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# User Experience Challenges in Real-Time Panic Attack Detection Systems

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## ABSTRACT

The advent of real-time panic attack detection systems represents a significant advancement in the realm of mental health support technologies, offering the potential to provide timely interventions and improve patient outcomes. However, the integration of these systems into everyday life is fraught with intricate user experience challenges that must be addressed to ensure their efficacy and user acceptance. This paper explores these challenges through a comprehensive analysis of the interaction dynamics between users and panic attack detection devices, focusing on aspects such as usability, accessibility, and the psychological impact of continuous monitoring.

Central to the user experience challenge is the balance between system sensitivity and specificity, which directly influences user trust and system reliability. Excessive false positives can lead to user frustration and desensitization, potentially diminishing the perceived value of the system. Conversely, false negatives pose a risk to user safety, raising ethical considerations regarding the technology's deployment. The paper examines these trade-offs and discusses the implications for system design, emphasizing the need for adaptive algorithms that can calibrate to individual user profiles over time.

Moreover, privacy concerns are paramount in the deployment of real-time monitoring systems. Users may be reluctant to adopt technologies that require extensive data collection, fearing breaches of confidentiality and misuse of sensitive information. This study evaluates the current landscape of data security measures and proposes frameworks for enhancing user trust through transparent data handling practices and robust security protocols. Finally, the paper considers the psychological effects of continuous monitoring on users, pondering whether such technologies might inadvertently exacerbate anxiety symptoms. It is imperative that these systems are designed not only to detect panic attacks but also to provide a sense of empowerment and reassurance to users. By addressing these user experience challenges, the paper aims to contribute to the development of more effective and user-friendly real-time panic attack detection systems, ultimately supporting broader efforts in mental health care innovation.

## 1. Introduction

The development of real-time panic attack detection systems represents a significant advancement in the intersection of mental health and technology. These systems aim to provide timely intervention and support to individuals experiencing panic attacks, thereby reducing the potential for distress and facilitating prompt care. Panic attacks, characterized by sudden and intense episodes of fear and physiological arousal, can have profound impacts on an individual's daily functioning and overall well-being. The integration of wearable technology and sophisticated algorithms for real-time detection offers a promising avenue for enhancing mental health care [3, 12].

Despite the technological promise, user experience (UX) challenges remain a critical hurdle in the widespread adoption and efficacy of these systems. The effectiveness of panic attack detection systems hinges not only on their technical accuracy but also on their acceptance and usability by end-users. Issues such as device comfort, data privacy, and the interpretation of alerts are essential components of UX that can significantly influence user compliance and trust [8, 13]. This paper explores these UX challenges, aiming to illuminate areas for improvement and innovation within the field.

### 1.1. Understanding Panic Attack Detection Systems

Panic attack detection systems are designed to monitor physiological indicators such as heart rate, skin conductance, and respiratory patterns, employing algorithms to identify the onset of a panic attack [5]. These systems often utilize wearable devices, which provide continuous data streams that are analyzed in real-time. The algorithms employed must be sophisticated enough to differentiate between panic attack symptoms and other physiological states, such as exercise or stress, to minimize false positives and negatives [1, 10].

The accuracy of these systems is paramount, as incorrect detection can lead to unnecessary anxiety or a lack of trust in the device. However, high accuracy alone does not guarantee user satisfaction or adherence. The systems must be perceived as reliable and beneficial by users, which depends on a seamless integration into daily life that respects user privacy and comfort [11].

### 1.2. User Experience and Device Comfort

A primary challenge in the design of panic attack detection systems is ensuring device comfort. Wearable devices need to be unobtrusive and comfortable for prolonged use. Bulky or uncomfortable devices can deter usage, regardless of their technical capabilities

[4]. The choice of materials, the ergonomics of the device, and its aesthetic appeal are critical factors that influence user acceptance. Research indicates that even minor discomfort can lead to significant reductions in compliance, thereby impacting the system's effectiveness [7].

Moreover, the device's interface and ease of use are crucial to the user experience. Users must be able to interact with the system intuitively, with clear instructions and support available. Complex interfaces or difficult-to-understand feedback can result in frustration and device abandonment [9].

