International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

Designing and Implementation of a Portable Patien Device for Lung Cancer Treatment and Screening

Ms. J. A. Sandhiya, T. Deepa, D. Esther Rajathi, V. Kalaivani,

AP/B. E. Biomedical Engineering, Department Of Biomedical Engineering,Gnanamani College Of Technology, NH-7, A. K. Samuthiram, Pachal (PO), Namakkal Dist.,Tamil Nadu-637018

ABSTRACT

Lung cancer remains a major global health problem for which prevention and early detection are crucial for effective treatment. This paper proposes an innovative approach that uses IoT technology to improve lung cancer prevention and treatment by integrating various sensors and devices. The main focus of this system is the use of the MQ4 sensor to detect acetone, a volatile organic compound (VOC) associated with lung cancer. The MQ4 sensor offers high sensitivity and selectivity for acetone, enabling early detection through breath analysis. In addition, a built-in breathing sensor monitors breathing patterns and provides valuable information about respiratory health. In addition, the system includes a SpO2 monitor (Peripheral Capillary Oxygen Saturation), which measures the oxygen content of the blood and provides a comprehensive assessment of lung function. This real-time monitoring of respiratory parameters facilitates early intervention and individualized treatment strategies. In addition, IoT technology is used to automate certain aspects of maintenance. DC ventilation is used to improve air circulation, remove air pollutants and maintain an environment conducive to lung health. In addition, the Peltier crystal is used for localized cooling/home therapy, which provides targeted therapy to relieve symptoms and improve patient comfort.

INTRODUCTION:

Lung cancer is a huge global health problem that requires urgent attention due to high mortality and often late diagnosis. Preventive measures and early detection strategies are key to effective management. In recent years, the development of technology has opened up new possibilities to improve both preventive and curative results. This paper presents an innovative approach that harnesses the power of sensor technology to revolutionize lung cancer prevention and treatment. Central to this approach is the integration of various sensors capable of detecting specific lung cancer-related biomarkers. Of particular importance is the use of the MQ4 sensor, known for its sensitivity and selectivity in the detection of acetone, a volatile organic compound (VOC) associated with lung cancer. When analyzing breath samples, this sensor offers a non-invasive method for early detection, offering a promising option for timely intervention.In addition to the MQ4 sensor, this system has a breathing sensor that tracks breathing patterns and provides information about respiratory health. These features are complemented by an integrated SpO2 (Peripheral Capillary Oxygen Saturation) display, which facilitates real-time monitoring of blood oxygen concentration. Together, these sensors provide a comprehensive assessment of lung function, enabling individualized treatment strategies tailored to a patient's unique needs. In addition, this paper explores opportunities to use Internet of Things (IoT) technology to automate certain aspects of maintenance. Integrating devices such as DC ventilation to improve air circulation and Peltier crystals for targeted cooling/home therapy, this system aims to improve patient comfort and optimize treatment outcomes.In conclusion, the proposed approach is an important step forward in the treatment of lung cancer, providing a multifaceted solution that addresses both prevention and treatment. Integrating cutting-edge sensor technology and IoT-based automation, this system promises to improve patient outcomes and ultimately reduce the burden of lung cancer worldwide

LITERATURE REVIEW

1 Title: Biomedical Image Analysis for Colorectal and Lung Cancer Detection Using the Tuna Swarm Algorithm with a Deep Learning Model - IEEE.By MARWA OBAYYA, MUNYA A. ARASI, And NUHA ALRUWAIS.Year: 2023.

This existing study develops a new biomedical image analysis for colon and lung cancer detection using tuna algorithm and deep learning (BICLCDTSADL).

The presented BICLCD TSADL technique investigates the detection and classification of colon and lung cancer in biomedical images. In addition, AFAO was performed to adjust the hyperparameters of the GhostNet technique. Additionally, AFAO was performed to adjust the hyperparameters the GhostNet technique. In addition, the ESN classifier (TSA) is used to detect lung cancer and colon cancer. A detailed comparative analysis highlighted the higher efficiency of the BICLCD TSADL technique compared to other approaches with a maximum accuracy of 99.33%.

