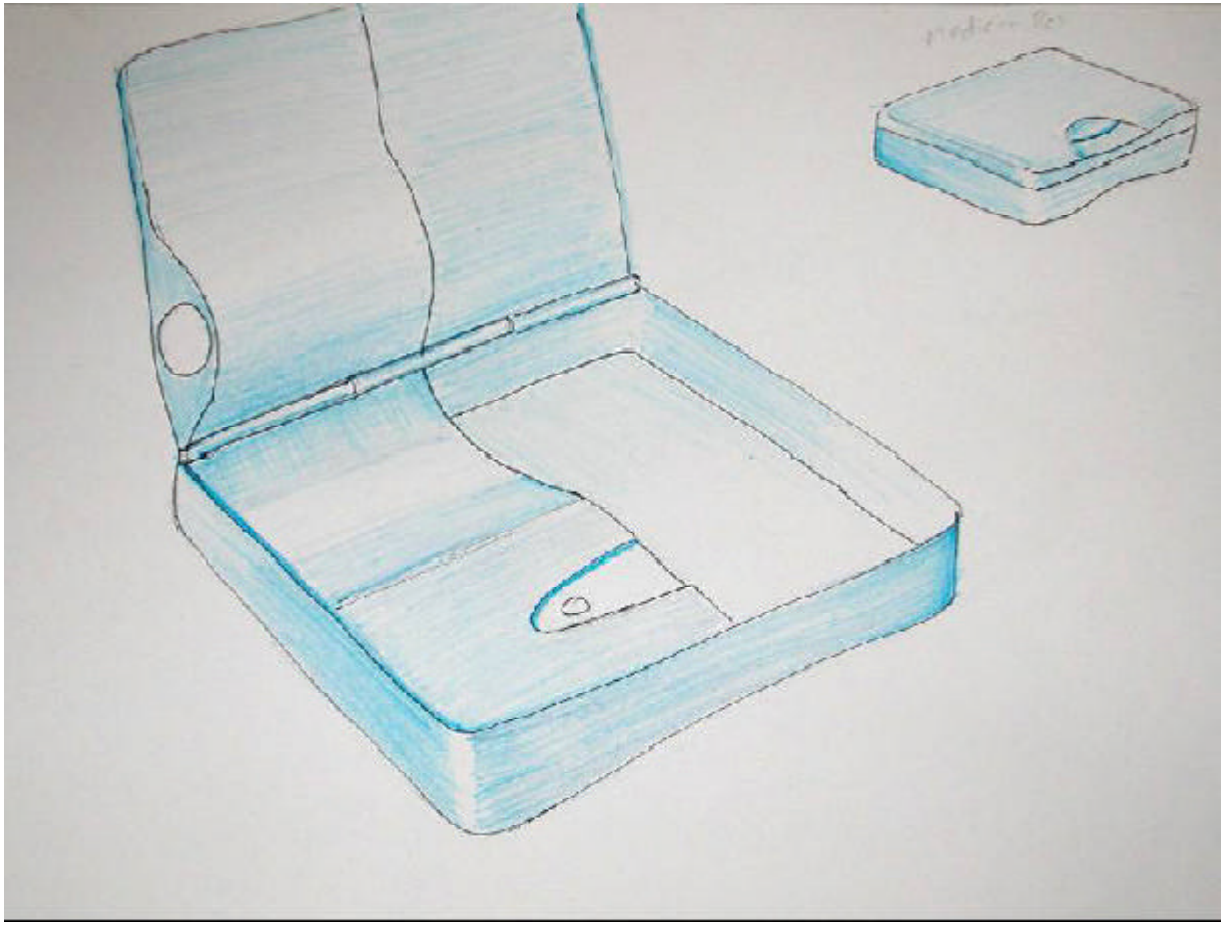
concept 2.2

Non modular system system



concept 2.3

Non modular system system

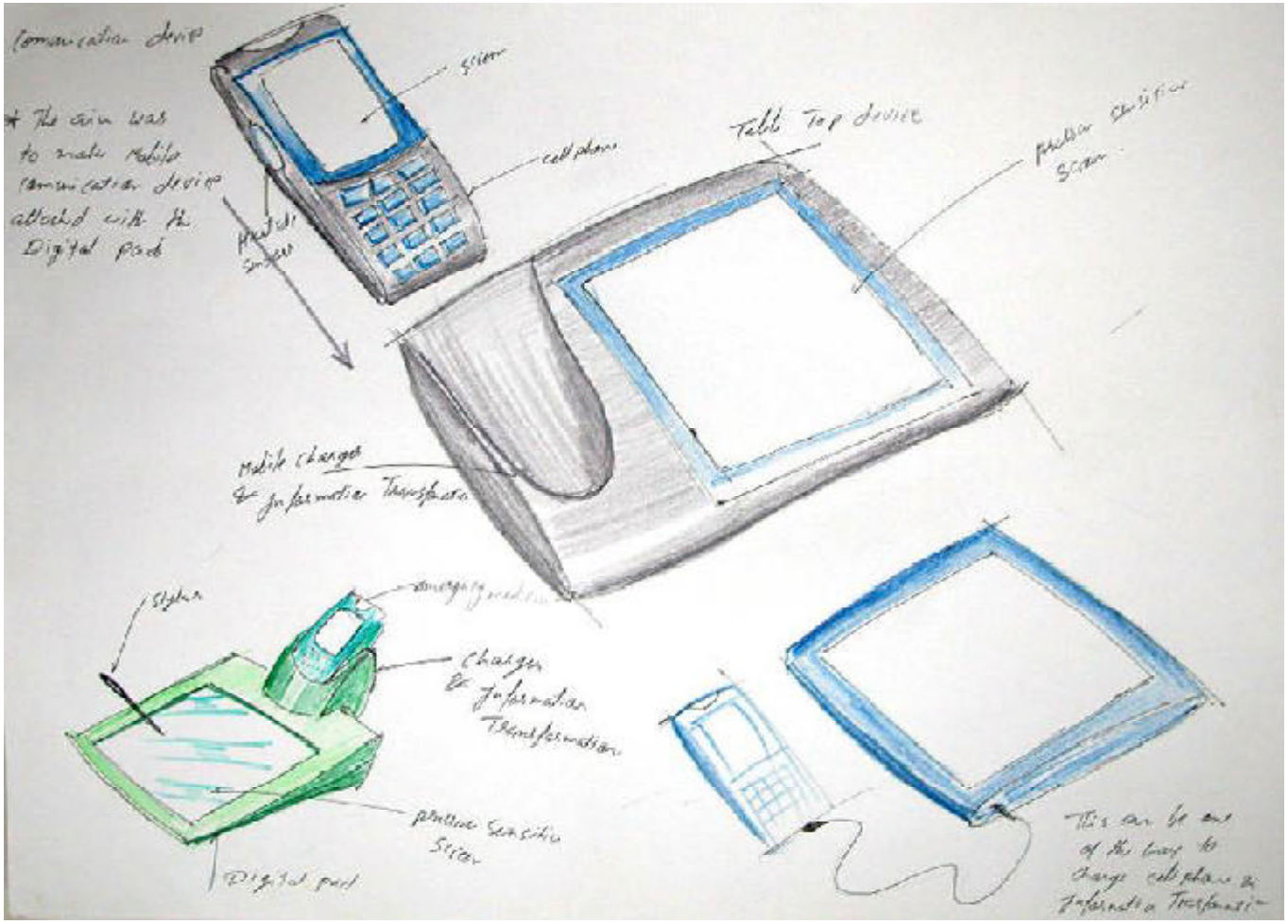


First stage evaluation of modularity (quantitative test)

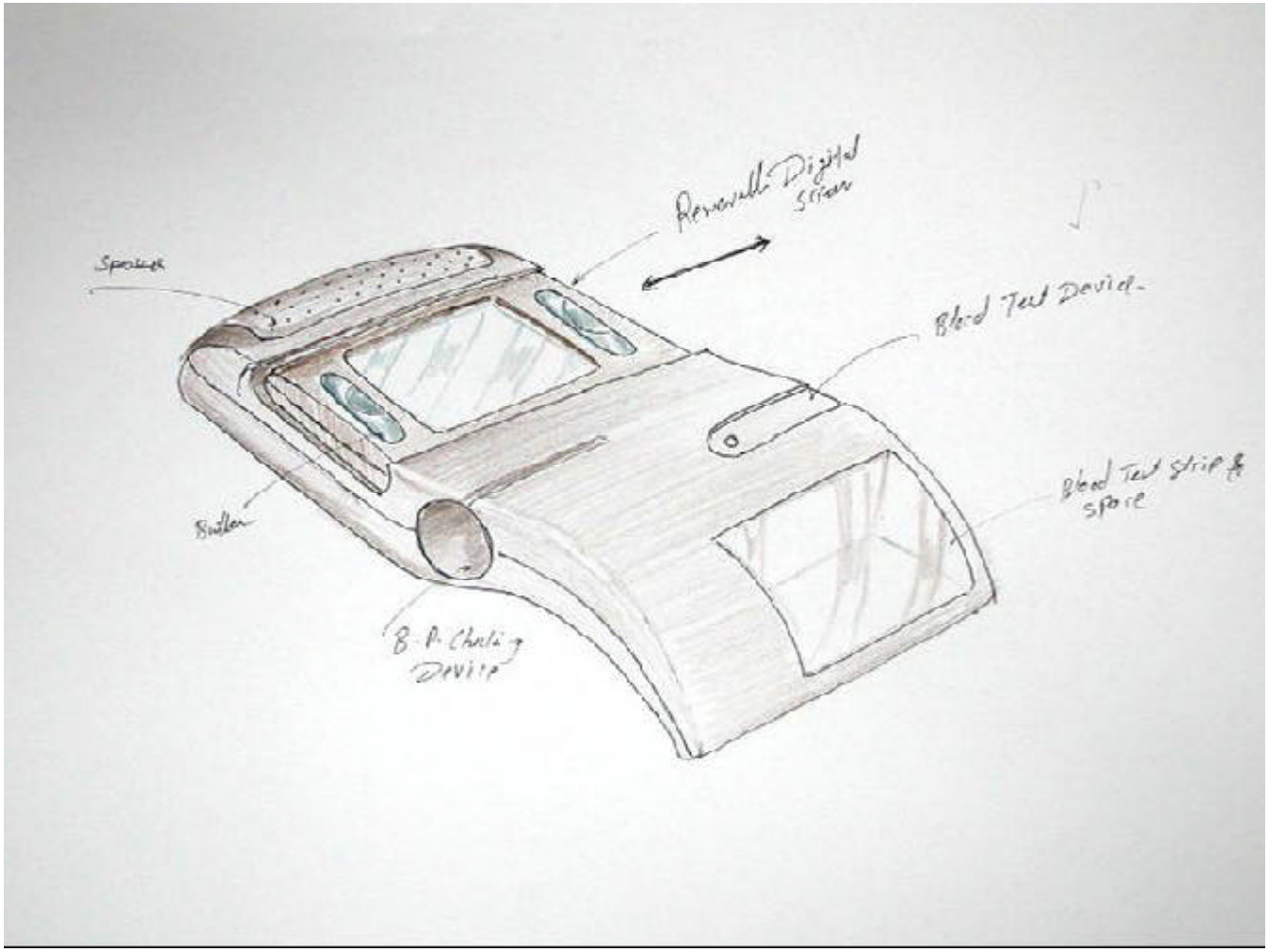
	C1.1 	C1.2 	C1.3 	C2.1 	C2.2 	C2.3 
Poor memory of an elderly person 10%	2	4	3	7	7	7
Shacking hands 10%	5	5	5	8	8	10
Easy to operate20%	10	15	12	15	15	15
Power supply 30%	5	25	10	30	30	30
Changeability As per requirement 30%	30	25	30	0	0	0
	52	74	60	60	60	62

