

**TELEMEDICINE TECHNOLOGY AND ITS FUTURE IMPACT IN
BANGLADESH**

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of Bachelor of Science in Computer Science and Engineering

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APPROVAL

This Project titled “**Telemedicine Technology And Its Future Impact In Bangladesh**”, submitted by Md. Rejwanul Hasan, ID No: 152-15-5767, Afsana Akter Liza, ID No: 152-15-5749, Mariz Mahamud, ID No: 152-15-5829 and Asha Dev, ID No: 152-15-6089 to the Department of Computer Science and Engineering, Daffodil International University has been accepted as satisfactory for the partial fulfillment of the requirements for the degree of B.Sc. in Computer Science and Engineering and approved as to its style and contents. The presentation has been held on 3rd May 2019.

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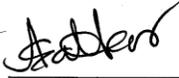
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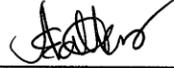
We hereby declare that, this project has been done by us under the supervision of **Dr. Syed Akhter Hossain, Professor and Head, Department of CSE** Daffodil International University. We also declare that neither this project nor any part of this project has been submitted elsewhere for award of any degree or diploma.

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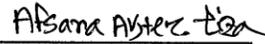


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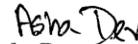
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ABSTRACT

Telemedicine offers an answer for giving master medicinal consideration to country individuals in the under-favored World. Telemedicine alludes to the utilization of data and correspondence innovation to give and bolster medicinal services mostly to provide discussion. It is likewise an approach to give medicinal strategies or examinations to remote areas. It can possibly improve both the quality and the entrance to social insurance administrations conveyance while bringing down expenses even in the shortage of assets. Enthusiasm for the field has expanded drastically during the 1990s. Be that as it may, it is an extraordinary distress that telemedicine methods have been a work in progress for almost 35 years. Be that as it may, it has incredible breadth to improve and furthermore it can definitely give an immense number of individuals step by step. A fruitful telemedicine framework can be a model for further telemedicine related undertakings in the creating scene. We are attempting to talk about on fruitful usage of Telemedicine innovations and future effect in Bangladesh. We will talk about all effective telemedicine advances over the world here. Bangladesh has an incredible breadth for building up a brilliant telemedicine show. In this paper we are going to demonstrate to you some of fruitful model of telemedicine innovation and talk about future extension in Bangladesh. We proposed a model with square outline in this examination work.

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CHAPTER 1

INTRODUCTION

To provide clinical health care from distance telemedicine is used in telecommunication and information technology sectors. It overcomes distance barriers which improve access to medical services that are not available in distant rural communities. For economic and social development, recent advancement of Information and communication technologies (ICTs) play vital roles. Telemedicine is obviously a hopeful cost-effective and reasonable alternative that has been displayed to impede deaths and uplift functional recovery [1]. Telemedicine commits a great possibility of providing remarkable improvement and cost-efficient ingress to the quality of health care facility to the unprivileged communities [2]. Furthermore, ICT is not widely used in the health care sector in Bangladesh. But we can say uses of telemedicine will make a notable contribution to the betterment of the health-related sector and surely improve the present situation [3]. Bangladesh has successfully launched her first satellite & this satellite will bring enormous development in the telemedicine sector in Bangladesh. It opens the door of Telemedicine. Technology has not been introduced significantly in the health care sector to provide perfect services though the government of Bangladesh is trying to focus on that field to help with the help of non-government organization [4]. Many papers focus on the transmission of medical information over wireless networks. But recent topics such as communication networks and its services such as monitoring of the patient, processing of information, deployment of the system, security of data and privacy of system with data, and so on. Basically, we focused on the popular technologies used in telemedicine in recent time. MEMS, Data integrity and validation, knowledge robots, Human-machine interaction, technology transfer are the focused area for technological aspects of telemedicine [5, 6, 7, 8]. We will focus on Medical Information Websites, Mobile Apps, Live Video and Audio Conferencing, Remote Patient Monitoring Equipment, Secure email etc. types technologies in our work. We will explore perfect technologies in depth and generalize satisfaction with telemedicine technologies are needed to improve because of deficiencies in the methodology of the current standard. Bangladesh can set an example of perfect telemedicine technology.

1.1 Motivation

Telemedicine is right now a hot topic in medical science. In clinical health sector telemedicine can create a great change. Lack of proper service methodology people are deprived of the blessing of this technology. It is a matter of great regret that in Bangladesh there is no such practice in medical science. If a computer engineer and a medical scientist collaborate themselves to establish a perfect telemedicine model, then there are lots of scope for developing. However, there are lots of technologies available right now, they have some issues like they are high expensive for installation, very much tangled to operate. In Bangladesh, we need a cost-effective and easy use technological model. A mobile based application can be an example of cost-effective telemedicine technology. An AI based application which can detect the age of the patient and also when a patient is not capable of giving input then it will understand the problem by using vocal instruction can be established as the rapid using of smartphones nowadays. People who earn only five thousand a month, he can afford a smartphone. Thanks to the abundance of smart phones among regular people, is immensely helpful for telemedicine purpose. From 1990s' researchers are trying to set a model for telemedicine technology because of rapid revolution of clinical health sector. For this reason, the idea of proposing a perfect telemedicine technology model which is AI based application. Our main focus is to provide cost-effective technology which is possible to establish in Bangladesh in future.

