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Smart Wearable Devices for Golf Swing Analyzer System

Description: Golf Analyzer System is an intelligent performance monitoring system designed to analyze and improve a golfer's swing and overall performance. The project aims to connect players, coaches, and training platforms through modern technology and data-driven insights, enhancing training efficiency and user experience.

Fig. 1. Smart Glove, Smart Shoulder Belt, Smart Coxa Belt.

Fig. 2. Experiment with professional golfers in golf simulator room.

Fig. 3. Printed Circuit Board Design.

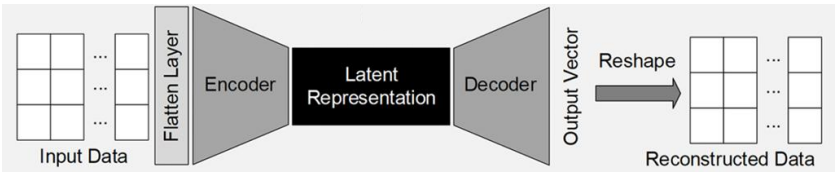

Fig. 4. Data pipeline with deep learning model.

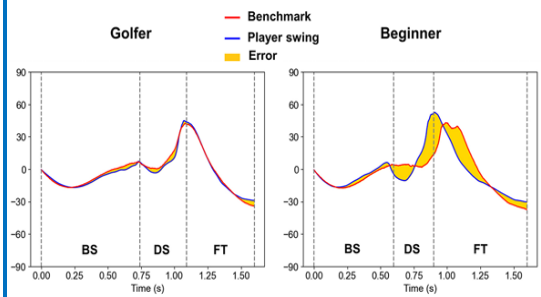

Fig. 5. Reconstructed compared between golfer and beginner.

Fig. 6. Software Development and Deployment.

Contributions:

- Hardware development for collecting golf swing data from wearable devices.
- Software development for processing, analyzing, and visualizing swing performance metrics.
- A beta-Variational Autoencoder (βVAE), an unsupervised learning model, learns to extract and redefine features by encoding input data into a latent space and then reconstructing it. The model's performance is assessed based on the quality of the latent representation and the reconstructed data.
- IoT integration for seamless data transmission from wearable devices to the cloud database.
- Real-time motion and performance monitoring to help golfers refine their technique.
- Player and coach management for data sharing, progress tracking, and performance analysis.

Links and Results: Video | Github Repository

Achievement: Published a paper in **IEEE Internet of Things Journal** from this project.

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E-Smart Health Care

Description: E-Smart Health Care is an intelligent health monitoring system focusing on tracking heart rate and respiration rate based-on PVDF sensor. The project aims to connect patients, doctors, and healthcare facilities, improving healthcare efficiency through modern technology and optimized user experiences.

