

# Health Screening Device

*Designing of a primary health check up  
kiosk for HealthATM group.*

*Semester III Project Report  
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# Declaration

I declare that this written document represents my ideas in my own words and where others' ideas or words have been included, I have adequately cited and referenced the original sources.

I also declare that I have adhered to all the principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any idea/data/fact/source in my submission.

I understand that any violation of the above will be cause for disciplinary action by the Institute and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been taken when needed.

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Industrial Design Centre, Indian Institute of Technology, Bombay  
February 3<sup>rd</sup>, 2014



# Approval Sheet

The project titled 'Designing of a primary health check up kiosk' by Edu Mohan, is approved for partial fulfilment of the requirement for the degree of 'Master of Design' in Industrial Design

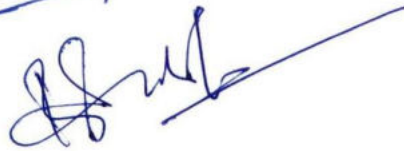
Guide

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Chairperson

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Internal Examiner

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External Examiner

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Date

14-04-2014



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Anyone I missed out

The library. The internet.

*Edu Mohan*

*February 3<sup>rd</sup>, 2014*

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# 1. Abstract

Health care has always been a primary concern for man. Health is not just mere absence of illness or diseases. It is a state of complete physical, mental, and social well-being (*WHO, 1946*). Due to the changing lifestyle of the population and with the growth in modernization, people are forced to lead a hurried day and maintain an unhealthy diet, thus leading to various health issues. The nature of these health problems are such that they affect both genders equally and in early ages leading to health deterioration. The major problem is that often initial discomfort is ignored. The visible symptoms appear too late to take a precautionary measure thus leading to a chronic condition. Hence awareness and frequent health checkups are necessary for remaining on the safer side of life. Providing easier means to take control of the health is the solution this project is proposing. The idea is to create an automated self-service health kiosk so that the consumer can have quick, convenient and affordable access to the knowledge of his state of wellness and avail primary and preventive services on time. The kiosk can be installed in high traffic areas such as malls, gyms and corporate lounges. People can take five to ten minutes out of their busy schedules to get a comprehensive primary health report. This report can be used as a baseline for future consultations if necessary. Thus people can take charge of their health condition and well being can be ensured.

## 2. Introduction

The project was pitched to me by HealthATM group, a start-up in IIT Bombay. Being involved in developing healthcare kiosks, they approached IDC for the product design and development part of the kiosk. Prof. Chakravarthy and Prof. Purba Joshi (my guide for the project) introduced me to the stake holders, Mr. Dhilly Babu and Mr. Shreyans Gandhi and the project was set to motion. The main aim was to design and optimise a solution for self operated or an assisted health kiosk which provides and promotes the common man to ensure preventive health care against lifestyle diseases.

The steps involved during the design process are as follows.

### Data Collection

Studies were conducted by reviewing existing journals and other sources of information available to know more about the domain of preventive health care and lifestyle diseases. Once the context and comprehension was set, a deeper look into the existing products in the market, various types of devices available, etc. were done. Views of an expert, a doctor was considered. Some families from surrounding areas were also interviewed. For the final design, Indian anthropometric data was considered to make sure the product suits well for the targeted group.

## Ideation and Concept evaluation

Concepts were generated depending upon the project brief. An initial analysis of the ideas were done based on feasibility and need.

## Final Design

The final concept was made considering various factors of effectiveness. The feedback from the faculty and stake holders were also incorporated as much as possible to make the design better.

## 3.Context and comprehension:

When people are ill, they visit a doctor. Those living in urban areas have easier access to primary healthcare services. Those in rural areas and interior parts of the country might not have that easy an access, even in cases of medical emergency. Such is the disparity in our times. Even so, it is the people in urban areas who suffer from a host of diseases, many of which arise from the busy lifestyle they lead. No exercise leads to obesity; skipping meals causes acidity and ulcers; smoking causes cancer, emphysema, increased stress and blood pressure variations; excessive fat consumption leads to heart disease; excessive alcohol consumption causes cirrhosis; and lack of sleep results in receding memory and energy.

Two types of people were interviewed over the course of the project. People who visit a doctor regularly and those who are a bit reluctant to do the same. Most people have a family doctor whom they visit at the signs of slightest discomfort. Often all three generations of the family visit the same general physician, who in serious cases refers them to a specialist, or a higher medical authority. The families often trust the doctor completely in such cases.

In case of people reluctant to visit a doctor, they have encountered a bad experience or two in terms of ineffective medication or worst, a wrong diagnosis. They float from one doctor to another, often preferring to visit an established hospital only in the case of a serious ailment or an emergency. These people prefer to monitor their health themselves, taking special efforts to remain fit and healthy. They make use of the periodic health checkups offered by their organisations.

In case of a visit to the doctor, the patient is often accompanied by a relative. He/she has to take a token number and wait outside the doctor's cabin until they are called in. Then the doctor asks about the patient's discomfort. If the doctor knows the patient, often general well-being is discussed, keeping the mood light. Then he/she proceeds to perform the check-up. The check-up is a process that is highly dependent on feedback. This in turn is dependent on how comfortable the patient is with the doctor. In most cases, the doctor assures the patient that he/she'll be fine and proceeds to prescribe some medicine. In serious cases, the doctor forwards the case to another doctor who would probably be more competent in handling the case.

The first group of people have a much more ethical approach perhaps. They choose a mandatory all-encompassing health check-up, in a formal environment. Thus both groups ensure their good health in two totally different approaches.

The project was mainly aimed at encouraging health check-ups for people leading a busy, fast paced lifestyle. Hence it was necessary for me to study the host of diseases that affect this population. The kiosk services and consecutively the project would be incomplete without explaining a bit on these lifestyle diseases.



## 4.Literature Research

## 4.1 Study about various Diseases

### 4.1.1 Diabetes Mellitus

Diabetes (Madhumeha in Hindi; meaning honeyed urination) is one of the modern lifestyle diseases so widespread that everyone knows at least one person suffering from it. It is a dangerous condition in which the human body excrete the excess sugar content present in the blood through urine. It is often characterised by excessive urination, increased thirst and increased hunger. Diabetes is mainly of two types:

Type 1: In this type, the pancreas does not produce enough insulin to regulate the blood sugar levels. This happens due to malfunctioning of the beta cells in the Islets of Langerhans in the pancreas.

Type 2: Here, the body cannot effectively utilise the insulin produced due to insulin resistance. This is the type of diabetes which is found in a large mass of the population.

Another type of diabetes may occur during pregnancy, referred to as gestational diabetes. It is often a precursor to type 2 diabetes, if not treated well.

Our body releases the hormone insulin to regulate blood sugar levels. Scientists have identified some particular genes that make people more likely to develop insulin resistance and diabetes. The common causes of diabetes are excess weight, lack of physical activity and stress.

The condition of excess sugar levels in the blood termed as Hyperglycaemia is a common effect of excessive diabetes. This can lead to the risk of serious damage to our essential organs like eyes, kidneys, heart and even basic functioning of our body. (*Dr.Health.md, 2014*)

There is no known cure for diabetes. Managing the sugar levels close to normal is the only way to fight this disease. But even this has to be done without letting the sugar level dip below normal leading to hypoglycaemia. This can usually be achieved with the right diet, exercise, and use of prescribed medications (insulin in the case of type 1 diabetes; medications, and sometimes insulin too, in type 2 diabetes).

## 4.1.2 Cardiovascular Diseases

Heart is one of the most vital organs in the human body, and like any other organ, it needs oxygen and nutrients from the blood to perform its functions in a healthy manner. The coronary arteries are the vessels responsible for the supply of oxygenated blood to the heart.

Cholesterol deposits, also called plaque, can build up within these arteries and make them narrow as shown in figure 1, and affect the blood supply to the heart and cause most heart problems including angina or chest pain. The cholesterol build up is a direct result of an unhealthy lifestyle and bad eating habits. (<http://www.webmd.com/heart-disease/guide/diseases-cardiovascular>)

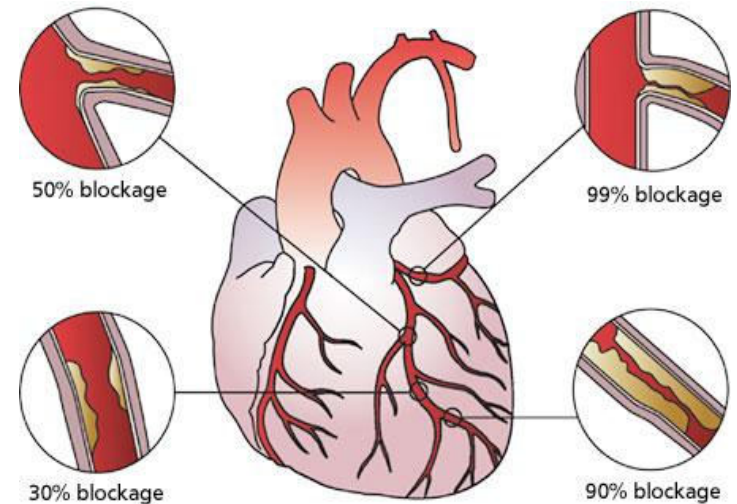


Figure 1: Cholesterol deposits in coronary artery  
[www.jeevansanjeevani.org](http://www.jeevansanjeevani.org)

### 4.1.2.1 The major types of heart diseases are listed below.

- Arrhythmia: This happens when the heart beats start getting erratic. It can either be harmless or extremely dangerous. It can increase chances of other heart issues.
- Cardiomyopathy: This is a heart disease in which the muscles of the heart do not function normally.
- Congenital heart disease: The disorders in the organ that are present at birth and may be diagnosed immediately after birth or much later in life.
- Congestive heart failure: This is the condition that can result from any heart-related problem that makes it difficult for the organ to pump sufficient blood through the body. As a result of that many of the body's organs are then deprived of essential blood supply.
- Coronary artery disease (CAD) or coronary heart disease (CHD): This disease hardens the heart arteries and constrict (usually as a result of plaque build-up), and restricts blood flow to the vital organs. CAD is also the leading cause of angina and heart attacks.  
(<http://www.webmd.com/heart-disease/guide/diseases-cardiovascular>)

- Hypertensive heart diseases: It is caused by high blood pressure.
- Inflammatory heart disease: This refers to an inflammation of the organ's muscles and/or the tissue surrounding them.
- Valvular heart disease: This refers to a disease involving one or more of the valves of the heart
- Blood pressure: This is the most common cardiovascular diseases.
- Myocardial infraction (Heart attack): It happens when blood stops flowing properly to some part of the heart and the heart muscle is injured because of not receiving enough blood. Usually this is because one of the coronary arteries that supplies blood to the heart develops a blockage due to an unnatural build-up of white blood cells, cholesterol and fat. The situation is called "acute" when it is sudden and extremely serious.

