Winners

**Title**

Developing a Novel Muscle Fatigue Index for Wireless sEMG Sensors: Metrics and Regression Models for Real-Time Monitoring

**Abstract**

Muscle fatigue impacts performance in sports, rehabilitation, and daily activities, with surface electromyography (sEMG) widely used for monitoring. In this study, we analyzed sEMG signals, evaluating time, frequency, and combined-domain metrics to identify reliable fatigue indicators. Using these metrics, we developed a novel fatigue index through regression modeling, capturing fatigue progression and enabling personalized muscle-specific assessment. Integrated into a wireless BLE-enabled sensor platform, the system combines seamless body placement, mobility, and real-time data transmission. An initial calibration phase ensures adaptation to individual muscle profiles, enhancing accuracy. By balancing on-device processing with efficient wireless communication, this platform delivers scalable, real-time fatigue monitoring across diverse applications.

# Possible Titles Mhtsos

1. Developing a Novel Muscle Fatigue Index for Wireless sEMG Sensors: Metrics and Regression Models for Real-Time Monitoring
2. A Novel Fatigue Index for IoT-Enabled Wireless sEMG Networks: Signal Processing and BLE-Based Real-Time Monitoring for Health Applications
3. IoT-Driven Fatigue Analysis: A BLE-Enabled Wireless sEMG System with Advanced Metrics and Machine Learning Models

# Possible Paper Titles Johns

1. Wireless Muscle Fatigue Monitoring: Real-Time Muscle Fatigue Assessment Using BLE-Enabled sEMG Sensors
2. An Integrated Wireless Sensor System for Real-Time Muscle Fatigue Detection via sEMG Signals
3. Muscle Fatigue Index Estimation on Embedded Wireless Sensor Platforms: A Case Study with BLE and sEMG Signals
4. Wireless Transmission and On-Board Processing of sEMG Metrics for Muscle Fatigue Analysis
5. Edge Computing on BLE-Enabled Sensors for Real-Time Muscle Fatigue Monitoring via sEMG Signals
6. Optimizing Wireless sEMG Sensor Networks for Real-Time Muscle Fatigue Assessment and Feedback
7. BLE-Based Wireless Sensor Platform for In-Situ Muscle Fatigue Monitoring Using Regression Models
8. Towards Autonomous Muscle Fatigue Monitoring: Embedded sEMG Metric Processing and Wireless Transmission
9. Wireless Sensor Networks in Muscle Fatigue Analysis: A BLE-Based Approach with On-Device Processing
10. Smart Wireless Sensors for Real-Time sEMG Data Acquisition and Muscle Fatigue Prediction

(a bit less about wireless now:)

1. Real-Time Muscle Fatigue Monitoring Using sEMG Metrics and BLE-Enabled Embedded Systems
2. Edge Processing of sEMG Metrics for Muscle Fatigue Assessment with Wireless Data Transmission
3. Muscle Fatigue Index Estimation from sEMG Signals: A Hybrid Approach Combining Embedded Processing and Wireless Communication
4. On-Device Processing and Regression Modeling for Muscle Fatigue Analysis via sEMG Signals
5. sEMG-Based Muscle Fatigue Monitoring with Integrated Edge Computation and BLE Communication

# Possible Abstracts Mhtsis

1. Muscle fatigue analysis plays a pivotal role in optimizing athletic performance and rehabilitation. Surface electromyography (sEMG), when integrated into wireless sensor networks, offers immense potential for real-time physiological monitoring. However, conventional methods often rely on predefined fatigue indicators, lacking adaptability to dynamic fatigue patterns. This study presents an advanced framework for wireless sEMG-based muscle fatigue monitoring, emphasizing novel metrics and regression modeling techniques.  
     
