PANIC DISORDER DETECTION

Mini Project documentation submitted to

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In partial fulfilment of the requirements for the award of the degree of

BACHELOR OF TECHNOLOGY

In

COMPUTER SCIENCE AND ENGINEERING (DATA SCIENCE)

Submitted By

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CERTIFICATE OF COMPLETION

This is to certify that the UG Project Phase-1 entitled "**PANIC DISORDER DETECTION**"
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ABSTRACT

Panic disorder is a type of anxiety disorder characterized by recurrent and unexpected panic attacks. Panic attacks are intense episodes of fear or discomfort that usually reach their peak within minutes and are accompanied by physical symptoms such as rapid heartbeat, shortness of breath, chest pain, dizziness, and a sense of impending doom.

Detecting panic disorder involves recognizing the signs and symptoms of panic attacks and assessing their frequency and impact on an individual's life.

 Overall, the detection of panic disorder involves recognizing the symptoms of panic attacks, assessing their frequency and impact, and conducting a thorough evaluation by mental health professionals. Early detection and appropriate treatment can significantly improve the quality of life for individuals with panic disorder.

These attacks can cause significant distress and impairment in social, occupational, and other important areas of functioning. Despite its prevalence, panic disorder is often underdiagnosed or misdiagnosed due to the subjective nature of symptom reporting and the overlap of symptoms with other medical conditions.

There is a critical need for an objective, reliable, and accessible system for the early detection and accurate diagnosis of panic disorder. Such a system should leverage advanced technologies, including data analysis and machine learning, to overcome the limitations of current diagnostic methods.

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1.INTRODUCTION

1.1 OVERVIEW: -

Panic disorder is a type of anxiety disorder characterized by recurrent and unexpected panic attacks. Panic attacks are intense episodes of fear or discomfort that usually reach their peak within minutes and are accompanied by physical symptoms such as rapid heartbeat, shortness of breath, chest pain, dizziness, and a sense of impending doom.

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A person with panic disorder may experience symptoms such as severe feelings of terror, rapid breathing, and rapid heart rate. People with panic disorder may experience these attacks unexpectedly and for no apparent reason, but they can also be preceded by some sort of triggering event or situation.

This overview outlines the Panic Disorder Detection using Machine Learning project, emphasizing its objectives, methodology, expected outcomes, and impact on healthcare delivery and patient care. Adjustments can be made based on specific project requirements and stakeholder needs to ensure successful implementation and deployment.

Current diagnostic methods rely heavily on patient self-reporting and clinical observation, which can be subjective and time-consuming. An automated detection system can provide consistent, objective, and timely diagnosis, improving patient outcomes.

The Panic Disorder Detection System has the potential to revolutionize the way panic disorder is diagnosed and managed. By leveraging advanced data analysis and machine learning, this project aims to improve early detection, enhance diagnostic accuracy, and ultimately, provide better patient care. Panic Disorder Detection system encompasses the comprehensive range of activities, objectives, and boundaries related to the development and deployment of a system aimed at identifying and diagnosing panic disorder in individuals

1.2 PURPOSE: -

The purpose of developing a Panic Disorder Detection system using machine learning is multifaceted, aiming to address various clinical, societal, and technological needs. Here are the key purposes:

1. Early Diagnosis

- **Timely Identification:** Enable the early identification of panic disorder symptoms before they become severe, improving the chances of successful treatment.
- **Prevention of Escalation:** Prevent the escalation of symptoms by providing early intervention, which can significantly reduce the severity and frequency of panic attacks.

2. Improved Diagnostic Accuracy

- **Reduce Misdiagnosis:** Enhance diagnostic accuracy by leveraging machine learning algorithms to analyse complex patterns and symptoms, reducing the likelihood of misdiagnosis.
- **Objective Assessment:** Provide an objective assessment tool that complements the subjective evaluations performed by healthcare professionals.

3. Personalized Treatment

- **Customized Care Plans:** Generate personalized treatment recommendations based on individual patient profiles, leading to more effective and tailored therapeutic strategies.
- **Continuous Monitoring:** Allow for continuous monitoring of patient symptoms, enabling dynamic adjustments to treatment plans as needed.

