Smart Point-of-Care Respiratory Diseases Tracking via NODEMCU and ML

Ms. P.PREETHI. M.E., Assistant Professor, Department
of Computer Science and Engineering
Ms. B.JUBEDHA , B.E, Student of Computer Science Engineering
Ms. M.DHANUSHA, B.E, Student of Computer science and Engineering
St. Joseph College of Engineering, Sriperumbudur, Chennai.

Abstract

Respiratory diseases are a significant global health concern, with their timely and accurate diagnosis being crucial for effective treatment and management.Traditional methods of disease tracking often lack real-time data and require specialized equipment, limiting their accessibility and effectiveness, particularly in resource-constrained settings. In response, this study proposes a novel approach leveraging the NodeMCU microcontroller and machine learning algorithms to develop a smart point-of-care respiratory disease tracking system. The abstract of the paper highlights the development and potential of a smart point of care respiratory diseases tracking system, integrating IoT technology with machine learning algorithms. This innovative system aims to address the challenges in respiratory disease management by enabling real-time monitoring, early detection of changes in respiratory status, and personalized interventions. By leveraging wearable sensors and NodeMCU, the system offers scalability, cost-effectiveness, and adaptability to various healthcare settings. Through continuous data collection and analysis, it has the potential to revolutionize respiratory healthcare delivery, ultimately improving patient outcomes and reducing healthcare costs on a global scale.

Introduction

Respiratory diseases represent a significant global health challenge, with conditions such as asthma, chronic obstructive pulmonary disease (COPD), and respiratory infections causing substantial morbidity and mortality worldwide. Timely detection, monitoring, and management of these conditions are crucial for improving patient outcomes and reducing healthcare costs. Traditional methods of respiratory disease tracking often lack real-time monitoring capabilities and personalized interventions, highlighting the need for innovative solutions.

In recent years, advancements in Internet of Things (IoT) technology and Machine Learning (ML) have paved the way for smart healthcare systems capable of real-time data collection, analysis, and intervention. This paper introduces a smart point of care respiratory diseases tracking system that leverages NodeMCU, an open-source IoT platform, and ML algorithms for enhanced monitoring and management of respiratory conditions.

By integrating wearable respiratory sensors with NodeMCU, the system enables continuous monitoring of key respiratory parameters such as breathing rate, airflow, and oxygen saturation levels. The collected data is transmitted wirelessly to a central database, where ML algorithms analyze patterns and detect anomalies indicative of respiratory diseases or exacerbations.

Literature survey

Model for Predicting Complications of Hemodialysis Patients Using Data From the Internet of Medical Things...

Authors:W.-H. Hsieh, C. C.-Y. Ku, H. P.-C. Hwang, M.-J. Tsai, Z.-Z. Chen

Year : 2023

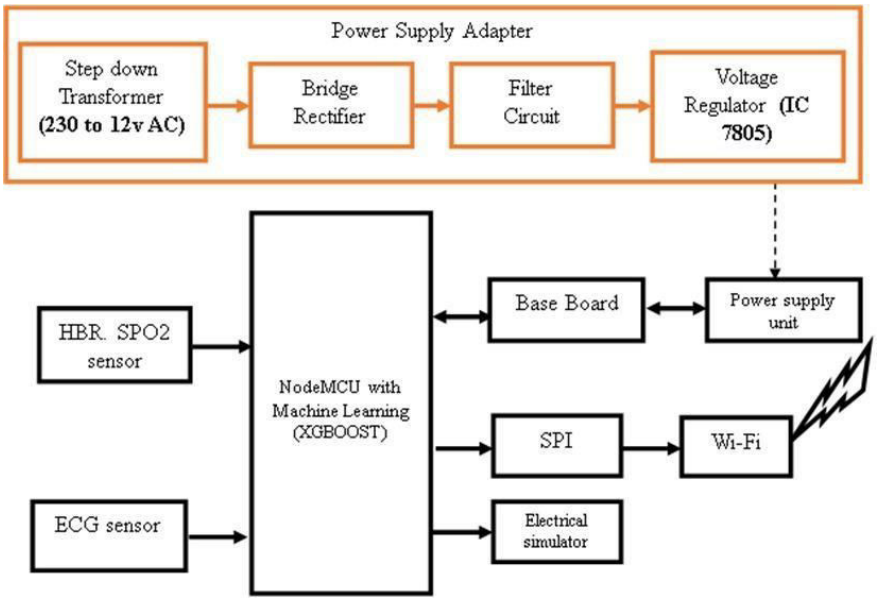
- Machine Learning (ML) methods, integration of data from Internet of Medical Things (IoMT) and Electronic Medical Records (EMR), feature parameter selection using Pearson’s correlation, eXtreme Gradient Boost (XGBoost) algorithm

Pros & Cons

- High accuracy in predicting complications, early warnings for medical staff, potential to improve treatment quality and patient safety.
- Requires integration platform for data collection, may require further validation through clinical tests.