1.2 Objectives

The objective of this research to find out suitable telemedicine technology among all existing's. After identifying the perfect model, we will compare them with each and discuss which is suitable for Bangladesh and also discuss about future impact in Bangladesh. The proposed model is user friendly and most importantly cost-effective.

- To find out advance technology on telemedicine
- To set up cost-effective technological model for Bangladesh and other countries.

- Comparing between all existing models.
- To serve people in rural areas.

1.3 Contribution Summary

- We achieved 2 medical acceptance for our proposed model.
- We searched over all technologies and establish a new technological model.
- Cost-effective and user-friendly service for all ages.
- We showed comparison and successful implementation in Bangladesh.

1.4 Thesis Outline

The thesis is organized as follows:

- Chapter 2 contains the background summary and an overview of the main technologies.
- Chapter 3 shows proposed methodology.
- Chapter 4 shows implemented technologies.
- Chapter 5 shows the comparative analysis results and Future impact in Bangladesh.
- Chapter 6 contains the future work and conclusion

CHAPTER 2

BACKGROUND STUDY

Introduction

In this chapter, we discuss on several research work done by the researchers in Telemedicine technologies related area.

All wellbeing administrations require a talented workforce so as to convey successful social insurance, however it is regularly difficult for wellbeing frameworks in creating nations to accomplish indistinguishable dimension of expert abilities from industrialized nations. This emerges in light of the fact that the abnormal state of illness trouble in more unfortunate nations exacerbates the issue of supporting sufficient human services frameworks from their restricted assets. However there has been just a restricted reaction by the worldwide network to the high illness troubles in creating nations, and venture by more extravagant nations in more unfortunate nations has been deficient (Sachs 2001).

One way that more extravagant nations could bolster the social insurance frameworks of less fortunate nations is by helping with structure the scientific limit in those nations (Harris and Tanner 2000). Wellbeing innovation exchange is one technique for structure limit: expert abilities are granted to neighborhood professionals who would then be able to give benefits that will improve the soundness of the nearby populace (Donald 1999). One method of innovation exchange, so far unevaluated, is to utilize telemedicine as a type of correspondence and learning between experts in more extravagant and less fortunate nations. In this paper we notice the reasons why Bangladesh needs to move for telemedicine and its future degree. We likewise present the past and on-going telemedicine mechanical exercises and undertakings in everywhere throughout the world just as Bangladesh. Investigating these tasks we have discovered a few elements which ought to be evaluated cautiously for fruitful usage of telemedicine application. At last, we propose a model telemedicine arrange for Bangladesh that can improve wellbeing offices through telemedicine by making an association between provincial wellbeing office suppliers and extraordinary medical clinics.

2.1 Literature Review

To attain our research aspect, we reviewed many research articles and journals, conference papers, magazines, books and also visited different sites related to telemedicine technology. In addition to that most up-to-date journals are discussed in this part with their weaknesses as well as strengths.

Internet-based telemedicine is proposed by Hasan, Jahidul considering the cost and accuracy [9]. In this paper, they focus on the importance of implementing telemedicine applications in Bangladesh with recent technologies. They propose an internet-based cost-effective optimal solution with video conferencing system using the digital camera, the digital scanner, color television, and computer. They illustrate cases from the Diabetic Association of Bangladesh. M. Sanaullah et al. [3] proposed existing fiber optic telemedicine network architecture is the backbone of Bangladesh. They have also presented telemedicine overview in Bangladesh perspective which is more rigorous, cost-effective and speedy model. Its applicability to communicate between patient and doctors is also shown in this paper. According to this paper, the telemedicine network architecture can be linked with WBAN with the internet of the mobile system network.

This research was conducted by Johnston and others titled "The cost-effectiveness of technology transfer using telemedicine" described transferring system between South Africa and United Kingdom (UK) using teleophthalmology can be possible as a mode of technology. This paper has reported on the practitioner's convenience and cost-effectiveness surround a technology transfer project using teleophthalmology to provide advice of a specialist to practitioners in South Africa. For a developing country, the set-up costs were the biggest proportion of the entire costs. On the other hand to make in the health care system an entire set-up cost of around £27000 can be seen as an unpretentious investment for an industrialized based country [10].

This research project shows using telemedicine to transfer technology to help the capacity raising in the health care systems is a costeffective way for wealthier countries than poorer countries. Pavlopoulos et al. [11] developed a portable medical device uses GSM mobile telephony that links and allows the acquisition and transmission of requisite biosignals, bidirectional telepointing capability and still images of patients which is worked for emergency telemedicine applications. And also allows the paramedics to work in a hands-

free mode enhances the system functionality of an advanced man-machine interface, while receiving data and communicating with experts in a hospital. This was successfully exhibited in 4 European experimental sites.

