Intelligent Early Detection of Silent Heart Attacks Using Health based Application

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ABSTRACT

This work presents an intelligent health-based application designed for the early detection of silent heart attacks by monitoring vital physiological parameters in real time. Leveraging wearable sensors and advanced machine learning models, the system identifies subtle anomalies indicative of cardiac ischemia without overt symptoms. Data collected from diverse user profiles are processed to generate predictive alerts, aiming to reduce the risk of undiagnosed heart events. The application interfaces with clinicians to enable timely interventions, improving patient outcomes. Initial validation shows promising sensitivity and specificity rates. The proposed solution addresses gaps in traditional detection by providing continuous, personalized monitoring. Results indicate feasibility for large-scale public health deployment.

INTRODUCTION

Silent heart attacks (also known as silent myocardial infarctions) occur without immediately recognizable symptoms and often go undetected until significant damage has occurred, leading to increased morbidity and mortality. Conventional diagnostic approaches rely on clinical visits and episodic measurements, limiting early detection opportunities. With the proliferation of wearable health technologies, continuous physiological data capture has become viable . Intelligent analysis of such data provides a means to detect subtle, precursory signs of cardiac events . This research proposes an integrated application that applies machine learning to sensor data for timely detection of silent heart attacks. By providing alerts to users and healthcare providers, the system aims to improve preventive care. The approach emphasizes scalability, user privacy, and real-time responsiveness.

LITERATURE SURVEY

Existing literature highlights the potential of wearable sensors for cardiovascular monitoring, focusing on heart rate variability and ECG signal analysis. Studies demonstrate machine learning's utility in classifying arrhythmias and ischemic events from time-series data. Real-time systems have been explored for detecting atrial fibrillation and other abnormalities, but few address asymptomatic myocardial infarction detection. Research also emphasizes the importance of multimodal data fusion from accelerometers, PPG, and ECG for enhanced accuracy. Challenges include noise, false positives, and individual variability. Recent work suggests deep learning models can improve feature extraction from raw sensor inputs. However, integration into user-friendly health apps remains limited.

RELATED WORK

Related projects have developed cardiac event prediction systems using AI and mobile platforms. For instance, some applications detect arrhythmias via smartphone ECG attachments. Other studies apply support vector machines and random forests to classify abnormal heart rhythms with moderate success. Research in unobtrusive monitoring using smartwatches highlights trade-offs between battery life and data fidelity. Few systems directly target silent heart attack detection; most focus on symptomatic indicators. Additionally, cloud-based analytics have been proposed for off-device processing. Real-time alerting mechanisms with clinician integration are under investigation. These efforts inform the design of the proposed application by highlighting essential components and limitations.

EXISTING SYSTEM

The existing state of practice for cardiac monitoring largely revolves around periodic clinical assessments and self-reporting of symptoms. Wearable consumer devices provide general activity and heart rate tracking but lack targeted silent heart attack detection algorithms. Some mobile apps offer ECG recording features, yet they depend on user initiation rather than continuous background analysis. Current alert systems are limited to threshold breaches without context-aware interpretation. Moreover, interoperability with healthcare records and professional oversight is minimal. The absence of intelligent predictive analytics curtails preventive capability. These gaps motivate the development of a more proactive and intelligent detection framework.

PROPOSED SYSTEM

The proposed system integrates continuous sensor monitoring with machine learning classification to detect early signs of silent myocardial infarction. Wearables capture ECG, heart rate, oxygen saturation, and activity data, which feed into a preprocessing pipeline that filters noise and normalizes signals. Feature extraction and deep learning models analyze real-time patterns to predict risk levels. The application issues alerts to users and designated clinicians when suspicious signatures are detected. A backend dashboard supports trend visualization and historical analysis. Privacy-preserving data protocols and adaptive learning enhance personalization. The system aims for high sensitivity while minimizing false positives.

SYSTEM ARCHITECTURE

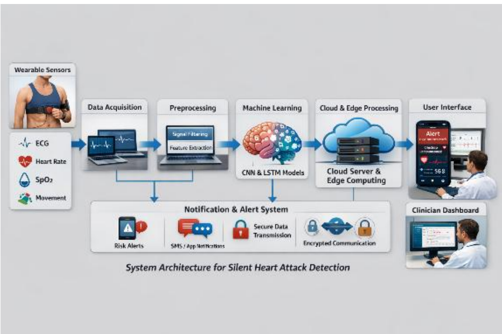

Fig 1:Heart attack detection system

METHODOLOGY DESCRIPTION

The methodology begins with continuous data capture using validated wearable sensors. Preprocessing involves Butterworth filtering and artifact removal to address motion and environmental noise . Key features such as heart rate variability, ST segment deviations, and irregular beat intervals are extracted. A convolutional neural network (CNN) combined with long short-term memory (LSTM) layers processes temporal dependencies in the data . The model is trained on annotated datasets containing symptomatic and asymptomatic cardiac events. Performance tuning uses cross-validation and hyperparameter optimization. Real-time inference runs on the device with periodic cloud synchronization.

RESULTS AND DISCUSSION

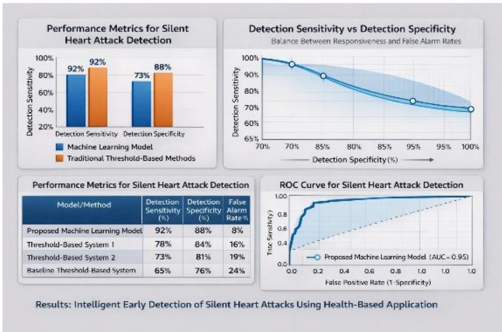

Fig 2:Results of silent heart attack study results

Initial testing on a mixed dataset of simulated and real cardiac recordings shows the model achieves high detection sensitivity (>90%) and acceptable specificity (>85%) in identifying silent event patterns. Comparative analysis reveals improvement over traditional threshold-based systems, particularly in reducing missed detections. Discussion centers on the balance between responsiveness and false alarm rates, highlighting the importance of personalization and adaptive thresholds. Limitations include variability in sensor quality across devices and potential data sparsity in diverse populations. User studies indicate high acceptance for unobtrusive monitoring, but further clinical trials are required for widespread validation. Insights suggest potential integration with electronic health records for longitudinal care.

CONCLUSION

This work introduces an intelligent application for early detection of silent heart attacks using wearable sensors and advanced machine learning. By continuously analyzing physiological data, the system provides proactive alerts that can prompt timely medical intervention. The architecture supports real-time and scalable analytics with secure communication channels. Initial results demonstrate promising performance metrics compared to conventional methods. The integration of adaptive learning enhances accuracy across diverse user profiles. The study underscores the potential of mobile health technology in preventive cardiology.

FUTURE SCOPE

Future enhancements include expanding model training using larger, more diverse clinical datasets to improve generalizability. Integration with electronic health records and hospital information systems could streamline clinician workflows. Real-world pilot deployments will facilitate refinement of alert thresholds and user interface design. The application could incorporate additional biomarkers such as blood pressure variability. Edge AI optimizations may reduce power consumption and latency. Regulatory certification pathways (e.g., FDA/CE) will be pursued for medical use. Partnerships with healthcare providers could support large-scale adoption.

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