Final Project Report

Company: *Fitbit*
Product: *Senior Health Tracker*

Group 17:

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Executive Summary

To start off this project we had to create a *proposal* of the different companies we wanted to work on and different products that we wanted to create. We looked at three different companies and three different products for each company, making that nine in total. The biggest result from the proposal was finding out which company we were going to work with. After completing the proposal, and being given which company from the professors and the teaching assistant, we began to work on the specific company that was chosen for us, which was FitBit.

Phase 1 was primarily about working on the company and industry analysis. We had to take the company and look at it as closely as possible in order to identify what the industry around it looked like, what the company strategy looked like, and what their goals are as a company. By looking at all the different factors that go into a company analysis, we can further assess what exactly to do with the proposed product and how it fits into the company. Knowing about our company gives us an advantage as to what we need to do in order to remain where we are or grow further as a company. We want to make sure that everything we are adding to the proposed product will actually do something for the company and benefit them in some way, shape, or form. Knowing about the industry also gives us a look at the competitors which is important for us so we know what products are currently on the market that are similar to our proposed product and what we need to look out for in order to succeed.

In *Phase 2*, we began to work on developing a House of Quality for the potential new product that we want to bring to market for FitBit; this product was taken from Phase 2 and chosen by the professor and teaching assistants, which was the Senior Health Tracker. Since we now know the market, due to the analyses we completed in Phase 2, we can start to take a look at the proposed product itself. The first thing that needed to be done for this phase was to take a closer look at the products that the Senior Health Tracker would be competing with, which we would then need to create FAST diagrams for. Creating these can give us an idea of what our product would need to look like and also how it would function. We then needed to find out what the consumer needs and the technical metrics and assess them all on different importance scales and convenience scales would need to be in order to make this proposed product something that is ready to be put onto the market. Then we would benchmark our proposed product with other products that are on the market, which we did research about when we created the different FAST diagrams, in order to obtain a better understanding of which consumer needs and which technical metrics are important for us. The last step is to create a concise list of consumer needs and technical metrics that we want to work with while creating the proposed product, which is very important because we need to always keep these in mind when creating a whole new product.

The next step would be Phase 3 which is the Conceptual Design of the product. First we figure out the main function of the product, then we can create the sub-functions of the proposed product in a Function Structure, again using that same list of needs and metrics. This helps us when creating a product because we are more aware of what the product should look like at this point in the project. We also use the FAST diagrams from the previous steps in order to make sure that our new proposed product has all the correct functions and will actually work. Using the Function Structure and the sub-functions we created, we then produce solution principles to the sub-functions in order to build different designs for the proposed product. Organizing the sub-functions and solution principles into a morphological matrix is the next step in the product which then goes into the creation of multiple designs. Having the morphological matrix allows us to take a look at different approaches in order to get the best designed product out into the market. Taking the morphological matrix, we have to select different solution principles in order to develop six new concept ideas that will incorporate those solution principles. These concept ideas will need to be drawn by hand with a real life explanation of how they work, so that we know it is not just from the morphological matrix but is something that will be fully functional. Then, we have to identify a set of selection criteria from the technical metrics and consumer needs, from Phase 2, that evaluates the product concepts that have been created. We will then create the utility function and rank the concepts using that, which in the end will get us the best product that matches the criteria and should be used for further development. The last step is a completed FAST diagram of the new proposed product that has been selected from the utility function. The completed FAST diagram gives us a sense of having an almost completed product that will be ready for the next step of the process which would be prototyping.

Structured Problem-Solving Process Outline

The following template of structured problem-solving process (SPSP#) is specifically designed to be applied to all project implementation phases:

SPSP01 Define the problem/tasks.

SPSP02 Design the strategy/treatment to solve the the problems:
Define the framework/steps of analysis (unique to each problem) to follow.

SPSP03 Execute the strategy/treatment:
- All works are clearly stated/represented;
- Appropriate assumptions necessary as part the process are explained;
- Individual sections are formatted/separated to improve readability;
- All explanatory text are accompanied by clearly labeled figures, tables, and diagrams as necessary;
- Sources of information are identified.

SPSP04 Check all work/analysis performed.
- Quantitative analysis (calculations) are double-checked independently according to the data/information provided in the exam instructions;
- Procedural analysis/components are coupled-checked according to lecture notes and course handouts.

SPSP05 Draw on conclusions based on the comprehensive results of the analysis and the context of the market/industry.

PHASE00: PROJECT PROPOSAL

SPSP01: Define the Problem

Phase00 of the report ranks 9 product concept ideas for different companies in order of preference

SPSP02: Strategy/Treatment

Phase00 of the report implements the following specifically-designed steps for solving the problem:

A. Generate a list of 10 large high-tech companies.
The companies selected must satisfy the following five constraints:
- Outside of these companies: Facebook, Amazon, Apple, Netflix, Google, Microsoft, Intel & Tesla;
- The company cannot be a pure software or services company;
- The company must be US-based;
- The company must manufacturer products that are a combination of hardware and software;
- The company's annual sales revenue must be above $1Billion.

B. Select 03 companies from the list.

C. Brainstorm 03 ideas for new products for each of the 03 companies (09 total product ideas).
The idea cannot be a pure software application but a combination of hardware and software, i.e. a robot; For each idea:
- State the societal/customer needs that the product will satisfy;
- Name the product;
- Provide a brief description of the product.

D. Rank the 09 product ideas.

SPSP03: Execution

This section implements the process identified in the previous section.

A. A list of 10 large high-tech companies that satisfy the requirements:
- *Dell*
- *GoPro*
- *Fitbit*
- *Roku*
- *Boeing*
- *AT&T*
- *Comcast*
- *Cisco*
- *Ford*
- *HP*

B. Companies selected for the next stage:
- *GoPro*
- *Fitbit*
- *Ford*

C. Brainstorm 03 ideas for new products for each of the 03 companies:

GoPro:

Product Idea01: 3D-Mapping Camera/LIDAR

Need: 3D images and VR pictures are not easily captured or shared.

Description: A durable camera that can survive extreme environments and capture them in 3D space. This would allow for areas to be recreated in VR/AR and have the possibility of being adapted to numerous use cases.

Product Idea02: ROV w/ Camera

Need: Commercial ROV for photographers, videographers, and hobbyists to explore new terrain that is otherwise difficult/expensive to access

Description: A tethered teleoperated remotely operated underwater vehicle (ROV) equipped with a GoPro camera that allows users to explore caves, kelp forests, and other forms of terrains from the comfort of the shore or a boat. GoPro has a wide selection of both cameras and a flying drone, but not a combination for the ocean. The product application is vast.

Product Idea03: Portable GoPro Media Station

Need: A device that allows for editing of footage, control of auxiliary equipment, sharing to social media platforms on the go, and an addition to the GoPro ecosystem.

Description: A tablet/console with an integrated battery that would allow for the docking of any GoPro camera and rapid transfer of all stored data to the station. While using a GoPro drone, the station could be used to control the vehicle. After editing, the final footage can be uploaded to any number of social media platforms.

Fitbit:

Product Idea01: Senior Health Tracker

Need: An ultra-portable device for people needing consistent health statistics tracking/reporting. Easier access and carry makes it more convenient and practical to achieve consistent monitoring. The product design focuses on simplicity and accessibility to improve user-friendliness, especially for senior customers.

Description: A wearable technology which tracks a person's data. It can be customized to automatically report diagnostics to the person's doctor and/or family.

Product Idea02: Bike-Mounted Activity Tracker

Need: A smaller and more accessible device that tracks and presents physical/performance statistics (i.e. heart rate, metabolic rate, hydration level, etc.) during cycling activity.
Mounted phones are inconvenient to use.

Description: A device mounted at the front of a bicycle that reads, records, and simultaneously presents the cyclist's health and performance statistics. Records contribute to the data pool on the cyclist's long-term health progress.

Product Idea03: Brain Scanner Accessory

Need: A lack of commercial scanner for brain-related activity/symptom.

Description: A headwear-and-fashion-incorporated brain scanner that scans particular brain activities/conditions that sensors elsewhere would not be able to detect; able to provide general data (i.e. mood and mental habits) in addition to medical-related information.

Ford:

Product Idea01: Ford OBD Scanner w/ Tutorials

Need: To reduce consumer vehicle maintenance costs due to a lack of knowledge customers have on the product, both in terms of problem diagnostics and how to fix them.

Description: Suggesting areas of component replacement (i.e. coolant, oil, ties, etc), diagnosing areas needing maintenance/fixing.
Provides the customers with tutorials on maintaining/fixing the vehicle (to a practical extent).

Product Idea02: Biometric Entry System

Need: Improving the efficiency of unlocking/entering vehicles and security as well.

Description: Use biometric technology (a combination of retina detection, facial scan, and general measurements) to unlock for entering vehicles. An additional option of fingerprints scan is also available (no physical contact is needed without using this option).

Product Idea03: See-Through A-Pillar

Need: Better visibility with no A-pillar visual interference/blocking.

Description: Set of cameras that will provide live videos on the inside of the A-pillars to provide vision for blind spots.
Blind spots may occur when the A-pillar (also called the windshield pillar), side-view mirror, or interior rear-view mirror blocks a driver's view of the road.

D. Rank the 09 product ideas:

01 ROV w/ Camera, GoPro
02 See-Through A-Pillar, Ford
03 Brain Scanner Accessory, Fitbit
04 Biometric Entry System, Ford
05 Portable GoPro Control/Editing/Sharing Station, GoPro
06 Durable 3D Mapping Camera/LIDAR, GoPro
07 Health Tracker, Fitbit
08 Bike Mounted Activity Tracker, Fitbit
09 Ford OBD Scanner w/Tutorials, Ford

Note: the top three product ideas were not assigned to the group/project for further development by the (07 Health Tracker was assigned by the course instruction).

SPSP04 Check The Work

Report fulfills tasks identified by the instructions. After reviewing this phase we believe that all of our proposals are realistic, workable and could be carried forward into the other phases of this project.

SPSP05 Conclusions

The initial phase of the product conceptual design remains at a higher level that imposes the least amount of restrictions on creativity/vision, but is also ineffective in helping to realize the ideas. The following phases apply specific frameworks in converting *ideas* into actual *designs* (their significance). With the information and product specifications we have hypothesized in this section we feel comfortable moving into the future phases of this project with what we have. While further research will need to be done to determine more about which products are most viable, what is currently in place is viable.

Phase 0 and 1 Connector

With the Proposal now complete, we can begin work on a specific company and product. This means the work we will be doing can be narrowed down to a more fine level than what was being done for the Proposal. Once a product and company has been selected we can begin to break apart competing products and companies to see what they have done correctly and incorrectly in order to make our product the best it can be.

PHASE01: COMPANY & INDUSTRY ANALYSIS

SPSP01: Define the Problem

Phase01 of the report designs & implements all necessary processes/framework to conduct a company & industry analysis for the company *Fitbit*.

SPSP02: Strategy/Treatment

Phase01 of the report consists of two main sections, each specifically-designed steps/tasks to completing the report:

01 Company Analysis:

- **A.** Identify the company's vision statement;
- **B.** Identify the company's mission statement;
- **C.** Identify the company's business goals;
- **D.** Identify the company's technology strategy;
- **E.** Identify the company's product/market strategy;
- **F.** Develop the functional (evolutionary) map(s) of the company.

