European Journal of Technical and Natural Sciences 2026, No 4
ISSN 2414-2352

PREMIER Publishing
ppublishing.org

DOI:10.29013/EJTNS-26-4-113-122

POTENTIAL INNOVATIVE DESIGNS OF MEDICAL EQUIPMENT BASED ON CONTACTLESS MONITORING METHODS (Contactless methods for active online monitoring based on electromagnetic resonance spectroscopy, including applications in liquid media, and prospective innovative medical equipment for the smart physician's office based on these methods)

Maryna Savchenko [1]

[1] Expert in recreational technologies and human resource restoration consultant in psychological climate stabilization for innovative startups Esthetician_maryna_fl Kharkiv, Ukraine

Cite: *Savchenko M. (2026). Potential innovative designs of medical equipment based on contactless monitoring methods. (Contactless methods for active online monitoring based on electromagnetic resonance spectroscopy, including applications in liquid media, and prospective innovative medical equipment for the smart physician's office based on these methods). European Journal of Technical and Natural Sciences 2026, No 4.* https://doi.org/10.29013/EJTNS-26-4-113-122

Abstract

This article examines innovative contactless methods for monitoring the composition of liquid media as a technological foundation for the development of next-generation medical equipment, particularly intelligent diagnostic systems and real-time monitoring platforms. Special attention is devoted to modern impedance-resonance and electromagnetic resonance technologies, as well as their advanced modifications employing novel engineering materials, composite materials, and carbon-carbon structures subjected to repeated pyrolysis to enhance measurement sensitivity, stability, and analytical performance.

Computer modeling performed by the author demonstrates that these technologies provide the engineering basis for the development of more than ten categories of innovative medical devices. Guided by advanced analytical methodologies, including the Theory of Inventive Problem Solving (TRIZ), the author conducted an extensive patent landscape analysis that resulted in the identification of numerous relevant U.S. patents and patent applications supporting the proposed technological concepts.

Based on comprehensive engineering analysis and systematic computer modeling using the author's proprietary innovation methodology, a series of technical proposals for new medical technologies and innovative engineering projects has been formulated. These concepts integrate advanced contactless monitoring methods with novel materials and composite technologies while providing opportunities for both horizontal and vertical integration with digital technologies, artificial intelligence, and modern computer engineering systems.

The publication also emphasizes that the preliminary engineering evaluation of the proposed devices and medical systems was carried out using professional computer-aided engineering and design software rather than conventional graphical modeling tools, thereby increasing the technical reliability and practical feasibility of the proposed innovation concepts.
Keywords: *Innovative medical equipment; Contactless active online monitoring methods; Innovative medical equipment based on contactless monitoring methods; Contactless active online monitoring based on electromagnetic resonance spectroscopy; Innovative medical equipment for the smart physician's office; Diagnostic systems and online monitoring systems; Real-time contactless monitoring and analytical processing of monitoring results*

Introduction

The following section presents a series of innovative medical engineering concepts based on contactless monitoring technologies and advanced electromagnetic resonance methods. The technological foundation of this project is based on the sensitivity of an electromagnetic resonance sensor to changes in the physical and physicochemical properties of liquid media. The proposed concept is intended to investigate the feasibility of performing a comparative, non-invasive assessment of the general condition of blood without collecting blood samples or penetrating the human circulatory system.

The underlying technological methodology has been developed through experimental studies evaluating changes in water composition produced by the introduction of precisely measured reference substances. During these experiments, the electromagnetic resonance sensor demonstrated the ability to detect microscopic variations in the composition of the liquid medium and to identify corresponding changes in the overall characteristics of the tested mixture.

The proposed sensor is designed as a ring-shaped solenoid into which a patient's finger is placed during the measurement procedure. Prior to examination, the sensor processor is supplied with reference statistical data describing resonance characteristics corresponding to physiologically normal blood parameters while taking into account the individual biological characteristics of the examined person. When the measured sensor response corresponds to the reference resonance profile – including resonance frequency characteristics, signal amplitude, dielectric permittivity, electrical conductivity, and acidity parameters – the system indicates conformity with the reference model by activating a green indicator.