2 Title: "Fundamental and Comparative Global and Local Feature Framework for Lung Cancer Differentiation Using CT Scan Images “IEEE.By MOHAMMAD A. ALZUBAIDI, MWAFFAQ OTOOM.Year: 2021.

This current paper presents a new framework for lung cancer detectionfrom CT scan images that includes global and local extraction steps. Using 1000CT scan images, global features are extracted using ten different image feature types and six machine learning algorithms. Integrating state-of-the-art sensor technology and IoT-enabled automation, this system promises to improve patient outcomes and ultimately reduce the burden of lung cancer on a global scale. The results show that Gabor Filter, Oriented Gradient Histogram (HOG) and HaarWavelet functions are better than others and Support Vector Machine (SVM) provides the highest accuracy. The excellent performance of local features reaches up to 97%accuracy, 96% sensitivity and 97% specificity...

MATERIALS AND METHODS

Patients with histologically confirmed primary lung cancer and patients visiting the ENT Department for benign disease, hereafter referred to as healthy controls, were recruited for referral to tertiary care. Hospital, Maastricht University Medical Center. Exclusion criteria were age under 18 years and a history of any therapy for a current tumor or cancer. Tumor characteristics and medical history were collected from patients' clinical records. TNM staging was determined according to the American Joint Committee on Cancer guidelines version 7.0. Both SCLC and NSCLC patients were included. Information on current smoking habits and smoking history was collected and reported by pack year. Non-smoking was defined as not smoking in the past month. Any side effects or side effects during or immediately after measurement were documented.

The measurements were performed in the throat and laryngology outpatient clinic. Verbal informed consent was obtained from all patients. The medical ethics committee approved the study protocol. Materials We used five enosis (serial numbers 259, 309, 315, 362 and 379) in this study. Agonies consists of three micro-hot plate metal oxide sensors with different surface properties (AS-MLV sensors, Applied Sensors GmbH, Reutlingen, Germany) and a Texan tube. The combination of the sensors and the Texan tube enables breath profiling. The cooking pots are periodically heated and cooled to 260-340 °C in 64 steps approximately every 20 seconds. The measurement consists of 36 of these intervals. During this process, the exhaled air passes over the sensors. Redox reactions of volatile organic compounds on the surfaces of metal oxide sensors cause changes in conductivity. In this way, a VOC profile is recorded for each patient. Figure 1. Receiver operating curve The patient's lips had to be closed over the mouthpiece at all times and a nose clip was used to prevent passage through the nose. A short test drive with inhalation and exhalation was performed so that the patient could familiarize himself with the device. Carbon filters were used to reduce the possibility of environmental VOCs affecting the measurement. The entire measurement period lasted about 15 minutes, if the patient inhales and exhales the device within 5 minutes of those 15 minutes. The remaining time was used to measure low VOCs inside the Texan tube and regenerate the sensors with clean filtered air. Making these measurements did not affect the normal diagnostic work. Patients did not receive an electronic nose for lung cancer screening in May 2018. 677 individual diagnostic results were obtained from the e-nose analysis. Both patients and healthy controls were divided into a training set and a blank set for validation.

EXISTING SYSTEM

This interesting study, they introduced supervised and unsupervised machine learning strategies to improve tumor characterization. Using deep learning algorithms, especially 3D convolutional neural network and transfer learning, a significant improvement in tumor classification was observed. In addition, task-dependent feature representations are integrated into the CAD system through a graphically regularized sparse Multi-Task Learning framework based on radiologist interpretations. Evaluation of lung and pancreatic tumor diagnosis challenges using 1018 CT and 171 MRI scans, respectively, presents state-of-the-art sensitivity and specificity results demonstrating the effectiveness of the proposed methods.

