E-Dentist for the People of Bangladesh

Abu Sadat Al Rafi, Khondaker Abdullah-Al-Mamun
United International University (UIU), Dhaka, Bangladesh

***Abstract*—This paper reviews the current telemedicine and telehealth systems in Bangladesh and points out that dental care has not yet received enough attention in this area. While some digital health solutions exist, they are mostly designed for general healthcare and do not meet the specific needs of dentistry. To address this gap, the paper proposes a complete e-Dentist model. The system will include features such as online appointment booking, a 3D dental structure to help patients identify symptoms, video consultations with dentists, digital prescriptions, automatic medication reminders, offline navigation to find nearby clinics, and emergency support services. By combining these functions, the proposed system aims to make dental care more accessible, affordable, and convenient for people across Bangladesh.**

I. Introduction

Oral health is a fundamental component of overall well-being and significantly influences an individual's quality of life. Poor dental health has been linked to various systemic diseases, including cardiovascular disorders, diabetes, and respiratory infections, thereby underscoring the importance of preventive oral care in maintaining general health [**?**], [**?**]. However, in Bangladesh, access to quality dental care remains substantially inadequate, particularly in rural and semi-urban regions. A significant portion of the population experiences considerable challenges in obtaining dental treatment due to geographical isolation, a shortage of skilled dental professionals, and limited healthcare infrastructure. As a result, many individuals neglect preventive check-ups and seek medical assistance only when conditions have progressed to severe or irreversible stages.

Socioeconomic constraints and low public awareness further exacerbate this issue. The high cost of dental treatment and limited knowledge of oral hygiene practices contribute to delayed or avoided care, especially among low-income families [**?**]. According to national health statistics, the dentist-to-patient ratio in Bangladesh is critically low compared to the World Health Organization (WHO) standards, particularly in rural districts [**?**]. This disparity highlights an urgent need for innovative, technology-driven solutions to extend dental healthcare services beyond traditional clinical environments and urban boundaries.

In recent years, advancements in *Information and Communication Technology (ICT)* have transformed the global healthcare landscape. Digital health technologies, such as *telemedicine* and *mobile health (mHealth)*, have emerged as powerful tools to enhance accessibility, efficiency, and continuity of care. In Bangladesh, telemedicine initiatives have already demonstrated significant potential by providing online consultations, digital prescriptions, and mobile-based health monitoring systems [**?**]. These solutions proved particularly effective during the COVID-19 pandemic, when remote healthcare delivery became essential for ensuring service continuity.

Despite these technological developments, the field of *dental telemedicine* in Bangladesh remains largely underexplored. Existing digital health platforms are primarily designed for general medical consultations and fail to address the unique diagnostic, therapeutic, and educational requirements of dental patients. This gap has prevented the full integration of dentistry into the broader telehealth ecosystem. Therefore, a specialized and comprehensive digital platform for dental care is essential to ensure equitable access, improve early diagnosis, and promote oral health awareness among underserved populations.

To address these challenges, this research proposes the development of an innovative **e-Dentist System**—a digital solution designed to make dental healthcare accessible, affordable, and efficient across Bangladesh. The system will be available on both *web* and *Android* platforms, ensuring usability across diverse socioeconomic groups. It will employ a centralized *cloud database* to securely manage patient data, appointment records, and treatment histories. Key features of the proposed system include:

- **Video consultations** with licensed dental professionals for remote diagnosis and treatment guidance.
- **Online appointment scheduling** with automated reminders to enhance patient engagement.
- **Electronic prescriptions** and personalized **medication schedules** for treatment management.
- **3D interactive dental models** to assist patients in identifying symptoms and understanding procedures.
- **Offline navigation tools** to help users locate nearby dental clinics and emergency support.
- **Instant emergency response** features for urgent dental care needs.

By integrating these functionalities, the proposed e-Dentist System aims to improve the reach, quality, and efficiency of dental healthcare services. It will facilitate timely access to professional care, encourage preventive oral health practices, and reduce disparities between urban and rural populations. Ultimately, the system aspires to contribute to Bangladesh's national goal of achieving *universal and inclusive healthcare for all*.

