PENGEMBANGAN SISTEM TELEMEDIKA BERGERAK & APLIKASINYA

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disampaikan pada 4th Biomedical Engineering Forum
Teknik Elektro - Universitas Ahmad Dahlan
Yogyakarta
10 April 2010

Masalah Pelayanan Kesehatan

- Disparitas status kesehatan antar wilayah
- Rendahnya kualitas pemerataan dan keterjangkauan akses pelayanan kesehatan
- Keterbatasan tenaga kesehatan dan distribusi yang tidak merata (Supari, 2006) (Purwadianto, 2008).

Telemedicine

- "The use of advanced telecommunication and information technologies to exchange health information and provide health care services across geographic, time, social and cultural barriers"
- It includes both, the clinical (diagnosis, treatment and medical records) and academic medicine (research, education and training)

Mobile Telemedicine System

Drivers

- rapid advances in wireless, and network technologies
- advances in communication and medical technologies
- The pervasiveness, cost effectiveness and availability of mobile phones (GSM and 3G networks)
- Availability and cost effectiveness of satellite communications

E-Health (WHO, 2005)

- Penggunaan teknologi informasi dan komunikasi dengan biaya efektif dan aman dalam mendukung bidang kesehatan dan bidang-bidang lain yang berhubungan dengan kesehatan, termasuk layanan perawatan kesehatan, pengawasan kesehatan, bahan-bahan kesehatan, dan pendidikan

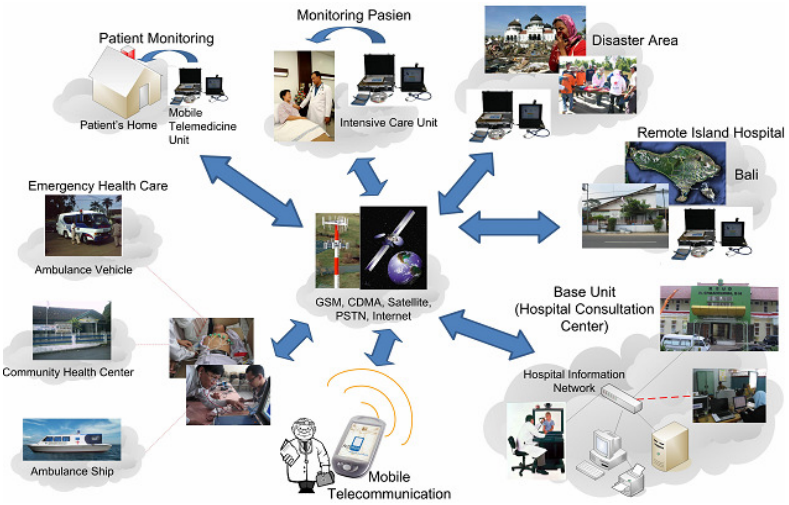
Kelebihan Telemedicine

- Increase the accessibility of and to professional caregivers
- Increase the quality and continuity of care to patients
- Increase the focus on preventive medicine through early intervention
- Reduce the overall cost of healthcare
- For education and training
- For providing services to remote areas in case of natural calamities, disasters and military and space operations.
- Remote monitoring

Telemedicine Categories

- Telehome Home Health Care
- Telepsychiatry
- Teleradiology
- General Telemedicine
- Telecardiology
- Telemedicine Consulting
- Teledermatology
- Emergency Telemedicine
- Telepathology
- Teledentistry
- Telesurgery