02 Industry Analysis:

- **A.** Develop the functional (evolutionary) map(s) of the industry/industries in which the company is embedded in;
- **B.** Perform Porter's Five (Six) Forces Analysis;
- **C.** Evaluate the cumulative force (market attractiveness) based on the Porter's analysis;
- **D.** Identify the company's competitive strategy;
- **E.** Evaluate key relationships between the company and forces in the business landscape.

SPSP03: Execution

This section implements the process identified in the previous section.

01 Company Analysis:

A. Company vision statement:

"Deliver innovative products consumers love and are confident in our vision for the future"

Source: *About Fitbit*

B. Company mission statement:

"To empower and inspire customers to live a healthier, more active life. Products are designed to provide experiences that fit seamlessly into the lives of the customers so that they can achieve your health and fitness goals, whatever they may be."

Source: *Fitbit Mission and Vision Statements Analysis*

C. Company business goals:

Focus on exploring more market share through accessibility, compatibility, and lower price tag (instead of achieving a higher level of premium-ship).

Source: *FITBIT MARKETING ANALYSIS STRATEGY RECOMMENDATIONS*

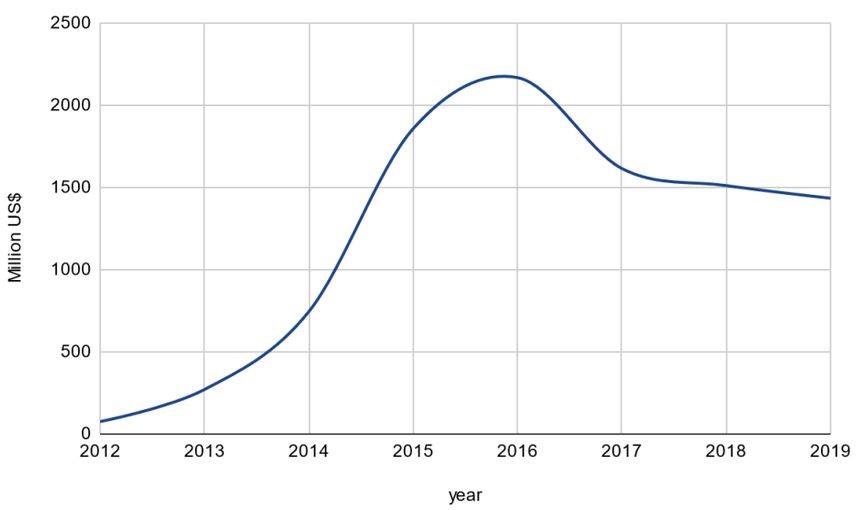
D. Company technology strategy:

Develop the most innovative and cost-effective technologies (focus on investment efficiency). Creating products that explore new technologies at a reasonable and affordable price will be appealing to the average FitBit customer.

E. Company product/market strategy:

Introduce more products with varying levels of price/technology level than competing firms to explore more market potential. By offering a wider variety of products at a range of prices, FitBit is more able to secure a larger market share.

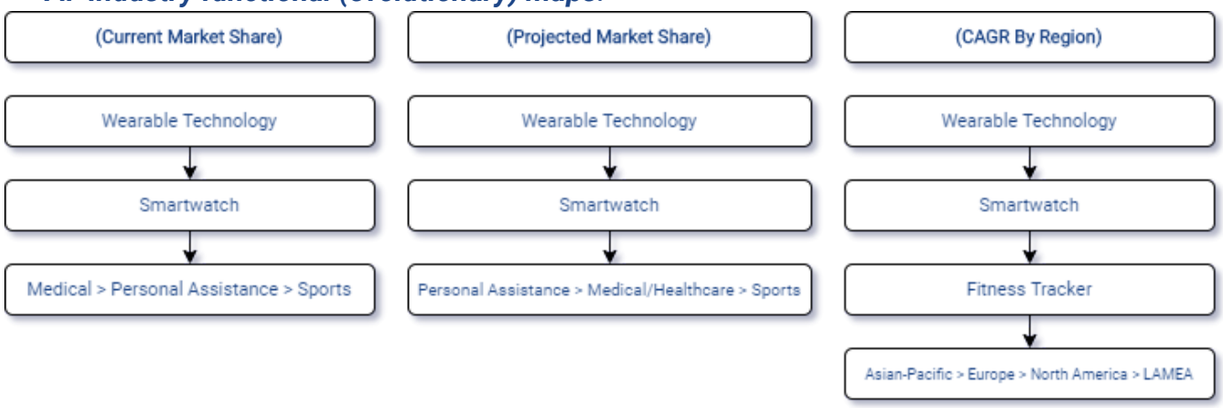
F. Company Functional (Evolutionary) Map:

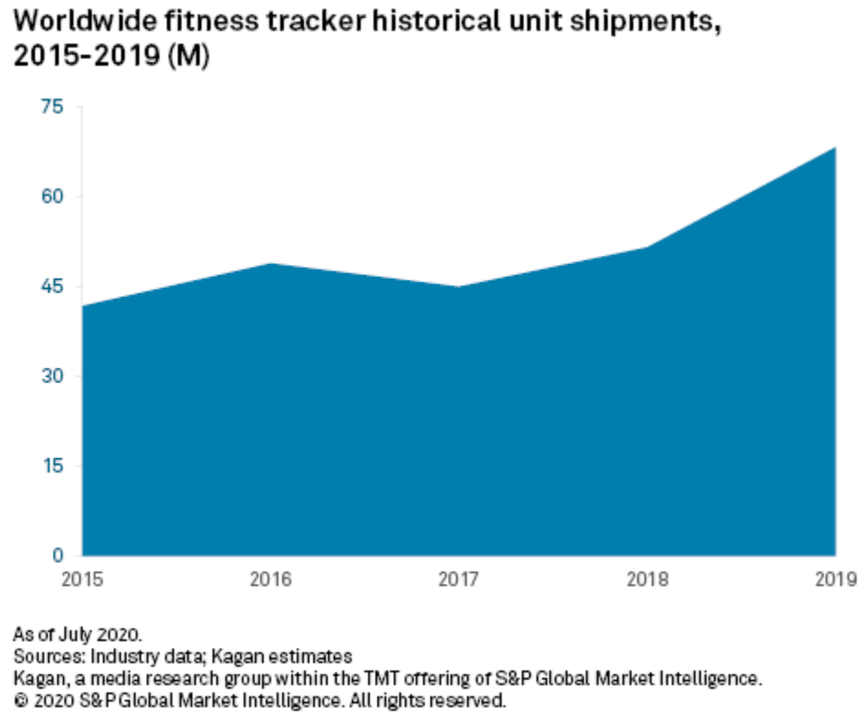


This graph shows the net revenue of the company since 2012.

02 Industry Analysis:

A. Industry functional (evolutionary) maps:





Note: Smartwatches with medical/health-monitoring emphasis are expected to have the largest growth rate due to the importance of health-related functions and the rising consumer demand for health-tracking.

Sources:*Fitness Trackers Market by Device Type (Fitness Bands, Smartwatch, and Others), Display Type (Monochrome and Colored), Sales Channel (Online and Offline), and Compatibility (iOS, Android, Windows, Tizen, and Others) - Global Opportunity Analysis and Industry Forecast, 2017-2023*
Smartwatch Market - Growth, Trends, Forecasts (2020 - 2025
Smartwatch Market By Product (Extension, Standalone, and Classical), Application (Personal Assistance, Wellness, Healthcare, Sports, and Others), and Operating System (WatchOS, Android, RTOS, Tizen, and Others): Global Opportunity Analysis and Industry Forecast, 2020-2027
Global Smartwatch Market Size, Share, Trends and Growth Analysis Report
Wearable Tech Fitness trackers on the rebound

B. Porter's Five (Six) Forces Analysis:

- ***Competition***
  - *Apple*
    - *Apple Watch* (31.7% market share)
    - WatchOS
    - Mixed use - fashion and athletics
  - *Garmin*
    - Activity/exercise oriented
  - *Samsung*
    - Mixed fashion and utility offerings
  - *Fossil*
    - Fashion first brand
    - Fitness aspects/models as well
- ***New Entrants***
  - *Mobvoi*
    - *TicWatch*
  - *HONOR*
    - *MagicWatch*

- ***Suppliers***
    - 200+ global suppliers
    - Struggles with scaling
    - OS developers
        - *Apple* (watchOS)
            - Exclusive
        - *Google* (Wear OS)
        - *Tizen* (Tizen OS)
        - *FitBit*
            - Exclusive
- ***Customers/Buyers***
    - Casual consumer
    - Individual athletes
    - Sports teams
    - Gym-goers
- ***Substitutes***
    - WHOOP
    - Built-in fitness tracking (phone)
    - Heart Rate band
    - Personal trainer
    - Peloton
- ***Complements***
    - Fitness Mapping apps
        - *Strava*
        - *Apple Health*
        - *Garmin Connect IQ*
        - *Endomondo*
    - Health Monitoring Apps
        - *Lost It*
        - *MyFitnessPal*
    - Third-Party Accessory Companies
        - Bands
        - Skins
        - Screen protectors
        - Chargers

Force	Key Determinants	Analysis	Intensity of Force
Rivalry between Competitors	Size	One dominant competitor	High
	Concentration	Several main players	
Threat of new entrants	Economies of scale	New entrants lack the economy of scale competitors have	Low to Medium
	Brand Identity	New entrants face many household-name companies	
Threat of substitutes	Price/Performance of substitutes	Wearable alternatives(e.g. Phone apps) offer smaller performance tracking of exercise, heart rate, sleeping tracking, nutrition, and weight	High
	Switching costs	Customers who switch from Fitbit memberships to other memberships can be costly	
Buyer Power	Buyer size	Fluctuates with demographic, health, and fitness trends	Medium
	Switching costs	Customers who switch from Fitbit wearables to other wearables can be costly	
Supplier Power	Supplier concentration	1 OS (Fitbit OS)	Low
	Supplier size	200+ Suppliers	
	Switching costs	Small switching costs due to supplier diversity	

Complement Influence	Switching costs	Fitbit uses both self-made and third-party software, switching cost is moderate	Medium

Sources: *Market share of wearables unit shipments worldwide by vendor from 2014 to 2019*
Best smartwatch 2020: the top wearables you can buy today

C. Evaluate the cumulative force (market attractiveness) based on the Porter's analysis:

Overall the smartwatch industry hovers around a moderate level of attractiveness. There are many opportunities for new companies to enter in areas where current market leaders have failed. There has not been a large amount of product design diversity nor have there been many products that delve into new opportunities. A new entrant would have the best luck trying to disrupt this industry by attempting to take it in a new direction or adding a feature that none of the current market offerings have.