II. Literature Review

Telemedicine and telehealth have been widely studied in Bangladesh, yet only limited attention has been given to dental healthcare through information and communication technologies. Dentistry, being a highly specialized branch of healthcare, requires more targeted solutions for patient–dentist

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communication, diagnosis, and follow-up treatment. Some studies in Bangladesh have introduced online-based appointment systems where patients can schedule visits with doctors remotely, focusing on features such as double booking, joint visits, staggered starts, and wave scheduling [1]. Such systems demonstrate the potential of digital platforms for healthcare but remain generalized and lack dental-specific functionalities.

Several mobile applications have also been developed to remind patients about medications. For example, Bhadane et al. [2] proposed an Android-based medication reminder using OCR (Optical Character Recognition) and ANN (Artificial Neural Network) to ensure timely intake of medicine, while other systems only provide basic alarm notifications [3]. These models are useful but do not address the unique challenges of dental patients, such as post-treatment care, scheduled antibiotic courses, or oral hygiene reminders.

mHealth technologies have also been designed for broader healthcare in Bangladesh, making wireless services more easily accessible to patients [4]. Similarly, offline navigation systems have been proposed to help users locate hospitals and health centers [5]. Furthermore, video calling systems for Android have been developed to connect patients with healthcare providers over Wi-Fi [6]. While these approaches demonstrate the growing adoption of telemedicine, they remain fragmented and are not specialized for dentistry.

Globally, the concept of tele-dentistry has gained increasing attention, where digital platforms are used for online consultations, oral health education, diagnosis, and patient follow-up [7]. However, in Bangladesh, tele-dentistry models are still underdeveloped, with existing systems offering limited features such as appointment booking or video consultation without integration into a centralized database or patient record system.

From these studies, it is evident that although telemedicine in Bangladesh has evolved with online appointment systems, medication reminders, mHealth, and video consultation platforms, there is still a significant gap in dental healthcare delivery. This motivates the proposal of a more comprehensive e-Dentist system that integrates appointment management, a 3D dental structure for symptom-based guidance, video consultation, prescription management, reminder systems, offline navigation, and emergency dental support, thereby providing a complete tele-dental solution for the people of Bangladesh.

III. Methodology

The proposed Teledentistry system structure can be implemented in Bangladesh with the current existing technologies and will benefit the people of Bangladesh. This research will follow both adaptive and quantitative methods.

Real-time consultation involves a video conference in which dental professionals and the patient, at different locations, may see, hear, and communicate with one another using advanced telecommunication devices and high-speed internet connections.

Store-and-forward, on the other hand, involves the exchange of clinical information and static images collected and stored in the telecommunication equipment. The dentist collects all the required clinical and radiographic information from the patient. This information is then sent to the specialist for consultation and treatment planning. The treatment is thus provided in a more timely, targeted, and cost-effective manner.

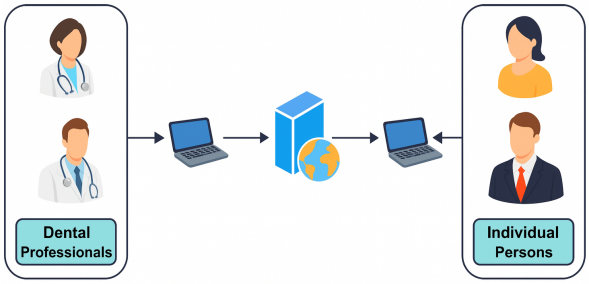


Fig. 1. Synchronous (real-time) consultation module

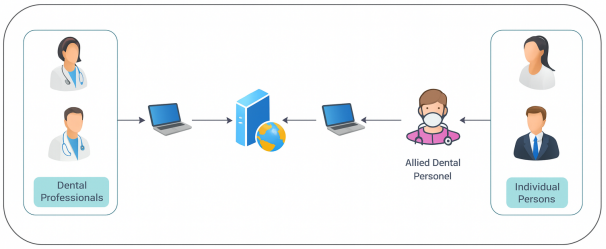


Fig. 2. Asynchronous (store-and-forward) consultation module

A. Design Analysis

Real-time consultation involves live video conferencing sessions between dental professionals and patients located in different geographical regions. With the support of high-speed internet and telecommunication devices, patients are able to directly interact with dentists, discuss symptoms, and receive instant recommendations. This reduces travel costs, waiting times, and improves accessibility to dental specialists.

