

HCI PROJECT

Topic : HealthWalks: Sensing Fine-grained Individual Health Condition via Wearable Devices.



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Problem Statement:

It is often seen that people suffering from various diseases such as cardiovascular disease and asthma are needed to be subjected for immediate treatment whenever the impact is faced. In such cases an intimation must be given to the caretakers so that the resources for the treatment are arranged as soon as possible. The early intimation can help in saving the life of the patient if the treatment is given on time.

Principle

The device is designed in such a way that it is user friendly and portable . It should have various sensors that would be able to detect the specific attributes that can be used to monitor the health of an individual . The device is designed such that it can be tied on an individual's wrist and the health conditions such as blood pressure , pulse rate , calories burnt (while walking or running), sleep cycle etc. can be kept track of.

Introduction:

By looking at the exciting developments in personalization, digitization, wellness, and patient engagement, care providers can improve health outcomes for the patients in a significant way. Navigating the complicated landscape of personal wearable devices, asthma inhaler sensors, and exercise apps can be promising in this field.

To facilitate fine-grained individual health condition sensing, we propose HealthWalks, an interpretable machine learning model that takes user location traces, the associated points of interest, and user social demographics as input, at the core of which a Deterministic Finite Automaton (DFA) model is proposed to auto-generate explainable features to capture useful signals.

Purpose

The significant purpose of the device is to monitor and keep track of the health of an individual . These devices will be used for improving the health and control of chronically ill patients and for those with conditions like asthma, COPD, diabetes, and cardiovascular disease.

- 1) Wearable devices in CardioVascular Diseases
- 2) Wearable devices in Asthma
- 3) Wearable devices in Blood Pressure
- 4) Wearable devices for weight loss

Deployment Procedure

1) Wearable Device in Asthma

Acoustic monitoring is a wearable device that can be used in asthma. Breathing sound measured by microphones over human skin can detect breathing patterns (respiratory rate, flow rate, tidal volume) and symptoms that may be due to asthma (wheeze, cough).

2) Wearable Device in CardioVascular Device

Heart rate (HR) measurements during rest and exercise can be used to predict the risk of cardiovascular disease. The device can be used to keep track of the heart rate of the individual suffering from the cardiovascular device and the device would inform the person(or the caretaker) if there are any complications in the heart beat rate.

3) Wearable Device in blood pressure

Hypertension is a leading cause of morbidity and mortality globally. Incorporating accurate blood pressure (BP) measurement within consumer-grade wearables has the potential to improve screening for hypertension and identify nocturnal or exercise hypertension, which have been linked to worse outcomes . The device can help in keeping track of the Blood pressure of the person who is suffering from the problem of variations in the blood pressure.

4) Wearable Device in Weight Loss

Individual's often tend to control their weight by doing physical activities such as walking , running , exercising etc. The wearable devices are used to make the person aware about the number of calories that have burnt by performing the specific activity and this would not only make the person to keep track of the weight but also motivate them to perform exercise. It is known that most of the cardiovascular diseases are due to increase in the weight of the person and by reducing the weight , one can at least reduce the chances of being vulnerable to heart diseases.

Process

The following are the generic steps to be followed for the deployment :

- Development of sensors, to keep track of various attributes such as calories, breathing rate, heart rate etc.
- The use of programming language such as python to calculate the calories burnt.
- Development of database to store the user data and activity tracking.
- Development of UI Design for the user to access the data.
- Setting up the criteria for the values in case of heart and breathing rate.
- Keeping track of all the data and updating the progress report.
- All the procedures mentioned below can be used to keep track using the sensors and the data is stored from a single device for the patients (or caretakers) to access.

Low - fidelity Prototype

1. LOGIN

EMAIL	
PASSWORD	
FORGOT PASSWORD?	