Key distinguishing features of the project

The implementation of this project is intended to result in the development of a medical device suitable for large-scale public use while providing a level of measurement accuracy traditionally associated with sophisticated laboratory diagnostic equipment.

The proposed device has the potential to fundamentally transform the approach to individual health monitoring by enabling rapid, non-invasive assessment of general blood condition, thereby significantly enhancing personal health protection and preventive medical care.

The device is based on an advanced nanometrological technology that has already demonstrated practical applicability in the semiconductor industry. This technological platform has undergone extensive engineering validation, is supported by comprehensive patent protection, and possesses significant licensing and commercialization potential.

Advantages of the proposed technology

The proposed technology establishes a new direction in medical metrology by combining highly sensitive nanoscale sensing with the principles of electromagnetic resonance.

This engineering approach is intended to achieve sensitivity to changes in the overall concentration of blood components at levels approaching **0.000001 milligrams**, while enabling completely contactless and remote monitoring without direct physical interaction with the examined individual.

Because the anticipated manufacturing cost is comparable to that of widely available consumer electronic products, the proposed technology also offers considerable social and public health benefits by making ad-

vanced diagnostic monitoring accessible to a broad population.

Laser and fiber-optic blood stimulation system for increasing hemoglobin concentration

A complementary project concept involves the development of a laser and fiber-optic system intended to increase hemoglobin concentration through controlled optical stimulation of blood.

The proposed system incorporates electromagnetic resonance monitoring technologies to provide continuous real-time assessment of the overall condition of blood during the treatment process. Such monitoring is intended to prevent exposure beyond established operating parameters that could otherwise result in undesirable or irreversible changes in blood properties.

The integration of continuous resonance-based monitoring with laser and fiber-optic therapeutic technologies is intended to improve procedural safety, optimize treatment parameters, and provide an additional level of control for advanced medical applications.

Figure 1.

The photograph illustrates disposable medical instruments developed on the basis of innovative fiber-optic technologies and protective coding solutions.

The underlying treatment methodology is based on the controlled application of concentrated spectral light within predefined wavelength ranges, frequency characteristics, pulse configurations, and peak optical power parameters designed to achieve the intended therapeutic effect.

Proposed project title

Device with disposable instrumentation for spectral optical blood treatment to increase hemoglobin concentration

Project classification

Research and Experimental Development (R&D) Project

Purpose, objectives, and scope of the project

The objective of this project is to develop a portable medical device based on advanced nanometrological principles and modern spectral-optical technologies capable of providing controlled therapeutic воздействие on blood while simultaneously performing continuous monitoring of its condition throughout the treatment process.

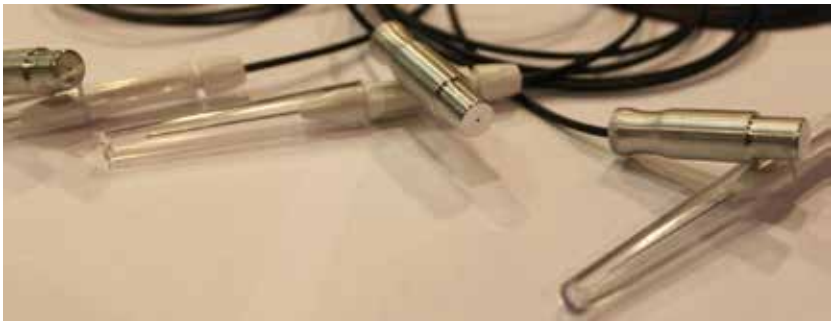
The integration of spectral-optical therapeutic technology with real-time electromagnetic resonance monitoring is intended to provide a stable, controlled, and highly effective process for supporting the restoration of critical blood parameters while maintaining continuous supervision of treatment conditions.

Key distinguishing features of the project

The principal distinguishing characteristics of the proposed project, device, and underlying technology include:

- a simple, reliable, and practical engineering design of both the medical device and its disposable instrumentation;
- the innovative adaptation of advanced technologies originally developed for high-precision semiconductor manufacturing and nanometrology to medical applications;
- the utilization of highly sophisticated optical and fiber-optic engineering solutions to achieve therapeutic effects previously unavailable through conventional medical equipment;
- the integration of disposable optical instrumentation with advanced monitoring technologies, thereby enhancing operational safety, measurement reliability, and clinical usability.