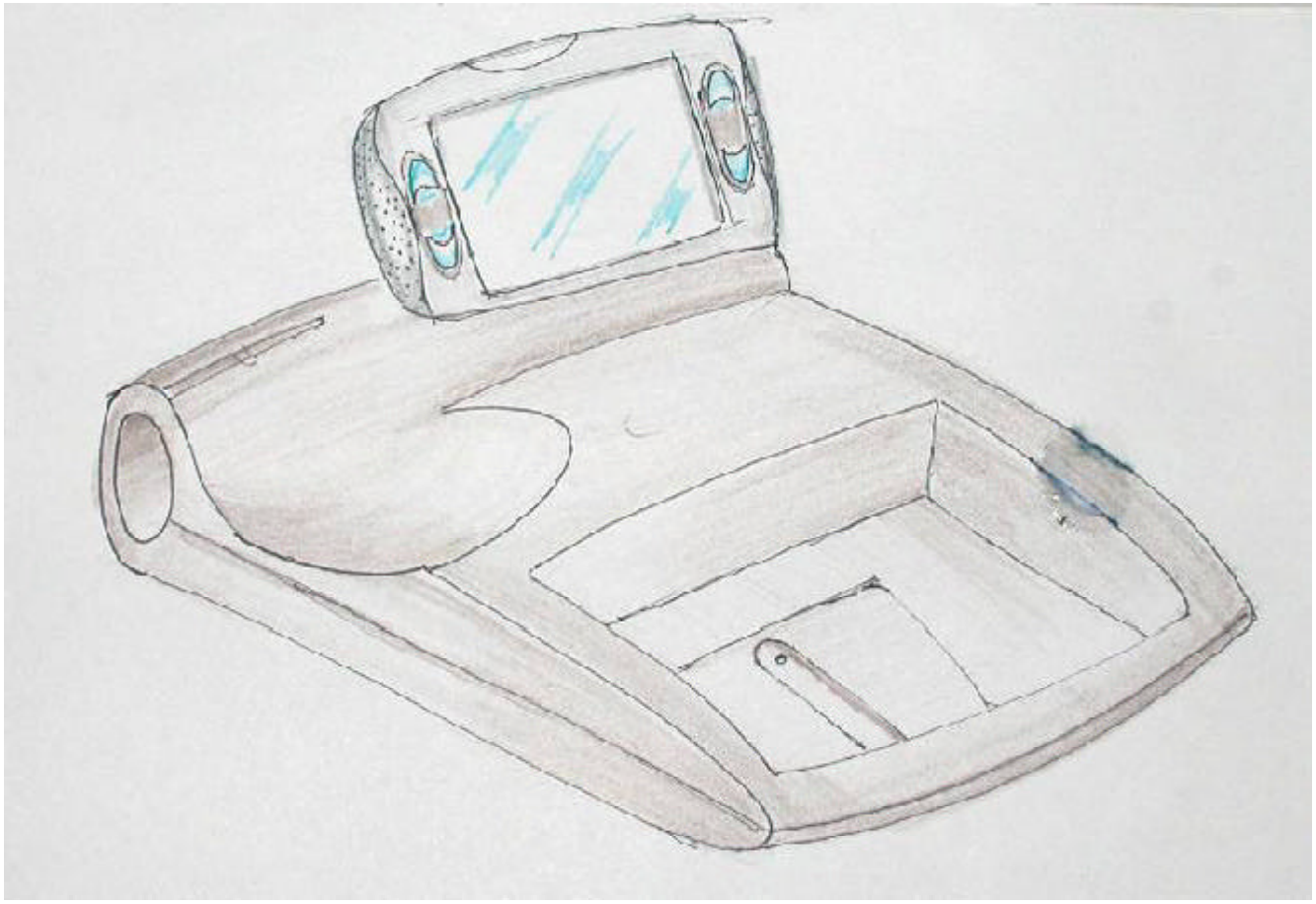
The system must be modular but, all modules must be in single case