Immediate treatment for a suspected heart attack is taking aspirin, which prevents further blood from clotting, and sometimes nitroglycerine to treat chest pain and to regulate oxygen supply. (<http://www.webmd.com/heart-disease/guide/diseases-cardiovascular>)

An acute heart attack is treated by restoring circulation to the heart, called reperfusion therapy, and most commonly used methods are angioplasty, where the arteries are pushed open, and thrombolysis, where the blockage is removed using medications. People with diabetes who have more than one blockage in their coronary arteries, may have to undergo bypass surgery. Ischemic heart disease, which includes MI, angina, and heart failure when it happens after MI, was the main cause of death for both men and women worldwide in 2011.

Major reasons and symptoms for cardiovascular diseases:

The primary factors causing heart diseases are smoking, high blood pressure, high cholesterol, diabetes, a family history of the condition, and obesity.

The pain may differ in elderly people, women, and people suffering from diabetes. In these cases, general fatigue and difficulty in carrying out simple routine tasks like walking or climbing stairs could be a warning sign. The symptoms of angina progress gradually as the artery narrows and blood flow to the heart reduces. Frequently people simply experience it as a discomfort, failing to associate it with pain, and ignore it completely until they suffer an attack. (<http://www.webmd.com/heart-disease/guide/diseases-cardiovascular>)

## 4.1.2.2 Diagnosis and tests

When a heart disease is suspected, the doctor will begin the procedure of diagnosis by recording a detailed history of the person's lifestyle, habits, general constitution, other medical conditions, etc. The type of tests recommended will depend of the person's proneness to angina. Catheterization (like an angiography procedure) can establish the presence of plaque, and the extent to which it is blocking blood flow in an artery, but not everyone demands this invasive technique. Stress tests and electrocardiograms (ECG) may be sufficient to diagnose the condition.

Stress testing involves the monitoring of the amount of stress that a patient can endure. A treadmill can be used to conduct it. In any case, stress test has to be carried out under strict medical supervision as over-doing it can lead to angina, breathlessness, erratic heart rhythms or even a heart attack.

ECG is a non-invasive technique in which heart disease can be detected by measuring the electrical impulses it generates. These impulses can be measured on the surface of the skin by attaching special equipment to the arms and legs. Normal muscles will reflect the electrical impulses normally, but if the muscles are affected by poor blood supply, an indication that the heart is functioning poorly or pumping too little blood, that too will be reflected in the ECG graph. (<http://www.drhealth.md/life-style-diseases/heart-diseases>)

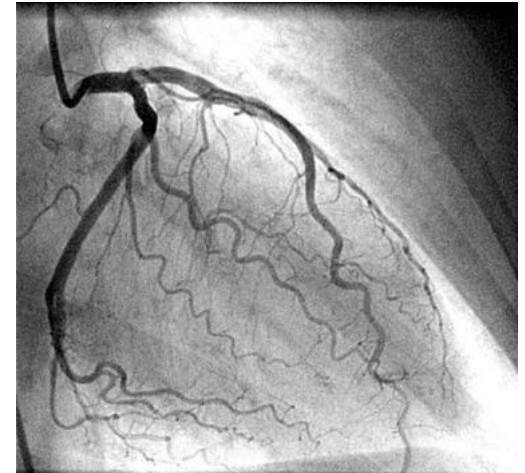


Figure 2 : Typical Angiogram  
([drsvenkatesan.wordpress.com](http://drsvenkatesan.wordpress.com))



## 4.1.2.3 Prevention and treatment

To prevent heart diseases one needs to cultivate a healthy lifestyle from early stages in life. Regular exercise, a nutritious diet, abstaining from smoking altogether can go a long way in preventing it.

However, if the presence of plaque is detected in the artery and is significantly blocking the passage of blood through it, an angioplasty, or ballooning, may have to be carried out. In this procedure a metal stent, which keeps the artery dilated to allow blood flow is inserted at the site of the blockage to prevent the artery from constricting again. After angioplasty, a patient is usually on anti-platelet medication to prevent blood clot formation. As a last resort, or in case of multiple blockages, a coronary artery bypass surgery may have to be done. (<http://www.drhealth.md/life-style-diseases/heart-diseases>)

## 4.1.3 Common Fever

Fever, pyrexia or controlled hyperthermia is when a human's body temperature goes above the normal range of 36-37C (98-100F) - it is a common medical sign. As the person's body temperature goes up, there may be a sensation of cold until the temperature becomes stable. An increased body temperature (fever) is one of the ways our immune system attempts to fight the infection. But sometimes it rises too high. In that case the fever can be serious and lead to complications.

Diagnosing a fever is simple - the patient's temperature is taken, if the reading is higher than the standard temperature of a human body, he/she has a fever. It is important to take the person's temperature when they are at rest because physical activity can warm up the body.

A person is said to have a fever if:

The temperature in the mouth is over 37.7C (99.9F)

The temperature in the rectum (anus) is over 37.5-38.3C (100-101F)

The temperature under the arm or ear is over 37.2C (99F)

A fever is a sign rather than a disease. When the doctor has confirmed there is an elevated body temperature, certain diagnostic tests may be required, depending on what other signs and symptoms exist, like blood tests, urine tests, x-rays and other imaging scans.  
(<http://www.medicalnewstoday.com/articles/168266.php>)

## 4.2 Study of self-diagnosis instruments

*(Much of the data below is sourced from Omron Medical Instruments websites worldwide.)*

### 4.2.1 Full body Sensors

This instrument provides full body sensing – a comprehensive understanding of your body composition to help you reach your fitness goals. Full body sensing is more correct than measuring with feet alone. It measures seven fitness indicators including body fat percentage, body mass index (BMI), skeleton muscle, resting metabolism, visceral fat, body age and body weight.

Figure 3: Full body sensor



### Activity Analysis

- Pull and detach the hand unit.
- Stand on the base, steadily.
- Hold the display device so that you can see the results.
- Hold your arm at 90 degrees to your body.
- Press the start button and wait for the beep before you get your results.

### Inferences

- The device performs much more than what is expected, powerhouse performance.
- Too much pre-information needed
- Instructions to the patient need to be delivered very clearly

[\(http://omronhealthcare.com/products/body-composition-monitor-scale-seven-indicators-hbf516b/\)](http://omronhealthcare.com/products/body-composition-monitor-scale-seven-indicators-hbf516b/)

## 4.2.2 ECG Monitoring Device

### Activity Analysis

•Take out leads and connect as instructed:

First lead on the right wrist

Second lead on the left wrist

Third lead on the left foot

•Be seated and wait for the beep.

This instrument makes a 30-second recording of your heart's waveform, instantly and discretely. The cordless operation and direct on screen display allows a quick scan of the heart condition. The ECG analysis report provides information on heart beating rate, rhythm and the ECG waveform. The single lead recording runs for 30 seconds and includes a multilevel display of deviations from the norm as well as the date and time of the recording, the heart beat rate and the short cut analysis.

### Inferences

•The common perception is that an ECG is a typical hospital environment diagnostic test

•Machine is not overwhelming thus ensuring fairly good results



Figure 4 : ECG monitoring device

(<http://www.omron-healthcare.com/eu/en/our-products/electro-cardiograph/electro-cardiograph>)

## 4.2.3 Blood Pressure Monitoring Device

This is often a single button operated device that easily measures the blood pressure at home. This monitor can detect Irregular heartbeats while blood pressure is being measured. If irregular Heartbeat is detected, an indicator will appear alerting you so that you can consult with your medical professional. This device has managed to do away with the perception that BP measurement cannot be done at home and that too without any hassles.



Figure 5 : Blood pressure monitoring device  
(<http://omronhealthcare.com/products/3-series-upper-arm-blood-pressure-monitor-bp710/>)

### Activity Analysis

- Sit down in a relaxed position without crossing your legs.
- Expose your upper arm
- Place the cuff approximately 2.5 cm above from the elbow crease.
- Fasten the cuff comfortably without making it too tight
- Press the O/I button to switch on the monitor
- Press start. The cuff will slowly inflate and deflate.
- Make a note of the measurement and the pulse reading.
- Take 2 readings and average out.

### Inferences

- One of the most common and fairly accepted diagnostic devices
- Very useful for BP patients and post-operative home care

## 5. User interview

Three user interviews were conducted and documented. All the users belong to middle class or upper middle class families. They were asked questions about the frequency of their health check-ups and awareness of their health conditions

1.Sunita S (72): suffers from BP, spondylitis, knee pain. But she doesn't use any home medical diagnosis devices apart from thermometer. She found the full-body sensor pretty intriguing. But owing to her limited education, she couldn't figure out heads or tails of her results. She prefers the assurance that a doctor offers while telling her the results.

2. Neha S (46): suffers from tennis elbow, mild spondylitis. Had a much better response to the full body sensor. She understood exactly what the device was doing, got a rough idea of how it would do it and so on. She also seemed more content about the results.

3. Manohar Kadam (76): suffers from kidney pain and has recently suffered from a mild MI. Has been advised against any invasive procedure. Hence he needs constant monitoring. This has been made easy by home BP monitoring machine. After initial hesitation, the device and its results are now more trusted by Mr.Kadam.

## 6. Inferences from the research and the design opportunity

For an individual, to check these parameters, either he needs to go to a diagnostic clinic or he should invest in purchasing all the equipment. In case of a diagnostic centre, the results will be available only after a minimum of 5-6 hours or sometimes it could even prolong to a day or two depending upon the work load in the centre. If the user decides to buy these equipment, he/she needs to invest a minimum of 5500 INR to buy even the cheapest products available in the market. Thus there is a scope for such a monitoring kiosk which can save both time and money and provide the user with accurate results.

The user interviews gave insights that a setup to check primary health could work well in the case of an average individual. Thus the target user group is being limited to people of age 20-60 years. Physically Challenged people are excluded .

## 7. Study of Parallel Products

### 7.1 Wellpoint Health Kiosk

The Wellness group has designed a health kiosk to monitor an individual's wellbeing including various features like blood pressure monitoring, body mass index calculation, heart beat rate, blood pressure, hydration quota and body fat content measurement without a clinical visit.