An article by Perednia et al. titled "Telemedicine technology and clinical applications" said that the medical community should exercise telemedicine as both a means of communication and a new diagnostic or therapeutic modality. Proper skepticism and caution should be matched by the decisive implementation when there are well-defined opportunities to serve distressed populations. Research into safety, efficacy, cost-effectiveness, and satisfaction must be a high priority, and providers should be kept up to date with telemedicine developments [12].

The authors Enrique Dorrnzoro Zubiete, Luis Fernandez Luque and Ana Veronica described current systems embodiments in the WSN domain and there were several applications that concentrate on telemonitoring and fall detection using wireless technologies like BlueTooth or ZigBee [13]. A review paper conducted by Pamela Whitten and others suggested that delivery of healthcare via telemedicine is satisfactory to patients in a variety of situations, but, by addressing this point in a rather perfunctory way most studies have raised numerous questions than answers [14].

2.2 Clinical Application and Wireless Sensor Network

Bangladesh is a thickly populated nation. The population thickness of Bangladesh is higher than in neighboring nations India (about multiple times) and just about multiple times that of Pakistan. In light of the gigantic populace in Bangladesh, very nearly 1142 individuals for each sq. Km live. In the event that we investigate the web supporters in Bangladesh, at that point we can see that practically 90.501 million endorsers who utilize the web persistently. According to the Bangladesh telecommunication regulatory commission, mobile internet subscribers are increasing day by day. Analyzing statistics in this field it could be mentioned that mobile internet subscribers are extending that shown in TABLE 1.

Table 1: The Internet Subscribers (Data at The End of August, 2018) [18]

OPERATOR	SUBSCRIBERS (Million)
Mobile Internet	84.685
WiMAX	0.083
ISP + PSTN	5.733

Remote Sensor Network (WSN) are ending up progressively essential for observing patients both in the clinical setting and at home. They give more solace to patients, with the nonappearance of wires lessening costs and giving greater flexibility. WSN are additionally major in AAL since these brilliant frameworks, custom fitted to client needs, gather data about clients and their surrounding so as to give customized criticism. Remote Sensor Networks can incorporate crucial sign sensors and furthermore ecological sensors, for example, air quality. Regardless of the developing utilization of remote interchanges in the wellbeing space and AAL frameworks the examination writing evaluating preliminaries of these advances is still rare. This paper gives a precise audit of the utilization of WSN in the wellbeing space. A WSN comprises of spatially circulated, independent sensors (detecting hubs) that participate to screen physical or ecological conditions, for example, temperature, sound, vibration, weight, and so on.

The main components of a WSN are:

- Sensing hub: each detecting hub is furnished with a microcontroller and a power source. The detecting hubs screen conditions, directing little preparing activities and transmitting this information to other detecting hubs in the system.
- Transmission innovation: to transport information among system hubs. WiFi, Bluetooth, Zig-Bee, and RFID are the most prevalent transmission advances. Picking between them will rely upon lifetime augmentation, heartiness and adaptation to non-critical failure.

WSN requires security strategies to confirm and give privacy, demonstrates that if sensors can't be effectively verified the off-base data might be put away in the medicinal record. Validation techniques can be powerful in forestalling false information infusion and Denial of Service (DoS) assaults. Credibility, honesty, and confidentiality between biosensors must be ensured. An intriguing finding in our examination was the absence of papers detailing nature of security angles. This is astonishing since the information gathered by remote sensors might be of indispensable significance or contain delicate data. In our hunt technique we went for both home frameworks and clinical frameworks, yet sadly, we found for the

most part precedents in the clinical setting. We just discovered precedents alluding to conceivable outcomes of utilizing WSN for AAL yet no preliminaries about usage.

There are a few applications that emphasis on telemonitoring and fall location that utilization remote advancements like ZigBee or BlueTooth. As referenced, these executions would benefit from more preliminaries, enduring longer and with more members to give increasingly itemized data about framework self-rule and solace. Ensuring the security and genuineness of the transmitted information is likewise an imperative goal. To accomplish this, security systems must be actualized. Remote transmission advancements can be influenced by various types of obstruction. As the information transmitted in telemedicine frameworks is touchy, having the capacity to give unwavering quality is crucial.

As referenced, a standout amongst the most imperative difficulties concerns the utilization of guidelines. These measures would help by giving a typical interface that would make it conceivable to incorporate these generally confined frameworks. This is a critical objective at AAL where there are a wide range of sorts of sensors. Furnishing them with an institutionalized interface would make it simpler to incorporate and organize them.

Current status up to this point, transmission of a high-goals, full-movement video flag was conceivable just using costly or little-accessible modalities, for example, satellite uplinks costing more than \$400 every hour or microwave towers. Ongoing improvements in digitization and information pressure advancements permit transmission of the colossal measure of data required for video with significantly less transfer speed. In this manner, while an undigitized (for example simple), uncompressed video flag would ordinarily require what could be compared to 90 million bits for each second for transmission, generally a similar measure of data would now be able to be transmitted at 384000 bits for every second. The decrease in data transfer capacity permits reasonable transmission of full-movement, decently high-goals, shading sound video pictures over long separations. Transmission costs for these packed signs are around one tenth the expenses of satellite transmission. While the gear cost for an IATV telemedicine site is currently \$50000 to \$100000, diminishing expenses of equipment, programming, and transmission propose that high-goals, full-movement IATV may before long be accessible to medicinal facilities and workplaces at a small amount of that cost.

