

Wearable Device for the Management of Panic Attacks



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Problem

Panic attacks can be embarrassing and disruptive.

Those who suffer frequent panic attacks need a way to subtly monitor and manage these episodes. Symptoms of a panic attack include: heart palpitations, accelerated heart rate, sweating, trembling, abnormal breathing, chest pain or discomfort, nausea, dizziness, or fear of dying.

Solution

A discreet wearable will provide insight and help guide the wearer through an attack.

A wearable biofeedback device with discreet built-in sensors can help manage embarrassing, recurring panic attacks. The device will provide ambulatory monitoring and real-time analysis of biometric signals, comparing features of this data to known panic attack symptoms to detect an episode, and immediately intervene.

Design Requirements

1. Data Collection

Sensors continuously collect biometric data that is then relayed to the central processing unit.

2. Data Analysis

Sensor data is compiled, stored, and compared to the user's normal vital signs to detect a panic attack. Information from the main sensors (heart rate, respiration, skin conductance level) are cross-referenced with the control sensors (thermometer, IMU, microphone) to remove false positives. With the decision algorithm shown below, the system decides how and when to initiate intervention protocols.

3. User Feedback and Intervention

Once a panic attack is detected, the user interacts with the wearable both through mindful breathing techniques prompted by vibrational motors and a smart phone application. The system will continue to monitor, update, and adjust the protocols to ensure the user is responding well throughout the episode.

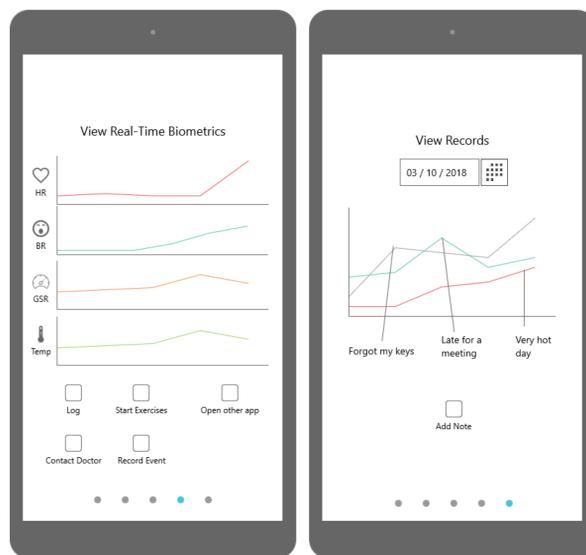
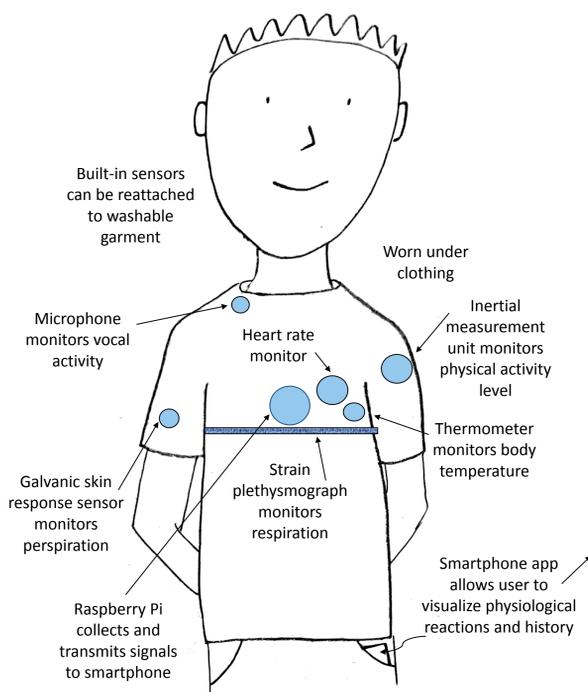
Hardware

- Heart Rate Sensor
Detects elevated heart rate caused by stress
- Strain Plethysmograph
Measures breathing rate and volume
- Galvanic Skin Response Sensor
Detects sudden and intense changes in emotion
- Inertial Measurement Unit
Detects physical activity as a control for false positives
- Raspberry Pi 2 Model B
Collects and analyzes data from the wearable device
- Vibration Motor
Guides the user through breathing exercises

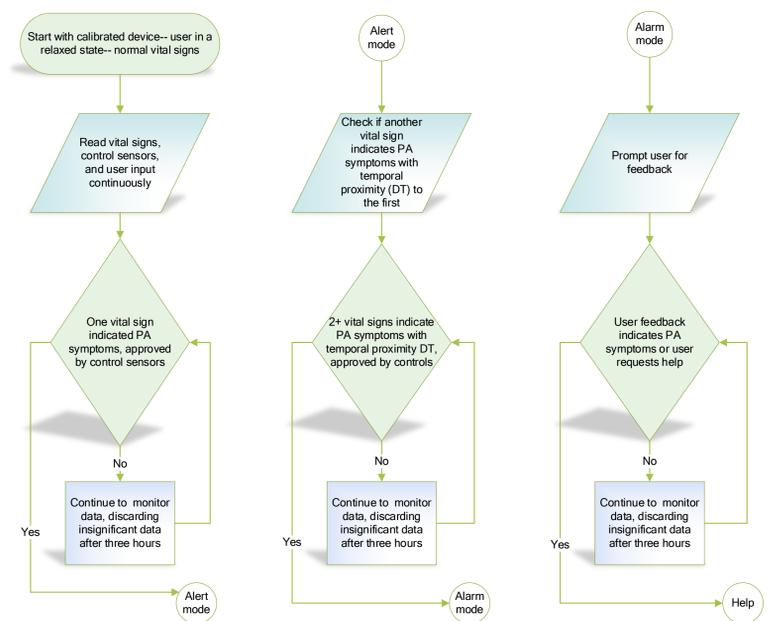
Control Signal	Abnormal Biometric Signal		
	HR	Respiration	GSR
IMU	Increased heart rate due to activity	Increased respiration due to activity	Increased skin conductance level due to sweat
Temperature			Increased skin conductance level due to heat
Voice Sensor		Increased respiration volume and rate due to speaking	

False Positive Indicator Color Code
Primary
Secondary
No correlation

Design Overview



Smartphone App Mockup



System Diagram

Conclusion

A panic attack is an obstruction to normal daily life that is difficult to live with. Through the use of a wearable panic attack management device, users are able to live relatively normal lives, free from stressful, embarrassing panic attacks. Long-term sensor data records and self-reported symptom history will allow users to understand and manage their unique physiological reactions and discover patterns related to their episodes. Biometric data and records of panic attacks will also provide useful information about a patient to healthcare providers.

Ethics Statement: Our team used only open-source and legally obtained software for the production of this project.