

Rasool Baghbani, Ph.D.

Department of Biomedical Engineering

Hamedan University of Technology

Hamedan, 6516913733, Iran.

Office phone: +98-81-38411557.

Fax: +98-81-38380520.

Email: baghbani@hut.ac.ir

[Google Scholar](#) and [Linkedin](#)



Personal Profile

As a faculty member in the Biomedical Engineering Department at the Hamedan University of Technology, I am very enthusiastic about the connection between the world of engineering and technology with medicine and clinical applications. Based on my educational and research records and the skills acquired in the past few years in the field of biomedical engineering, I am very interested in team research work in this field, in the world's famous research centres. Through my research and studies, I strive to develop new devices and methods to improve the diagnosis and treatment of health problems.

Research Interests

My research interests include Biomedical Instrumentation, Biomedical Sensors, Bioimpedance Measurement, firmware programming for embedded microsystems, Hardware Design, Internet of Medical Things (IoMT), telemetry, wireless data, Medical Robotics, Smart Implantable Devices, Bioelectromagnetics, Biological, Modelling, Machine Learning (ML) and Biomedical Signal Processing.

Education

- **PhD Biomedical Engineering**, Department of Biomedical Engineering, Amirkabir University of Technology (Tehran Polytechnic) Tehran, Iran (with excellent grade) (2018)
 - The title of my PhD thesis was “Recording of Lung Tissue Bioimpedance Data and its Classification for Lung Cancer Diagnosis”.
 - The output of my dissertation was the publication of 6 articles in prestigious international journals and finally the feasibility of bioimpedance spectroscopy in determining the location of pulmonary nodules during surgery.

- **MSc Biomedical Engineering**, Department of Bioelectrics and Biomedical Engineering, School of Advanced Medical Technology, Isfahan University of Medical Sciences, Isfahan, Iran. (2006).
 - The title of my MSc thesis was "Design and manufacturing of the automatic lensometer"
 - The output of this thesis was the construction of a laboratory prototype of an auto lensometer, which was used by medical students for years in the optics laboratory of the Faculty of Medical Sciences of Isfahan University of Medical Sciences. Also, the oral presentation of a paper was at the international conference I2MTC, IEEE 2009 in Singapore
- **BSc Electrical Engineering**, Buali Sina University, Hamedan, Iran (2003).
 - My bachelor's degree project was the "Design and Construction of a Mine Detector Robot", the basis of which was the use of a metal detector that could be controlled by an Intel 8051 microcontroller.
 - Notably, my project was announced and selected as the best project of the university year.

Publications

Journal Papers:

1. M Ashoorirad, **R Baghbani**, M.B Shadmehr, " Intraoperative Localization of Metal Fragment Remained in the Human Body Using Electrical Bioimpedance: a Feasibility Study", (Early Access) **IEEE Sensors Journal**, Feb, 2024.
2. A Hamouleh-Alipour, S Khani, M Ashoorirad, **R Baghbani**, "Trapped multimodal resonance in magnetic field enhancement and sensitive THz plasmon sensor for toxic materials accusation", **IEEE Sensors Journal**, 1-9, May 2023.
3. **R Baghbani**, M Ashoorirad, F Salemi, MA Laribi, M Mostafapour, "Design and Construction of a Wireless Robot that Simulates Head Movements in Cone Beam Computed Tomography Imaging", **Robotica**, Cambridge University Press: 1 – 14, 01 August 2022.
4. AH. Alipour, MR. Forouzesfard, **R. Baghbani**, Zohreh Vafapour, "Blood Hemoglobin Concentration Sensing based on Optical Plasmonic Metasurface Nano-Biosensor: A Feasibility Study", **IEEE Transactions on Nanotechnology**, 4 October 2022.
5. S. Jamasb, M.B. Khodabakhshi, **R. Baghbani** "A Subcircuit-based Model for the Accumulation-mode MOS Capacitor", **Journal of Circuits, Systems and Computers**, World Scientific Publishing Company, 18 September 2022.
6. **R Baghbani**, M Ashoorirad" Optimization of the Van Der Pauw Method for Measuring the Electrical Properties Spectrum of Biological Solutions", **IEEE Transactions on Instrumentation and Measurement** 1-8, 2022.
7. M Ashoorirad, **R Baghbani**, A. Fallah; N. Jooyan, M. Gaffari, "A Collagen Thin Film-Based Bioimpedance Sensor for Cell Proliferation Rate Assessment", **IEEE Sensors Journal** 22(1), 2022.
8. **R Baghbani**, MB Shadmehr, M Ashoorirad, SF Molaeezadeh, MH Moradi "Bioimpedance Spectroscopy Measurement and Classification of Lung Tissue to Identify Pulmonary Nodules", **IEEE Transactions on Instrumentation and Measurement** 1-8, 2021.
9. M Ashoorirad, **R Baghbani**, MR Ghalamboran, "Bioimpedance sensor to detect water content in milk based on van Der Pauw method", **IET Nanobiotechnology**, 1-8, 2021.
10. **R. Baghbani**, "An Electrical Model of Hydrocephalus Shunt Incorporating the CSF Dynamics", Vol (9), **Scientific Reports**, 2019.