4. Enhanced Healthcare Delivery

- **Streamlined Processes:** Streamline the diagnostic process, reducing the burden on healthcare professionals and allowing them to focus more on patient care.
- **Resource Optimization:** Optimize healthcare resources by identifying high-risk patients who require immediate attention and allocating resources more efficiently.

5. Patient Empowerment

- **Informed Patients:** Empower patients with insights into their condition, helping them understand their symptoms and treatment options better.
- **Self-Monitoring Tools:** Provide tools for patients to monitor their symptoms and progress, fostering a proactive approach to their mental health.

6. Research and Development

- **Data-Driven Insights:** Contribute to research by providing valuable data and insights into the patterns and triggers of panic disorder, aiding in the development of new treatment methods.
- **Algorithm Advancement:** Advance the field of machine learning and its application in mental health by developing and refining algorithms that can be used for other psychological disorders.

7. Public Health Impact

- **Awareness and Education:** Raise awareness about panic disorder and its symptoms, reducing stigma and encouraging more individuals to seek help.
- **Community Support:** Foster community support by providing data-driven insights that can be used to develop public health initiatives and support programs.

8. Ethical and Regulatory Compliance

- **Patient Safety:** Ensure patient safety by providing a reliable and accurate diagnostic tool that adheres to medical standards.
- **Data Privacy:** Maintain strict compliance with data privacy regulations (e.g., HIPAA, GDPR) to protect patient information and maintain trust

2.LITERATURE SURVEY

2.1 EXISTING PROBLEM

Detecting and diagnosing panic disorder present several challenges in the current healthcare landscape. Here are the key issues:

1. Underdiagnosis and Misdiagnosis*:* Panic disorder symptoms often overlap with those of other medical and psychological conditions, leading to frequent misdiagnosis. Symptoms like chest pain, palpitations, and shortness of breath can be mistaken for cardiac or respiratory issues

2. Limited Access to Mental Health Professional: There is a significant shortage of mental health professionals, making it difficult for many patients to access timely and specialized care.

3. Complexity of Symptoms: Panic disorder can manifest in diverse ways, with symptoms varying widely among individuals, making it challenging to identify a one-size-fits-all diagnostic approach.

4. Patient Engagement and Adherence: Ensuring patient engagement and adherence to treatment plans is challenging, particularly in cases where individuals do not fully understand their condition or the importance of follow-up care.

5. Bias and Disparities in Care: Socioeconomic factors, racial and ethnic disparities, and other social determinants of health can influence the quality and accessibility of care, leading to unequal diagnosis and treatment outcomes.

2.2 PROPOSED SOLLUTION

To address the existing problems in panic disorder detection, the following solutions are proposed:

1. **Advanced Data Collection and Integration**

- **Multi-Source Data Aggregation:** Collect data from diverse sources such as electronic health records (EHR), patient surveys, wearable devices, and online health forums to provide a comprehensive view of patient health.

- **Real-Time Data Integration:** Implement systems that can integrate and process real-time data from wearable devices and mobile health apps, enabling continuous monitoring of symptoms.

2. Machine Learning for Accurate Diagnosis

- **Pattern Recognition Algorithms:** Develop and deploy machine learning models capable of recognizing complex patterns and correlations in symptom data to accurately diagnose panic disorder.
- **Natural Language Processing (NLP):** Use NLP techniques to analyze clinical notes and patient reports, extracting relevant information to support diagnosis.

3. Standardization of Diagnostic Criteria

- **Unified Diagnostic Protocols:** Create standardized diagnostic protocols based on machine learning models to ensure consistency across different healthcare settings.
- **Automated Diagnostic Tools:** Develop automated tools that assist healthcare providers in diagnosing panic disorder by providing evidence-based recommendations.

4. Enhanced Accessibility to Mental Health Services

- **Telemedicine Integration:** Integrate telemedicine platforms to provide remote diagnosis and consultation, particularly beneficial for individuals in rural or underserved areas.
- **Mobile Health Applications:** Develop mobile health applications that allow patients to track their symptoms, access resources, and communicate with healthcare providers.

