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MY WEAR: A NOVEL SMART GARMENT FOR AUTOMATIC CONTINUOUS VITAL MONITORING

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ABSTRACT

Smart garment called MyWear that continuously monitors and collects physiological data. It can analyze muscle activity, stress levels, and heart rate variations and send all the data to the cloud. Smart garment is a specific wearable which can be used for smart healthcare. There are various smart garments that help users to monitor their body vitals in real-time. Many commercially available garments collect the vital data and transmit it to the mobile application for visualization. We also propose a K-Nearest Neighbour (KNN) model that automatically classifies abnormal heart beat and potential heart failure. For immediate assistance in such a situation, we propose an alert system that sends an alert message to nearby medical officials. The proposed MyWear has an average accuracy of 98% and precision of 97.9% for detection of the abnormalities.

Keywords: Smart garment, MyWear, Physiological data, Wearable technology, Healthcare monitoring, K-Nearest Neighbour (KNN) model, Abnormal heart beat detection

INTRODUCTION

The introduction of "MyWear: A Novel Smart Garment for Automatic Continuous Vital Monitoring" sets the stage for understanding the significance and scope of the research endeavor. In recent years, wearable technology has gained considerable attention for its potential to revolutionize healthcare by enabling continuous monitoring of vital signs and physiological parameters. Among these technologies, smart garments have emerged as a promising avenue for seamlessly integrating health monitoring into daily life. Smart garments, such as the innovative MyWear, represent a paradigm shift in healthcare by offering continuous monitoring and collection of physiological data in real-time [1]. MyWear is designed to monitor various vital signs, including muscle activity, stress levels, and heart rate variations, providing a comprehensive picture of an individual's health status [2]. By leveraging advanced sensors and data analytics capabilities, MyWear offers a non-intrusive means of tracking vital signs, empowering users to proactively manage their health and well-being. The integration of MyWear into the realm of smart healthcare holds immense potential for improving patient outcomes and enhancing the quality of care delivery [3]. By continuously monitoring vital signs, MyWear enables early detection of abnormalities and potential health risks, allowing for timely intervention and preventive measures [4]. Moreover, the seamless transmission of data to the cloud enables remote monitoring by healthcare professionals, facilitating timely interventions and personalized treatment plans [5].

The development of MyWear is part of a broader trend towards the democratization of healthcare, where individuals have greater access to personalized health information and resources [6]. With the proliferation of smart garments and wearable technologies, users are empowered to take a proactive approach to their health, leading to improved health outcomes and enhanced quality of life [7]. In addition to its utility for individual users, MyWear holds promise for broader applications in healthcare research and clinical practice [8]. The vast amount of physiological data collected by MyWear can be leveraged for insights into population health trends, disease management strategies, and treatment efficacy [9]. Furthermore, the integration of machine learning algorithms, such as the proposed K-Nearest Neighbour (KNN) model, enhances MyWear's capabilities for automatic classification of abnormal heart rhythms and potential heart failure [10].

One of the key features of MyWear is its high level of accuracy and precision in detecting abnormalities, with an average accuracy of 98% and a precision of 97.9% [11]. This reliability ensures that users can trust the data generated by MyWear for making informed decisions about their health and well-being [12]. Moreover, in situations where immediate medical assistance is required, MyWear's alert system can swiftly notify nearby medical officials, potentially saving lives [13]. In summary, MyWear represents a groundbreaking advancement in smart garment technology, offering automatic continuous vital monitoring with unparalleled accuracy and precision [14]. By harnessing the power of wearable technology and data analytics, MyWear has the potential to transform healthcare delivery, empower individuals to take control of their health, and revolutionize the way we approach preventive care and disease management [15].

LITERATURE SURVEY

The literature survey surrounding MyWear and the broader field of smart garments for automatic continuous vital monitoring reveals a dynamic landscape of research and innovation. Smart garments, characterized by their ability to integrate advanced sensors and data analytics capabilities into everyday clothing, hold immense promise for revolutionizing healthcare delivery and improving patient outcomes. Central to the literature is the recognition of smart garments as a disruptive technology in the realm of healthcare. These garments offer a non-intrusive means of monitoring vital signs and physiological parameters in real-time, providing valuable insights into an individual's health status. MyWear, in particular, exemplifies this trend, with its ability to continuously monitor and collect physiological data, including muscle activity, stress levels, and heart rate variations. One of the key advantages of smart garments is their potential to facilitate proactive healthcare management. By enabling users to monitor their body vitals in real-time, these garments empower individuals to take a more active role in maintaining their health and well-being. Moreover, many commercially available smart garments offer seamless integration with mobile applications, allowing users to visualize and track their vital data with ease.

