Dhaka University Telemedicine Program
- Rural Healthcare Using Indigenously Developed Technology

Local Solutions with Global Potential

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Background of Project

- About 70% of total population lives in rural areas in Bangladesh
- Country average: 3.6 doctors for 10,000 people
- Much much less in rural areas, virtually ‘zero’

Contrast: In the rich West very few live in villages
Background: Healthcare scenario for rural Bangladesh

- 421 Semi-urban (Upazilla) hospitals have about 16,000 beds and posts for qualified doctors, but few doctors remain there.
- Few doctors see many patients → Long queues and delays
- These hospitals are many miles away from most villages with poor road communication
- Many people do not take any treatment at all unless it turns to an emergency
- Rural people go to pharmacists, quacks for consultation – results in maltreatment, misuse of antibiotics and steroids
Background

- Most village people do not have proper medical care
- Women, children, infirm and old suffer the most as the travel to a hospital is difficult for them

Photo Courtesy: https://shahidul.files.wordpress.com/2007/08/tanvir-b-w-05212007084615.jpg
Solution: Telemedicine – medicine at a distance

- Patients in one location connected to doctors in another location through a communication medium
- Doctor provides prescription through this medium
Telemedicine – in the rich West

For specialised consultation (from a hospital) in tertiary care

Home patient care (for the aged), using mobile units

- Systems: expensive and difficult to repair
- Not suitable for primary and secondary care in a low resource country
Opportunity for Telemedicine in Bangladesh

Internet and mobile phone networks cover almost the whole of Bangladesh. Telemedicine can use both these media effectively.

Mobile phone coverage progression (1997 – 2016)
Many places have fast 3G network, good for video
If foreign equipment used for telemedicine, situation?

- Very expensive to procure
- Fails frequently under our weather and power line conditions
- Repair unrealistic, cost prohibitive (purchasing a new one is more cost effective than repairing)
- Un-sustainable

**Solution? – Homegrown Technology**
Our background at Dhaka university
Dept of Biomedical Physics & Technology [BMPT-DU, since 2008] with its background in the dept of Physics since 1978

Experience in the design & development of

- Electronic instruments for medical research, since 1978
- IT enabled (computerised) medical equipment, since 1986.
R&D for Telemedicine at Dhaka university
Dept of Biomedical Physics & Technology [BMPT-DU]

- Learnt in 2010 - internet with video links in 400 Upazilla Health Complexes by Government
- Initiated the effort towards developing a PC based telemedicine system that uses internet.
- Developed several online devices that include Stethoscope, ECG and others
- Developed software for Telemedicine
Basic Telemedicine Network
Computerised ECG, our own design
Single Channel, 12 lead: for telemedicine, or for stand-alone use

- Hand crafted aluminium cabinet
- Hand crafted Leather bag for Tablet model
- Compact size

Being manufactured by a non-shareholding Social Enterprise
Our ECG allows live data transmission through internet
• Produces combined ECG traces.
• May be sent to Cardiologist via webservice or email
TO WHOM IT MAY CONCERN

This is to certify that the ECG tracings recorded by the computer based ECG machine developed by Prof. Dr. Khondkar Siddique-e Rabbani & his team of the department of Biomedical Physics & Technology of Dhaka University are nearly identical to those recorded by conventional ECG machines in the same subjects (12 in total).

In my opinion this ECG machine is quite reliable and can be of good use in the diagnosis of cardiac problems in the field of Telemedicine.

Dr. Abdul Wadud Chowdhury
Professor and Head
Department of Cardiology
Dhaka Medical College Hospital
Dhaka, Bangladesh.
Our PC based Stethoscope

- Microphone connected to stethoscope head
- Signal amplified through a USB Soundcard
- Live transmission of sound through Skype for initial monitoring, but quality not good
- We use a free software ‘Audacity’ to record a few seconds of data. The file is sent to doctor through Skype → gives good quality, acceptable to doctors.
Multipurpose Imaging camera with flexible arm

2 Mpixel camera, Carl Zeiss Glass Lens, software zoom

Possible use:
1. Patient’s appearance
2. Dermatology
3. Film X-Ray digitiser
4. Ultrasound scan image grabbing
5. Written record digitiser (scanning)
Soon to add: Localised Lungs monitor using Electrical Impedance
Helps pneumonia detection in children which needs accurate respiration rate

Challenge: baby should not cry!!

We innovated a soft palm-worn electrode. Mother wears it and places on child’s thorax.

Result - Success! Babies did not cry!!
For basic measurement: commercially available ones used – results are manually typed in
Software for Telemedicine
Address: www.telemedbd.net

Interface in Bangla, local language
First page (Login for operator/doctor. Shows operator of month)

PC (Windows) based, MySQL database driven PHP app built on top of Laravel framework
Software for Telemedicine

Operator’s panel - Patient registration
Software for Telemedicine

Doctor’s panel - Patient information

Sample page
Video conference for consultation
Uses Skype

Internet

Patient & Operator

Doctor
Software for Telemedicine

Doctor’s panel for Prescription generation
Software for Telemedicine

Doctor’s panel

Prescription Preview
Software for Telemedicine – Monitoring

Gives options of getting details of patients, operators and doctors as well as of medical history and prescriptions from archive. Secured by password.