D. Company competitive strategy:

Company strategy:	To pursue a premium, differentiating positing in the U.S. market, by offering quality products that increase their customers' willingness to pay
Issues in the market:	- Low barriers to entry for new entrants - An attractive market will increase the number of companies offering similar products - High threat of substitutes since many company like Apple are offering similar products
Strategy of Fitbit:	- **Cost-Leadership Competitive Strategy** - Constantly finding ways to differentiate their products Expand their presence in international markets - Increasing their focus on health data to provide more information to users - Focusing on brand loyalty and developing programs to attract new buyers - Have built a trusted band platform focused on fitness tracking - Started partnering with insurance companies that will attract more buyers - Fitbit is constantly improving and developing new strategies to have a competitive advantage over other companies

E. Evaluate key relationships between the company and the forces in the business landscape:

Suppliers	Buyers	Key Partners
• Outsources manufacturing to Chinese companies and buys in bulk quantities • Can easily switch between suppliers • Suppliers do not have much power since Fitbit can switch suppliers	• Athletes • Business professionals • Active individuals • Average person concerned about their health	• Android and Samsung • IOS and Apple products • API policy allows for expanding partnerships with developers to create health apps that interact with Fitbit • Target • Bank of America • Time Warner • BP • Amazon

SPSP04 Check The Work

No steps were missed. No errors found

SPSP05 Conclusions

The commercial health tracker/smart wearable device industry & market is becoming more and more sophisticated and the room for growth/breakthrough without major innovation is becoming less and less likely. New products with innovative features/other significant advantages are needed to be successful in the market.

Phase 1 and 2 Connector

Moving forward from Phase 1, and the company and industry analyses, we can now begin to work on developing a *House of Quality* for a potential new product that we want to bring to market for our chosen company. Based on the work that we have done in the project proposal and finding out which exact product we are going to be working on, with the help of the professor and teaching assistants, we can now develop a full house of quality on the product that was decided on, which for us is the **Senior Health Tracker.** Since we know the market now, due to the analyses, and know what we need to make sure the Senior Health Tracker provides in order to compete with the other companies and products, we must break down similar products to the one we are creating using a *FAST diagram* in order to identify the key functions of the products and how they work. After doing the research on the other products, we can now go in and begin developing our product.

The first step in creating the actual HOQ would be to specify which *consumer needs* and *technical metrics* need to be met. From there we can assess the importance of each need and of each metric, then correlate them through a *convenience scale*. We also need to assess the technical metrics on its own convenience scale, which then will become the top of the house. The next step would be to *benchmark the proposed product* along with other products in the market, which we did research about when we created the different FAST diagrams, in order to obtain a better understanding of which consumer needs and which technical metrics are important for us. The last step is to create a *concise list of consumer needs and technical metrics* that we want to work with while creating the proposed product.

PHASE02: DEVELOPING HOUSE OF QUALITY

SPSP01: Define the Problem

The problem (task) of this phase of conceptual product design is to conduct all necessary processes/framework to develop a House of Quality (HOQ) for the proposed *Health Tracker* product.

SPSP02 Strategy/Treatment

The analysis implements the following steps for solving the problem (developing the HOQ):

Step01: Identify key competing products as well as products with similar functions and technologies as the proposed product;
Step02: Identify a step-wise process for developing a Function Analysis System Technique (FAST);
Step 03: Implement the FAST process for key, existing products identified in step 02;
Step 04: Identify the key consumer needs (hierarchical) and product specifications for the proposed product based on information obtained from previous steps;
Step 05: Identify a stepwise process for developing HOQ;
Step 06: Implement the HOQ development process for the proposed product.

SPSP03 Execution

This section contains the implementation/representation of the treatment/plans of the problem.

Step01: Key competing products and products with similar functions & technologies:

- *Apple Watch Series*
- *Apple Watch SE*
- *Mobvoi TicWatch Sport*
- *HONOR Watch ES*
- *Samsung Galaxy Watch Active2*
- *Samsung Galaxy Watch 3*
- *Koretrak Watch*
- *Fossil Sport*
- *Fossil Gen 5*
- *Garmin Vivofit 4*
- *Garmin Vivosmart HR*
- *Oura Ring*
- *WHOOP Strap 3.0*
- *Xiaomi Mi Band 5*
- *Mevofit Echo Ultra*
- *Moov HR*
- *Lookee Sleep Monitor*
- *Dreem 2*

Step02: Identifying FAST development steps:

A. Understanding how the product works though research**;**
B. Make a list of the important subsystems that are relevant for the FAST diagram;
C. Make a list of the main/primary function(s) and the sub-functions of the system and subsystems;
D. Write down the main/primary function(s) for the system (product, biological systems, etc.), place on the right-most;

E. Organize the FAST diagram with the "*WHYs?*" to the right and the "*HOWs*" to the left;
F. Work from both ends of the diagram to minimize error.

Step03: Implementing the FAST process for two existing products:

Product 01: Sphygmomanometer (Blood Pressure (BP) Monitor; i.e. Omron 5 Series® Wireless Upper Arm BP Monitor):

A. Brief, top-level description of the internal working of a BP monitor:

Blood pressure is measured by a pressure sensor (determines the systolic pressure & pulse rate) at the point of initial blood flow from a restricted state. This is achieved by inflating a cuff with an air pump surrounding the upper arm or wrist with sufficient pressure to prevent blood flow in the local main artery. The pressure is then gradually released to allow the detection of the moment of blood flow. The diastolic pressure is determined by the measurement taken when the blood flow is no longer in a restricted state. The complete measurement cycle is controlled automatically by a microcontroller.

B. List of important subsystems:

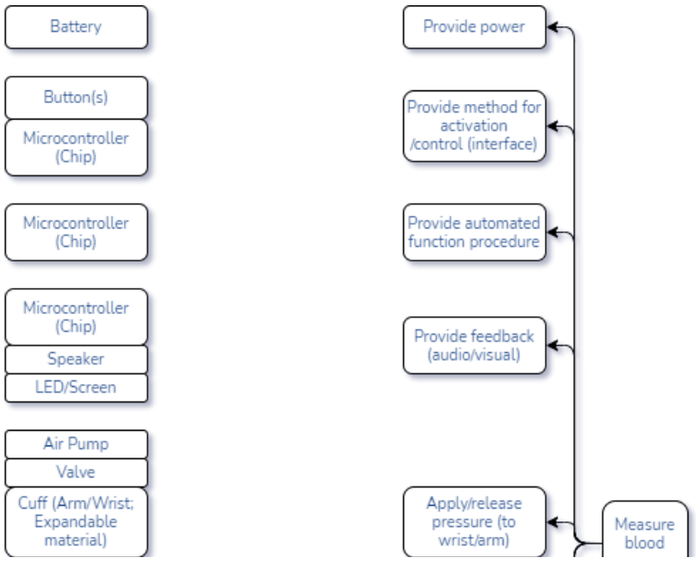
- Battery
- Touch Button(s)
- Microcontroller (Chip)
- Speaker
- LED/Screen
- Air Pump
- Cuff (Arm/Wrist; Expandable material)
- Valve
- Pressure Sensor
- USB/other External Port
- Case/Frame

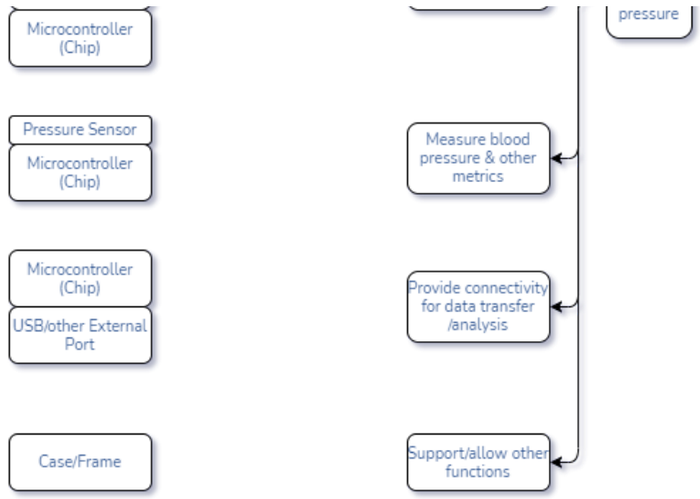
C. List of the sub-functions:

- Provide power
- Provide method for activation/control (interface)
- Provide automated function procedure
- Provide feedback (audio/visual)
- Apply/release pressure (to wrist/arm)
- Measure blood pressure & other metrics
- Provide connectivity for data transfer/analysis
- Support/allow other functions

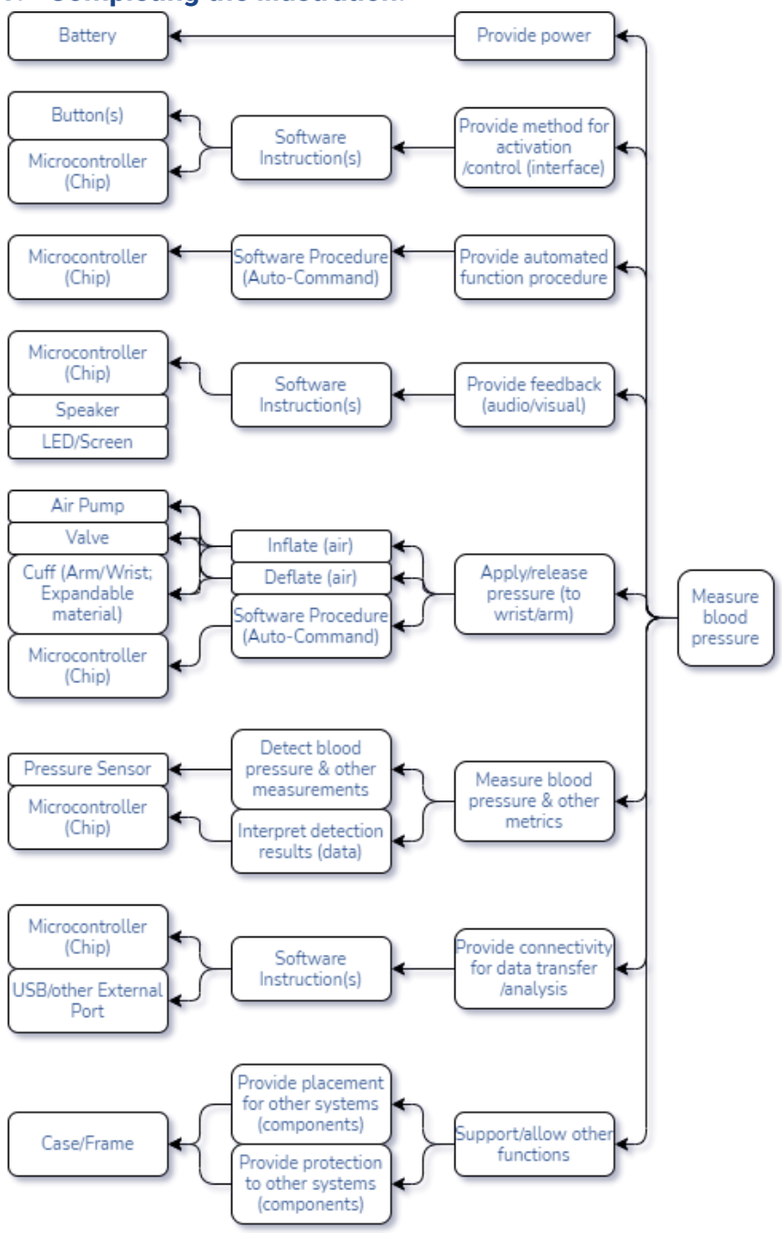
D. System main/primary function(s) (place on the right-most):

E. Organizing the diagram with the "*WHYs?*" to the right and "*HOWs*" to the left:





F. Completing the illustration:



Sources: *How Do Blood Pressure Monitors Work?*
Oscillatory Blood Pressure Monitoring Devices

Product 02: Optical Heart Rate Sensor (Polar OH1):

A. Brief, top-level description of the internal working of an OHRS (optical heart rate sensor):

An OHRS uses a combination of gathered data to determine a user's heart rate.