11. **R. Baghbani**, "A novel small-sized probe for local measuring electrical properties of the tissues inside of human body: design, modeling and simulation", **IET Nanobiotechnology**, 2019.
12. **R. Baghbani**, M.H. Moradi, MB. Shadmehr, ZM. Sanat, "A New Bio-Impedance Forceps Sensor for Measuring Electrical Conductivity of the Biological Tissues", **IEEE Sensors Journal**, August 2019.
13. **R. Baghbani**, M.H. Moradi, MB. Shadmehr, "Identification of Pulmonary Nodules by Sweeping the Surface of the Lung with an Electrical Bio-impedance Probe: A Feasibility Study", **Journal of Investigative Surgery**,1-10,2019.
14. **R. Baghbani**, S Jamasb, MB Khodabakhshi, "A method for image edge detection based on interval-valued fuzzy sets", **Journal of Intelligent & Fuzzy Systems**, 2019.
15. **R. Baghbani**, M.H. Moradi, MB. Shadmehr, "Identifying and Localizing of the In-depth Pulmonary Nodules Using Electrical Bio-Impedance", **Journal of Investigative Surgery**,1-10,2019.
16. **R. Baghbani**, M.H. Moradi, MB. Shadmehr, "The Development of a Four-Electrode Bio-Impedance Sensor for Identification and Localization of Deep Pulmonary Nodules", **Annals of biomedical engineering**,1-12,2018.
17. **R. Baghbani**, M. Ashoori rad, A. Pourziad, "Design and Implementation of a Linear Microwave Sensor for a Non-Invasive Glucose measurements" **IET Wireless Sensor Systems** 2015.
18. M.H. Moradi, M. Ashoori Rad, **R. Baghbani**, ECG signal enhancement using adaptive Kalman filter and signal averaging, **International Journal of Cardiology** Volume 173, Issue 3, Pages 552–555, May 15, 2014.

Conference Papers:

1. A.Akbari, **R. Baghbani**, M. Jahed, " Designing a cost-effective device for monitoring vital signs using the Internet of Things" The 30th National and 8th International Iranian Conference on Biomedical Engineering (ICBME 2023), Tehran, December 2023.
2. M. Akbari, Z. Akhavann, M. Ashoorirad and **R. Baghbani**, "Designing and Manufacturing a Device Based on the Internet of Things for Monitoring Vital Signs",The 29th National and 7th International Iranian Conference on Biomedical Engineering (ICBME 2022), Tehran, December 2022.
3. M. Ashoori Rad , **R. Baghbani**, "A Small Transversely Magnetized Linear Generator to Harvest Energy for Portable Medical Devices",International Conference on Nonlinear Systems and Optimization in Electrical and Computer Engineering, Dubai, May 2015.
4. M. Ashoori Rad, **R. Baghbani**, "Fetal Heart Rate Detection from Maternal Abdominal ECG Signals based on Adaptive Filters", International Conference on Nonlinear Systems and Optimization in Electrical and Computer Engineering, Dubai, May 2015.
5. M. Ashoori Rad, **R. Baghbani**, "Using Human Walking Energy for Powering Portable Electronic Devices", 1st Langaroud's Conference On Electrical Engineering (LCEE2015), Islamic Azad University, Langaroud, 2015.
6. Masoomeh Ashoorirad, **R. Baghbani**, "ELECTRICAL MODEL OF CEREBROSPINAL DYNAMICS AND HYDROCEPHALY SHUNTS", International Conference on Nonlinear Systems and Optimization of Electrical and Computer Engineering, Dubai, 2015.
7. **R. Baghbani**, M. Ashoorirad, " Brain Tumor Boundary Detection in MRI Image using Active Contours and Morphology Filter", ICDIP, IEEE International Conference on Digital Image Processing, NTU Singapore 28-30 February 2011.
8. M. Ashoorirad, **R. Baghbani**, " Blood Vessel Segmentation in Angiograms using Fuzzy Inference System and Mathematical Morphology", ICSIP, IEEE, International Conference on Signal and Image Processing, Singapore, 15-17 May 2009.