The users are supposed to fill up a questionnaire regarding their medical history and basic information about the body to evaluate the status of their vital bodily functions. The test results from the health kiosk can be printed or saved in the mobile phone as a text message to keep track of their complete medical history and the progress over time.

This provides an easy and quick way to keep track of your vital functions on a daily, weekly or monthly basis. It encourages sharing the medical data among doctors and the other users and taking feedbacks from medical professionals. It saves the patients' time and money by lowering the frequency of clinic visits and facilitates the early detection of any risk factor in the system.



Figure 6: Wellpoint health kiosk

<http://www.wellpointgroup.com/Kiosk.aspx>



It was designed to be a mobile health care unit which is self-operated and intuitive. The existing products measures most of the parameters other than the blood glucose level. An invasive test has to be performed in that regard.

The setup exists in The United Kingdom. No product of similar nature exists in Indian context.

Wellpoint health kiosk: this is one of the top products in the market. It gives very convenient results in the form of text messages and other digital medium. The layout along a vertical axis also ensures easy placement in public areas. The design is visibly mobile. It has a sense of urgency to it. But for a health device it is also weak in form. Another major issue is lack of privacy. (<http://www.wellpointgroup.com/Kiosk.aspx>)

## 7.2 Phoenix Health Care Kiosk

This is a set up based in The United States, a self-monitoring health kiosk to monitor the vital elements regarding health. This product also boasts of long term tracking of specific health trends, thus encouraging a positive lifestyle in the people. It is successfully being used and installed in community centres, shopping malls, entertainment clubs and other public areas for use.

The phoenix health care kiosk is equipped with :

- Biometric reading device
- Standard blood pressure cuff
- Weight scale
- BMI measuring clip
- A screen which can be utilised for displaying not only instructions and results but also advertisements and other marketing initiatives.
- It is inclusive of a printer inside which allows you to print your receipts and other reports (<http://www.phoenixkiosk.com/software-solutions/personal-health-station-kiosks>, n.d.).



Figure 7 : Phoenix health care kiosk version 1—  
[www.phoenixkiosk.com](http://www.phoenixkiosk.com)

## 7.2 Phoenix Health Care Kiosk



Figure 8 : Phoenix health care kiosk version 2  
[www.phoenixkiosk.com](http://www.phoenixkiosk.com)

This is another health care kiosk by phoenix. It has integrated data base for health records, billing, scheduling, and patient's registration. It has customised properties to suit the specific need of the context such as visitor management, Self-check-in, appointment scheduling and information directory.

This system has two-way benefits for both the healthcare provider and the patient, for example

- Reduced overhead costs
- Employee proficiency
- Data management
- Efficient Time management

(<http://www.kioskmarketplace.com/showcase/product/3791/Healthcare-Kiosks>, n.d.)

Phoenix Health Care Kiosk: these kiosks use a seating diagnosis method. This is a very convenient addition. the first design has no privacy, but the second one offers it. the design is also visibly sophisticated. The integrated database is a much needed feature that phoenix kiosks offer.

## 7.3 Higi Kiosk Station

Higi kiosk station enables you to find out the statistics of the patient's weight, body mass index, pulse and blood pressure - the four vital parameters of your body. You can easily track the patterns and changes taking place in your body by keeping a track record of your reports and breaks it down on weeks, months and yearly basis.

It also allows you to build a community and get connected with different people of the same lifestyle and health statistics you have (<https://higi.com/>, n.d.).

Higi kiosk station: this kiosk is more of a medical-social networking oriented kiosk, even the design reflects it.



Figure 9 : Higi kiosk station

<https://higi.com>

## 8. Expert Interview

As a part of my research I went ahead and interviewed a medical practitioner to get a clear insight of the practical issues that I might have to tackle while designing a product like a health kiosk.

I contacted Dr. Prashant Pawar, a surgeon in Fortis hospital to give me inputs based on his long experience in the medical field.

According to him, the factors like mobile phone interference and atmospheric effects will affect the readings of electro-cardiogram and blood pressure. A non-professional cannot understand these discrepancies in the reports. The invasive tests like blood glucose measurement will not be affected by the extraneous interference.

He also suggested that a device can be as accurate as a traditional medical check-up but it needs to be calibrated once in a while.

## 9. Anthropometric Data used

Body Part	Value considered	Reason	Values	Maximum value Possible
Shoulder width (biacromion)	95th	To provide maximum contact area for backrest ensuring maximum comfort to all users, extreme data are used	415	455
Waist width	95th		312	470
Hip Width	95th		406	550
Popliteal height	50th	The average value caters to both the extremes and the gap acts as a buffer for longer or shorter lengths	419	540
Buttock - popliteal	50th		451	595
Lower Lumbar	5th	To provide maximum contact area for backrest ensuring maximum comfort to all users, extreme data are used	72	256
Upper lumbar	95th		352	427
Elbow-Elbow	50th	To accommodate both extreme users and intermediate. Providing a max/min value will cause problems for the users on the opposite end of the spectrum	494	821
Knee-knee(relaxed)	50th		369	681
Thigh Clearance	95th		639	710

*(Indian anthropometric dimensions for ergonomic Design practices Dev Kumar Chakravarthy)*

## 10. Design brief

The aim of the project is to create an automated self-operated health kiosk which can facilitate quick access to primary and preventive health care and provide the user with a primary health report.

The kiosk is proposed to have components such as:

- Height measuring device
- Weight measuring device
- Full body sensor for measuring body fat
- ECG monitoring device to check the heart condition
- Blood pressure monitoring device
- Blood glucose level monitor
- Oximeter for measuring the oxygen content in blood
- Digital thermometer for recording body temperature

These units will be integrated using a Raspberry-Pi unit and would provide the user with primary health information.

Target user group being middle class and upper middle class people from 25-60years of age, the product would be placed in high traffic areas like malls, gyms, corporate offices etc.

## 11. Initial Ideations

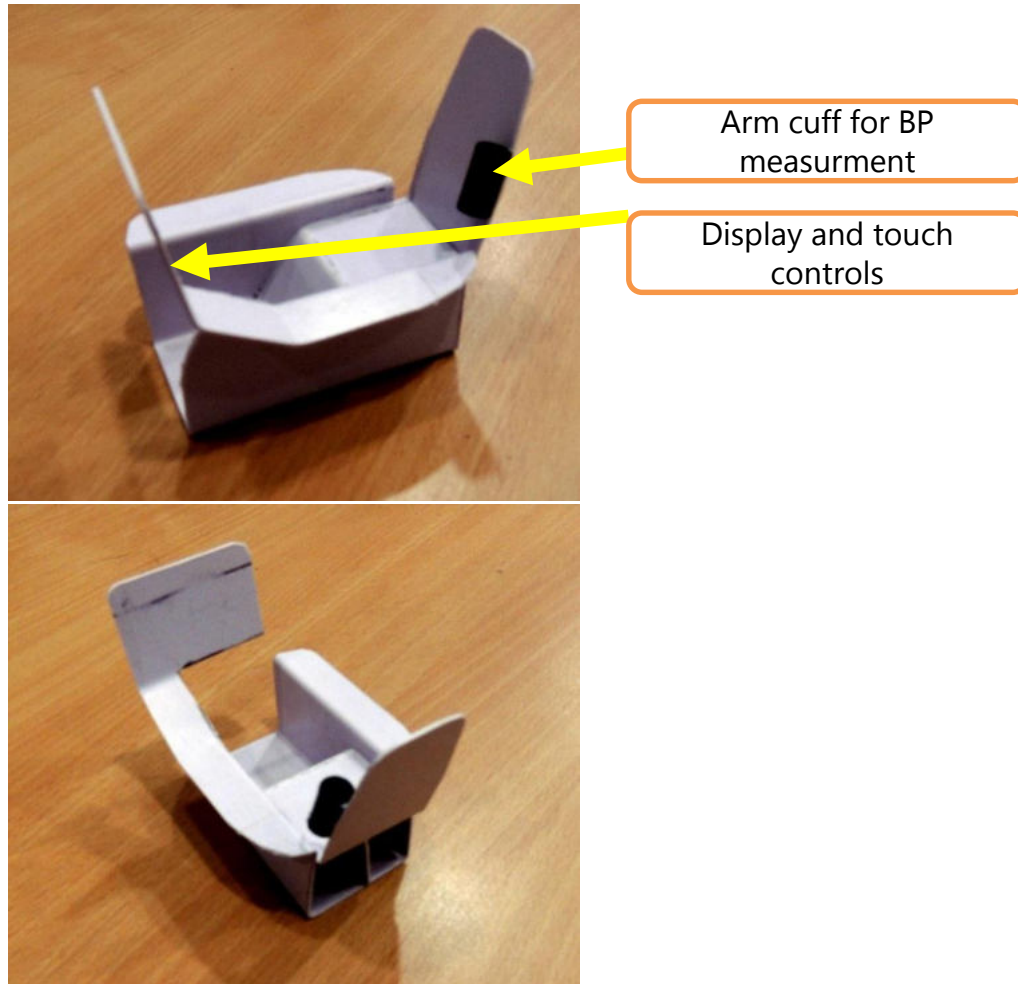
Based on the research and studies conducted, 3 directions of explorations were decided.

- A smart chair in which all the systems are integrated
- A medium sized kiosk which can provide moderate levels of privacy and ambience isolation
- A full sized kiosk which can be installed in indoor conditions to provide complete privacy, ambience isolation and can also accommodate a trained assistant.



## 11.1 Initial Ideation

### Direction 1



*This design was a chair integrated with a display and devices for checking health conditions.*

#### *Advantages:*

- Smaller unit
- Less expenses
- Easy to transport
- Easy to setup
- Upper arm BP measurement – better accuracy

#### *Disadvantages*

- No privacy for user
- No privacy for information
- Difficult to maintain sanity
- If chair mechanism fails, the whole unit has to be shut down
- Noise from surroundings could lead to inaccurate results.