2. SIGN UP

CREATE ACCOUNT

NAME:-

D.OB:-

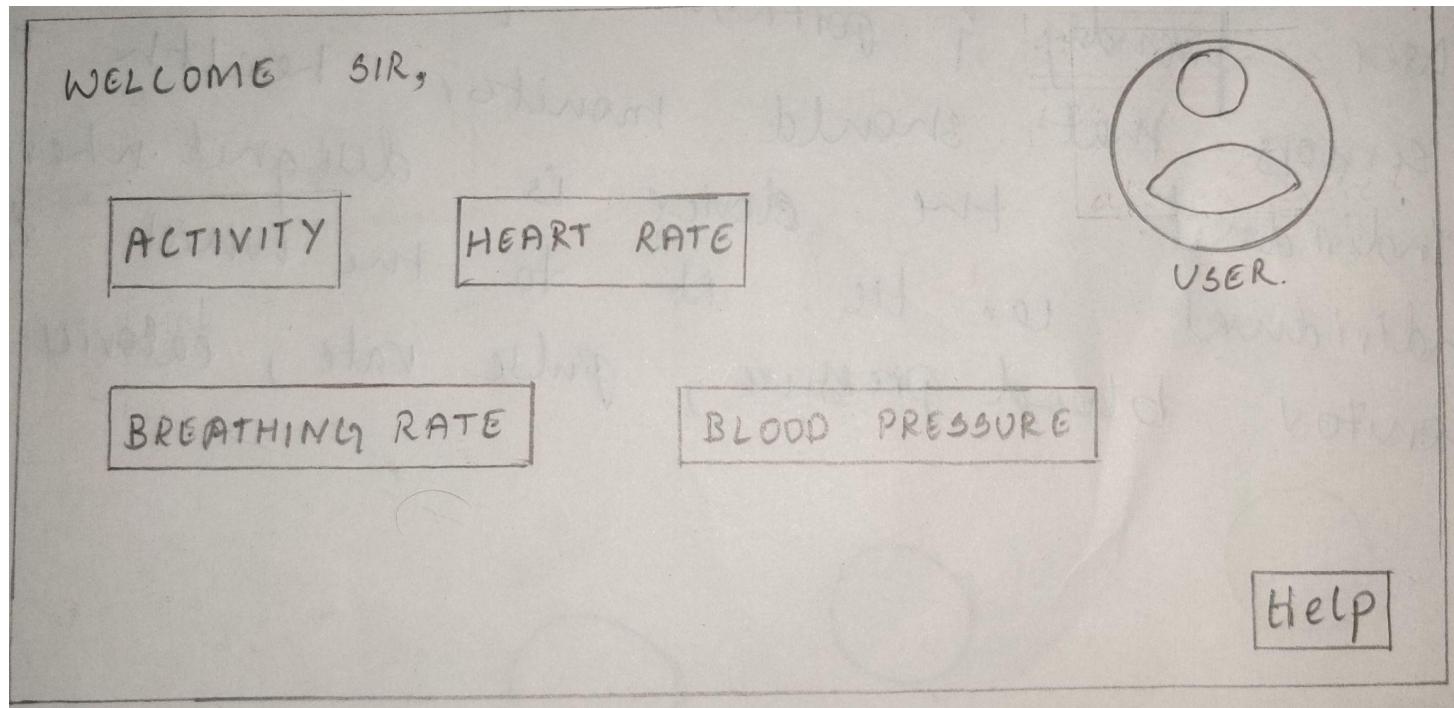
SEX:-

E-MAIL:-

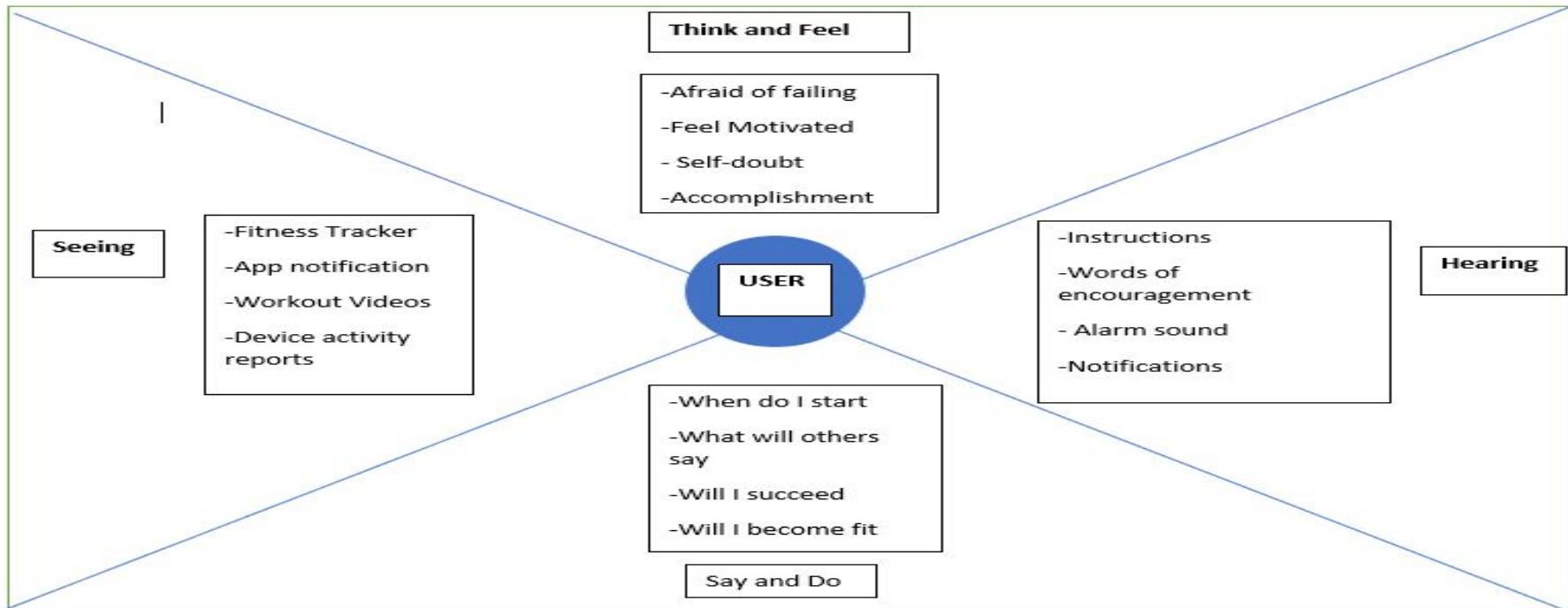
PASSWORD:-

CONFIRM PASSWORD:-

3. FRONT END WEB PAGE

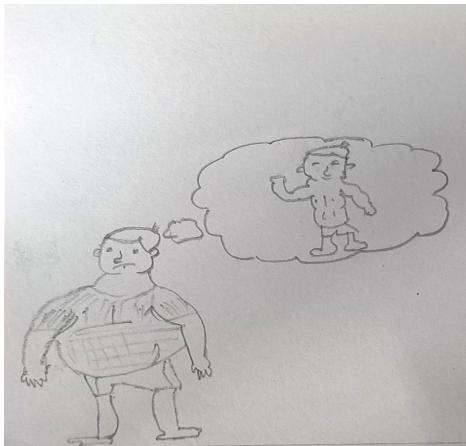


Empathy Map



Pains	Gains
<ul style="list-style-type: none">-Tracker/app limitations-Not knowing where to start from-Not enough motivation or encouragement	<ul style="list-style-type: none">-Reducing weight/getting in shape-Good mood-Better Health and fitness

Storyboarding for fitness tracking



A boy wants to be fit. He ponders in head(makes a cloud of thought) about being fit.