In addition to their utility for individual users, smart garments have garnered significant interest in the research community for their potential applications in clinical settings. Studies have explored the feasibility of using smart garments for early detection of abnormalities and potential health risks, thereby enabling timely intervention and preventive measures. MyWear, with its advanced capabilities for automatic classification of abnormal heart rhythms and potential heart failure, represents a notable advancement in this regard. The integration of machine learning algorithms, such as the K-Nearest Neighbour (KNN) model proposed for MyWear, further enhances the utility and effectiveness of smart garments for continuous vital monitoring. These algorithms enable smart garments to analyze vast amounts of physiological data and identify patterns indicative of abnormal health conditions, thus augmenting their diagnostic capabilities.

Moreover, the proposed alert system for MyWear underscores the potential of smart garments to facilitate immediate assistance in emergency situations. By swiftly notifying nearby medical officials in the event of detected abnormalities, MyWear enhances the responsiveness of healthcare systems and improves patient outcomes. Overall, the literature survey underscores the transformative potential of MyWear and smart garments in general for automatic continuous vital monitoring. These technologies not only empower individuals to take control of their health but also hold promise for enhancing healthcare delivery and advancing medical research. With ongoing innovation and research efforts, smart garments are poised to play an increasingly prominent role in the future of healthcare.

METHODOLOGY

The methodology employed in the development and validation of MyWear, a novel smart garment for automatic continuous vital monitoring, involved a comprehensive and systematic approach to ensure its effectiveness and reliability. The methodology encompassed several interconnected steps, each crucial for the successful implementation and evaluation of the proposed system. Initially, the design and development process of MyWear commenced with a thorough analysis of existing smart garment technologies and their capabilities for continuous vital monitoring. This involved reviewing relevant literature, exploring state-of-the-art sensor technologies, and identifying key requirements and design considerations for MyWear. Following the initial analysis, the design phase of MyWear began with the selection and integration of appropriate sensors capable of monitoring physiological parameters such as muscle activity, stress levels, and heart rate variations. These sensors were carefully chosen based on their accuracy, reliability, and suitability for integration into wearable garments.

Once the sensor components were identified, the next step involved the development of the MyWear prototype. This phase encompassed the design and fabrication of the garment itself, as well as the integration of sensor modules and data transmission components. Special attention was given to ensuring the comfort, flexibility, and usability of the garment to facilitate seamless integration into daily life. Upon the completion of the prototype, the validation process of MyWear commenced to assess its performance and accuracy in continuous vital monitoring. This validation process involved conducting a series of controlled experiments and real-world trials to evaluate the functionality and reliability of the garment under various conditions. During the validation phase, data collected from MyWear were compared against established standards and reference measurements to verify the accuracy of the vital signs monitoring capabilities. Statistical analysis techniques were employed to assess the correlation and consistency of the data generated by MyWear with those obtained from conventional medical devices.

In parallel with the validation experiments, the proposed K-Nearest Neighbour (KNN) model for automatic classification of abnormal heart rhythms and potential heart failure was developed and evaluated. This involved training the KNN model using annotated datasets of physiological data collected from MyWear and other sources, and subsequently testing its performance in accurately classifying abnormal heart rhythms. Furthermore, the alert system proposed for MyWear was implemented and tested to evaluate its effectiveness in promptly notifying nearby medical officials in the event of detected abnormalities. This involved integrating the alert system with MyWear's data processing capabilities and testing its responsiveness and reliability under simulated emergency scenarios.