The first technology consists of the light emitting diodes(LEDs) and photodiodes (PDs) used to emit and detect the transmission of light through the skin. The second technology is that of a 3D acceleration sensor that detects how the user's movement is affecting the spectroscopy. The third and final technology used is an electrical contact sensor that detects whether the device is in firm contact with the skin. An OHR algorithm is used in the monitor to calculate the user's heart rate based on the above observations: spectroscopy, motion, and skin contact. The calculations are handled with a microprocessor and can (ideally) wirelessly transfer the data.

B. List of important subsystems:

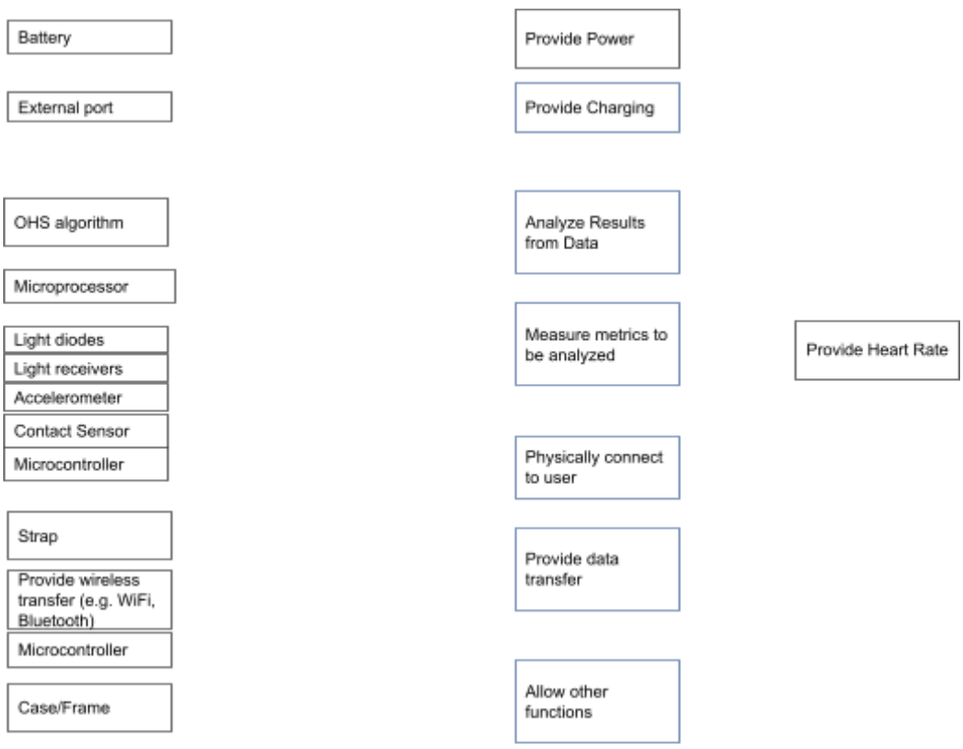
- Battery
- LED diodes
- Photodiodes
- Accelerometer
- Contact Sensor
- Microcontroller
- Strap
- Port Charger

C. List of the sub-functions:

- Provide power
- Provide charging
- Analyze results from data
- Measure metrics to be analyzed
- Connect device to user
- Provide feedback to user
- Provide data transfer
- Support/allow other functions

D. System main/primary function(s) (place on the right-most):

E. Organizing the diagram with the "*WHYs?*" to the right and "*HOWs*" to the left:



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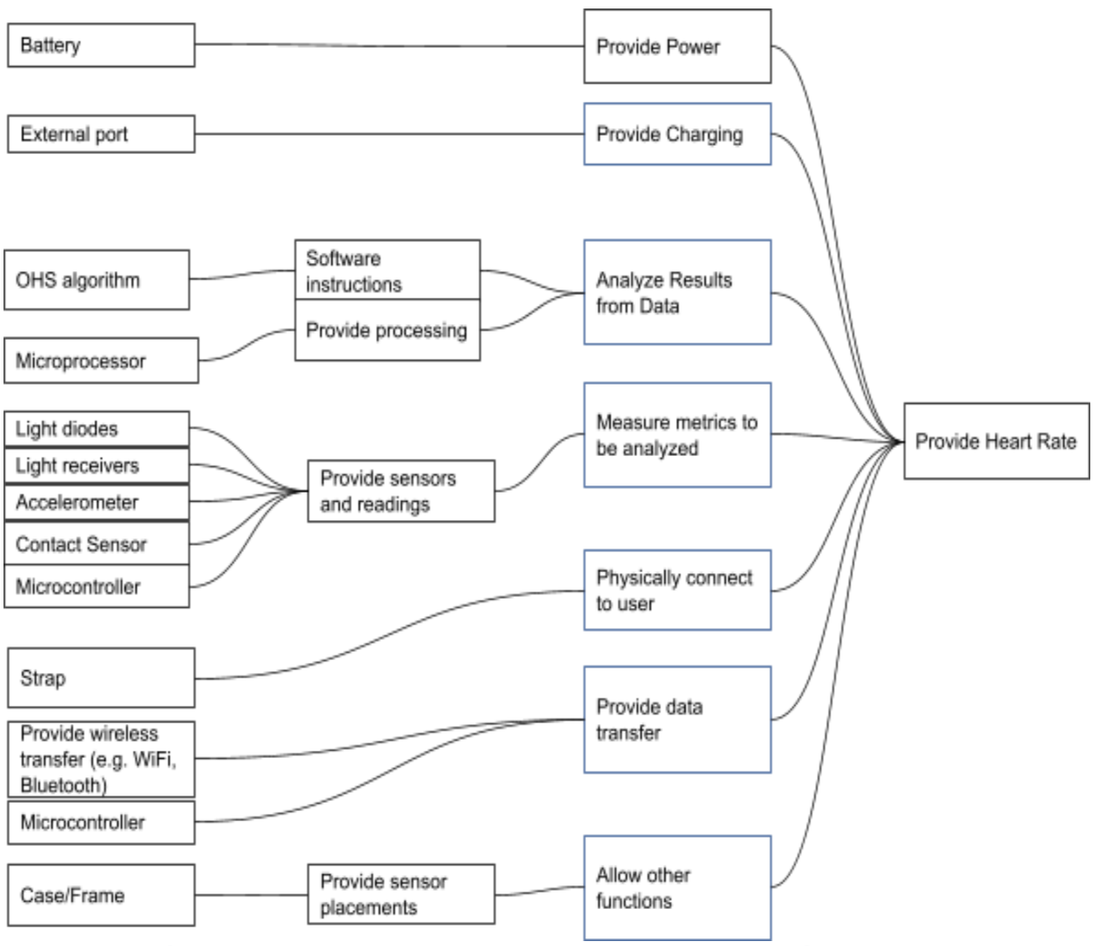
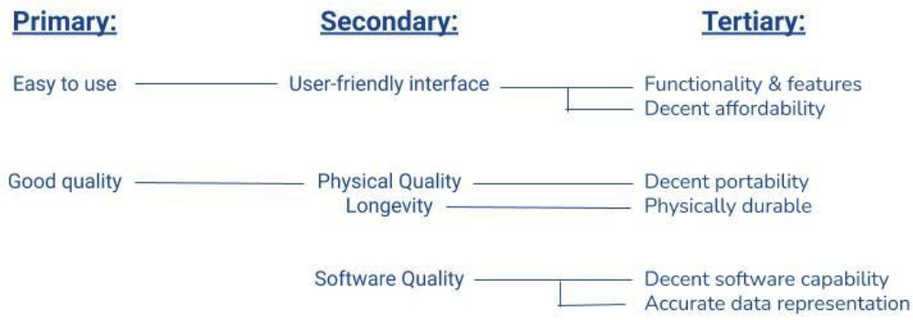


Step 04: Identifying the key consumer needs and product specifications:



Customer Needs:

- Decent battery life
- Physically durable
- Decent affordability
- User-friendly interface
- Data tracking
- Decent storage capacity
- Decent software capability
- Accurate data representation
- Decent portability
- Functionality & features

Technical Metrics:

- Dimensions (thickness, width, etc.)
- Storage Capacity
- Expandable memory
- Processing power
- Compatibility
- Up-to-date software
- Display quality
- Accurate data representation
- Waterproof level
- Response time

Step 05: Identifying HOQ development steps:

A. Assess the importance of each customer needs using a convenience scale;
B. Assess the importance of each technical metrics using a convenient scale;
C. Correlate customer needs and technical metrics using a convenience scale;
D. Correlate the technical metrics to each other using a convenient scale (place the half of the matrix above diagonal on top of the technical matrix);
E. Benchmarking: access a set of competing products **(a)** from the viewpoint of the customers (customer benchmarking) and **(b)** from the technical (engineering) viewpoint (technical benchmarking), both by using a convenient scale;
Add to the results from the previous step to complete the illustration.

Step 06: Implementing the HOQ development process for the proposed product:

A. Assessing the importance of each customer needs (convenience scale):

Decent battery life	8/10
Physically durable	8/10
Decent affordability	7/10
User-friendly interface	8/10
Data tracking	9/10
Decent storage capacity	7/10
Decent software capability	8/10
Accurate data representation	9/10
Decent portability	8/10
Functionality & features	9/10

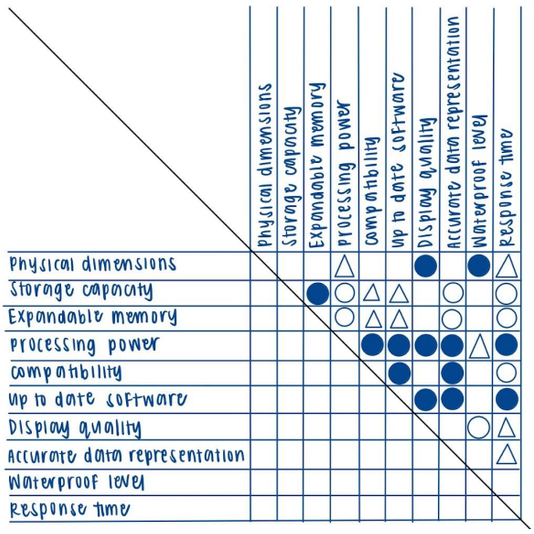
B. Assessing the importance of each technical metrics (convenient scale):

8/10	Dimensions
7/10	Storage capacity
9/10	Expandable memmory
9/10	Processing power
8/10	Compatiblity
8/19	Up-to-date softwear
7/10	Display quality
9/10	Accurate data representation
9/10	Waterproof level
8/10	Response time