Design

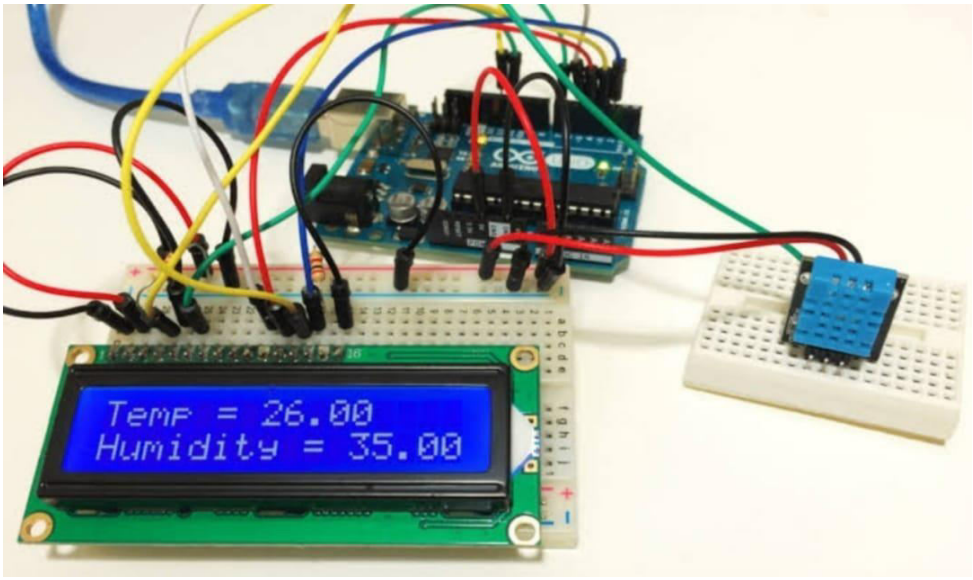
NodeMCU: This serves as the central control unit of the system, integrating Wi-Fi connectivity and processing capabilities. It receives data from the sensors, processes it, and transmits it to the central database for analysis.Wearable Respiratory Sensors*: These sensors are attached to the patient to monitor key respiratory parameters such as breathing rate, airflow, and oxygen saturation levels. They typically include components such as respiratory rate sensors, airflow sensors, and pulse oximeters.Power Supply*: The circuit requires a power source to operate efficiently. This could be a battery pack or a power adapter, depending on whether the system is designed for portable or stationary use.Wireless Communication Module*: This module enables wireless communication between the NodeMCU and the central database, allowing for real-time transmission of data.

