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A Literature Survey on BIO-PULSE AI based Medcare App

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Abstract: *The MedCare Chatbot signifies a significant leap forward in healthcare technology, providing users with individualized medical guidance and prescription suggestions. Going beyond its primary functions, this inventive chatbot incorporates a pioneering feature centered on the identification of skin diseases through image processing techniques. Utilizing the capabilities of artificial intelligence and computer vision, the MedCare Chatbot can analyse images of skin conditions submitted by users, furnishing precise diagnoses and treatment recommendations. This paper details the design, implementation, and assessment of this advanced functionality seamlessly integrated into the MedCare Chatbot. Employing a dual strategy of symptom-based prescription advice and image-based skin disease detection, the MedCare Chatbot aims to enhance healthcare accessibility and empower users to actively manage their well-being*

Keywords: Medical App services, Prescription generating, Detecting Skin Diseases

I. INTRODUCTION

In recent times, the infusion of technology into healthcare systems has brought about a transformative shift in the accessibility and delivery of medical services. Intelligent chatbots have emerged as a promising remedy to meet the escalating demand for efficient and personalized healthcare guidance. The embodiment of this trend is seen in the MedCare Chatbot, a comprehensive platform that amalgamates symptom-based prescription recommendations with advanced image processing capabilities for the detection of skin diseases. This groundbreaking chatbot harnesses the prowess of artificial intelligence and machine learning to scrutinize user-provided symptoms and images, furnishing precise diagnoses and personalized treatment plans.

The incorporation of image-based skin disease detection within the MedCare Chatbot represents a notable progression in telemedicine and dermatological care. Traditionally, seeking specialized healthcare services for skin conditions often necessitates in-person consultations with dermatologists, posing challenges for individuals in remote areas or those with limited mobility. MedCare Chatbot addresses this predicament by enabling users to directly upload images of their skin conditions to the platform, facilitating remote consultations and diagnoses. Employing state-of-the-art image processing algorithms, the chatbot accurately identifies various skin diseases, facilitating early detection and intervention.

Beyond its diagnostic functionality, MedCare Chatbot also serves as an educational tool, furnishing users with valuable information about diverse skin conditions and available treatment options. Through interactive features and personalized recommendations, the chatbot empowers users to make informed decisions about their health, fostering proactive healthcare management. Furthermore, the integration of image-based skin disease detection underscores a broader trend of incorporating cutting-edge technologies into healthcare solutions, showcasing the transformative potential of artificial intelligence in revolutionizing medical diagnostics and treatment

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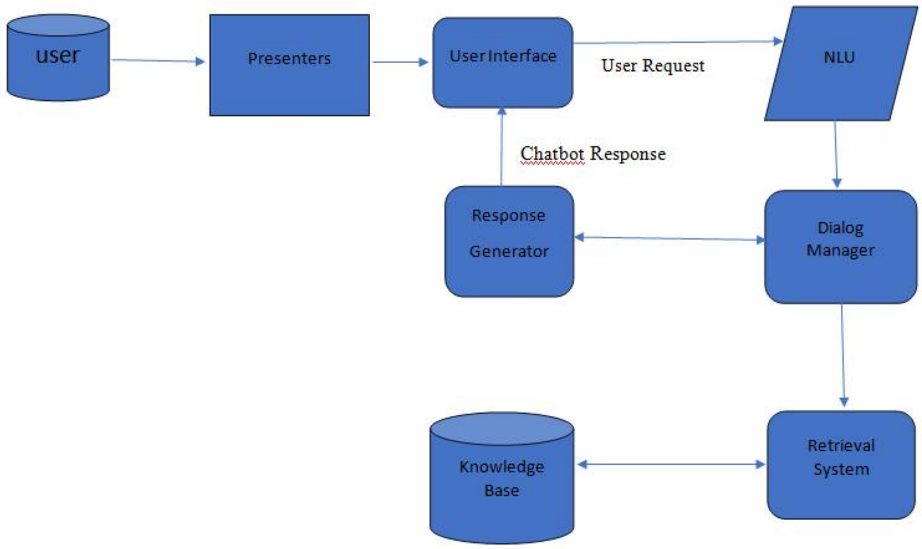
II. SYSTEM ARCHITECTURE



III. LITERATURE SURVEY

3.1 Characteristics and mortality of elderly patients admitted to Intensive Care Unit

The research paper outlines the development of an integrated healthcare device aimed at non-invasively monitoring glucose levels, pulse rate, and Body Mass Index (BMI) of patients. The device utilizes spectral and infrared (IR) sensors to measure near-infrared wavelengths and transmit light from the finger to a photo-diode, which converts the measurable voltage into glucose values. This data is integrated into a mobile app for real-time display and indication of further treatment needs. Additionally, a pulse sensor is integrated into the app to monitor pulse rate. The device's effectiveness is demonstrated through experiments, showing comparable results to invasive glucose monitoring methods.

