iJRASET
International Journal For Research in
Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH
IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 12 Issue: V Month of publication: May 2024

DOI: https://doi.org/10.22214/ijraset.2024.61232

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 12 Issue V May 2024- Available at www.ijraset.com

Dental Carries Prediction and Prevention

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Abstract: A large percentage of people worldwide suffer from dental cavities, which are prevalent disorders. They caused by bacterial activity, can lead to permanent damage to teeth. They pose a risk to tooth health without timely intervention. In order to stop additional harm, early identification and treatment are essential. Traditionally, x-rays or a direct visual inspection are done by dentists to detect cavities. On the other hand, automated systems that employ image processing methods including region recognition, binary image synthesis, and RGB to Gray conversion can help locate cavities in x-ray pictures. Automated tools that utilize ordinary cameras for dental image analysis are also being explored, showing promising results.
Keywords: Relocation, Computer vision techniques, input, images, users, object dimensions, webapp, furniture.

I. INTRODUCTION

A. Background

In recent years, the integration of machine learning (ML) algorithms with healthcare applications has garnered significant attention due to its potential to revolutionize disease prediction and prevention. This paper presents a novel approach towards dental cavity prediction and prevention through the utilization of ML techniques. The project involves the collection of data from users regarding their dental conditions, coupled with image analysis for the accurate prediction of cavities. Additionally, the system incorporates an appointment booking option, facilitating seamless communication between patients and dental practitioners. This paper outlines the architecture, methodologies, and outcomes of the project, showcasing its potential to enhance dental care by leveraging advanced computational techniques. Dental cavities remain a prevalent oral health issue globally, affecting individuals of all ages. Traditional methods of cavity detection often rely on visual inspection and manual assessment by dental professionals, which can be subjective and prone to errors. Moreover, preventive measures are often reactive rather than proactive, leading to higher treatment costs and increased patient discomfort. In response to these challenges, our project aims to develop a comprehensive solution that combines ML algorithms with user-generated data to predict and prevent dental cavities effectively.

The core component of our project revolves around the integration of ML models capable of analyzing both textual data describing dental conditions and images of oral cavities. By leveraging advanced techniques, our system can extract relevant features and patterns indicative of cavity development. This holistic approach enables early detection of cavities, allowing for timely interventions and preventive measures. In this paper, we provide a detailed overview of the project's architecture, including data collection methods, ML model development, and system implementation. Additionally, we present experimental results and validation analyses demonstrating the efficacy and accuracy of our approach in cavity prediction and prevention. Overall, our project represents a significant advancement in dental care, offering a scalable and technology-driven solution to address the challenges associated with cavity detection and management.

B. Problem Statement

Despite advancements in dental care, the prevalence of dental cavities remains a persistent challenge, contributing to significant healthcare costs and patient discomfort. Traditional methods of cavity detection rely heavily on manual examination by dental professionals, leading to subjective assessments and potential diagnostic errors. Moreover, the current approach to cavity management often lacks proactive preventive measures, resulting in missed opportunities for early intervention and increased treatment complexity. Furthermore, the accessibility and efficiency of dental care services are hindered by outdated appointment scheduling systems, leading to inefficiencies in resource allocation and patient dissatisfaction. There is a pressing need for an integrated solution that leverages machine learning algorithms to enhance cavity prediction accuracy, implement personalized preventive strategies, and streamline appointment booking processes. This project aims to address these challenges by developing a comprehensive system that utilizes machine learning techniques to analyze patient data, including textual descriptions of dental conditions and images of oral cavities. By harnessing advanced algorithms, the system will provide accurate cavity predictions, enabling timely interventions and personalized preventive recommendations.

C. Objectives

1) *Machine Learning Algorithm Development:* Develop and implement machine learning algorithms for accurate prediction of dental cavities.
2) *Multimodal Data Analysis:* Create a robust system capable of analyzing textual descriptions and images of oral cavities for enhanced prediction accuracy.
3) *Efficiency Evaluation:* Evaluate the efficacy and performance of the developed system through rigorous testing and validation.
4) Enhanced Accessibility of Dental Care: Optimize appointment scheduling and improve communication channels to enhance accessibility of dental care services.
5) *Collaboration with Dental Professionals:* Collaborate with dental professionals to ensure practicality, usability, and effectiveness of the system.
6) *Personalized Preventive Strategies:* Incorporate user-generated data to personalize preventive strategies and recommendations for individual patient profiles.

