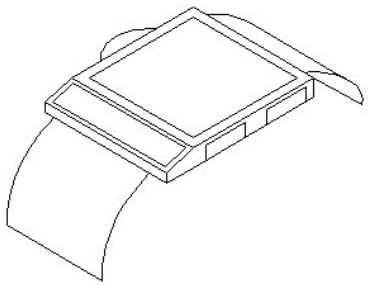
Sports Performance Monitor



A requirements elicitation & prototyping

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Elicitation Plan

The requirements elicitation method we have chosen to use is user interviews. This is the most practical method of elicitation given the busy schedule of us and our users. Our interviews will produce information similar to a scenario; however we are tailoring our questions to specific activities that could be benefited from our product. The following are the basis of the questions we will be asking our users to gain information about these activities as well as questions about usability and feature preferences of the performance monitor device we plan on developing.

Information to be Elicited from Users:

- Types of activities user engages in during users athletic hobbies
- Tools user uses to accomplish these activities
- Functions these tools provide the user
- Functions these tools are lacking
- Whether or not these lacking characteristics hinder performance
- Annoyances with tools/functions
- Size requirements
- Weight requirements
- Interface Complexity
- Material Requirements
- Form Factor requirements
- If the user neglects to mention a feature we are planning to provide in our product then we plan to obtain the users opinion on that feature as well as additional features we did not think of that user desires in a performance monitoring product.
- Whether or not the user would utilize any of the functions of the tools they currently use or the functions our tool may provide outside of their athletic hobbies.

Elicitation Questions
(Robert Pastel)

- What type of physical activities do you perform in?
  "Cross-Country Skiing, hiking, rollerblading and kayaking"

- What type of tools do you use during these activities?
  "For hiking I use GPS and a compass, for back country skiing I use GPS and a compass"

- Why do you use GPS?
  "I use GPS to mark locations along the way. I then use it to find my way back to my starting point and to gauge the distance traveled. I find the GPS bearing is inadequate at displaying my heading correctly so I use a traditional compass instead."

- What did tools you use before you used GPS?
  "Just used the a map, and my sense of the area"

- What are some of the current problems with GPS?
  "There are a plethora of problems actually. Too heavy. Too expensive. Slow response time from GPS unit, especially when moving. It doesn't have separate power buttons; the light button doubles as a power button. Cycling through the pages has forward and a backward, but should need 2 buttons; I would prefer a joystick style button. And it doesn't need all 5 pages to browse through"

- What GPS functions do you find necessary?
  "marking waypoints, going to waypoints, the compass, and distance to the next waypoint"

- What type of form factor would you like this performance monitor to have?
  "I don't like to wear watches, so I would like it to be something I could put in my pocket. I would like the batteries to be easily interchangeable. I have given up on wristwatches entirely. I would like its orientation to be distinguishable in my pocket."

- What type of weight requirements would you like the unit to have?
  "Not too heavy to be in my front shirt pocket or pants pocket, maybe weigh less then a small paperback book"

- What type of things would you expect in the units interface?
  ”Large display. Visible in low light, one button to perform most functions. Several screens with large numbers and limited amount of information displayed on screen.”

- What are some other functions you would like the unit to perform?
  ”Body temperature, air temperature, heart rate, and the current humidity”

- What type of materials would you like the unit to be made of?
  ”Plastic”

- Would you find an emergency broadcast function useful?
  “Yes”

- Would you find a weather function useful?
  ”yes. I would like it to display local pressure, expected time to rain, etc. and the expected temperature.”