The development process involves the design of circuits for filtering, photo-diode integration, and power conditioning, all aimed at accurately measuring glucose levels and pulse rate. The mobile health care app is developed using MIT App Inventor 2, providing functionality for monitoring glucose, BMI, and pulse rate. The app displays real-time data and allows for alarm notifications to alert patients for further treatment. Experimental results show promising outcomes, with the device demonstrating accuracy in measuring glucose levels and pulse rates across multiple patients. However, further research and testing are suggested to enhance accuracy and expand the device's capabilities.

3.2 Design of mHealth Application for Integrating Antenatal Care Service in Primary Health Care

The study focuses on designing a mobile health (mHealth) application, named SIMORI, for integrating antenatal care (ANC) services in primary health care (PHC) settings, particularly targeting both in-house clinic services and community works. The research employs a user-centered design (UCD) approach to identify user needs and ensure the functionality and usability of the application. Through in-depth interviews with prospective users and usability testing of mock-up mobile applications, functional features such as pregnancy registration and monitoring were identified. The study concludes that the UCD framework is instrumental in designing SIMORI, indicating its usefulness for integrating ANC services in PHC.

The literature review highlights the importance of integrated ANC services in PHC settings and the role of mHealth applications in improving maternal health outcomes. Previous research in developing countries has focused on various aspects of eHealth, including electronic health records (EHR) and mHealth applications for ANC purposes. However, gaps remain in the development of mobile applications that address the specific needs of diverse end-users involved in ANC processes, particularly in integrating community-based ANC services. Therefore, the study proposes a UCD framework for designing SIMORI, aiming to bridge this gap and improve the quality of ANC data in PHC settings.

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3.3 Predicting Heart Disease at Early Stages using Machine Learning

The detection and prediction of heart disease present a significant challenge in healthcare, prompting the exploration of machine learning techniques to aid in early diagnosis. Heart disease, including conditions like coronary artery disease (CAD) and heart failure (HF), remains a leading cause of mortality worldwide. Factors such as age, gender, lifestyle habits, and medical history contribute to the risk of developing heart disease. Traditional diagnostic methods like angiography are costly and time-consuming, underscoring the need for non-invasive, automated approaches for early detection. Machine learning algorithms, including artificial neural networks (ANN), support vector machines (SVM), decision trees (DT), random forests (RF), and naïve Bayes (NB), have shown promise in analyzing medical datasets and predicting heart disease. These algorithms process attributes such as gender, age, blood pressure, cholesterol levels, and ECG results to generate predictions.

Several studies have explored the effectiveness of machine learning models in predicting heart disease. For instance, research by Liaqat Ali et al. utilized a combination of X^2 statistical models and deep neural networks to achieve a classification accuracy of 93.33%. Similarly, Ashir Javeed et al. developed a model integrating random search algorithms and random forest techniques, resulting in an accuracy of 93.33%. Other studies, such as those by Dr. Kanak Saxena et al. and Deepika et al., focused on decision tree, support vector machine, and naïve Bayes algorithms, achieving accuracies ranging from 86.3% to 95.55%. These findings underscore the potential of machine learning in enhancing early detection and prediction of heart disease, offering valuable insights for healthcare practitioners and patients alike.

3.4 Unexpected Health Issues Prediction In Medical Data Using Apriori Rare Based Outlier Detection Method

The paper presented at the 2019 International Conference on Vision Towards Emerging Trends in Communication and Networking (ViTECoN) focuses on predicting unexpected health issues using an Apriori rare-based outlier detection method applied to medical data. The authors emphasize the growing prevalence of hazardous diseases and the importance of early detection to alleviate their impact. Traditional classification algorithms are limited in their ability to predict diseases in advance, prompting the need for outlier detection techniques to alert patients beforehand.