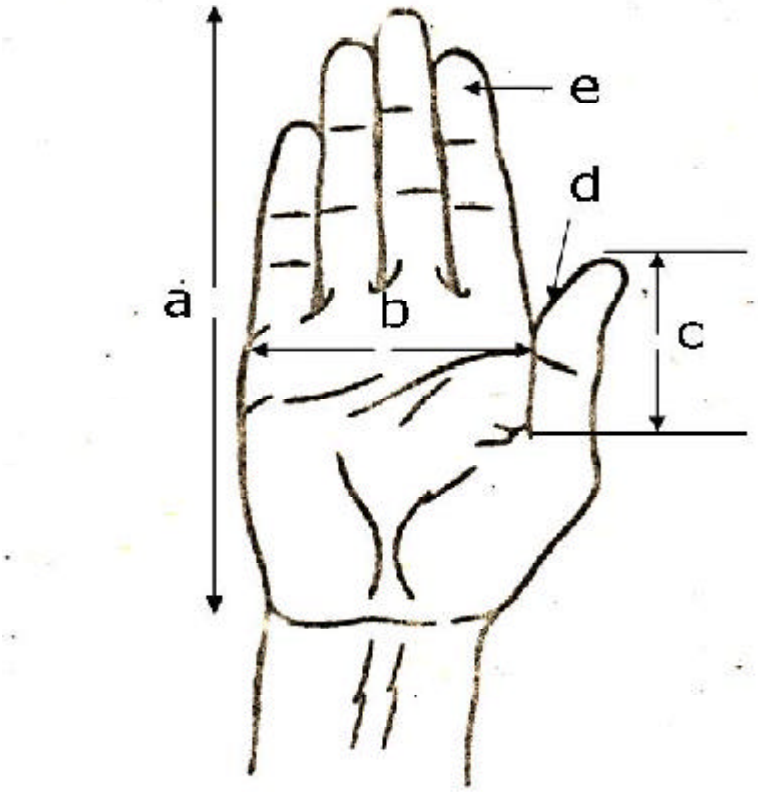
Mobile & stationary device relationship



Mobile & stationary device relationship







Ergo Grip

- Height of palm 160-200mm
- Breadth of hand 55-80 mm
- Height of thumb 55-70mm
- Breadth of thumb 18-25mm
- Breadth of finger 15-20mm

Thermocol models

mobile device

Third stage evaluation of product (quantitative test)

Mobile device

a

b

c

grip	form	
4	5	9
6	4	10
6	6	12

Thermocol models

stationary device

Third stage evaluation of product (quantitative test)
stationary device

a

b

c

usability	form	
3	5	8
6	7	13
5	6	11

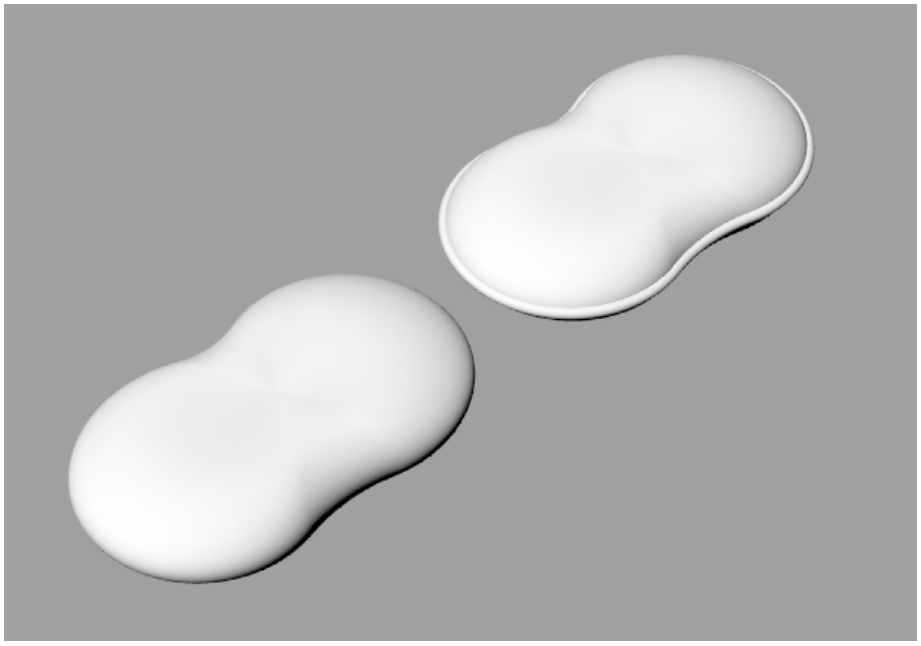
Problem with B.P. checking

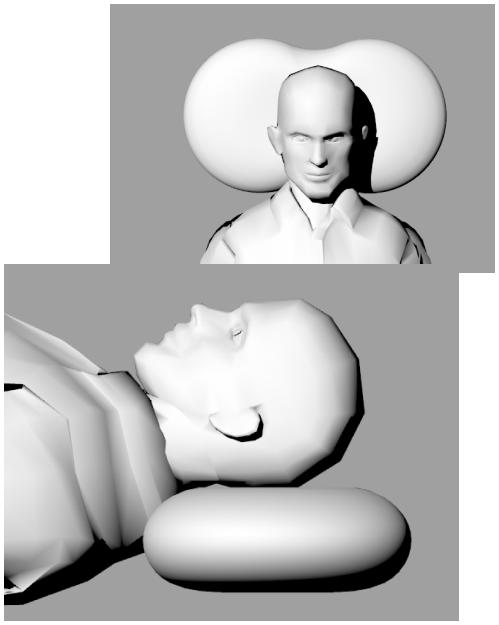
It is difficult to insert finger from side,
difficult to create sufficient space for hand