Figure 2.



Advantages of the proposed technology

The proposed technology and the engineering solutions developed for its implementation are characterized by the following advantages:

- utilization of a well-established and experimentally validated technological platform;
- application of technological components and engineering elements that already have counterparts in large-scale industrial production;
- full patentability of both the technology and its individual engineering components;
- simple operation and ease of use, allowing the system to be employed by healthcare professionals without specialized technical training.

Contactless system for non-invasive reduction of subcutaneous adipose tissue

The proposed system incorporates a dedicated operating algorithm specifically designed for controlled contactless treatment of subcutaneous adipose tissue.

Within this concept, electromagnetic resonance technology performs continuous three-dimensional monitoring of the treatment zone, enabling precise localization of the thermal energy applied to the layer of subcutaneous fat most responsive to therapeutic exposure.

The electromagnetic resonance monitoring system also provides continuous measurement and regulation of treatment temperature throughout the procedure, thereby ensuring stable operating conditions and improving process control.

Purpose, objectives, and scope of the project

The project is intended to develop a technology and corresponding medical equipment for the non-invasive reduction of subcutaneous adipose tissue using engineering solutions based on the physical principles of electromagnetic resonance and modern nanometrology.

The primary objective is to create a medical device together with an integrated treatment methodology capable of performing highly localized and precisely controlled processing of subcutaneous adipose tissue without invasive surgical intervention while minimizing undesirable side effects.

The project encompasses comprehensive scientific research followed by engineering

development and prototype implementation based on the obtained research results.

Key distinguishing features of the project

The principal innovation of the proposed project lies in the application of electromagnetic resonance nanometrology for highly precise, localized, actively controlled, and continuously monitored thermal treatment of subcutaneous adipose tissue.

Advantages of the proposed technology

The principal advantage of the proposed technology is its ability to maintain continuous control over all critical treatment parameters. Such precision is intended to achieve effective localized processing while avoiding thermal injury or damage to adjacent untreated tissues, thereby maximizing procedural safety and treatment accuracy.

Electromagnetic resonance system for the early detection of malignant neoplasms

The proposed system has been developed in several engineering configurations.

The most innovative concept is based on specially designed patient-specific examination garments manufactured from electrically conductive carbon-carbon composite fabric. Owing to the unique structure of the woven material, the textile itself functions as either a planar or three-dimensional solenoid, enabling contactless electromagnetic resonance measurements.

The examination procedure is performed by dividing the patient's body surface into multiple monitoring zones. The reflected resonance signal obtained from each zone is compared with a statistical reference signal corresponding to a clinically healthy individual with the same body dimensions and garment size.

The carbon-carbon composite material is suitable for repeated sterilization using conventional autoclave procedures and may also be sterilized using microwave technology.

A second system configuration is intended for localized examinations and incorporates a sensor assembly geometrically adapted to the anatomical region corresponding to the organ under investigation.

Comparison of the resonance signal obtained from the examined organ with the corresponding reference signal from healthy tissue provides the basis for identifying changes that may warrant further clinical investigation.

Purpose, objectives, and scope of the project

The objective of this project is to develop a technology and medical device intended to investigate the feasibility of extremely early detection of malignant neoplasms using contactless electromagnetic resonance monitoring. The project aims to develop a medical system based on advanced contactless nanometrological and electromagnetic resonance technologies with a projected analytical sensitivity capable of detecting structural changes on the order of approximately 100 angstroms and mass variations approaching 0.000001 milligrams.

Such analytical sensitivity is intended to support the identification of pathological changes at their earliest stages, thereby creating opportunities for timely clinical assessment and medical intervention before irreversible disease progression occurs.

Key distinguishing features of the project

The proposed project is characterized by fundamentally novel primary and auxiliary engineering solutions.

The technical concepts underlying the proposed technology are fully patentable and are presented as original engineering developments. The proposed system is designed using components and materials already available through industrial manufacturing, thereby eliminating the need for developing specialized production technologies.

Advantages of the proposed technology

The principal advantage of the proposed technology is its exceptionally high analytical sensitivity, which constitutes the foundation of its projected diagnostic capabilities.