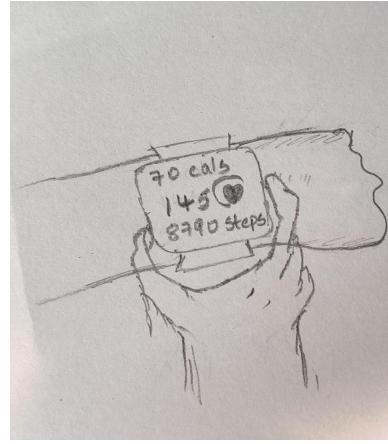
Next week, on his birthday, his mom gifts him a wearable device



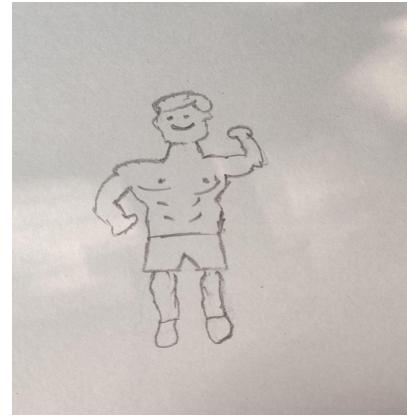
He is confused about what to do with it. He doesn't know about its features and proper use.



Next day, he wears the device and goes jogging

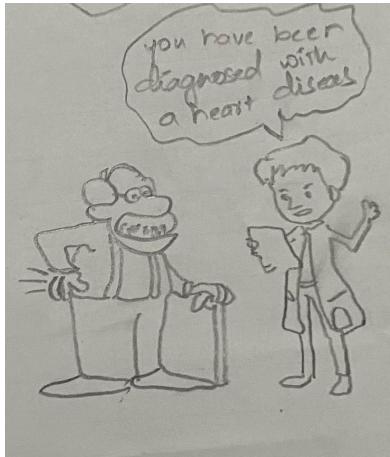


He comes back and realizes he can view the: distance he ran, calories burnt, Monitor and track heart rate.

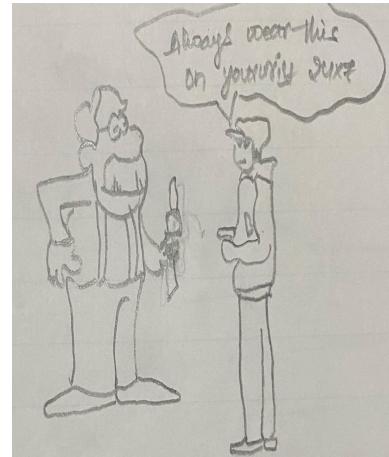


Next picture, he is in better shape and he is very happy while looking at this device.

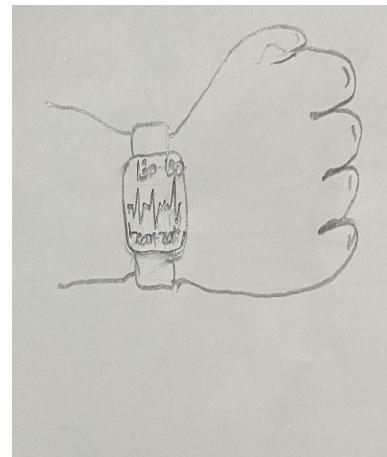
Storyboarding for heartbeat detector



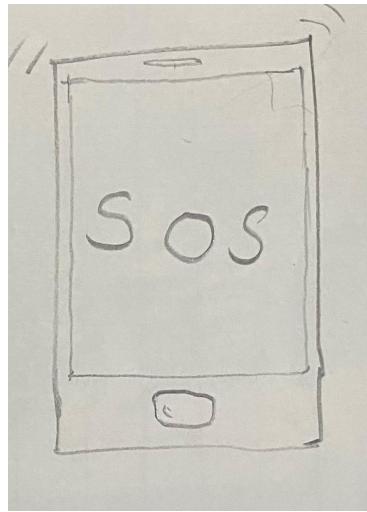
An old man when consulting a doctor got to know that he is diagnosed with a heart disease