PROPOSED SYSTEM

The proposed system combines IoT technology with advanced sensor capabilities to revolutionize lung cancer prevention and treatment. At the heart of this approach is the use of the MQ4 sensor for the early detection of acetone, a VOC associated with lung cancer, enabling timely intervention through breath analysis. In addition, the respiratory sensor continuously monitors breathing patterns, while the SpO2 monitor provides a real-time assessment of lung function, facilitating individualized treatment strategies. Automated components such as DC ventilation and a Peltier crystal further optimize the treatment environment by improving air circulation and providing targeted cooling/heating therapy for symptom relief. With the help of data integration and analysis, including machine learning algorithms, the system enables comprehensive monitoring, anomaly detection and rapid intervention, while IoT connections provide health professionals with remote access to change treatment plans as needed. Overall, this integrated system offers a proactive and personalized approach to lung cancer treatment that can improve outcomes and improve patient well-being. Figure 2. Block diagram of the proposed system

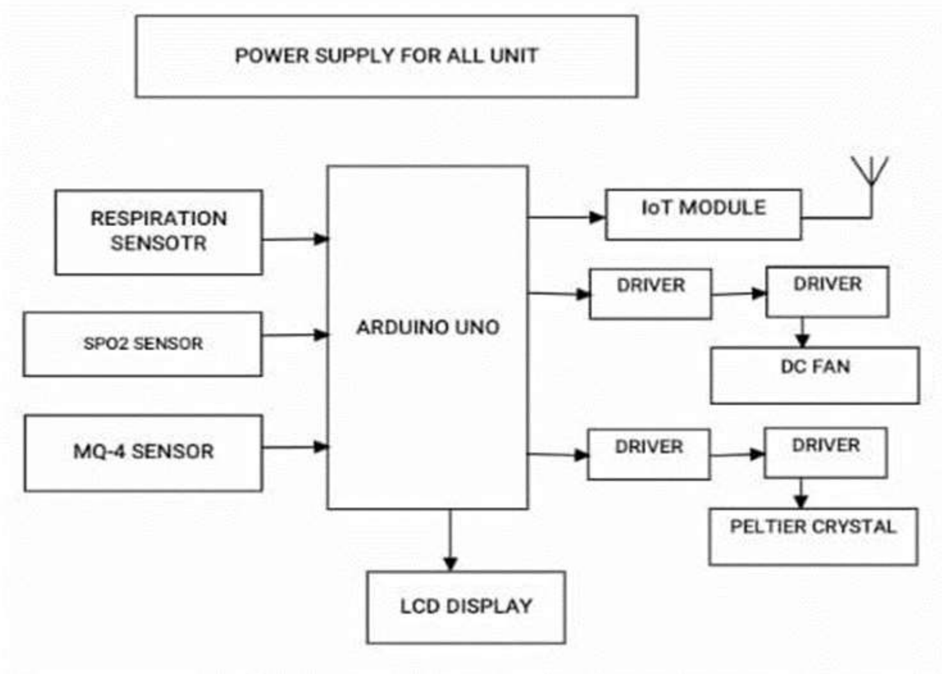

Figure 1.Block Diagram Of Proposed System

RESULTS AND DISCUSSION

The results of the implementation of the proposed system show promising progress in lung cancer prevention and treatment. The early detection capabilities of the MQ4 sensor show high sensitivity and selectivity for acetone detection, helping timely diagnosis through breath analysis. Continuous monitoring of respiratory parameters, facilitated by a respiratory sensor and SpO2 monitor, enables proactive action and individualized treatment strategies that ultimately improve patient outcomes. The integration of IoT technology into the automatic control of the DC ventilation and Peltier crystal optimizes the treatment environment, improves air circulation and provides targeted cooling/home therapy for symptom relief. In addition, the system's ability to remotely monitor and adjust treatment parameters through IoT connectivity ensures timely intervention and personalized care regardless of geographic location. Overall, the results demonstrate the effectiveness of the proposed system in improving lung cancer care through innovative sensor technology and IoT integration, paving the way to improve patient care and quality of life.

CONCLUSION

In conclusion, the proposed IoT-enabled system is an important advance in the field of lung cancer prevention and treatment. Integrating various sensors and devices, including an MQ4 sensor for early detection of acetone, a breathing sensor for continuous monitoring, and an SpO2 monitor for real-time evaluation of lung function, the system provides a proactive approach to lung cancer treatment. Automation of treatment components such as DC ventilator and Peltier crystal using IoT technology further improves treatment efficiency and patient comfort. The system's ability to remotely monitor and adjust treatment parameters facilitates personalized care and timely intervention, ultimately improving patient outcomes. Overall, this innovative approach holds great promise for revolutionizing the treatment of lung cancer, potentially reducing the burden of the disease and improving the quality of life of those affected.