II. LITERATURE REVIEW

A. Review of existing system

Businesses utilize a broad range of software and technologies inside the automated logistics management systems that are now in place to effectively manage their supply chain activities. Transportation Management Systems (TMS), which concentrate on organizing and maximizing transportation-related tasks like route planning, transport selection, and load optimization, are commonly included in these systems. Order choosing, shipment procedures, inventory tracking, and other warehouse operations are all managed in large part by Warehouse Management Systems (WMS). Based On current survey there is no system that will calculate object dimensions [3] and based on these dimensions give us the estimated cost.

TABLE I. Literature Survey

Sr. No:	Date	Name	Flaws
1.	2019	Measuring size of an object using computer vision.	Reference object should be easily identified. Camera height/angle should be known. It does now work well when the object has several areas with significantly various colours.
2.	2022	Real-Time Object Measurement Using Image Processing.	Requires a white background.
3.	2023	Real-Time 3D Object Detection and Recognition Using a Smartphone.	It is possible to mistakenly consider two distinct objects of the same class to be the same object. Sizes provided might not be accurate. Does not work well with smaller objects.
4.	2021	An Embedded Real-Time Object Detection and Measurement of its Size.	Possible only with raspberry pi and raspberry camera.
5	2020	An Object Recognition and Volume Calculation Method Based on Yolov3 and Depth Vision	It can only provide the volume of the object.
6	2021	Realtime Object's Size Measurement from Distance using OpenCV and LiDAR.	Accuracy of measuring distance from LiDAR differs from different type's LiDAR sensor. Changing the camera requires the respective camera's dataset to train the model. Providing insufficient data for model training.

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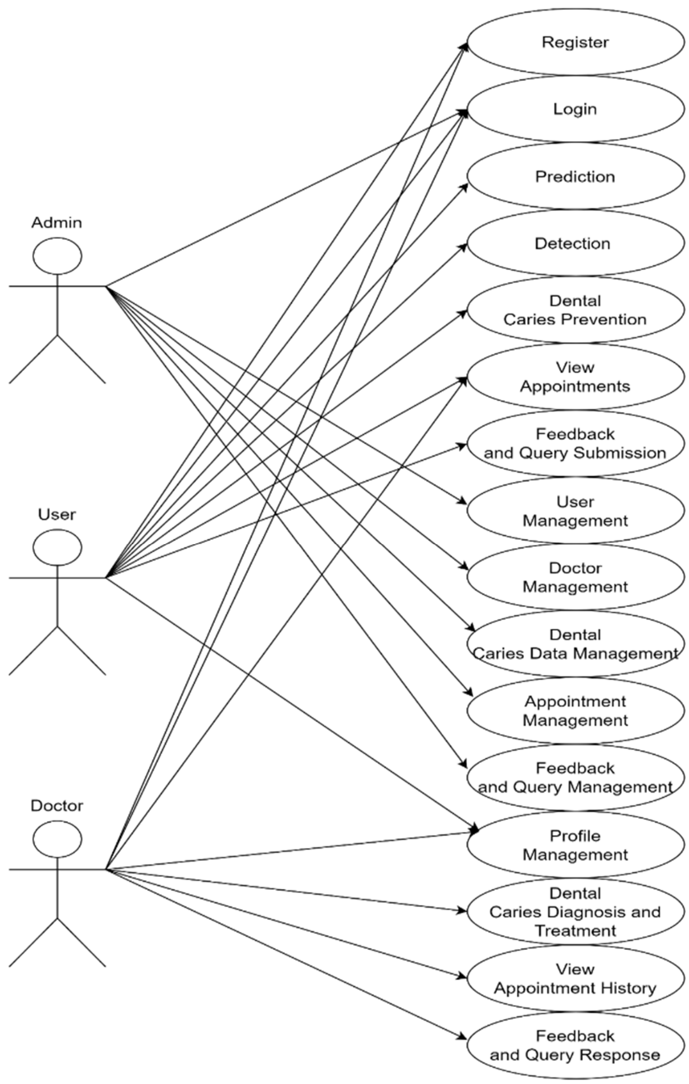
III. PROPOSED METHODOLOGY