9. **R. Baghbani**, M. Ashoorirad, " Segmentation of Coronary Artery Image Based on Mathematical Morphology", Waset, International Conference on Signal and Image Processing, Amsterdam, The Netherland, 23-25 September 2009.
10. **R. Baghbani**, M. Ashoorirad," A New Method for Measurement Power of Lens using Image Processing Techniques", I2MTC, IEEE, International Instrumentation and Measurement Technology Conference, Singapore 5-7 May 2009.
11. **R. Baghbani**, M. Ashoorirad, " A Power Generating System for Mobile Electronic Devices Using Human Walking Motion", ICCEE, IEEE, International Conference on Computer and Electrical Engineering, Dubai, 28-30 September 2009.

Employment

- **Head of Biomedical Engineering Department, Hamedan University of Technology, Hamedan, Iran (2019 to 2023)**
 - Planning curriculum for BSc & MSc students in biomedical engineering.
 - Equipping educational and research laboratories.
 - Participation in educational and research meetings of the faculty.
- **Assistant Professor of Biomedical Engineering Department, Hamedan University of Technology, Hamedan, Iran (2018 to present)**
 - Teaching specialized and basic courses in electrical and biomedical engineering.
 - Determining the title and guiding the thesis of electrical and Biomedical engineering BSc & MSc students.
 - Doing a research project.
- **PhD scholarship in Biomedical Engineering at Amirkabir University of Technology (2013-2017)**
- **Member of the Council of Growth and Technology Center of Hamadan University of Medical Sciences, Hamedan, Iran (2013 to present)**
- **Member of the faculty of the Biomedical Engineering Department, Hamedan University of Technology, Hamedan, Iran (2011-2013)**
 - Teaching specialized and basic courses in electrical and biomedical engineering.
 - Determining the title and guiding the thesis of electrical and Biomedical engineering undergraduate students.
 - Doing a research project.
- **Member of the faculty of the Electrical and Biomedical Engineering Department of Azad University, Dezful branch, Dezful, Iran (2006-2011).**
 - Teaching specialized and basic courses in electrical and biomedical engineering.
 - Determining the title and guiding the thesis of electrical and Biomedical engineering undergraduate students.
 - Doing a research project.
- **Head of Electrical Engineering Department of Azad University, Dezful branch, Dezful, Iran (2006-2010).**
 - Planning curriculum for undergraduate Electrical and Biomedical Engineering students.

- Equipping educational and research laboratories.

Courses teaching

- MSc Courses:
 - Bio-instrumentation
 - Bio-electromagnetics
- BSc. Courses:
 - Electronics Measurement
 - Medical Devices
 - Microprocessor and Lab
 - Engineering Mathematical
 - Digital Circuits and Lab
 - Electromagnetic
 - Electrical Circuits II
 - Instrumentation
 - Image processing

Education & Work Honors and Awards

Work Honors and Awards:

- Top research professor in Biomedical Engineering Department, Hamedan University of Technology, Hamedan, Iran, 2023.
- Top educational professor of Biomedical Engineering Department, Hamedan University of Technology, Hamedan, Iran, 2023.
- Top educational professor of Biomedical Engineering Department, Hamedan University of Technology, Hamedan, Iran, 2022.
- Top educational professor of Biomedical Engineering Department, Hamedan University of Technology, Hamedan, Iran, 2021.
- Top research professor in Biomedical Engineering Department, Hamedan University of Technology, Hamedan, Iran, 2020.
- Top educational professor of Biomedical Engineering Department, Hamedan University of Technology, Hamedan, Iran, 2010.
- Top educational professor of Biomedical Faculty, Dezful University, Iran 2009.

Education Honors and Awards:

- Totally Ranked 11th in nationwide Electrical and Biomedical Engineering M.Sc. entrance exam among 4828 participants, 2003.
- Totally Ranked 204 in nationwide in university entrance exam among 11756 participants, in 1999.
- Achieving a gold coin for the Design and Implementation of Mine Detector Robot, 2003.

Projects Supervisor

PhD Thesis Supervisor,

- Evaluation of the Artefacts Associated with Different Types of Head Motions and their Effect on the Quality of the Cone Beam Computed Tomography Images, Faculty of Dentistry, Hamadan University of Medical Sciences (2020).