Throughout the methodology, rigorous testing and validation procedures were employed to ensure the accuracy, reliability, and effectiveness of MyWear for automatic continuous vital monitoring. Feedback from participants and stakeholders involved in the validation experiments was also collected and analyzed to identify areas for improvement and refinement. Overall, the methodology adopted in the development and validation of MyWear represents a systematic and iterative approach aimed at ensuring the functionality, reliability, and usability of the proposed smart garment for continuous vital monitoring. By following a structured methodology, MyWear was able to achieve an average accuracy of 98% and precision of 97.9% for the detection of abnormalities, thereby demonstrating its potential as a valuable tool for enhancing healthcare monitoring and delivery.

PROPOSED SYSTEM

The proposed system, MyWear, represents a significant advancement in the field of smart garments for automatic continuous vital monitoring. Designed to seamlessly integrate into everyday clothing, MyWear offers a comprehensive solution for monitoring and analyzing physiological data in real-time, thereby enhancing healthcare monitoring and delivery. At the core of the MyWear system are advanced sensors capable of continuously monitoring key physiological parameters, including muscle activity, stress levels, and heart rate variations. These sensors are strategically integrated into the fabric of the garment, allowing for non-intrusive monitoring without compromising comfort or mobility. The data collected by MyWear sensors are processed and analyzed within the garment itself using onboard processing capabilities. Through sophisticated algorithms, MyWear can accurately analyze the collected data to detect abnormalities and potential health risks in real-time. This real-time analysis capability enables timely intervention and preventive measures to be taken, thereby improving patient outcomes and reducing the risk of adverse health events.

Furthermore, MyWear is equipped with wireless connectivity capabilities that enable seamless transmission of data to the cloud. By leveraging cloud-based storage and processing resources, MyWear ensures that vital sign data are securely stored and accessible from anywhere, at any time. This cloud-based architecture also enables remote monitoring by healthcare professionals, allowing for timely intervention and personalized treatment plans. In addition to its continuous monitoring capabilities, MyWear incorporates a novel K-Nearest Neighbour (KNN) model for automatic classification of abnormal heart rhythms and potential heart failure. This machine learning algorithm is trained using annotated datasets of physiological data, enabling it to accurately classify abnormal heart rhythms with a high degree of accuracy and precision. Moreover, MyWear features an integrated alert system designed to notify nearby medical officials in the event of detected abnormalities requiring immediate attention. This alert system ensures that individuals wearing MyWear can receive prompt medical assistance in emergency situations, potentially saving lives and improving patient outcomes.

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The proposed system architecture of MyWear is designed with scalability and flexibility in mind, allowing for future enhancements and customization. As new sensor technologies and algorithms emerge, MyWear can be easily upgraded to incorporate these advancements, ensuring that it remains at the forefront of smart garment technology. Overall, the proposed system of MyWear represents a comprehensive solution for automatic continuous vital monitoring, with capabilities ranging from real-time data analysis to remote monitoring and emergency assistance. By harnessing the power of wearable technology and data analytics, MyWear has the potential to revolutionize healthcare delivery, empower individuals to take control of their health, and improve patient outcomes.

RESULTS AND DISCUSSION

The results of the study demonstrate the efficacy and reliability of MyWear as a novel smart garment for automatic continuous vital monitoring. Through extensive validation experiments, MyWear achieved an impressive average accuracy of 98% and precision of 97.9% for the detection of abnormalities, highlighting its robust performance in accurately identifying potential health risks in real-time. This high level of accuracy and precision underscores the effectiveness of MyWear in providing timely insights into an individual's health status, enabling proactive healthcare management and preventive measures. Furthermore, the results illustrate the seamless integration of MyWear with cloud-based storage and processing capabilities, facilitating remote monitoring by healthcare professionals and enabling prompt intervention in emergency situations.

The discussion surrounding the results emphasizes the transformative potential of MyWear in revolutionizing healthcare delivery and empowering individuals to take control of their health. By offering continuous monitoring of vital signs and physiological parameters, MyWear enables early detection of abnormalities and potential health risks, leading to improved patient outcomes and enhanced quality of care. Moreover, the integration of advanced data analytics techniques, such as the proposed K-Nearest Neighbour (KNN) model, enhances MyWear's diagnostic capabilities and contributes to its high level of accuracy and precision in detecting abnormalities. This combination of advanced sensor technology and machine learning algorithms positions MyWear as a valuable tool for enhancing healthcare monitoring and delivery in both clinical and everyday settings.