His grandson gave him a heart rate monitoring device for any emergencies



The device used to monitor heart rate and send regular updates to his grandson



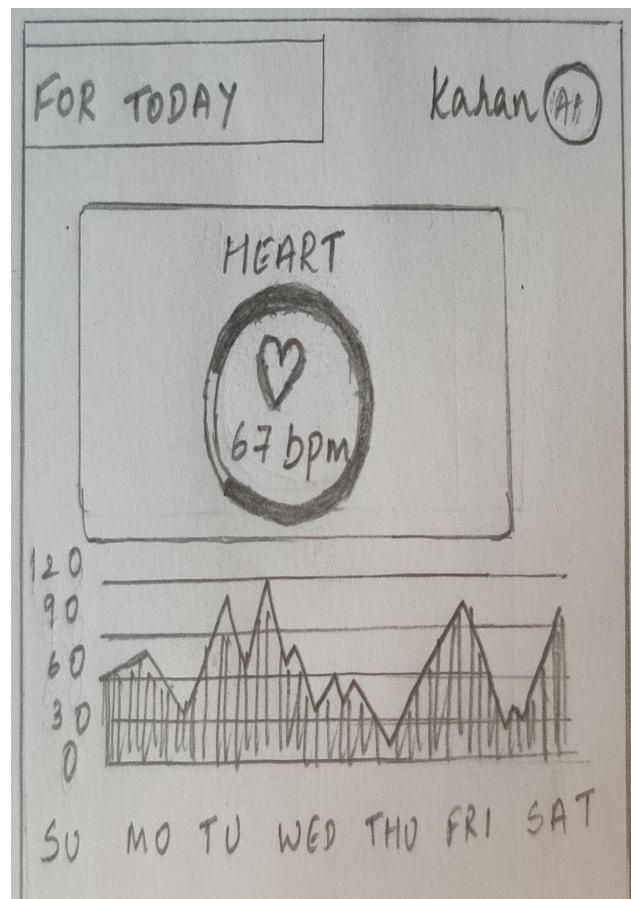
After 1 month , the heart rate of the old man deviates from the normal range and the device sent sos messages to all the listed devices



Grandson rushed to his aid and immediately took him to a nearby hospital in an ambulance

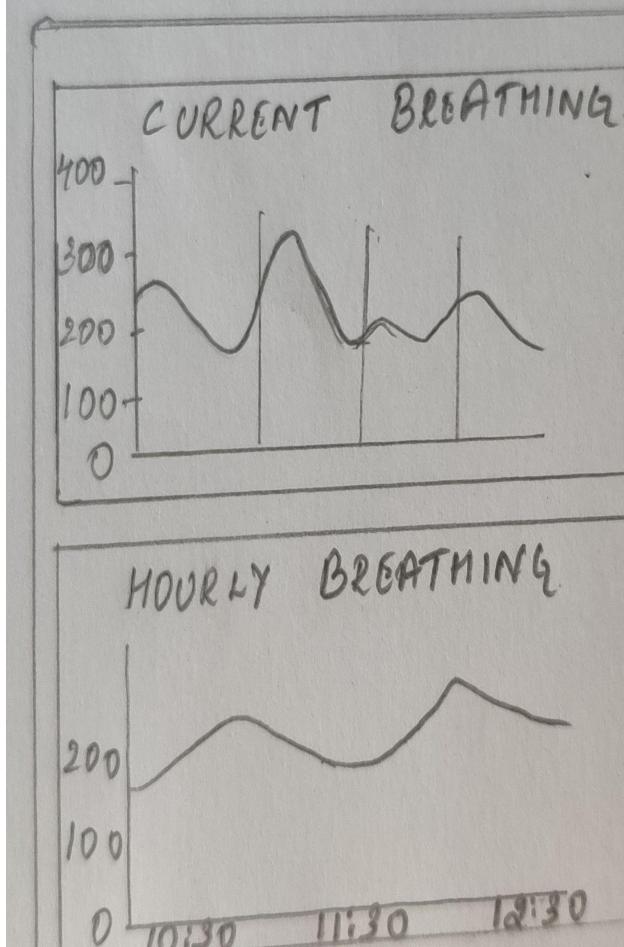
High Fidelity Prototype

Interface for Heart rate



1. This is a High-fidelity of the Heart rate tab.
2. Heart rate (HR) measurements during rest and exercise can be used to predict the risk of cardiovascular disease.
3. A simple design where the user can keep track of his/her heartbeat.

