IDEAS GENERATION

**Idea 1: Open circuit board design**

The initial idea involves a simple yet very affordable approach. The design incorporates an exposed printed circuit board that would be custom made by a CNC engraver printer. This would allow for a single board as opposed to multiple boards being stacked on top of one another.

Possible features to include:

- Headphones.
- Solar panel (for battery power regeneration).
- LED indicators for breathing (anxiety coping technique).
- Vibrating motor.
- Panic button and user interface buttons.

The exposed circuit board approach requires protection from the elements as seen in this example.

This design would use an LED matrix for displaying the time. LED matrixes are very power efficient and quite simple to program.
Project Development and Realisation ---- Evidence of Creativity (Ideas Generation)

Idea 1 (continued): Components and Circuit schematic:

Potential Circuit components:

- Atmega 328p microcontroller: The brains of the watch, responsible for processing inputs and outputs.
- Bubble LED matrix.
- Lithium Polymer battery (500 mah, 3.7volts.)
- Headphones.
- Surface mount light emitting diodes (lights).
- Transistor (used to power motor).
- Resistors
- Current blocking diodes
- Power boosting circuitry
- Capacitors
- Solar Panel (small calculator solar panel size)
- Pulse sensor (heart rate)
**Project Development and Realisation ---- Evidence of Creativity (Ideas Generation)**

**Idea 1 (continued): Anxiety/panic detection and coping mechanism:**

My first idea had a very simple one way method of helping the user deal with their panic attack.

Breathing is perhaps one of the most effective ways to deal with a panic attack. A lot of the symptoms of a panic attack including dizziness and light-headedness are caused by hyperventilation, however there are many more methods used to deal with panic attacks, which this design cannot provide.

**Evaluation:** This design is one of the simplest methods of dealing with panic attacks. However, it only offers the user one method of dealing with their anxiety, which is the major flaw in the idea. From personal experience and professional advice you need a whole host of techniques in-order to effectively deal with a panic attack, if one technique isn’t working you need to try others until the panic has dissipated. Another technical issue surrounding this design is the incorporation of audio that allows the user to put on headphones and be guided through the breathing exercise. This is a very challenging task, as it requires the use of an audio playback circuit which can be very difficult to program and requires a lot of power. The design also requires the use of a CNC engraver printer, this is a difficult procedure as extensive knowledge in circuit design and layout is required.

**Further Action:** For the reasons above I have decided to use an OLED (organic light emitting diode) screen instead of lights and audio for displaying the anxiety/panic coping techniques as it will provide the user with more than one technique. Also I have decided to not use the custom open circuit design as it is difficult to produce and it can also lead to corrosion since the components are exposed to the elements.
Idea 2: Rectangular design

This design incorporates an OLED (organic light-emitting diode) screen which projects various information, including time, body temperature, heart rate and anxiety/panic coping techniques. The design is much more user friendly than the first idea, as it allows the user to take full control of the device through the use of user buttons on the side of the watch. The screen allows for multiple anxiety coping techniques to be utilized. If the user is experiencing a panic attack he/she can press the ‘panic button’ which then initiates the first program, if the first technique does not work and panic still persists then the user can press the panic button again and the next technique will be projected onto the screen, this will continue until the panic has dissipated.
Idea 2 (continued): Components/design layout/circuit schematic/design influences

An RGB LED is a red, green and blue LED all in one. These LEDs combine all three primary colours to create thousands of different hues of light. In this design I propose to use an RGB LED to project the user’s current heart rate. This will be useful as it will subtly prompt the user that a panic attack may be coming and thus draw less attention to the panic sufferer. A blue colour will indicate that the heart rate is normal, whilst red indicates that it is fast.
Idea 2 (continued): Components/design layout/circuit schematic/design influences

The positioning of the heart rate sensor was influenced by other watch designs, such as the ID107 smart wristband watch (pictured above).

The heart rate sensor operates using Pulse oximetry, which is a noninvasive photo-based technique to measure heart rate.

The CAD back view showcases slots for the heart rate and temperature sensors.

Underside of watch, showcasing the heart rate sensor and temperature sensor.

LED transmitter and photon detector. This part of the sensor will need to face down on the wrist.

An example of a heart rate sensor (Sparkfun® MAX 30105 particle sensor).

Image from Sparkfun.com
Project Development and Realisation ---- Evidence of Creativity (Ideas Generation)

Idea 2 (continued): Software layout

Firmware/software Flowchart: This flowchart demonstrates how the watches’ software could possibly operate, each block represents what the watch will display on its screen.