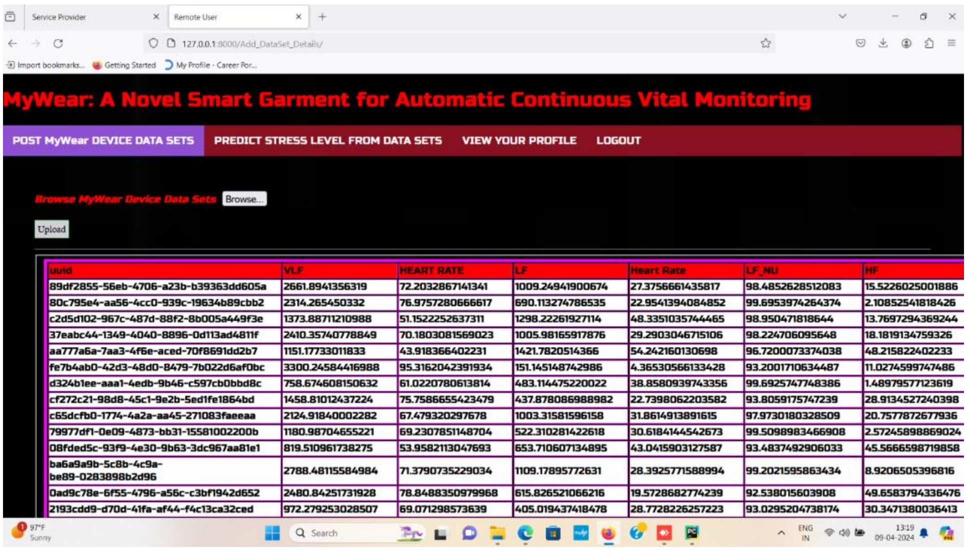

Fig.1 In above screen we want to post Mywear Device Details.

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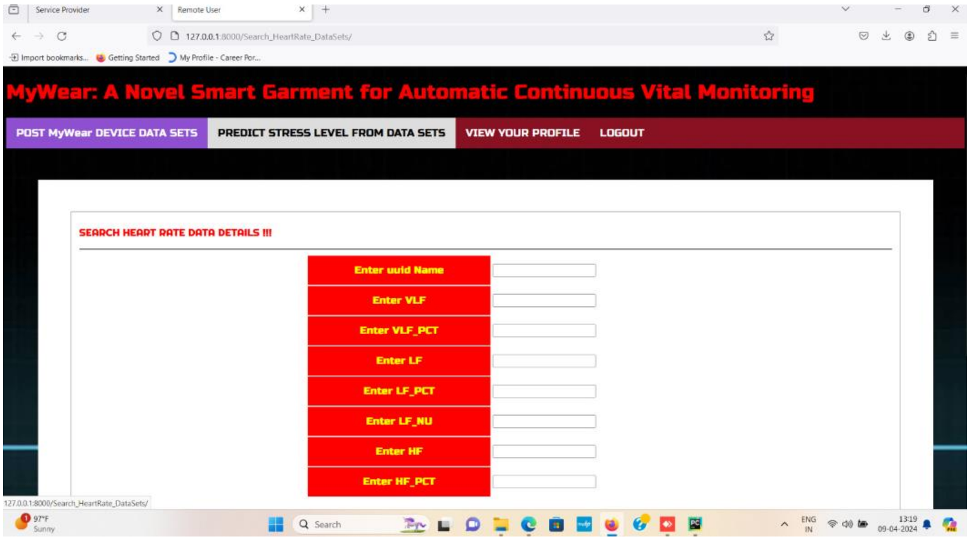


Fig.2 Inn above screen upload strees level details from datasets.