Final product

Final product

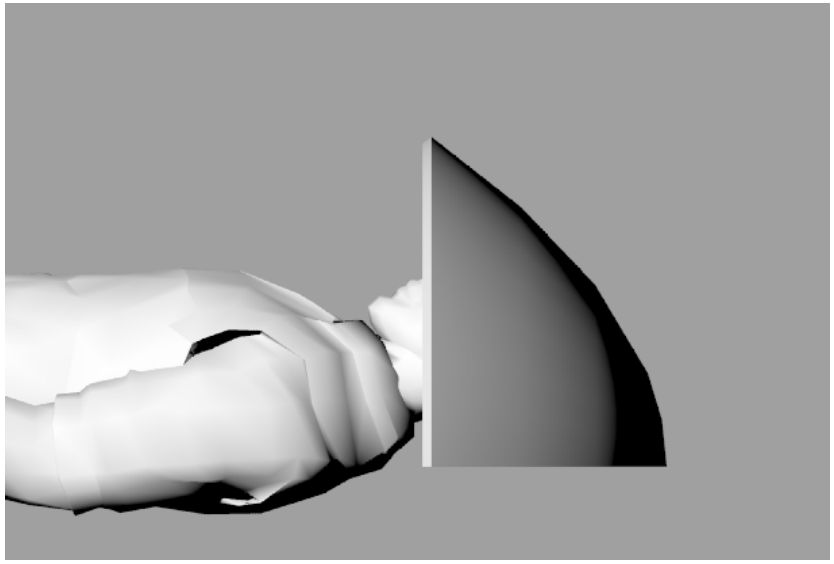
Speaker system concept 1

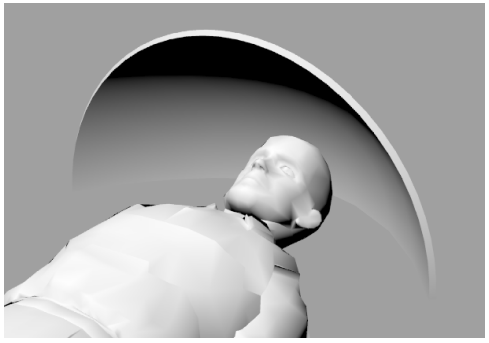




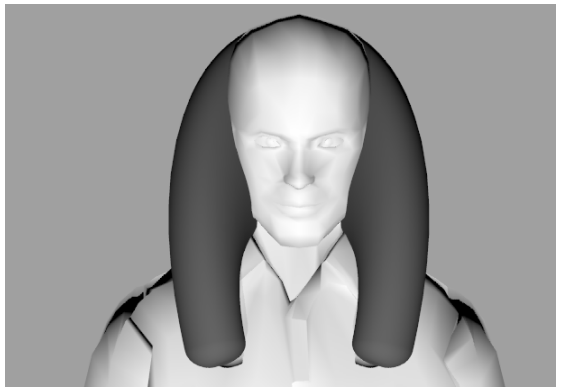
Inbuilt speaker system

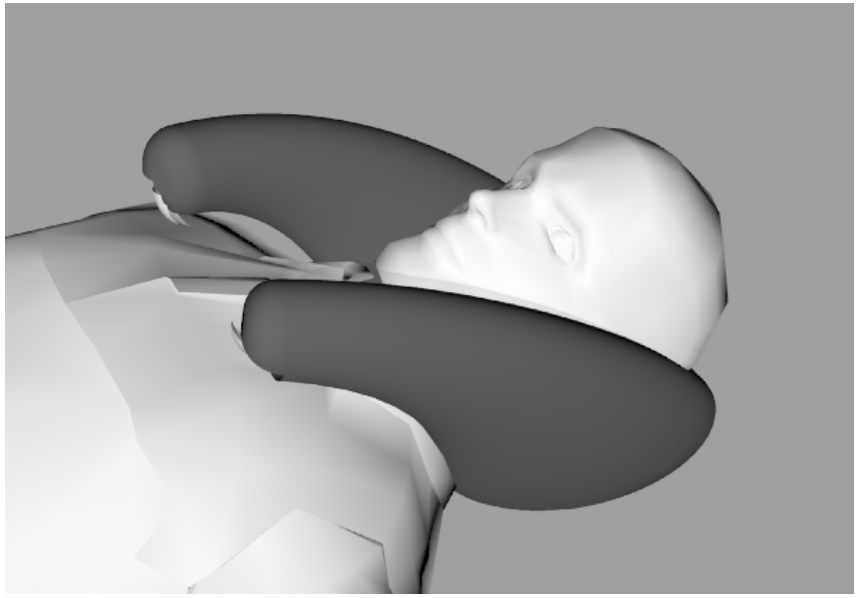
Speaker system concept 2



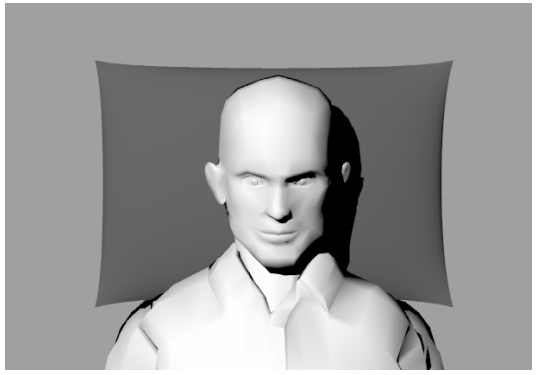


Speaker system concept 3

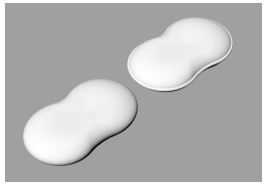
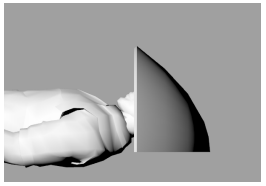
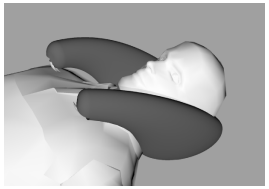
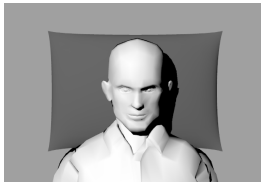