   The system collects sEMG signals during sustained isometric contractions and implements a suite of time-domain and frequency-domain metrics to capture fatigue progression. A novel fatigue index is proposed, leveraging regression models trained on hypothetical fatigue trends to quantify fatigue with unprecedented precision. Key innovations include robust noise-reduction techniques, the fusion of multifractal and empirical mode decomposition analyses, and seamless wireless integration using Bluetooth Low Energy (BLE). Experimental results demonstrate the reliability and efficiency of the developed system, highlighting its potential to revolutionize athlete management and rehabilitation protocols through real-time, accurate fatigue assessments.
2. Muscle fatigue analysis is vital for enhancing athletic performance and rehabilitation. This study presents an IoT-enabled wireless system leveraging Bluetooth Low Energy (BLE) for real-time surface electromyography (sEMG) monitoring. A novel fatigue index is developed using advanced signal processing techniques, including multifractal and empirical mode decomposition analyses, and regression models. These methods ensure accurate and adaptive fatigue monitoring while maintaining energy efficiency. Validated through controlled experiments, this system offers a robust and scalable solution for health monitoring applications, demonstrating its potential to revolutionize athlete training and rehabilitation through precise physiological insights.
3. Muscle fatigue monitoring has gained critical importance in health and sports applications. This study introduces an IoT-enabled system leveraging Bluetooth Low Energy (BLE) for real-time surface electromyography (sEMG) signal acquisition and fatigue assessment. The system employs advanced signal processing techniques, including multifractal and empirical mode decomposition analyses, to extract meaningful fatigue metrics from sEMG data. A novel fatigue index is developed using regression models trained on hypothetical fatigue trends, offering enhanced accuracy and adaptability. By combining energy-efficient wireless communication with robust data analytics, the proposed system sets a new standard for real-time physiological monitoring in wearable technologies.
4. Surface electromyography (sEMG) is a powerful tool for muscle fatigue analysis, yet conventional methods lack the precision needed for real-time applications. This study develops a novel fatigue index using advanced signal processing techniques, including multifractal analysis and empirical mode decomposition, to identify reliable fatigue metrics. Regression models trained on diverse fatigue trends enable adaptive monitoring and quantification of fatigue progression. Integrated with Bluetooth Low Energy (BLE) technology, the system ensures seamless wireless communication and low-power operation. Experiments conducted on isometric contractions validate the index, highlighting its potential to advance wearable physiological monitoring systems in sports and rehabilitation.

# Possible Abstracts Jons

Abstract 1:

Muscle fatigue significantly affects performance in sports, rehabilitation, and daily activities. Surface electromyography (sEMG) signals have emerged as a reliable tool for assessing muscle activity and fatigue. In this study, we developed a BLE-enabled wireless sensor system capable of acquiring and transmitting sEMG data for fatigue analysis. The system evaluates time-domain, frequency-domain, and combined-domain fatigue metrics and utilizes regression modeling to estimate a novel fatigue index. By integrating on-board processing capabilities, the system can compute fatigue-related metrics directly on the sensor node, reducing communication overhead and improving real-time responsiveness. This wireless architecture enhances the scalability and deployment of fatigue-monitoring systems across diverse applications.

Abstract 2:

Real-time monitoring of muscle fatigue is essential in sports performance, rehabilitation, and occupational safety. Surface electromyography (sEMG) signals offer valuable insights into muscle activity, but existing systems often rely on raw data transmission, increasing energy consumption and latency. In this study, we propose a BLE-based wireless sensor platform capable of both data acquisition and on-board computation of fatigue metrics. Metrics derived from time, frequency, and combined domains were validated for their correlation with fatigue progression. A regression model was then employed to compute a novel fatigue index directly on the sensor node. The findings demonstrate the feasibility of embedding fatigue analysis within wireless sensor systems, enabling efficient and scalable deployment.

Abstract 3:

Monitoring muscle fatigue using surface electromyography (sEMG) signals is a critical application of wireless sensor networks (WSNs). In this study, we developed a BLE-enabled wireless sEMG sensor platform designed to assess fatigue in real-time. The system integrates data acquisition, pre-processing, and metric evaluation directly on the sensor node, reducing wireless transmission load. Additionally, regression models were employed to estimate a new fatigue index based on time-domain, frequency-domain, and combined-domain metrics. The proposed system showcases the potential of edge computing within WSNs for fatigue analysis, improving both efficiency and scalability in real-world deployments.