## 11.2 Initial Ideation

### Direction 2

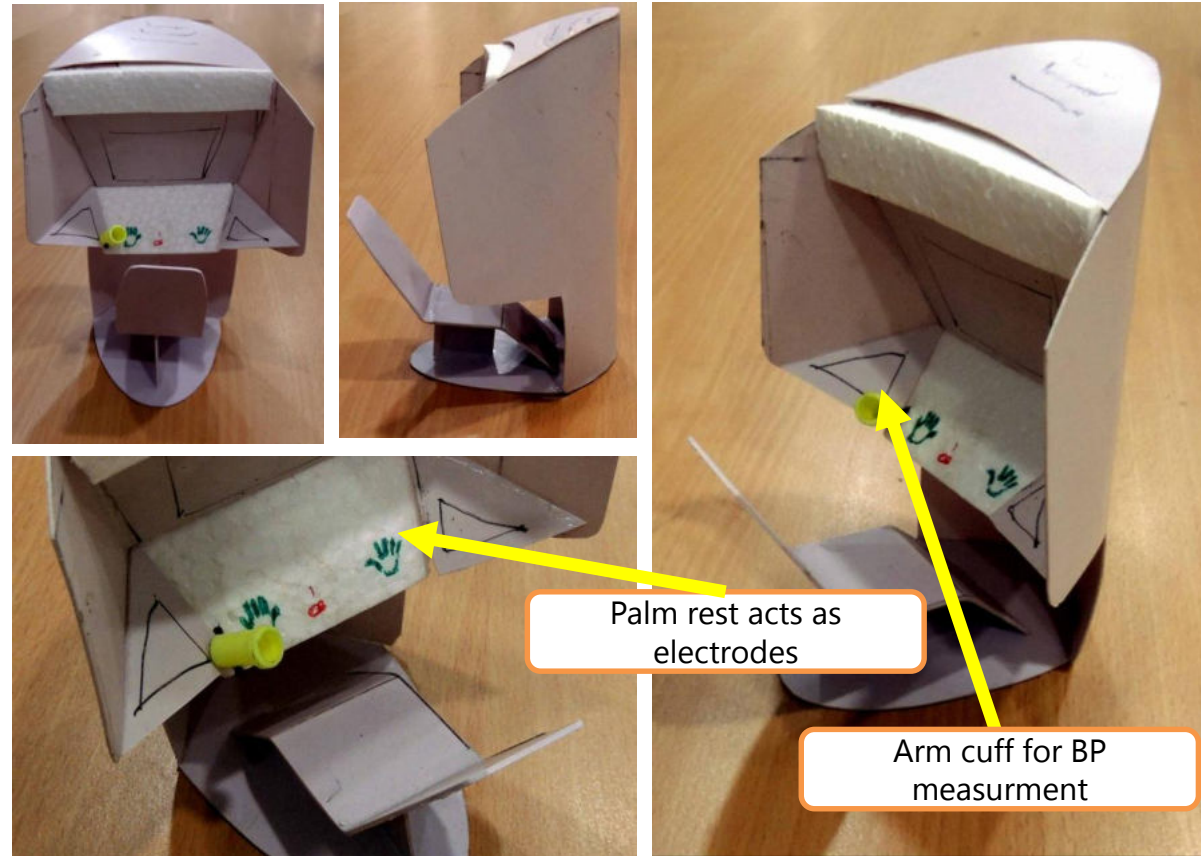
*The second directions was to create a kiosk with an integrated chair. The chair in this case measures the weight of the user and provides seating solutions*

#### *Advantages:*

- No need to stand up or change position
- Chair has minimal function – only weight
- Provides a dashboard for various purposes
- Better and accurate position for BMI calculation

#### *Disadvantages*

- No privacy for user
- Difficult to enter and exit
- BP measurement- wrist, not the most advisable position
- Hanging ECG electrodes
- Noise from surroundings could lead to inaccurate results



## 11.3 Initial Ideation

### Direction 3

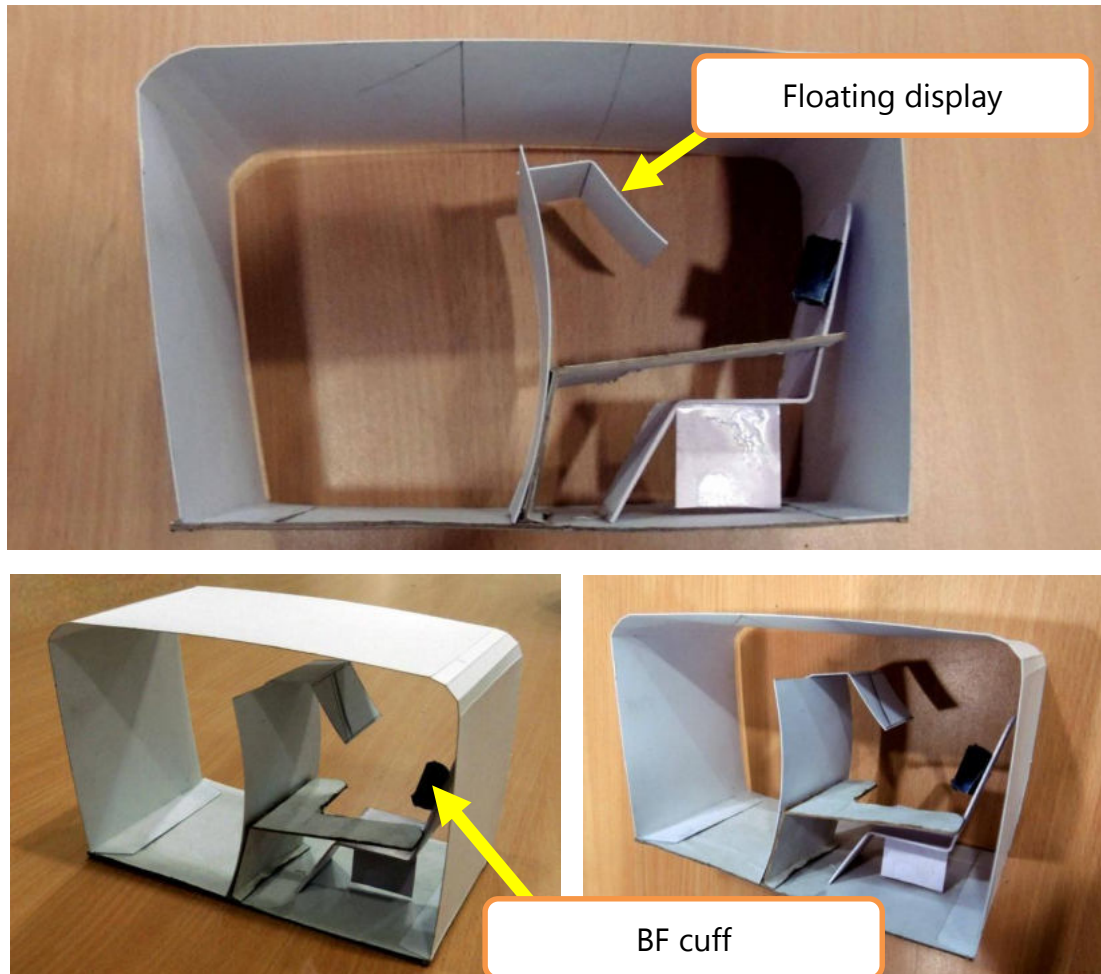
*This will be a full fledged kiosk which has a cabin and space for an assistant.*

#### *Advantages:*

- Isolation from ambient conditions
- Chair has minimal function – only weight
- Could facilitate a trained assistant also
- Privacy for user and information
- Recommended by the doctor
- Better and accurate position for BMI calculation
- Easy to maintain clean because of closed environment

#### *Disadvantages*

- Cost would be higher than earlier models
- Transport and setup would be difficult





## 12. Sketches and Iterations for various concepts

## 12.1 Sketches and Iterations for various concepts

### Concept 1

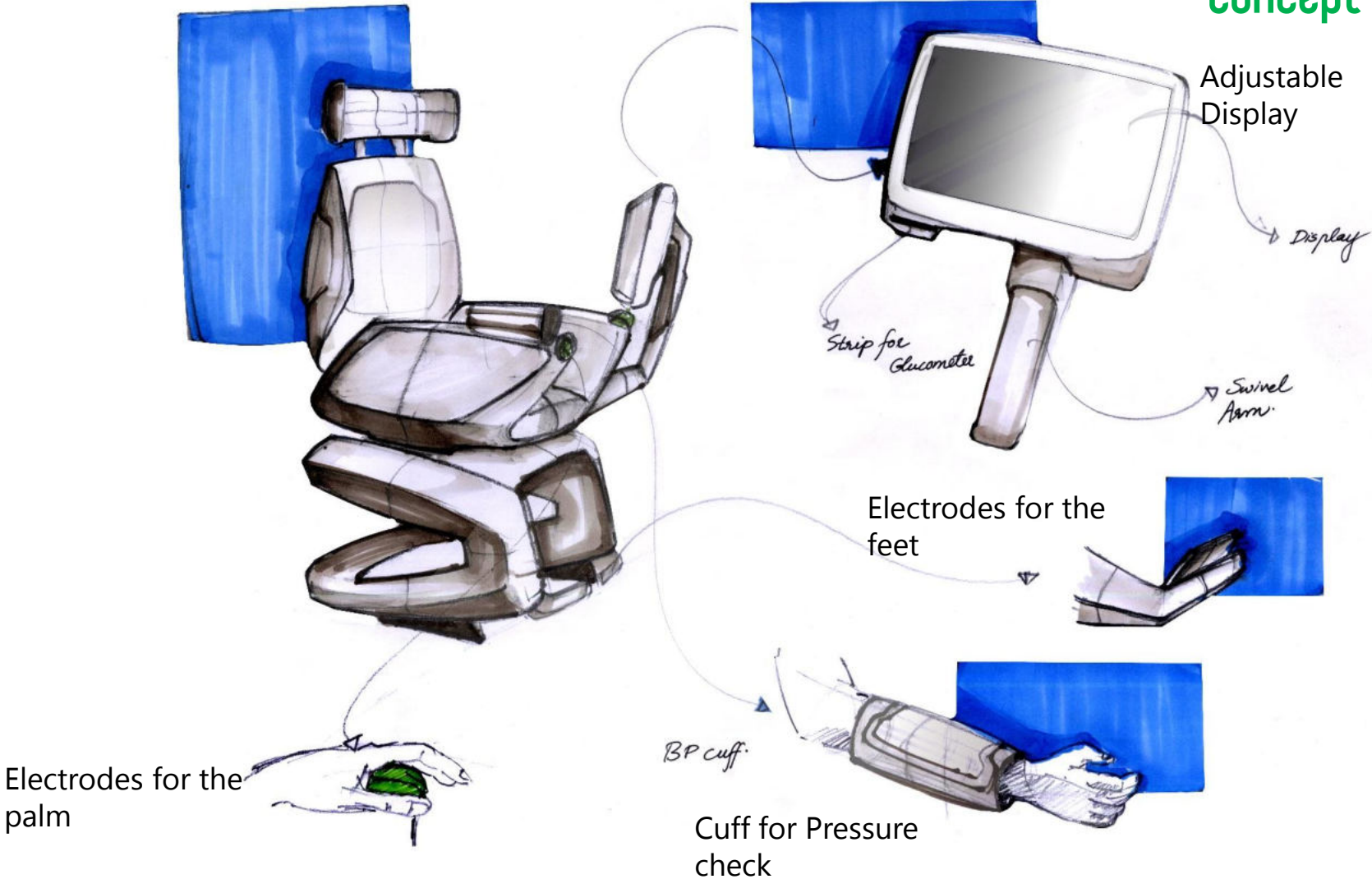


Inspired by a modern all-in-one reclining chair. The strong form is meant to re-assure the user. The arm-rest itself couples as a multi-parameter diagnostic device. Some form explorations are done in order to make it more futuristic.