5. Patient Engagement and Education

- **Interactive Patient Portals:** Implement patient portals that provide educational resources, symptom tracking tools, and personalized feedback to engage patients in their care.
- **Gamification Techniques:** Use gamification techniques to encourage adherence to treatment plans and regular symptom reporting.

3.THEORITICAL ANALYSIS

3.1. BLOCK DIAGRAM

Technical Architecture:
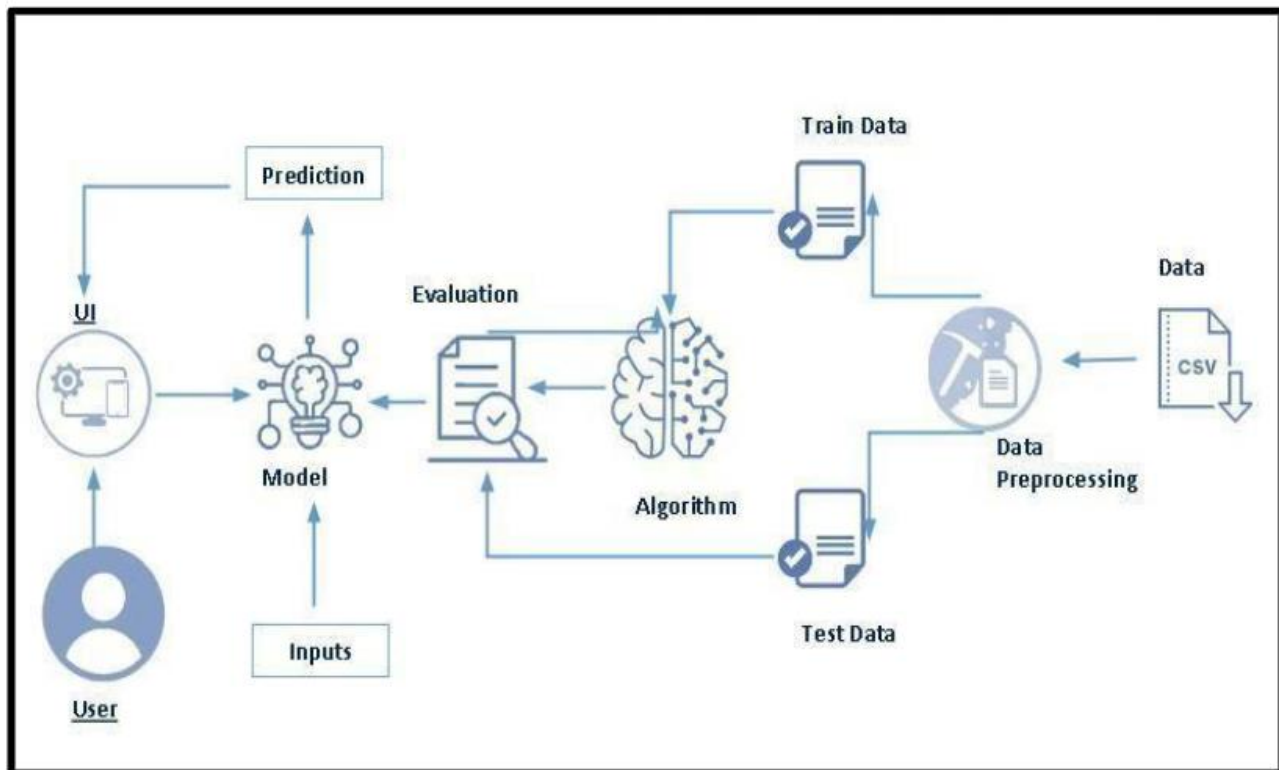
3.2. SOFTWARE DESIGNING

The following is the Software required to complete this project:

✧ **Development Environment**:

1. Used Jupiter Notebook as the primary development environment for data exploration, preprocessing, and initial model prototyping.

2. Leverage Python programming language for its rich ecosystem of libraries and frameworks suitable for machine learning and data analysis tasks.

◇ **Data Handling**:

1. Managed the transaction data stored in CSV format, ensuring data integrity and security throughout the processing pipeline.

◇ **Data Preprocessing Tools**:

1. Implemented data preprocessing techniques using libraries such as pandas and NumPy in Jupiter Notebook.
2. Cleanse data by handling missing values, outliers, and standardizing formats to prepare it for model training.