### 1.3. Privacy Concerns in Real-Time Monitoring

Real-time monitoring systems inherently raise significant privacy concerns, especially when dealing with sensitive health data. Users must trust that their data is securely stored and only used for intended purposes [2]. Transparency in data usage and robust security measures are essential to building this trust. The fear of data breaches or misuse can prevent users from engaging with these technologies, regardless of their potential benefits [6].

Legal and ethical considerations also play a role in addressing privacy concerns. Developers must navigate complex regulations and ethical standards to ensure compliance and protect user rights. This requires ongoing dialogue between technologists, ethicists, and legal experts to develop frameworks that safeguard privacy without stifling innovation [3].

### 1.4. Interpreting Alerts and User Trust

The interpretation of system alerts is another critical area influencing user experience. Users need to trust that alerts are accurate and that the system will notify them appropriately without causing undue alarm or complacency. Clear communication of alerts, including their significance and recommended actions, is crucial [12]. Systems that provide context and actionable advice tend to foster greater user trust and engagement [8].

To enhance trust, user feedback should be integrated into the development and refinement of detection systems. By involving end-users in the design process, developers can better understand user needs and preferences, leading to more effective and user-friendly solutions [13].

In conclusion, while real-time panic attack detection systems hold great promise for improving mental health care, addressing UX challenges is essential for their success. By focusing on device comfort, privacy concerns, and the clarity of system alerts, developers can create more effective and widely accepted solutions that genuinely enhance user well-being.

## 2. Related Work

The rapid advancement of technology in recent years has led to the development of novel systems aimed at detecting and managing panic attacks in real-time. These systems, often leveraging wearable devices and mobile applications, promise significant improvements in mental health care by offering timely interventions. However, the user experience (UX) challenges involved in the development and deployment of these systems are complex and multifaceted. This section reviews the existing literature related to the user experience challenges in real-time panic attack detection systems, aiming to highlight key findings and identify gaps in current research.

The literature on panic attack detection systems is burgeoning, with many studies focusing on the technical aspects of these systems, such as algorithms for detection accuracy and sensor integration. Nonetheless, the user experience, which is critical for the widespread adoption and effectiveness of these systems, has not been as thoroughly explored. User experience encompasses several dimensions, including usability, user satisfaction, and the emotional impact of system interactions, all of which directly influence the utility and acceptance of panic attack detection systems [3, 12].

### 2.1. User Interface Design and Usability

The design of user interfaces (UI) for panic attack detection systems plays a crucial role in ensuring user engagement and system efficacy. Studies have shown that intuitive and accessible UI designs significantly enhance the usability of these systems, thereby increasing user compliance and satisfaction [5, 8]. However, designing interfaces that are both functional and non-intrusive remains a challenge. The need for real-time feedback and alerts can lead to information overload, which may exacerbate anxiety rather than alleviate it [13]. Prior work suggests adopting minimalist design principles and ensuring that critical information is prioritized in user interfaces [9].

### 2.2. Wearable Device Integration

The integration of wearable devices into panic attack detection systems presents unique UX challenges. While wearables offer continuous monitoring capabilities, issues related to device comfort, battery life, and data privacy are significant barriers to user acceptance [1, 10]. The literature emphasizes the importance of designing wearables that are comfortable for long-term wear and have user-friendly interfaces that allow individuals to easily access and understand their data [11]. Moreover, transparency in data handling and robust privacy measures are critical to building user trust [4].

### 2.3. Emotional and Cognitive Considerations

Panic attack detection systems must account for the psychological state of users, which can vary significantly during anxiety episodes. The literature highlights the importance of systems that can adapt to the emotional and cognitive needs of users, providing tailored interventions that are both effective and comforting [2, 7]. Emotional design theories propose that systems should engage users emotionally and cognitively, providing reassurance and support rather than merely functioning as monitoring tools [6].

### 2.4. Longitudinal User Studies

Long-term user studies are essential to understand the ongoing impact of panic attack detection systems on user experience. However, such studies are relatively scarce in the literature. Existing research often focuses on short-term usability testing, which may not capture the full spectrum of user experiences over time [5]. Longitudinal studies could offer insights into user adaptation, the sustainability of system use, and the long-term psychological effects of relying on such technology for mental health management [10].

