

Healthcare Screening Systems for Cardiovascular Diseases

Semester III Project Report

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Approval Sheet

The project titled 'Healthcare Screening for Cardiovascular Diseases' by Naveed Ahmed, is approved for partial fulfilment of the requirement for the degree of 'Master of Design' in Interaction Design.

Guide



Chairperson



Internal Examiner



External Examiner



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Index

ix Abstract

1 Introduction

- 1 Lifestyle Diseases
- 3 Design Process

5 Data Collection

- 5 Methods
- 5 User Criteria
- 6 Findings
- 8 Existing Products

15 Technology Review

19 Personas

21 Project Brief

- 21 Problem Statement

23 Concept

- 26 Sketches & Initial Designs
- 31 Scenarios

40 Final Concepts

48 Integrated System

50 Evaluation

54 References

Abstract

Over the past two decades, sedentary lifestyles and unhealthy diet and occupational stress have led to a sharp rise in cases of cardio-vascular diseases (CVDs). Early subtle signs in these cases unusually go unnoticed and the disease gets identified when irreversible negative consequences become apparent.

Through user studies, it was found that people neglect their health and get checked-up only when someone close to them falls sick; and sometimes only to realize that it is too late. These diseases could be avoided if diagnosed early through regular check-ups and with enough awareness amongst susceptible groups. In the long run, this can prevent chronic illnesses. The project hence aims to create solutions for easy screening that would facilitate quick and hassle-free health check-ups.

The project had three outcomes—trigger events that help engage new users into the health system, a healthcare kiosk where a user can get himself checked-up and an online interface to manage health data. All these are interconnected as a larger system.

The social network of a patient who recently underwent a CVD is used to trigger and encourage preventive health behaviour among susceptible connections. This is done via direct intervention of the affected persons and online social networks. The social network includes the relationship of the user with members of the family and society.

The healthcare kiosk is an independent self-service setup where people can go and get themselves checked-up for signs that cause lifestyle diseases. The kiosk has devices that measure body parameters and collect minimum information required for initial analysis. Suggestions and recommendations on further detailed check-ups, doctors' information and future check-up schedules are then provided to the user based on the analysis.

The setup integrates with an online interface that takes health and family medical history of the user and assesses the risk to a particular disease over time. To predict risk, factors like hereditariness of a disease in the family and current medical data are used. The solution also encourages users to develop health behaviours that may help transform the current curative healthcare system to a more 'collaborative' one.

As devices used were mainly self-help, the user evaluation concentrated on how (and if) the users understood the instructions provided to use these devices and their ability to finish the tests successfully.

The devices were tested with the target user group and also those who have used personal medical devices earlier. Most of them could follow the video instructions and perform the tests themselves easily without much intervention.

Part of the evaluation also consisted to social prototyping and finding the effect of how the message spreads across one's contacts. For this, the growth of an online questionnaire over time were analysed along with interviews. The online questionnaire showed impressive results with most of the users referring family members than social contacts.

As part of the future work, there is a need to improve the motivation factor in the social network. The apparent and perceived hygiene of the kiosk is of prime importance that would drive people to actually use the system.

Introduction

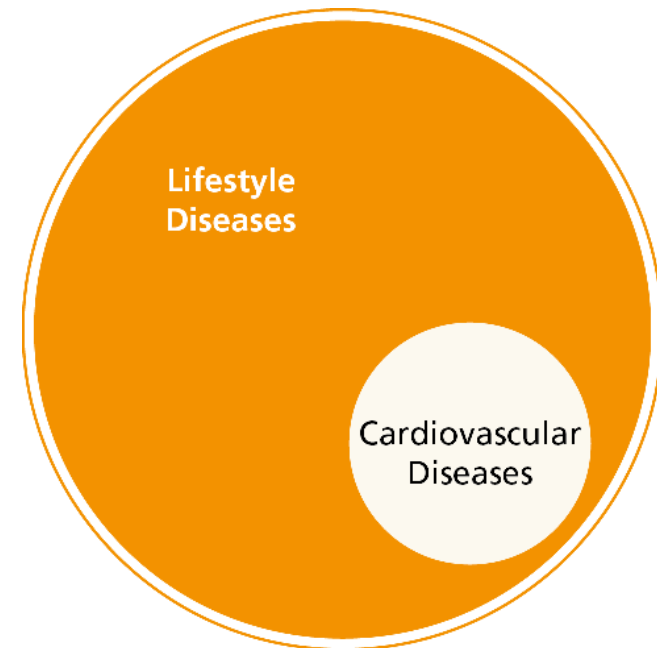
Healthcare ATM, a start-up at IIT Bombay, is involved in designing healthcare kiosks for screening diseases. The company plans for a kiosk where users can use various healthcare devices which would otherwise not be available at home or are expensive to procure. Other than generating a report of the tests, the features of the kiosk included telemedicine, appointment scheduling and doctor suggestions (HealthATM, 2013).

Lifestyle Diseases

Lifestyle Diseases (LDs) are diseases caused because of changes in people's lifestyles. These include Alzheimer's disease, asthma, some kinds of cancer, chronic liver diseases, pulmonary diseases, type-2 diabetes, heart diseases, metabolic syndrome, chronic renal failure, osteoporosis, stroke and depression. Reasons for LDs include sedentary lives, physical inactivity, unhealthy diet, obesity and stressful work lives (Mukesh Sharma, 2009).

Lifestyle diseases have become one of the major causes of deaths across the world and a main reason for premature illness in the younger population (WHO, 2011). This has been increasing at an alarming rate resulting in premature sickness, disability, death and financial loss to the victims (S.V.Mane, et al., 2012).

Cardiovascular diseases (CVDs) are diseases of the heart and the veins. Lifestyle diseases like hypertension, dyslipidaemia, diabetes mellitus, asthma and obesity are the major risk factors for development of CVDs (WHO, 2013). Demographically, LDs have been seen to be directly related to the affluence of the affected group in developing countries—irrespective of age and gender (Vorster, 2002) (Rukmini, 2013). In the past two decades, India has seen a sharp rise in cases of CVDs (Pappachan, 2011).



Cardiovascular diseases are a subset of a large number of lifestyle diseases.

In India, fast-paced lives and longer life expectancy over the past few decades has increased the exposure to the risk factors of CVDs. Urban India has shown a substantial prevalence of CVDs during this time. Increase in parameters like body mass index, blood pressure, etc. beyond the acceptable clinical range have been seen in most of the cases. Migration to urban India has only contributed to this, negatively.

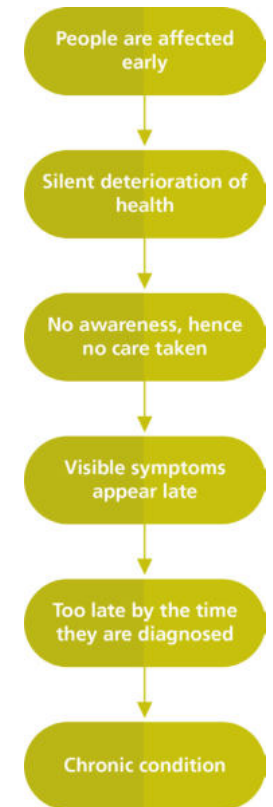
With globalization, food habits of people have also changed drastically. In recent times, there has been an increase in fat consumption and decrease in fibre-rich diet. These have made the general population more vulnerable to LDs (Shetty PS, 1997).

Preventive Healthcare

Preventive Healthcare or preventive medicine is the practice of taking measures to prevent diseases and promotion of health (Wikipedia, 2013). This is different from the traditional curative healthcare model where diseases and symptoms are treated once they appear, or, in most cases, when they get worse (Wikipedia, 2013).

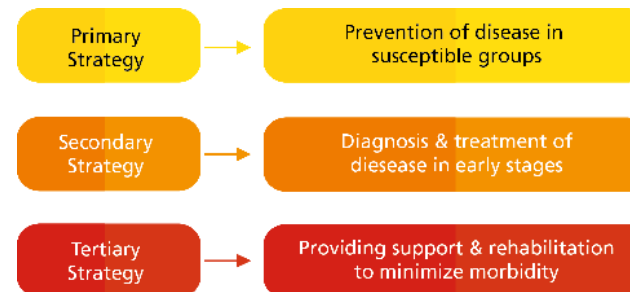
There are three kinds of preventive healthcare strategies – primary, secondary and tertiary. Primary prevention consists of practices for prevention of a disease in susceptible individuals or populations using techniques like vaccination, while in secondary prevention, methods are employed to diagnose and treat existent disease in early stages before it causes significant morbidity like in heart diseases. In tertiary strategy, measures are aimed at providing supportive care and rehabilitative services to minimize morbidity, for example in case of diseases like cancer (NLM, 2013).

The project currently deals with Secondary Prevention. By doing this, issues like painful procedures, chronic conditions, permanent damage and medical costs can be avoided. Preventive care includes examinations and screening based on an individual's age, health and family history. For example, a person with family history of diabetes would begin regular check-ups at an earlier age and/or more frequently than those with no such family history (Wikipedia, 2013).



Right: How a person gets affected by lifestyle diseases

Bottom: Different strategies used for disease prevention



Many lifestyle diseases do not show prominent signs in the early stages. Subtle signs like unusual thirst and hunger, dry mouth, irregular pulse, etc. usually go unnoticed. These diseases are identified when negative consequences like infections, sores, strokes or something severe, become apparent. Added to this, it has been noticed that certain profiles are deceptive. People with apparently low visible risk (e.g. slim, never smoked, etc.) have seen to be diagnosed with these diseases than those with visible risk factors (McConnachie A, 2001).

As illustrated in the chart on the left, people get affected early and due to lack of awareness (Saskia C. Sanderson, 2009) there is silent and gradual deterioration of health. As most of the prominent symptoms appear at a later stage of the development of disease, the risk gets accumulated and is late by the time people are treated. By this time, the condition has become chronic and permanent damage is done (I Darnton-Hill, 2004).

Hence, the only way to prevent these diseases is through interventions like recognizing symptoms early, assessing risk and proper post-diagnosis care amongst susceptible groups (K Srinath Reddy, 1998).

Design Process

During the project, user-centred design process was followed to understand the user needs, tasks and their environment before coming up with the final concepts and solution.

The steps involved in the process are mentioned below.

Data Collection

User studies and literature review were done to understand the motivations and triggers of why people get health check-ups done and to understand the conditions and symptoms of diseases.

The data obtained from user studies was used to generate insights using affinity diagrams¹. Some of the insights obtained were validated by comparing them to secondary data or directly with the users. By keeping the user and their environment in mind, critical problem areas were identified.

Ideation

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

Final Concept & Evaluation

The final concept was evaluated against various metrics to test their effectiveness and to find drawbacks. The feedback was incorporated into the existing design to make it better.

¹ Affinity diagrams is a method where data from contextual inquiries is arranged hierarchically based on all observations and are clustered into directly and indirectly related trends. (Kuniavsky, 2003)

Data Collection

User studies were done to understand the motivations and triggers of why people get health check-ups done, do they get them done in time to avoid complications, and how does this affect their health and problems of delayed decision making.

Currently, patients visit a pathological lab to get themselves checked-up. Many people even use home-based devices to keep a track of their health. While labs are presumed to be expensive in terms of money, home-based devices need high maintenance to ensure efficiency and accuracy.

A preliminary study of the idea of HealthATM revealed that the output of such a setup were doctors recommendations and this may not directly be usable for a person who visits the kiosk. It appeared that it needs a user-centric approach to find the right problems and a more tangible output. Producing a more usable report would make the setup more effective and help people take better informed decisions. Moreover, motivating getting people to use such a stand-alone system was not an easy task.

So, the purpose of user studies was to see how the outcome can be used to motivate people to get regular check-ups, design a proper screening system and to promote preventive health behaviour.

Methods

The process started with contextual inquiries of the target audience to understand their needs and to generate insights. Understanding check-up patterns and health concerns at different ages was part of this step.

Literature review and stakeholder interviews with doctors helped know the

importance of preventive care, cardiovascular diseases, their causes and risk factors. Ways and methods to screen patients with certain symptoms were also identified during this process.

Interviews were conducted with ten people from Mumbai (5), Chennai (3) and Jaipur (2)². Medical practitioners, doctors and public healthcare service were also interviewed.

Data obtained from doctors was used to validate certain facts that were acquired during interviews with patients and vice-versa. Affinity maps were made to understand the actual needs and focus areas.

User Criteria

Recruitment of users started with immediate family members and social circle. Initial data was helpful in understanding the basics and the interviews later extended to 'friends of friends'¹ who fit the bill. Some patients were also referred to by doctors. In all, ten users were interviewed, of which four were interviewed twice. The criteria used to select users for the interview is mentioned below.

Age group

Users in the late-20s (4), mid-30s (3), late-40s (3)² were recruited for interviews. People in late-20s and mid-30s are now more susceptible to CVDs and it was important to understand their needs. Similarly, people in their 40s were helpful in understanding triggers for check-ups and diagnosis.

¹ A term popularized by online social networks, it refers to individuals who share a common social contact or a friend.

² The numbers in brackets indicate the number of people interviewed in each age group.

Chronic or recent health condition

People with recently diagnosed health condition or a chronic condition were expected to provide insights into health management and their motivations behind getting check-ups done.

Family with health conditions

Sometimes not just users but those around users provide important insights into problems. These people are also directly influenced by the users' company. Hence, such people were interviewed to know the effect of someone else's health condition on them.

Educated, urban, both genders

The scope was restricted to the urban population for convenience and to keep the project more focussed.

Findings

The following were findings from user studies and stakeholder interviews.

Family history influences health check-ups

Several users got a medical check-up done, when someone close in the family or social circle was diagnosed with a severe health problem. The empathy that arose out of such situation proved to be a great motivator. Users with family history of CVDs were more likely to get regular or early health check-ups done, than those with no such medical history.

This factor of family can be used to indirectly persuade other family members for better health behaviour. People trust the word of a person they know than otherwise. They can hence be motivated to get check-ups done regularly. The people in turn can then motivate others, forming a network.

People visit a doctor only when a health condition gets severe

It was common for many users to wait until a problem became severe and visible symptoms appeared before they went to a doctor and got a check-up done. This was due to lack of time and/or lack of knowledge. In one case, a user had a tooth issue and used home remedies to suppress pain. It was not until there was excessive bleeding that the user decided to visit a doctor.

The user thought that it was not a significant enough problem that needs immediate attention and hence the treatment was delay causing permanent damage.

External factors force people to get check-ups

Formalities like visa, travel for pilgrimage etc. need medical reports to be submitted and people got tests done to avoid hassles. Users also got them done before long-term engagements like education abroad and long vacations. Check-ups in case of many employed users (that were interviewed) was connected to employer benefits. The last time they had got a check-up done was when they had to submit health documents to their employer.

The amount of motivation required for people to get a check-up done is very high. People look for tangible benefits. Unless people fear a negative consequence, it is not possible to get even a health check-up done. So, people should be sensitized about advantages and disadvantages of health care.

Conditions are sometimes diagnosed and treated by serendipity

In one case, a user had visited a doctor for a regular check-up for stomach upset, who was then recommended for a detailed abdominal scan. The test then revealed complications with the gall bladder. Such conditions might be discovered accidentally. The user was not even informed enough to recognize a gall bladder issue.

Looking for one problem revealed a different issue altogether. On the contrary, an efficient system that looks for a specific abnormality can be created.

High expenses deterred people from taking tests

Users said that medical check-ups were expensive. Doctors and diagnostic centres got several tests done that, the users thought, are not directly related to the ailment. This was perceived by users as a fraudulent practice. When asked, doctors said that multiple tests may be done to better triangulate the cause of a disease.

However, the system of 'cut-practice' amongst Indian doctors is a well-known fact and doctors sometimes prescribe tests that involve monetary gain. In some cases, doctors with lesser experience might prefer a diagnostic report than going with their gut. All these add to the increased cost to an individual. This may force some users stay away from medical tests, thereby causing a delay in detecting conditions that become chronic over time.

A trustworthy, low-cost and efficient service can be some of the features that can be included in the final solution.

People took necessary precautions post-diagnosis and were good at it

Almost all users, once diagnosed were careful about their health and got regular check-ups done. They used several personal medical devices to monitor their condition. In case of devices like blood glucose monitors that were not non-invasive³, people were initially reluctant but later got comfortable.