The proposed methodology combines Apriori rare-based Associative Classification to predict unexpected health issues by identifying outliers in healthcare datasets such as Mammography mass data, Chronic kidney disease, and Heart disease. The approach aims to enhance disease prediction accuracy by detecting outliers, ultimately outperforming existing Classification Based on Association rules (CBA) algorithms by 15% in terms of accuracy. The study emphasizes the significance of outlier detection in providing valuable insights for domain experts and improving disease prognosis through early identification.

3.5 Segmentation of skin from clinical photograph

The study presented by Noel C. F. Codella et al. focuses on skin segmentation in clinical photographs, addressing challenges such as varying lighting conditions, skin types, backgrounds, and pathological states. They collect 400 clinical photographs with skin segmentation masks from a primary care network, with 100 images used for training and fine-tuning, and 300 for evaluation. Using deep learning, they evaluate two variants of the U-Net architecture: U-Net and Dense Residual U-Net, finding that Dense Residual U-Nets show a 7.8% improvement in Jaccard index compared to classical U-Net architectures. They emphasize the importance of adequate representative data of diseased skin and highlight the utility of publicly available data sources for this task.

The study also compares the performance of different training scenarios, including direct transfer, direct training, and fine-tuning. They use three public datasets for pre-training and find that Dense Residual U-Net demonstrates significant improvements over traditional U-Net when applied directly to clinical photos, suggesting better generalization capabilities. Additionally, they observe that all networks perform similarly well with fine-tuning, emphasizing the importance of collecting representative datasets in the domain of diseased skin. Overall, the study highlights the potential of deep learning approaches for skin segmentation in clinical settings and underscores the need for robust training data to improve model performance.

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3.6 Machine learning for personalized skin care products recommendation engine

The research presented by Li, Cheng, Liao, and Huang addresses the challenges faced by consumers in selecting suitable skincare products amidst the vast array of options available in the market. With the increasing demand for cosmetic products, particularly facial skincare, users often encounter confusion and fatigue due to the overwhelming choices. Moreover, given the unique skin conditions of individuals, the use of inappropriate skincare products can lead to adverse effects such as skin damage and allergic reactions. Common facial skin issues include wrinkles, spots, acne vulgaris, and pores, each influenced by various factors like dryness, sun exposure, hormonal changes, and aging. Recognizing the importance of understanding one's skin quality and using skincare products correctly, the authors propose a machine learning-based recommendation engine to address these concerns.

The proposed system leverages machine learning and deep learning algorithms, particularly YOLOv4, for facial skin intelligence and product recommendation. YOLOv4's novel object recognition algorithm is employed to detect key features in facial images, allowing the system to identify areas of concern such as wrinkles, spots, and acne. Subsequently, sub-images of regions of interest (ROI) are extracted and used as input for multi-label models. Through the analysis of these sub-images, the system evaluates the correlation between feature parts and the degree of skin condition, providing a basis for optimizing the subsequent multi-label model. Additionally, image processing algorithms are utilized to preprocess facial images, automatically removing noise, enhancing features, and extracting relevant information for training the multi-label classification model. Ultimately, the prediction results generated by the machine learning model offer personalized skincare recommendations tailored to the user's specific skin condition, thereby aiding consumers in selecting suitable skincare products and maintenance ingredients to promote skin health and prevent damage.

3.7 Ensuring AI Is Helpful and Not Harmful in Health Care

The rapid integration of artificial intelligence (AI) into various industries, including healthcare, signifies a significant shift in decision-making processes and patient care. While AI-driven systems like ChatGPT are revolutionizing public perception, their adoption in healthcare has been cautious due to the potential consequences of errors in diagnosis, treatment, or operations. However, the potential benefits of AI in healthcare are immense, especially in underserved areas where access to care is limited. AI has the capacity to analyze vast amounts of data quickly, enabling faster clinical decisions and potentially reducing costs, particularly for vulnerable populations with socioeconomic inequities.

Ethical and regulatory considerations surrounding AI in healthcare remain complex. Addressing issues of bias, privacy, and accountability are paramount, requiring diverse teams and robust regulatory frameworks. Transparency, recognition of bias, and collaboration in decision-making are essential technical aspects, while ethical guidelines should focus on enhancing access to healthcare, empowering patients, and strengthening the patient-caregiver relationship. Ultimately, while AI can democratize access to healthcare by ingesting expert decisions, human oversight remains crucial in ensuring the best treatment outcomes.