Interface for Breathing rate

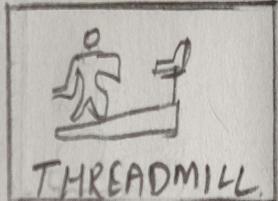


- 1) The given shows the breathing rate of an individual.
- 2) The graph is continuously updated depending upon the individual's condition.
- 3) Therefore any deviation from the normal breathing rate , the person is notified and precautionary measures can be taken.

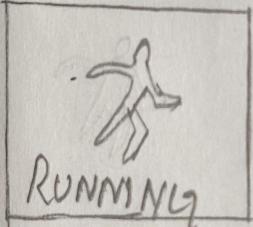
ACTIVITY



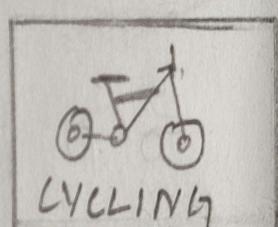
WALKING



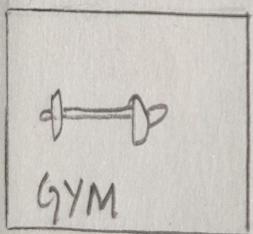
TREADMILL



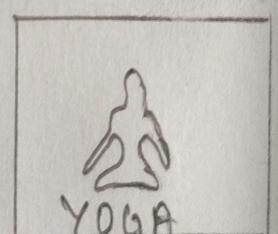
RUNNING



CYCLING



GYM



YOGA

Interface of activity.

- 1) This is the hi-fidelity interface of activity tab.
- 2) The interface consists of various exercises as it is shown.
- 3) The interface stores the data about these activities performed.
- 4) It stores the information such as the number of kilometres covered, no. of steps covered.
- 5) It also tells the number of calories burnt by doing the particular activity.

Heuristic Evaluation

1) Visibility of system status

The wearable device is connected to the mobile via bluetooth through an application. The UI design is made in such a way that it is convenient for the users to view all the data clearly , the new changes should be immediately updated and the current status of the system (that is the current values in terms of heart rate or calories burnt) should be updated and stored.

2) User control and freedom

The UI is designed in such a way that it would be easy for the users to undo or redo the things in the application. If the user clicks any tab by mistake , then the user can easily exit and does not need to go through the extended process. The UI is completely under the user's control and gives freedom to perform any action and come out of that action.

3) Consistency and standards

The design is properly designed making sure that there is no conspiracy between the various tabs/actions in the application . The consistency of the application is maintained so that it drives customer interests and the standards are needed to be maintained so that the applications competes with the modern technology.

4) Error prevention

The prevention of errors is the basic attribute of a good UI design . The error messages are popped up whenever there are issues in the application . The error - prone conditions are mostly eliminated , however in some conditions the user is provided with various warnings before the action is executed . Also , the design provides default options in case of error - prone actions .

5) Recognition rather than recall

The software design is kept simple and easily recognizable , the user does not need to remember a lot of tabs/ options .The data and the information required is clearly visible and easily retrievable . The information that a user requires to remember is made minimum .

6) Flexibility and efficiency of use

The design is flexible and allows the users to customize and operate the application as per their convenience . The user should be able to navigate between various options such as getting the calories burnt, the heart rate , breathing rate etc. The system is efficient and can be used by any individual without the need of any expertise .

7) Aesthetic and minimalist design

The design of the software is elegant and does not include any irrelevant information or rarely needed information .The design is kept minimal with all the essential options that are needed to keep track of the domains such as heart and breathing rate and the calories burnt .

8) Help and documentation

It's best if the system doesn't need any additional explanation. However, it may be necessary to provide documentation to help users understand how to complete their tasks. Help and documentation content should be easy to search and focused on the user's task. The documentation is kept concise and the steps to be followed are mentioned clearly while operating the system .

9) Help users recognize, diagnose, and recover from errors

Whenever , there is an error it should be expressed in understandable language and the problem should be indicated along with the probable solution .The actions that needs to be performed is suggested when a specific error occurs.

Thank you