Konsep Sistem Telemedika Bergerak



Telemedika Pada Peta e-Health

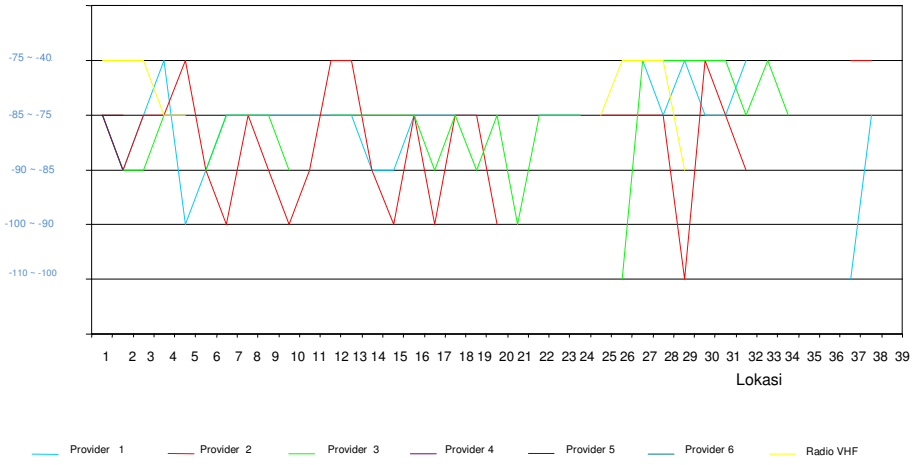
e-Medication vaccination database nursing emergency data
netc@rd Fitness biometry healthcare passport
HSP integration into healthcare infrastructure secure digital archive
directory of health service providers check-up telemedicine
mother-child programs Master Patients Index
blood donation database **e-Health** Health Professional Card
nationwide scheduling employer registration
allergy database DMP - Disease Management Programs
EHR - electronic Health Record organ donation database
e-government patient record healthcare portal e-referring

Aplikasi Sistem Telemedika Bergerak

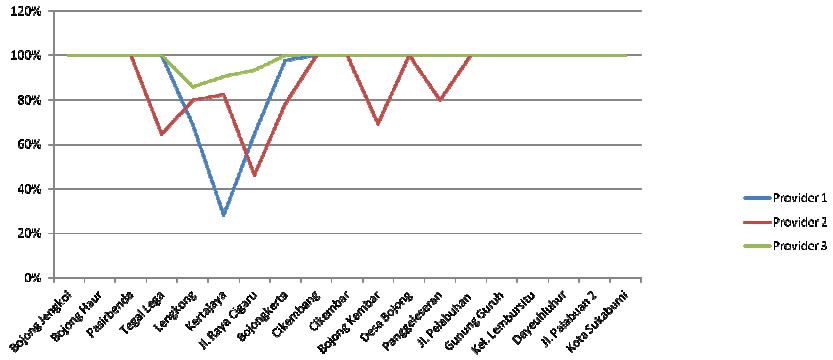
Masalah Pengembangan STB

Kota dan Kabupaten Sukabumi

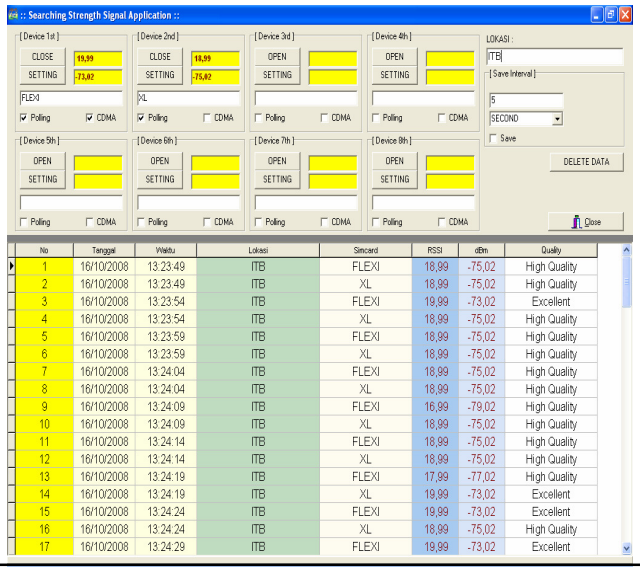
Pengukuran kuat sinyal di daerah Sukabumi (2005/2006



Ketersediaan *link* komunikasi 3 *provider* (Oktober, 2008)