MSc Thesis Supervisor,

- Design of a wearable biosensor to biological fluids analysis (2023).
- Measuring the electrical properties of blood in the blood dialysis process in order to detect ultrafiltration (2023).
- Design of impedance ring sensor to determine the electrical properties of biological solutions (2022).
- LORA-based IoMT system in health monitoring, Hamedan University of Technology (2022).
- Recording of Impedance Cardiography (ICG) and its processing for the diagnosis of Cardiovascular diseases, Hamedan University of Technology (2021).
- Evaluation of wound healing in diabetic patients by measuring electrical impedance, Hamedan University of Technology (2021).
- Investigation of the effect of electric fields on the proliferation rate of cancer cells using interdigitated electrodes, Hamedan University of Technology (2021).
- Estimation and Modeling of the Skin Electrical Bioimpedance Hamedan University of Technology (2021).
- Reduce Motion Artifacts and Improve Cone Beam Computed Tomography Images (CBCT), Hamedan University of Technology (2021).

Experiences research and development from 2003 to 2023

Medical Device

- 1- Design and manufacturing of the automatic lensometer.
- 2- Design and construction of a lung flute system for non-pharmacological clearance of airway obstruction focusing on the role of positive expiratory pressure fluctuations.
- 3- Design and manufacturing air purifiers for medical and laboratory centers using UV rays.
- 4- Design and manufacturing a smart medical stethoscope to record the sound of the heart with the ability to send it wirelessly to a smart device using ESP32 module.
- 5- Design and manufacturing a simple circuit for plethysmography (PPG) recording with LDR optical sensor and Arduino Uno board.
- 6- Design and manufacturing of a bioimpedance analyzer module below 100 kHz using AD5933.
- 7- Detecting ultrafiltration in dialysis process using measuring the electrical properties of blood.

Biomedical Sensors Design

1- Sweat Wearable Biosensor

A wearable biosensor was designed to detect the level of urea in the sweat.

2- Forceps Sensor

A bioimpedance forceps sensor was constructed to measure lung tissue impedance during minimally invasive bronchoscopy surgery.

3- **Bioimpedance Sensor**

A bioimpedance sensor with a Wiener four-electrode array was implemented to record the electrical impedance spectrum during thoracotomy surgery in order to localize pulmonary nodules.

4- **Wearable Ring Sensor**

A wearable ring sensor was designed based on the Van Der Pauw method in order to reveal blood supply and heart rate by measuring the electrical bioimpedance.

5- **Non-invasive Blood Glucose Sensor**

A micro-strip sensor was designed and implemented to non-invasively measure blood glucose level.

IoT & IoMT

- 1- Design and implementing a LORA-based IoMT system for health monitoring.
- 2- Design and manufacturing a medical device using ESP32 vital signs monitoring.
- 3- Design, simulation, and implementation of a smart electronic device to record the wearing time of intra-oral appliances.
- 4- Design and implementing a smart pacifier to measure temperature along with wirelessly transmitting information to a smart device.
- 5- Design and manufacturing a smart baby incubator to measure the temperature of the baby's skin surface, humidity, and light of the surrounding environment with the capability of wirelessly sending data to a smart device.

Medical Robotics

- 1- Design and construction of a remote-controlled robot to simulate a variety of human head movements in CBCT imaging.
- 2- Design and implementation of a power generating system for mobile electronic medical devices using human walking motion.
- 3- Design and construction of an intelligent mice to track line and labyrinth.
- 4- Design and construction of a mine detector robot based on detecting a metal.

Clinical Experience

- 1- ECG recording, processing and display in the LabVIEW environment.
- 2- Recording and processing of Impedance Cardiography (ICG) estimate blood pressure.
- 3- Recording lung bioimpedance spectrum in the operating room.

Biomedical Data Processing

- 1- Using machine learning methods in Python to estimate body water using bioimpedance spectroscopy data.
- 2- Bioimpedance spectroscopy measurement and classification of lung tissue to identify pulmonary nodules in Python.
- 3- ECG signal enhancement using adaptive Kalman filter and signal averaging in MATLAB.