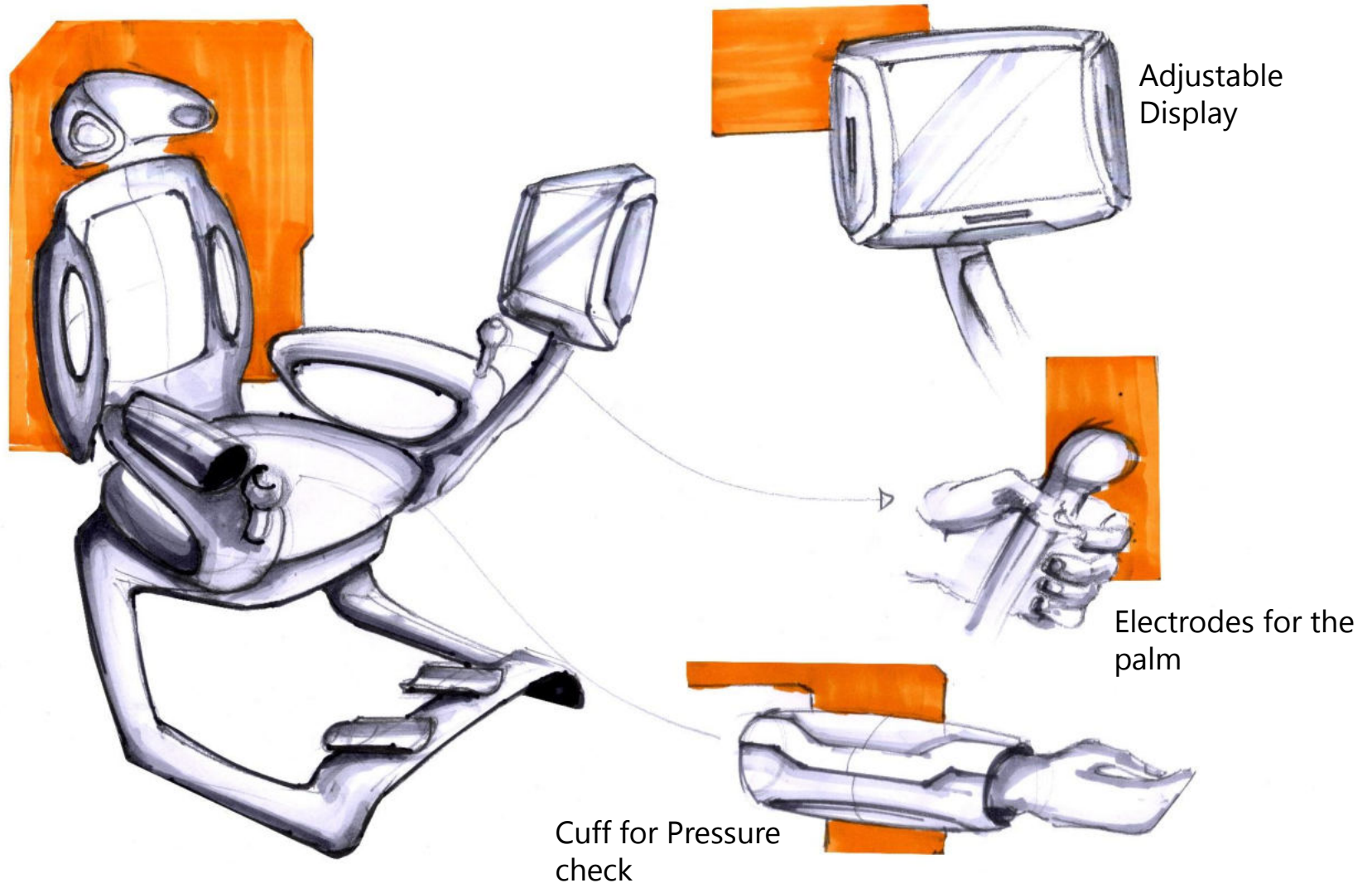
# 12.1 Sketches and Iterations for various concepts

## Concept 1



# 12.1 Sketches and Iterations for various concepts

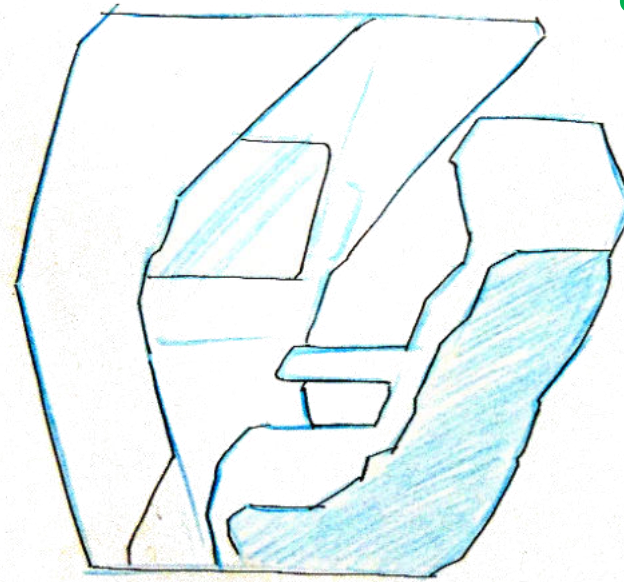
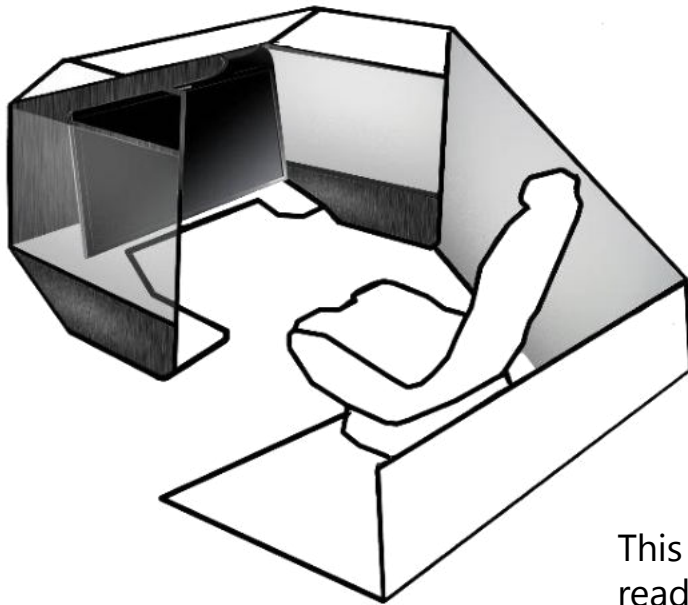
## Concept 1





## 12.2 Sketches and Iterations for various concepts

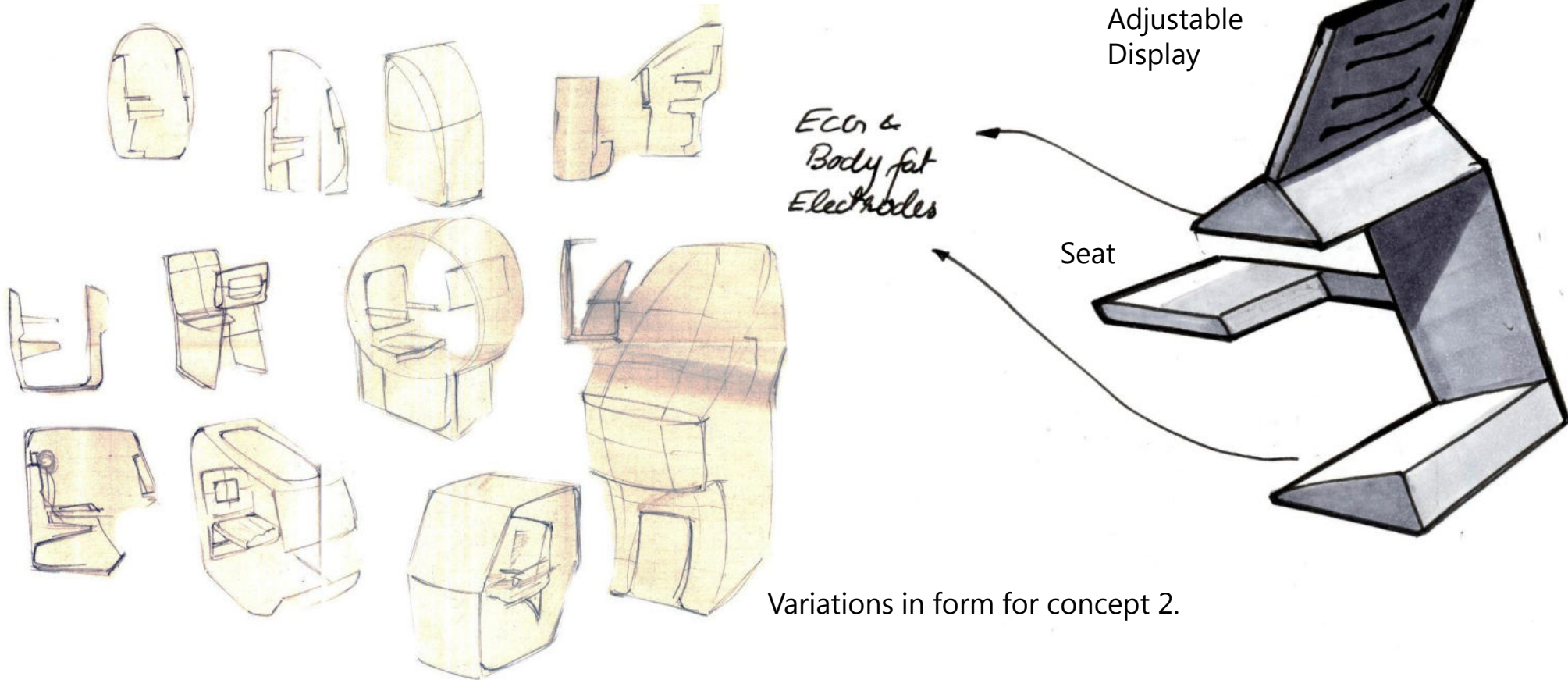
### Concept 2



This model is more like a cabin. The design offers better readability and ensures privacy of results to the user. A faceted theme runs throughout the product.