Tampilan Pengukuran Kuat Sinyal

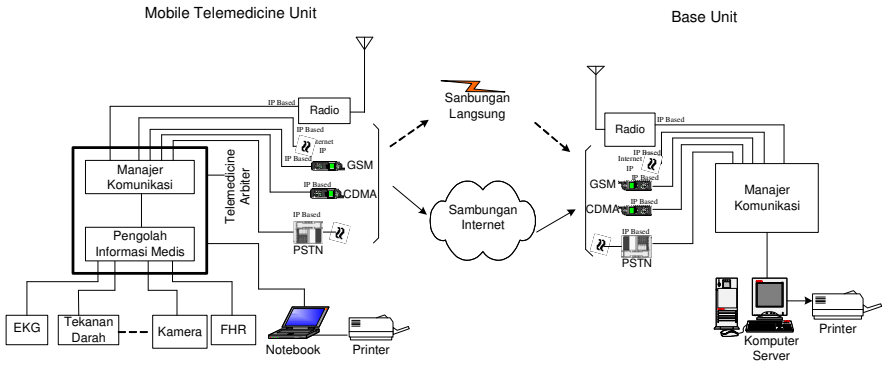


No	Tanggal	Waktu	Lokasi	Simcard	RSSI	dBm	Quality
1	16/10/2008	13:23:49	ITB	FLEXI	18,99	-75,02	High Quality
2	16/10/2008	13:23:49	ITB	XL	18,99	-75,02	High Quality
3	16/10/2008	13:23:54	ITB	FLEXI	19,99	-73,02	Excellent
4	16/10/2008	13:23:54	ITB	XL	18,99	-75,02	High Quality
5	16/10/2008	13:23:59	ITB	FLEXI	18,99	-75,02	High Quality
6	16/10/2008	13:23:59	ITB	XL	18,99	-75,02	High Quality
7	16/10/2008	13:24:04	ITB	FLEXI	18,99	-75,02	High Quality
8	16/10/2008	13:24:04	ITB	XL	18,99	-75,02	High Quality
9	16/10/2008	13:24:09	ITB	FLEXI	16,99	-79,02	High Quality
10	16/10/2008	13:24:09	ITB	XL	18,99	-75,02	High Quality
11	16/10/2008	13:24:14	ITB	FLEXI	18,99	-75,02	High Quality
12	16/10/2008	13:24:14	ITB	XL	18,99	-75,02	High Quality
13	16/10/2008	13:24:19	ITB	FLEXI	17,99	-77,02	High Quality
14	16/10/2008	13:24:19	ITB	XL	19,99	-73,02	Excellent
15	16/10/2008	13:24:24	ITB	FLEXI	19,99	-73,02	Excellent
16	16/10/2008	13:24:24	ITB	XL	18,99	-75,02	High Quality
17	16/10/2008	13:24:29	ITB	FLEXI	19,99	-73,02	Excellent

Kriteria Evaluasi Teknologi

- Bandwidth : Transmission rate in kbps
- Latency Real time and Delayed
- Availability : the percentage of the time the network or particular link is operational
- Security : availability, confidentiality, and integrity
- Ubiquity : influenced by network's geographic scope and by rules regulating participation

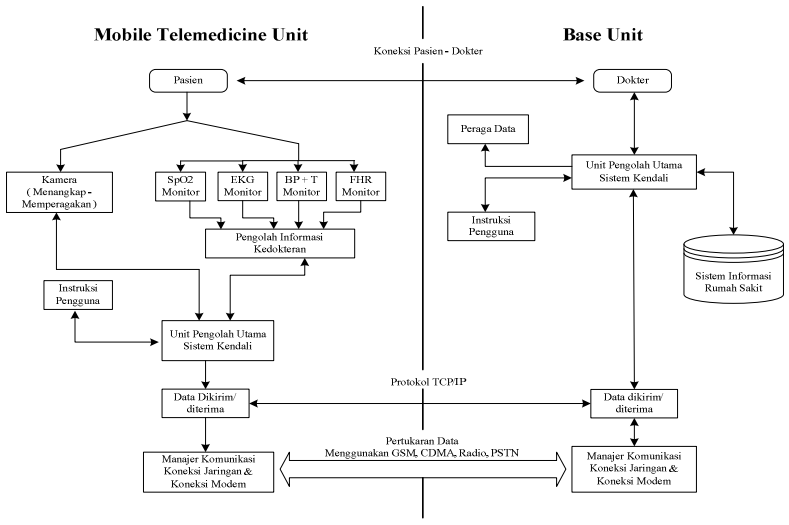
Arsitektur STB dengan *Multi Communication Links*