3.8 Automatic identification of skin lesions

The research conducted by Madhurshalini M, Chitra Nair, and Nidhi Goel from IGDTUW in New Delhi, India focuses on using deep learning techniques for automatic identification of skin lesions to improve access to dermatology care. They address the significant global challenge of inaccessible skincare by proposing an alternative approach that leverages technology, particularly artificial intelligence (AI).

Skin diseases affect a large portion of the global population, with nearly two-thirds of people experiencing them. However, access to quality dermatology care is limited, especially in regions like India where there is a shortage of dermatologists. To bridge this gap, the researchers propose a method that combines deep convolutional neural networks (CNNs) for image-based classification and a feed-forward neural network for symptom-based classification. By ensembling these two classifiers, they achieve an accuracy of 87.71% in classifying skin diseases, demonstrating the potential of their approach to provide accessible skincare through web and mobile applications. This research contributes to addressing the United Nations' goal of ensuring good health and well-being for all.

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3.9 Facial skin image classification system using Convolutional Neural Networks

In this paper, a facial skin image classification system using Convolutional Neural Networks (CNN) deep learning algorithm is developed to address the changing trends in the facial skincare market, which now caters to a younger demographic. The system aims to quickly and accurately determine the quality of facial skin, classifying it into three categories: good facial skin quality, bad facial skin quality, and face makeup detection. Two CNN architectures are proposed and compared with LeNet-5. The architecture with three convolution layers, three pooling layers, and four fully connected layers achieves the highest recognition rate. This system provides an innovative approach to facial skin analysis, enabling users to better understand their skin condition and improve skincare routines.

The experimental results demonstrate the effectiveness of the proposed CNN architectures in classifying facial skin images. Model 2, with three convolution layers, three pooling layers, and four fully connected layers, outperforms the other models in terms of accuracy and error rates. By leveraging deep learning techniques and smartphone technology, the system offers a convenient and objective solution for facial skin analysis, potentially revolutionizing the way individuals assess and manage their skincare needs.

3.10 New technologies are making earlier diagnosis and better patient outcomes a reality by investigating the eye

The advancement in eye imaging technologies is revolutionizing the early detection and diagnosis of major eye diseases like age-related macular degeneration (AMD), diabetic retinopathy, and glaucoma, as well as neurological conditions such as Alzheimer's and Parkinson's. Technologies like fundus imaging and optical coherence tomography (OCT) have been crucial in providing morphological information about eye structures but lack the ability to measure key functional parameters like blood oxygenation and metabolic rate of oxygen consumption, which are vital for assessing eye health. However, recent innovations such as photoacoustic remote sensing (PARS) microscopy and OCT angiography (OCTA) are addressing this gap by enabling pre-diagnosis of eye diseases before symptoms appear. PARS offers non-contact imaging of the eye, allowing for functional imaging of the retina and in-situ tissue imaging during surgery, while OCTA provides detailed analysis of retinal blood flow, aiding in the early detection of vision-threatening conditions.

Additionally, advancements in telemedicine and self-testing devices are empowering patients to monitor their eye health from home. Companies like EyeQue have developed affordable and convenient tools like the VisionCheck device, which attaches to smartphones to perform accurate refraction tests. This innovation enables patients to track changes in their vision over time and access virtual care, contributing to the democratization of eye care. As telemedicine becomes more prevalent, these self-testing devices have the potential to complement traditional clinical assessments and improve patient outcomes by facilitating early detection and intervention for eye diseases.

3.11 Pandemic Situation Awareness Must Support Both Individualized Medicine and Public Health Invited Paper

The paper discusses the vital role of Situation Awareness (SA) technologies in supporting decision-making during pandemics, focusing on both individualized patient care and public health policy. It emphasizes the need to integrate information from various levels, including individual patient data and epidemiological insights, to enhance decision-making across the healthcare spectrum. Highlighting the COVID-19 pandemic as a prime example, the authors stress the importance of SA in rapidly collecting, analyzing, and sharing critical patient information among medical professionals while also informing public health guidelines and policies.

Furthermore, the paper discusses the clinical overview of COVID-19, emphasizing risk factors, initial presentations, disease courses, complications, and necessary laboratory findings. It underscores the importance of monitoring diverse symptoms and laboratory markers to understand disease progression accurately. Additionally, it addresses the role of new technologies in transforming medical practice, such as Electronic Health Records (EHR) and big data analytics, in facilitating continuous data collection, analysis, and sharing within an Integrated Healthcare System (IHS). The authors envision a future where SA infrastructure enables the seamless integration of individual patient data with epidemiological insights, leading to more effective disease management and policy development.