The target users will hence be those in pre-diagnosis state. Screening people with early symptoms and doing it right is what would be of importance. People once diagnosed definitely take enough care of themselves. The triggers of such people to do timely check-ups and medications will be helpful in designing the final solution.

³ A medical procedure is strictly defined as non-invasive when no break in the skin is created or there is no skin break (Inv13).

People need high motivation to get tests done

Due to some of the earlier mentioned reasons like cost and time, people were reluctant to use the available facilities. And in most of the cases, the initial motivation required to get a test done was significantly high.

So it was of primary importance to provide proper triggers in place to get medical check-ups and a provision to manage and know about health.

Affinity to a cohort is directly related to awareness about a health condition

Doctors observed that patients from urban areas are more aware of lifestyle diseases than the rural areas. Urban population is more susceptible to such health conditions (Vorster, 2002) and hence the increased familiarity. Also, media campaigns by hospitals and sugar-free products helped increase the awareness and inquisitiveness amongst people.

However, only a very small percentage of urban people were aware of these diseases, but on a comparative basis this was higher than the rural population (Saskia C. Sanderson, 2009).

Existing Products

Existing products that worked on a similar model as vending machines were studied - machines that are standalone, self-service, simple-to-use and need high motivation to be used. These are products that people do not use on a regular basis.

Some of the examples are mentioned below.

Weighing Machines in Indian Railway & Bus Stations

One of the most prime model which one of the initial design ideas had was to follow the model of the coin-operated Indian weighing machines. These Weighing Scales (or Machines) were huge colourful stand-alone contraptions that dotted railway stations and bus stations in India. One could go, slide a one rupee coin in the slot and check their weight. These, fortunately or unfortunately, have disappeared from most of the locations. (Dutt, 2013)

There were certain ideas from this product that could be used in the solution. These were isolated self-service machines which people used for fun and checked their weight when they had nothing much to do while waiting for a bus or a train. A slight increase in their weight, in most cases, subconsciously triggered health concerns amongst people. Though made with a commercial intent, these playful machines got people to worry about their health.

At the time when these machines were launched in the market, private weighing scales or healthcare devices in homes were a rare phenomenon. This was probably the reason it became popular. Similarly, a solution catering to people who cannot afford or are aware of these devices will be helpful.



A typical weighing machine in an India

Source: Flickr/yaapraaf



A Photobooth in Germany. The final design ideas are very similar to the concept of a photobooth

Source: Wikimedia

Photobooth

Photobooths are automated service machines that have been with us for quite some time now. A machine that worked on the model of a vending machine, people could go to a Photobooth, insert a coin and get their photographs clicked. Based on the type of the machine, these photos were delivered within 5mins to 30secs (Wikipedia, 2013). Started in the early 20th-century, these have stood the test of time including the major wars, depression, the computer era and the age of personal cameras. (NYT, 2013)

Instructions in a photobooth are straight forward and simple. Intricate issues like getting the posture right, the correct payment to be made and feedback before and after taking the photograph are handled in simple ways. The seat is designed in a way that posture is right in most of the cases and the payment is usually either by coins or credit cards. A beep and a flash are feedback for conveying that the photograph is being taken. Privacy is maintained by a curtain.

Photobooths are probably the closest to the health kiosk concept. The mode of operation, the need of privacy and the frequency of use are very similar to the features which a health kiosk should have. The design of the photobooth itself is something that the final design can be based upon.

These installations are a rare phenomenon in India and few of them can be seen in malls in the metros. India has scattered small photo studios that are assisted and shoot photographs on request. So, photo booths probably never picked up as a phenomenon.

Personal Medical Devices

Personal Medical Devices are now part of the household equipment for many people. These include weighing scales, BP machines and blood glucose monitors. With the increase in diseases and non-availability of personal time, these machines prove very handy to monitor and keep track of one's health.

However, these devices are usually purchased when the user is diagnosed with a particular condition that needs regular health monitoring. In most of the cases, there is no such monitoring done by the user prior to the diagnosis.

Nowadays, most of the healthcare devices couple with smart phones to store, track and analyse information. While tracking health data on a continuous basis, these devices can also help doctors to monitor a patient's vitals remotely and over a longer period of time. (Singer, 2009)

Personal healthcare devices often tend to generate inefficient data, have technical problems, steep learning curve, fitting issues and sometimes even give inconsistent results (Fixya, 2013). This is due to improper handling and maintenance. The devices usually are not of very good quality to keep the costs low.

Alternatively, a kiosk with well-maintained high-end equipment, certified reports and personnel assistance along with short service times will definitely serve the purpose of health monitoring for individuals.



Several personal medical devices. Top: Personal Glucose Meter, Bottom: Several devices to keep track of various body parameters

Source: Flickr / brianjmatis,juhansonin



These days, the most commonly used personal medical devices are glucose monitors and blood pressure monitors. These devices cases are easy to use even for first timers or people get used to the process as early as the second time itself.

In case of glucose monitors, people are apprehensive in the beginning as it involves an invasive procedure and they would not have done something like that without supervision before. But over time, this gets resolved too. The glucose monitors also come with a booklet where people are expected to keep a track of their glucose levels over time. But people don't use them as they are content with the numbers that appear at that instant.

In case of BP monitors, there are two kinds of monitors available in the market – the wrist-based and arm based. The medical associations recommendation usage of arm-based devices for better accuracy and error prevention (O'Brien E 1993).

The main issue in these devices is the proper placement and size of the wrist cuff. An improper fitting of the cuff might result in erroneous readings.

All these problems can be solved to a great extent with accurate and well-maintained systems at the kiosks. Common issues like error due to mishandling by users, taking mean values and mapping with current health conditions to give more precise numbers can be handled. Further, storage of data over time and forecasting based on history becomes easier.



Most commonly used personal medical devices today

Above: Personal Blood Pressure Meter
Left: Accu-Chek Active Blood Glucose Monitor

Source: Flickr / Tunstall Telehealthcare; PagueMenos

Vending Machines

Vending Machines are machines that dispense several items like tickets, beverages, snacks and other consumer goods to a customer automatically, on payment via credit card or cash. The ready availability at strategic locations like hospitals, highways, parking lots, schools, was one of the main reasons for the success of these machines. People could also buy goods in smaller quantities which would otherwise not be possible in a large setup. (Wikipedia, 2013)

But the vending machine phenomenon has not seen much success in India. Some of the reasons for it being India already has several small stores that dispense goods in small quantities, lack of technical knowledge, unease in using vending machines, etc. (Hande, 2012)

While some of the features of a vending machine can be used in the final solution, there can be improvements made in terms of making the operations simple for users.



A BestBuy vending machine selling goods-on-the-go.

Source: Wikimedia



Adaptation of ATMs in India saw quite a cultural challenges when they were introduced

Source: Flickr / mailliw

ATM Machines

The study of ATMs in India was something of interest for this project. When widely introduced in the 2000s, ATM machines were considered to be foreign entities to the culture. But, once people realized the benefits associated with them, issues like literacy or previous expertise were no more barriers to adoption. Due to existence of multiple cultures, ATMs required to have a common design to meet everyone's needs. Hence, personalization became a key to Indian market (Antonella De Angeli, 2004).

When compared to the kiosk, these are some of the important aspects that need to be taken into consideration while designing the final solution. Such kiosks currently do not exist in the Indian context and making it successful through proper design becomes the primary challenge.

The kiosk that in the intended design of this project has some other general aspects that can be borrowed from the ATMs. Similar to banking data, the personal health information that is being collected at the kiosk is highly confidential and private. Similar details are guarded very closely and strictly by banking regulations.

Though a central medical data regulation does not exist in India, there are regulations governing the collection, processing and usage of personal data (GOI, 2011). These guidelines have to be taken care of in the final design and how the system ensures and conveys this security is important.

As an initial idea, mechanisms like swipe cards or finger-print recognition may be used for authentication of the user. Session time-outs, secure network connections, physical security and hardware protection are some of factors that need to be considered during building the system.

Technology Review

Available technologies were reviewed to understand the scope and extent to which concepts can be generated to promote preventive healthcare. The review started with a search to find available and emerging technologies in the healthcare sector and currently available technology.

Various machines are available that are used at home, personal and establishment level to screen people with diseases or for pathological processes. But this equipment is either expensive or inaccessible due to high cost.

Some of the easily available equipment are susceptible to bad maintenance that might affect the working of the device itself. With lesser cost comes an increase in inaccuracy and lesser confidence in final results.

- Blood Pressure Calculators
- Electrocardiogram Machines (ECG)
- BMI Calculator
- Pulse Oximeters
- Blood Glucose
- Social Networks

Prediction Algorithms

The most popular mechanisms available to predict health risk are the Framingham Heart Study (FHS) (Study, 2013) and the QRISK Calculator (QRISK, 2013).

FHS is an extensive long-term ongoing cardiovascular study which uses data from thousands of subjects and 50 years to create a prediction algorithm to assess cardiovascular risk of an individual over ten years. QRISK works on a similar model for prediction and is considered more accurate. Both the algorithms take the basic health data and map it to statistical data collected over multiple generations to assess the risk.

A prediction system that uses data from the kiosk and personal medical data to generate risk and susceptibility to a disease can be created.

Risk Assessment and Prediction (RAP)

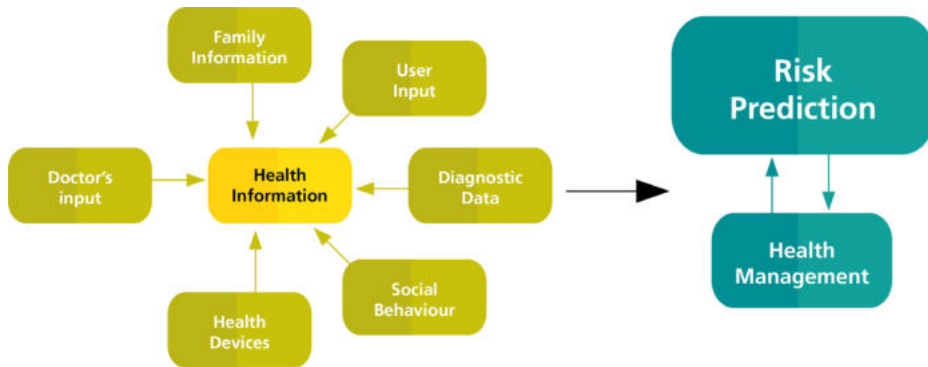
The RAP system takes various health and personal parameters as input and creates a prediction report of an individual's susceptibility to a particular disease. In this case, the prediction engine would predict the risk of a person getting a lifestyle disease.

As seen in the chart overleaf, the model takes various parameters like the diagnostic data, data from health devices, family medical information, user input, social behavioural data and even doctors input to generate an accurate prediction.

The fact that cardiovascular diseases and diabetes have a high probability of being inherited genetically, is primarily used to assess the users' susceptibility. These predictions are based on research data and algorithms like FHS and QRISK, that are used in the medical industry.

The system would regularly monitor the family medical data and update the users' risk. The risk is also based on how nearer or farther a particular family member is to the user. A direct relative like the brother with whom the person shares 100% identical genes will have more impact on the users' health than his uncle or cousin with whom the user shares only 50% or 25% of genetic data.

For example, the current risk percentage which may currently be '5% in the next 3 years' may suddenly go up to '10% in 2 years' if the brother or cousin is diagnosed with a disease. At the same time, regular exercise and healthy lifestyle will reduce



Different components of the prediction model

the risk. The RAP system will hence keep the user tension-free and help them change aspects of their lifestyle to improve health.

The adjacent model can work as the seed model on which the initial data collection and prediction will work on. Over time, as data is collected from various different nodes (users), the system becomes smarter and hence creates more intelligent results. It becomes a recursive system where the data created by one cohort is bootstrapped to create intelligent profiles and models that can be replicated for another cohort to assess and predict their risk.

As medical data for such instances is not easily available, health data collected through this system mixed with various ad-hoc data like work profiles, commute routes, type of social interactivity and other micro data, this system has the capability to be far more intelligent and self-sustaining than it would appear to be at this level.

It must be noted that the prediction analysis and output of the system is not prescriptive. It would assess the amount of risk a person has to a particular disease and recommend to user to undergo confirmatory tests at a diagnostic centre.

Possibility

The concepts proposed in the end can be developed based on the available technology. The modification required is either integration of independent equipment into a single system or miniaturization of the devices.

There is also a scope for simplifying the data collection process and the methods of how the collected data is utilized in a larger context.

Personas



Ashok: Young but oblivious to health risks and conditions

Ashok Kumar

Ashok Kumar is a 26-year old software engineer in Pune. He lives with his family in the suburbs that requires a 60-minute commute to the office. He is a heavy worker and works till late every day. This has resulted in irregular sleep schedules and eating habits over the past several years.

He frequents places like McDonalds and Pizza Hut multiple times in a week. His regime also includes visits to the local pub every weekend with his colleagues.

Health Status

Ashok is not much concerned about his health and does not follow any regular pattern in his diet or exercise. On insistence by his mother, he registered at the local gym but rarely goes there.

For him visiting a doctor is an unnecessary exercise and something that he does when things are really out of control. The last time he visited a doctor was when he had severe throat infection and a visa interview the following week.

He has heard of his senior colleagues and friends being diagnosed with certain like hypertension, but is not very inquisitive to find out the causes or talk to them about it. He got a full medical check-up done about 2 years back when he joined his company and had to submit documents for health insurance.

Sujatha Krishnamoorthy

Sujatha is a 42-year old school teacher in the KVIIT School in Powai. She lives with her husband Raman and kids in independent quarters allotted to them in the sprawling campus of IIT Bombay. They are a reserved family and often keep to themselves. Raman works as an administrative staff in IIT.

Sujatha's day is usually very organized. It starts with an early morning jogging and exercise, followed by breakfast with family. She spends the rest of the day in the school which ends at 5pm. In the evenings, she conducts tuition classes for the school kids, which is followed by a dinner and chat with family.

Health Status

Sujatha is a health conscious person and follows a strict exercise regime and healthy diet. Her husband, Raman is hypertensive, which forces the family to follow healthy dietary habits.

With a history of diabetes in her paternal family, she started taking regular care of herself and the family at an early stage. However, Raman, who also follows a strict regime like her was diagnosed with high BP about ten years back.

Medical check-ups are something they haven't heard of. The last time they got a check-up done was about 3 years back at a free check-up camp on campus. For normal ailments, they visit the seemingly poorly equipped IIT Hospital.



Sujatha: Middle aged and healthy but very socially active



Ajit: Sportsman and fitness freak, but health is not on mind

Ajit Sharma

Ajit Sharma is a 28-year old investment banker. He lives with his parents in Bangalore and regularly travels across the country due to his work profile. He is avid cyclist and often goes on cross-country treks with his friends.

While his normal days are filled with office work, his weekends are reserved for adventure sports. He has been doing this for quite a while and is popular amongst local groups.

Health Status

With regular exercise and healthy diet, Ajit ensured a healthy lifestyle throughout. Recently, one of his cousins was diagnosed with diabetes and their family doctor suggested he too get himself checked up.

The medical reports showed that Ajit is on the verge of being a diabetic and must take utmost care to get back to normal or to maintain his status quo. Ajit is now worried as he is new to such a health condition and does not know how to change or monitor his health amidst his busy work schedule.

Project Brief

After the user studies and research, the initial project brief and problem statement was redefined with the help of the insights that were obtained during the analysis.

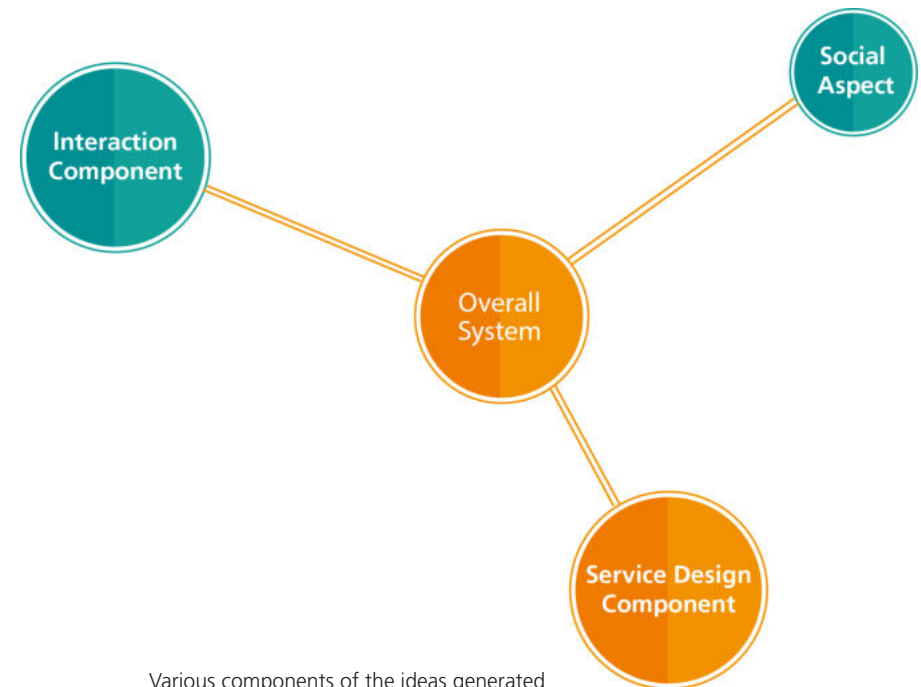
Problem Statement

In the initial stages of the project, problem areas were identified where design can be used to identify the risk factors and symptoms amongst patients. The project also aims at promoting preventive health behaviour through the solution. The scope of the project would be to screen people only for cardiovascular diseases and is limited to the urban scenario.