Evaluation: This approach is far more complicated than the first idea, most importantly it offers multiple anti-anxiety techniques which would allow the user to try different techniques to remove their panic and thus would be more effective. Therefore this approach to the software will be utilised in the final design. I will now need to research the most effective anti-anxiety techniques as to allow for a wide range of different techniques to be programmed into the watch. I will also look further into possibly connecting the watch online.
**Project Development and Realisation ---- Evidence of Creativity (Ideas Generation)**

**Idea 3:** Curved watch design (Final design)

The third design concept incorporates a curved rectangular shape whilst still using all of the same electronics mentioned in the 2\textsuperscript{nd} idea. This shape aims to improve comfort and also improve on the aesthetic qualities of the watch. The previous design lacked comfort since its sharp rectangular edges cut into the wrist, this design will solve this problem. This design also incorporates new features including:

- Slots for ‘status’ LEDs (lights) which will showcase the battery level of the watch and the heart rate of the user.
- Extended section for the heart rate sensor which will press up against the wrist to maintain skin contact and thus allowing for accurate readings.
**Features/improvements:**

**Status LEDs**

Solidworks CAD of watch with circuit board and RGB LEDs.

- This design utilises micro RGB (Red, Green & blue) LED lights as opposed to the last design which used full sized LEDs. This allows for much more space and thus 2 status lights can be used as opposed to one.
- **Heart rate RGB:** Changes colour in relation to heart rate (as explained in idea 2)
- **Battery level RGB:** Displays real time battery level using different colours to represent the current battery level.
  - Green = Full
  - Blue = Half
  - Red = empty

**Heart rate sensor**

- The extended space under the watch allows for the heart rate sensor to press firmly up against the user’s wrist. The last design simply incorporated a small hole for the heart rate sensor and did not have good contact. On-top of this the extended space allows for more room for the circuitry. The extension also has rounded edges as to improve comfort levels.
- The space is designed to fit the Sparkfun MAX30105 heart rate sensor (right).
**Project Development and Realisation ---- Evidence of Creativity (Ideas Generation)**

**Wrist band joint design:**
The wrist band joint is a critical design aspect of my watch. To ensure that I created the most aesthetically pleasing and functional wrist band joint I went through a variety of renditions.

**Design 1: Simple square blocks**

The first design approach involved two simple square blocks with 1mm holes. The pins of the wrist band can simply click onto each side and attach the band.

**Evaluation:**

| Aesthetics | 4/10 |
| Functionality | 9/10 |

**Design 2: Curved hole**

The second design was an attempt to improve aesthetics. The design includes a seamless transition curving into the wrist band joint.

**Evaluation:**

| Aesthetics | 6/10 |
| Functionality | 7/10 |

**Design 3: Curved side slots**

The final design includes features from both the first and second designs. The sides are curved as to improve aesthetics and there is a small slot for the wrist band to sit in.

**Evaluation:**

| Aesthetics | 8/10 |
| Functionality | 9/10 |

**Evaluation:** I have decided to go with this design incorporating a curved watch case. Out of all the designs explored the curved watch approach seems to be the most effective both aesthetically and functionally. I will also use the 3rd design for the wrist band joint design. The design will now need to be tested for durability and functionality this will be completed in the design testing stage.
**Project Development and Realisation --- Evidence of Creativity (degree of difference & exploration of existing ideas)**

**Degree of Difference**

Something in common with all of these current existing technologies is that they do not provide the user with coping strategies and instructions on how to deal with their panic/anxiety attack. All of these devices listed are very good at monitoring the symptoms of a panic attack however from personal experience and from professional advice from psychologists, the only way to lower the severity of a panic attack is to sit with the symptoms and using your breathing and mindfulness strategies deal with the panic attack. Monitoring is very useful for both the user and their psychologist, however personally applying anti-anxiety techniques whilst experiencing a panic attack is perhaps the best non-drug related method of dealing with anxiety and panic disorder. My device will set out to do just that.

All of the pre-existing technologies are also expensive, thus making such devices out of reach for many people.

My project will focus on exposure. One of the most efficient ways of dealing with anxiety is to not respond to the ‘fight or flight’ response. That is, if you are experiencing a panic attack you need to stay in the environment in which the panic occurred and using your techniques (given to you on the watch) wait until the panic lowers down to a stable level. This ensures that if the user goes back to the same environment in the future their anxiety levels will be much lower.

**How my Device will differ from existing ideas: (Degree of difference)**

- **User has Panic attack** (determined by heart rate or a button).
- **Existing Method:** Send detailed biometric data to phone or computer.
- **My Method:** Vibrate watch, subtly notifying user of a panic attack.
- **Encourage user to stay in his/her environment.** (Message on screen).
- **Begin Anxiety/Panic coping techniques (breathing/mindfulness).**
- **My method as opposed to current existing methods will encourage the user to stay put, and deal with their panic using medically approved anxiety coping techniques. Much like dealing with other fears, by exposure.**