

PAN ASIA ICT R&D Grants Programme

Interim Report

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DEVELOPMENT OF ICT-BASED TELEMEDICINE SYSTEM FOR PRIMARY COMMUNITY HEALTH-CARE IN INDONESIA

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SYNTHESIS

This Interim Report describes current progress on the "Development of ICT-Based Telemedicine System for Primary Community Health Care in Indonesia" project being carried out from November 2002 to December 2003. In the first few months of the project implementation, we had significantly unforeseen difficult problems particularly in convincing the medical personnel and to start the collaboration with various target institutions, namely Bandung Health Office, Referral Hospitals, and the existing 70 Community Health Centres in Bandung area.

After solving the problems, we managed to achieve the targeted objectives, although unavoidable delays occurred on certain aspects. The ICT-based Telemedicine System for Primary Community Health-Care that has been designed, covers: a health office, a referral maternity hospital, and a number of selected Community Health Centres in Bandung. The associated software modules are to provide the following main telemedicine applications: medicine data recording & reporting, patients' data recording & reporting, tele-coordination, community health education, and limited tele-consultation.

Significant improvements in day-to-day health care services have shown in some *Puskesmas* (Community Health Centre), especially thanks to the "Medicine Data Recording & Reporting Software Package" provided by the project. We prepare to offer installation and training of the software package to more Community Health Centres.

We found that human resource training, familiarization and socialization of the "computer & telemedicine" needed relatively much more time than our expectation.

-The project has shown its significant roles in the human resource development for the community health care. Further supports in HRD aspects have been planned for the next stage.

-The project has also provided considerable supports to the academic activities through giving the opportunity to the students to face the real challenges in improving the community health care in Indonesia.

The results of the project activities have shown (in part), and are expected to demonstrate further benefits of the ICT-based telemedicine system to the Indonesian Community Health Care. Further supports from the Government, related health institutions and other organizations are therefore expected.

As the project has shown its encouraging results, we propose that the AMIC, IDRC, APDIP and APNIC could provide their political supports to promote and enhance the application of Internet & Communication Technology for the benefit of Community Health Care and Education in Indonesia. The financial supports for further implementations of the ICT-based Telemedicine System for Community Health Care in this country is also very much appreciated.

RESEARCH PROBLEM

In this project, the fundamental problem of the Primary Community Health Care in Indonesia is how to overcome the relatively high Maternal Mortality Rate (MMR). It is expected that the ultimate goal of the activities will be in continuously decreasing the MMR. A number of different solutions have been proposed by various groups in the country, and our Research Group on Biomedical Engineering has been focusing on the development of ICT-based Telemedicine System.

In Indonesia, there are more than 7600 (seven thousand and six hundred) Community Health Centres (CHCs, *Puskesmas*) to serve more than half the total population of about 220 million. Due to the shortage of human-resources in health care, the primary health care system operates on "referral system" which relies on communication and transportation infrastructure. In the city of Bandung, about 5000 patients per day are being served by 70 (seventy) Community Health Centres.

RESEARCH FINDINGS

A number of research findings obtained in the said period of the project are as follows:

- An ICT-based Telemedicine System for Primary Community Health-Care has been designed. The system prototype covers: a health office, a referral maternity hospital, and a number of selected Community Health Centres in Bandung.
- Associated software modules have been designed and realized to provide the following main telemedicine applications: medicine data recording & reporting, patients' data recording & reporting, tele-coordination, community health education, and limited tele-consultation.
- The existing Internet and Telecommunication infrastructure (in Bandung area) has sufficient flexibility to implement the prototype of our "ICT-based Telemedicine System for Primary Community Health-Care".

FULFILLMENT OF OBJECTIVES

As mentioned in the proposal, the project objectives are as follows:

- (1).Develop a Recommendation to Reform the ICT Policy in Indonesia, specifically on the Socio-equities and Communities-sustainability on the use of internet networking for Social & Community application, with emphasis on health related activities.
- (2).Develop, implement, install & conduct a trial run of 6 *Puskesmas* medical stations (*Puskesmas* = Community Health Centre = CHC)
- (3).Establish a Pilot network of "Primary Community Health Centre Internet-based Telemedicine System" consisting of: 6 *Puskesmas* stations, 1 health office, and 1 referral hospital, in selected under-served urban & rural areas of Bandung/its suburbs.

- (4).Implementing a Pilot Internet-based Digital Healthcare Infrastructure (by linking Community Health Centres, Health Office, & Referral Hospital).
- (5).Enhancing day-to-day Primary Community health-care delivery
- (6).Assist in decreasing the MMR (Maternal Mortality Rate) in Indonesia.