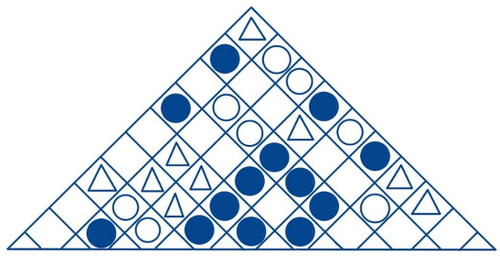
C. Correlating customer needs and technical metrics (convenience scale):

Customer Needs \ Tehcnical Metrics		Dimensions	Storage capacity	Expandable memmory	Processing power	Compatiblity	Up-to-date softwear	Display quality	Accurate data representation	Waterproof level	Response time
		8/10	7/10	9/10	9/10	8/10	8/19	7/10	9/10	9/10	8/10
Decent battery life	8/10				●		○				
Physically durable	8/10	●						○		●	
Decent affordability	7/10	●	▫	▫	△	△	○	○	○	●	△
User-friendly interface	8/10	△				○	△	●	△		●
Data tracking	9/10		△	△	●	○	●		○		●
Decent storage capacity	7/10		●	●	△						
Decent software capability	8/10				△	○	●	○	○		●
Accurate data representation	9/10		△	△	●	○	○		●		●
Decent portability	8/10	▫						△		△	
Functionality & features	9/10	●	△	△	●	●	●	○	△	○	●

D. Correlating technical metrics to each other (convenient scale). The top half of the matrix is placed on top of the technical matrix:



E. Customer Benchmarking & Technical Benchmarking:



Customer Needs \ Tehcnical Metrics	Dimensions	Storage capacity	Expandable memmory	Processing power	Compatiblity	Up-to-date softwear	Display quality	Accurate data representation	Waterproof level	Response time	Customer Benchmaking: Apple Watch	Oura Ring	Our Product
	8/10	7/10	9/10	9/10	8/10	8/19	7/10	9/10	9/10	8/10			
Decent battery life	8/10				•		○				7/10	9/10	8/10
Physically durable	8/10	•						○		•	7/10	7/10	7/10
Decent affordability	7/10	•	▫	▫	△	△	○	○	○	•	△	6/10	6/10	7/10
User-friendly interface	8/10	△				○	△	•	△		•	8/10	/	7/10
Data tracking	9/10		△	△	•	○	•		○		•	8/10	9/10	8/10
Decent storage capacity	7/10		•	•	△							8/10	/	7/10
Decent software capability	8/10				△	○	•	○	○		•	9/10	5/10	7/10
Accurate data representation	9/10		△	△	•	○	○		•		•	8/10	9/10	7/10
Decent portability	8/10	▫						△		△		8/10	10/10	8/10
Functionality & features	9/10	•	△	△	•	•	•	○	△	○	•	10/10	5/10	7/10
Technical Benchmaking: Apple Watch		7/10	9/10	5/10	9/10	3/10	9/10	9/10	7/10	9/10	9/10			
Technical Benchmaking: Oura Ring		10/10	5/10	0/10	6/10	3/10	6/10	/	9/10	9/10	7/10			
Technical Benchmaking: Our Product		7/10	7/10	5/10	8/10	6/10	7/10	7/10	8/10	8/10	8/10			
Unit		in	GB	GB	Hz	type	type	cd, px	type	g/m^2	ms			

This following list of target customer needs & technical specifications are identified based on the analysis conducted during the development of the HOQ:

Customer Needs:
- Decent (extra) functionality & features
- Accurate data representation
- Decent affordability
- Decent accessibility/compatibility

Technical Specifications:
- (Have) Innovative technology
- Decent processing power
- Sensor accuracy/efficiency

SPSP04 Check the Work
This work has been double checked by all participating members and is as up to date and accurate as possible. We have looked at a variety of external products in order to best generate metrics for success and determine what customers want in a health tracker.

SPSP05 Conclusions
Through the process of developing the House of Quality (HOQ) for Fitbit's Senior Health Tracker we have determined where it could develop an edge in the market against other products, how it operates, and how it stacks up against the competition. Now that the HOQ has been built, we know how to proceed for our conceptual analysis of this product and have a strong base from which to build off of going forward.

Phase 2 and 3 Connector

Now that we have the *FAST diagrams* and the *House of Quality* for the **Senior Health Tracker** and know about which technical metrics and consumer needs that are more important for us to tackle we can work on the *Conceptual Design* of the product. The *Conceptual Design* consists of creating multiple designs for the proposed product using the list of needs and metrics that were created in Phase 2. The first thing that is needed is the main function of the proposed product and the energy that flows in and out of the system. Once we know the main function of the product then we can create the sub-functions of the proposed product in a *Function Structure,* again using that same list of needs and metrics. Using the Function Structure and the sub-functions we created, we then produce *solution principles* to the sub-functions in order to build different designs for the proposed product. Organizing the sub-functions and solution principles into a *morphological matrix* is the next step in the product which then goes into the creation of multiple designs.
Taking the morphological matrix, we have to select different solution principles in order to develop six new concept ideas that will incorporate those solution principles. These concept ideas will need to be drawn by hand with a real life explanation of how they work. Then, we have to identify a set of selection criteria from the technical metrics and consumer needs, from Phase 2, that evaluates the product concepts that have been created. From there, we need to create the utility function and rank the concepts using that, which in the end will get us the best product that matches the criteria and should be used for further development. The last step would be to take the proposed product and create a completed FAST diagram of the new proposed product that has been selected from the utility function.

PHASE03: CONCEPTUAL DESIGN

SPSP01: Define The Problem(s)
Decide on the plan & implement the conceptual design process for the proposed product as a team.

SPSP02: Strategy/Treatment
Step01: Provide visual representation of energy flowing in & out of the system (black box; this is a illustration of the main function/purpose of the system);
Step 02: Create an abstract functional representation of the intended product (function structure) based on the work done in phase 02;

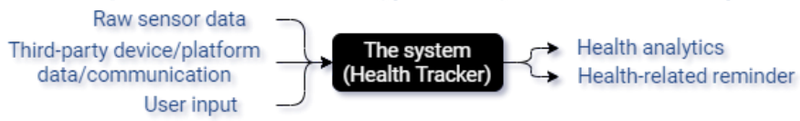
Step 03: Generate solution principles (SPs) for each sub-function; organize SPs in a morphological matrix (MM);
Step 04: Generate 6 alternative product concepts by suitably combining the SPs in MM;
Step 05: Identify a set of selection criteria that evaluates the product concept comprehensively taken into account the customer needs and technical metrics (identified in phase 02);
Step 06: Develop a utility function (UF) to rank the concepts to make the decision for further development:

i.
Generate the relevant selection criteria (combination of criteria selected from the customer needs & technical metrics in the HOQ) for comparing & assessing the alternative design concepts;
ii.
Organize the selection criteria as a hierarchy;
iii.
Assign relative weights at each level of the hierarchy;
iv.
At each level of the hierarchy, compute the absolute weights for each selection criterion.

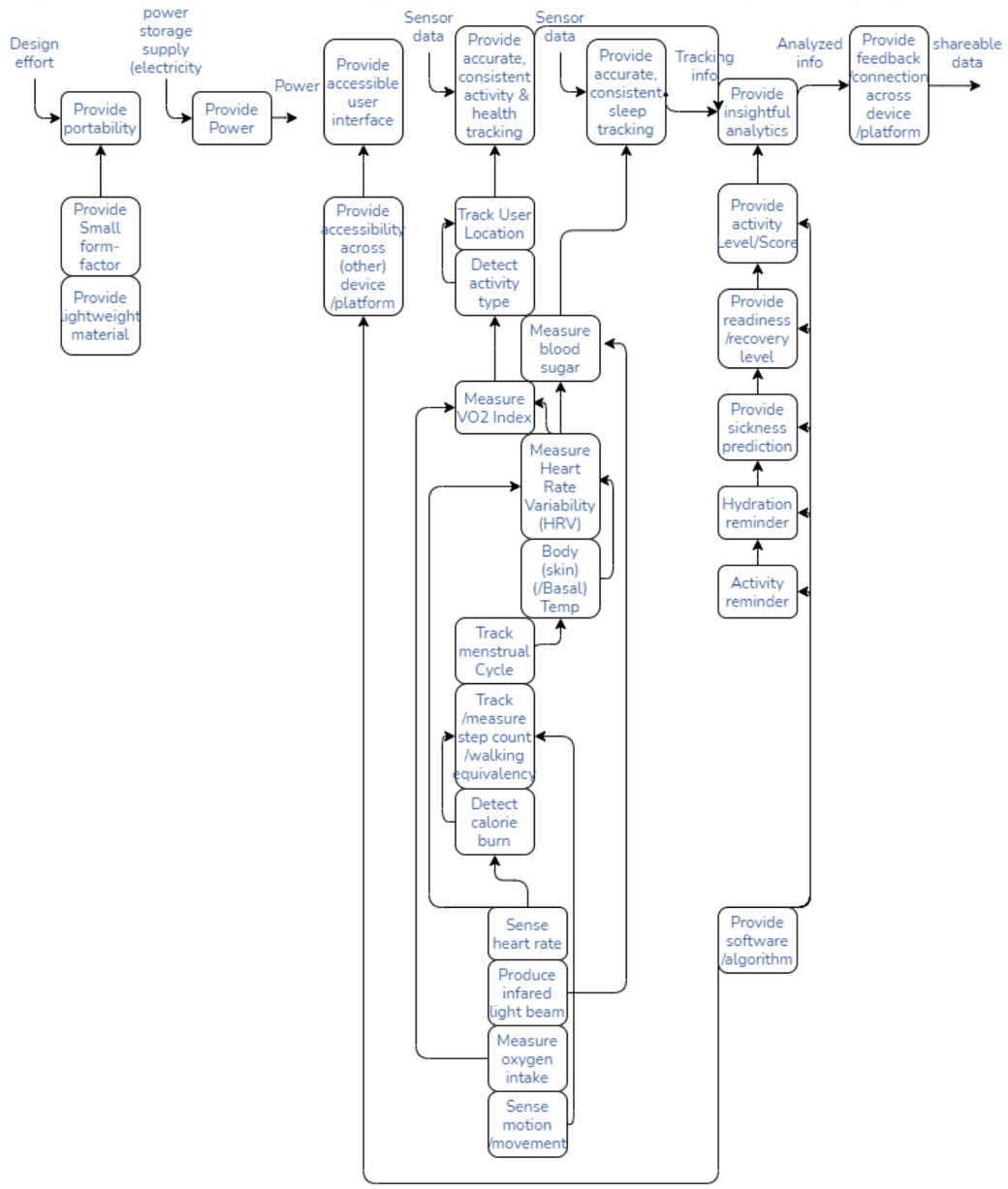
Step07: Provide functional representation (FAST) for the selected product concept.

