

# Research Topics

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## Education

- **Ph.D. IN MECHANICAL ENGINEERING, CZECH TECHNICAL UNIVERSITY IN PRAGUE (CTU).**  
⇒ Field of study: Control and Systems Engineering  
Thesis entitled: "Lung tumor motion prediction by neural Networks"
- **Visiting student for a research project (scientific research), TOHOKU UNIVERSITY**  
⇒ Project: Intelligent Prediction Method of Lung Tumor Motion for Highly Accurate Radiation Therapy. Address: Sendai, Japan.
- **M.Sc. IN COMPUTER SCIENCE, THE NATIONAL CENTRE OF RESEARCH AND TECHNOLOGICAL DEVELOPMENT (CENIDET),**  
⇒ Field of study: Artificial Intelligence. Thesis entitled: "Validation and Verification Automatic Module of Extracted Rules of a Neural-Symbolic Hybrid System"

- **B.Sc. IN COMPUTATIONAL SYSTEMS ENGINEERING, “TECHNOLOGICAL INSTITUTE OF LAZARO CARDENAS”**,  
⇒ Field of study: Distributed systems and networks. Internship project: "Exploitation of Resources of a CMU Camera for its Started up on a ROMIC Robot"
- **Visiting student for a research project (Summer of the scientific research)**,  
Institution: National Institute of Nuclear RESEARCH (ININ),  
⇒ Project: “Exploitation of Resources of a CMU Camera for its Started up on a ROMIC Robot”. Address: Ocoyoacac, Mexico.

# Internet of things-health monitoring

## Motivation

- Present the wearable, portable, and battery-operated electrocardiogram acquisition card.
- Obtain a processing architecture for the QRS complex detection in ECG signals that present low-amplitude QRS, negative QRS, nonstationary random effects, and a low signal-to-noise ratio.
- Implement the adaptive threshold algorithm for the detection of the QRS complex, taking advantage of its high calculation speed and minimization of memory storage.
- Cardiac arrhythmias classification based on long-duration ECG signal fragments analysis.
- Implement cloud-based processing.
- Propose a data transmission security.

# Fault diagnosis of rotating machinery

## Motivation

- Implement a dynamic model to identify patterns in the vibration signals to achieve the modeling of vibration values during real time monitoring.
- Categorize the state of the machine according to the severity categorization from the norm ISO 10816-1 standard guidelines.
- Record the vibration signals by means a vibrometer.
- Record the vibration data in real time using Raspberry Pi.
- Implement an alert system by means of an Andon system, which indicates that maintenance is required through assigned colors.

## Motivation

- Record photoplethysmography (PPG) signals.
- Perform noise elimination on the PPG signals.
- Implement event detectors.
- Implement event visualization.
- Use additional cardiovascular measurements to PPG to increase accuracy.
- Implement a PPG-based machine learning model for hypertension classification.

# Electromyography signal processing

## Motivation

- Develop recommendations for EMG sensors and sensor placement procedures.
- Develop an architecture for EMG preprocessing.
- Implement an EMG modeling method.
- Implement a noninvasive analysis of muscles of the hand.
- Implement an adaptive spatial filtering of high-density EMG for reducing the influence of noise and artifacts in myoelectric signals.

- **R. Rodríguez-Jorge**, I De Leon-Damas, J Bila, J Skvor, *Internet of things-assisted architecture for QRS complex detection in real time*, *Journal of Internet of Things*, Vol 14 (2021), pp. 100395, <https://doi.org/10.1016/j.iot.2021.100395>. Elsevier.
- **R. Rodríguez-Jorge** and J. Bila, *Cardiac Arrhythmia Prediction by Adaptive Analysis via Bluetooth*, MENDEL, Vol. 26, No. 2, pp. 29-38.  
<https://doi.org/10.13164/mendel.2020.2.029>.
- S. Cervantes, A. Mexicano, José-Antonio Cervantes, **Ricardo Rodríguez**, and Jorge Fuentes-Pacheco, *Binary Pattern Descriptors for Scene Classification*. IEEE LATIN AMERICA TRANSACTIONS, VOL. 18, NO. 1, JANUARY 2020,  
<https://doi.org/10.1109/TLA.2020.9049465>. Indexed in JCR, Impact Factor: 0.804.
- Vergara V., O. O.; Cruz S., V. G.; **Rodríguez Jorge, Ricardo**; Nandayapa A., M. de J. (2016). *Editorial for Volume 7 Number 3 Recent ADvances in Augmented Reality (RADAR)*. International J. of Combinatorial Optimization Problems and Informatics, 7(3), Indexed in Web of Science, Redalyc, Latin Index, <https://ijcopi.org/ojs/article/view/22>.



- **Ricardo Rodríguez**, Adriana Mexicano, Jiri Bila, S. Cervantes, and Rafael Ponce, “Feature Extraction of Electrocardiogram Signals by Applying Adaptive Threshold and Principal Component Analysis,” Journal of Applied Research and Technology, Volume 13, Issue 2, 2015, <https://doi.org/10.1016/j.jart.2015.06.008> (Indexed in JCR, CONACYT, impact factor: 0.447).