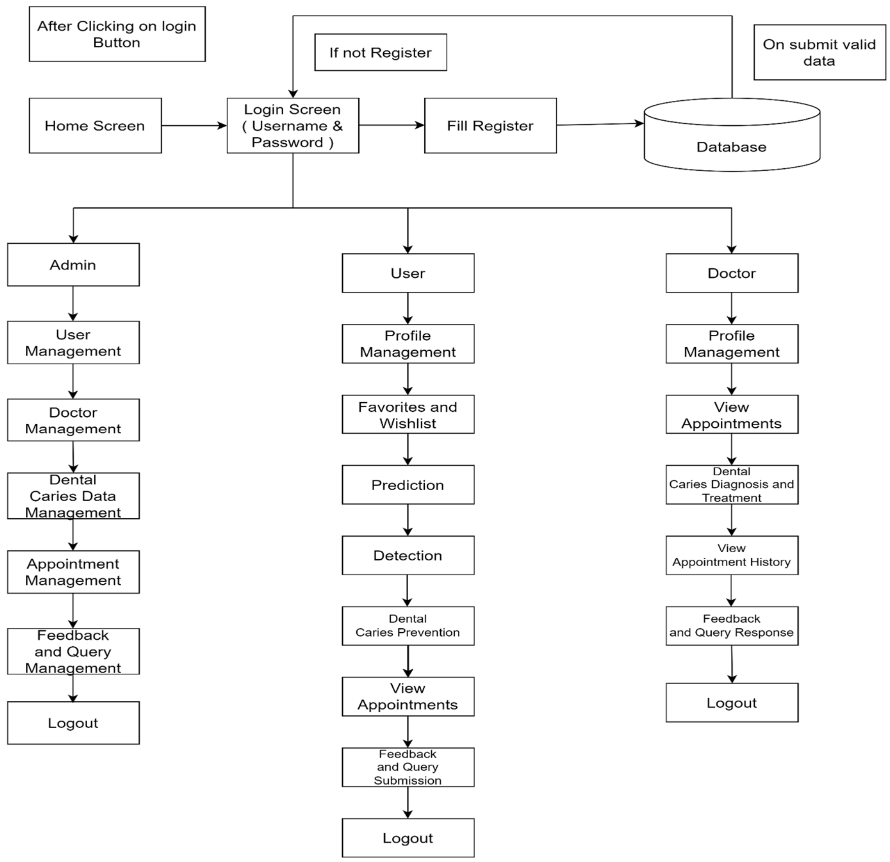
A. Phase 1

The dataset collection for the Dental Caries Detection and Prevention System involved the acquisition of a diverse and representative range of dental images and patient records. These images encompassed various tooth surfaces, such as occlusal, lingual, buccal, and labial, to ensure comprehensive coverage. Patient records included information like age, dietary habits, and oral hygiene practices to enable personalized risk assessments. Ethical considerations, including data privacy and informed consent, were meticulously addressed to ensure data security and respect for patients' rights. The dataset's quality and diversity are pivotal for the project's success, providing a robust foundation for training machine learning models for caries detection and risk assessment.



B. Phase 2

In creating the Random Forest algorithm for the Dental Caries Detection and Prevention System, a robust ensemble learning approach was employed. The algorithm was designed to harness the power of decision trees, combining them into a forest to enhance accuracy and reduce overfitting. It involved the selection of a diverse set of features extracted from dental images, including texture, color, and cavity characteristics. The algorithm was trained on the dataset, utilizing bagging and feature randomization techniques to build a multitude of decision trees. These trees collectively formed the Random Forest, which offered a highly accurate and interpretable model for dental caries detection and personalized risk assessment in the quest for improved oral healthcare.



C. Phase 3

The User Interface (UI) model for the Dental Caries Detection and Prevention System was meticulously designed for a seamless user experience. It featured a user-friendly interface catering to both patients and dental professionals. Users could easily upload dental images for analysis, receive personalized caries risk assessments, and access tailored preventive recommendations. The UI incorporated interactive elements and intuitive navigation, ensuring accessibility and ease of use. Additionally, it provided clear, visually informative explanations of the system's diagnostic results, fostering transparency and patient engagement. This UI model played a pivotal role in making advanced dental care accessible and understandable, empowering individuals to take control of their oral health.