B. Network Model Architecture

The store-and-forward model enables the collection of patient information, including clinical data, radiographic images, and case histories, which are then securely transmitted to specialists for review. The dentist or primary caregiver collects and uploads all necessary data to the system, where it is stored in a cloud database. Specialists can later analyze the data and prepare treatment plans. This approach ensures timely, cost-effective, and targeted care delivery.

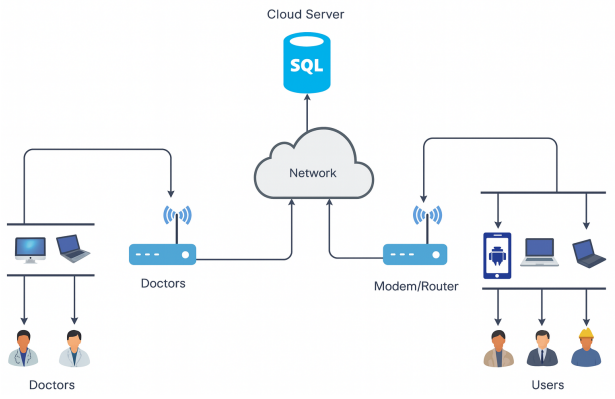


Fig. 3. Proposed teledentistry system architecture

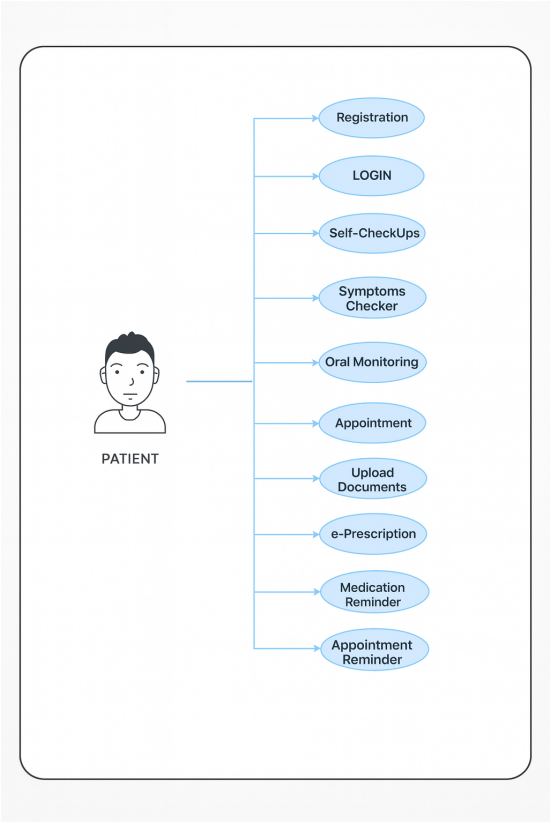
C. Platforms

The proposed system is primarily designed as an Android-based application to ensure accessibility to a wide user base in Bangladesh. A cross-platform technology such as PhoneGap will be employed to expand support to multiple devices. The Android application will be developed using Android SDK tools and integrated with web APIs to enable communication with the central cloud. Microsoft Azure will serve as the backend database, ensuring real-time data access and synchronization across platforms.