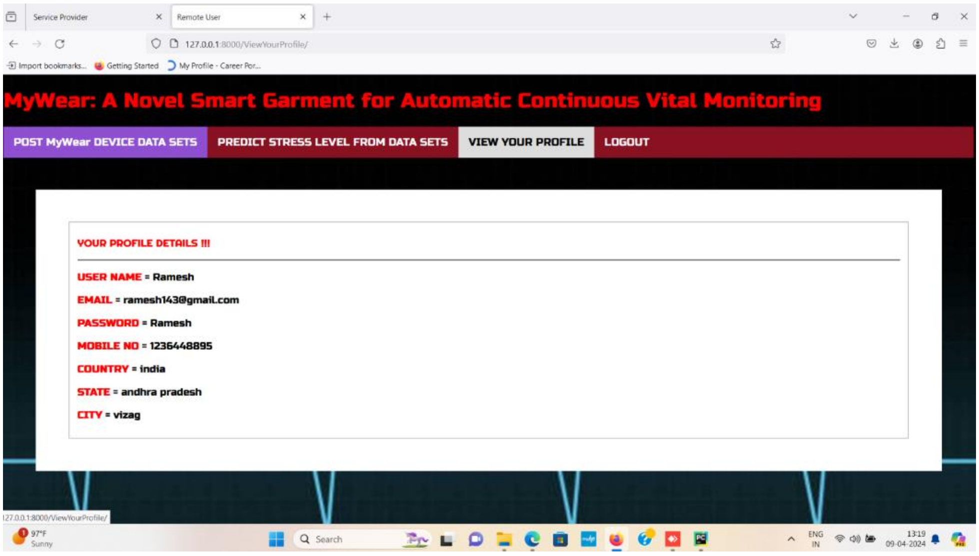
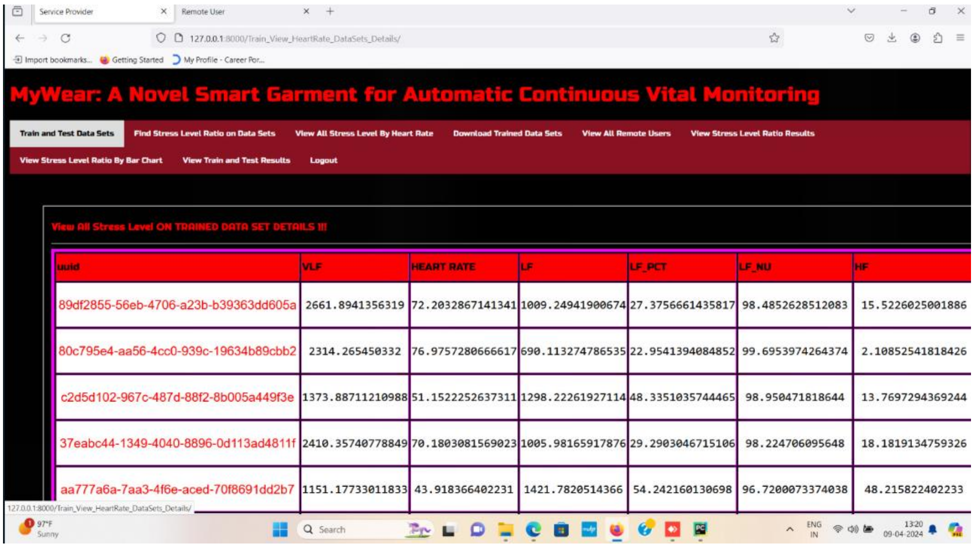


Fig.3 In above screen we want enter details and view profile.