IV. PROCESS DESIGN

A. User Module

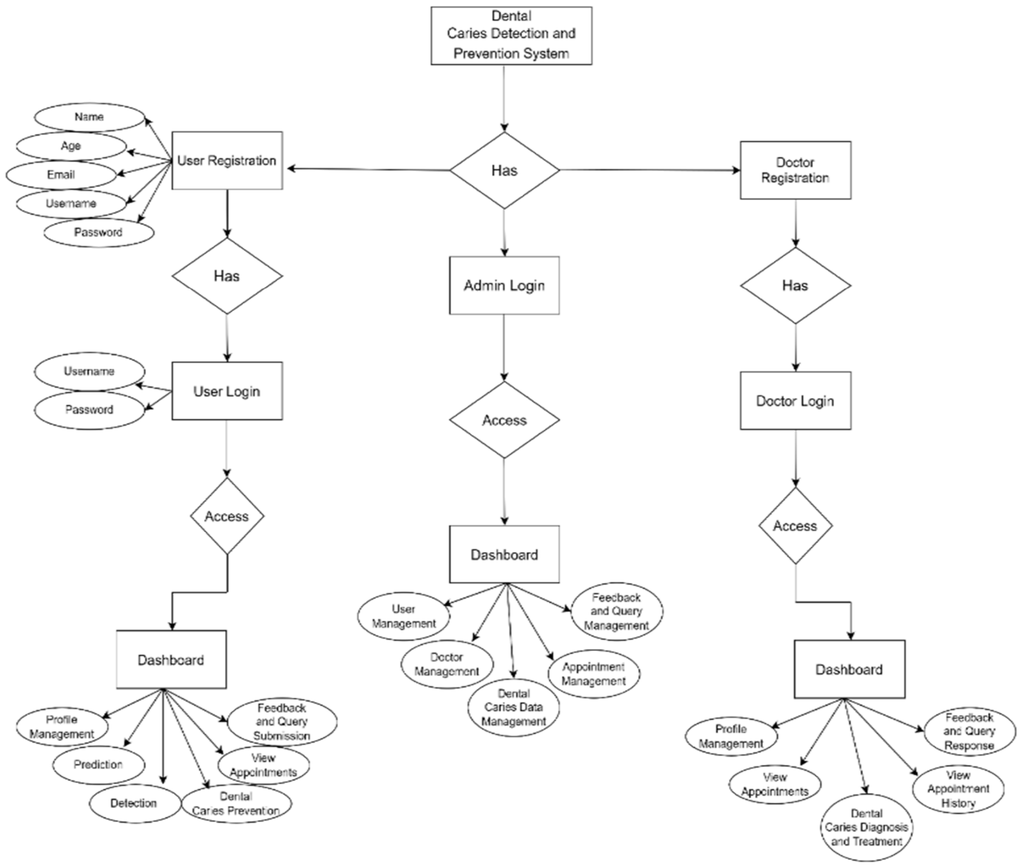
1) *Registration:* The user can register using their basic details.
2) *Login:* They can log in using their credentials.
3) *Profile Management:* They can manage and update their profile.
4) *Prediction:* For the prediction of dental carries, the user would be required to put an input as necessary. The system will predict if the user has dental caries or not.

B. Admin Module

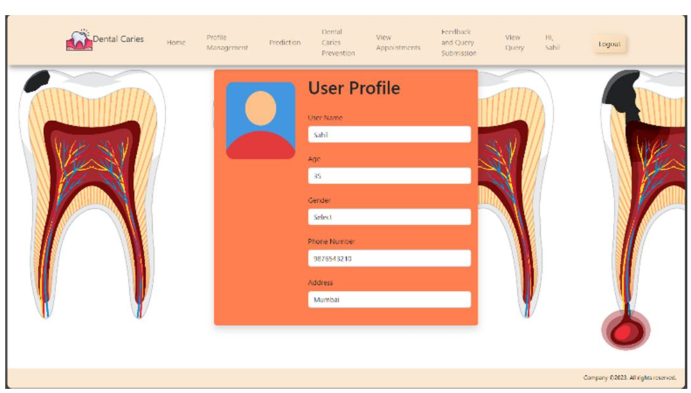
1) *Login:* The admin can log in using their credential.
2) *User Management:* The admin can view all the users and their details.
3) *Doctor Management:* They can view the doctors' details and approve doctor requests.
4) *Dental Caries Data Management:* They can add and view articles and resources.
5) *Appointment Management:* They can view and approve appointments.
6) *Feedback and Query Management:* They can manage the feedback and queries of the users.