- Would you find a PC link function very useful?
  ”Yes very. I would like to be able to configure the devices interface via the PC link software. As well as program the buttons”

- Given the list of features would you use this device outside of you activities?
  ”No”

Elicitation Questions
(Charles Wallace)

- What type of physical activities do you perform?
  “Running, Biking, and Cross-country skiing”

- What type of tools do you use when performing these activities?
  ”For running I use a watch, and for biking I use a little computer device that keeps track of my distance and my speed”

- What type of functions do these tools perform?
  ”The watch is used for timing(stopwatch), I also use it to gauge the distance I travel. For the bike computer it measure the distance I travel and the speed that I am traveling at”

- What functions are these tools lacking?
  “The watch is lacking the distance measuring feature”

- What type of size requirements would you have for this device?
  ”Probably 50% larger then my current watch”

- What kind of weight requirements would you expect this device to have?
  ”Light”

- What type of material would you like the device to be made of?
  ”Doesn’t matter to me”

- What type of form factor would you like this device to have?
  ”Doesn’t matter, anything would be fine, just small”

- Considering the devices you use now, what type of interface would you like this device to have?
  “A stopwatch that turns on and off easily. A light that turns on and off easily. A way to show the stop watch and regular time simultaneously would also be nice.”

- Would you find a GPS function useful?
  "What is GPS?”

- GPS tracks your location
  "I would find it useful because sometimes I get lost."

- What other features would you find useful?
  "A way to record my distance traveled."

- If the device had a detachable face would you use it to replace your bike computer?
  "If it had at least the functionality the bike computer has now."

- Given the list of features would you use this device outside of you activities?
  ”No, I would wear my current watch.”

Elicitation Results

The following are the results of our interviews. In parentheses after each statement is the number of users that gave that statement if it was more than 1.

Athletic Hobbies

- Cross Country Skiing (2)
- Biking
- Rollerblading
- Kayaking
- Hiking
- Running

Tools Used During Athletic Hobbies

- GPS
- Compass
- Bike Computer
- Digital Watch

Functions Tools Provide

GPS

- Waypoint Setting
- Waypoint Viewing
- Distance Between Waypoints

Compass

- Direction

Bike Computer

- Distance
- Speed

Digital Watch

- Stopwatch

Functions Tools are Lacking

GPS

- Adequate compass display

Digital Watch

- Distance

Whether or Not Lacking Characteristics Hinder Performance

No for all characteristics

Annoyances with Tools/Functions

GPS

- Too heavy
- Too expensive
- Slow response time
- Cumbersome waypoint naming

Digital Watch

- Cannot not show time and stopwatch simultaneously
- Stopwatch difficult to turn on and off
- Light difficult to turn on and off

Size Requirements

- Large screen
- Total diameter not greater than 1.5"

Weight Requirements

- Light

Interface Complexity

- Stopwatch on/off easily
- Light on/off easily
- Easy to show regular time and stopwatch simultaneously
- Large numbers/screens
- Few buttons

Material Requirements

- Molded plastic

Form Factor requirements

- Comfortable in hand and pocket
- Orientation easily distinguishable
- Easily changeable batteries

Use of Tools/Functions outside of hobbies

None

Additional Features Desired

- Weather
- Heart rate
- Body Temperature

Results Analysis
(Prototype development)

The following are the conclusions we have drawn from our user interviews as well as important elements of the physical and interface design.

Our user base is inconsistent. The only common athletic hobby among our user base is cross country skiing. As a result we will attempt to tailor the prototype device to several hobbies even though some users may or may not utilize the functionality as such.

The device should have the following features. The rationale for the features chosen was based on the availability of the information the features provide, the information we received from the users during the interviews as well as the cost of each feature.

- GPS (set waypoints without naming, distance between waypoints, compass)
- Current Speed
- Odometer
- Current Body Temp
- Current Heart rate
- Current Time
- Weather Forecast
- Stopwatch
- Light
- Power button
- Alarm
- Date

Physical Design

The device should be no larger than 2" in diameter and the screen should be large

The screen will be no greater than 2" but will be as close to 2" as possible while still being able to keep it water resistant and sufficiently protect it from damage during normal use.

The device should be comfortable in the hand and pocket

Because the device must be no greater than 2" in diameter, but also comfortable in the hand and pocket, the device will have an optional cradle that it can be snapped into. The optional cradle will be approximately 3" by 4" in size. Further user testing of the prototype will need to be conducted to find the optimal size.

The device should be light and be made of molded plastic

The device will be made of the lightest molded plastic material we can find that still matches our budget, water tightness and everyday use durability constraints.