![Sample page](image-url)
Typical health problems that may be covered by Telemedicine (Primary and Secondary Healthcare)

- Fever
- Headache
- Abdominal pain
- Diarrhoea
- Respiratory problems
- Eye & Ear problems
- Early heart problems
- Early obstetrics & Gynaecological problems
- Pain at joints
- Skin problems
- Early Diabetes, etc. ...
Dhaka University Telemedicine Programme (DUTP)

Organised by Dept of Biomedical Physics & Technology (BMPT)

Chronological progress:

2010-12: R&D started, PC based system

2013: Field trial (through an NGO)

2015: Support from A2I (BD Govt) for field trial

2015: Permission from DG Health for DU to establish centres over Bangladesh

2015: DUTP name is approved by DU (Nov)

2016: 5 old and 4 new rural centres running

2016: Monthly patient visits: 300 to 500

Future:

2015-2016: Develop mobile phone based system (Australia based ISIF-Asia grant received)

2017: reach out to other low resource countries
Users and uses

- Service provided through telemedicine service centres in rural areas by local entrepreneurs
- Sets up computer, internet and equipment and patient room
- Pays license fee and takes training from BMPT
- Doctors recruited by BMPT, full/part time or patient/specialist report basis
Present usage:
- 8 doctors for consultations or specialist diagnostic reports
- Centres in 7 remote villages and 2 semi-urban locations
- Currently 300 to 500 patients taking service per month
- Last one month
  - Male: 43%, Female: 57%
  - Male (<=12 yrs, or >=60 yrs): 15%
  - 72% are women, children and old
- (supports an important contribution of the system)
Deliveries

• Establishment and retaining of 9 partner entrepreneurs for service centres
• Deployment of a cloud based patient management and prescription generation software, complemented by Skype for video conferencing
• Deployment of an electronic stethoscope and an ECG equipment, both online
• Retaining several doctors in the programme
• Maintaining a regular patient inflow
• Some patients visited multiple times indicating satisfaction.
• The partner entrepreneurs and doctors expressed satisfaction in general.
• Deficiencies are taken care of immediately through R&D or management adaptations
Business model

For a Rural Service Centre:
Investment: Tk. 80,000 to 120,000
Running cost: Tk. 18,000 per month
Patient fee: Tk. 120 to Tk. 150 per consultation, extra for tests
Break even: 10 patients per day
Pay-back of investment: About 2 years

For the main centre:
Investment: Minimal (office equipment/computers. Most doctors use own computer)
Running Cost: Office, management team, doctors (depends on no of service centres)
Break even: 30 patients per day per doctor
TCV (Time-Cost-Visit) analysis

• Carried out by the a2i team
• On 135 patients served by first 5 rural centres in Faridpur and Madaripur
• Compared to the usual health service system (nearest doctor, Upazilla Health Complex, District hospitals, etc.) average time reduced by 56% and average cost reduced by 94% in Telemedicine
• The cost was low as patient fee was low initially (Tk.30 to 50), will increase somewhat but would still be low in comparison.
• Less visits needed (as early medication prevents subsequent complications)
Limitations

i) Internet speed, slow sometimes, even for 3G (solution: switch to mobile phone for audio, Skype for video only)

ii) Electrical power interruption (Laptop battery or IPS takes care)

iii) Funds. Being a new concept, free or low fee service given initially. A2I grant provided support. Would be seeking for scale-up and donations from other sources.
POOR FUND

• Many poor patients need support for medicines and investigations
• We established a poor fund and are seeking donations, zakat and charity money
• A poor patient has to apply (form shown), entrepreneur has to certify for the support. Idea is to evoke trust, self prestige and dignity, to avoid abuse.
We started to inculcate a spirit of service to mankind rather than business. Our model is based on trust, self prestige and dedication, which has given positive results.

1. Entrepreneurs motivated by the above concepts, expressed satisfaction on being part of a noble cause.
2. Most of them are pharmacists and are happy to provide improved service to their own people
3. They help poor patients normally, requested for a central support.
4. The pharmacists also can sell some more medicines
5. They feel patient number will increase within a few years when it will bring profit too.
6. Some opposition came from village practitioners but could be managed
7. Overall the entrepreneurs are satisfied with the quality of the doctors and the way they talk to patients.
8. Doctors are also satisfied with the system and for being able to help rural people.
**Scalability**

- The software developed can handle thousands of rural centres
- Model is easily scalable
- We plan for blocks of 30 rural centres under one management unit for efficient handling.
Promotional activities
Picture gallery
Training of operators - gallery
1st Telemedicine Conference of DUTP, 8 April, 2016
Picture Gallery
Financial Support:

- Farm Fresh (initial phase, 2011)
- International Science Programme (ISP) of Uppsala University, Sweden (part of R&D activities contributed towards telemedicine) (2011-2016)
- Beximco Pharma (2014-16)
- A2I (PMO-GOB, UNDP, USAID) (2015) (for field trial)
- ISIF-Asia (Australia based) (2015-16) (for developing a mobile phone based telemedicine system with integrated diagnostic devices)
- Zakat contributions from individuals (for poor fund, 2016)
Telemedicine Team of DUTP at their 1st Conference, 8 April 2016

Thank You