Tahapan Pengembangan STB

- Fungsi STB
- Spesifikasi
- Pengembangan skenario aplikasi
- *System requirements*
- Pengolah informasi kedokteran
- Manajer komunikasi
- *Mobile telemedicine unit / Portable telemedicine unit*
- *Base unit*
- Integrasi STB

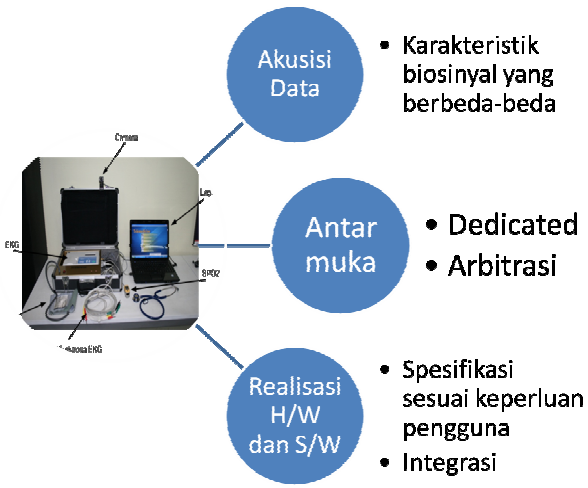
Aliran Informasi STB



Perancangan dan Realisasi

- Interface card for each connected medical devices
- Integration the interface cards to medical information concentrator
- S/W for data acquisition
- User interface software
- S/W for base unit include PIR
- Software for data communication
- S/W application
- Realization portable telemedicine unit

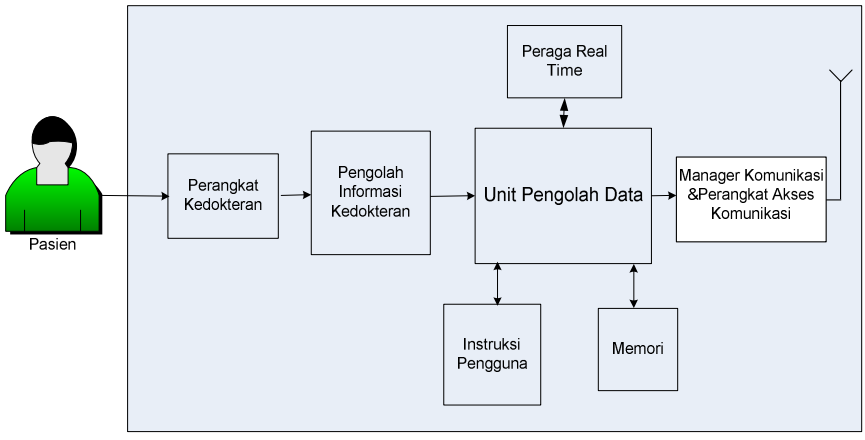
Instrumentasi



Mobile Telemedicine Unit

- Responsible for collecting medical information, and display critical signals, e.g. ECG, BP, FHR
- Must be able to write and to record data
- Support data transaction via variety of communication links, and automatically transmit patient's biosignal to Base Unit
- Comprises of medical devices, digital camera, telemedicine arbiter, and a processing unit that can be PC or laptop.

Diagram Blok
Mobile Telemedicine Unit



Parameter Perancangan

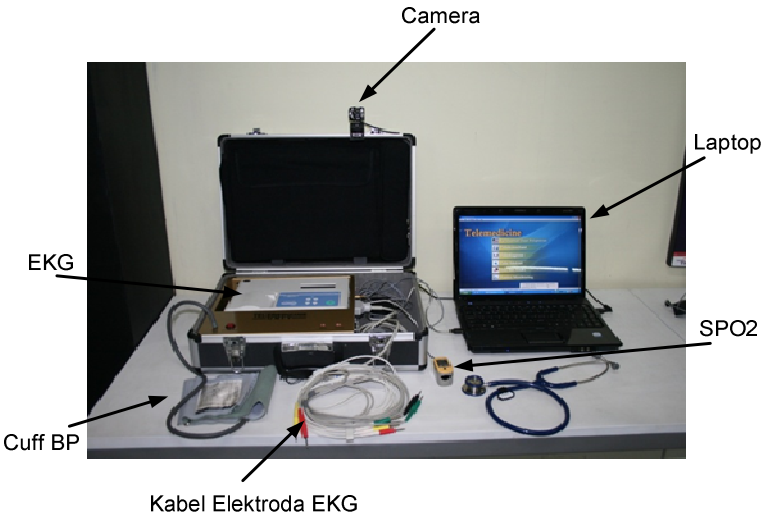
- Kompleksitas
- Unjuk kerja sistem
- Pemenuhan fungsional
- Keandalan sistem
- Portabilitas dan tahan benturan mekanik
- Ekonomis