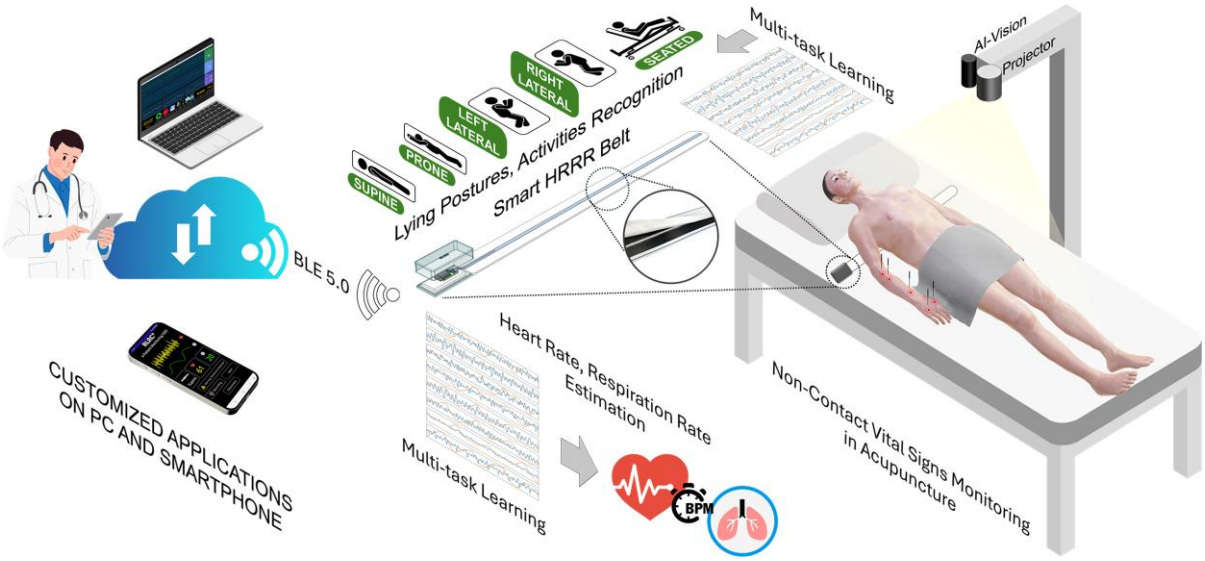

Fig. 1. System was developed to apply in acupuncture, integrating with AI-Vision and Projector.

Fig. 2. Hardware Design.

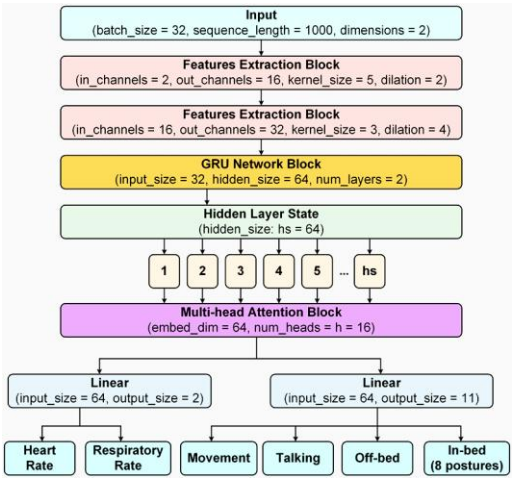

Fig. 3. Model Architecture.

Contributions:

- Hardware development for collecting heart rate and respiration rate data from PVDF sensor.
- Software development for data processing and visualization.
- The hybrid deep learning model integrates feature extraction, GRU, and multi-head attention blocks to learn patterns from sensor data. Final predictions are made for heart rate, breath rate estimation and activity classification.
- Mobile application for real-time health monitoring and alerts.
- IoT integration for seamless data transmission from devices to the cloud.

Links and Results: Video | Github Repository

Achievement: Two papers are in Revision in **Computers in Biology and Medicine, IEEE Internet of Things Journal** from this project.

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Smart Insole for Golf Swing Analyzer

Description: The smart insole for golf is a wearable system designed to measure and analyze foot pressure distribution during a golfer's swing

Fig. 1. Hardware Design.

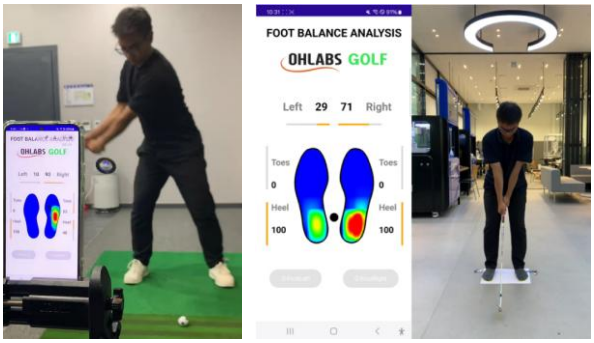

Fig. 2. Results.

Contributions:

- Designed and developed a pressure-sensing insole capable of accurately capturing dynamic foot pressure during golf swings
- Created a visualization tool that provides golfers with intuitive feedback on balance, stability, and weight shift.

Links and Results: **Video** | **Github Repository**

Wireless Body Sensor Network

Description: Wireless Sensor Network is a distributed sensing system designed to collect, transmit, and analyze environmental or physiological data through interconnected wireless sensor nodes.

Fig. 1. Prototype design.

Fig. 2. Wireless nodes and protocol.

Contributions:

- Wearable device development for sensor nodes equipped with wireless communication modules
- Data acquisition and processing for real-time environmental.
- Software platform for data collection, visualization, and system control.