The important aspect of the project would be to design triggers that will motivate people to get health check-ups done. Placing hot triggers¹ to persuade people to undertake a particular task which would then lead to a larger task would be something that the solution will look into. An avenue to facilitate preventive healthcare will also be created.

The project does not claim to be a solution to existing lifestyle diseases, but provide avenues for quicker diagnosis and prevention. The solution will help change the users' attitude towards their personal health and create an environment where patients and doctors act as collaborators.

In the larger context of the healthcare system, this set of integrated devices cannot exist in isolation and should be integrated with other existing systems to function as a holistic system.



Various components of the ideas generated

¹ Hot triggers are triggers that are strategically placed to make motivated people positively do something. This is important in case of making a behaviour a habit. This is based on BJ Fogg's Behaviour Model (BJF13)

The concept now consisted of three components that would make the solution complete.

Social Component

Utilizing the social network, integration with other health devices and services, behavioural change through triggers, following-up further tests

Interaction Component

Covering aspects like composition of the actual device, user interaction, mode of operation (self-service or assisted), general design, cultural and user experience considerations

Service Design Component

Integrating the design into the current healthcare system, services rendered, fixed or mobile facility, pre and poster encounter scenarios

The project will concentrate on creating triggers to persuade people, making them persistent enough to get a task done and necessary follow-ups to translate these behaviours into a habit. This will be done by leveraging the power of social networks.

Here, the term 'social network' means the relationships of the user with other members of the family and societal connections and not just online social networks like Facebook, Twitter, etc.

Concept

Based on time and complexity of the components, the scope of the project was further limited to only two out of three components – Interaction Component & Social Component. (as in Project Brief)

The Social Component would work on motivating people to get health check-ups done, with the help of their social circle. It also contains an online portal that would take in user medical data, triangulate with family medical history, doctors input and other important health information to assess a risk.

The Interaction Component would be to devise an integrated set of devices where people could go and get checked for various health parameters. With the scope limited to cardiovascular diseases, only parameters like blood pressure, electrocardiogram (ECG), blood glucose and body fat-muscle percentage will be measured.

The design would screen patients based on their susceptibility to a particular disease and provide recommendations on the next steps to be taken. The idea is to create a healthcare solution which would provide users with a mechanism to detect symptoms at an early stage and to keep track of their health parameters so that precautions can be taken in advance.

User Studies had shown that people need quick and hassle-free mechanisms where they can get themselves tested without much intervention from the doctors. So, the proposed solution must take care of tests that would screen people for symptoms in their early stages and then recommend people for detailed check-ups.

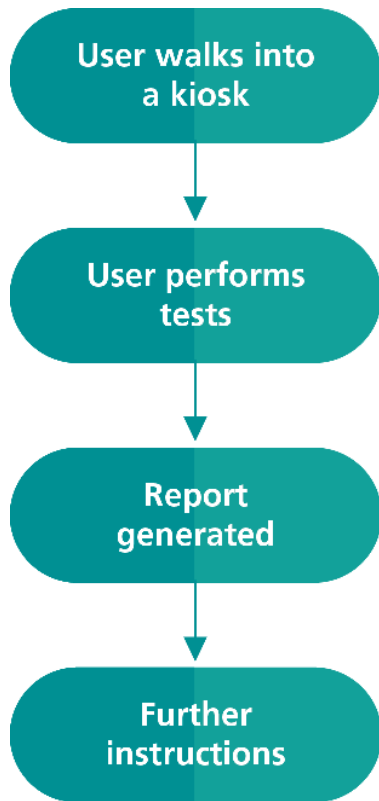
Social Component: Triggers and Follow-ups

It is a known fact that immediate family and friends acts as bigger motivators for a person than a third person. Based on this concept, the design will look into how these instances can be utilized to motivate people to get health check-ups done. This will start with key motivators in the family who would then use hot triggers to motivate other members of the family. These key members would be someone who has been recently diagnosed with a health condition or a prime influencer of the user.

The triggers would be placed in such a way that over time, these become habitual. The amount of the motivation required would then be comparatively lower than what it initially was. With motivated people getting check-ups done, data also will be regularly collected to generate user health patterns.

The data collected via individual users will be used to create a central pool of intelligence that is driven by family data to predict and analyse the risk of an individual to a disease. This data will in turn be used as a trigger and a motivator to inculcate further preventive health behaviour among family members. Hence, people backed with valid data would become influencers with maximum conversion rate.

With family in place, the system can also look into influencing other members of the social groups to be motivated and get check-ups done. Over time, this data can be used to predict models in people with similar work, geographic or age profiles.



Overview of user task flow in the kiosk

Interaction Component: Health Screening Kiosk

Cardiovascular Diseases (CVDs) are silent diseases and only regular check-ups can help in detecting early symptoms. Early screening and diagnosis can avoid complications that arise out of chronic diseases. A Health Screening Kiosk (HSK) would be an independent self-service station where users can get checked up for vital parameters.

The HSK will integrate check-up devices that currently exist independently, into a single setup. At the end of the check-up, the kiosk will generate a report of basic parameters that can be used for further diagnosis.

Certain aspects of the ideas were also inspired from the existing products. Features like standalone and isolated self-service kiosks, ease of use, users' motivation to manage themselves after diagnosis were tried to incorporate into the final solution.

The kiosks may be set-up in corporate offices, housing communities and shopping malls as quick service nodes. They can also be used in medical centres to screen patients and for prescribing further medical tests.

An overview of the user interaction with the kiosk can be seen in the adjacent chart.

As the kiosk works on a self-service model, the interactions with the kiosk would be simple - the user walks into the kiosk, performs tests himself and then uses the report generated for detailed tests. The report, created using certified medical information, would recommend the user for lifestyle changes and further health check-ups.

Tests at the kiosk

The primary aim of the system would be to screen users based on their susceptibility to a particular disease. This will be done only cardiovascular diseases and diabetes which are caused by lifestyle changes. Factors that cause cardiovascular diseases range from congenital conditions, constant anxiety to emotional stress. However, the

tests conducted as part of the kiosk will use easily measurable parameters like heart rate, body fat, hypertension and blood glucose levels.

Multiple-lead ECGs and detailed blood tests are common tests to determine cardiovascular diseases. But these are confirmatory and may not be required at the initial level for screening. The kiosk would hence act as a screener that would, based on the data collected from the tests, recommend the user to go ahead for a confirmatory test.

By using the kiosk, the number of people who might go through the lengthy test processes can be reduced and it can be easily known if a person is at a higher risk of a disease or not. Knowing the amount of risk in a timely manner can be life-saving in most of the cases.

As the kiosk is a self-service station, most of the tests need to be simple and non-invasive. And for the convenience as minimum and hassle-free as possible. From a wide range of tests that are available for screening people with conditions, the following tests were determined as these would provide enough data to assess the risk of a person to various lifestyle diseases. They were also selected due to speed and ease of use.

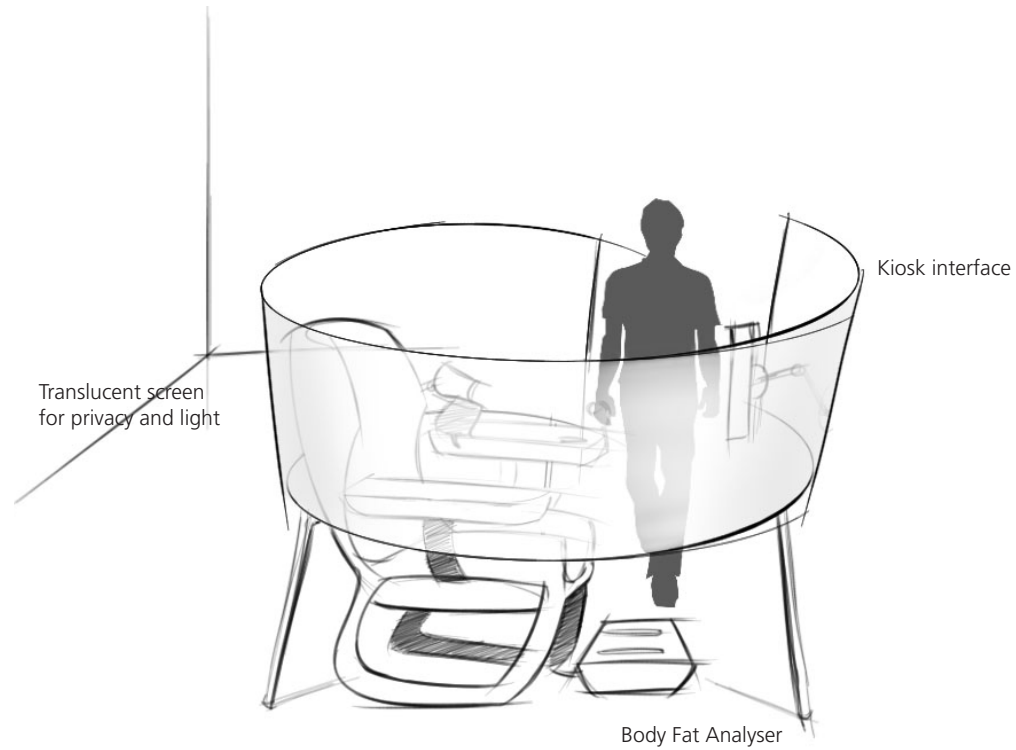
Research had shown that certain tests need to be done before others to avoid erroneous data. Hence, the order of the tests to be done was concluded to be the following.

Electrocardiogram (ECG)
Blood Pressure
Body Fat Analysis
Blood Glucose
Blood Pressure (2nd time)

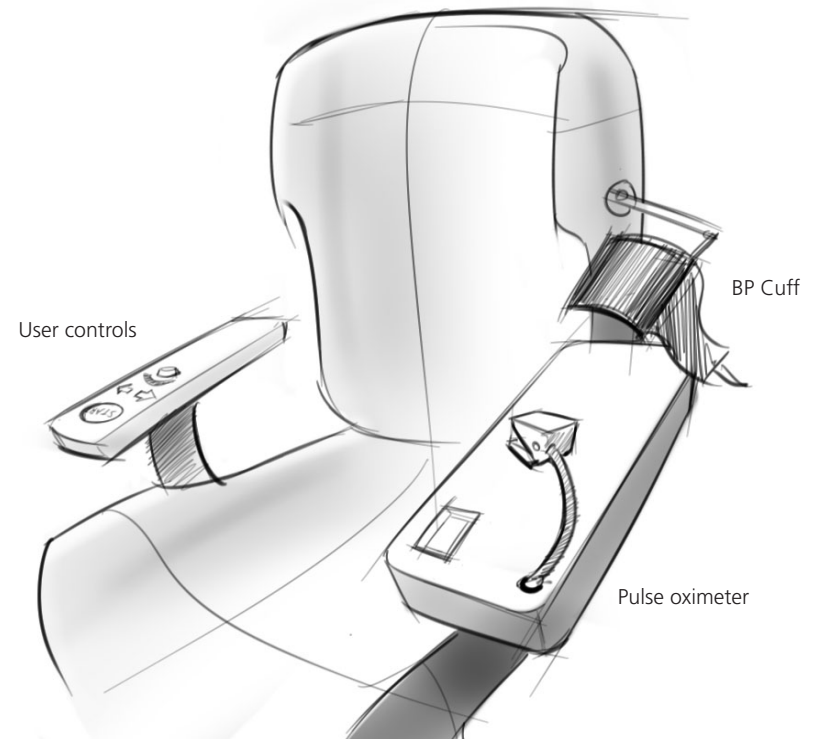
As the physiological state of the user during the screening process cannot be determined the blood pressure values are taken twice to produce a mean value.

The only invasive procedure in the whole process is the blood glucose test which would require a drop of blood for analysis. Though there are non-invasive techniques available in the market, they are currently expensive or not accurate. With advancement in healthcare technology, the non-invasive glucose monitoring method can be included in the process.

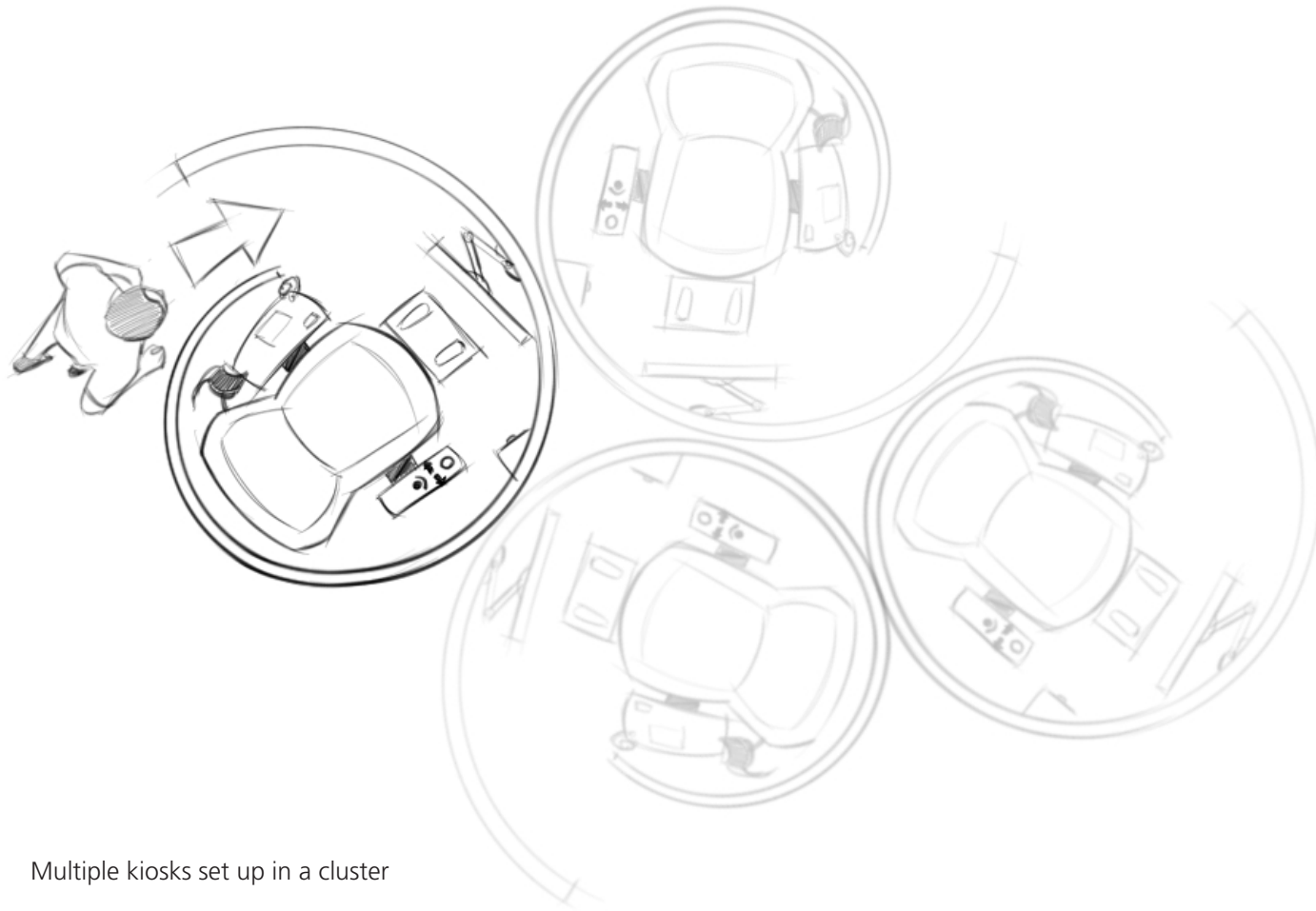
Health Screening Kiosk Sketches



An individual kiosk setup



Chair integrated with various devices



Multiple kiosks set up in a cluster

Initial Interface Screens: Version 1

Initial screens of the kiosk interface that used images in a step-by-step manner to give instructions to the user

instahealth Help Me

Health No. GO


An unique code been sent to your registered mobile number

Unique Code GO


[I am new user, Please help.](#)

instahealth Ashok Kumar Help Me


Body Fat & Muscle Analysis



- 1 Pull and detach the hand unit



- 2 Now, stand firmly on the base
- 3 Hold the device so that you can see the display.