The orientation of the device should be easily distinguishable

Finger grips will be molded into the aforementioned cradle

The device should have easily changeable batteries

The device will have a knurled screw on cap on the back to remove and replace the battery. The optional cradle will house a battery pack that is slid in and out of the back by pressing down on a tab.

The device should be able to be turned on or off

The device will be able to be turned on or off to conserve battery power. This will be accomplished through simultaneously pushing buttons.

Interface Design

The stopwatch should be easy to turn on/off

The user will navigate to the stopwatch function using the wheel and wheel button. The stopwatch will be turned on/off via one of the other buttons. The stopwatch will be cleared by pressing both buttons simultaneously

The light should be easy to turn on/off

The light will operate in 2 modes: By default any button press or turning of the wheel will turn on the light for a predefined period of time. The light can also be turned on indefinitely by pressing and holding the light button for a predetermined amount of time, and turned off in the same manner

The device should be able to display a stopwatch and the current time simultaneously

When the user chooses the stopwatch function from the menu of functions, the stopwatch will be displayed on the main screen and the current time will be displayed on the auxiliary screen (the smaller screen on the lower half of the device)

The device should have large numbers and screens

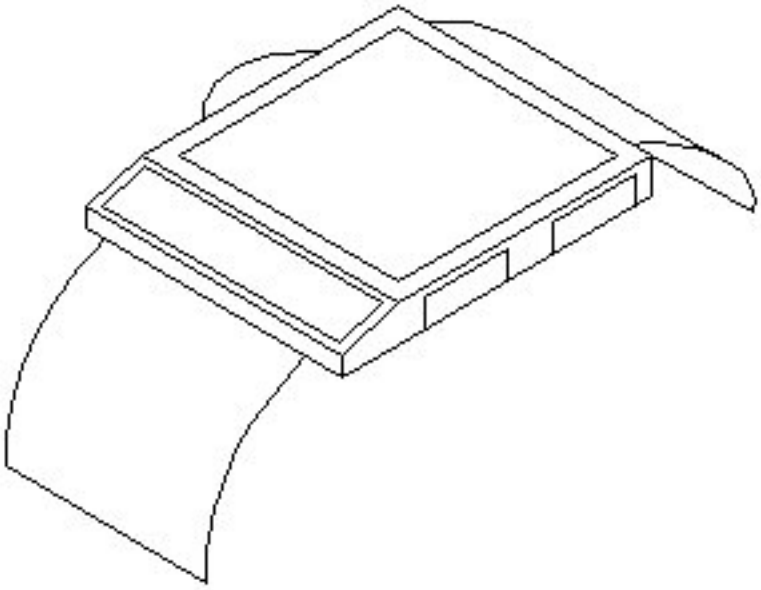
The information shown on the screen will be as large as possible while still maintaining a sufficient distance between data (the desired distance will be a function of further user testing once the prototype is developed)