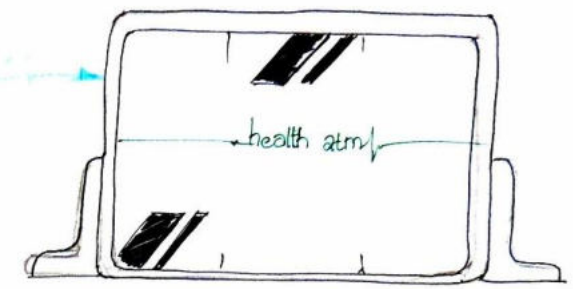
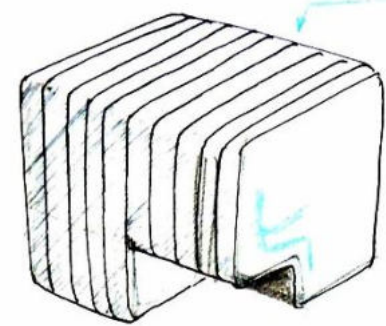
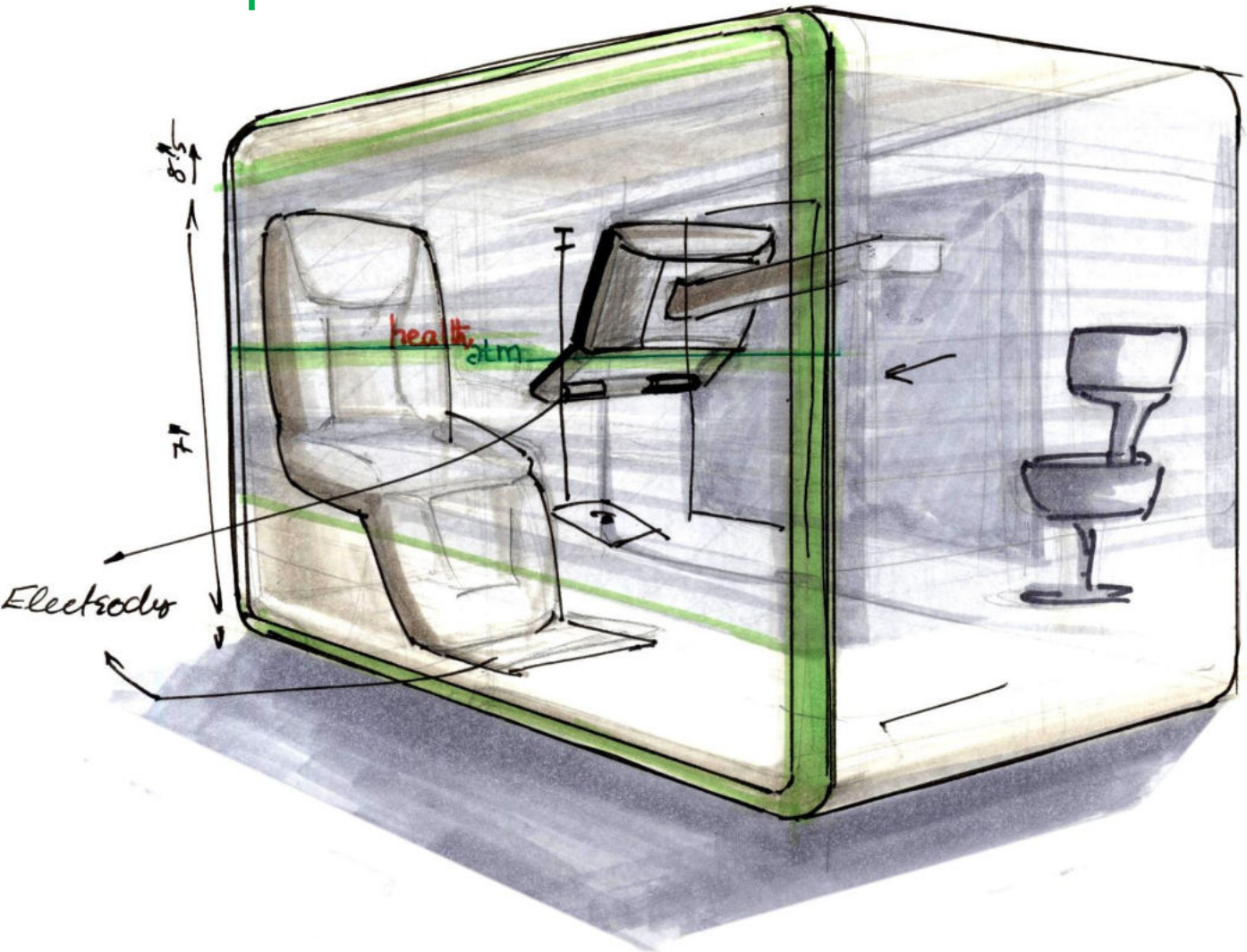
## 12.2 Sketches and Iterations for various concepts

### Concept 2



# 12.3 Sketches and Iterations for various concepts

## Concept 3



This is like a full-fledged cabin with the seat comfortably placed at its heart. Explorations can be done in terms of materials like partially mirrored glass wall etc.

# 13. Concept Evaluation

Features	Concept 1	Concept 2	Concept 3
•Height measuring device	0	0.4	0.6
•Weight measuring device	0.33	0.33	0.33
•Full body Sensor	0.33	0.33	0.33
•ECG monitoring device	0.33	0.33	0.33
•Blood pressure monitoring device	0.33	0.33	0.33
•Blood glucose level monitor	0.33	0.33	0.33
•Oximeter	0.33	0.33	0.33
•Digital thermometer	0.25	0.25	0.5
Privacy for user	0	0.3	0.7
Privacy of information	0	0.5	0.5
Equipment safety	0.2	0.2	0.6
Cost of manufacture	0.5	0.4	0.1
Isolation from environment	0	0.2	0.8
Waste disposal	0.1	0.3	0.6
Water dispenser	0	0	1
Portability	0.9	0.1	0
Assembling/Disassembling	0.5	0.25	0.25
Floor space requirement	0.5	0.3	0.2
Assistant	0	0	1
Ease of access	0.45	0.35	0.2
Ease of use	0.3	0.3	0.3
Place for branding and value addition	0	0.4	0.6
Modularity	0.3	0.3	0.4

The three concepts were evaluated keeping in mind various priorities.

- Factors in green have the highest priority
- Factors in yellow are basic equipments which are incorporated in the setup
- Factors in blue are value added features which can/may be neglected

c1	2.23	0.7	3.05	9.61
c2	2.63	1.6	2.3	12.36
c3	3.08	2.7	4.55	18.81

Devices and instruments

Highest priority features

Secondary Features

The Final evaluation was done using formula  
 $\text{Sum} = 2 \times \text{yellow} + 3 \times \text{Green} + \text{Blue}$

Concept 3 came out as the top scorer.



## 14. Final Concept

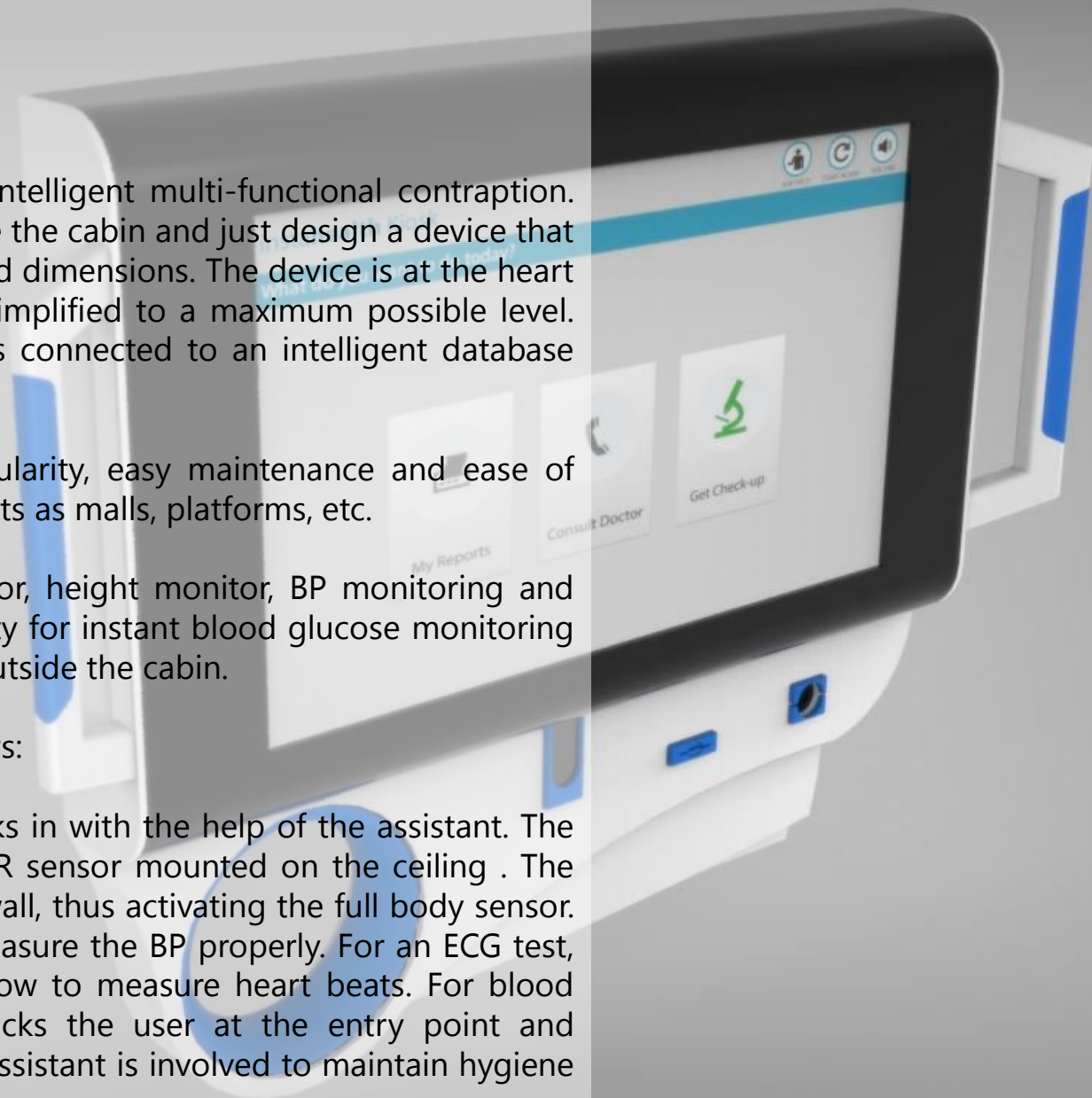
The final concept was finalised to an intelligent multi-functional contraption. the project scope was revised to exclude the cabin and just design a device that integrates with a cabin of any design and dimensions. The device is at the heart of a multi-task activity that has been simplified to a maximum possible level. The retractable, wall mounted device is connected to an intelligent database that feeds data into a secure network.