Abstract 4:

The integration of wireless sensor networks (WSNs) with surface electromyography (sEMG) technology offers promising solutions for real-time muscle fatigue monitoring. In this study, we present a BLE-enabled sensor platform capable of collecting and processing sEMG signals to identify fatigue-related metrics across time, frequency, and combined domains. A regression model was trained to estimate a novel fatigue index, allowing on-board metric computation and optimized wireless transmission. This approach minimizes data bandwidth requirements while maintaining accuracy, enabling scalable and efficient deployment in sports, rehabilitation, and industrial environments.

Abstract 5:

Muscle fatigue monitoring using surface electromyography (sEMG) sensors has become increasingly critical in healthcare, sports, and occupational safety. This study presents a BLE-enabled wireless sensor platform for real-time fatigue assessment. The platform combines sEMG signal acquisition, metric extraction (time-domain, frequency-domain, and combined-domain), and regression-based fatigue index estimation. By incorporating on-board processing, the system reduces communication overhead and extends battery life. This architecture highlights the potential of wireless sensor networks for scalable and real-time muscle fatigue monitoring applications.

Abstract 6:

Wireless sensor networks (WSNs) have revolutionized physiological monitoring, including muscle fatigue assessment. This study introduces a BLE-enabled sEMG sensor system capable of collecting, processing, and transmitting fatigue-related metrics in real-time. The platform evaluates metrics across time, frequency, and combined domains, and employs regression modeling to create a novel fatigue index. With edge computing capabilities, the system can process metrics locally, minimizing wireless data transfer and energy consumption. This approach enhances the feasibility of deploying wireless fatigue-monitoring systems across diverse applications.

Abstract 7:

Accurate assessment of muscle fatigue is essential for optimizing performance and rehabilitation outcomes. In this work, we developed a BLE-enabled wireless sensor platform designed to monitor sEMG signals and compute fatigue-related metrics in real-time. The platform processes time, frequency, and combined-domain metrics locally and transmits a summarized fatigue index using regression modeling. This architecture reduces data transmission overhead and increases energy efficiency, positioning wireless sensor networks as a powerful tool for real-time fatigue assessment.

Abstract 8:

Wireless sensor networks (WSNs) combined with surface electromyography (sEMG) technology present an opportunity to monitor muscle fatigue in real-time. This study introduces a BLE-enabled sensor platform that performs on-board processing of sEMG signals to extract fatigue-related metrics and transmits a regression-derived fatigue index. Metrics from time, frequency, and combined domains were analyzed to ensure accurate fatigue assessment. The system demonstrates the potential of edge computing in wireless fatigue-monitoring applications, reducing latency and communication overhead.

Abstract 9:

In this study, we present a BLE-enabled wireless sensor platform for muscle fatigue assessment using surface electromyography (sEMG) signals. The system collects sEMG data, evaluates time-domain, frequency-domain, and combined-domain metrics, and applies regression modeling to estimate a fatigue index. By enabling on-board metric processing, the platform minimizes wireless data transmission requirements, improving energy efficiency and scalability. This wireless architecture demonstrates significant potential for real-time fatigue monitoring in sports, rehabilitation, and occupational safety.

Abstract 10:

Wireless sensor networks (WSNs) are increasingly being adopted for physiological monitoring applications. In this study, we designed a BLE-enabled sEMG sensor platform capable of real-time muscle fatigue assessment. The platform performs on-device computation of fatigue-related metrics across time, frequency, and combined domains, followed by regression-based fatigue index estimation. The processed data is then wirelessly transmitted to external systems for visualization and analysis. This approach reduces communication overhead and improves system efficiency, making it ideal for scalable fatigue-monitoring deployments.