The device should have few buttons

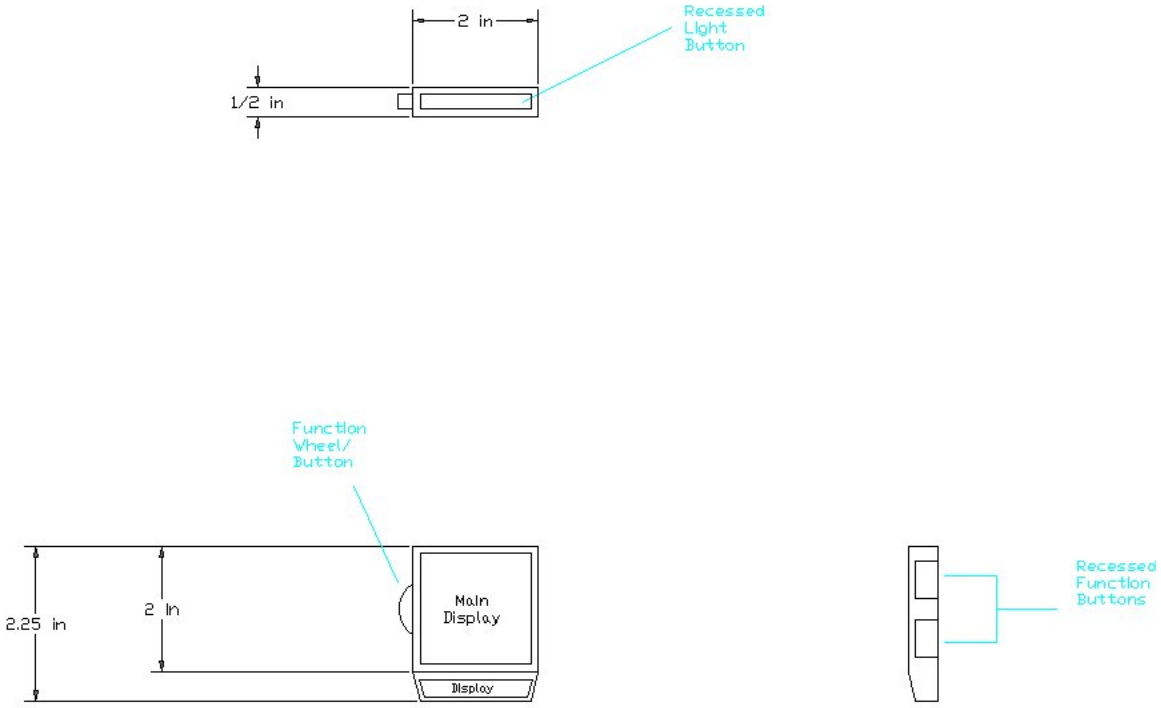
The device will have 2 buttons and a ratcheting scroll wheel which doubles as a button when pressed on (similar to a scroll mouse wheel)

Prototype Schematics

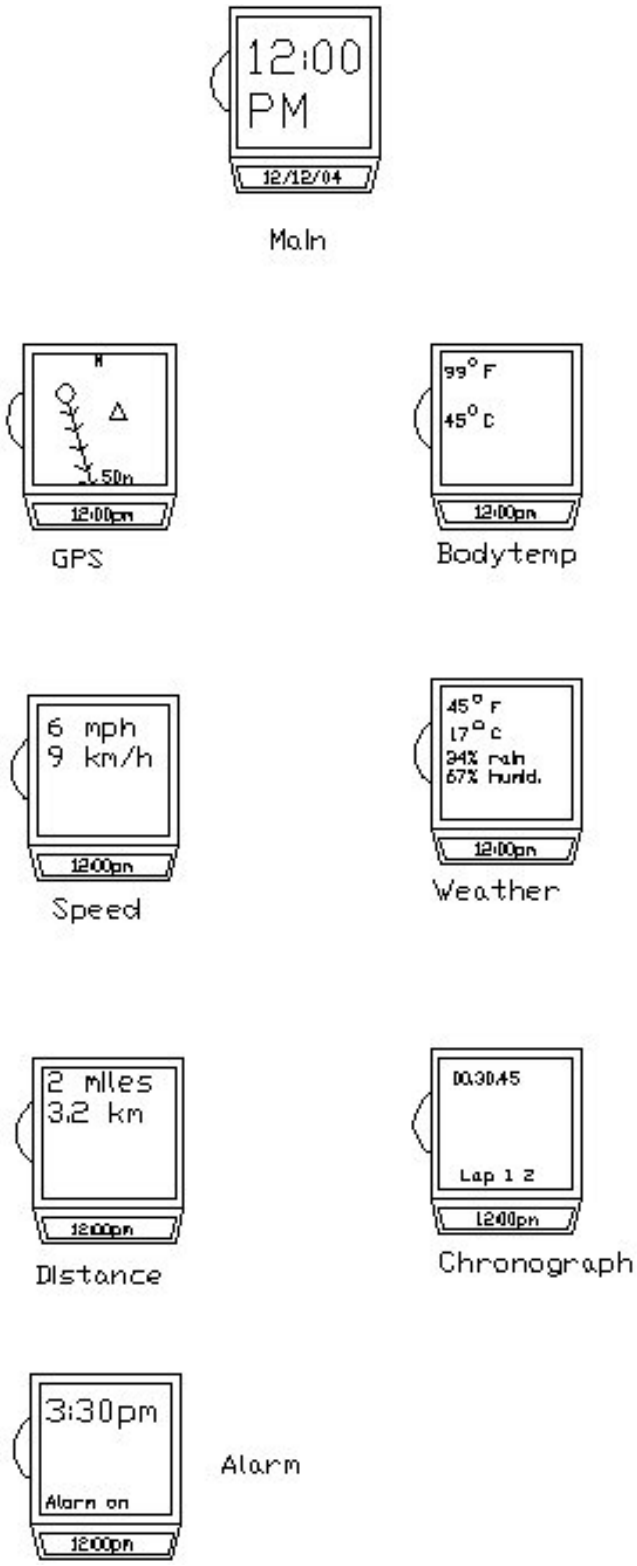
This is the physical design of the prototype in a pictorial view to better help understand the design of the performance monitor.