◇ **Feature Selection/Drop**:

1. Used feature selection techniques (e.g., correlation analysis, feature importance) to identify and retain relevant features that contribute to fraud detection.
2. Dropped irrelevant or redundant features to improve model performance and reduce computational overhead.

◇ **Model Training Tools**:

1. Trained machine learning models (Random Forest, Decision Tree, Extra Trees, SVM, XG Boost) using scikit-learn and XG Boost libraries in Jupiter Notebook.
2. Optimize hyperparameters and validate models using cross-validation techniques to ensure robust performance.

◇ **Model Accuracy Evaluation**:

1. After model training, accuracy and performance evaluation tools, such as Scikit-learn metrics or custom validation scripts, will assess the model's predictive capabilities. You'll measure the model's ability to predict based on historical data.
2. Performed comprehensive analysis to select the best-performing model for deployment in the disorder detection system.

✧ **UI Based on Flask Environment**:

1. Develop a user interface (UI) using Flask, a lightweight web framework for Python, to visualize fraud detection results and system performance.

2. Integrate with back-end functionalities to display real-time monitoring dashboards, transaction alerts, and reporting features for administrators and users.

4.EXPERIMENTAL INVESTIGATION

1. **Data Preprocessing**

   o **Data Cleaning**: Handle missing values, remove duplicates.

   o **Normalization**: Normalize the physiological data for consistency.

   o **Feature Engineering**: Create new features if necessary, such as heart rate variability.

2. **Exploratory Data Analysis (EDA)**

   o **Descriptive Statistics**: Calculate mean, median, standard deviation, etc.

   o **Visualization**: Plot graphs to understand the distribution and relationships in the data.

3. **Feature Selection**

   o Identify the most relevant features for panic disorder detection using techniques like correlation analysis, feature importance from tree-based models, or recursive feature elimination.

4. **Model Development**

   o **Train-Test Split**: Divide the data into training and testing sets (e.g., 80/20 split).

   o **Model Selection**: Choose models to experiment with (e.g., Random Forest, SVM, LSTM).

   o **Training**: Train the models on the training data.

   o **Hyperparameter Tuning**: Use grid search or random search to find the best hyperparameters.