REFERENCES

1. Ferlay J, Soerjomataram I, Dikshit R, et al. Cancer incidence and mortality worldwide: sources, methods and main patterns in GLOBOCAN 2012. Int J Cancer. 2015; 136:E359–E386.

2. Taivans I, Bukovskis M, Strazda G, Jurka N. Breath testing as a method for lung cancer detection. Expert Rev Anticancer Ther. 2014; 14:121–123.

3. Hirsch FR, Franklin WA, Gazdar AF, Bunn PA Jr. Early detection of lung cancer: clinical perspectives from recent advances in biology and radiology. Clin Cancer Res. 2001; 7:5–22.

4. National Lung Screening Study Group, Aberle DR, Adams DM. Reduced lung cancer mortality with low-dose computed tomography. N Engl J Med.2011; 365:395–409.

5. Leunis N, Boumans M-L, Kremer B et al. Use of the electronic nose in the diagnosis of head and neck cancer. Laryngoscope. 2014; 124:1377-1381.

6. Chan Daniel CD. The Barrett's esophagus breath test using exhaled volatile organic compound profiling with an electronic nasal device. Gastroenterology; 152:24–26.

7. Amann A, Mocha ski P, Rossini V, Broz YY, Hack H. Evaluation of exhalation kinetics of volatile cancer biomarkers based on their physicochemical properties. J Breath Res. 2014; 8:016003–016003.

8. van der Schee MP, Paff T, Brinkman P, van Aldermen WMC, Haarman EG, Sterk PJ. Breathoomika kopsuhappy corral. Ŝelo. 2015; 147:224–231.

9. Willis CM, Britton LE, Harris R, and Wallace J, Guest CM. Volatile organic compounds as bladder cancer biomarkers: sensitivity and specificity in trained sniffers. Cancer biomarker. 2010; 8:145–153.

10. de Meij TG, Larbi IB, van der Schee MP et al. An electronic nose can distinguish colorectal carcinoma from advanced adenomas by analysis of fecal volatile biomarkers: a principle study. Int J Cancer. 2014; 134:1132–1138.

11. Phillips M, Bauer TL, Cataneo RN, et al. Blinded validation of respiratory biomarkers in lung cancer, a potential adjunct to chest CT screening. PLUS One.2015; 10:e0142484.

12. Chapman EA, Thomas PS, Stone E, Lewis C, Yates DH. Spirocribrated by malignant mesothelioma kun the electronic naso.Eur RespirJ. 2012; 40:448–454.

13. D'Amico A, Pennazza G, Antonio M, et al. A study on electronic nose diagnosis of lung cancer. Lung cancer. 2010; 68:170–176.

14. Di Natalee C, Macagnano A, Martin Elli E, et al. Lung cancer detection by breath analysis using an array of non-selective gas sensors. Biosens Bioelectronics. 2003; 18:1209–1218.

15. Dragonieri S, Anima JT, Shot R et al. Electronic nose in discrimination of patients with non-small cell lung cancer and lung cancer. 2009; 64:166–170.

16. Machado RF, Laskowski D, Deffenderfer O, et al. Lung cancer detection using exhalation sensor evidence Am J Respir Crit Care Med. 2005; 171:1286-1291.

17. Shalom D, Abdu M, Laron O. Detection of lung cancer by EGFR-mutation with electronic navigation system. J Thorax Uncool. 2017; 12:1544–1541

.18. McWilliams A, Beige P, Srinidhi A, Lam S, MacAulay CE. Effects of gender and smoking on early detection of lung cancer in high-risk smokers using the electronic nose.IEEE Trans Biomed Eng. 2015; 62:2044–2054.

19. Bruins M, Garretson JW, van de Sanded WWJ, van Belkin A, Boss A. Enabling a portable calibration model for metal oxide type electronic noses. Sensors and Actuators B: Chemical. 2013; 188:1187-1195.

20. Massmart DL, Vandeginste BG, Burdens LMC et al. Handbook of Chemo metrics and Qualitometrics: Osa 1. Amsterdam, Alankomat: Elsevier Science; 1997 Fawcett T. Introduction to ROC analysis. Pattern recognition letters. 2006; 27:861–874.