Realisasi Mobile Telemedicine Unit

- Mudah dibawa dan cukup ringan,
- Mempunyai sumber daya tersendiri yang dapat beroperasi lebih dari 60 menit untuk membawa pasien pada keadaan darurat,
- Dilengkapi dengan *user friendly interface*,
- Dapat mengumpulkan dan menampilkan biosinyal pasien yang diperlukan, seperti sinyal EKG, BP, SpO2, temperatur, dan FHR baik langsung maupun tidak langsung,
- Dapat merekam informasi dan data pasien,
- Serta mendukung berbagai teknologi komunikasi.

Mobile Telemedicine Unit dan EKG

Portable Telemedicine Unit



Base Unit / Doctor Unit

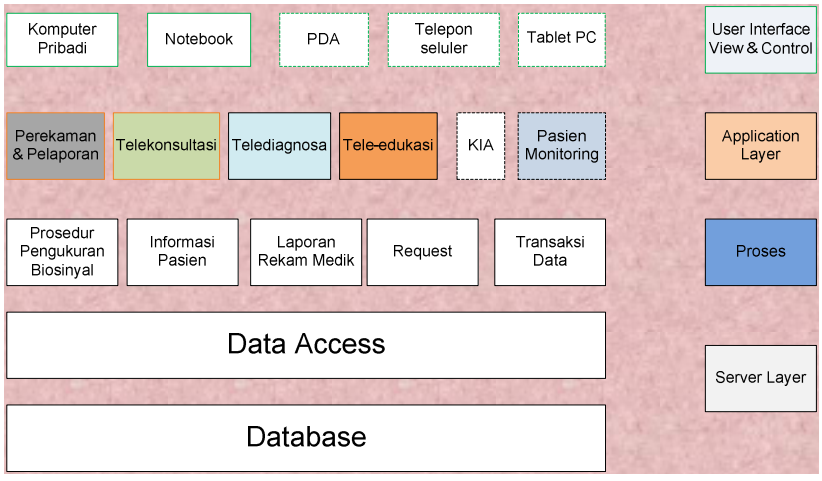
- Located at a hospital or Community Health Centre (CHC). In this case, it is placed at RSUD R. Syamsudin S.H.
- Equipped with a PC to display incoming signals from the telemedicine unit, and communication manager as a transceiver
- Implement continuous scanning to monitor incoming information and response to them as soon as possible
- Integrated with PIR (Patient Information Record)

Komputer *Server* di *Base Unit*

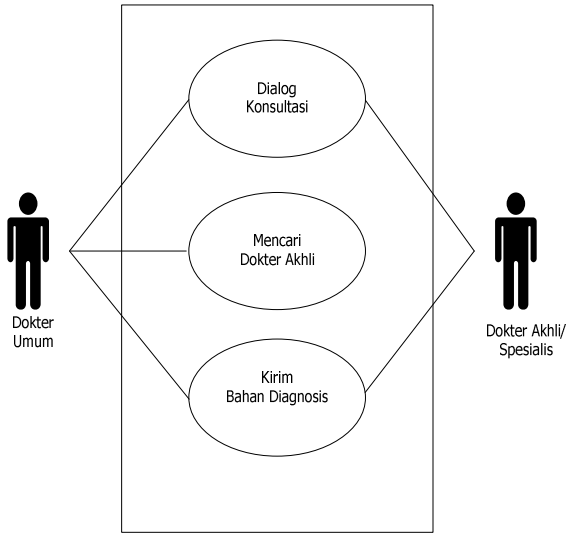
Perangkat Lunak STB

- Model client-server, the Telemedicine unit is the client, and the Base unit is the server
- Acquire of patient related information
- Store and display data of the patient
- Maintain and control connection between the Telemedicine unit and the Base unit over several communication means
- Schedule doctor appointments
- Capture image/other data from the output of medical equipments
- Support PIR (Patients Information Record)