Electromagnetic resonance system for the early detection of reduced calcium concentration in bone tissue

This project is based on a sensor garment concept similar to that proposed for

the early detection of malignant neoplasms. The principal distinction is that the statistical reference database consists of analytical measurements corresponding to bone tissue with physiologically normal calcium concentration.

Research and Experimental Development (R&D) Project

Purpose, objectives, and scope of the project

The project is intended to investigate the scientific principles underlying the preventive assessment of changes in calcium concentration within bone tissue and to develop a corresponding contactless diagnostic technology.

The primary objective is to create a universal medical device capable of detecting variations in calcium concentration with a projected analytical sensitivity approaching 0.000001 milligrams.

Key distinguishing features of the project

The principal innovation of the proposed system lies in the application of electromagnetic resonance nanometrology for the contactless detection and assessment of changes in calcium concentration throughout bone tissue.

Advantages of the proposed technology

The proposed technology and its implementation methodology offer significant advantages over existing approaches. These advantages include high analytical accuracy and sensitivity, enabling the detection of even minimal deviations during routine outpatient examinations at a stage when corrective or therapeutic intervention remains both feasible and clinically effective.

Real-time electromagnetic resonance system for monitoring bone fracture healing

The proposed system is based on a flexible and elastic solenoid fabricated from electrically conductive carbon-carbon composite fabric produced through the pyrolysis of viscose textile substrates. The textile solenoid is configured as a localized bandage positioned over the fracture site and continuously connected to a processor containing statistical reference data representing the electromagnetic resonance characteristics of healthy bone tissue.

Purpose, objectives, and scope of the project

The purpose of this project is to conduct scientific research and engineering development leading to the creation of a technology and equipment for real-time therapeutic monitoring capable of supporting clinical decision-making throughout the active phases of treatment and rehabilitation.

The principal innovative characteristics of the proposed project include:

- application of electromagnetic resonance principles to identify structural changes in bone tissue within the fracture zone;
- completely contactless monitoring without any direct physical interaction during examination;
- capability for continuous remote monitoring of the patient's condition;
- high analytical accuracy and measurement sensitivity;
- reliable identification and interpretation of monitoring results through integrated signal analysis.

Advantages of the proposed technology

The proposed technology combines high measurement accuracy and analytical sensitivity with continuous remote transmission and interpretation of monitoring data. This enables timely clinical decision-making in real time and has the potential to improve the effectiveness of treatment and rehabilitation.

Electromagnetic resonance system for the therapeutic destruction of cholesterol plaques in arteries

The proposed project investigates the development of an electromagnetic resonance therapeutic system intended for the targeted treatment of cholesterol plaques within arterial vessels through controlled resonance-based energy delivery while providing continuous monitoring of treatment parameters.

Electromagnetic resonance system for the detection and non-invasive treatment of arterial cholesterol plaques

The proposed system is based on the capability of electromagnetic resonance technology to distinguish between muscular tissue and liquid media. By continuously comparing resonance signals, the system is intended to identify with high precision the boundary between soft tissue and blood, corresponding to the arterial wall.

Following localization of the treatment area, controlled thermal energy is directed toward regions of the arterial wall containing cholesterol plaque deposits. The treatment process is designed to maintain precise temperature control and three-dimensional spatial localization of the thermal exposure. Under controlled thermal conditions, the plaque material is intended to undergo gradual structural degradation, after which the resulting products are expected to be eliminated through the body's natural biological metabolic processes.

The proposed therapeutic methodology is conceived as a preventive treatment strategy in which periodic procedures are performed to reduce or limit the progressive accumulation of cholesterol deposits within arterial vessels.

From an engineering perspective, the system consists of electromagnetic resonance sensor modules mechanically integrated with pulsed thermal energy generators through a flexible positioning and adjustment mechanism.

The same structural platform and electromagnetic resonance localization technology may also support other forms of therapeutic energy delivery depending on the intended clinical application, including radiological and laser-based methods for superficial treatment.

Purpose, objectives, and scope of the project

The project is intended to investigate and develop technologies and medical equipment for the non-invasive detection and treatment of cholesterol plaques within arterial vessels.

The primary objective is to conduct comprehensive scientific research and experimental investigations that will establish the scientific and engineering foundation necessary for the subsequent development, prototyping, and evaluation of the proposed system together with its intended clinical methodology.