In the period of November 2002 to December 2003, the following project objectives (or additional objectives) have been achieved:

(1).In general, our recommendation strongly suggest that the Indonesian Government, ICT related organizations/institutions/companies, and the whole community to actively promote and to provide full supports on the use of ICT for Educational & Health Care applications.

(2).PC-based Medical Stations with their associated Software Module(s) have been installed in the following Community Health Centres (*Puskesmas*):

- Puter Community Health Centre
- Talagabodas Community Health Centre
- M. Ramdhan Community Health Centre

Some other Community Health Centres (*Puskesmas*) are in the process of software installation and on-site users' training.

*PC-based Medical Stations with their associated Software Module(s) have also been installed in Bandung Health Office (*Dinas Kesehatan Kodya Bandung*) and Astana-anyar Maternity Hospital.

(3).A Pilot Network of "Primary Community Health Centre Internet-based Telemedicine System" using Wireless LAN technology has been completed. The pilot network covers: Bandung Health Office (*DKK Bandung*), Puter Community Health Centre (*Puskesmas Puter*), Astana-anyar Maternity Hospital (*Rumahsakit Bersalin Astana-anyar*), and Biomedical Engineering Laboratory (BME ITB). Internet connection is provided through the BME ITB node.

*Additionally, Bandung Health Office and Talagabodas CHC have also internet connections through "dial-up" (using Public Switched Telephone Network = PSTN telephone).

(4).A Pilot Internet-based Digital Healthcare Infrastructure has been partially implemented, covering: Bandung Health Office, Puter Community Health Centre, Astana-anyar Maternity Hospital, Talagabodas Community Health Centre, and Biomedical Engineering Laboratory (BME ITB).

Additional "nodes" are in the process of software installation and on-site users' training.

(5).Day-to-day Primary Community health-care activities (especially medicine & patient data recording and reporting) have shown significant improvements through the use of telemedicine technology. Technical supports are provided by the team members periodically to a number of "nodes" (Community Health Centres, Health Office, and Hospital). These aspects (continuous HRD & technical supports) are very important for a sustainable operation of the Community Health Care Telemedicine System.

(6). Since the use of telemedicine technology involves only a very small number of CHCs (8 units out of the existing 70 CHCs), health office, and hospital, and the experiments have been conducted only for relatively short period, there is NO significant Maternal Mortality Rate decrease YET. But, with more and more CHCs, health offices, and referral hospitals involved in the Telemedicine System, community health care services will be gradually improved. Therefore, we certainly expect that Maternal Mortality Rate will decrease more significantly.

PROJECT DESIGN AND IMPLEMENTATION

In the period of November 2002 to December 2003, the following Project Design and Implementation activities can be reported:

- We have produced a system design of the “ICT-Based Telemedicine System for Primary Community Health Care”, as shown in Fig. 1. The original system design consisted of 6 (six) Community Health Centres, Bandung Health Office, and Astana-anyar Maternity Hospital. We also utilize the following existing telecommunication & internet infrastructures: Wired PSTN (Public Switched Telephone Network), Wireless/microwave LAN (Local Area Network), Mobile Wireless Network (GSM & CDMA operators), and Fixed Wireless Network (CDMA). The wireless alternatives have specially been designed for areas where PSTN connections are not available, or for specific purpose (i.e. mobile CHCs).
- The project has completed the following software design and implementation activities:
 - Medicine Data recording & reporting software module, and its users’ manual.
 - Patient Data recording & reporting software module
 - Web-based community health education has been designed and implemented in a number of CHCs
- Further re-design and implementation activities are still in progress:
 - Changes on the reporting formats of the Medicine Software Module and the Patient Software Module requested by the Community Health Centres, have forced us to do further software re-design and modification activities.
 - We have also decided to implement Web-based programming for the software modules, so that they will be almost platform independent.
- The project has also completed the Design & Implementation of Fixed Wireless (Microwave LAN) Network for Telemedicine System covering 4 nodes: Puter CHC (located 1.4 km from BME-ITB), Bandung Health Office (located 2 km from BME-ITB), Astana-Anyar Maternity Hospital (RSB-AA, located 4.7 km from BME-ITB), and Biomedical Engineering Laboratory ITB (BME-ITB). The implementation activities were divided into some parts: Equipment procurement phase-1, laboratory testing, sites survey, equipment procurement phase-2, and Installation & Field testing.