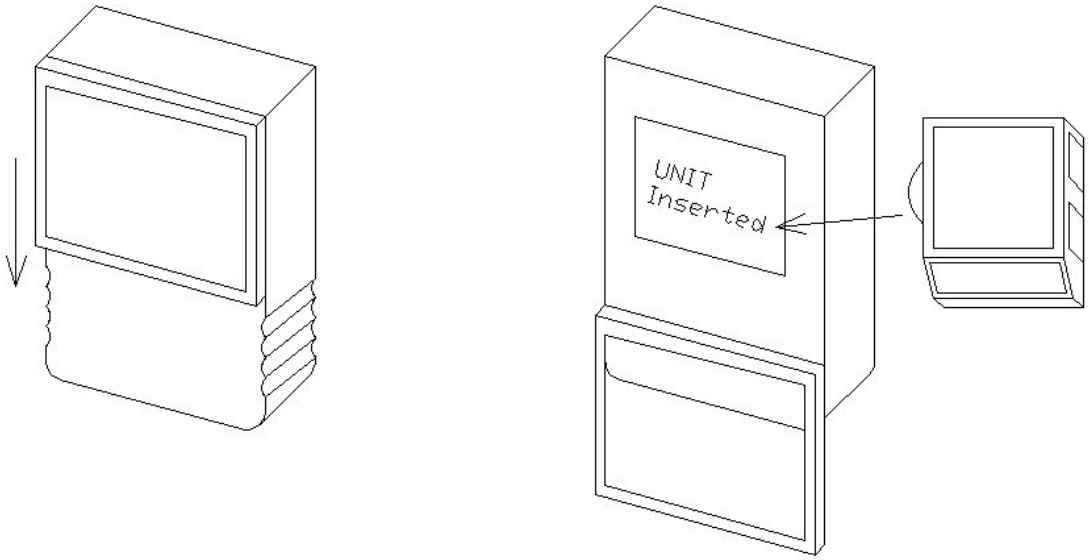
3-Dimensional view of the performance monitor