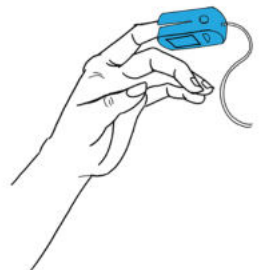


- 4 Make sure your arms are 90° to your body

- 5 Press start and wait for beep

instahealth Ashok Kumar Help Me

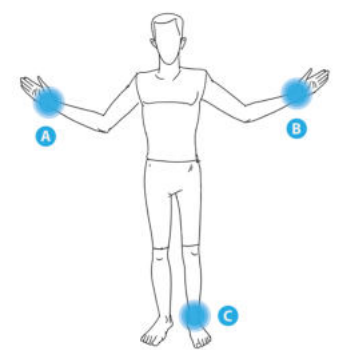
Oxygen Saturation (SpO₂)



- 1 Clean your index finger with a wet wipe
- 2 Place the oximeter on the finger with the red-side on top
- 3 Press start and wait for the beep
- 4 Keep the oximeter back in the socket

instahealth Ashok Kumar Help Me

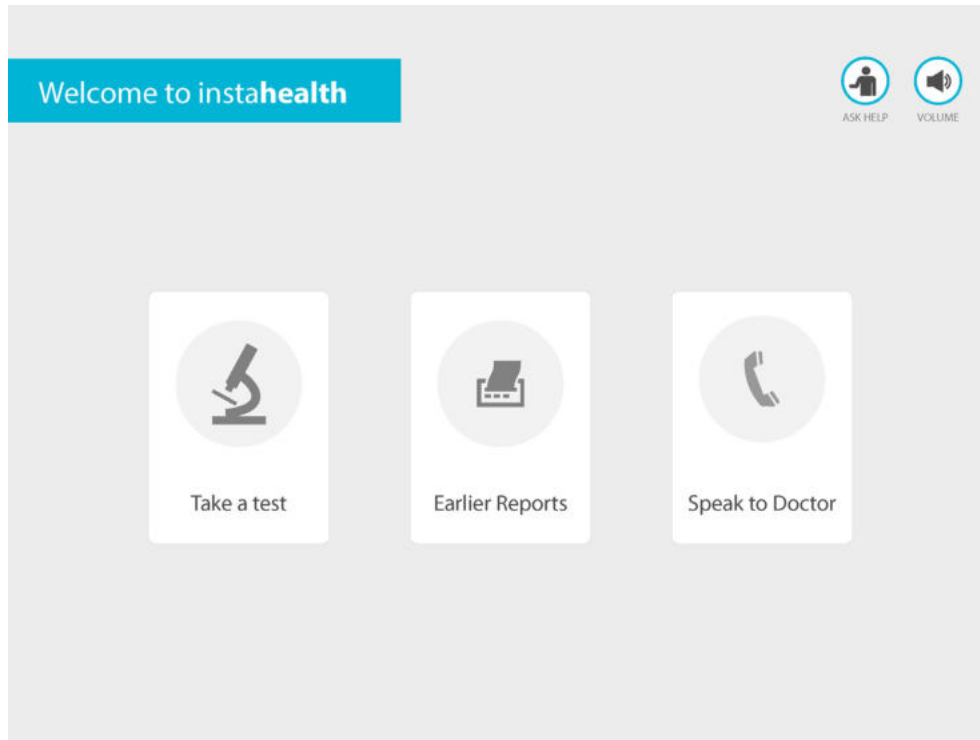
Electrocardiogram (ECG)



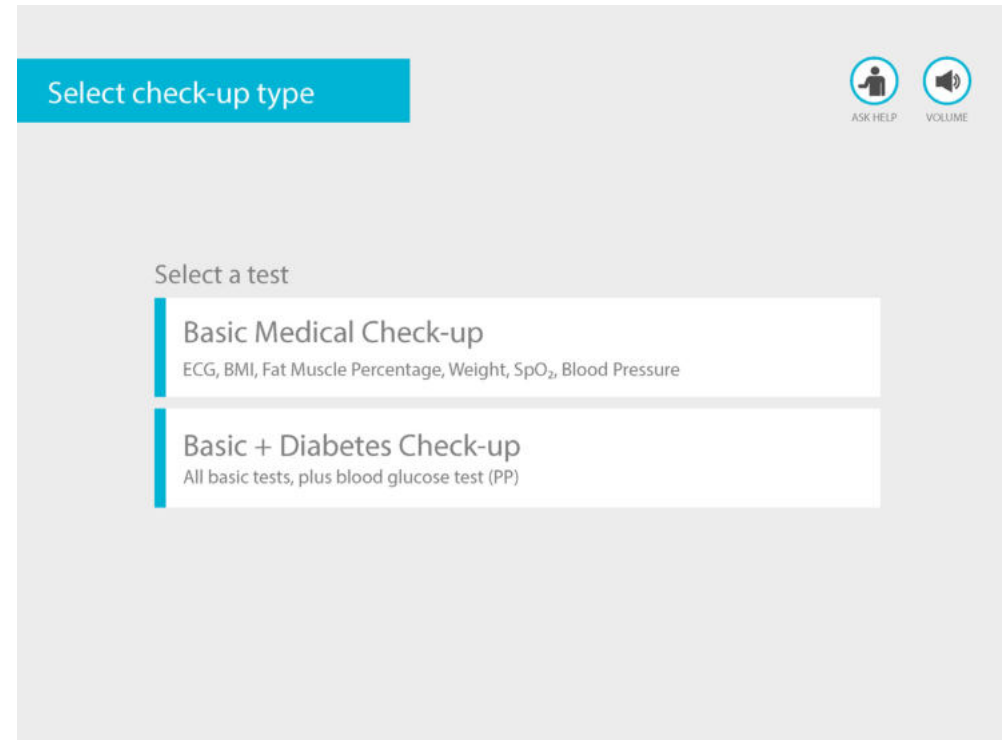
- 1 Take out leads from Box 3 and connect as shown in the diagram
- 2 A on the right wrist
B on the left wrist
C on the left foot
- 3 Be seated, press start and wait for beep

Initial Interface Screens: Version 2

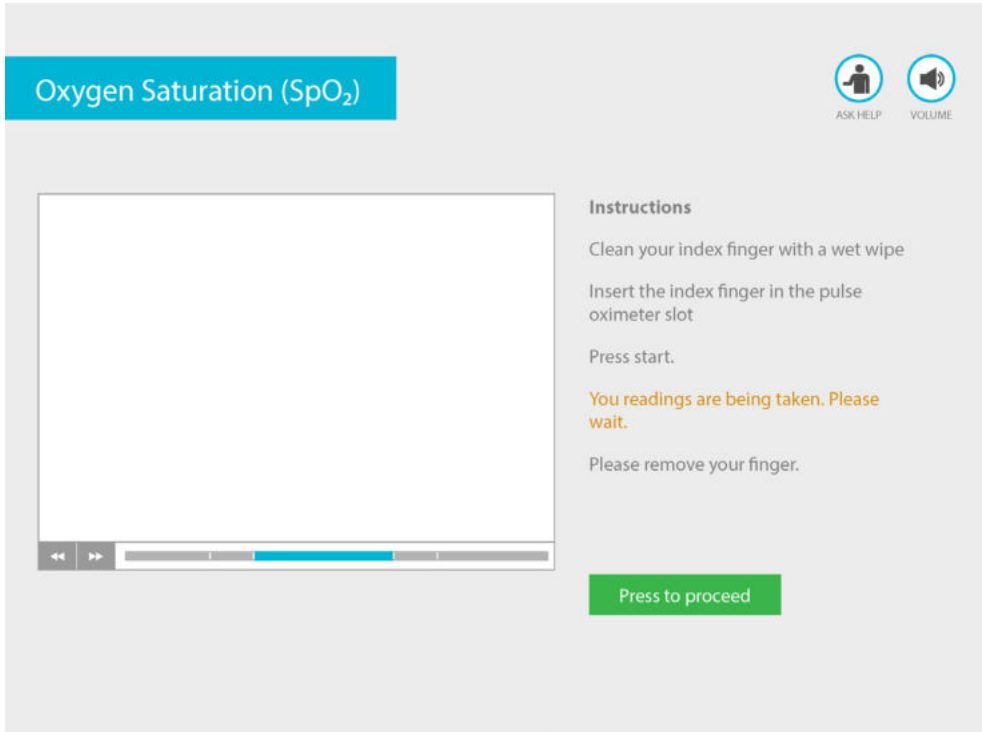
Second iteration of the screens which now has video as a method to give instructions to the user



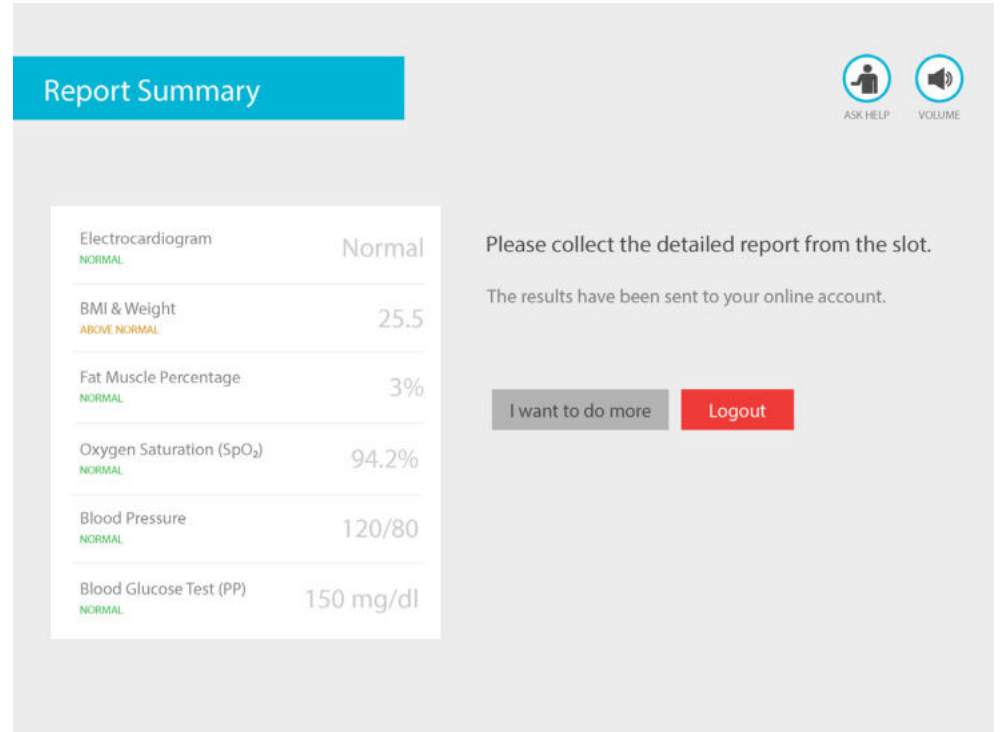
First screen with selection options



Type of test selection



Screen showing video with textual instructions on the right



Final report screen

Scenarios

The following three scenarios describe the working of the system and the flow of the user.

Scenario 1

This scenario describes a social situation that triggers a user into using the health service kiosk

Scenario 2

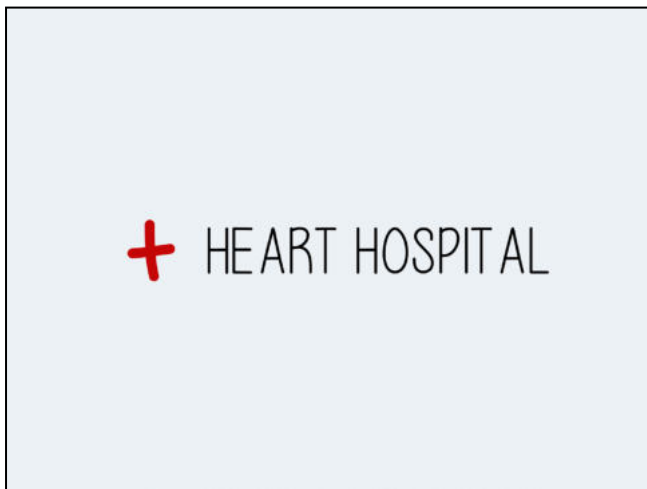
A scenario showing the interaction of an user with the online system and risk assessment system.

Scenario 3

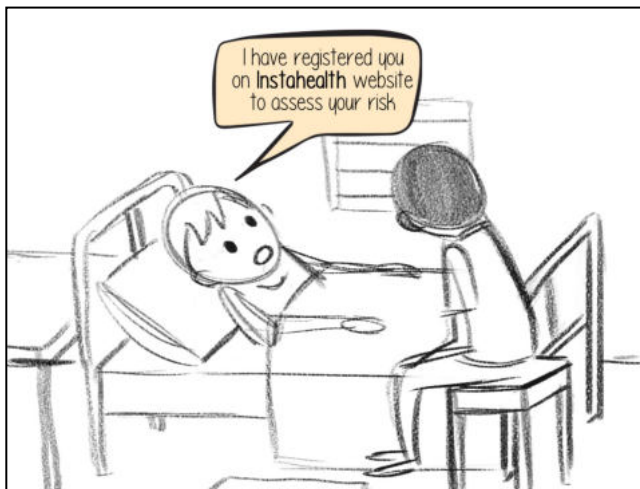
Users' devices are inter-connected and a follow-up check-up is pushed to the user.

Scenarios are overleaf.

Scenario 1: A social situation that triggers a user into using the health service kiosk



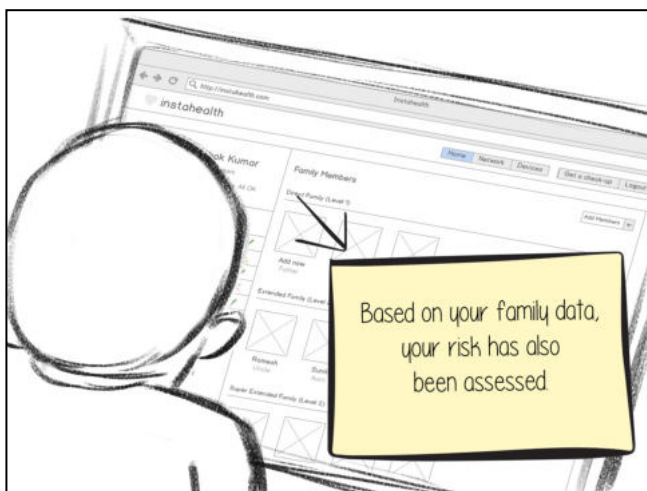
Ashok visits his cousin Vijay who is hospitalized due to a heart attack



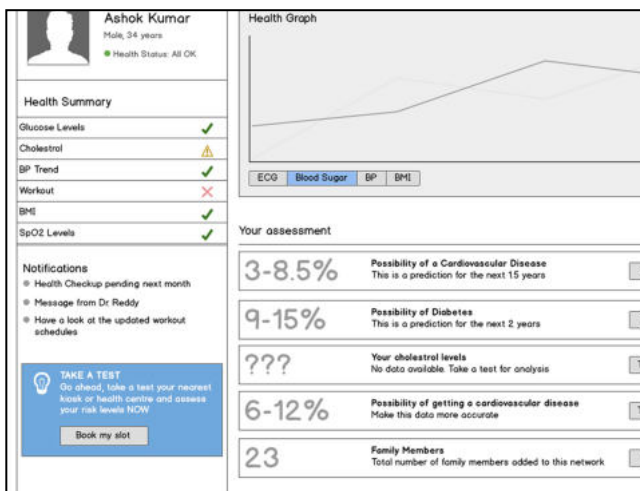
During the conversation, Vijay he has entered Ashok's name in the prediction system along with other family members



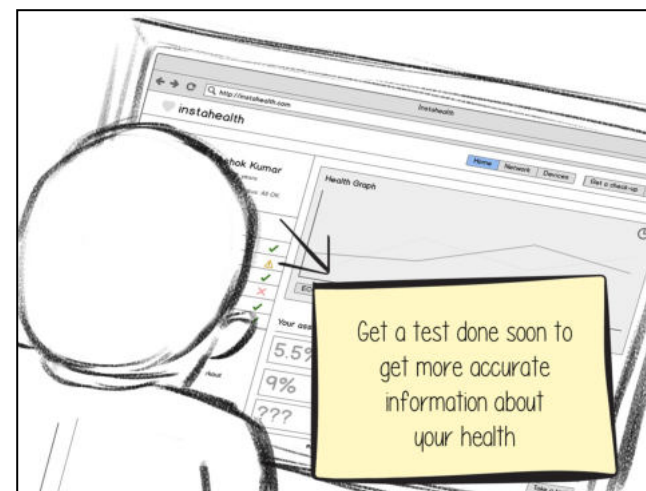
Vijay warns him that prevention is better than cure and suggests him to get a check-up done soon.