Key distinguishing features of the project

The principal innovation of the project lies in the integration of electromagnetic resonance technology with precisely controlled inductive thermal treatment for the identification, localized disruption, and subsequent biological elimination of cholesterol plaques and their degradation products.

Advantages of the proposed technology

The proposed technology is characterized by the high analytical accuracy and sensitivity of its electromagnetic resonance sensor modules. These capabilities are intended to support the detection of cholesterol plaque formation at its earliest stages and to facilitate therapeutic intervention while the deposits remain comparatively small and more readily managed through non-invasive treatment.

Electromagnetic resonance scanning system for preventive assessment of skeletal muscle condition

The proposed system consists of an electromagnetic resonance scanning module designed to move across the body surface during examination. The system incorporates at least two sensor elements whose magnetic field vectors intersect, creating a controllable three-dimensional sensing volume. The geometry of this intersection can be adjusted according to the specific diagnostic objectives of the examination.

An additional reference sensor continuously determines and controls the effective depth of investigation.

The fundamental physical principles governing the operation of the system remain the same as those described for the preceding applications. Consequently, they are not repeated for each individual implementation of the proposed technology.

Purpose, objectives, and scope of the project

The purpose of this project is to conduct fundamental scientific research leading to the development of the initial engineering requirements for subsequent prototype design and experimental development.

The primary objective is to prepare the complete engineering documentation, manufacture a functional prototype, and perform a comprehensive program of preliminary technical testing.

The project is intended to produce a prototype medical device capable of performing preventive assessment of skeletal muscle condition using technological principles based on electromagnetic resonance.

Key distinguishing features of the project

The proposed project is characterized by the following innovative features:

- assessment of skeletal muscle condition through identification and interpretation of electromagnetic resonance sensor signals;
- acquisition of integrated reflected resonance signals representing the overall structural and functional condition of muscle tissue, including its physiological activity.

Advantages of the proposed technology

The proposed technology enables completely contactless layer-by-layer assessment of skeletal muscle tissue while generating a three-dimensional representation of its overall condition.

Electromagnetic resonance system for preventive detection of bronchial and pulmonary secretions

The proposed system consists of a sensor array together with positioning mechanisms that accurately orient the sensors during examination.

Its operating principle is based on comparative analysis of resonance signals obtained from clinically healthy individuals and corresponding signals acquired from the examined patient.

The sensor assembly incorporates a central processor together with a dedicated analytical coprocessor. The software required for signal processing and comparative analysis is intended to be developed as part of the project.

The system is designed to detect deviations from established reference resonance characteristics. The magnitude of these deviations is intended to provide an indirect indication of the presence and relative extent of bronchial or pulmonary secretions.

The proposed technology is conceived as a preventive diagnostic tool that may reduce the need for certain conventional radiographic examinations in selected clinical applications.

Purpose, objectives, and scope of the project

The objective of the project is to develop an efficient diagnostic device together with its associated technology and methodology for improving preventive medical examinations and supporting the earlier detection of respiratory disorders.

The proposed application of electromagnetic resonance phenomena for preventive diagnostic assessment represents an original engineering concept requiring comprehensive scientific investigation.

Key distinguishing features of the project

The proposed technology is characterized by:

- high analytical accuracy and diagnostic performance;
- broad potential applicability within preventive and clinical medical practice;
- relatively low equipment and operating costs;
- significant potential public health benefits through earlier identification of disease processes.

Advantages of the proposed technology

The principal advantages of the proposed technology include:

- completely non-invasive operation without known harmful effects during or after examination;
- simple operating procedures requiring minimal user training;

- favorable cost-effectiveness relative to the anticipated diagnostic capabilities;
- the potential to substantially improve the effectiveness of preventive diagnostic screening.

Electromagnetic resonance system for preventive monitoring of arterial blood flow velocity

The proposed system employs flexible sensor solenoids manufactured from electrically conductive carbon-carbon textile composites. These sensors are positioned at selected anatomical monitoring points or localized regions of the patient's body. During examination, the flexible sensor assemblies conform closely to the skin surface, allowing resonance signals to be acquired and analyzed for the assessment of arterial blood flow velocity. The proposed methodology is based on comparison of measured parameters with statistically established reference values representing normal blood flow characteristics.