Radiology and pathology are particularly fit to a store-and-forward arrangement. They have someone of a kind prerequisite, be that as it may, most prominently for high-goals pictures than are utilized for most sorts of clinical conference. Most teleradiology and telepathology programs are at present separate from the IATV intervened telemedicine programs. More than 7000 teleradiology frameworks have been sold to date by two of the biggest makers (Image Data, San Antonio, Tex, oral correspondence, July 15, 1994, and Icon Medical Systems, Campbell, Calif, oral correspondence, July 15, 1994). In the initial a half year of 1994, around 15 interfacility teleradiology programs in North America gave teleradiology administrations to around 90 remote locales and translated roughly 22 000 studies.

It is evaluated that 60 devoted telepathology frameworks are as of now being used in the United States (Thomas Arnold, Roche Image Analysis, Elon College, NC, oral correspondence, in the United States at a quickening rate. In 1990, four telemedicine ventures utilizing IATV for patient conferences were dynamic in North America. In December 1993, there were 10, and by December 1994, no less than 50 IATV projects were either dynamic or in different phases of arranging and execution. Late government financing portions guarantee that somewhere around twelve new tasks will be expedited line in 1994-1995.

Most US telemedicine programs are being supported, in any event to some extent, by state and government reserves. Somewhere around 13 diverse government allow programs with an aggregate of \$85 million in telemedicine subsidizing were affirmed for monetary 1994. A few states are supporting and building best in class telemedicine frameworks with substantial capital speculations of their own. Georgia has apportioned around \$8 million for a program that presently connects six destinations, with an arranged development to at least 40 in future years (L. Adams, Medical College of Georgia, Augusta, oral correspondence, July 20, 1994). Military applications seem, by all accounts, to be creating parallel to programs in the non-military personnel division. Ongoing allocations have granted more than \$70 million to military telemedicine programs, including roughly \$15 million for teleradiology alone (COL Fred Goerringer, US Army Medical Materiel Agency, Ft Detrick, Md, oral correspondence, July 15, 1994).

2.3 Union Digital Centre

So as to assemble extra assets and bridge effectiveness gains for giving rustic individuals advanced data and benefits and creating business enterprise, the legislature has drawn in home developed adolescents under open private association which is called PPP in the venture. In spite of the desire, numerous business people procure change least and are compelled to withdraw the endeavor abandoning the guarantee of the telecentre disturbed. With regards to encouraging dropouts from constrained salary understanding and anticipating a supported dimension of pay accomplish importance. This examination intends to distinguish factors that have effect on the inconstancy of business person's pay. For gathering information from included accomplices it studied 30 business visionaries on the web and met other administration partners. Since all business people couldn't be come to through the web 10 of them are met top to bottom alongside significant administration authorities and neighborhood illustrative of the Upazilla from 16 UDCs of 4 locals. We visited Rangpur, Dinajpur, Mymensing and Keraniganj for gathering information for our exploration work. It characterizes the continued pay as 4000 to 5000 (surmised USD 55) Bangladeshi Taka every month and anticipated it utilizing the paired strategic relapse. It discovers the real empowering influences of continued pay and the interrelationship among them that advance from the interchange of accomplices. The investigation finds that most UDCs are to some degree sensibly bolstered with the fundamental ICT gear, while others are embellished with cutting edge hardware, to give a scope of administrations including declarations, e-government and business type. Be that as it may, the dimension of gear and administrations crosswise over focuses differs relying upon the degree of help from the legislature, the UP and the business enterprise of the private accomplice. The size of contributions from open accomplices and the business person's venture have been observed to be related with the quantity of individuals including distraught visiting these communities for administrations. Every one of these factors are related with the pay of the business visionary with various sizes. The speculation that organization segments, for example, foundation and administration inputs, enterprising limit alongside individuals' investment all have a noteworthy part in clarifying the month to month continued pay is tried utilizing the twofold model and observed to be mostly upheld.

The creator contends that a portion of the data sources still couldn't make any huge commitment because of the absence of compelling association of pertinent accomplices. Yet, to guarantee monetary manageability of all UDCs and to keep the dropouts of business person's the expansion in units of these components can assume a critical job. There is many individuals who are ordinary client of web in our nation. Be that as it may, the UISC's are in rustic zone who has web offices. They can without much of a stretch serve residents the individuals who are not equipped for going town for their better treatment. Thus, UISC's can assume essential job in the event that we give them legitimate telemedicine display engineering. If we can develop a proper telemedicine architecture then it can be possible to utilize these huge internet subscribers for the betterment of the healthcare sector of Bangladesh. Union Information Service Centre performs a great role in telemedicine sector. Here we have shared an exact number of UISC's and some of the related sectors who brandish telemedicine in Bangladesh below in TABLE 2.