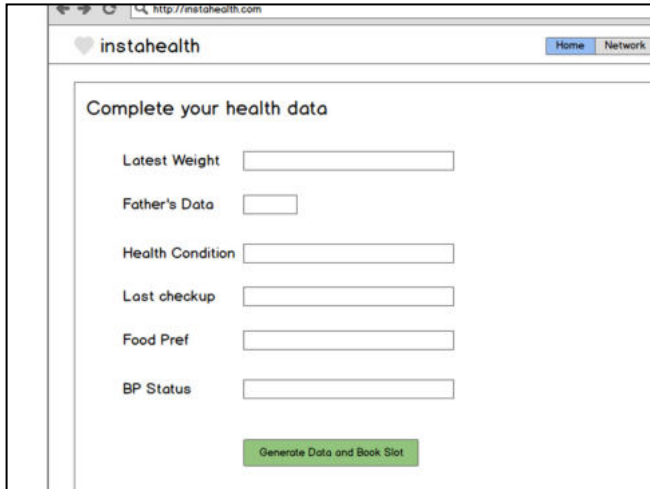
On reaching home, Ashok goes online and find his risk assessment



Ashok sees that by using his parameters ceratin risk has been calculated



If Ashok gets more tests done, he can get more accurate data



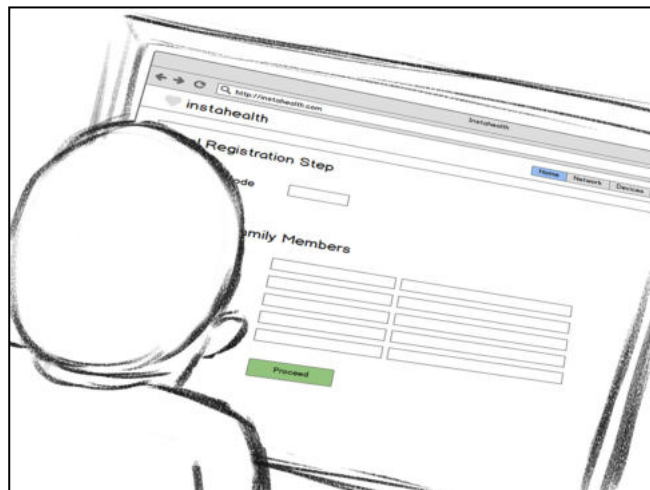
Ashok enters more of his personal data and books an appointment at the nearest kiosk



He gets an immediate confirmation message from Instahealth.



Ashok also gets a link to the download app



Before leaving, the website asks him to refer five family members to the website.



Within a few mins, Ashok gets an update that his cousin Raju has also got an assessment done.



It's been a since booking appointment, but Ashok got busy with office work and never went for the check-up

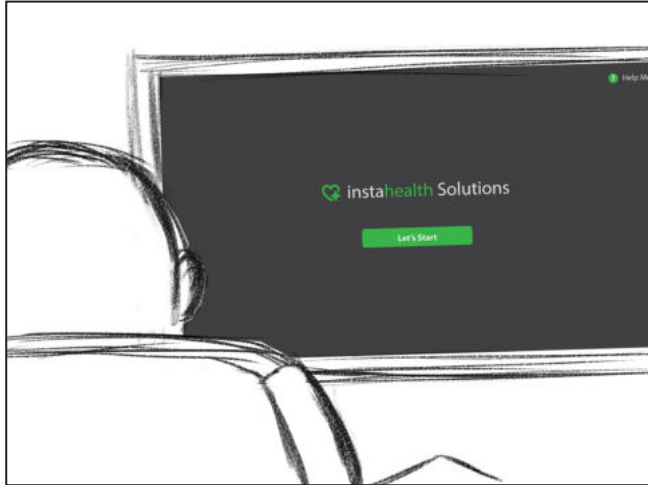


When Ashok is in the mall that weekend with his wife, he gets an alert.

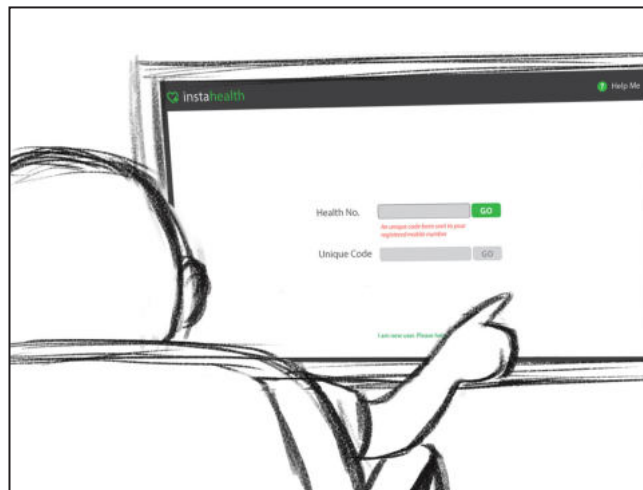


On insistence from his wife, they go in search of the kiosk and finally find one.

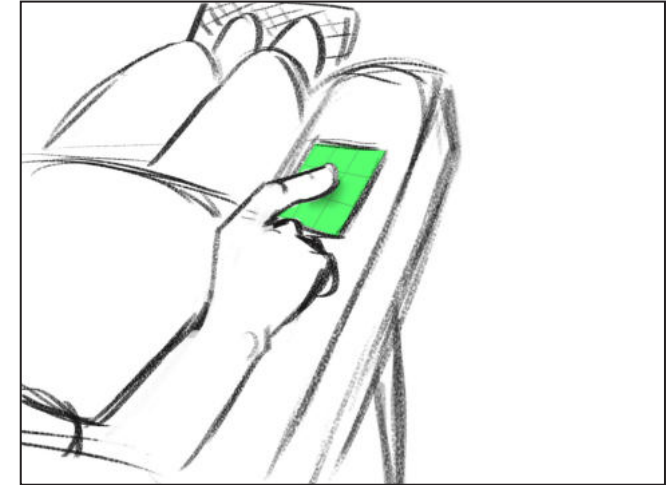
Scenario 2: Interaction with the online system



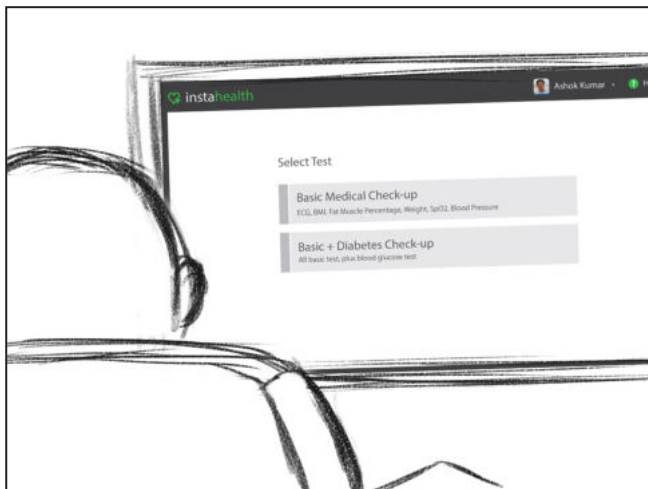
Ashok is sitting in the chair and starting the test



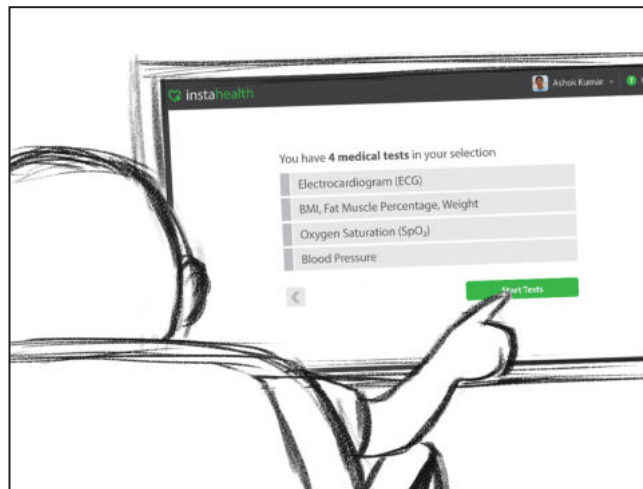
As Ashok has come here for the first time, he logs in using his email ID



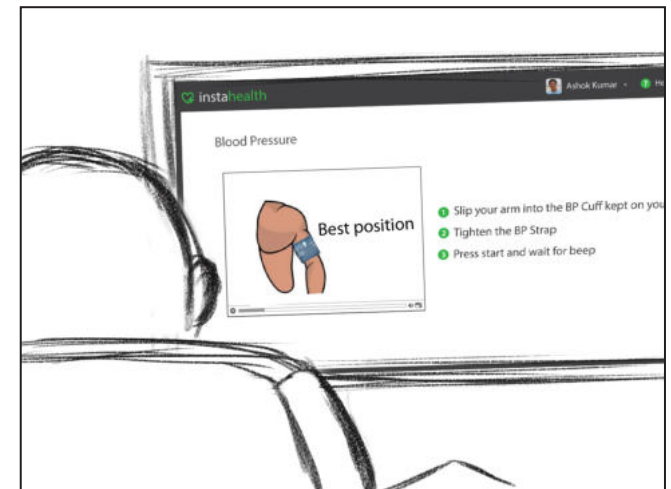
He scans his fingerprint to register his biometric data. Next time he just has to use his finger to login.



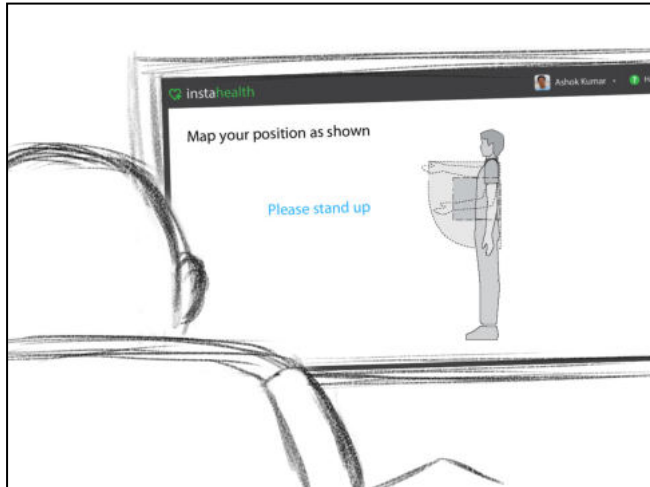
Ashok gets to select the type of test



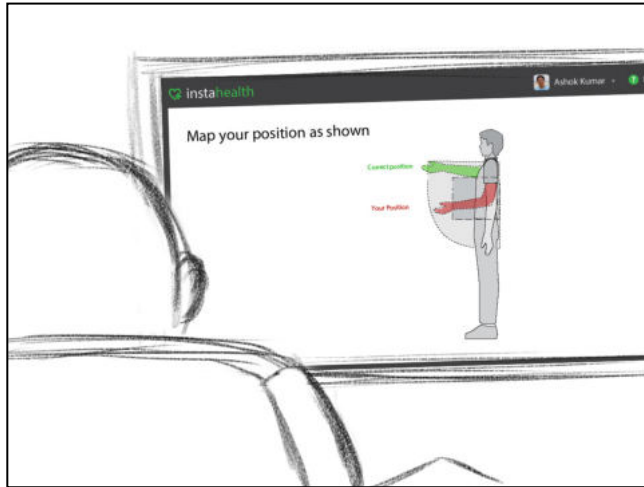
Asfter selecting he is shown the list of tests and he hits 'Start'



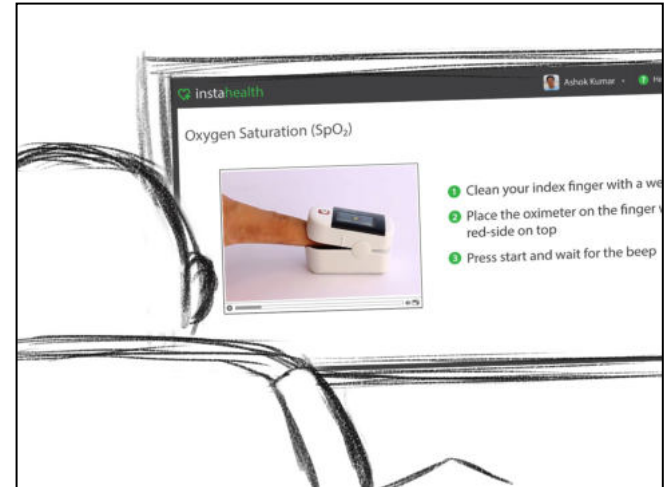
Video shows how to use the devices properly



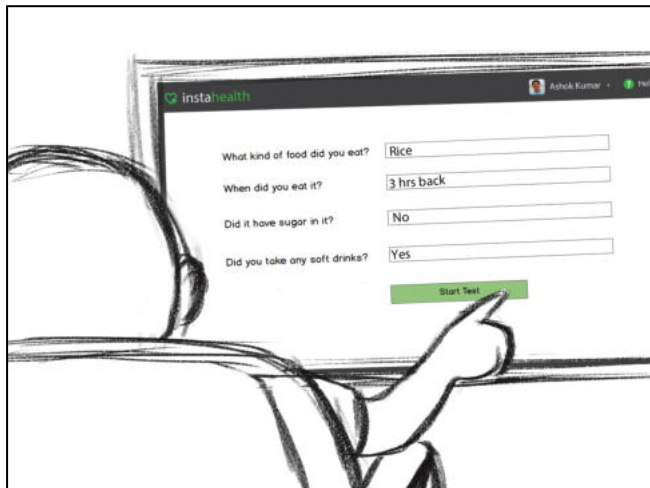
Kiosk asks him to stand and do the posture as shown



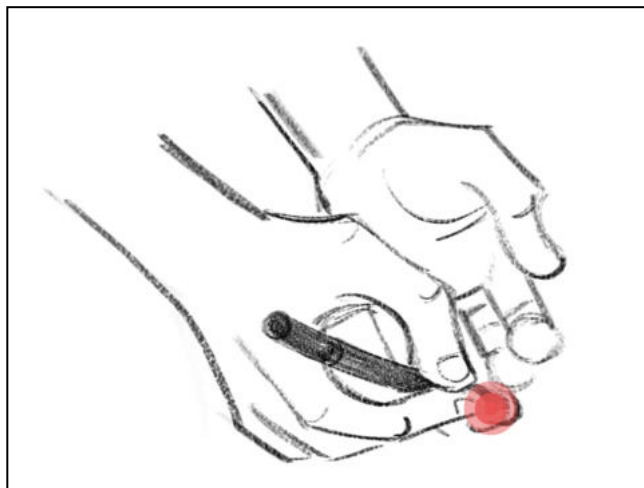
The screen maps his current position so that he can match with the intended position



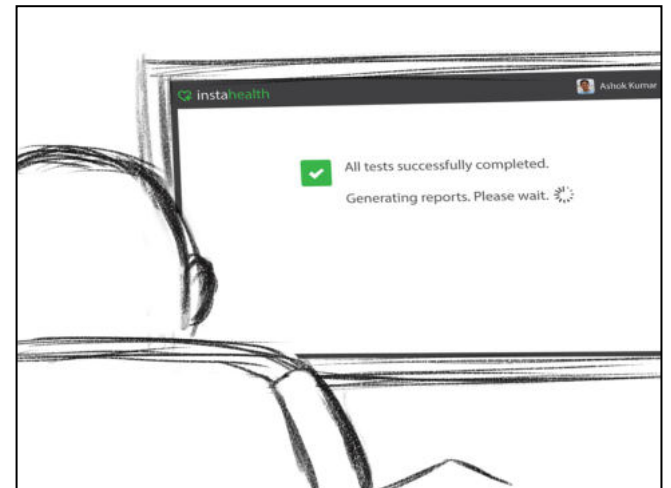
The system also corrects him if he has not used a device properly



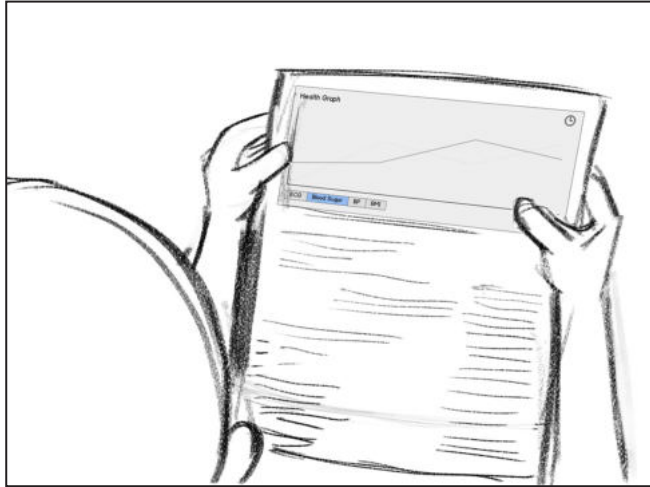
Ashok has to answer some questions before taking the glucose test



Ashok is apprehensive, but a personnel at the kiosk comes in to help him with the blood test.