3.12 Predicting Covid-19 Cases using Machine Learning

The paper proposes a solution to address the lack of access to medical services in remote and underdeveloped areas through the use of cloud-based remote medical consultancy. It highlights the challenges faced in such areas, including the scarcity of doctors, unavailability of proper medicines, and limitations in accessing medical care during emergencies or late-night hours. The proposed solution involves the use of mobile agents connected to a cloud-based medical system, which can diagnose diseases based on symptoms provided by patients in their native language. The system aims to provide expert medical advice and prescriptions using locally available medicines, improving access to healthcare in remote areas where traditional medical services are limited.

By leveraging modern technologies such as cloud computing and mobile applications, the proposed system offers a cost-effective and accessible solution to address healthcare challenges in remote areas. Through the use of mobile agents and a cloud-based medical system, patients can receive expert medical advice and prescriptions tailored to their specific needs and available resources. The system's ability to operate in multiple languages and provide locally relevant medical solutions makes it well-suited for addressing the diverse healthcare needs of remote communities. Overall, the proposed solution has the potential to significantly improve the quality and accessibility of healthcare services in underserved areas, contributing to better health outcomes for individuals living in remote and underdeveloped regions.

3.13 Detecting diseases with medical prescriptions

The article discusses the rapid integration of artificial intelligence (AI) into healthcare and the significant impact it has on patient outcomes and decision-making processes. While AI adoption in healthcare is slower compared to other sectors due to the potential severity of errors, its potential benefits are substantial. AI has the capability to analyze large amounts of data quickly, leading to faster clinical decision-making, especially in areas with limited access to care. However, ethical concerns arise regarding the role of AI in decision-making, as well as issues related to data privacy, bias, and regulatory frameworks. The article emphasizes the need for diverse teams and transparent, ethical guidelines to ensure AI in healthcare maximizes benefits while minimizing harm.

Overall, the article highlights the potential of AI to revolutionize healthcare by improving access to care, empowering patients, and reducing administrative burdens for healthcare providers. However, it also underscores the importance of responsible regulation and ethical considerations to address concerns related to bias, data privacy, and the complex interaction between AI systems and healthcare professionals.

3.14 An Effective Machine Learning Approach for Identifying Non-Severe and Severe Coronavirus Disease 2019 Patients in a Rural Chinese Population

The study described an innovative machine learning approach to effectively categorize the severity of COVID-19 infections in a rural Chinese population. By utilizing a combination of random forest (RF) and support vector machine (SVM) models optimized by a slime mould algorithm (SMA), the framework aimed to predict the severity of COVID-19 infections based on patient demographic data and 26 blood routine indexes. The research collected retrospective data from COVID-19 patients admitted to a hospital in China, dividing them into severe and non-severe groups based on specific criteria. Blood samples were collected for routine examination, and machine learning methods were employed to analyze the data and predict severity. The RF-SMA-SVM model demonstrated superior performance compared to other algorithms, highlighting its potential for assisting clinicians in making informed medical decisions regarding COVID-19 diagnosis and treatment in rural areas.

In summary, the study's findings contribute to the growing body of research on utilizing machine learning techniques for disease diagnosis and prediction, particularly in the context of COVID-19. By leveraging RF, SVM, and SMA algorithms, the proposed approach offers a promising tool for accurately categorizing COVID-19 severity, which is crucial for effective clinical management and resource allocation, especially in rural healthcare settings.

3.15 Towards Universal Cardiac Care

The paper explores the development of telecardiology systems tailored for resource-constrained and economically disadvantaged communities, aiming to extend cardiac care to underserved populations. Traditional telecardiology

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systems, reliant on transmitting ECG data to diagnostic centers, face challenges in regions lacking grid power and stable communication networks. To address this, a two-tier telecardiology framework is proposed, employing compressive sampling and anomaly detection techniques to operate effectively under severe infrastructure constraints. This approach enables the provision of baseline cardiac care, including periodic checkups, to remote rural areas with limited access to healthcare facilities. Additionally, a focus is placed on continuous monitoring for post-operative patients, achieved through a cost-effective home-based monitoring service that detects and transmits only anomalous beats, thereby reducing bandwidth and physician workload.