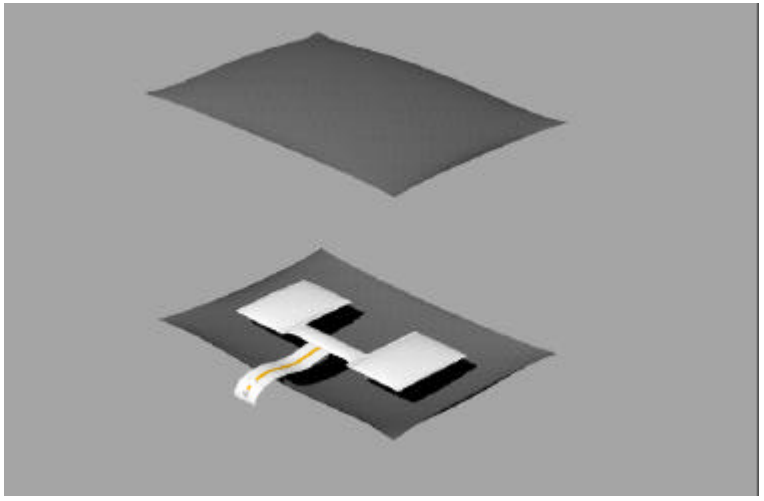
Speaker system concept 4

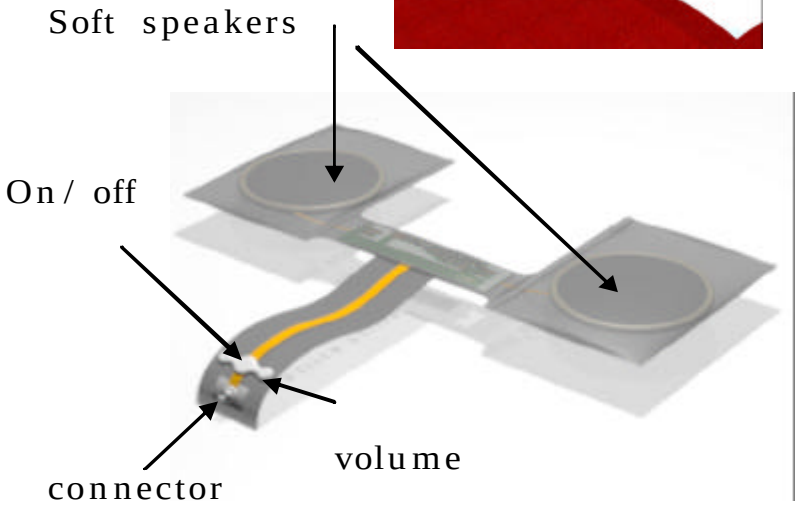


Evaluation of concepts

					
Comfort	5	2	1	7	
Familiarity	5	0	4	7	
	10	2	5	14	

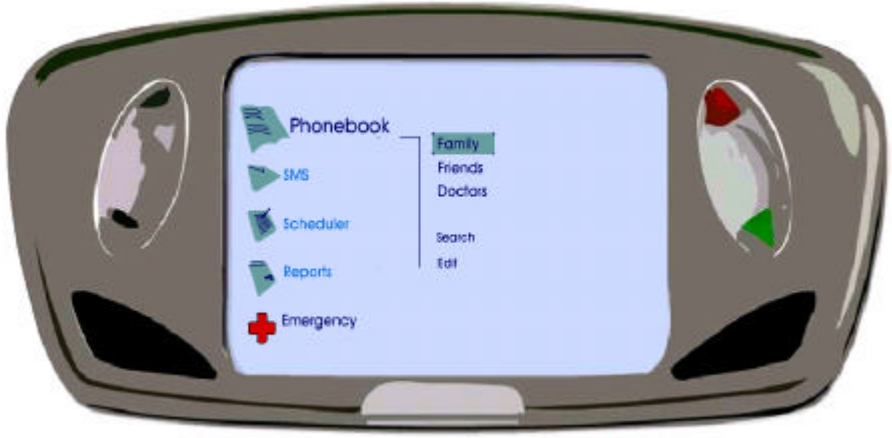
Final speaker system



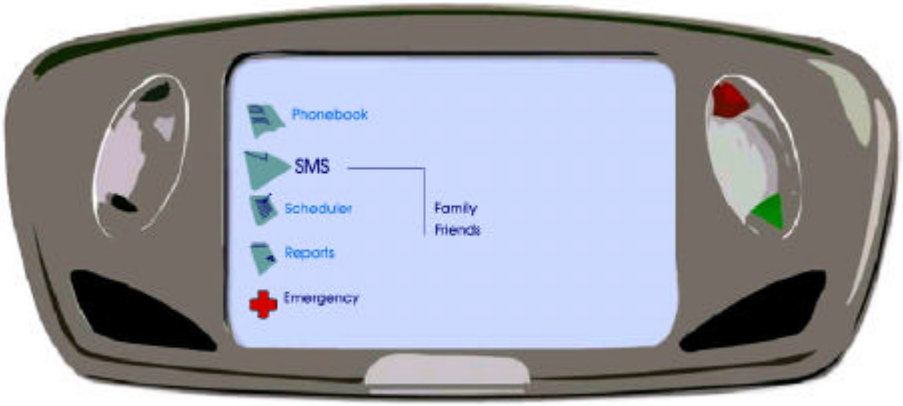


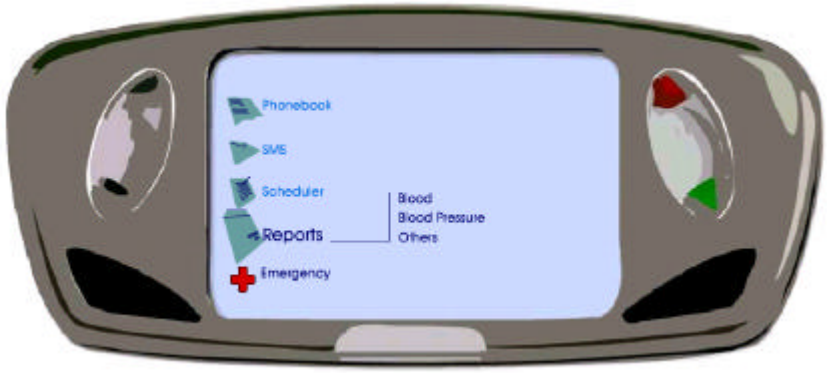
Product interface

The interface is purposely design to operate by minimum keys to avoid more fingers movement.