Table 2 Number of UISC's With Some of The Related Sectors

Total UISC	4501
Solar panel based UISC	1013
The Laptop with Internet facilities	2000
Community Health Clinic	11000

CHAPTER 3

PROPOSED METHODOLOGY

3.1 Proposed model

Figure 1 demonstrates the block diagram that represents the implementation procedure of the proposed model. It shows the block diagram of the proposed architecture. In the proposed architecture at first connect with all-time available doctors with the patient which will automatically detect the age of patient by using AI with the help of camera. Then it will go for direct video conversation between the doctor and patient. While video conversation is running doctor will write the report. After finishing conversation patient will get the report with the desired medicines. Doctor will take the picture and send directly to the patient.

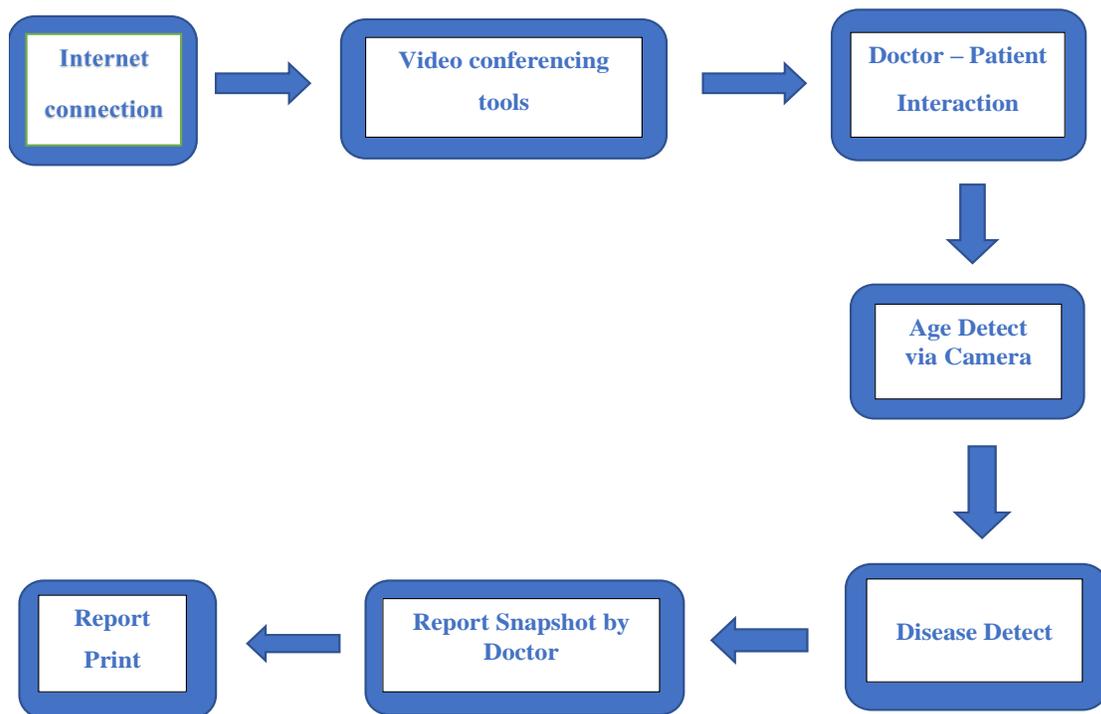


Figure 3.1.1: Minimum Cost Telemedicine Service Block Diagram

3.2 Workflow

Figure 2 shows the work flow diagram of the proposed model. For getting better telemedicine service we will use internet connection facilitated device like smartphones. An AI based application which will identify the age of the patient by using its camera. “A minimum cost video conferencing Smart Application” removes the barrier of expensive technological support in telemedicine sector. Our workflow describes the full process of our proposed model. At first, patient need to establish a connection for video calling. If it performs then go for Doctor searching. If doctors are available then video conferencing starts. Before starting application detects age. If patients’ age is not more than 18, then it will go for Child specialist or else go for Adult section. Finally, doctor will send a report by taking picture and if picture found then print.