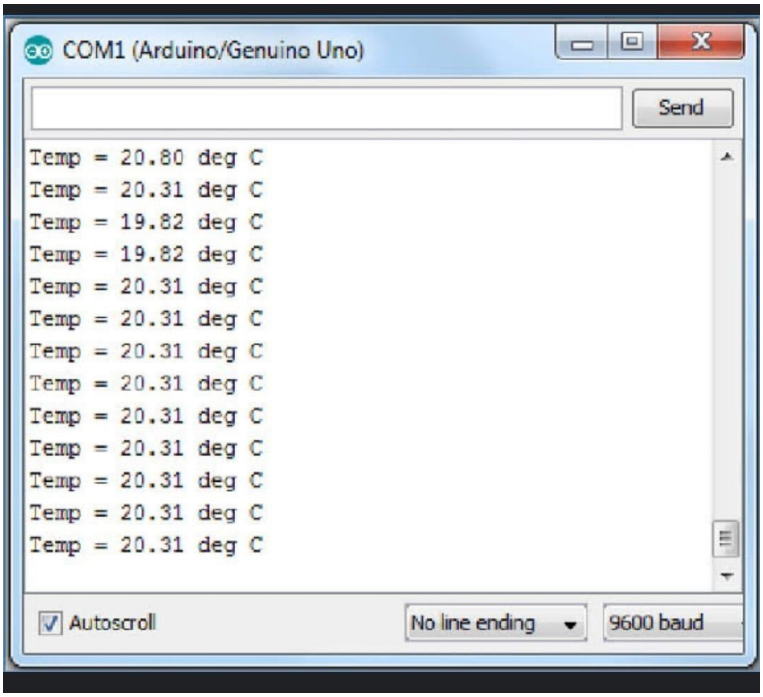


Implement a feedback loop mechanism where users can report misclassifications, helping to improve the model further.

Ensure that the system is scalable to handle increasing loads and maintainable for long- term usage by monitoring performance and updating dependencies as needed.

Snapshots


Temp = 26.00
Humidity = 35.00


COM1 (Arduino/Genuino Uno)
Send
Temp = 20.80 deg C
Temp = 20.31 deg C
Temp = 19.82 deg C
Temp = 19.82 deg C
Temp = 20.31 deg C
Temp = 20.31 deg C
Temp = 20.31 deg C
Temp = 20.31 deg C
Temp = 20.31 deg C
Temp = 20.31 deg C
Temp = 20.31 deg C
Temp = 20.31 deg C
Temp = 20.31 deg C
Temp = 20.31 deg C
Autoscroll
No line ending
9600 baud

Conclusion

In the development of a smart point of care respiratory diseases tracking system represents a significant advancement in healthcare technology. By harnessing the power of IoT and ML, this system offers real-time monitoring, early detection of respiratory changes, and personalized interventions, ultimately leading to improved patient outcomes. With its scalability, cost-effectiveness, and adaptability to various healthcare settings, this innovative solution has the potential to revolutionize the management of respiratory conditions on a global scale. As further research and development are conducted, we can expect to see even greater strides in respiratory healthcare delivery, ultimately benefiting patients and healthcare providers alike.

Future enhancements

Enhanced Sensor Capabilities*: Integration of advanced sensors to capture additional respiratory parameters or improve the accuracy of existing measurements.

References

- Kondo, T., et al. (2023). Prediction of Short-Term Mortality of Cardiac Care Unit Patients Using Image-Transformed ECG Waveforms. IEEE Journal of Translational Engineering in Health and Medicine, 11, 191-198. doi: 10.1109/JTEHM.2023.3250352

- Baek, J.-W., & Chung, K. (2023). Multi-Context Mining-Based Graph Neural Network for Predicting Emerging Health Risks. IEEE Access, 11, 15153-15163. doi: 10.1109/ACCESS.2023.3243722

- Tsai, C.-W., Jiang, R., Zhang, L., Zhang, M., & Yoo, J. (2023). Seizure-Cluster-Inception CNN (SciCNN): A Patient-Independent Epilepsy Tracking SoC With 0-Shot-Retraining. IEEE Transactions on Biomedical Circuits and Systems, 17(6), 1202-1213. doi: 10.1109/TBCAS.2023.3327509

- Moradi, H., et al. (2023). Monitoring medication optimization in patients with Parkinson's disease. In 45th Annual International Conference of the IEEE Engineering in Medicine & Biology Society (EMBC), pp. 1-4. doi: 10.1109/EMBC40787.2023.10340618

- A Systematic Literature Review on Plant Disease Detection: Motivations, Classification Techniques, Datasets, Challenges, and Future Trends, Wasswa Shafik, Rosyzie Anna Awg Haji Mohd Apong, Liyanage Chandratilak De Silva, 2023.

AUTHOR 1

Ms.P.PREETHI M.E., Assistant Professor, Department of Computer Science and Engineering at St.Joseph College of Engineering, Sriperumbudur, Chennai, TamilNadu.

AUTHOR 2

Ms.B.JUBEDHA B.E., Student of Computer Science and Engineering at St.Joseph College of Engineering, Sriperumbudur, Chennai, TamilNadu. I had attended Workshops, Seminars in Python, Web development, Full stack development.

AUTHOR 3

Ms.M.DHANUSHA B.E., Student of Computer Science and Engineering at St.Joseph College of Engineering, Sriperumbudur, Chennai, TamilNadu. I had attended Workshops, Seminars in Python, Web developmen