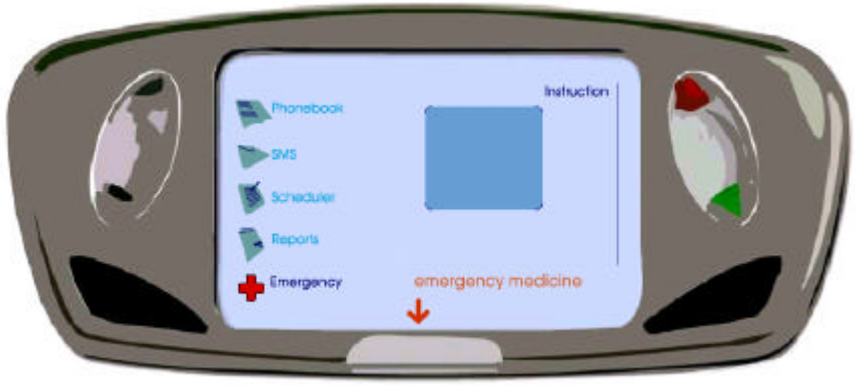


The key on left side is to operate up & down & the key on right side is to operate enter & cancel.

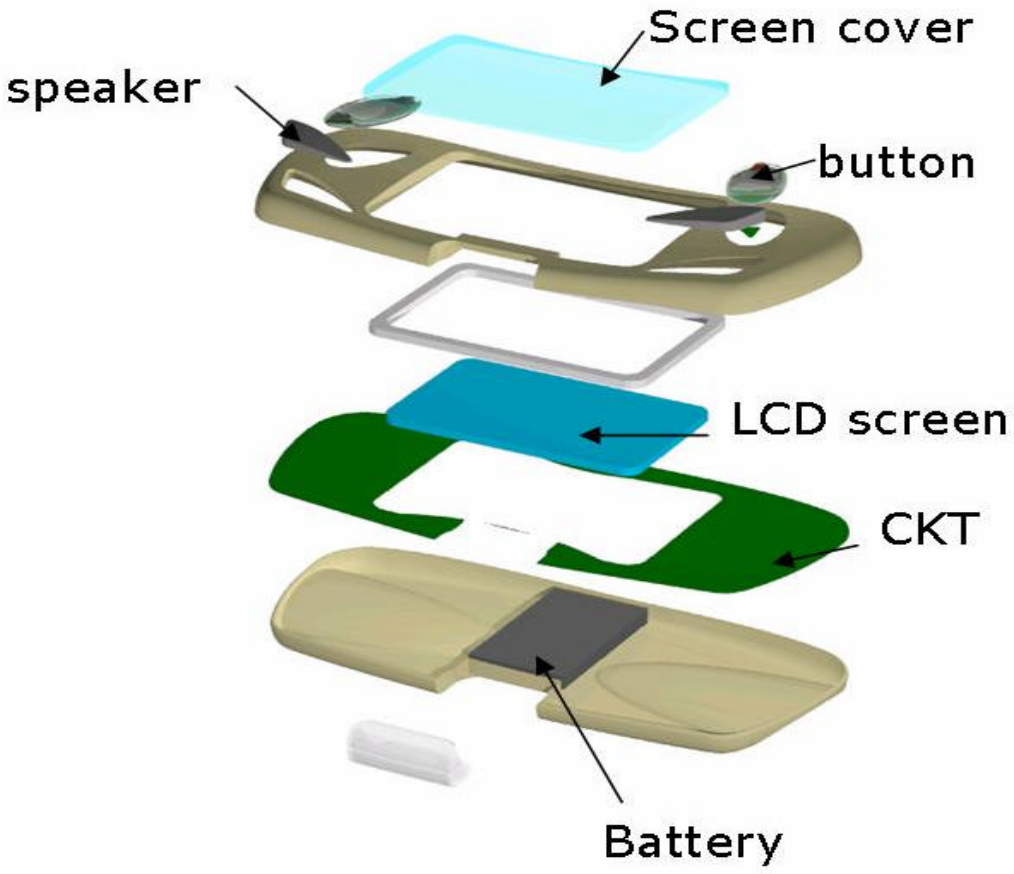

Phonebook
SMS
Scheduler
Reports
Emergency
Family
Friends


Phonebook
SMS
Scheduler
Reports
Emergency
Blood
Blood Pressure
Others


Phonebook
SMS
Scheduler
Reports
Emergency
Medicines
Tests
Reminders
Others


Phonebook
SMS
Scheduler
Reports
Emergency
Instruction
emergency medicine

Internals of mobile device



Suggested material

polyphenylene oxide (PPO) It exhibits

- low moisture absorption
- Good electrical insulation properties
- wide temperature range
- humidity range
- It has superior impact strength
- long-term dimensional stability

product Material

1) ABS (Acrylonitrile Butadiene Styrene)