Furthermore, the paper outlines strategies for low-cost continuous monitoring of cardiac conditions, particularly targeting economically disadvantaged urban populations. By leveraging dictionary-based compression techniques and anomaly detection algorithms, the proposed telecardiology system optimizes the transmission of critical ECG data while minimizing bandwidth requirements and professional workload. Through rigorous validation on physiological databases, the efficacy of these methods is demonstrated, highlighting their potential to significantly reduce healthcare costs and improve access to personalized cardiac care for vulnerable communities. Overall, the proposed telecardiology frameworks represent a significant step towards achieving universal cardiac care by addressing the unique challenges faced by resource-constrained and economically disadvantaged populations.

3.16 Chatbot Implementation to Collect Data on Possible COVID-19 Cases

The implementation of a Chatbot to assist in detecting possible cases of COVID-19 and alleviate pressure on the primary healthcare system is a significant innovation in the field of telemedicine. Developed by a team of experts from the Universidad de las Americas in Ecuador, this Chatbot leverages artificial intelligence to simulate human-like conversations and provide users with reliable information about COVID-19. By integrating the Chatbot into the university's healthcare system and website, individuals can access immediate assistance and information about COVID-19 symptoms, prevention measures, and general inquiries related to the virus. The Chatbot operates 365 days a year, providing automatic and immediate responses to users' queries, thereby reducing the operational load on healthcare staff and offering a new means of accessing medical services, especially outside typical working hours.

The Chatbot's architecture, implemented using the Snatchbot platform, allows for streamlined communication flows across various channels, including web applications and messaging services. Through a user-friendly interface, individuals can interact with the Chatbot, which is equipped with a decision tree based on natural language processing and machine learning. The Chatbot's features, such as automatic responses and predefined questions, optimize response times and save users valuable time in seeking relevant information about COVID-19. Despite the positive response from users regarding the usefulness of the tool, there is room for improvement in enhancing user experience and reducing response times further. Overall, the implementation of this Chatbot represents a promising solution to support healthcare systems during the COVID-19 pandemic and demonstrates the potential of technology to facilitate access to medical information and services.

IV. RESEARCH GAP AND FUTURE IMPLEMENTATIONS

Existing medical chatbots often lack personalization, offering generic responses without considering individual user preferences, medical history, or contextual factors.

Research focus could be on developing chatbots capable of tailoring interactions based on user characteristics and dynamically adapting responses to various scenarios to address this issue.

The clinical validity and accuracy of medical chatbots pose significant challenges, necessitating research to assess their effectiveness in delivering precise medical information, diagnoses, and treatment recommendations compared to established medical practices and guidelines.

Integrating medical chatbots into existing healthcare systems faces technical and logistical hurdles.

Research gaps exist in creating interoperable chatbot platforms that seamlessly integrate with electronic health records (EHRs), telemedicine platforms, and other healthcare IT systems while ensuring data security and compliance with regulatory standards.

Future implementations of medical chatbots are poised to transform healthcare delivery and patient engagement through advanced personalization features driven by artificial intelligence (AI) and machine learning algorithms. These innovations will enable chatbots to tailor responses based on individual user characteristics, preferences, and medical history, thereby enhancing user experience and instilling greater trust in the technology. Integration of natural language processing (NLP) capabilities will further enhance chatbots' ability to understand and respond to nuanced user queries, contributing to a more seamless and effective interaction between users and the technology.

V. CONCLUSION

Our project successfully deployed a Chatbot leveraging artificial intelligence to assist in identifying potential COVID-19 cases and easing the burden on primary healthcare facilities. Developed in collaboration with Universidad de las Americas in Ecuador, the Chatbot seamlessly integrates into the university's healthcare system and website, providing users with accurate information regarding COVID-19 symptoms, preventive measures, and general inquiries related to the virus. Utilizing the Snatchbot platform, the Chatbot's architecture enables efficient communication across multiple channels, including web applications and messaging services, offering users immediate responses to their queries through a user-friendly interface. By operating 24/7, the Chatbot reduces the workload on healthcare personnel and provides individuals with an accessible avenue for medical assistance, particularly outside of traditional healthcare hours. Overall, our Chatbot implementation signifies a significant advancement in telemedicine, showcasing the potential of technology to support healthcare systems during global health crises like the COVID-19 pandemic.

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