- During the project implementation phase, we faced a number of significant problems, among others:
 - Users (or potential users) were in general very difficult to be convinced about “the new” (telemedicine) system and its benefits. The team members had to provide more than allocated time and efforts for this purpose. Formal and non-formal meetings, presentations and discussions had been conducted.
 - Users’ requirements significantly changed from time to time, thus software re-design had to be done frequently.
 - Human resource training, familiarization & socialization of the “computer & telemedicine” needed relatively much more time than our expectation
 - Project management problems arising from the above mentioned points.
 - Two additional CHCs with NO PSTN access were requested to be included in the project. The technical problems were challenging, but needed more time & efforts.

- On the Gender issues related to the project activities, we note the following points:
 - 62.5% of the 8 participating Community Health Centres (CHCs) are headed by female Medical Doctors.
 - 35% female participants (out of the total 20 participants) attended the Tele-medicine training workshop conducted on the 11 – 15 August 2003.
 - in the project, we have 60% female staff members and students participating actively.

PROJECT OUTPUTS AND DISSEMINATION

Project Outputs :

-System Design of the “ICT-Based Telemedicine System for Primary Community Health Care”. The system prototype consists of 6 (six) Community Health Centres (CHCs, *puskesmas*), Bandung Health Office (*DKK = Dinas Kesehatan Kotamadya Bandung*), and Astana-anyar Maternity Hospital (*Rumahsakit Bersalin Astana-anyar = RSBA*). Figure-1 shows the simplified block diagram of the ICT-Based Telemedicine System for Primary Community Health Care. The 6 CHCs (number 1 to number 6) were selected among the existing 70 (seventy) CHCs in Bandung area.

The Bandung Health Office later requested two additional CHCs (number 7 and 8) to be included in the telemedicine project; since wireless mobile system were used, the design can also be implemented for mobile CHCs.

-Software packages (modules):

-Medicine Data Recording & Reporting Software Package (Module), and Users’ Manual of the software module.

-Patient Data Recording & Reporting Software Package (Module).

-Patient Data Acquisition & Processing Package, installed and tested in Bandung Health Office (*DKK Bandung*)

-Published websites

-A number of prototype Websites have been prepared and published for evaluation purposes. The published prototype websites are as follows:

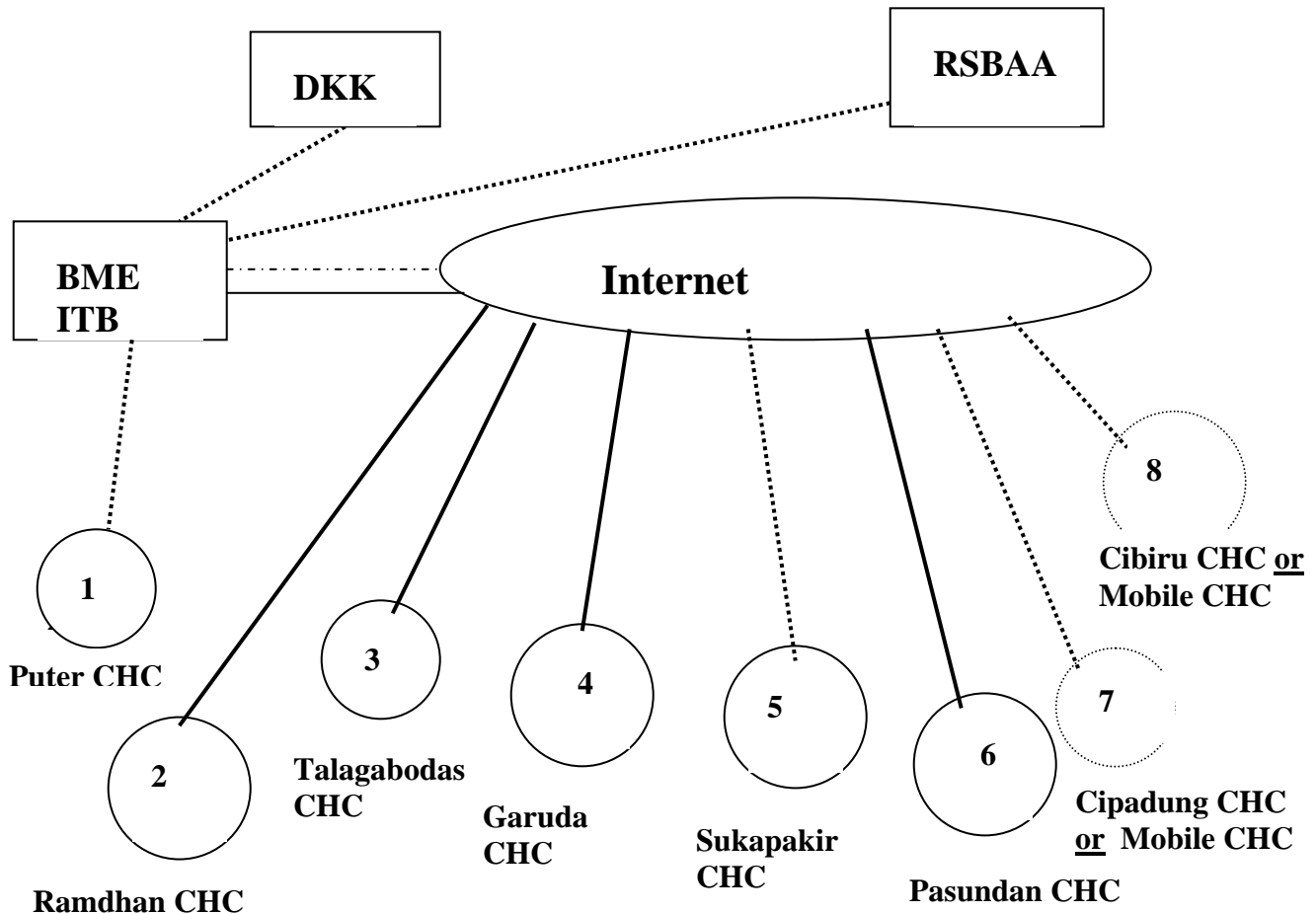


Figure 1. Simplified Block Diagram of the ICT-Based Telemedicine System for Primary Community Health Care

- Puter CHC (*Puskesmas Puter*): since January 2003
- Talagabodas CHC (*Puskesmas Talagabodas*): since March 2003
- Bandung Health Office (*Dinas Kesehatan Kodya Bandung*): since April 2003
- Ramdhan CHC (*Puskesmas M. Ramdhan*): since September 2003
- Astana-anyar Maternity Hospital (*Rumahsakit Bersalin Astana-anyar*): since September 2003.

Based on various feedbacks and comments received, we have been designing and implementing new websites for the Community Health Office, Community Health Centres, and Hospitals. The new ("blank") websites are expected to be completed and

made available in February 2004. Additional new materials and information up-dates are expected to be added/keyed-in by the assigned personnel from the respective Community Health Office, Community Health Centres, and Hospitals.

-Training Workshop for Users/Operators

-“Workshop on Introduction to Computer and Telemedicine”: the first workshop of the series was conducted in ITB (Bandung) on 11 – 15 August 2003, and attended by 20 paramedics and administrative personnel. They were selected from the existing 70 Community Health Centres (*Puskemas*) and Community Health Office in Bandung. The hands – on activities in the workshop were enthusiastically followed by all the attendee.

-We have obtained sufficient inputs for improving our future two consecutive training workshops, which were planned to be conducted in February 2004.

Project Disseminations:

To promote the activities and results of our project on “ICT-Based Telemedicine for Primary Community Health Care”, the following activities have been conducted:

- A formal meeting with the key personnel in the Bandung Health Office was conducted, followed by a number of follow-up discussions, formal & non-formal meetings and presentations, and organizing of “Introduction to Telemedicine Seminars” for medical doctors (responsible person of the Community Health Centres in Bandung area).
- A number of Technical Meetings were also conducted with key personnel in different community health care institutions/units, namely: Bandung Health Office, Astananyar Maternity Hospitals, Puter CHC, Talagabodas CHC, Ramdhan CHC, and some other CHCs.
- Invited Interview in TV-7 (Local TV Station, based in Jakarta): Topics on Telemedicine System for Community Health Centre, Jakarta, 2 August 2003.
- Invited Presentation in Telemedicine Seminar, Jakarta 9 August 2003, organized by Faculty of Medicine, University of Indonesia. Our presentation (in Bahasa Indonesia), on “Introduction to Telemedicine & Its Application in Community Health Care” was one of the invited paper presentation. Simulations (demo) & discussions on the “Tele-consultation system” have also been conducted.
- Paper presentation on Telemedicine System for Community Health Care, in World Congress on Medical Physics & Biomedical Engineering, Sydney, 24 – 29 August 2003. A paper entitled “Development of An Internet-Based Tele-consultation Facilities for Community Telemedicine System in Indonesia” was presented. At the conference, we had both formal & non-formal fruitful discussions on Telemedicine activities and exchange of experience with international participants involved in this field.
- Invited Presentation in Telemedicine Seminar, Bandung 8 October 2003, organized by Faculty of Medicine, University of Padjadjaran Bandung. We presented an invited paper in Bahasa Indonesia, on Telemedicine System for Community Health Care. A short demo on Telemedicine & Tele-consultation System was also conducted, followed by interactive discussions.