SPSP03: Execution

Step01: Visual representation of energy flowing in & out of the system (black box):



Step02: Abstract functional representation of the intended product (FS):



Step03: Solution principles for each sub-function, organize SPs in a morphological matrix:

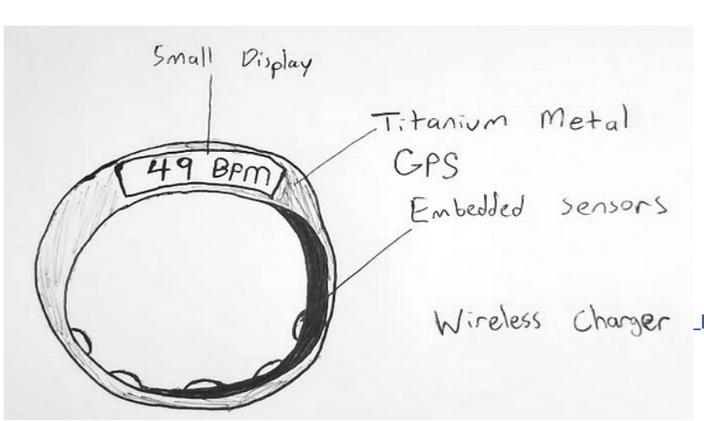
Primary Function(s)	Secondary Function(s)	Tertiary Function(s)	Morphological Matrix
Provide portability	Small form factor enables portability		Use lightweight material/structural design
Provide accurate activity tracking	Track User Location		GPS
			Bluetooth Beacon
			Internet connection (at certain locations)
	Detect activity type	Based on data from sensors, algorithms will determine what activity is taking place	Motion sensor; Softwear (algorithms)
	Calorie Burn	Sense heart rate (Pulse oximeter), analyze with algorithms	Heart rate sensor; Softwear (algorithms)
Provide accurate sleep tracking	Provide analysis from health tracking (heart rate, HRV, movement) to determine sleep cycles, patterns, etc.		Provide sleep analytics (algorithms)
Provide accurate, consistent health tracking	Blood Sugar	To produce Infared light beam (measured thru Infared light beam technology) https://www.diamontech.de/home	Quantum cascade laser
			Red laser
	VO2 Index	Measure oxygen saturation (Pulse oximeter) Measure oxygen intake thru a mask (mL/kg/min).	Pulse oximeter & mask
	Heart Rate Variability (HRV)	Softwear/algoritm to analyze/tack	Heart rate sensor; Softwear (algorithms)
	Heart Rate		Heart rate sensor; Softwear (algorithms)
	Body (/Basal) Temperature		Temperature sensor
	Menstrual Cycle	Sense body(skin) temperature (temperature sensor). Menstrual cycle is measured by tracking body (skin) temperature trends: https://support.ouraring.com/hc/en-us/articles/360025587493-An-Introduction-to-Body-Temperature	Provide temperature sensor; Softwear (algorithms)
	Step Count/Walking Equivalency	Sense motion/movement (accelerometer)	Pedometer, motion sensor, estimate based on distance traveled
			Motion sensor; Softwear (algorithms)
Provide accessible user interface	Provide means to access on phone or other device	Provide software	Bluetooth
			NFC
			WiFi
			Software (Google Health)
Provide insightful analytics	Activity Level/Score	Provide algorithm...	Personalized scoring (Machine learning & algorithms)
	Readiness/Recovery Level	Provide algorithm...	Personalized scoring (Machine learning & algorithms), benchmarks
	Provide Sickness Prediction	Provide algorithm...	Temperature sensor; Personalized scoring (Machine learning & algorithms)
	Hydration reminder	Remind user at set time intervals	Internal timer/clock, internet connection, phone clock
Provide Power			Wind energy
			Provide charging (electric wired, wireless, solar)
			Electricity (battery)
			Gas (ICE)
			Solar panel

As illustrated in the MM above, systems/methods of realization (the HOW's) for each function (and their corresponding sub-function) are included in the right most column titled "Morphological Matrix". Each system (or a combination of systems in each category) is possible a way of realizing the corresponding intended function/sub-function. Each of the following product concepts consists of a different combination of systems, and each will be ranked according to the selection criteria (to be developed) for a final selected product concept for further development.

Step04: Alternative product concepts:

Concept01: The FitRing

Primary Function(s)	'How?'
Provide portability	Use lightweight material/structural design
Provide accurate activity tracking	GPS
	Bluetooth Beacon
	Internet connection (at certain locations)
	Motion sensor; software (algorithms)
	Heart rate sensor; software (algorithms)
Provide accurate sleep tracking	Provide sleep analytics (algorithms)
Provide accurate, consistent health tracking	Quantum cascade laser
	Red laser
	Pulse oximeter & mask
	Heart rate sensor; software (algorithms)
	Temperature sensor; software (algorithms)
	Pedometer, motion sensor, estimate based on distance traveled
	Motion sensor; software (algorithms)
Provide accessible user interface	Bluetooth
	NFC
	WiFi
	Software
Provide insightful analytics	Personalized scoring (Machine learning & algorithms)
	Personalized scoring (Machine learning & algorithms), benchmarks
	Temperature sensor; Personalized scoring (Machine learning & algorithms)
	Internal timer/clock, internet connection, phone clock
Provide Power	Wind energy
	Provide charging (electric wired, wireless, solar)
	Electricity (battery)
	Gas (ICB)
	Solar panel
Securely attach to user	Velcro
	Buckles
	Spring bar
	Buckle and strap
	Friction



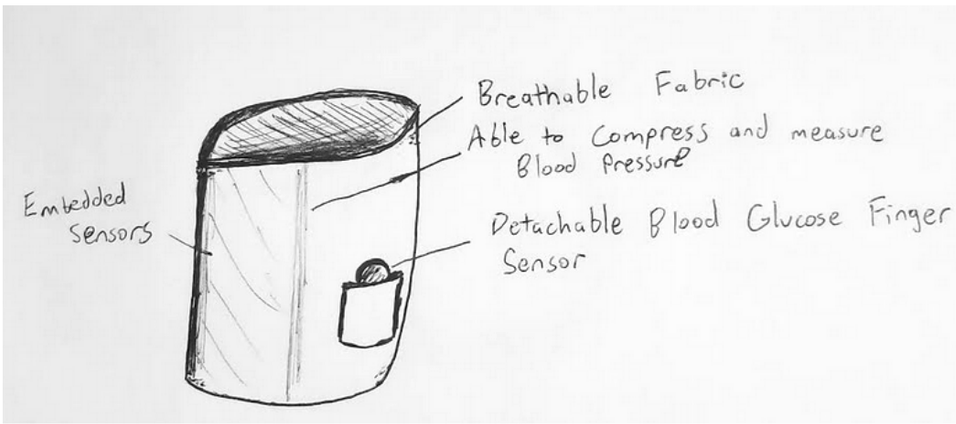
<- FitRing: Concept Illustration

The FitRing uses lightweight and durable titanium metal to cover the index, middle, or ring finger of a person. It contains embedded sensors and

trackers including GPS, a bluetooth beacon to sync data, WiFi connection, a heart rate sensor, a pulse oximeter, a temperature sensor, and a pedometer. A small display indicates the resting and continuous heart rate of the wearer. The Fitbit OS provides personalized analytics through machine learning algorithms. Furthermore, the FitRing has an internal clock, wireless charging, and red lasers for the sensors.

Concept02: The FitBand

Primary Function(s)	'How?'
Provide portability	Use lightweight material/structural design
Provide accurate activity tracking	GPS
	Bluetooth Beacon
	Internet connection (at certain locations)
	Motion sensor; software (algorithms)
	Heart rate sensor; software (algorithms)
Provide accurate sleep tracking	Provide sleep analytics (algorithms)
Provide accurate, consistent health tracking	Quantum cascade laser
	Red laser
	Pulse oximeter & mask
	Heart rate sensor; software (algorithms)
	Temperature sensor; software (algorithms)
	Pedometer, motion sensor, estimate based on distance traveled
	Motion sensor; software (algorithms)
Provide accessible user interface	Bluetooth
	NFC
	WiFi
	Software
Provide insightful analysis	Personalized scoring (Machine learning & algorithms)
	Personalized scoring (Machine learning & algorithms), benchmarks
	Temperature sensor; Personalized scoring (Machine learning & algorithms)
	Internal timer/clock, internet connection, phone clock
Provide Power	Wind energy
	Provide charging (electric wired, wireless, solar)
	Electricity (battery)
	Gas (ICB)
	Solar panel
Securely attach to user	Velcro
	Buckles
	Spring bar
	Buckle and strap
	Friction



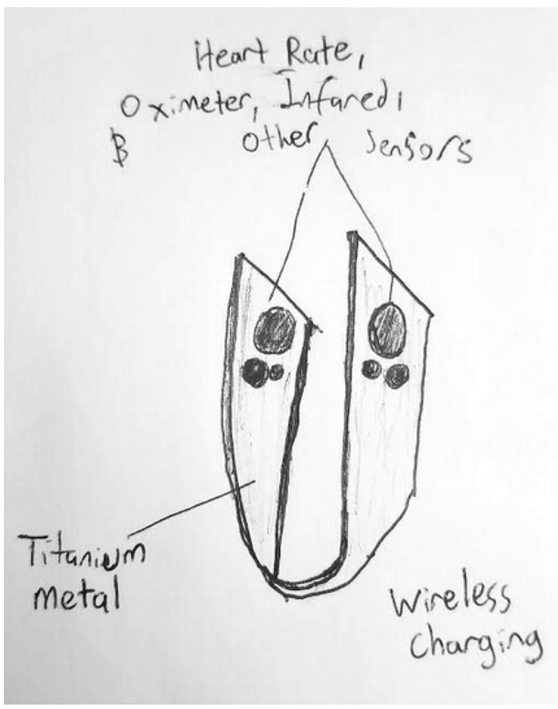
FitBand: Concept Illustration

The FitBand health tracker is made of a comfortable and breathable fabric which can be adjusted to the wearer's arm. A detachable blood sugar sensor is embedded within the fabric and can be used to measure glucose levels via finger spectroscopy readings. The band contains a small air compressor and pneumatic tubes which are able to expand and provide pressure to the arm. In this way, blood pressure can be determined with a sensor. There is a bluetooth beacon and WiFi connectivity to sync data. Also embedded in the device is a heart rate sensor, oximeter, temperature sensor, and pedometer. The FitBit OS will provide personalized analytics. The device has an electric battery and can be wirelessly charged.

Concept03: The FitClamp

Primary Function(s)	**'How?'**
Provide portability	Use lightweight material/structural design
Provide accurate activity tracking	GPS
	Bluetooth Beacon
	Internet connection (at certain locations)
	Motion sensor; software (algorithms)
	Heart rate sensor; software (algorithms)
Provide accurate sleep tracking	Provide sleep analytics (algorithms)
Provide accurate, consistent health tracking	Quantum cascade laser
	Red laser
	Pulse oximeter & mask
	Heart rate sensor; software (algorithms)
	Temperature sensor; software (algorithms)
	Pedometer, motion sensor, estimate based on distance traveled
	Motion sensor; software (algorithms)
Provide accessible user interface	Bluetooth
	NFC
	WiFi
	Software
Provide insightful analytics	Personalized scoring (Machine learning & algorithms)

	Personalized scoring (Machine learning & algorithms), benchmarks
	Temperature sensor; Personalized scoring (Machine learning & algorithms)
	Internal timer/clock, internet connection, phone clock
Provide Power	Wind energy
	Provide charging (electric wired, wireless, solar)
	Electricity (battery)
	Gas (ICB)
	Solar panel
Securely attach to user	Velcro
	Buckles
	Spring bar
	Buckle and strap
	Friction

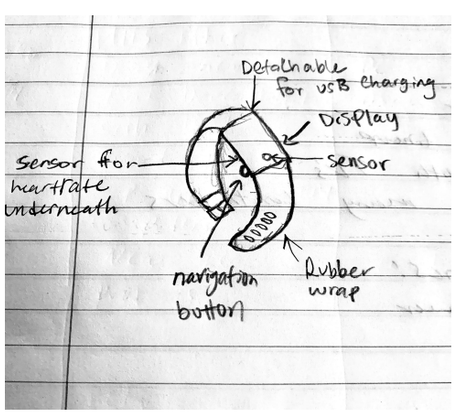


<- FitClamp: Concept Illustration

The FitClamp is a state-of-the-art health tracker which clamps onto the wearer's earlobe. On both sides are embedded heart rate, infrared, and other sensors. The device has wireless charging capabilities and an electric battery. It connects with the user's phone via bluetooth and the FitBit OS provides personalized analytics to the user.