In conclusion, while significant progress has been made in the technical development of panic attack detection systems, the user experience challenges remain an area ripe for further exploration. Addressing these challenges is critical to the success and acceptance of these systems, necessitating a comprehensive approach that incorporates user-centered design principles and robust empirical research.

## 3. Methodology

The methodology employed in this study is pivotal to understanding the user experience challenges associated with real-time panic attack detection systems. This section delineates the research design, participant selection, data collection techniques, and analysis methods utilized in this investigation. Given the complexity and sensitivity of detecting panic attacks in real time, the research framework is structured to ensure robustness, reliability, and ethical integrity.

The study is anchored on a mixed-methods approach, combining qualitative and quantitative strategies to capture the multifaceted nature of user experiences with panic attack detection technology. This dual approach allows for a comprehensive understanding of both the subjective experiences of users and the objective performance metrics of the detection systems. Previous literature underscores the importance of mixed-method approaches in user experience research, particularly in health technology applications [3, 5, 9].

### 3.1. Research Design

The research design is structured to evaluate user interactions with real-time panic attack detection systems across multiple dimensions. A longitudinal study format is adopted to observe user experiences over an extended period, allowing for the identification of both immediate and long-term challenges. This design choice is informed by prior studies which highlight the evolving nature of user interactions with health technologies [7, 13].

### 3.2. Participant Selection

Participants were recruited from a diverse demographic pool to ensure the generalizability of the findings. The selection criteria included individuals diagnosed with panic disorder, as identified by healthcare professionals, and who have used or are currently using real-time panic attack detection systems. The sample size was determined based on statistical power analysis to ensure adequate representation and validity of results, in line with methodologies suggested by Johnson and colleagues [12].

### 3.3. Data Collection Techniques

Data collection involved both self-reported measures and system-generated data. Participants were asked to complete detailed questionnaires and participate in interviews to elicit insights into their experiences, perceived usefulness, and challenges faced while using the systems. Concurrently, user interaction data was collected from the detection systems to provide objective metrics on system performance and user engagement. This approach aligns with the recommendations of Robinson et al., who advocate for the integration of qualitative and quantitative data to enhance research depth [10].

### 3.4. Data Analysis

The data analysis process was bifurcated into qualitative and quantitative streams. For qualitative data, thematic analysis was employed to identify recurring themes and patterns in user experiences, utilizing the framework established by Braun and Clarke [8]. Quantitative data were analyzed using statistical software to conduct descriptive and inferential statistics, focusing on metrics such as detection accuracy, false positives, and user adherence rates. This dual analysis ensures a holistic understanding of the data, as emphasized by Anderson and Martinez in their respective studies [4, 7].

### 3.5. Ethical Considerations

Ethical considerations were paramount in this study, given the sensitive nature of mental health data. Informed consent was obtained from all participants, with

assurances of confidentiality and the right to withdraw from the study at any point. The research protocol was reviewed and approved by an institutional review board, ensuring compliance with ethical standards in research involving human participants [2, 11].

In conclusion, the methodology outlined in this study is designed to comprehensively address the user experience challenges in real-time panic attack detection systems. By integrating diverse data sources and employing rigorous analytical techniques, this research aims to contribute meaningfully to the existing body of literature on health technology user experience [6].

## 4. Results

The investigation into user experience challenges within real-time panic attack detection systems reveals a complex landscape, where the integration of technology and human factors is paramount. As these systems become increasingly sophisticated, understanding user interaction and experience becomes crucial to ensure both efficacy and user satisfaction. This section delineates the findings from our study, focusing on the primary user experience challenges identified, and situates these findings within the broader context of existing literature.

In recent years, there has been significant interest in developing wearable technologies and mobile applications capable of detecting panic attacks in real-time [3, 12]. These systems aim to provide timely interventions, thereby reducing the severity and duration of panic episodes [8]. Despite technological advances, user experience challenges remain a significant barrier to widespread adoption and effectiveness. Our study provides insights into these challenges, drawing from both quantitative data and qualitative feedback.

### 4.1. Accuracy and Reliability of Detection Systems

A critical challenge identified is the perceived accuracy and reliability of panic attack detection systems. Users often express skepticism about the system's ability to accurately detect panic attacks without false positives or negatives [5, 13]. Previous studies highlight similar concerns, noting that inaccurate detections can lead to unnecessary anxiety and distrust in the system [1]. Our findings indicate that users are particularly sensitive to false negatives, as these can result in missed opportunities for timely intervention.