Purpose, objectives, and scope of the project

The objective of this project is to develop a contactless medical device for the preventive assessment of the vascular system without the need for any invasive procedures.

The project encompasses a complete cycle of scientific research and experimental development activities leading to the design, construction, and validation of the proposed medical device.

The fundamental inventions underlying the project represent original engineering solutions that are intended to provide an exceptionally high level of measurement accuracy and analytical capability.

Key distinguishing features of the project

The principal innovation of the project lies in the practical implementation of electromagnetic resonance sensing for the measurement and identification of physiological parameters using engineering principles that represent an original technological concept.

All measurements are performed entirely without physical contact and are intended to operate without direct mechanical interaction with the patient's body.

Advantages of the proposed technology

The primary advantages of the proposed technology include its engineering simplicity, comparatively low production cost, and the combination of high measurement accuracy with advanced analytical interpretation of acquired data.

Electromagnetic resonance system for restorative stimulation of muscle tissue

The proposed system is intended to provide contactless electromagnetic resonance stimulation of skeletal muscle and soft tissues to support the restoration of their functional activity. The technology may be used either independently or in combination with thermal contrast therapy devices, as well as localized heating or cooling systems. By combining multiple electromagnetic resonance excitation modules operating at different functional levels with a high-precision resonance positioning system capable of controlling the depth of treatment with sub-millimeter accuracy, the proposed technology enables layer-by-layer electromagnetic resonance treatment of muscle tissue, either as a standalone therapy or together with contrast thermal treatment. For patients affected by arthritis and related musculoskeletal disorders, the proposed approach is intended to provide precisely localized therapeutic stimulation of affected tissues. The system also enables contrast therapy to be applied selectively within specifically identified pathological regions, thereby improving treatment precision and control.

Proposed project title

Device with instrumentation and contactless therapeutic modules for comprehensive electromagnetic resonance stimulation of muscle tissues, including internal organs, to support the restoration of their functional activity.

Purpose, objectives, and scope of the project

The project is intended to develop, on the basis of advanced nanotechnology and electromagnetic resonance engineering, a medical device capable of supporting restorative therapeutic procedures in outpatient

settings without dependence on specialized medical facilities. The proposed technology is based on established physical principles of electromagnetic resonance and incorporates a family of patented engineering solutions protecting both the structural configuration and technological concepts of the proposed system. The project includes a complete cycle of scientific research, engineering development, prototype construction, and experimental evaluation.

Key distinguishing features of the project

The principal distinguishing characteristics of the proposed technology include:

- completely contactless operation during all treatment procedures;
- application of the precision and analytical capabilities of electromagnetic resonance technologies;
- utilization of unique naturally occurring engineering materials within the device architecture;
- development of equipment suitable for routine outpatient medical practice.

Advantages of the proposed technology

The proposed technology is intended to provide exceptionally high spatial precision in identifying treatment locations and maintaining accurate positioning throughout therapeutic procedures. This high level of precision is expected to enhance the effectiveness of restorative and preventive treatment by enabling accurately controlled therapeutic intervention.

Conclusion

The concepts presented in this publication represent only a portion of the potential applications of electromagnetic resonance monitoring technologies. Numerous additional developments may be realized in the field of continuous real-time patient monitoring using contactless electromagnetic resonance sensors designed to operate without harmful effects or undesirable physiological consequences. For such applications, the author proposes the use of flexible composite solenoid structures that function not only as sensing elements but also as medical dressings. Because these structures are manufactured from carbon-graphite composite fabrics, disposable versions may simultaneously perform diagnostic monitoring and serve as sorptive wound dressings, thereby providing additional therapeutic benefits while supporting continuous physiological monitoring.

References

United States Patent Application No. **US 20130173180 A1**. *Determination of Attributes of Liquid Substances*. Published July 4, 2013.

United States Patent Application No. **US 20120029845 A1**. *Apparatus and Method for Fluid Monitoring*. Published February 2, 2012.

submitted 06.07.2026;
accepted for publication 20.07.2026;
published 31.07.2026

Contact: cosmetologist.savchenko@gmail.com