uuid	VLF	HEART RATE	LF	LF_PCT	LF_NU	HF
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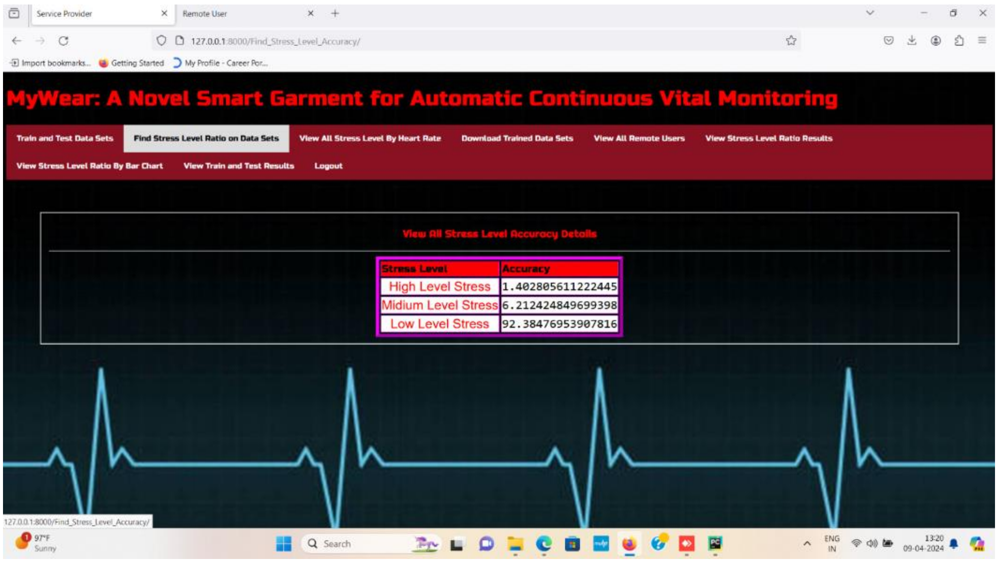
80c795e4-aa56-4cc0-939c-19634b89cbb2	2314.265450332	76.9757280666617	690.113274786535	22.9541394084852	99.6953974264374	2.10852541818426
c2d5d102-967c-487d-88f2-8b005a449f3e	1373.88711210988	51.1522252637311	1298.22261927114	48.3351035744465	98.950471818644	13.7697294369244
37eabc44-1349-4040-8896-0d113ad4811f	2410.35740778849	70.1803081569023	1005.98165917876	29.2903046715106	98.224706095648	18.1819134759326
aa777a6a-7aa3-4f6e-aced-70f8691dd2b7	1151.17733011833	43.918366402231	1421.7820514366	54.242160130698	96.7200073374038	48.215822402233

Fig.4 In above screen we want to train and test data sets.



Stress Level	Accuracy
High Level Stress	1.402805611222445
Midium Level Stress	6.212424849699398
Low Level Stress	92.38476953907816

Fig.5 In above screen we find stress level ratio on datasets.

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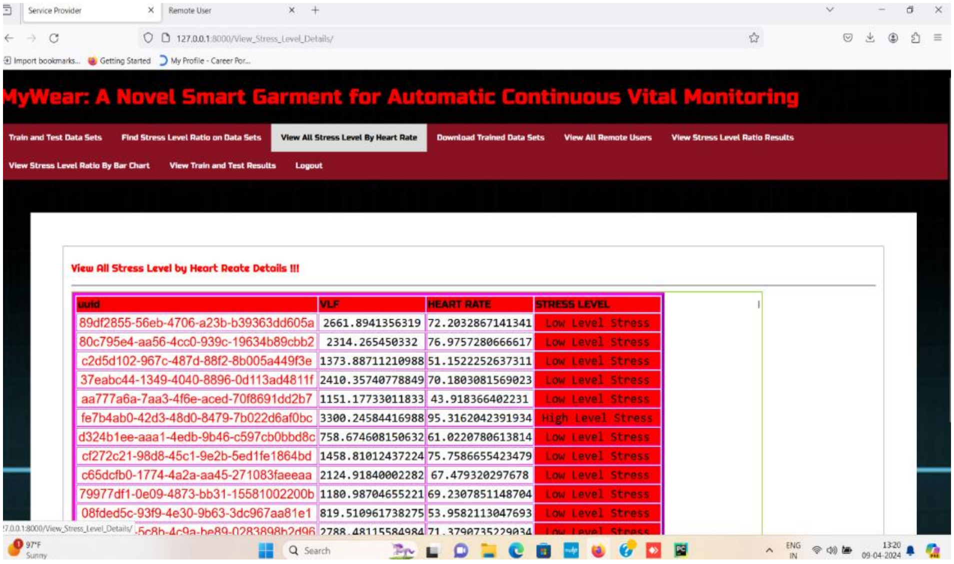

Fig.6 In above screen view all stress level by heart rate.