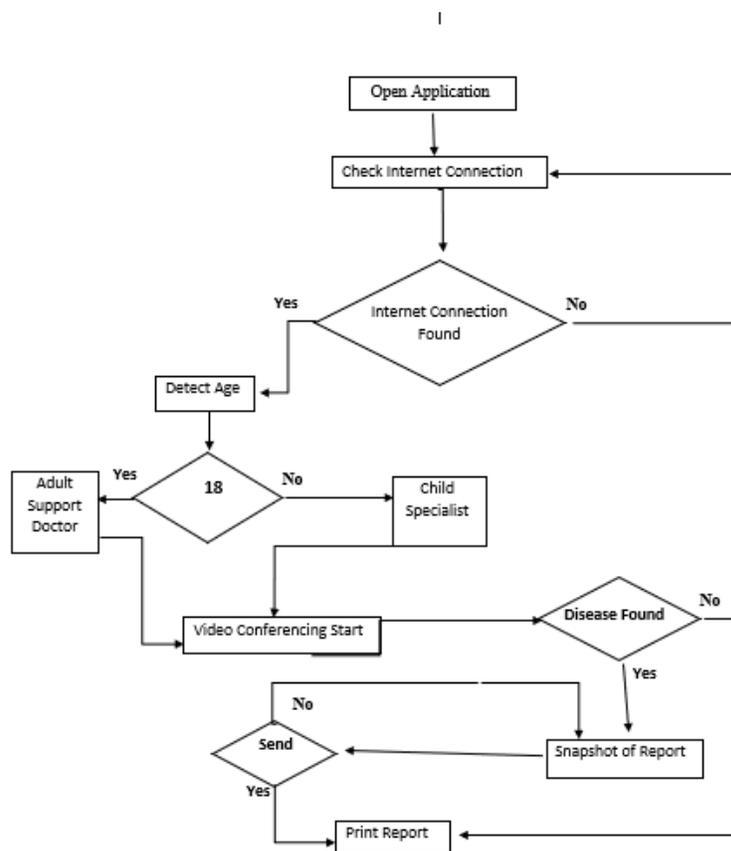


Figure 3.2.1: Minimum Cost Telemedicine Service workflow

CHAPTER 4

IMPLEMENTATION

4.1 Implemented Technologies

To identify telemedicine technologies and its future in Bangladesh several studies we have investigated like INSPEC, MEDLINE, PROQUEST, EMBASE, CINAHL, TIE which is known as Telemedicine Information Exchange database. There are so many telemedicine technologies found in recent era. Some of these are currently applicable and available. We discussed some of the popular technologies in telemedicine in this review article. By searching technology in telemedicine, we found voice and data communication facilities (email via VHF radio) were successfully installed in thirty-nine previously isolated health facilities in the province of Alto Amazonas in Peru. A baseline study was carried out in January 2001 and a follow-up evaluation in May 2002.

High quality service has been provided successfully in different levels of hospitals all over Bangladesh. Among these, there are 2 specialized hospitals named Bangabandhu Sheikh Mujib Medical University and National Institute of Cardiovascular Diseases, 3 district hospitals in Shatkhira, Nilphamari and Gopalganj including 3 sub-district hospitals in Pirgonj, Dakope and Debhata provide telemedicine services. Through this service, admitted patients in district and sub-district level hospitals can take suggestions from the specialized doctors from specialized hospitals instead of visiting the higher-level hospitals. Besides, web-camera has been given in each sub-district, district, medical college and post-graduate institute hospitals for the betterment of telemedicine technology. These hospitals, therefore, can also give tele-medicine service using Skype or any other video conferencing platform. Bangabandhu-1 satellite has opened the door of advance technologies for using in telemedicine and other sectors with high speed internet. The videophone technology to provide directly observed therapy called DOT program realized a substantial cost savings. The total cost for the videophone equipments (5 units) was \$1000. It is said that during 304 treatment doses, adherence on videophone DOT was 95%, and patient acceptance of the technology was excellent. And they say in selected cases, the use of videophone technology can maintain a high level of adherence to DOT in a cost-effective manner.

Micro Engineer Machine Systems (MEMS) which is another form of nano-technology represent new opportunities for telemedicine. Another review suggested either telemedicine service implementation is still not a part of mainstream clinical services, or it is not being reported in the peer-reviewed literature.

And also the depth and the quality of information were variable across studies, reducing the generalization ability. The reporting of service implementation and planning strategies should be encouraged. Given the fast speed technology driven environment of telemedicine may enable others to learn and understand how to implement sustainable services. Another review reported that, at the moment, the most convincing published evidence regarding the effectiveness of telemedicine deals with teleradiology, teleneurosurgery (transmission of CT images before patient transfer), telepsychiatry, transmission of echocardiographic images, and the use of electronic referrals enabling email consultations and video conferencing between primary and secondary health care providers [17]. On the other hands some of research articles describe about TAM. Technology Acceptance Model (TAM) was developed by Davis to explain computer-usage behavior. The theoretical grounding for the model is Fishbein and Ajzen's theory of reasoned action (TRA). According to TRA, beliefs influence attitudes, which in tum lead to intentions, which then guide or generate behaviors. TAM adapts this belief-attitude-intention-behavior relationship to an IT user acceptance model. Also, the goal of TAM is to provide an explanation of the determinants of computer acceptance that is general, capable of explaining user behavior across a broad range of end-user computing technologies and user populations, while at the same time being both parsimonious and theoretically justified.

There only a few numbers of hospitals have successful telemedicine technology with a very less amount of uses and they are Birdem general hospital, Ad-din medical college hospital, Telehealth365 Bangladesh, Apollo hospital and Popular diagnostic and Medinova medical services.



Figure 4.1.1: Image of a digital device for video conferencing

Figure 3 shows a digital device which has similar features that can be an example for telemedicine technological tools. This type of device has excellent application performance. All kinds of smart and advance applications are possible for run. Camera quality is enough for video conferencing. A doctor is staying at any place and patient as well, they can easily communicate with other by video conferencing. Right now, in Bangladesh almost 8.9 crore people have smartphones. So, there is no chance for impossibilities of establishment in Bangladesh.



Figure 4.1.2: Doctor patient relation over video conferencing[19].

Figure 4 shows the video conferencing situation where a doctor is at home and serve a patient from a long distance. There is no need to be present the two subjects in same place. Telemedicine refers these kinds of functions.