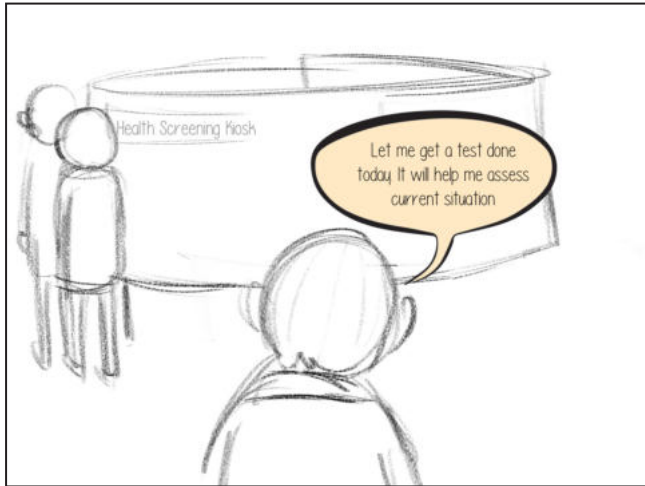


After everything is done, Ashok waits for the reports to be generated.

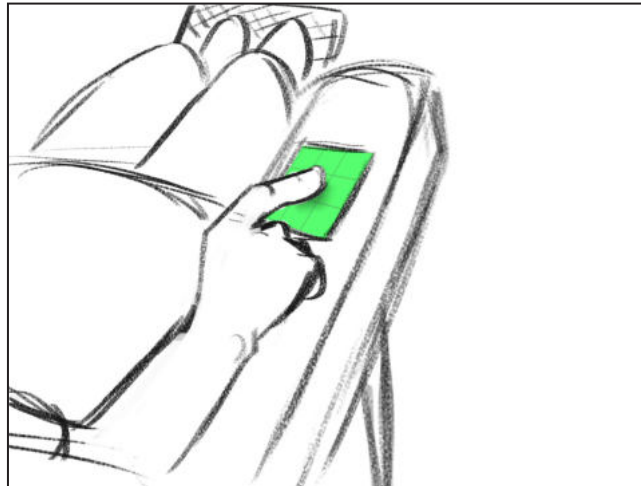


Report is generated and Ashok picks it up from the slot in the machine. As he walks out with the report, other users go in.

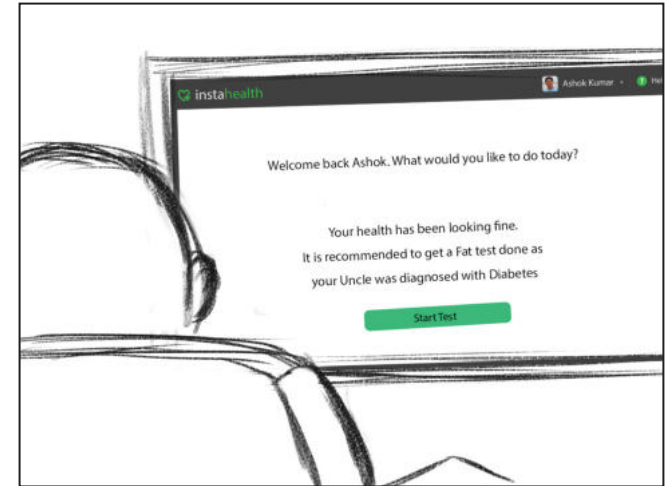
Scenario 3: User's devices are inter-connected and a follow-up check-up is pushed to the user.



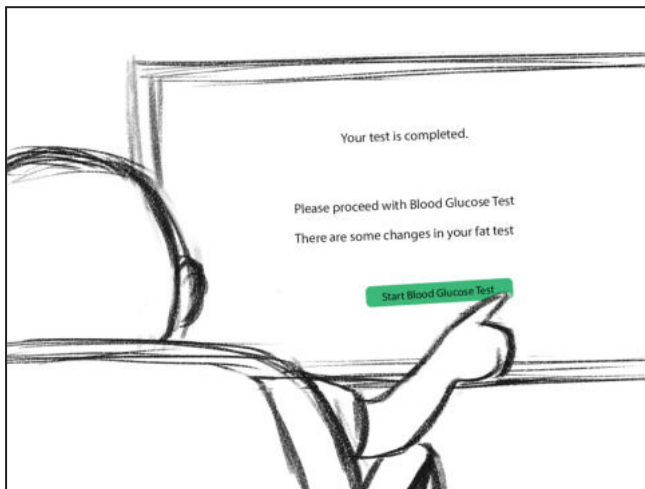
Ashok visits the Kiosk on recommendation from the portal



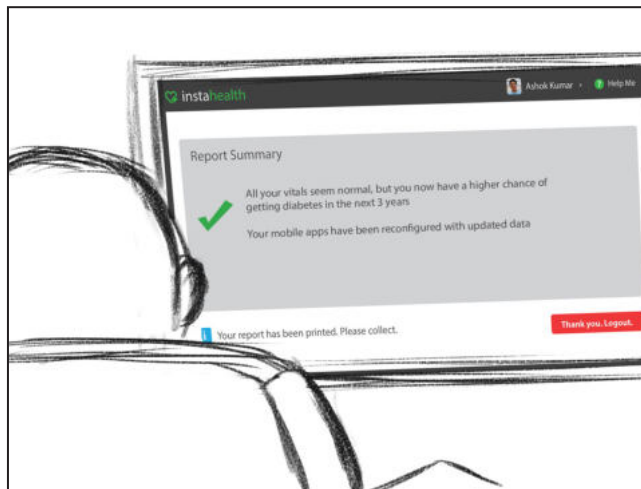
Ashok logs in via fingerprint ID as this is not his first time at the kiosk



The interface recognizes him and updates him about his status and tests to be done today.



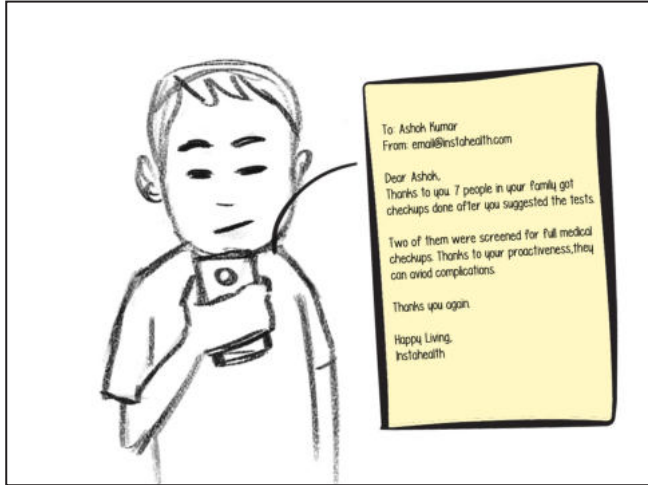
After the first test, the kiosk suggest him further test based on the calculated data



The kiosk generates a final report with recommendations. Some configurations have been sent to his mobile apps too.



Ashok gets an update on his phone too that his apps have been reconfigured based on the health data

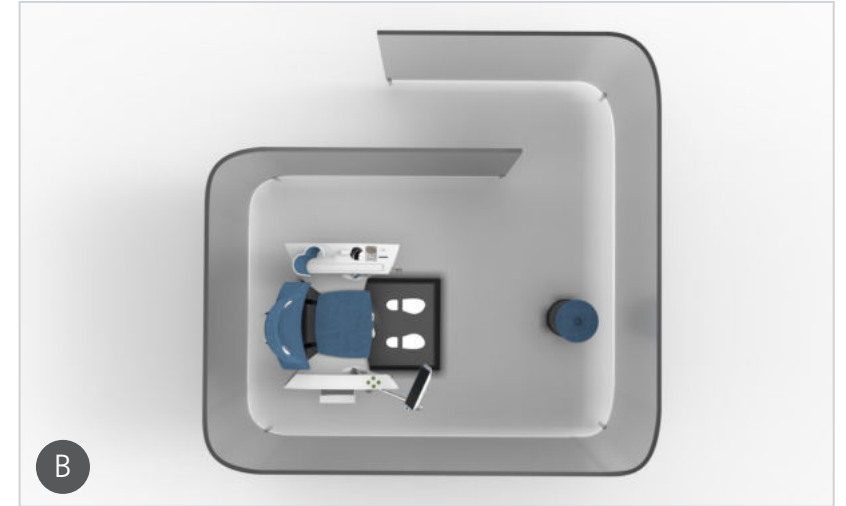
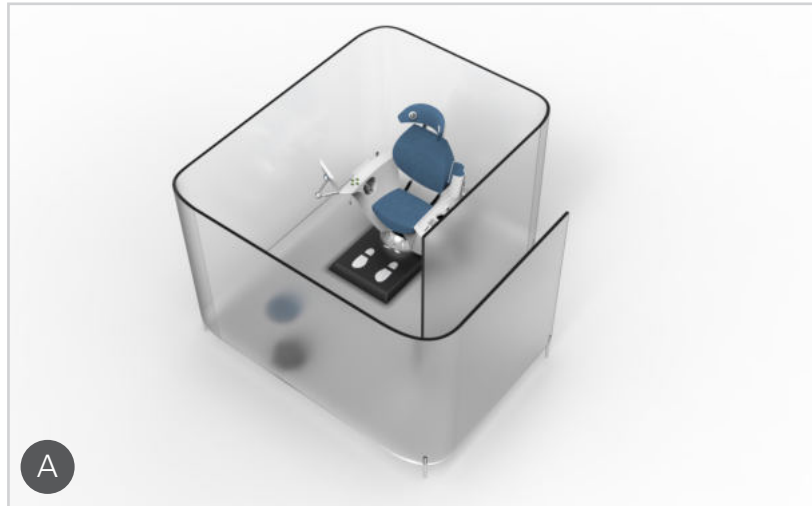


Later, Ashok also gets an email that several people in the network who got tested got benefited from it



Overall, many members in the family have benefited from this network by following preventive healthcare habits.

Final Concept: Kiosk

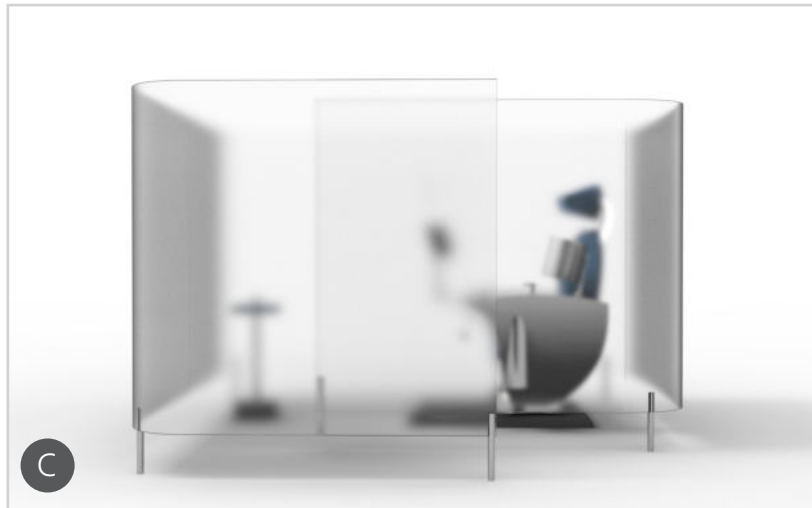


A
Side view showing kiosk
and the chair

B
Top view of the kiosk
showing space available

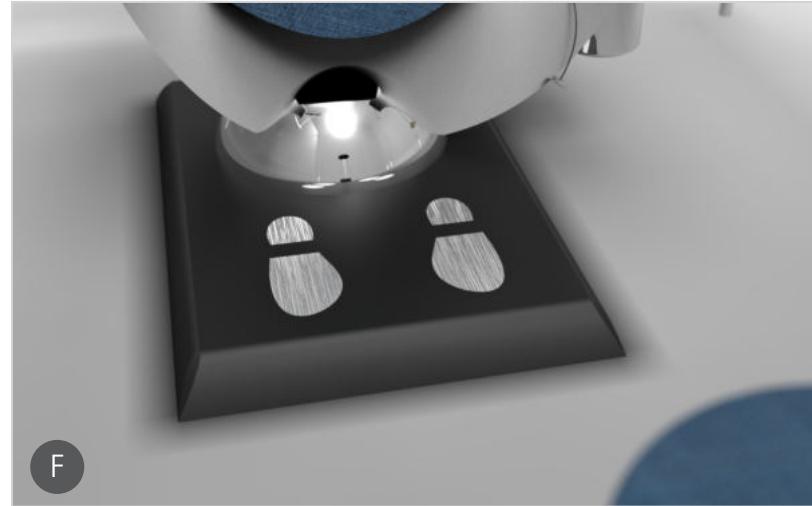
C
The chair is surrounded
by a translucent wall for
privacy