(a bit less about wireless now:)

Abstract 1b:

Muscle fatigue is a key factor influencing performance in sports, rehabilitation, and daily activities. Surface electromyography (sEMG) signals are commonly used for fatigue monitoring, but traditional systems often rely on centralized processing, increasing data transmission overhead. In this study, we present an embedded system capable of acquiring sEMG signals, extracting time, frequency, and combined-domain metrics, and estimating a novel fatigue index using regression modeling. The system utilizes edge computing to process fatigue metrics locally and transmits essential results wirelessly via BLE to a host device. This hybrid approach reduces communication overhead while maintaining accurate fatigue assessment, enabling efficient real-time monitoring.

Abstract 2b:

Accurate muscle fatigue assessment through surface electromyography (sEMG) signals plays a critical role in enhancing sports performance and rehabilitation outcomes. In this study, we propose an embedded platform capable of real-time sEMG signal acquisition, metric evaluation, and muscle fatigue index estimation through regression modeling. Metrics derived from time, frequency, and combined domains were validated for their correlation with fatigue progression. The embedded system reduces the need for raw data transmission by performing on-board computations and sending only key results wirelessly. This approach balances computational efficiency and communication reliability for scalable fatigue monitoring applications.

Abstract 3b:

Monitoring muscle fatigue through surface electromyography (sEMG) is essential in sports, healthcare, and ergonomics. In this work, we introduce an embedded sEMG sensor system that evaluates fatigue metrics across time, frequency, and combined domains and estimates a regression-based fatigue index. By leveraging on-board computation, the system processes metrics locally before transmitting them wirelessly via BLE to a central system for visualization. This architecture minimizes wireless data overhead and enhances real-time responsiveness, offering a practical solution for fatigue monitoring in various environments.

Abstract 4b:

Muscle fatigue assessment using surface electromyography (sEMG) signals requires robust processing and analysis to provide actionable insights. In this study, we developed an embedded system capable of capturing sEMG data, extracting relevant metrics across time, frequency, and combined domains, and applying regression techniques to estimate a novel fatigue index. By incorporating on-device metric processing, the system reduces reliance on continuous wireless data transfer, optimizing bandwidth and energy usage. Wireless communication is then used selectively to transmit key fatigue indicators, ensuring efficient real-time monitoring capabilities.

Abstract 5b:

Surface electromyography (sEMG) signals offer valuable insights into muscle fatigue, but existing systems often struggle with balancing data transmission efficiency and computational accuracy. In this study, we developed an embedded sEMG sensor system capable of acquiring, processing, and analyzing fatigue-related metrics in real-time. Metrics from time, frequency, and combined domains were validated and fed into a regression model to estimate a fatigue index. The embedded system reduces communication overhead by performing on-device computations, with results wirelessly transmitted for further analysis. This approach enhances the scalability and applicability of fatigue monitoring solutions.

Muscle fatigue significantly affects performance in sports, rehabilitation, and daily activities. In this study, we analyzed sEMG signals, evaluating time, frequency, and combined-domain metrics to identify reliable fatigue indicators. Using these metrics, we developed a **novel fatigue index** through regression modeling to capture fatigue progression. Integrated into a **wireless BLE-enabled sensor system**, our approach supports **real-time, muscle-specific fatigue monitoring**. The system includes an **initial calibration phase**, ensuring personalized adaptation to each user’s muscle response. This design combines **on-device processing and efficient wireless communication**, enabling practical and scalable fatigue monitoring.

Muscle fatigue impacts performance in sports, rehabilitation, and daily activities, with surface electromyography (sEMG) widely used for monitoring. In this study, we analyzed sEMG signals, evaluating time, frequency, and combined-domain metrics to identify reliable fatigue indicators. Using these metrics, we developed a novel fatigue index through regression modeling, capturing fatigue progression and enabling personalized muscle-specific assessment. Integrated into a wireless BLE-enabled sensor platform, the system combines seamless body placement, mobility, and real-time data transmission. An initial calibration phase ensures adaptation to individual muscle profiles, enhancing accuracy. By balancing on-device processing with efficient wireless communication, this platform delivers scalable, real-time fatigue monitoring across diverse applications.