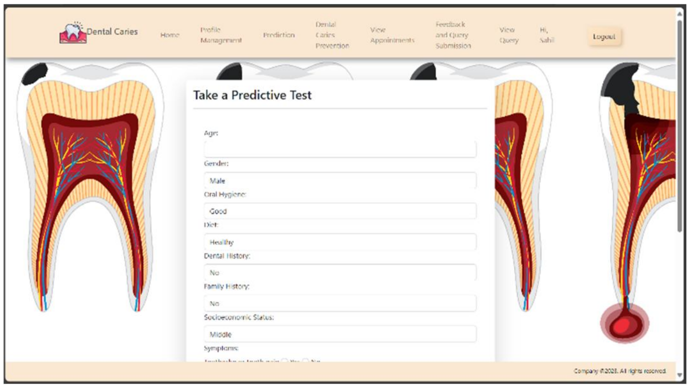
C. Doctor Module

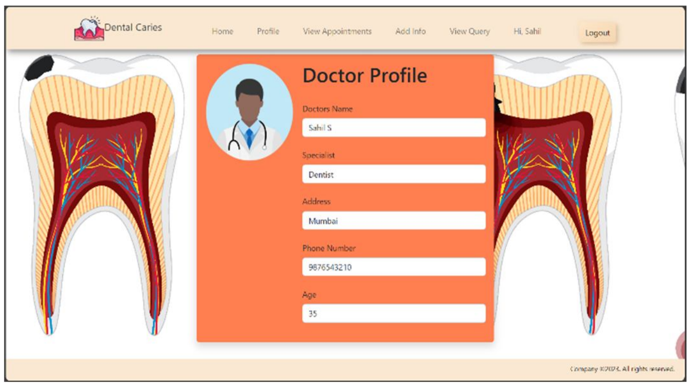
1) *Registration:* The admin will accept and reject requests after registration.
2) *Login:* After the admin accepts the requests, the doctor can login using their credentials.
3) *Profile Management:* The doctor can manage and update their profile.
4) *View Appointments:* They can view bookings and accept the requests for an appointement.
5) *Dental Caries Diagnosis and Treatment:* The doctor can view data of the user that was asked during prediction which will help him to diagnose and give prescription to patients.
6) *View Appointment History:* They can view all the previous appointements.
7) *Feedback and Query Response:* They can respond to the users' queries.

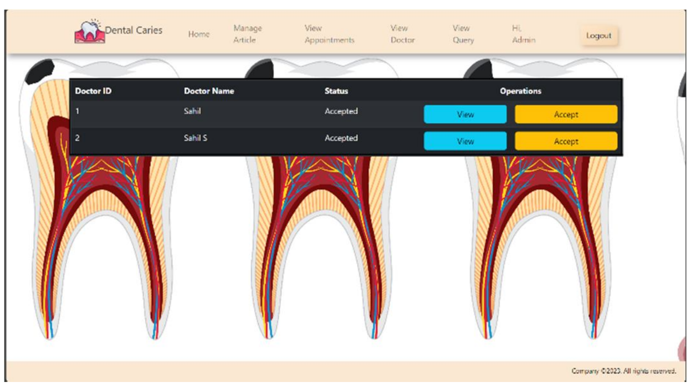


V. RESULT, CONCLUSION AND FUTURE WORK









VI. CONCLUSION AND FUTURE WORK

In conclusion, dental cavity prediction and prevention are critical components of maintaining oral health and overall well-being. As we have explored throughout this discussion, early detection of den- tal cavities through various diagnostic tools and techniques is essential in preventing their progression and minimizing the need for invasive treatments. Additionally, adopting effective preventive measures such as regular dental check-ups, proper oral hygiene practices, and a balanced diet can significantly reduce the risk of developing cavities. It is imperative for individuals to understand the significance of taking proactive steps in the preservation of their oral health. By combining the power of mod- ern technology with a commitment to preventive care, we can work towards a future where dental cavities become less prevalent and less severe, improving the quality of life for people of all ages. Furthermore, dental professionals play a pivotal role in educating patients about cavity prevention, early intervention, and the importance of maintaining good oral health habits. By working together with dental practitioners, individuals can embrace a holistic approach to oral health that focuses on both prediction and prevention. In essence, the pursuit of dental cavity prediction and prevention is a shared responsibility that requires the collaboration of patients, healthcare providers, researchers, and policymakers.