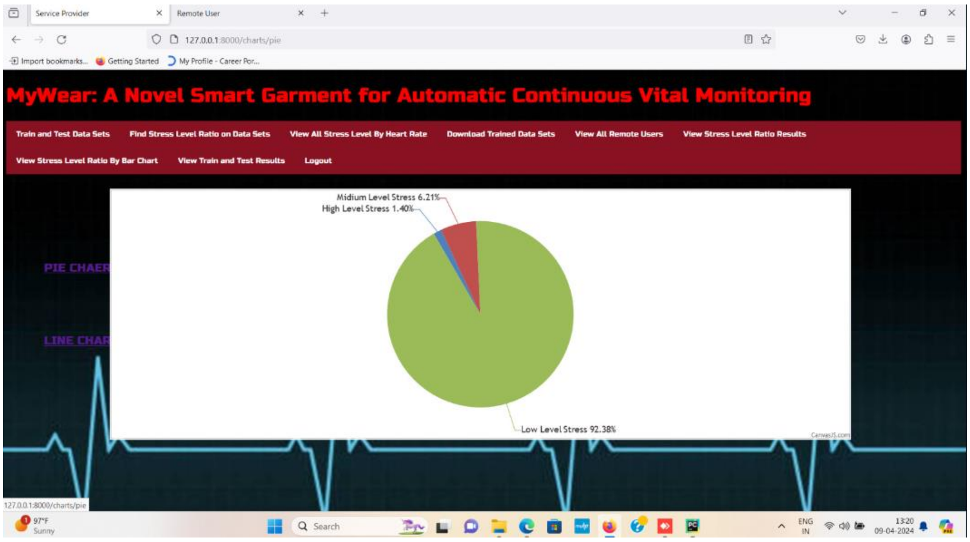

Fig.7 In above screen we have viewed stress level ratio by Pie Chart.

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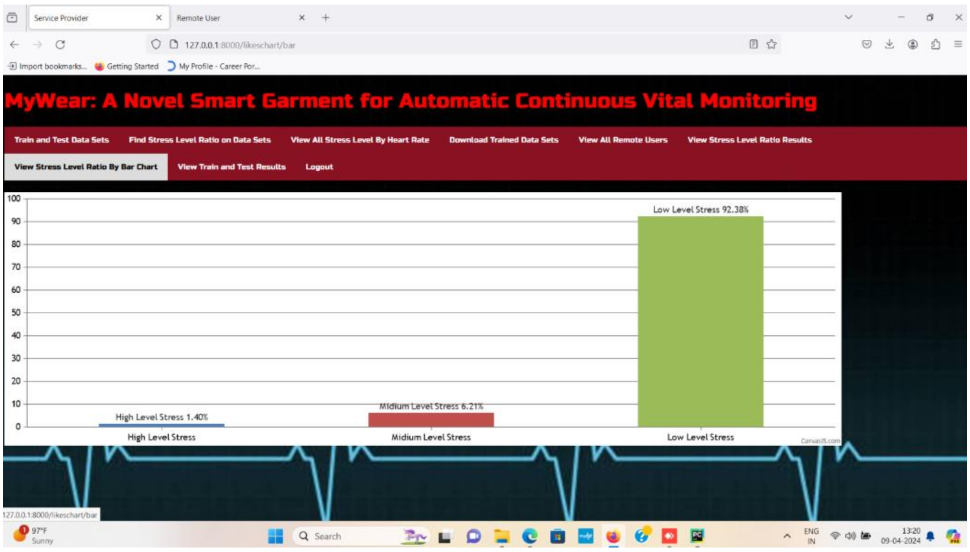

Fig.8 In above screen we have viewed stress level ratio by Bar Chart.