Concept04: Sleep WristTracker

Research shows that people's bodies recover when they sleep. The Sleep WristTracker provides sleep analytics, using its state-of-the-art software. The analytics provided are intelligent, insightful, and most importantly actionable information for the user's health and how it is affected by their sleep. The analytics will tell you how much more or less to sleep, how ready your body is to workout again, and what time of the day best suits your schedule to get the optimal amount of sleep. It comes equipped with heart rate sensors that monitor a person's sleep. The analytics are viewable on any device that is bluetooth enabled. It is powered by a USB and it is comfortable to wear while sleeping due to its lightweight design and structure.



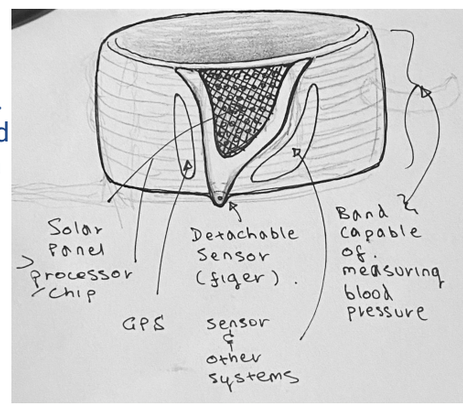
Primary Function(s)	Concept04: Sleep WristTracker
Provide portability	Use lightweight material/structural design
Provide accurate activity tracking	GPS
	Bluetooth Beacon
	Internet connection (at certain locations)
	Motion senser; software (algorithms)
	Heart rate sensor; software (algorithms)
Provide accurate sleep tracking	Provide sleep analytics (algorithms)
Provide accurate, consistent health tracking	Quantum cascade laser
	Red laser
	Pulse oximeter & mask
	Heart rate sensor; software (algorithms)
	Temperature sensor
	Provide temperature sensor; software (algorithms)
	Pedometer, motion sensor, estimate based on distance traveled
	Motion senser; software (algorithms)
	Stores smart tracking for two weeks
	Recovery level; sensors and software (algorithms)
Provide accessible user interface	Bluetooth
	NFC
	WiFi
	Software
Provide insightful analytics	Personalized scoring (Machine learning & algorithms)
	Personalized scoring (Machine learning & algorithms), benchmarks
	Temperature sensor; Personalized scoring (Machine learning & algorithms)
	Suggests sleep schedules based on vitals
	Provides sleep analytics
	Internal timer/clock, internet connection, phone clock
Provide Power	Wind energy
	Provide charging (electric wired, wireless, solar)
	Electricity (battery)
	Gas (ICB)
	Solar panel
Securely attach to user	Velcro
	Buckles
	Spring bar
	Buckle and strap

Concept05: The V-Band

Primary Function(s)	Concept05: The V-Band
Provide portability	Use lightweight material/structural design
Provide accurate activity tracking	GPS
	Bluetooth Beacon
	Internet connection (at certain locations)
	Motion senser; software (algorithms)
	Heart rate sensor; software (algorithms)
Provide accurate sleep tracking	Provide sleep analytics (algorithms)
~~Provide accurate, consistent~~	Quantum cascade laser

health tracking	Red laser
	Pulse oximeter & mask
	Heart rate sensor; software (algorithms)
	Heart rate sensor; software (algorithms)
	Temperature sensor
	Provide temperature sensor; software (algorithms)
	Pedometer, motion sensor, estimate based on distance traveled
	Motion senser; software (algorithms)
Provide accessible user interface	Bluetooth
	NFC
	WiFi
	Software
Provide insightful analytics	Personalized scoring (Machine learning & algorithms)
	Personalized scoring (Machine learning & algorithms), benchmarks
	Temperature sensor; Personalized scoring (Machine learning & algorithms)
	Internal timer/clock, internet connection, phone clock
Provide Power	Wind energy
	Provide charging (electric wired, wireless, solar)
	Electricity (battery)
	Gas (ICB)
	Solar panel
Securly attach to user	Velcro
	Buckles
	Spring bar
	Buckle and strap

The V-Band is made of lightweight materials (aluminum, carbon fiber) and equipped with the most commercially advanced sensors for health-tracking i.e. motion & heart rate sensors. It is designed to be placed securely around the wrist and The V-band device has a rechargeable battery that lasts up to a week. It connects with the user's phone and other third-party platforms/apps via bluetooth and the FitBit OS provides personalized analytics to the user.

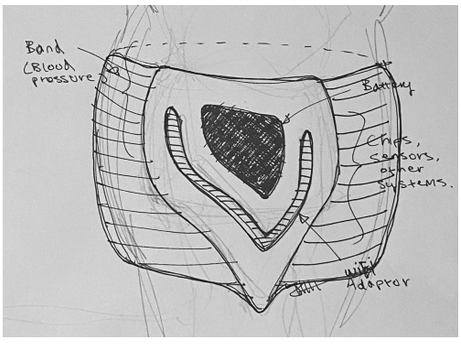


Concept06: The V-Band Lite

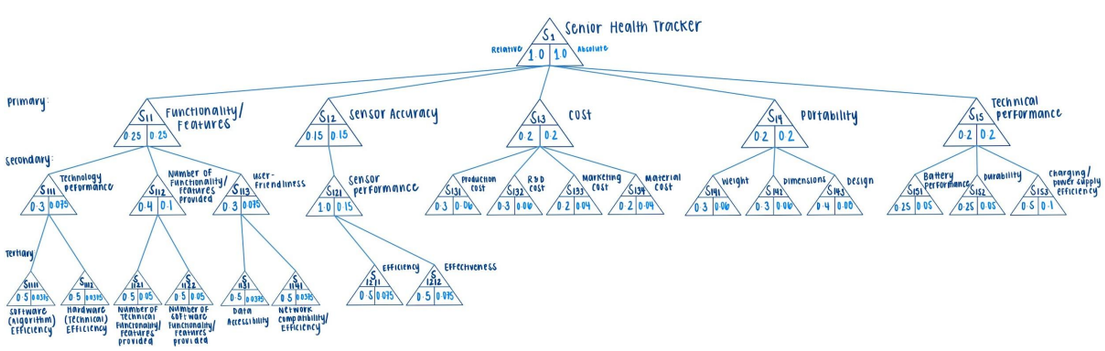
Primary Function(s)	Concept06: The V-Band Lite
Provide portability	Use lightweight material/structural design
Provide accurate activity tracking	GPS
	Bluetooth Beacon
	Internet connection (at certain locations)
	Motion senser; software (algorithms)
	Heart rate sensor; software (algorithms)
Provide accurate sleep tracking	Provide sleep analytics (algorithms)
Provide accurate, consistent health tracking	Quantum cascade laser
	Red laser
	Pulse oximeter & mask
	Heart rate sensor; software (algorithms)

	Heart rate sensor; software (algorithms)
	Temperature sensor
	Provide temperature sensor; software (algorithms)
	Pedometer, motion sensor, estimate based on distance traveled
	Motion senser; software (algorithms)
Provide accessible user interface	Bluetooth
	NFC
	WiFi
	Software
Provide insightful analytics	Personalized scoring (Machine learning & algorithms)
	Personalized scoring (Machine learning & algorithms), benchmarks
	Temperature sensor; Personalized scoring (Machine learning & algorithms)
	Internal timer/clock, internet connection, phone clock
Provide Power	Wind energy
	Provide charging (electric wired, wireless, solar)
	Electricity (battery)
	Gas (ICB)
	Solar panel
Securly attach to user	Velcro
	Buckles
	Spring bar
	Buckle and strap

The V-Band is a less premium version of the V-Band. It is made of lightweight silicon (case) and equipped with commercially competitive sensors for health-tracking i.e. motion & heart rate sensors. It is designed to be placed securely around the wrist and The V-band device has a rechargeable battery that lasts up to a week. It connects with the user's phone via bluetooth and the FitBit OS provides personalized analytics to the user.



Step05: Selection criteria to evaluate the product concepts comprehensively taken into account the customer needs and technical metrics (identified in phase 02):



- **Step06: Utility function to rank the concepts to make the decision for further development:**

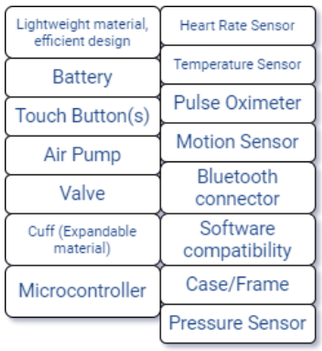
	Selection	Absolute	Concept 01		Concept 2		Concept 3		Concept 4		Concept 05		Concept 06	
	Criteria	Weights	Rating	Utility	Rating	Utility	Rating	Utility	Rating	Utility	Rating	Utility	Rating	Utility
prod. cost	S131	0.06	2	0.12	2	0.12	4	0.24	2	0.12	2	0.12	3.5	0.21
R&D cost	S132	0.06	2	0.12	1	0.06	1	0.06	1	0.06	2.5	0.15	3.5	0.21
marketing cost	S133	0.04	3	0.12	2	0.08	3	0.12	2	0.08	4.5	0.18	3	0.12
material cost	S134	0.04	2	0.08	3	0.12	2.5	0.1	2	0.08	3	0.12	3.5	0.14
weight	S141	0.06	5	0.3	3	0.18	5	0.3	2	0.12	3.5	0.21	3	0.18
dimensions	S142	0.06	5	0.3	2	0.12	5	0.3	4	0.24	3.5	0.21	3	0.18
design	S145	0.08	4	0.32	3	0.24	5	0.4	3	0.24	4.5	0.36	4	0.32
battery performance	S151	0.05	3	0.15	3	0.15	2	0.1	4.2	0.21	5	0.25	4	0.2
durability	S152	0.05	4	0.2	2	0.1	3	0.15	4	0.2	4	0.2	3.5	0.175
charging/power supply efficiency	S153	0.1	3	0.3	3	0.3	2	0.2	5	0.5	5	0.5	4	0.4
software (algorithm) efficiency	S1111	0.0375	4	0.15	4	0.15	4	0.15	4	0.15	4.5	0.16875	4	0.15
hardware (technical) efficiency	S1112	0.0375	4	0.15	4	0.15	3	0.1125	3	0.1125	4.5	0.16875	3.5	0.13125
number of technical functionality features provided	S1121	0.05	4	0.2	5	0.25	3	0.15	3	0.15	5	0.25	4	0.2
number of software functionality/feautres provided	S1122	0.05	4	0.2	5	0.25	3	0.15	2	0.1	4.5	0.225	4	0.2
data accessibility	S1131	0.0375	5	0.1875	5	0.1875	5	0.1875	3	0.1125	4	0.15	4	0.15
network compatibility	S1141	0.0375	5	0.1875	5	0.1875	4	0.15	3	0.1125	4	0.15	3	0.1125
efficiency	S1211	0.075	4	0.3	3	0.225	4	0.3	4	0.3	4	0.3	3.5	0.2625
effectiveness	S1212	0.075	4	0.3	4	0.3	3	0.225	4	0.3	4	0.3	4	0.3
		SUM		CU		CU		CU		CU		CU		CU
		1.00		3.685		3.17		3.395		3.1875		4.0125		3.64125

As shown in the table, product concept 05 (The V-Band) scored the highest in cumulative utility (4.0125), it will be the product concept to proceed for further development.