As we continue to advance in our understanding of dental health, it is our collective duty to promote practices that preserve the integrity of our teeth, ensuring not only brighter smiles but also a healthier and happier future.

Future endeavors could focus on refining the machine learning algorithms by incorporating additional data sources such as genetic predispositions, dietary habits, and socio-economic factors to further enhance prediction accuracy. Moreover, exploring novel techniques in image analysis, such as 3D imaging and spectroscopy, could provide deeper insights into cavity progression and aid in the development of more precise diagnostic tools. Additionally, extending the system to accommodate real-time data streaming and continuous monitoring of dental health parameters could enable proactive intervention and personalized preventive care. Collaborative efforts with dental research institutions could facilitate large-scale clinical trials to validate the effectiveness and scalability of the system across diverse populations. Furthermore, integrating patient feedback mechanisms and leveraging advancements in human-computer interaction could enhance user engagement and satisfaction, ultimately fostering long-term adoption and impact in clinical practice.

REFERENCES

[1] Akselrod-Ballin, A., Chorev, M., Shoshan, Y., Spiro, A., Hazan, A., Melamed, R., Barkan, E., Herzel, E., Naor, S., E., Koren, G., Goldschmidt, Y., Shalev, V., Rosen-Zvi, M., & Guindy, M. (2019). Predicting Breast Cancer by Applying Deep Learning Linked Health Records and Mammograms. Radiology, 292(2), 331–342. https://doi.org/10.1148/radiol.2019182622

[2] Ali, R.B., Ejbali, R., & Zaied, M. (2016). Detection and Classification of Dental Caries in X-ray Images Using Deep Neural Networks. Arteaga, C. (2019, October 22). Interpretable Machine Learning for Image Classification with LIME. Medium. https://towardsdatascience.com/interpretable-machine-learning-forimage-classification-with-lime-ea947e82ca13

[3] Berdouses, E. D., Koutsouri, G. D., Tripoliti, E. , G. K., Oulis, C. J., & Fotiadis, D. I. (2015). A computer-aided automated methodology for the detection and classification of occlusal caries from photographic color images. Computers in Biology and Medicine, 62, 119–135. https://doi.org/10.1016/j.compbiomed.2015.04.016

[4] Chicago Tribune. (2019, May 21). Canary System. Chicagotribune.Com. https://www.chicagotribune.com/business/blue-sky/chi-dentist-office technology-canarysystem-bsi-story.html

[5] Codella, N. C. F., Nguyen, Q.-B., Pankanti, S., Gutman, D. A., Helba, B., Halpern, A. C., & Smith, J. R. (2017). Deep learning ensembles for melanoma recognition in dermoscopy images. IBM Journal of Research and Development, 61(4/5), 5:1-5:15. https://doi.org/10.1147/jrd.2017.2708299