5. **Model Evaluation**

   o Evaluate the models on the test set using metrics like accuracy, precision, recall, F1-score, and ROC-AUC.
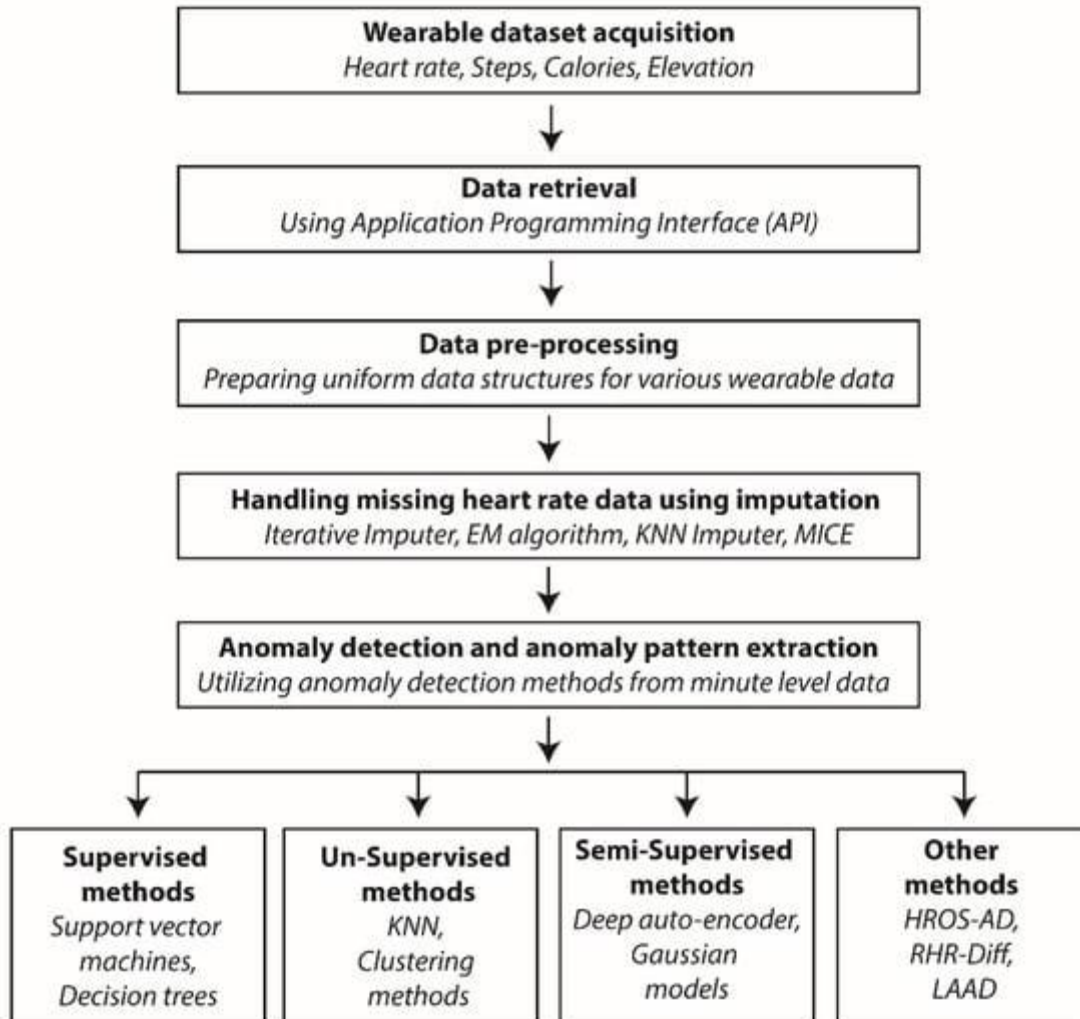
6. **Real-time Implementation**

   o Develop a system to implement the trained model for real-time detection.

   o Integrate the model into an application for continuous monitoring and detection.

7. **Validation and Feedback**

   o Validate the system with clinical experts.

   o Collect feedback from users and healthcare providers for continuous improveme

5.FLOWCHART

Wearable dataset acquisition
Heart rate, Steps, Calories, Elevation

↓

Data retrieval
Using Application Programming Interface (API)

↓

Data pre-processing
Preparing uniform data structures for various wearable data

↓

Handling missing heart rate data using imputation
Iterative Imputer, EM algorithm, KNN Imputer, MICE

↓

Anomaly detection and anomaly pattern extraction
Utilizing anomaly detection methods from minute level data

↓

Supervised methods	**Un-Supervised methods**	**Semi-Supervised methods**	**Other methods**
Support vector machines, Decision trees	*KNN, Clustering methods*	*Deep auto-encoder, Gaussian models*	*HROS-AD, RHR-Diff, LAAD*

7.ADVANTAGES AND DISADVANTAGES

ADVANTAGES: -

1.Early Intervention:

- **Timely Alerts**: Early detection allows for timely alerts, which can help individuals take preventive actions to mitigate the onset of a panic attack.
- **Reduced Severity**: Early intervention can reduce the severity and duration of panic attacks.

2.Improved Management:

- **Personalized Care**: Detection systems can provide personalized recommendations and interventions based on real-time data.
- **Data-Driven Insights**: Continuous monitoring provides valuable insights into patterns and triggers, aiding in better management of the disorder.

3. Enhanced Safety:

- **Immediate Support**: Alerts can notify caregivers or healthcare providers, ensuring immediate support during severe episodes.
- **Emergency Response**: In critical situations, automated alerts can facilitate faster emergency responses.

4. Increased Awareness:

- **Self-Awareness**: Individuals become more aware of their symptoms and triggers, leading to better self-management.
- **Education**: Access to data and feedback can educate individuals about their condition and effective coping strategies.

5.Reduced Healthcare Costs:

- **Preventive Care**: Early detection and management can prevent severe episodes that require costly emergency care.

- **Efficient Resource Use**: Continuous monitoring can optimize the use of healthcare resources by identifying those in immediate need.