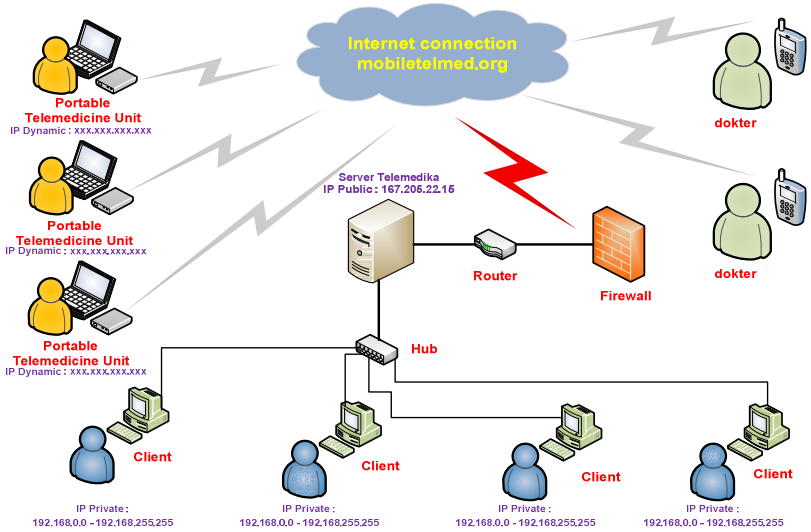
Arsitektur Perangkat Lunak STB



Use Case Diagram Telekonsultasi



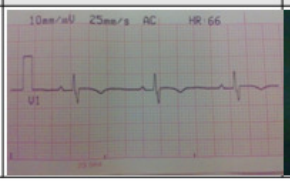
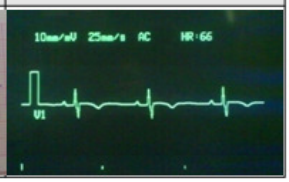
Jaringan Sistem Telemedika Bergerak



Uji Coba

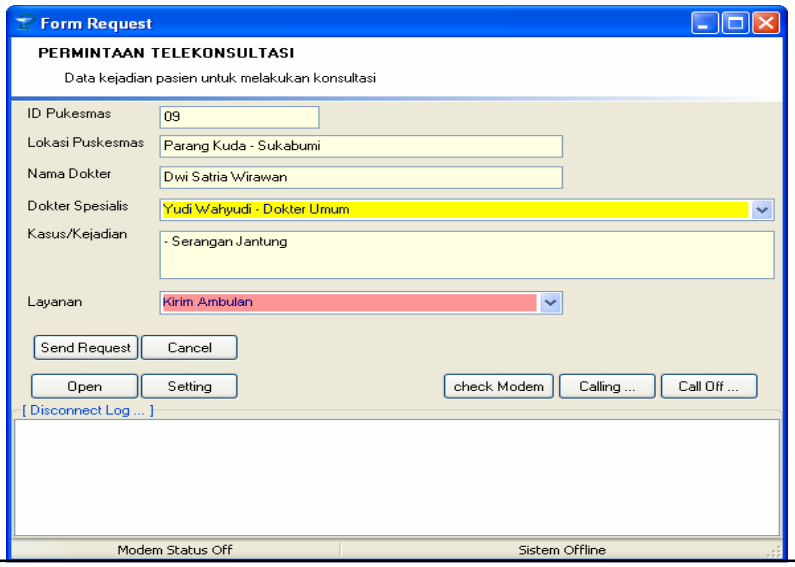
- Uji coba fungsional
- Uji coba transmisi data
- Uji coba skenario aplikasi

Contoh Hasil Uji Coba [1/3]