Links and Results: **Video** | **Github Repository**

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Smart Golf Club Sensing for Golf Analyzer System

Description: Smart Golf Club Sensing for Golf Analyzer System is designed to enhance golfer performance by club path recognition in real time. Integrated embedded AI in the club sensing device provide comprehensive parameter about club path. The collected data are processed on-edge and mobile application provide golfers with detailed performance feedback.

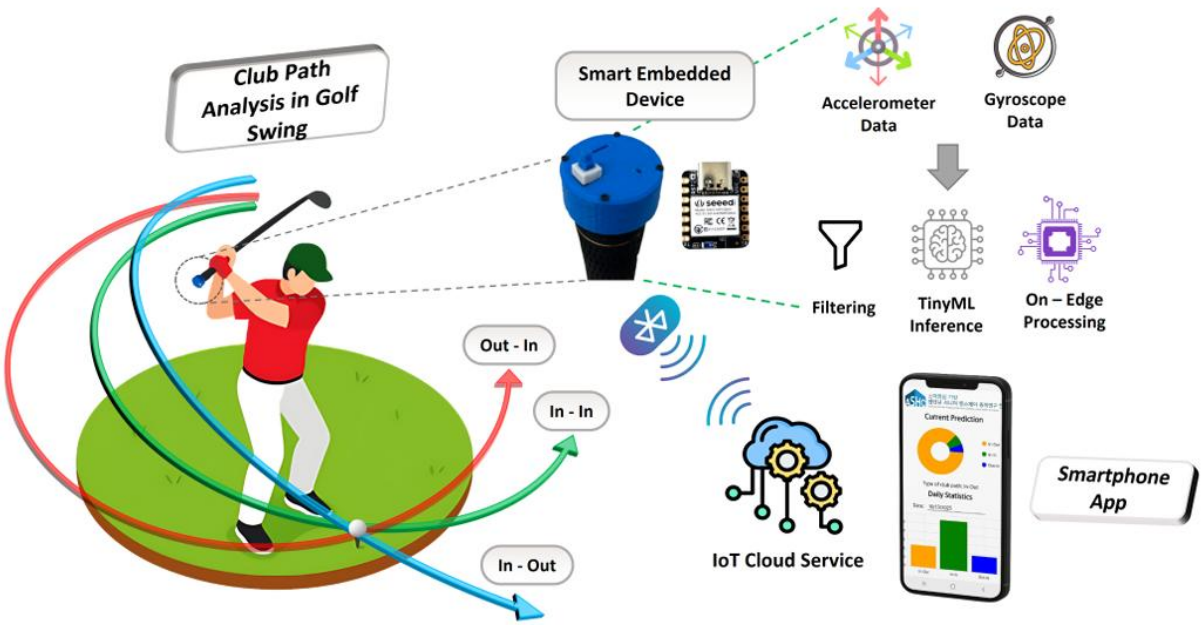

Fig 1. Club Path Analysis in Golf Swing, processed on-device.

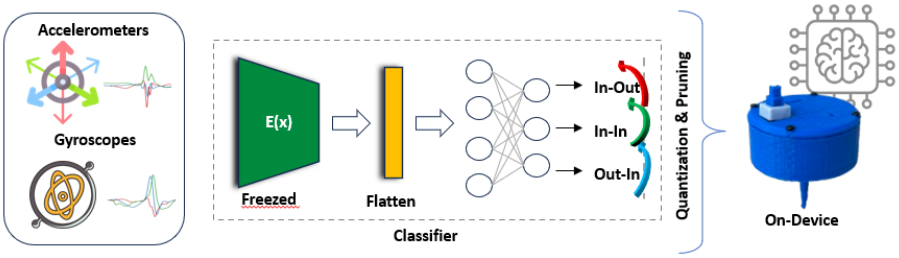

Fig 2. On-Device Processing with Tiny Neural Network.

Fig 3. Application in the real.

Contributions:

- Hardware development for collecting motion data from smart club based on IMU sensor.
- Tiny Neural Network was deployed on nrF52840 MCU to predict club path.
- All processing are processed on-device, including data collection (accelerometer and gyroscope), filtering, inference the lightweight model.
- A mobile application is developed for result synchronization with the device, command control, and cloud database management.

Achievement: Submitted a paper in **IEEE Sensor Journal** from this project.