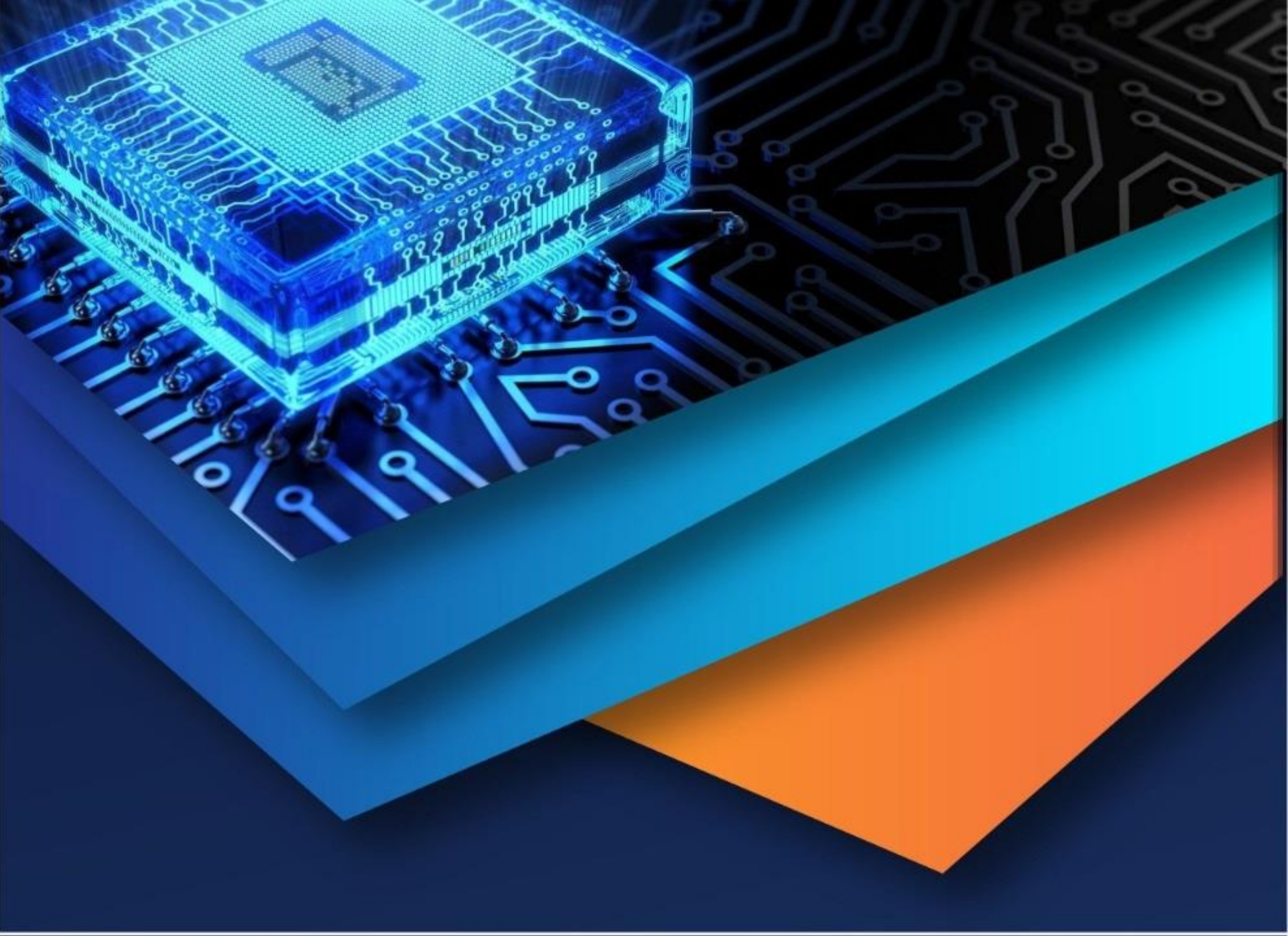
[6] Bhattacharjee Density of dentistry personnel (total number per 1000 population, latest available year). (2018, December 28). Retrieved from https://www.who.int/gho/healthworkforce/dentistrydensity/en/.

[7] Detective, T. D. (2020, January 31). The 80/20 Split Intuition and an Alternative-Split-Method. https://towardsdatascience.com/finally-why-we-use-an-80-20-split-for-trainingand-test-data-plus-an-alternative-method-oh-yes-edc77e96295d

[8] K. Lounis and M. Zulkernine, "Attacks and Defenses in Short-Range Wireless Technologies for IoT," in IEEE Access, vol. 8, pp. 88892-88932, 2020, doi: 10.1109/ACCESS.2020.2993553.

[9] Wei, J. W., Suriawinata, A. S., Vaickus, L. V., Ren, B. R., Liu, X. L., Wei, J.W., & Hassanpour, S. H. (2019, October). Generative Image Translation for Data Augmentation in Colorectal Histopathology Images. https://arxiv.org/pdf/1910.05827.pdf

[10] J.Tooth Decay (Caries or Cavities) in Children. (n.d.). Retrieved from https://www.hopkinsmedicine.org/health/conditions-and-diseases/toothdecay-caries-orcavities-in-children.



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