CAPACITY BUILDING

- Operator Training on “Introduction to Computer and Telemedicine” for paramedics & operators in both Bandung Community Health Office and Community Health Centers has been organized in BME – ITB (Bandung), on the 11 – 15 August 2003. Twenty personnel from more than 13 Community Health Centers in Bandung had successfully completed the training. Improved similar trainings have been planned in the near future, since human resource development is an important aspect for the success of the project.
- A number of new graduates (masters and engineers on Biomedical Engineering) with special interests in Telemedicine system for Community Health Care had been graduated. In the period of April 2003 to October 2003, the graduates were: Diana L., Ivan Mulyana, Zainur Budi Akbari, Rendo A. Wibawa, Wahyu T. Adiyasa, Hamdani S., Agus Komarudin, Ansor Usman. They have had beneficial opportunity in working and supporting the project implementations.
- Internal Training for Telemedicine Developers have been (and will be continuously) conducted during the course of the project.
- The project has received interests and various positive response from Bandung Community Health Office, some Referral Hospitals and a number of Community Health Centres.
- The Department of Electrical Engineering ITB donated 4 (four) sets of PC to be used in the laboratory for the telemedicine development purposes.

PROJECT MANAGEMENT

At the embarking stage, the project had to solve a number of technical & management related problems that influenced the overall schedule of the project. Through continuous coordination and efforts, the problems had been gradually solved. Most of the targeted objectives had been achieved, although some unavoidable delays were occurred. Therefore, the Overall Project Management as well as the Project Timeline had to be modified. Since some targets were completed behind schedule, in the last few months the activities have been accelerated.

IMPACT

The following impacts of the project have been observed:

- After a number of presentations and discussions conducted with medical professionals (mostly medical doctors), as well as encouraging experimental results, the awareness

on the use of PCs in the target Community Health Centers, Health Office, and Referral Hospital have increased significantly.

- Increase Awareness on the application and benefit of PC for the improvement of community health care services and management was noted. We found that more and more Community Health Centres have their own PCs.
- Increase interests on the applications of PC-based Telemedicine System for Community Health Care. More and more *Puskesmas* (Community Health Centers) have shown their interest in joining the Telemedicine program. Due to the limited resources and time, we have to do selection and prioritizing on the scope/coverage of the project. It is expected to continue and support further development of the ICT-based Telemedicine System for Community Health Care in Indonesia.
- To obtain even greater and significant impacts, various dissemination activities should be conducted continuously in the near future and to cover larger group of target audience.

OVERALL ASSESSMENT

In general, with regard to the overall assessment, the following points are noted:

- The overall system design of the “ICT-Based Telemedicine System for Primary Community Health Care” has been completed. The system prototype consists of: Bandung Health Office, Astana-Anyar Maternity Hospital, and 8 Community Health Centres in Bandung area.
- The Software packages for Medicine & Patient Data Recording and Reporting have been completed, and installed in some Community Health Centres.
- The Design & Implementation of the Fixed Wireless (Microwave LAN) Network for Telemedicine System has been completed. The four nodes covered by the wireless system are: Bandung Health Office, Astana-Anyar Maternity Hospital, Puter CHC, and BME – ITB.
- Training workshop and on-site installation & training activities have been completed and/or in progress. Continuous telemedicine system testing and applications are conducted.
- Although some unavoidable delays were noted, accelerated improvement activities are in progress. Completion of the originally targeted objectives on the expected time is expected.

RECOMMENDATIONS

At this stage, the team members proposed the following recommendations:

- After a number of presentations and on-site Telemedicine System experiments, more and more *Puskesmas* (Community Health Centres) have shown their interests in joining the Telemedicine program. But due to the limited resources and time, we can only cover relatively small percentage (e.g. $8/70 = 11,43\%$) of the CHCs in Bandung area, or only about 0,105% of the number of CHCs in Indonesia. Therefore, it is expected that PAN ASIA ICT R & D Grants Programme could continue to support further implementations of the ICT-based Telemedicine System for Community Health Care in Indonesia.
- The AMIC, IDRC, APDIP and APNIC are also requested to provide political supports to promote and enhance the application of Internet & Communication Technology for the benefit of Community Health Care and Education in Indonesia.

FINANCIAL REPORT

The following three Annexes describe the financial matters concerning the project and its activities:

- Annex A – Financial Report Form 1 (Cash Summary)
- Annex A – Financial Report Form 2 (Statement of Expenses)
- Annex A – Financial Report Form 3 (Statement of Estimated Expenses)

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