The advantage is unprecedented modularity, easy maintenance and ease of installation even in complex environments as malls, platforms, etc.

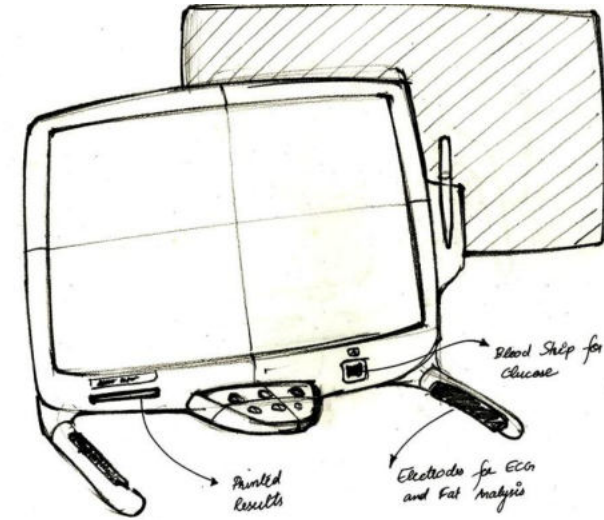
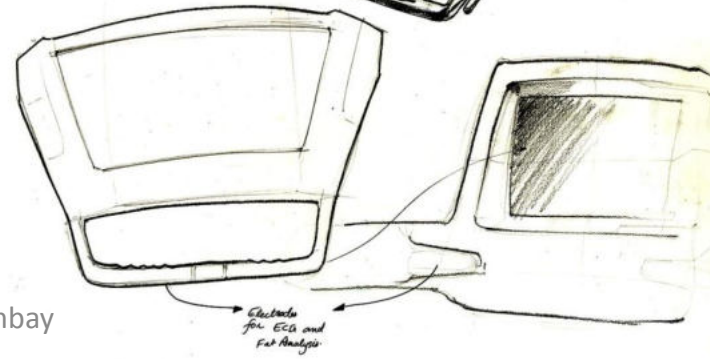
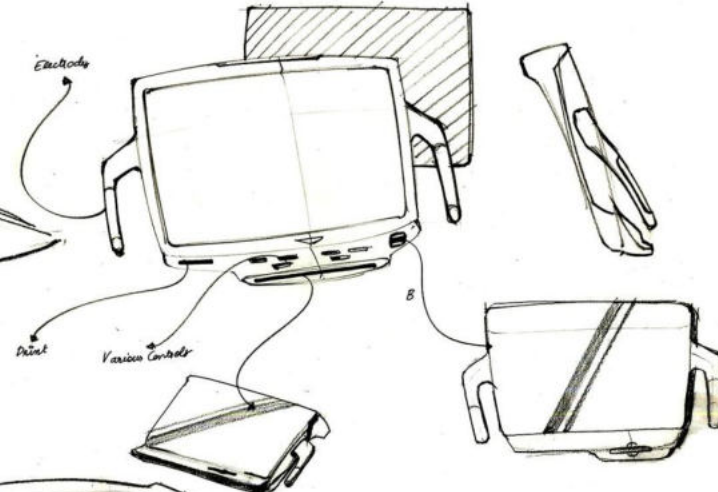
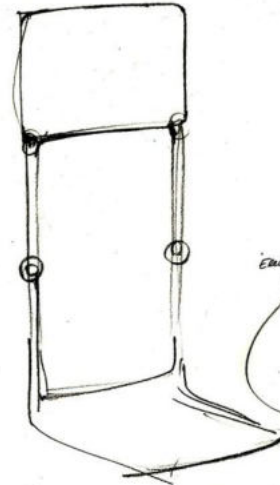
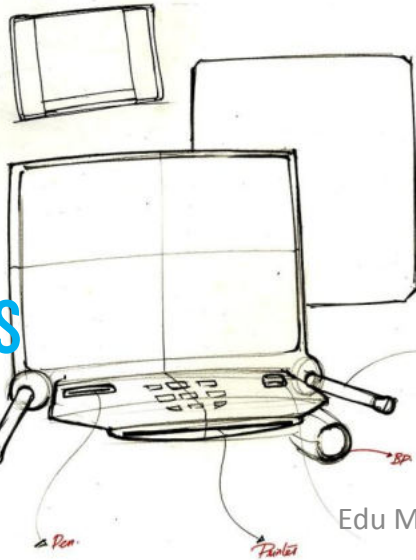
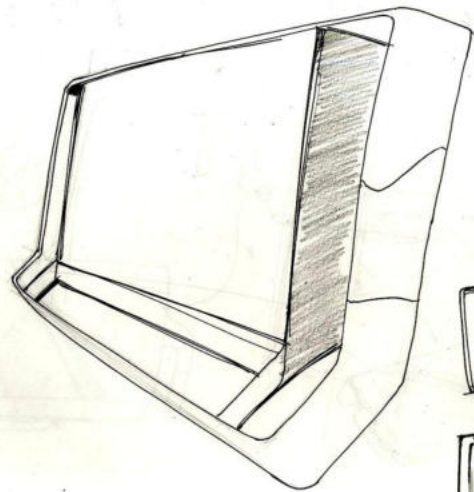
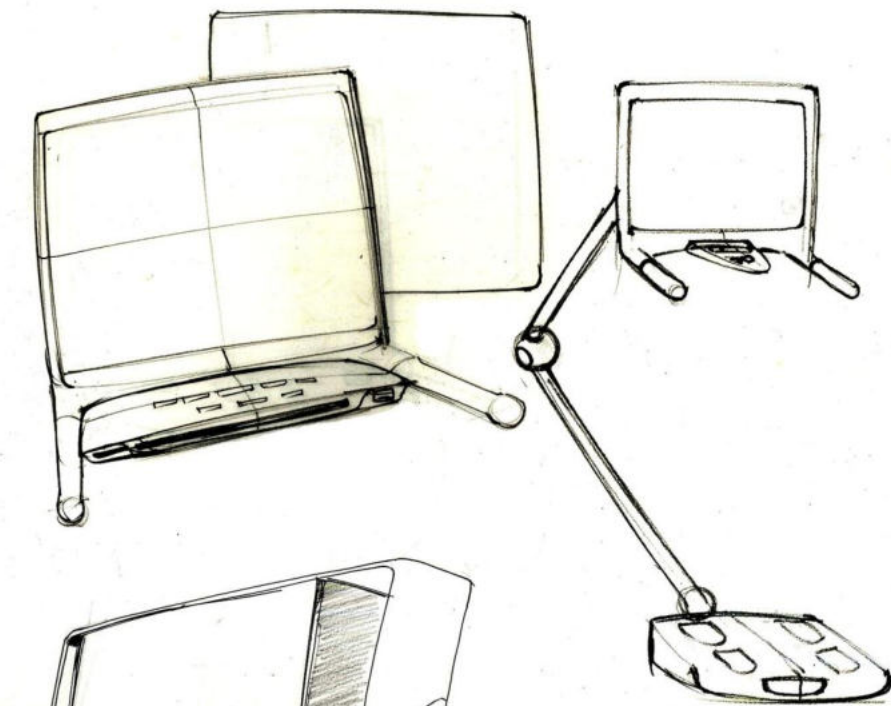
The checkups include a full body sensor, height monitor, BP monitoring and ECG among others. there is also a facility for instant blood glucose monitoring with the help of the assistant who sits outside the cabin.

A typical activity at this kiosk is as follows:

The user walks into the kiosk and checks in with the help of the assistant. The height of the user is measured by an IR sensor mounted on the ceiling . The user retracts the contraption from the wall, thus activating the full body sensor. He/she is then asked to sit down to measure the BP properly. For an ECG test, an instructional screen tells the user how to measure heart beats. For blood glucose monitoring, the assistant pricks the user at the entry point and provides him/her with a test strip. The assistant is involved to maintain hygiene as this is an invasive test.



# Concept Variations







Concept and  
Ideation —

Test with  
Sketch for  
concepts

Evaluation

+ why  
modular  
unit?

Learning for  
kiosk study

Inference  
from  
activity  
analysis

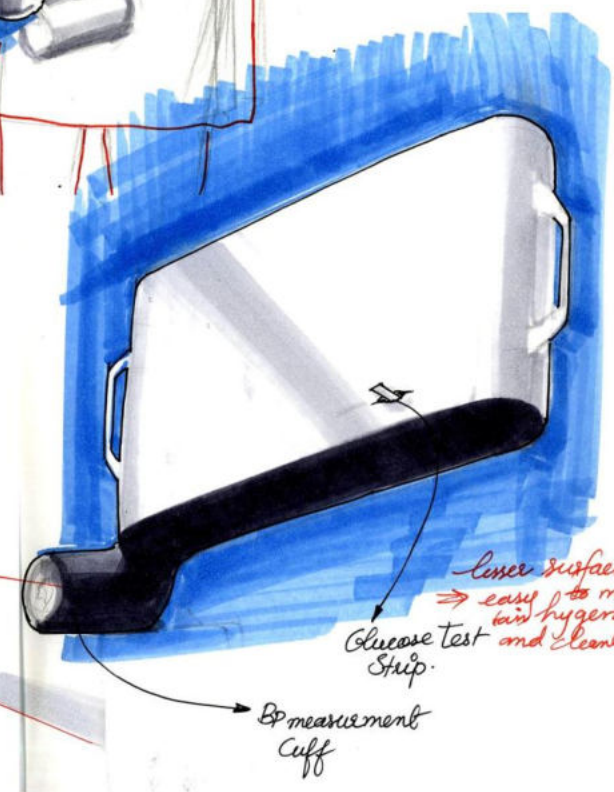
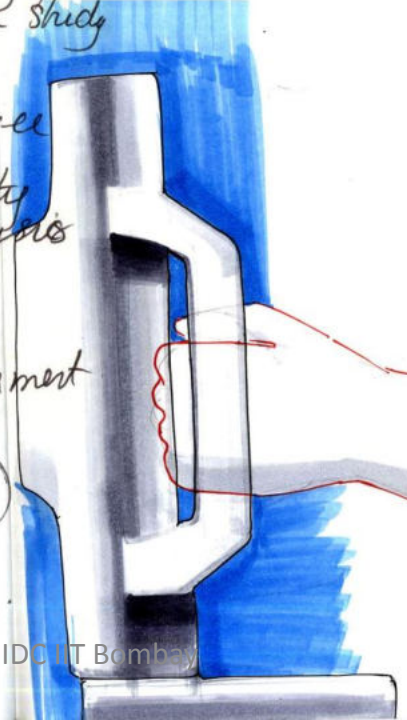
height  
measurement