D
The chair with various
components





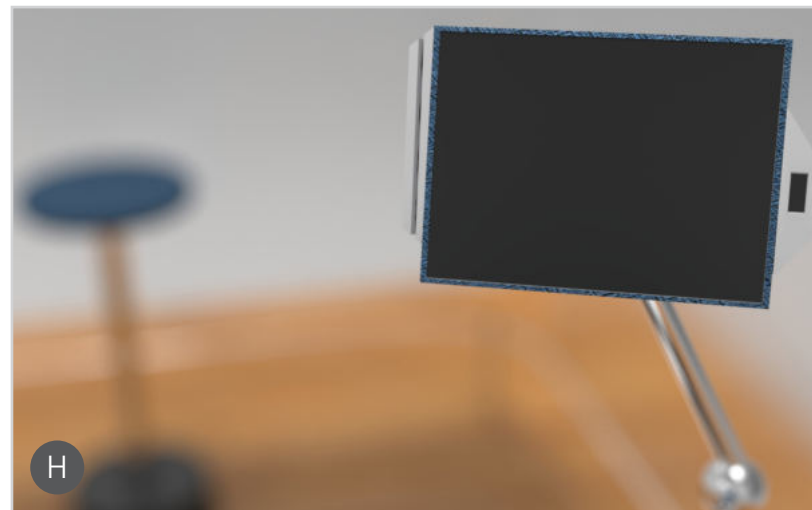
E



F



G



H

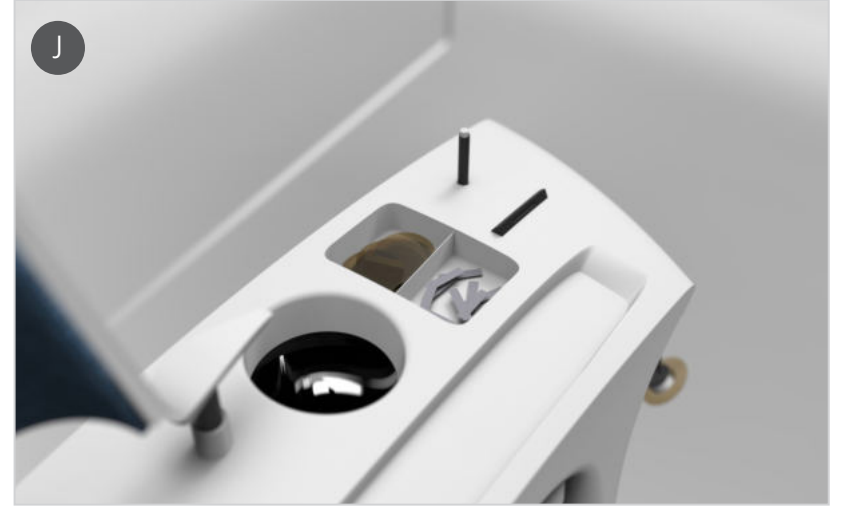
E
Front-view of the chair
set-up

F
The base of the chair
contains terminals of the
fat analyser

G
The chair with an average-
sized Indian person sitting

H
The touchscreen of the
kiosk which the user
interacts with

Final Concept: Kiosk Components

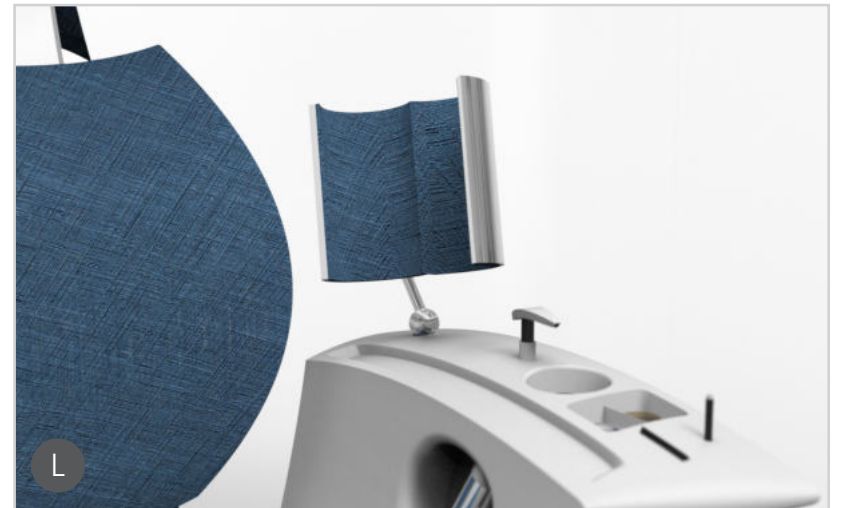


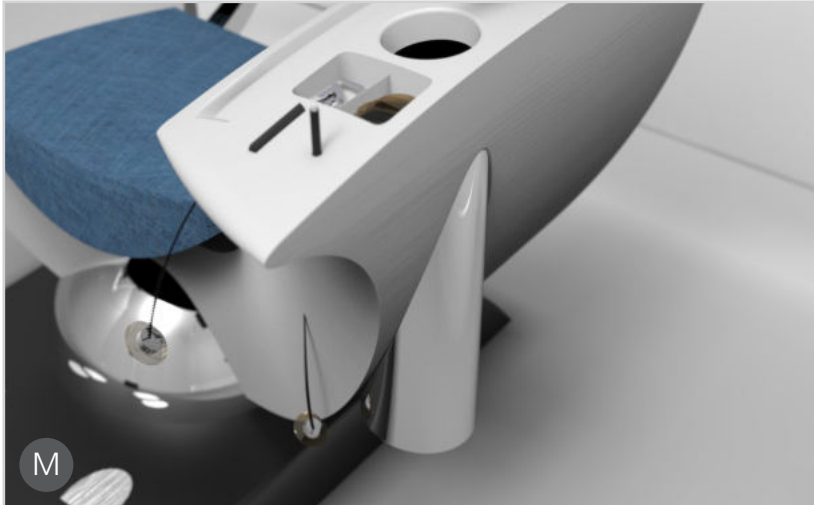
I
The view showing what the user sees when he is seated

J
The left side is a dashboard containing various instruments and storage

K
The screen is on the right and controls on the handle

L
BP cuff on the left side

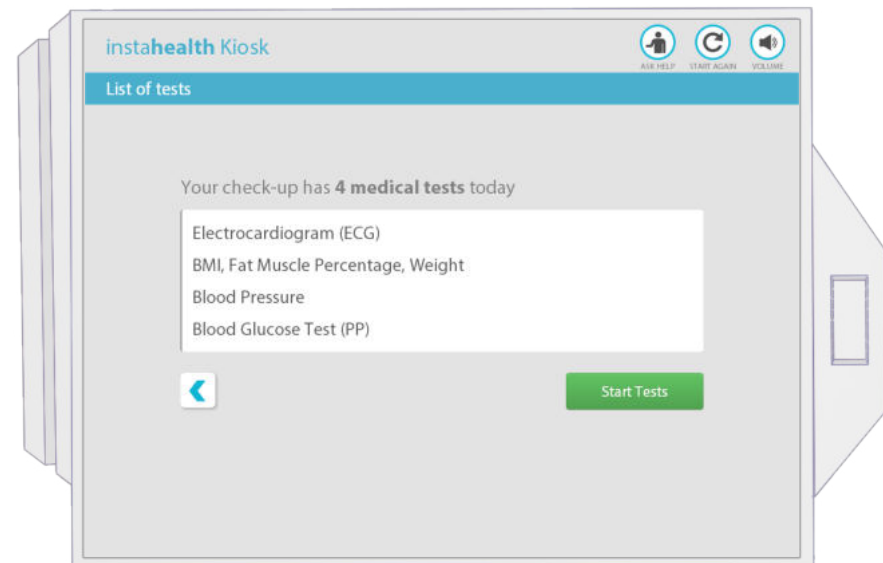
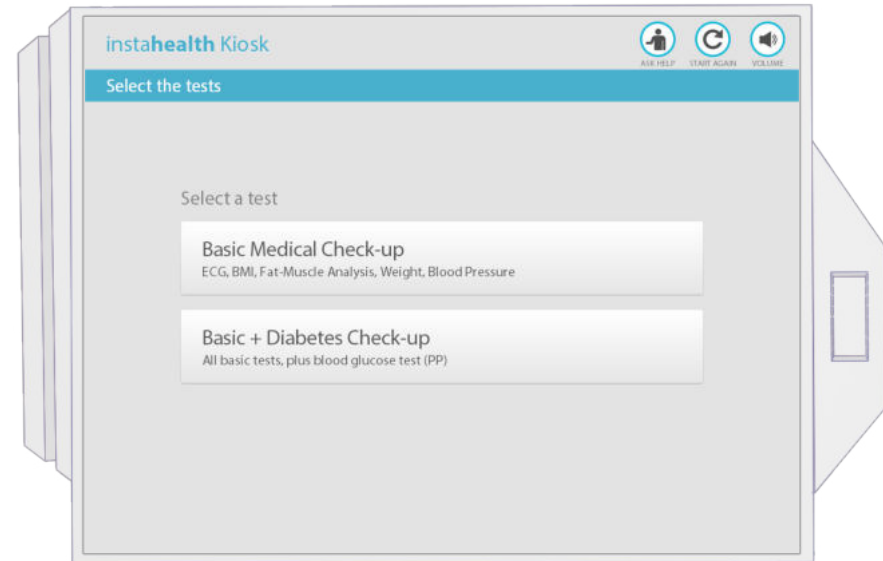
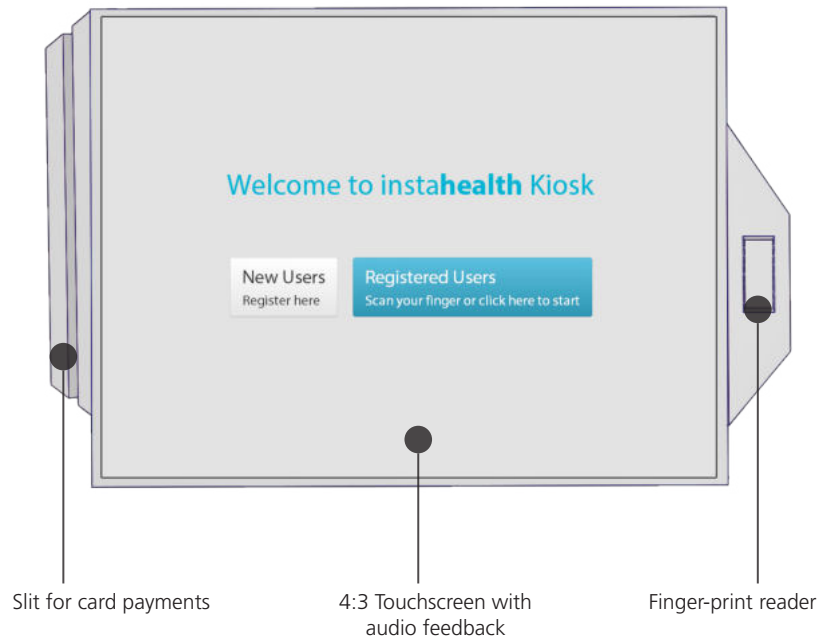




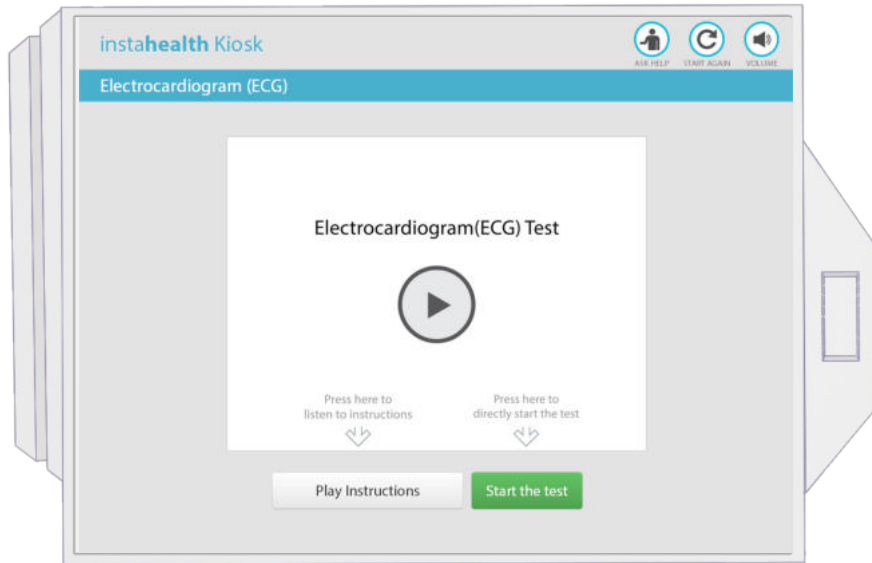
M
The right side also
contains a removable
trash collector

N
The other side of the
right hand rest has a slit
through which the printed
reports can be collected

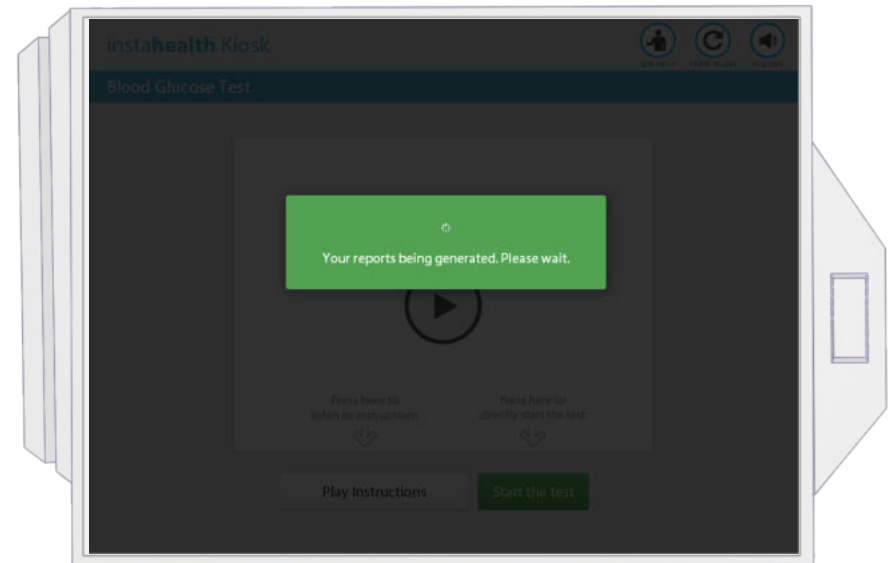
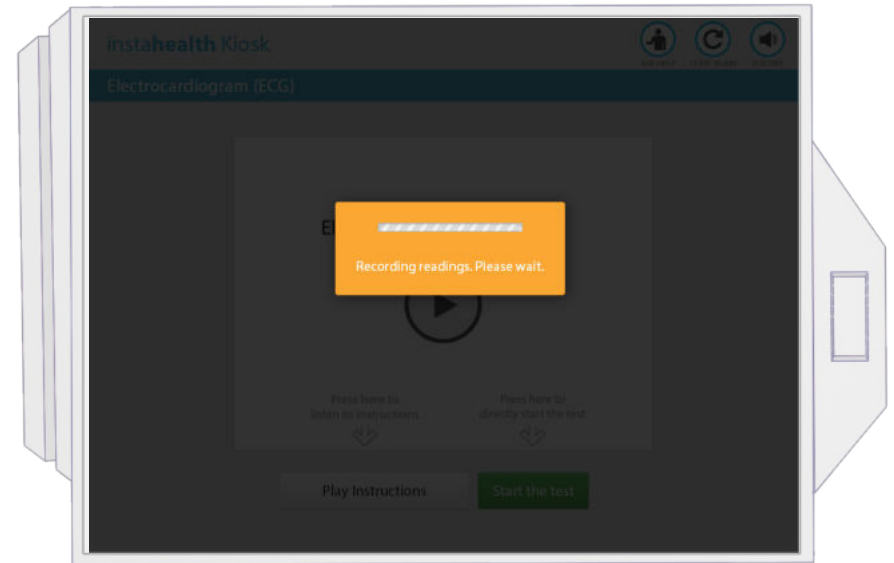
Final Concept: Kiosk Screen and Interface



Video playing on the screen



Screens showing status during system operations



Final Concept: Reports

Reports are generated based on the parameters and health data of the user. There are three main categories of reports that can be distinguished based on the colour scheme used.

Everything OK

Report, green in colour, shows that all parameters are within acceptable range and do not have any immediate risk to the user

General Risk

Report, yellow in colour, shows 'General Risk' when a few of all the parameters are beyond the acceptable range. The user is recommended to visit the nearest test lab to get a detailed check-up done. Most of the users would probably fall in this category.


Critical Risk

The red report shows that the user is at an immediate risk of a major health catastrophe based on the data collected. The user is strongly recommended to visit the nearest hospital for a detailed analysis.

The report types and recommendations would be based on standard health and medical information complemented by the individuals personal and family health information.

The reports on the right are only indicative.

instahealth Test Report



201203552

Ashok Kumar
Reg. No. : 201203552

Test Date : March 23, 2012
Location : Star Complex Mall, Andheri, Mumbai (25012)
Type : Basic + Diabetes Test

EVERYTHING OK
Next Test Date
Sep 23, 2012

BODY MASS INDEX	BLOOD PRESSURE	BLOOD GLUCOSE LEVELS (PP)	ECG MAP
WEIGHT 75kg BMI 24.0 Underweight <18.5 Normal 18.5 - 25 Overweight 25 - 30	113/69 Low BP <90/60 Normal 90/60 - 140/90 High BP >140/90	82 mg/dl Normal upto 140	HEART RATE 72 bpm Rate and Rhythm Normal

FAT ANALYSIS		
MUSCLE % 36.7 Low <33.3 Desirable 33.3 - 39.3 High 39.4 - 44.0	BODY FAT 25.0 Low <8.0 Desirable <8.0 - 19.9 High 20.0 - 24.0	VISCERAL FAT 8 Desirable <10 High 10 - 14 Very High >14

REPORT SUMMARY

- Great! All your reports are normal.
- Your BMI has gone up slightly in the past 6 months. At this pace, you will reach 'risk zone' soon.
- Your blood pressure and glucose levels are more than the previous test.
- Your next check-up date is Sep 23, 2012
- 5-8% of people same as your health status develop diabetes in the next 3 years.
- You have family history of heart diseases and obesity. Your numbers over the past one year have been rising too.