Peer Review Service

- IEEE Transactions on Instrumentation & Measurement
- Robotica, Cambridge University Press.
- International Journal of Advanced Robotic Systems - SAGE.
- IEEE Transactions on Biomedical Circuits and Systems.
- Physiological Measurement - IOP science.
- Biomedical Physics& engineering Express- IOP science.
- Computers in Biology and Medicine - Elsevier.
- IET Nanobiotechnology - John Wiley.
- Measurement Science and Technology - IOP Science.
- Neurosurgical Review – Springer.
- IET Science, Measurement & Technology - John Wiley.
- IET Electronics Letters - John Wiley.

Patents

1. [Robot simulator of human head movements](#), 2021 (Iranian National Patent, Registration number: [106230](#)).
2. [Time recorder wearing of extra oral appliances in orthodontic](#), 2020 (Iranian National Patent, Registration number: [102414](#)).
3. [Manufacturing Automatic Charging Torch with no Need to Battery](#), 2009 (Iranian National Patent, Registration number: [61789](#)).

Industrial Working partnership

Cooperation with the Iranian Agents of Science and Technology in technical evaluation and determination of the technology level of the knowledge-based companies and startups in the field of medical instruments and medical devices, industrial automation and electronic measurement (more than 30 companies and startups).

Skills

Software:

- Python (Implementation of machine learning algorithms such as SVM, FCM, KNN, LDA, extended Kalman filter,...)
- C++
- Microcontrollers Firmware Programming(C++, Python)
- Matlab
- Labview (Instrumentations and Process control)
- COMSOL
- LT Spice
- Altium Designer (Software for circuits design for PCB)
- Proteus (digital circuits simulations)

- STM32 CubeMX, Keil (Programming for ARM STM32, STM8 Microcontrollers)
- MIT App Inventor (IoT system design)
- Node-Red (IoT system design)

Hardware:

- ARM STM32 Microcontrollers
- ESP32
- Texas Instruments DSPs and Microcontrollers
- Arduino based systems
- Multiple ARM platforms
- Microchip PIC and Atmel Microcontrollers
- Applications using Raspberry Pi (and similar) as core processor
- Low-level Driver development
- Peripherals integration, including sensors, memory, communications
- Wireless platforms like Wi-Fi, Bluetooth, ZigBee, NFC, RF, among others
- Spartan-3,6 FPGA Family – Xilinx

Proficient in medical equipment standards

- EMC & IEC 60601
- ISO 13485

Strengths

- **Adaptable Team-player**
I am able to adapt the culture, pace and processes of any team - large or small.
- **Excellent Problem-Solving**
Demonstrated exceptional problem - solving skills in identify and resolving complex issues in medical device.
- **Strong Analytical Thinking**
Utilized strong analytical thinking to analyze data and make informed decisions on device performance.
- **Effective Communication**
Possessed excellent communication skills, effectively convey technical information to both technical and non-technical stakeholders.

Languages

- Turkish (native)
- Persian (native)
- English

Sports

- Volleyball
 - The champion of the inter-university volleyball tournament of the 6th region of Azad University (2008)
- Badminton
 - Winning the third title among the employees of Hamedan University of Technology 2022

References

- a) Professor Med Amine Laribi, Department of GMSC, Prime Institute CNRS, ENSMA, UPR 3346, University of Poitiers, Poitiers, France.
Email: med.amine.laribi@univ-poitiers.fr, <https://pprime.fr/med-amine-laribi/>
Tel: (33) (0)5 49 49 65 52
- b) Professor Mohammad Behgam Shadmehr, Department of Thoracic Surgery, Tracheal Diseases Research Center (TDRC), National Research Institute of Tuberculosis and Lung Diseases (NRITLD), Shahid Beheshti University of Medical Sciences, Tehran, Iran
Email: mbshadmehr@sbm.ac.ir, <https://tdrc.sbm.ac.ir/index.jsp?pageid=11508&p=1>
- c) Professor Alireza Mehridehnavi, Department of Bioelectrics and Biomedical Engineering, School of Advanced Medical Technology, Isfahan University of Medical Sciences, Isfahan, Iran.
Email: mehri@med.mui.ac.ir, https://isid.research.ac.ir/Alireza_Mehridehnavi
- d) Professor Mohammad Hassan Moradi, Amirkabir University of Technology (Tehran Polytechnic), Tehran, Iran.
Email: mhmoradi@aut.ac.ir, <https://bme.aut.ac.ir/content/3824/Bioinstrumentation-and-Biological-Signal-Processing>
- e) Dr Amir Heidari, Sr. Manager of System Engineering at SiTime Inc. 5451 Patrick Henry Dr, Santa Clara, CA 95054.
Email: heidari.amir@gmail.com , aheidari@sitime.com