Trou

Description



By - Chamfers for  
Big Partition  
lines  
White Blue Green  
Simple.



lense surface  
=> easy to maintain hygiene and cleaning  
Glucose test strip

Bp measurement  
Cuff

Final Concept

## 15. Final Model



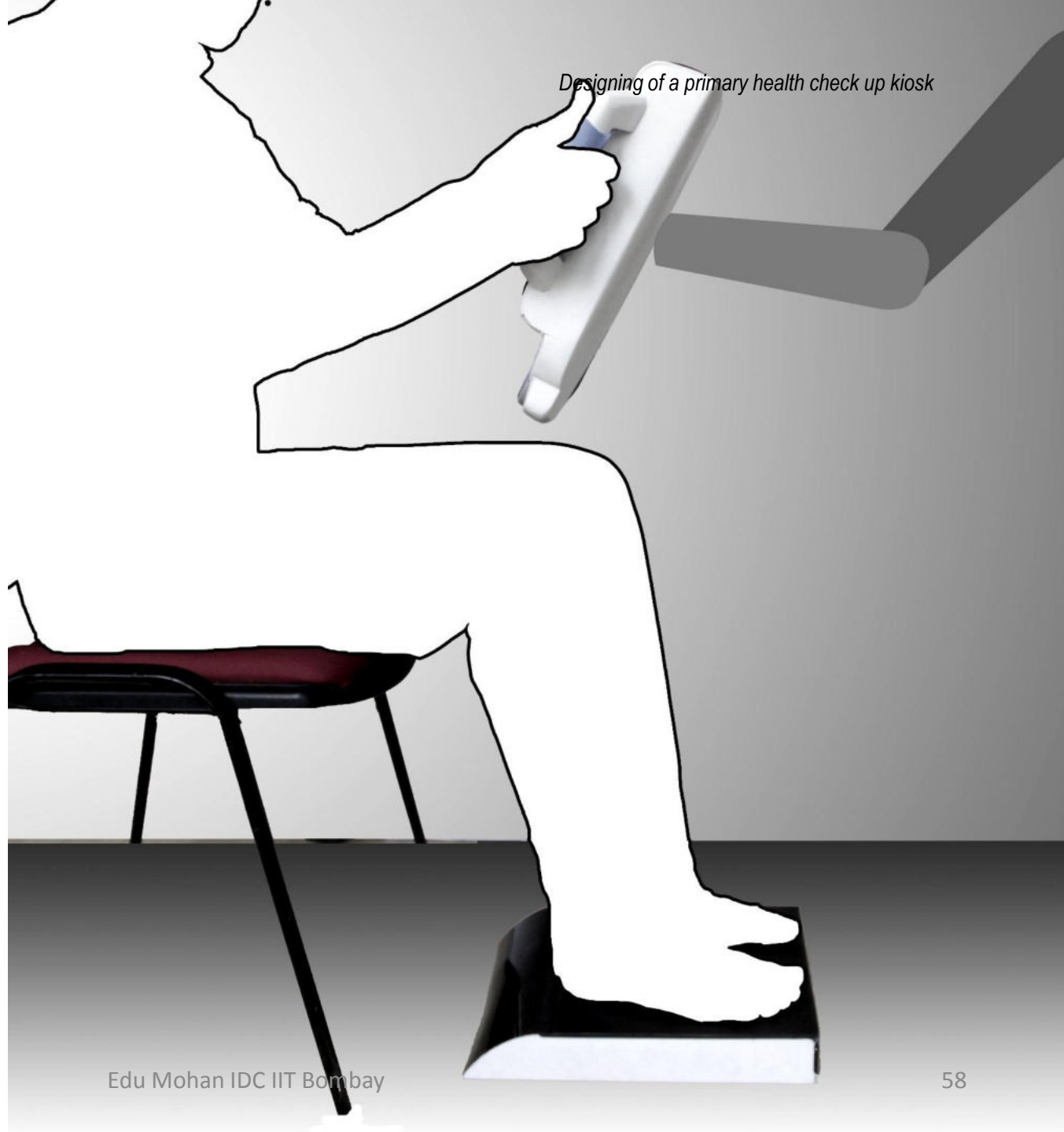




## 16. Usage scenario

### **Activity at this kiosk includes:**

The user walks in – checks in - the assistant pricks at the entry point - provides test strip - The height of the user is measured by an IR/ultrasonic sensor mounted on the ceiling - retracts the device - thus activating the full body sensor - follow instructions - n asked to sit down – strip in glucometer - finger in Pulse oximeter sensor – hand in BP cuff - measure the BP – hand on the handle/foot on electrode - ECG test





After confirmation of user profile through biometric identification, the user has to select one of the following three options: call doctor, check previous reports or get a check-up done. The device offers affordance for the various check-ups that the health kiosk facilitates.

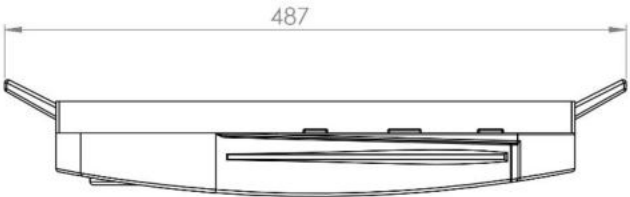
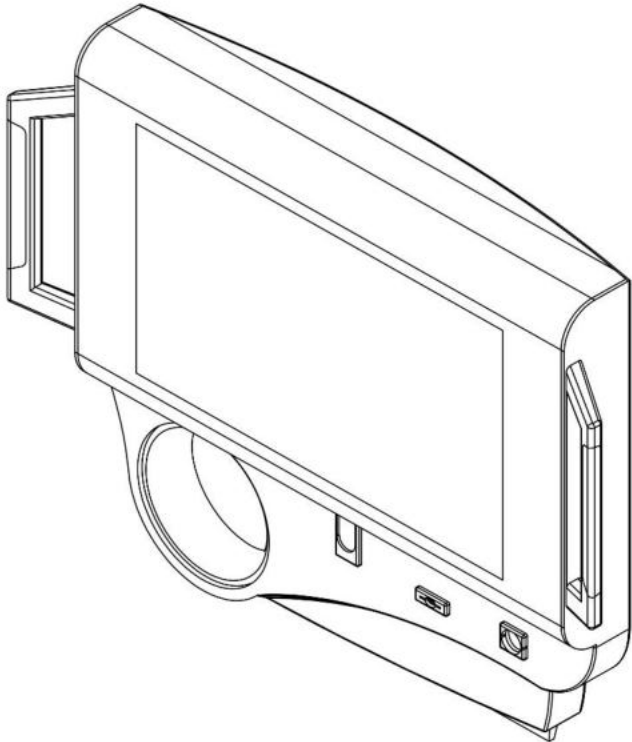
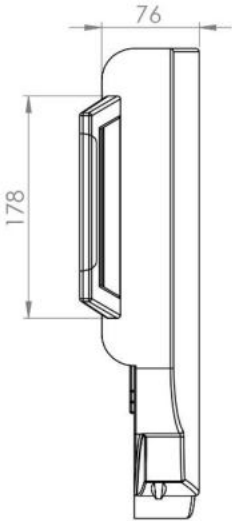
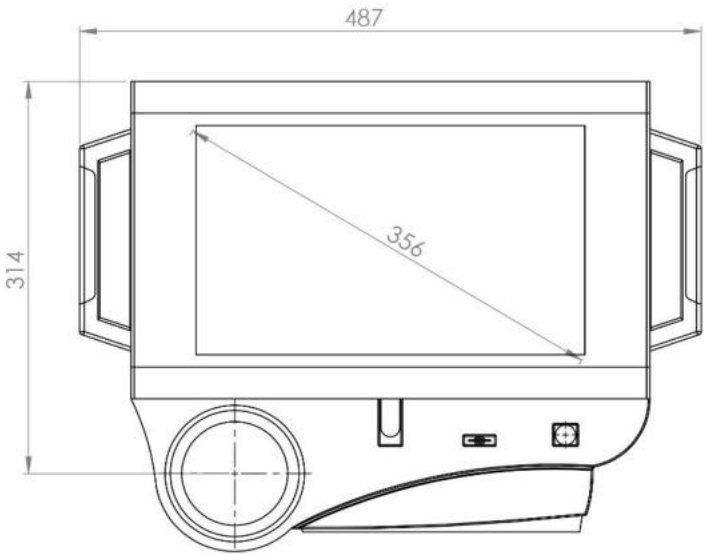


The checkup begins by measurement of the user's height. It further proceeds by conducting a body mass analysis through the electrodes on the handle and the foot pad.



The device then prompts the user to insert his hand into the circular cuff for blood pressure measurement.

17. Dimensions



UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MILLIMETERS SURFACE FINISH: TOLERANCES: LINEAR: ANGULAR:				FINISH:		DEBUR AND BREAK SHARP EDGES		DO NOT SCALE DRAWING		REVISION	
NAME		SIGNATURE		DATE				TITLE:			
DRAWN											
CHK'D											
APPV'D											
MFG											
Q.A											
						MATERIAL:		DWG NO.			
						WEIGHT:		SCALE:1:5			
								SHEET 1 OF 1			

A3

## Conclusion

A non-functional prototype of the final design was made. The project was discussed with the client, Mr. Dhilly Baby from the HealthATM group and feedbacks were taken. They were willing to carry the project forward and do further research and development.

Factors for designing public devices and interactive platforms were understood to a higher extend through the project. This also gave way for an opportunity to work in real time with a client. Knowledge about healthcare and related devices were acquired through the project because it was along the same lines.



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