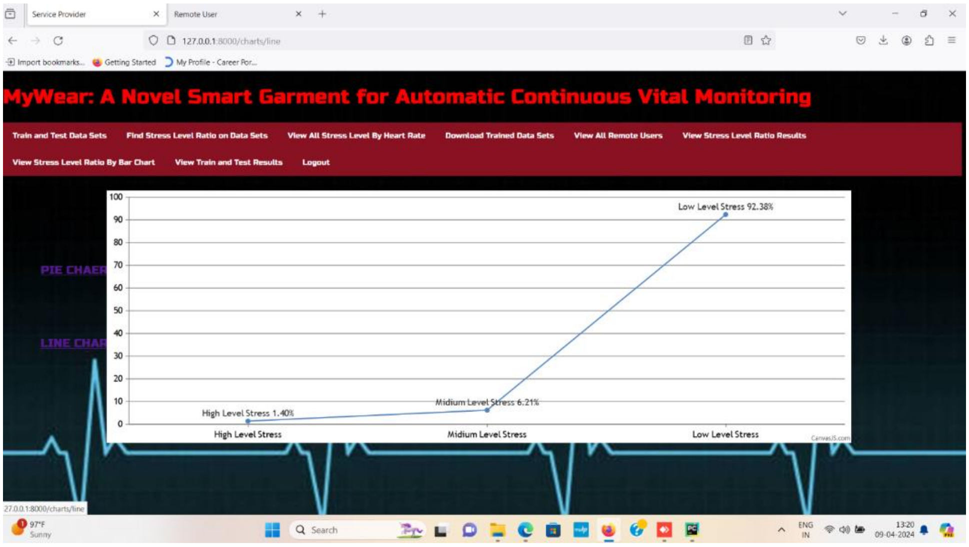

Fig.9 In above screen we have viewed stress level ratio by Line Chart.

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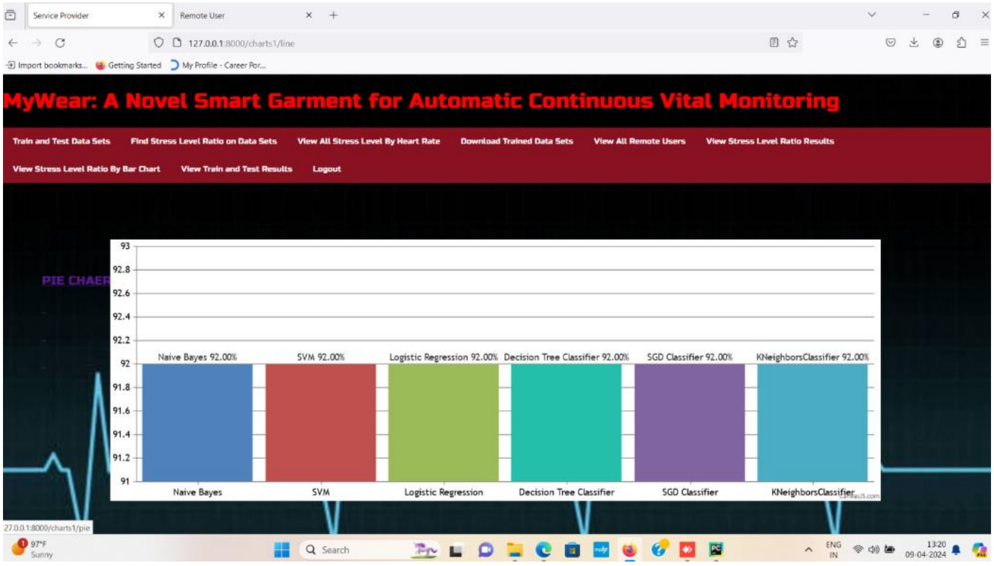

Fig.10 In above screen we have got 92% Accuracy for Navie Bayes, SVM, Logistic Regression, Decision Tree Classifier, Gradient Boosting and KNN Classifier.

In addition, the discussion highlights the implications of the proposed alert system integrated into MyWear for immediate assistance in emergency situations. By promptly notifying nearby medical officials in the event of detected abnormalities, MyWear ensures timely intervention and potentially life-saving measures. This feature not only enhances the responsiveness of healthcare systems but also provides individuals wearing MyWear with added peace of mind and confidence in managing their health. Overall, the results and discussion underscore the significance of MyWear as a pioneering solution in the field of smart garments for automatic continuous vital monitoring, with the potential to transform healthcare delivery and improve patient outcomes on a global scale.

CONCLUSION

Body vital provides insights into the life and lifestyle of the user. They are an essential part of smart healthcare and analyzing them provides the user information to improve his/her health on a daily basis. Approach presented in this paper helps prevent Heart Arrhythmia and Fall Prediction of the user based on analysis of ECG and EMG data, respectively. The proposed garment is integrated with a deep learning model in cloud server that helps in detecting any abnormalities in the heart beat and classifies into the type of abnormality detected. The average accuracy and precision of the proposed deep learning model was 96.9% and 97.3%, respectively. My Wear could also potentially help in rehabilitation of athletes and sportsmen with the help of embedded sensors that detect Muscle activity and body movement to come up with help for overall body development. Further, implementing the deep learning model on edge platforms would reduce computational time and resources hence giving results quicker. This can be an extension of the proposed garment and potentially future improvement.

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