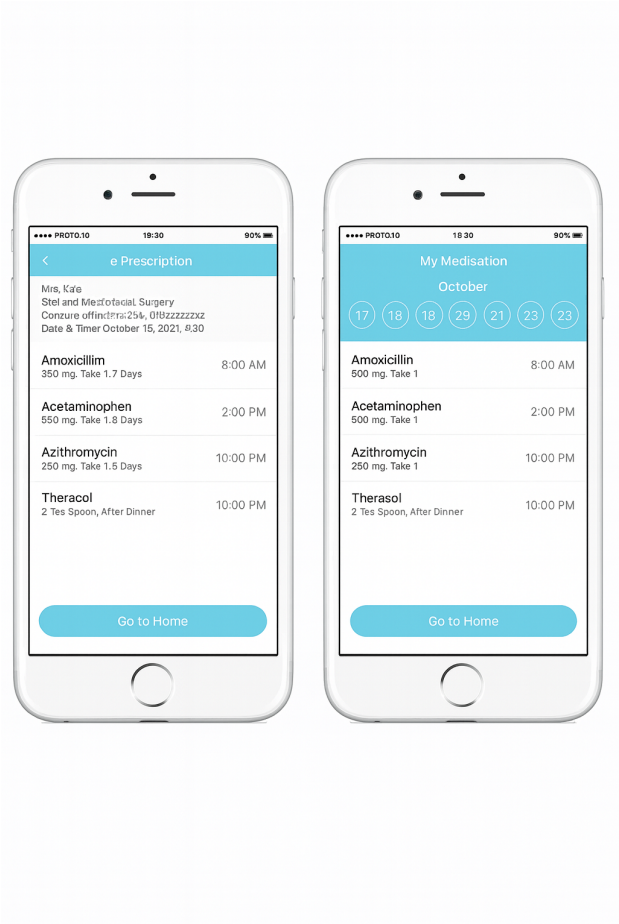
D. Services Analysis

Nowadays, many health service systems have been implemented as part of telehealth. By collaborating all of those services in this system and by adding some additional methods of healthcare, the Teledentistry system service architecture has been designed.

- **Case Diagram: Patient Preview**



- **User Can Select Oral Symptoms**
  Users can select the symptoms before getting an appointment with the dentist by knowing whether they have a major or minor oral disease. The system will check the provided symptoms, and by analyzing them, it will show the user their oral risk. Based on the risk analysis, the system will suggest whether a dentist consultation is needed or not.
- **Monitor Oral Health**
  For primary oral health check-ups, monitoring oral health condition, monitoring oral risk factors, and getting notified for regular check-ups can be done through this system. This module can be applied in: monitoring school children's oral health and risk factors, health campaigns, and initiatives based on risk factors.
- **User Can Give Appointment from Anywhere**
  Giving appointments manually is time-consuming and costly. Using this system, users can book appointments directly. The system is designed to automatically generate appointment reminders from the available list, sending notifications to users about their appointment time.
- **Doctors Can Generate e-Prescriptions**
  Doctors can view all appointed patients' lists and their information. They can also update their own information and add prescriptions through the system.



- **Medication Reminder System**
  By analyzing the prescription, the system will automatically generate a medication reminder schedule, which will notify users about their dosages.

IV. FUTURE PROSPECTS

- Improve oral risk level detecting technique
- Machine learning technique regarding symptoms checking
- Provides services to disadvantaged children
- Virtual oral/dental health campaign
- Live chat with dental professionals on emergency
- Oral health monitoring for specific group of individuals

V. CONCLUSION

This E-Dentist system has been designed by using different system model and methods provided in different research works. This system can also be extended with the exiting technology and can make it more efficient and useful for the users. People will get proper benefit of this solution when they can afford internet connectivity and little bit of knowledge of mobile phones. It can be helpful as a learning tool and people can get the information of oral healthcare services around them.

REFERENCES

[1] I. Sherly, R. Sinha, and A. Banerjee, "Online appointment scheduling system with advanced features," *International Journal of Advanced Research in Computer Science*, vol. 8, no. 7, pp. 77–82, 2017.

[2] A. Bhadane, P. Patil, and R. Chavan, "Android based medication reminder using ocr and ann," *International Journal of Computer Applications*, vol. 123, no. 6, pp. 21–25, 2015.

[3] A. Rahman and S. Karim, "A simple mobile alarm-based medicine reminder system for elderly patients," in *Proceedings of the International Conference on Mobile Computing and e-Health*, 2016, pp. 45–49.

[4] M. M. H. Chowdhury, M. H. Rahman, and M. S. Uddin, "mhealth in bangladesh: Current status and future prospects," *Journal of Health Informatics in Developing Countries*, vol. 12, no. 2, pp. 1–9, 2018.

[5] P. Deb, T. Rahman, and M. Alam, "Offline navigation system for health services in bangladesh," *International Journal of Computer Science and Information Security*, vol. 14, no. 4, pp. 89–95, 2016.

[6] N. Shrideep, K. Patel, and R. Verma, "Android based video calling system over wi-fi," *International Journal of Emerging Trends in Engineering and Development*, vol. 4, no. 2, pp. 150–154, 2014.

[7] M. Estai, Y. Kanagasingam, M. Tennant, and S. Bunt, "A systematic review of the research evidence for the benefits of teledentistry," *Journal of Telemedicine and Telecare*, vol. 22, no. 6, pp. 323–329, 2016.