To address these concerns, it is essential to enhance the algorithms underpinning these systems. Incorporating machine learning techniques and physiological data could improve detection accuracy [10]. Furthermore, transparent communication regarding the system's

limitations and the provision of user feedback loops can help build trust and improve user satisfaction [11].

## 4.2. User Interface and Usability

Another significant challenge pertains to the user interface and overall usability of panic attack detection systems. Our study found that users frequently struggle with complex interfaces and unclear instructions, which can be particularly problematic during high-stress situations [4]. Literature underscores the importance of intuitive design in enhancing user experience, especially in health-related applications where user stress levels are already elevated [7].

The integration of user-centered design principles is crucial to address these issues. Simplifying navigation and providing clear, concise instructions can enhance usability. Additionally, adaptive interfaces that cater to individual user preferences may further improve user experience [9].

## 4.3. Privacy and Data Security Concerns

Privacy and data security are paramount concerns highlighted by users. The sensitive nature of panic attack data necessitates stringent data protection measures to prevent unauthorized access and misuse [2]. Our findings reveal that users are hesitant to adopt these technologies due to fears of data breaches and lack of control over personal information [6].

Addressing these concerns requires a dual approach: implementing robust data encryption protocols and providing users with transparent data management policies. Educating users about how their data is collected, stored, and used can enhance trust and encourage adoption [3].

## 4.4. Integration with Existing Health Systems

The integration of panic attack detection systems with existing health systems remains a challenge. Users often encounter difficulties in synchronizing their data with healthcare providers, which can impede effective treatment planning [12]. The literature suggests that interoperability between new technologies and established health records is crucial for seamless user experience and improved health outcomes [8].

Developing standardized protocols that facilitate data sharing while maintaining privacy could enhance system integration. Collaborations between technology developers and healthcare professionals are essential to ensure these systems meet clinical requirements and user needs [13].

In conclusion, while real-time panic attack detection

systems hold great promise, significant user experience challenges must be addressed to realize their full potential. By focusing on accuracy, usability, privacy, and integration, developers can create systems that not only detect panic attacks effectively but also deliver a positive user experience. Future research should continue to explore these dimensions, guided by user feedback and technological advancements [1, 5].

## 5. Discussion

The advent of real-time panic attack detection systems represents a significant advancement in mental health care, offering the potential to provide timely intervention and support. However, the development and deployment of these systems face considerable user experience (UX) challenges that must be addressed to ensure their effectiveness and acceptance. The discussion of these challenges is pivotal, as it informs both the technical and human-centered aspects of system design. This section delves into the multifaceted UX issues associated with real-time panic attack detection systems, drawing from a rich body of literature to frame the discussion.

Real-time detection systems operate at the intersection of technology and personal well-being, requiring a delicate balance between accurate monitoring and user comfort. The ability of these systems to function unobtrusively, deliver timely alerts, and integrate seamlessly into users' lives is crucial. As such, the discussion encompasses various dimensions of UX challenges, including technological constraints, ethical considerations, and user engagement strategies.

### 5.1. Technological Constraints and Sensory Limitations

The performance of panic attack detection systems is inherently tied to the capabilities of the underlying technologies. These systems often rely on a combination of wearable devices, sensors, and data analysis algorithms to monitor physiological signals such as heart rate, skin conductance, and respiratory patterns [3, 12]. A critical challenge is ensuring the accuracy and reliability of these sensors under different conditions. Variability in sensor performance can lead to false positives or negatives, potentially affecting user trust and system credibility [8].

Moreover, the integration of multiple sensory inputs necessitates sophisticated data fusion techniques to provide real-time insights. The computational demands of processing large volumes of data in real-time can pose significant technical challenges, particularly in resource-constrained environments [13]. Additionally, ensuring the privacy and security of sensitive health data remains a paramount concern, requiring robust

encryption and data protection measures [5].

## 5.2. Ethical Considerations in User Monitoring

Real-time monitoring of physiological and behavioral data raises important ethical considerations. Users must be informed about the extent and nature of data collection, processing, and storage to make informed consent decisions [1]. Transparency in how data is used and the potential ramifications of data breaches are critical factors influencing user acceptance [10].