Due to lack of proper technologies availability in rural area the government of Bangladesh have decided to establish Union Digital Centre which is called “Digital Dokan”.



Figure 4.1.3: Image of a UDC

Figure 5 shows Kollani Union Parishad which is in Pirgacha Upazila, Rangpur Districts' Union Digital Centre. This UDCs' name is farmers information center. Access to Information (a2i) is such a project where new entrepreneurs can invest.



Figure 4.1.4: A telemedicine technological based company [19]

Figure 6 shows the successful implementation in clinical health sector where doctor serve a patient through video calling but here, they use google glass. Augmedix is a company who provide telemedicine service using google glass. But it is very expensive use of technology.



Figure 4.1.5: Services of UDC

Figure 8 shows the services of UDC where we can see all kinds of digital services are available here. Among them most popular is Birth-certificate, death certificate. Also people come here to know environment status, Exam results. Mobile banking facilities and electric bill payment services are also popular among rural people. They can easily get their services through the UISC's.

CHAPTER 5

COMPARATIVE ANALYSIS

5.1 Comparative Analysis

Only few numbers of hospitals of Bangladesh have telemedicine technology. It is very costly and the equipment for accessing telemedicine technology is not affordable for hospitals in Bangladesh. We got exact number of mechanisms- Teleconferencing, Videoconferencing, Store and Forward. It also looked over the tools and trades, machines and also described about future in telemedicine. But it could not give us exact concept on the tools. Here we found there are some of companies who provide telemedicine services in Bangladesh such as E-health solutions, DGHS- Telemedicine service, DU Telemedicine, Grameenphone mobile operator- Tonic, Banglalink mobile operator- Healthlink, Robi mobile operator- Robi Shassthosheba, Airtel mobile operator- Airtel Shasthosheba. So, we brought out the telemedicine providers who are trying to meet people with technology. Our article describes the all telemedicine technologies and providers that no other reviews couldn't give you that.

Prior to this knowledge we have showed a comparative analysis here-

TABLE 3 COMPARATIVE ANALYSIS OF RESEARCH REVIEWS IN TELEMEDICINE TECHNOLOGY

WORK DONE	OBJECTS DEALT WITH (DOMAIN)	COST-EFFECTIVE	SUCCESS	POSSIBLE IN BANGLADESH
01	VHF- Radio	NO	NO	×
02	Video- DOT	NO	YES	✓
03	Standard- DOT	YES	YES	✓
04	MEMS	NO	NO	×
05	Mobile Network	YES	YES	✓
06	TAM	YES	NO	✓
07	Artificial Intelligence	NO	NO	×
08	Transfer- Technology	NO	NO	×
09	Wireless Network	NO	NO	✓

VHF radio technology is not possible to establish in Bangladesh and it is not cost-effective. Video-dot and Standard-dot technologies are also can't be possible to run. On the other hands they are not cost-effective and successful. Micro Engineer Machine Systems (MEMS) and other forms of nano-technology represent new opportunities for telemedicine [6]. But it is very costly and can't be possible to successfully run in Bangladesh. Knowledge Robots can open new opportunities in telemedicine but it is highly expensive to implement and right now it is not possible to run in Bangladesh but in future it may be possible. Using mobile calls directly is very expensive method. A research work by Md. Rakibul Hoque et al. [4] said in May 2009, mHealth which is named as Health Service through Mobile Phone was established by ministry of health in each of all upazila hospitals and district hospitals of Bangladesh. But the govt. could not run the program for long time. Wireless Sensor Network technology is not easy process to use and has security use. So, it is difficult to maintain and implement in health sector properly.

The CRP digital cameras and email telemedicine links are model for further telemedicine projects in the developing world. Telemedicine has provided us with tremendous support for our patient management system at CRP in Bangladesh [15].

The transferable Technology for the use of Teleophthalmology proposed by k Johnston and team cannot be applicable for Bangladesh. Though it is cost-effective but the success rate of using it very low in South Africa where it was used.

Technology Acceptance Model (TAM) proposed by Paul J Hu and team is cost-effective and can be possible to establish is Bangladesh but its success rate was very low. There have lots of limitations in clinical way. However, based on data collected from 408 physicians, the utility of TAM for explaining acceptance of telemedicine technology by physicians was evaluated. The results suggested the general adequacy and applicability of TAM in this professional context as indicated by fairly reasonable goodness-of-fit indexes for the model [16].

Portable tool kit designed by Uzzal Kumar Prodhan and team was cost-effective but it had lots of limitations for diagnosing a patient because it could not identify all kinds of diseases with their tool kit. So, it failed in success rate.

5.2 Future Impact in Bangladesh

Telemedicine in Bangladesh developed in mid to late 90s. Numerous doctors and specialists in Bangladesh were rehearsing casual teleconsultation with their partners in various nations. The early activities were sporadic and disorderly and the vast majority of them were situated available and forward advances, for example, messages and messages. A progressively formal methodology was taken simply after 1999.