2) polyphenylene oxide

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ISBN: 81-223-0624-1

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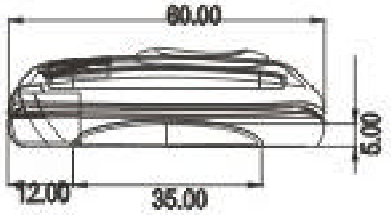
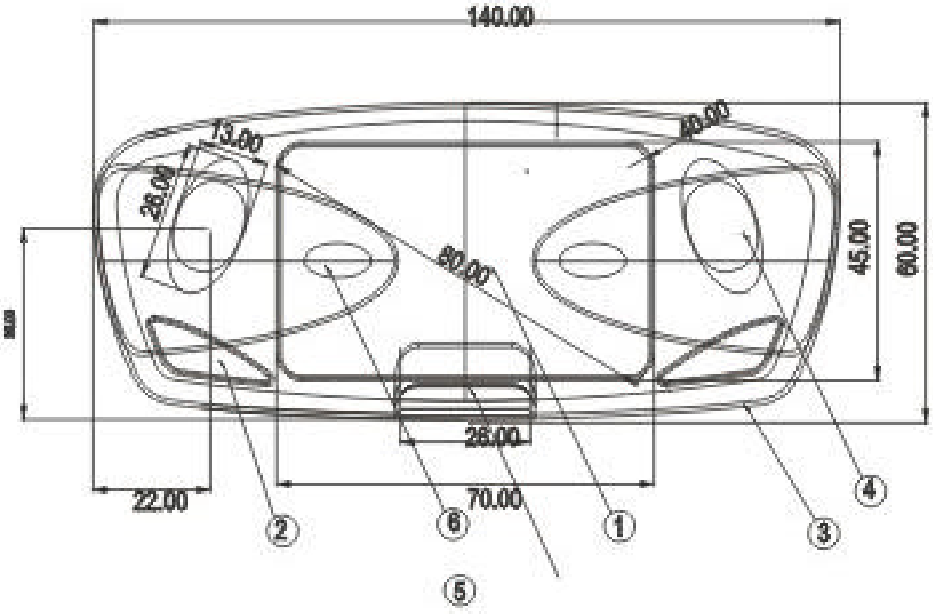
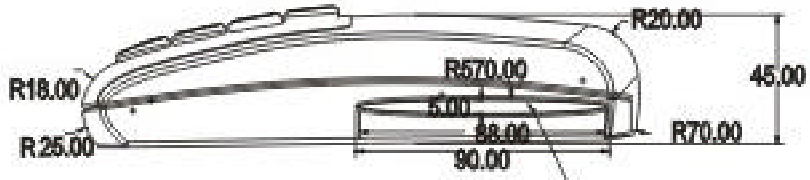
IDC, IITB

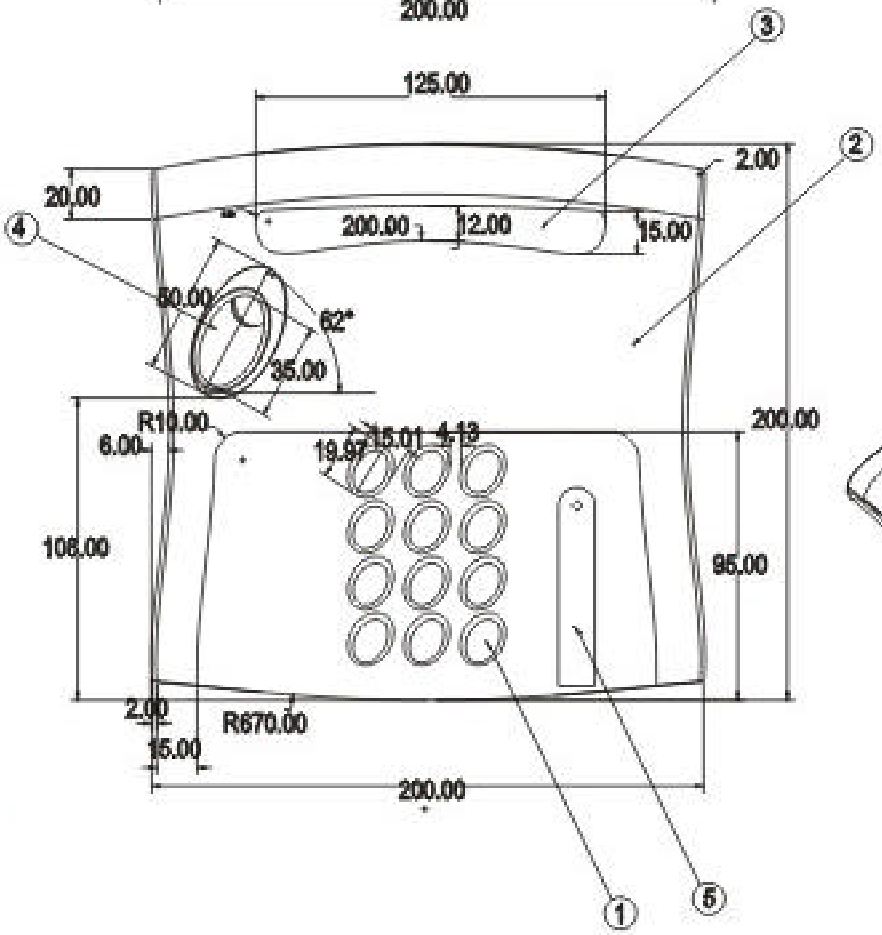




SR No.	PART NAME
6	Heart beat measuring electrode
5	Emergency Medicine Case
4	Operating key
3	Body case
2	Speakers
1	Colour LCD Screen

PROJECT NAME : Digital Caretaker for Elderly	
DRAWING NAME : Mobile Device	
DATE : JULY 2003	PROJECT II : SEMESTER IV
COMPLETED BY : DHANANJAY NAMDEORAO WAGH	
ROLL No. : 01613009	ACADEMIC YEAR : 2001-2003
GUIDE : PROF. VIJAY P. BAPAT	
IDC, IIT BOMBAY POWAI, MUMBAI - 400 076	SCALE: SHEET:





6	Mini Disc Drive
5	Blood Sugar measuring instrument
4	B P Measuring Instrument
3	Mobile Recharging Slot
2	Body case
1	Operating Key
SR No.	PART NAME

PROJECT NAME : DIGITAL CARETAKER FOR ELDERLY	
DRAWING NAME : MOBILE DEVICE	
DATE : JULY 2003	PROJECT II : SEMESTER IV
COMPLETED BY : DHANANJAY NAMDEORAO WAGH	
ROLL No. : 01613009	ACADEMIC YEAR : 2001-2003
GUIDE : PROF. VIJAY P. BAPAT	
IDC, IIT BOMBAY POWAI, MUMBAI - 400 076	