Now that we have determined that the V-Band is the best product for development, we can go forth to the most detailed look we have taken to a product thus far in the phase and project as a whole. We will need to determine what subsystems the product will have, dissect it into a FAST diagram, and prepare it for further work such as prototyping and durability testing. After this it will go to the commercialization phase where even more detail, down to every component, will be needed.

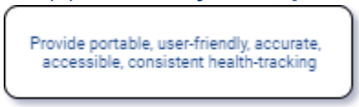
Step07: Functional representation (FAST) for the selected product concept:

A. List of the subsystems:

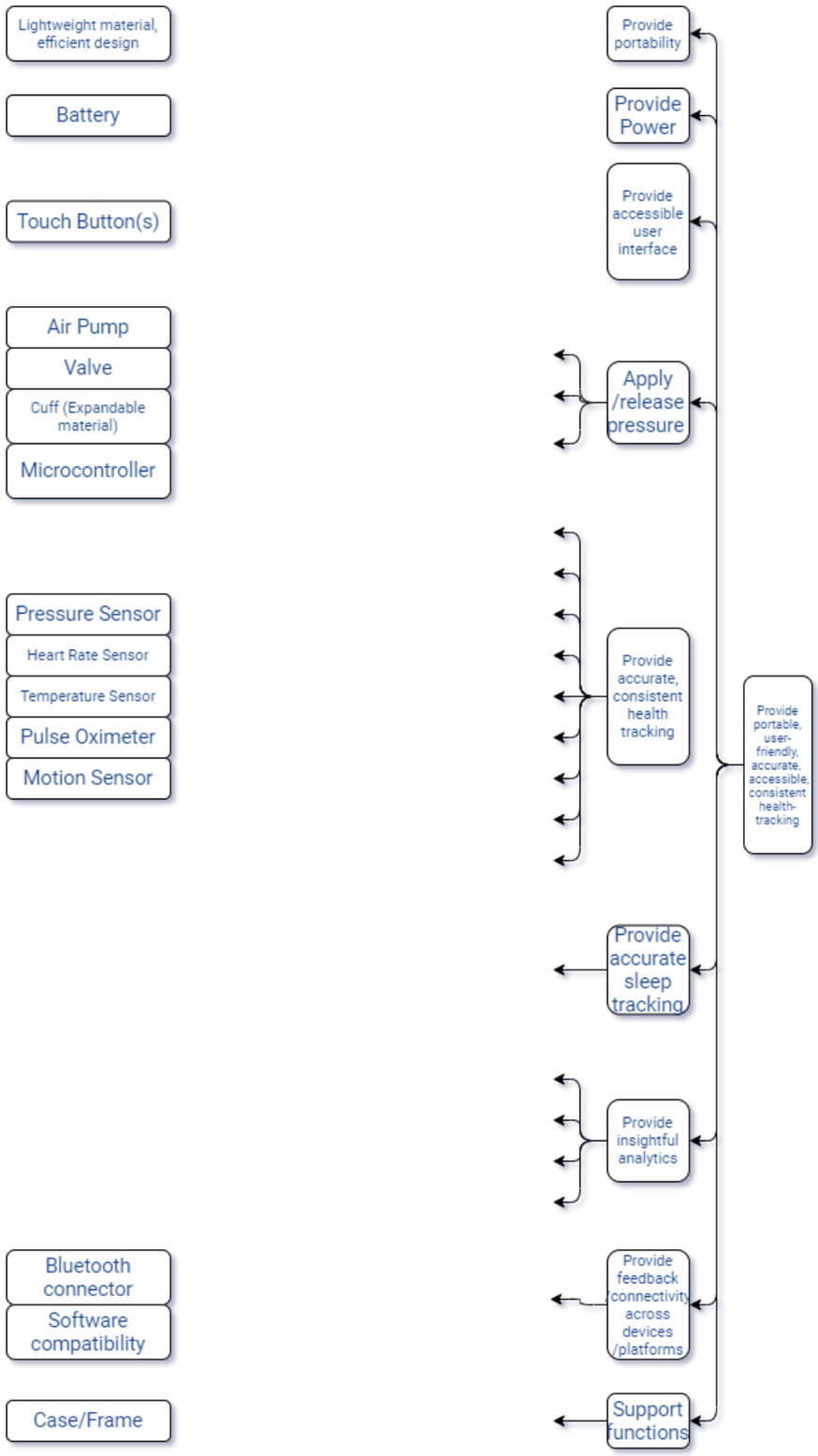


B. List of the main/primary function(s) and the sub-functions of the system and subsystems;

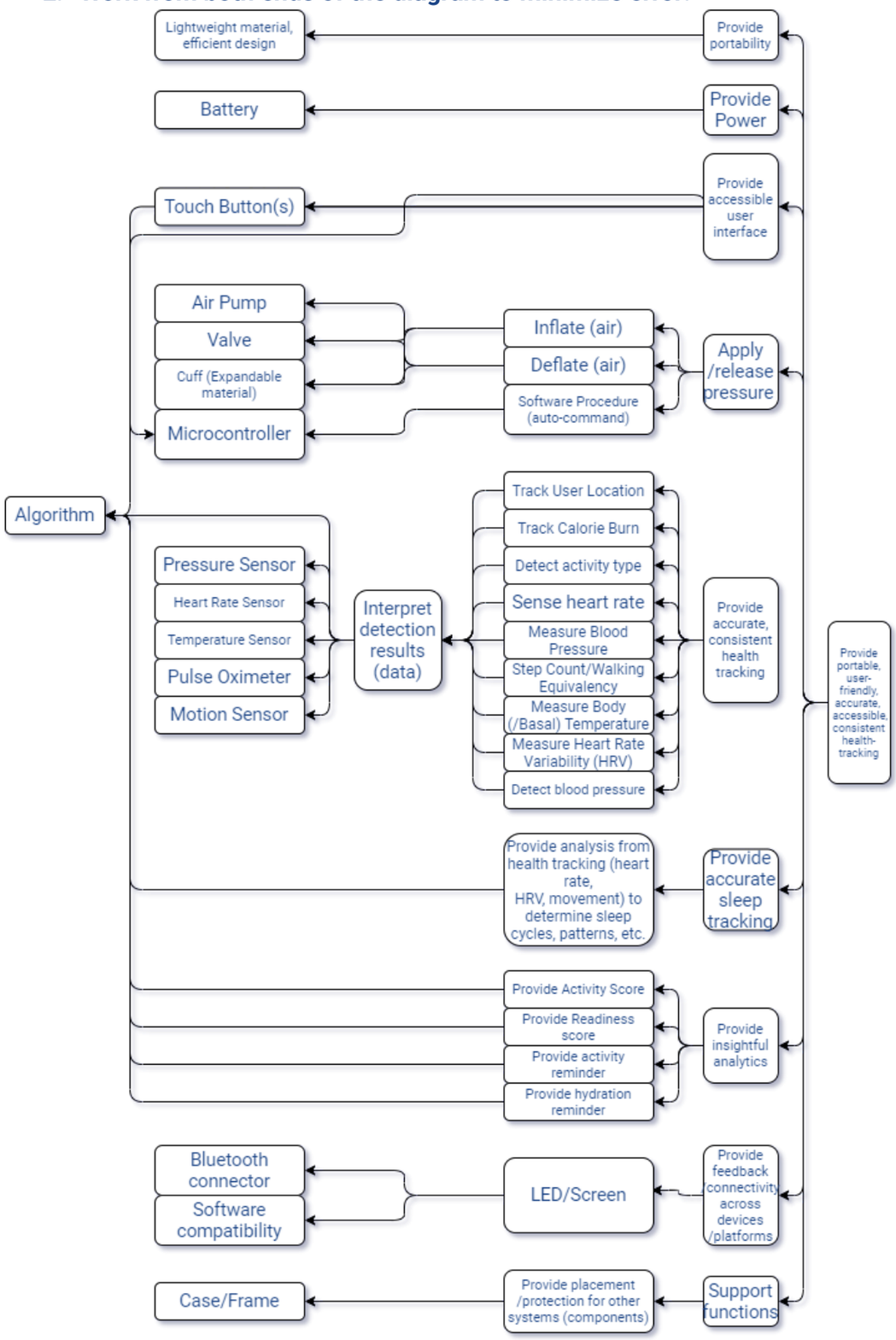
C. Main/primary function(s) for the system, place on the right-most:



D. Organize the FAST diagram with the "*WHYs?*" to the right and the "*HOWs*" to the left:



E. Work from both ends of the diagram to minimize error:



SPSP04 Check The Work

All work done in this section has been checked over with the previously completed phases as a reference as well as any outside sources. Everything appears to be correct and up to date with many revisions implemented. The analysis of different materials and technical specifications is consistent between products, both within our morphological matrices and when measured in the utility function.

SPSP05 Conclusions

Designing a product for customer consumption is a complex and detailed process. It is key to identify what is most important, especially when weighting your utility function, in order to provide the consumer with the most value (and ensure your success in the marketplace). Making accurate assessments of a variety of products can be boiled down to doing due diligence when it comes to research. You must know the competing products, what consumers want, and how to best implement these features appropriately.

Conclusions and Guidelines

Starting at the beginning of this project, we developed a series of product concepts for a variety of companies including Ford, GoPro, and Fitbit. From here we chose the top 3 products and went in depth with one general product idea. After selecting this one product, research was done to determine consumer needs, and then further analysis to match them to technical specifications and measurements. At the same time we dissected competing products to the senior health tracker in order to see how they operate on a technical level. From here we were able to design our house of quality which is what we used to decide what should be most emphasized in our various specific product concepts.

During the design stage of our product concepts we first built a morphological matrix that showed what possible options could be used for each technical function of a possible device. After these were built, detailed drawn designs of each product were put to paper in order to better show how a theoretical device would operate. After the product designs were visualized and matched with morphological matrices, each design was run through our custom utility function and found that the V-Band was our best product due to its high score.

This is where Phase 3 ended and the project as a whole concluded. The next steps would be to complete the development phase by undertaking a failure mode analysis and design for manufacturability analysis. After the development phase we move to the commercialization phase where the product is prepared for manufacturing and distribution. More will be discussed about the complexities of supply chain management in CSE171B Management of Technology II: Supply Chain Management.