1999 First telemedicine interface was built up by an altruistic trust named Swinfen Charitable in Bangladesh. It built up a connection between the Center for the Rehabilitation of the Paralyzed (CRP) in Dhaka (the capital city of Bangladesh) and Royal Navy Hospital, Haslar, UK. It was email based association. It utilized an advanced camera to catch still pictures which was then transmitted by means of email. It was an extremely fruitful task. An assessment of the 27 referrals made amid the primary year of activity demonstrated that tele consultancy had been helpful and practical. In view of the accomplishment of the Bangladesh venture, the Swinfen Charitable Trust provided computerized cameras and tripods to more medical clinics in other creating nations.

- July 1999: Telemedicine Reference Center Ltd. (TRCL) Dhaka, Bangladesh, a privately-owned business propelled its voyage with an eager venture to set up telemedicine undertaking to help specialists recognize maladies at beginning time. Dr Sikder M. Zakir, President and CEO of TRCL said "In the event that we get the ailments in beginning period, at that point it is conceivable to spare multiple times more cash that are being spend". Before all else TRCL connected 200 master who offered their master sentiment to country specialists. Despite the fact that it is a secretly supported task, Ministry of Health and Family Welfare of the Bangladesh Government was assuming a huge job in the execution. TRCL began possibility study and framework advancement to build up national and universal telemedicine administrations.

- Mid - 2000: Grameen communications took rural tele-health initiatives using wireless technology.

April 2001: the Bangladesh Telemedicine Association (BTA) was formed. But the lack of government participation the technology remains out of reach to majority of poor people of the country.

- 2007 September: The task 'ICT in rustic Bangladesh' is working for the improvement of human services offices in country Bangladesh through ICT. The undertaking is supported by SPIDER

(the Swedish program for ICT in creating districts) for the time of September 2007– December 2009 and is in a joint effort with Grameen correspondences, Bangladesh; Grameen telephone, Bangladesh; Bangladesh Sheikh Mujib Therapeutic College, Bangladesh; and International Institute of Information Technology (IIIT), India. The general objective of the undertaking is to improve the execution of country wellbeing laborers and increment the entrance to social insurance administrations for provincial poor in the locale of Magura in Bangladesh.

In spite of the fact that telemedicine isn't a panacea though issues identified with wellbeing couldn't care less, it can limit the issues that are connected with time in far off. Telemedicine exercises are still in essential dimension in Bangladesh. There is no help to meet the crisis restorative need, for example, heart stroke, and disjoin damage for individuals in remote territories. Many creating nations have actualized telemedicine systems which have made an association between remote medical clinics and exceptional emergency clinics. We can take India, China as. China has three noteworthy telemedicine systems. The IMNC organize is principally founded on phone line and Internet. To give information transmission over low data transfer capacity they are utilizing ground-breaking picture pressure calculation that can diminish the record measure drastically. Bangladesh government constantly belittled past telemedicine ventures. This is as per our perspectives that the administration have heaps of duty in this angle. It ought to urge private associations to put resources into telemedicine usage. In Bangladesh most extreme extensive emergency clinic and extraordinary medical clinics are in Dhaka. By setting up a telemedicine arrange among effectively settled wellbeing focuses with cutting edge restorative foundations, the social insurance experts in particular fields, for example, cardiology, urology, oncology, psychiatry, medical procedure and numerous others, can access or trade data for conclusion, treatment and avoidance of ailment. With current Bangladesh media transmission foundation continuous telemedicine is conceivable up to locale level between unique human services suppliers and region medical clinics. There is optical fiber connect in the majority of the regions.

Web office is likewise accessible in most extreme sub-town (Thana). Be that as it may, data transfer capacity isn't sufficiently wide. Store and forward premise telemedicine backing can be extended up to Thana level by utilizing phone lines. The accomplishment of Telemedicine relies upon the improvement of data and media transmission framework structure. Media transmission division in Bangladesh has a tremendous blast over the most recent couple of years.

CHAPTER 6

CONCLUSION AND FUTURE WORK

6.1 Conclusion

Telemedicine guarantees incredible potential in giving critical improvement and financially savvy access to nature of medicinal services to the under-served networks. In this paper we center around the need of executing telemedicine application in Bangladesh. We likewise present the past and progressing telemedicine undertakings and future prospects of telemedicine as for Bangladesh. A portion of the real projects started by the Government of Bangladesh were the advancement of physical framework like Thana Health Complexes (THC), region emergency clinics, medicinal school clinics all through the nation. Including telemedicine in existing wellbeing focuses can make it simpler and less expensive to give human services to the general population in remote territories. The quantity of crisis visits to the emergency clinic can be decreased. Pointless affirmations can be kept away from. In this paper we have additionally prescribed a few proposals with respect to execution of telemedicine in Bangladesh. We emphatically feel that the legislature ought to belittle private associations to put resources into telemedicine division. Telemedicine can serve not just by giving medicinal services administrations to remote individuals yet in addition create new wellspring of business.

6.2 Future Work

We are here trying to describe all existing's telemedicine technologies and their implementation in various location. Here in Bangladesh we proposed a natural architecture with the help of Artificial Intelligence. Our proposed model can be completed by us. But a competitive android developer and a programmer can establish our proposed application.

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