Orthographic view of the performance monitor

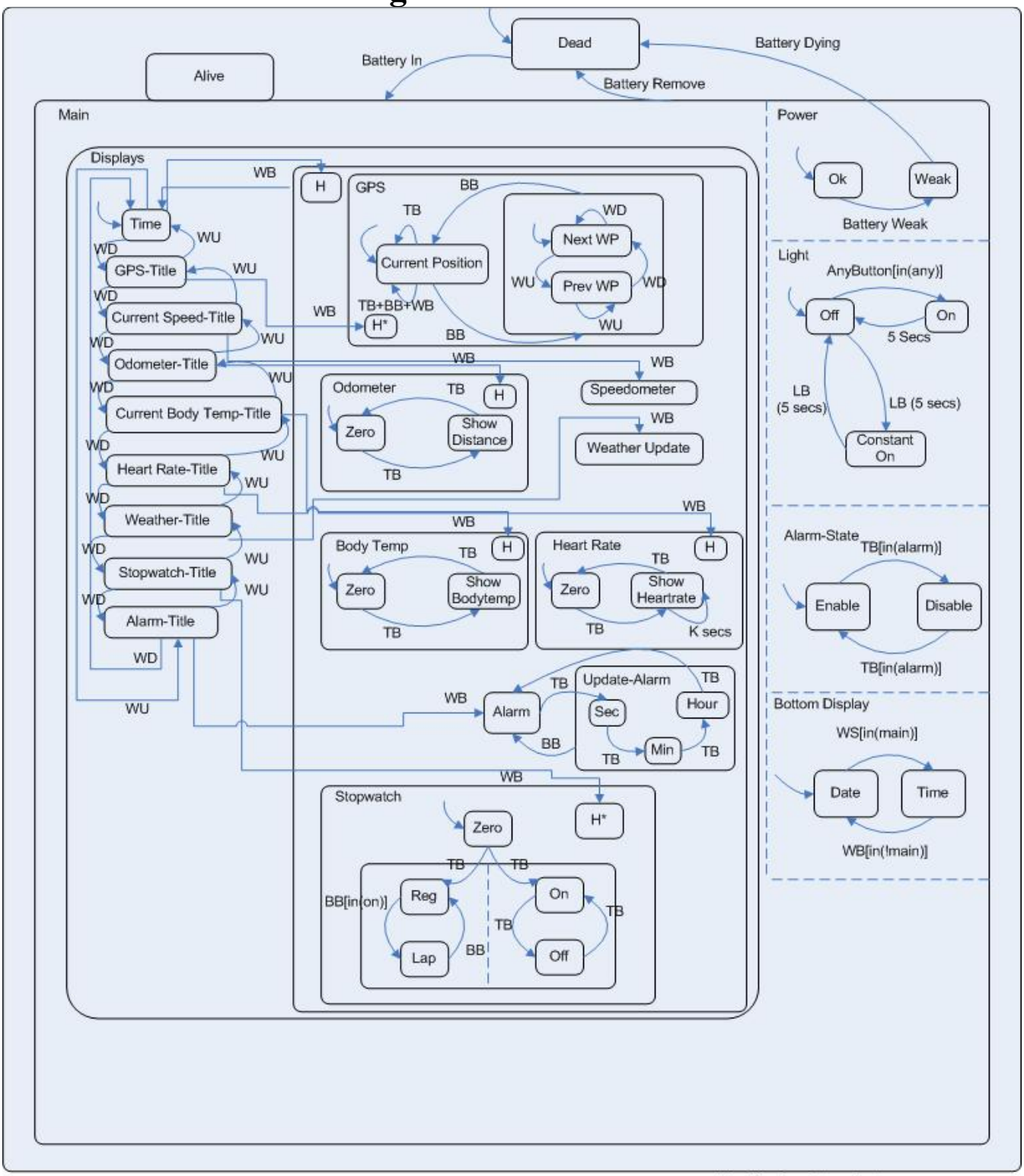


Screens (Menus) of the Performance Monitor



Cradle Housing (optional battery)
For performance monitor

Statechart Diagram for Performance Monitor



BB – Pressing bottom button
TB – Pressing top bottom
WS – Scrolling the wheel in either direction
WB – Pressing the wheel button
WU – Scrolling the wheel up
WD – Scrolling the wheel down

Statechart Diagram Description

Main State

This is where the monitor initially starts and returns to for most of the use. The main state displays the time on the big screen and displays the date on the small screen. From there the user can scroll the wheel up or down to change to the next state, which is denoted WU for a wheel up scroll, WD for a wheel down scroll, and WB for a wheel button press. Once a desired menu is listed on the screen the user can issue a wheel button press to enter that mode of the performance monitor; then issue a wheel button press once again to return to the main menu. If the user is at the main state and issues another wheel button press the state will change to the previous mode (such as GPS, weather, etc) that it was in.