The intrusive nature of continuous monitoring also necessitates a discussion on user autonomy and consent. Users should have the ability to control the level and scope of monitoring, with options to pause or stop data collection when desired [11]. Ethical design principles should guide the development of these systems, ensuring that user rights and preferences are prioritized [4].

## 5.3. User Engagement and System Acceptance

For panic attack detection systems to be effective, they must be embraced by users. This requires a thoughtful approach to user engagement, encompassing both the design of user interfaces and the delivery of alerts and interventions [7]. Systems should be intuitive and user-friendly, minimizing the cognitive load and complexity associated with their use [9].

Moreover, the timing and manner of alerts play a crucial role in user experience. Alerts must be timely and actionable, providing users with clear guidance on how to respond to potential panic attacks [2]. Personalization of alerts and interventions, based on user preferences and historical data, can enhance user satisfaction and adherence [6].

In conclusion, addressing the user experience challenges in real-time panic attack detection systems requires an interdisciplinary approach that combines technical innovation with ethical and human-centered design principles. By focusing on technological robustness, ethical transparency, and user engagement, these systems can fulfill their promise of improving mental health outcomes and supporting individuals in managing panic attacks effectively.

## 6. Conclusion

The development and deployment of real-time panic attack detection systems represent a significant stride in the intersection of healthcare and technology. These systems have the potential to dramatically improve the quality of life for individuals prone to panic attacks by providing timely interventions. However, the user

experience (UX) challenges associated with these systems are both complex and multifaceted. This paper has explored these challenges in depth, identifying key areas that require attention from both researchers and practitioners to enhance system effectiveness and user acceptance.

The findings of this study underscore the importance of understanding user needs and preferences in the design and implementation of real-time panic attack detection systems. It is crucial to balance technological capabilities with human factors to ensure that these systems are not only functional but also user-friendly and accessible to those who need them most.

## 6.1. Technological and Design Implications

The technological framework of panic attack detection systems must prioritize user-centric design principles. As noted in previous studies [3, 12], effective UX design involves more than just interface aesthetics; it requires a deep understanding of user interactions and the context of use. Our research highlights that systems must be intuitive, minimizing cognitive load and avoiding overwhelming users with complex interfaces [8, 13].

Furthermore, the integration of machine learning algorithms that can accurately predict panic attacks in real-time is critical. These algorithms must be trained on diverse datasets to improve accuracy and reliability across different populations [1, 5]. The challenge lies in ensuring that these models are transparent and interpretable so that users can trust the system's outputs and predictions [10].

## 6.2. User Acceptance and Ethical Considerations

User acceptance is a pivotal factor in the success of panic attack detection systems. Prior research emphasizes the importance of trust and perceived usefulness in user adoption of health technologies [4, 11]. Our findings suggest that building trust requires addressing privacy concerns and ensuring data security, as users are more likely to engage with systems that safeguard their personal information [7, 9].

Ethical considerations also play a significant role in the deployment of these systems. It is imperative to ensure that the technology is equitable and accessible to all users, regardless of socioeconomic status or technological literacy [2]. Additionally, developers must consider the potential psychological impact of false positives and negatives, which could exacerbate anxiety rather than alleviate it [6].

### 6.3. Future Research Directions

The landscape of real-time panic attack detection systems is still evolving, and there are numerous avenues for future research. One promising direction is the exploration of multimodal data inputs, such as combining physiological signals with behavioral data, to enhance detection accuracy [3, 12]. Additionally, longitudinal studies are needed to assess the long-term effects of these systems on user mental health and well-being [8].

Another critical area for future investigation is the personalization of system interfaces and alerts. Personalized systems that adapt to individual user preferences and behaviors could significantly improve user engagement and satisfaction [5, 13]. Researchers should also explore the integration of feedback mechanisms that allow users to contribute to system improvements, fostering a collaborative relationship between technology and end-users [1].

In conclusion, while real-time panic attack detection systems hold great promise, achieving widespread adoption requires addressing the UX challenges highlighted in this paper. By focusing on user-centered design, ethical deployment, and continuous improvement through research, we can ensure that these systems provide meaningful support to those who need them most.

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