Everything OK Report

instahealth Test Report



201203552

Ashok Kumar

Reg. No. : 201203552

Test Date : March 23, 2012

Location : Star Complex Mall, Andheri, Mumbai (25012)

Type : Basic + Diabetes Test



Visit Clinic Soon
Details below

BODY MASS INDEX

WEIGHT **75kg**

BMI **25.8**

Underweight: <18.5
Normal: 18.5 - 25
Overweight: 25 - 30

BLOOD PRESSURE

138/95

Low BP: <90/60
Normal: 90/60 - 140/90
High BP: <140/90

BLOOD GLUCOSE LEVELS (PP)

142 mg/dl

Normal: upto 140

ECG MAP

HEART RATE **75 bpm**

Rate and Rhythm: Normal

FAT ANALYSIS

MUSCLE % **36.7**

Low: <33.3
Desirable: 33.3 - 39.3
High: 39.4 - 44.0

BODY FAT **25.0**

Low: <8.0
Desirable: <8.0 - 19.9
High: 20.0 - 24.0

VISCERAL FAT **8**

Desirable: <10
High: 10 - 14
Very High: >14

REPORT SUMMARY

- Some of your numbers are above normal.
- Your blood pressure, glucose and BMI levels HAVE GONE UP.
- Visit a doctor with the next 3 days for cholesterol tests.
- People with high blood pressure levels usually develop hypertension within few weeks.
- Hypertension may lead to severe heart problems, kidney issues and other chronic diseases.

RECOMMENDATIONS

- Your next appointment with doctor is November 12, 2013
- There are 7 diabetologists in your area
- You must control your diet and food habit. Visit our website for complete information.

General Risk Report

instahealth Test Report



201203552

Ashok Kumar

Reg. No. : 201203552

Test Date : March 23, 2012

Location : Star Complex Mall, Andheri, Mumbai (25012)

Type : Basic + Diabetes Test



Visit Clinic Immediately
Details below

BODY MASS INDEX

WEIGHT **93kg**

BMI **25.8**

Underweight: <18.5
Normal: 18.5 - 25
Overweight: 25 - 30

BLOOD PRESSURE

113/69

Low BP: <90/60
Normal: 90/60 - 140/90
High BP: <140/90

BLOOD GLUCOSE LEVELS (PP)

180 mg/dl

Normal: upto 140

ECG MAP

HEART RATE **80 bpm**

Rate and Rhythm: Normal

FAT ANALYSIS

MUSCLE % **36.7**

Low: <33.3
Desirable: 33.3 - 39.3
High: 39.4 - 44.0

BODY FAT **25.0**

Low: <8.0
Desirable: <8.0 - 19.9
High: 20.0 - 24.0

VISCERAL FAT **8**

Desirable: <10
High: 10 - 14
Very High: >14

REPORT SUMMARY

- All basic parameters are some in the danger zone.
- You were above normal during the previous test too.
- Your glucose levels are very high and may lead to severe eye problems soon.
- Visit your doctor immediately for detailed blood tests.
- People with test results like yours were diagnosed with irreversible chronic conditions.
- 8-10% people with similar weight needed to be put on long-term medication to avoid complications.
- 1-3% people with your BP levels have undergone more than one heart surgery.

RECOMMENDATIONS

- You must visit a doctor immediately
- Your appointment has been fixed with a nearby cardiologist for Sunday, 9pm. Visit our website to change it.
- 7% of people with your readings were seen to have been diagnosed with cardiac problems

Critical Risk Report

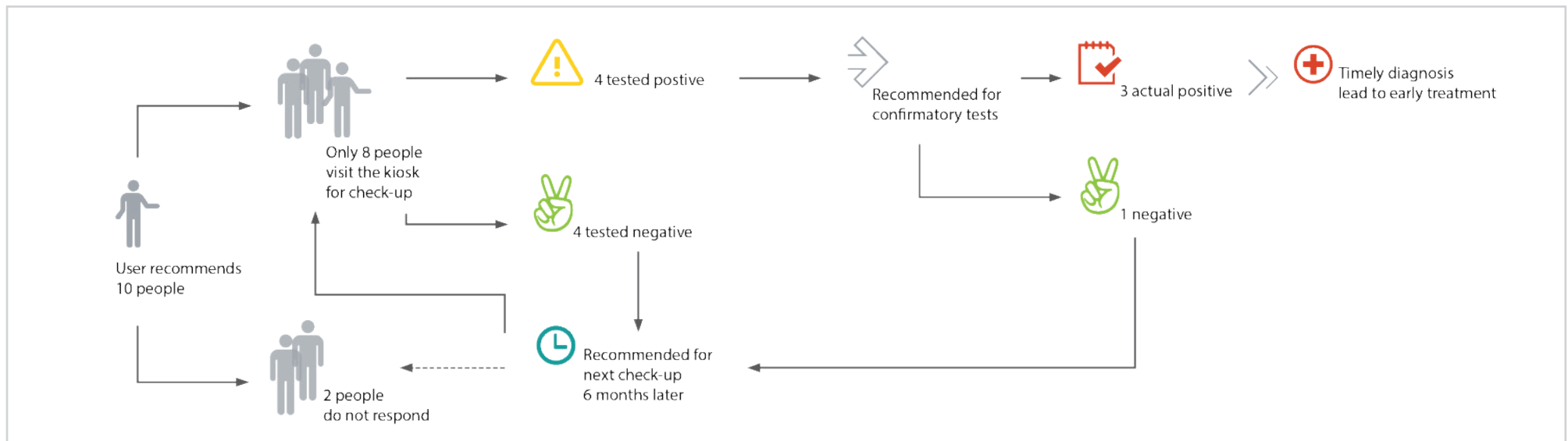
Integrated System

The complete functioning and interactions between the various components of the system is as follows.

The illustration below shows how users are screened in the system and how they are followed up for further check-ups.

The table on the right looks at the larger system and explains how each component interacts with each other, the actions of each player and the impact of each step on the next. As in the Scenarios, it can be noticed that each vertical is a continuation of the earlier one and forms an individually part of the system.

Each of these verticals may have feedback loops that are connected to the earlier steps. These are due to motivations or triggers that are created by actors to involve more people in the system. This may also be due to follow-up check-ups that are recommended to the users.



	Trigger Events	Online Interaction	Encounter at Kiosk	Follow-up	Further Visits
Actions	<ul style="list-style-type: none"> Motivating users via their social network 	<ul style="list-style-type: none"> Detailed encounter with online component Risk Prediction & Assessment Used as a trigger 	<ul style="list-style-type: none"> Usage of devices 	<ul style="list-style-type: none"> Follow-up for checkups Integration of data with other devices 	<ul style="list-style-type: none"> Further checkups
Actors	<ul style="list-style-type: none"> Users, family, social circle, devices 	<ul style="list-style-type: none"> Users, data 	<ul style="list-style-type: none"> Users, medical devices, portable devices, kiosks 	<ul style="list-style-type: none"> Users, integrated medical data, devices, social network 	<ul style="list-style-type: none"> Users, kiosk, medical devices, portable devices
Effect	<ul style="list-style-type: none"> Motivated Users 	<ul style="list-style-type: none"> Users know risk to a particular disease. 	<ul style="list-style-type: none"> Users get screened Screened users are pushed for detailed medical tests. Diagnosed patients may be put on early medication 	<ul style="list-style-type: none"> Users motivate more users. Users keep track of each others health 	<ul style="list-style-type: none"> Users keep track of their health and do further check ups whenever necessary
Viral Effect	<ul style="list-style-type: none"> All people are motivated (For e.g.100) 	<ul style="list-style-type: none"> Few people may use the online system or get a checkup done. (about 50 people) Some of ecommended to use the kiosk (For e.g. 25) 	<ul style="list-style-type: none"> 34% of the users may be screened for CVDs (For e.g. 7) These 7 users go for further medical checkups 	<ul style="list-style-type: none"> All registered users are followed up by the system These users motivate further people in their network and family into using the system or getting checkups (For e.g. 100) 50% of these people get motivated enough 	<ul style="list-style-type: none"> Followed-up user do regular checkups
Components	<ul style="list-style-type: none"> People 	<ul style="list-style-type: none"> Web portal 	<ul style="list-style-type: none"> Kiosk and interface 	<ul style="list-style-type: none"> Mobile devices, web portal 	<ul style="list-style-type: none"> Kiosk and interface

Evaluation

The interaction and the social components of the final concept were evaluated independently. Both the components were tested with the users and actual conditions were simulated to obtain the required information during testing.

The interaction component requires people to operate a self-service setup and it has to be ensured that the interface and interactions are usable and error-free operation even from first time users. Usability evaluation of the kiosk interface was done for this purpose.

The social component required testing at a social level to understand people's behaviour and their thought process. This was important to know whether the triggers that are being planned would work in the way they are intended. The concept of social prototyping was used to test this phenomenon.

Usability Evaluation

Method

Heuristic Evaluation and Think Aloud Tests of the interface was conducted with the users. The heuristic evaluation was done against Jakob Nielsen's Heuristics for User Interface Design.

For Think Aloud Test, the complete UI and set up (as shown in the adjacent mock-up) was simulated and the users were asked to perform the whole task of conducting the tests using the devices. Along with Think Aloud test, the users were also observed for how they used the various devices and if they understood the instructions given on the screen. The instructions were given via various videos and photographs on the kiosk screen.

User Criteria

As project deals with youngsters in the age group of 25-40, similar users were recruited for usability evaluation. For convenience, these users were recruited within the IIT Bombay campus as it has a varied kind of users.

The following was the user criteria for recruiting users (tentative)

- 3 PhD students (as most of them in IIT are above 25)
- 2 IIT Bombay Staff (as they were above the age of 30 and of moderate education levels.)
- 2 People with existing health conditions who used such devices on a regular basis.

Result

The devices were tested with the target user group and also those who have used personal medical devices earlier. Most of them could follow the video instructions and perform the tests themselves easily without much intervention.

Users were a bit apprehensive about invasive tests but that might be as most of them were first time users. The apprehension will reduce once the user is acquainted with the process and also if the hygiene factor in the kiosk is increased further.



Social Prototyping

The idea of social prototyping was explored after following a research paper on the same method (Aishwarya Iyengar 2013).

In design solutions where actual social conditions and scenarios cannot be simulated, situations which mimic the system in terms of behaviour and components are created. Users are then put in such a context and are observed for their response to the system.

In the current project, this was done at two levels - online questionnaire and direct interviews.

User Criteria

The online questionnaire was circulated amongst a user base of the age group 25-40.

Interviews were conducted amongst people who have recently been diagnosed or have been suffering with cardiac diseases and diabetes over a period of time.

Method

In the questionnaire method, a web page was created that gave a quick overview of lifestyle diseases and in the end, users were asked to respond to a questionnaire. The questionnaire consisted of list of questions about personal health and was circulated via social media and email.

The questionnaire was answered by 36 people.

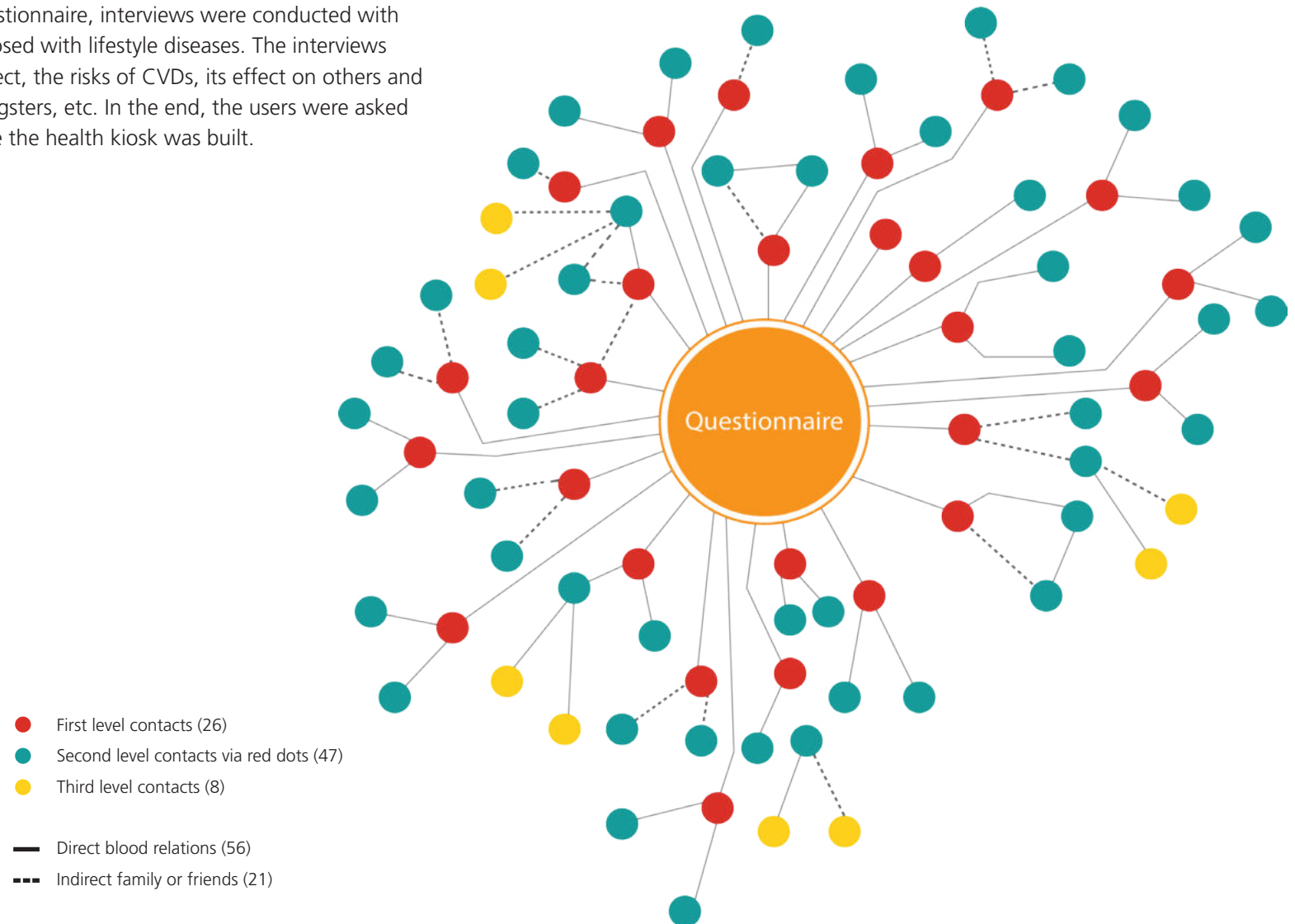
The users at the end of the questionnaire were asked to refer people who could be affected by CVDs and lifestyle diseases. It was assumed that as they were sensitized about risks of lifestyle diseases, they would refer others for check-ups. The referred



persons were then emailed and asked to fill the questionnaire too. The intent was this exercise was to understand how the network was spreading and the degree of penetration.

After a week of the release of the questionnaire, interviews were conducted with people who have been recently diagnosed with lifestyle diseases. The interviews started with explaining about the project, the risks of CVDs, its effect on others and family, how it has been affecting youngsters, etc. In the end, the users were asked whom they would refer if a system like the health kiosk was built.

In all, five interviews were conducted.



Results

Questionnaire

The graph on the left shows the spread of the network over a period of two weeks during which 36 people responded to the questionnaire.

From the analysis of the responses to the questionnaire, it was seen that

- Most of the people who referred were in the age bracket of 24-29
- People referred family in most of the cases, than friends and colleagues.
- People referred siblings and cousins more than parents.
- In the current scenario, people referred mainly family after Level 1 and friends after Level 2

Interviews

The following inferences were made from the interviews.

- People reacted differently based on their age and health conditions.
- Older people referred siblings, spouse and kids in the end.
- A person who recently suffered stroke was concerned that these issues could affect people at a younger age too. He was worried about his children.
- Younger people mainly referred siblings, cousins and spouse and not parents. In the current case, the interviewee's parents were already diagnosed with certain health conditions.
- One person said that irrespective of a referral program, I would urge my close friends and family to go for regular check-ups.

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