GPS State

Once in the GPS state the display shows the user as a triangle. At the top of the screen the letter of your current compass orientation is displayed. A user can scroll through waypoint(s) by pressing the bottom button, denoted BB, to enter the scroll waypoint state. Once in the scroll waypoint state the user can scroll the wheel up to go to the previous waypoint and scroll the wheel down to go to the next waypoint. Then the user can press the bottom button once again to go back to set waypoint state. In the set waypoint state the user can press the top button, denoted TB, to set a waypoint at the current location. The nearest waypoint is displayed in relation to the user and is connected to the next waypoint with a vector containing arrows to denote the direction traveled to the next waypoint. Also the distance to the next waypoint is displayed on the screen. In the set waypoint mode the user can clear all the waypoints created by pressing the top button, bottom button, and wheel button simultaneously, denoted TB+BB+WB. The user can then press the wheel button to exit the GPS state. In the bottom screen the time is always displayed in this state.

Speed State

In the speed state the only thing that is displayed on the screen is the current speed which is obtained from the GPS information. The user can then press the wheel button to exit the Speed state. In the bottom screen the time is always displayed in this state.

Odometer State

In the odometer state the monitor the screen displays the current distance traveled in kilometers as well as miles. It initially starts at zero and once the user issues a top button press the odometer starts keeping track of distance updating the display. If the top button is pressed again the odometer is set back to zero. The user can then press the wheel button to exit the Odometer state. In the bottom screen the time is always displayed in this state.

Body Temp State

In the body temp state the only thing that is displayed on the screen is the user's current body temperature. Initially it is zero until the user issues a top button press to start the body temperature sampling. If the top button is pressed again, the display back to zero. The user can then press the wheel button to exit the Body Temp state. In the bottom screen the time is always displayed in this state.

Heart rate State

In the heart rate state the only thing that is displayed on the screen is the user's current heart rate. Initially it is zero until the user issues a top button press to start the heart rate sampling. If the top button is pressed again, the display back to zero. The user can then press the wheel button to exit the Heart rate state. In the bottom screen the time is always displayed in this state.

Weather State

In the weather state the display contains the current temperature in degrees Celsius and Fahrenheit, the percent chance of a weather condition such as rain or snow, and the humidity, all which is obtained from the GPS information. The user can then press the wheel button to exit the weather state. In the bottom screen the time is always displayed in this state.

Stopwatch State

The stopwatch initially displays zero once the users issues a top button press the monitor starts counting the time. If the bottom button is pressed while the time is counting the lap time is saved and displayed on the screen. If the bottom button is pressed the lap is reset. If the top button is pressed while it is counting the counter will stop. The user can then press the wheel button to exit the stopwatch state. In the bottom screen the time is always displayed in this state.

Alarm State

In the alarm state if the top button is pressed it will enable the alarm and if pressed again it will disable the alarm. To update the alarm you press the bottom button, and then press the top button to update the each category of the alarm (hours, min, and sec). And press the bottom button to exit to the standard alarm state. The user can then press the wheel button to exit the alarm state. In the bottom screen the time is always displayed in this state.

Bottom Display State

The time is displayed any time you are in any state and a wheel scroll is issued. The date is displayed only in the main state

Light State

If any button is pressed the light will turn on for 5 seconds. If the light button, denoted LB, is pressed and held for 5 seconds then the light will stay in constant mode. If the light button is pressed and held again for another 5 seconds then the light will turn off again.

Power State

If the battery is weak then the system will die.

Conclusion

The information elicited from the users was helped to model this sports performance monitor. Although is hard to predict the market impact with an item such as this, we believe it would serve itself to be very useful as a sports performance monitor. As we have learned, one user of the device can vary quite a bit to another user as well as the features that the users will use. You can never have a product that would satisfy every user's needs because trade-offs arise such as functionality with complexity, and size requirements with features to say the least. But we have learned through this project that a mean has to be developed when designed a product. For example Dr. Pastel hates to wear things on his wrist to we had to include a cradle in which the user can put the device into to carry around as well as extend battery life. With our feature set, a price of around $70 seems to be very acceptable. With the current rate that integrated circuits are shrinking, advancements in power storage and complexity of software are going it is very viable to see a product like within the market in few years, maybe with even many more features than we have included in our product.