6.Support for Research:

- **Data Collection**: Large-scale data collection can support research into the causes, patterns, and effective treatments for panic disorder.
- **Improved Treatments**: Insights from detection systems can lead to the development of more effective treatments and interventions.

DISADVANTAGES: -

1.Privacy Concerns:

- **Data Security**: Continuous monitoring and data collection raise concerns about the security and privacy of sensitive personal information.
- **Data Misuse**: There is a risk of data being misused or accessed by unauthorized parties.

2.Reliability and Accuracy:

- **False Positives/Negatives**: Detection systems may produce false positives (incorrectly indicating a panic attack) or false negatives (failing to detect a real panic attack).
- **Model Limitations**: Machine learning models may not generalize well across diverse populations or adapt to individual variations.

3. Dependency:

- **Over-Reliance**: Individuals may become overly reliant on detection systems, potentially neglecting other important aspects of their mental health care.
- **Loss of Autonomy**: Excessive dependence on technology for managing health can lead to reduced personal autonomy and self-efficacy.

4.Cost and Accessibility:

- **Initial Costs**: The initial cost of purchasing wearable devices and setting up the detection system can be high.
- **Accessibility**: Not all individuals may have access to the necessary technology, leading to disparities in care.

5.Technical Issues:

- **Device Malfunction**: Wearable devices and mobile apps can malfunction or require regular maintenance, which can be inconvenient.
- **Battery Life**: Continuous monitoring can drain the battery life of wearable devices quickly, requiring frequent recharging.

6. User Compliance:

- **Consistency**: Users may forget or neglect to wear their devices consistently, leading to incomplete data collection.
- **Engagement**: Sustaining long-term engagement with the detection system can be challenging for some individuals.

8.APPLICATIONS

1.Healthcare Monitoring

- **Outpatient Care**: Continuous monitoring for individuals diagnosed with panic disorder to provide real-time feedback and alerts.
- **Emergency Response**: Automatically alert healthcare providers or emergency contacts during severe panic attacks, facilitating prompt intervention.

2.Telemedicine

- **Remote Consultations**: Integrate panic disorder detection with telemedicine platforms to provide data-driven insights during virtual consultations.
- **Continuous Care**: Enable healthcare providers to monitor patients remotely and provide ongoing support and adjustments to treatment plans.

3. Research and Development

- **Clinical Studies**: Use large-scale data from detection systems to conduct research on the causes, patterns, and treatment effectiveness of panic disorder.
- **New Therapies**: Develop and test new therapeutic interventions based on real-world data and insights obtained from continuous monitoring.

4.Educational Institutions

- **Student Support**: Provide support for students dealing with anxiety and panic disorders, helping them manage stress and improve academic performance.
- **Counselling Services**: Integrate detection systems with school counselling services to provide real-time monitoring and support.

5.Insurance and Risk Management

- **Health Insurance**: Offer discounts or incentives for using panic disorder detection systems as part of a health insurance plan.
- **Risk Assessment**: Use data from detection systems to assess health risks and develop personalized insurance plans.

9.CONCLUSION

In conclusion, panic disorder detection systems represent a significant advancement in mental healthcare, leveraging technology to provide timely and effective support for individuals experiencing panic attacks. By integrating physiological, self-reported, and environmental data, these systems offer a comprehensive approach to monitoring and managing panic disorder. Through continuous improvement and integration with existing healthcare frameworks, panic disorder detection systems can become a vital tool in the fight against anxiety and panic disorders, ultimately contributing to a healthier and more resilient society.

10.FUTURE SCOPE

future scopes for detecting panic disorder:

1. **Biometric Monitoring**: Algorithms could analyse these data patterns to detect signs of panic attacks before they occur or to monitor the frequency and severity of attacks over time.
2. **AI and Machine Learning**: Advanced machine learning models could be trained on large datasets of biometric and behavioural data to identify patterns associated with panic disorder.
3. **Natural Language Processing (NLP)**: Analysing patterns in speech and language through NLP algorithms could help detect linguistic markers associated with panic disorder during conversations or in written communications.
4. **Genetic Markers**: Research into genetic predispositions and biomarkers associated with panic disorder could lead to genetic tests that identify individuals at higher risk

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