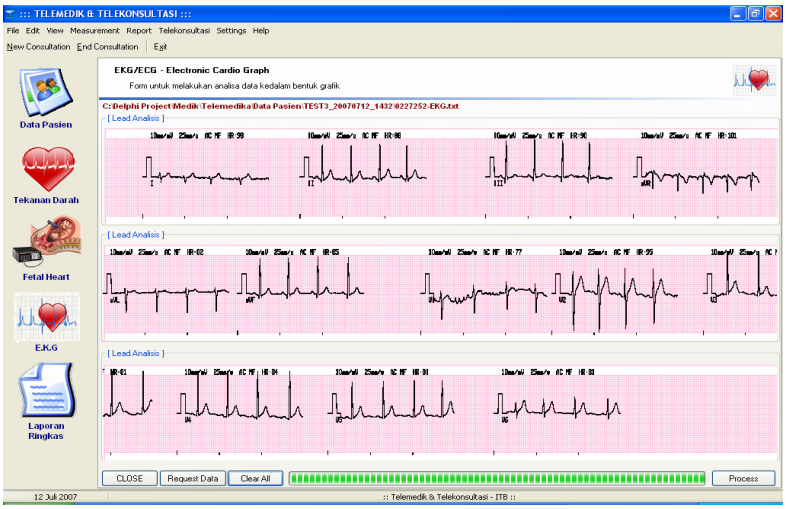
Nama Lead	Tampilan Hasil Pengukuran Sinyal EKG	
	Pada kertas grafik	Pada layar komputer
V1		

Pengujian Telekonsultasi di Puskesmas

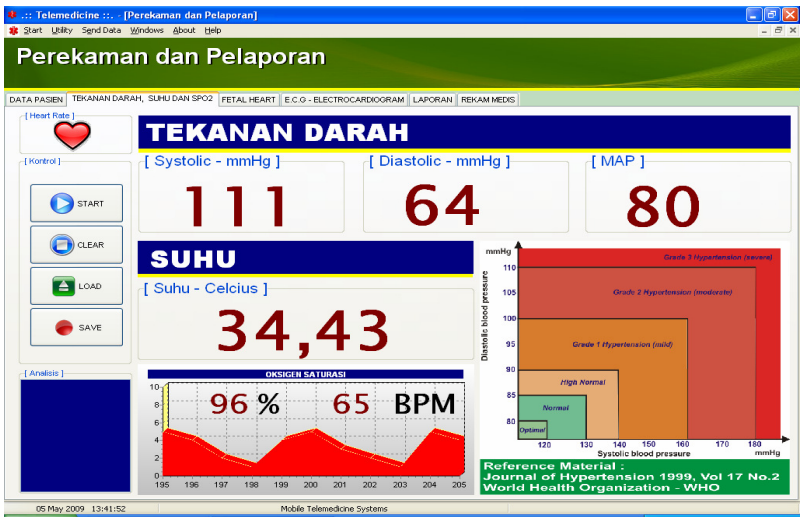
Permohonan Telekonsultasi



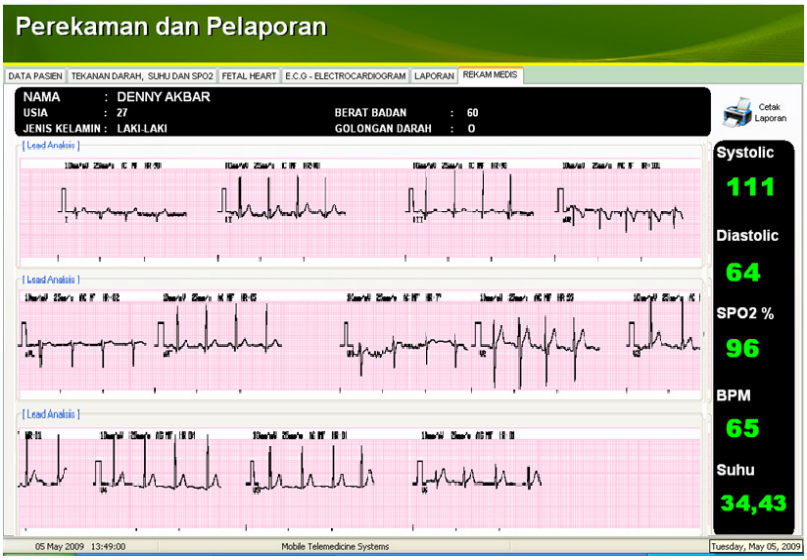
Pengukuran Sinyal EKG



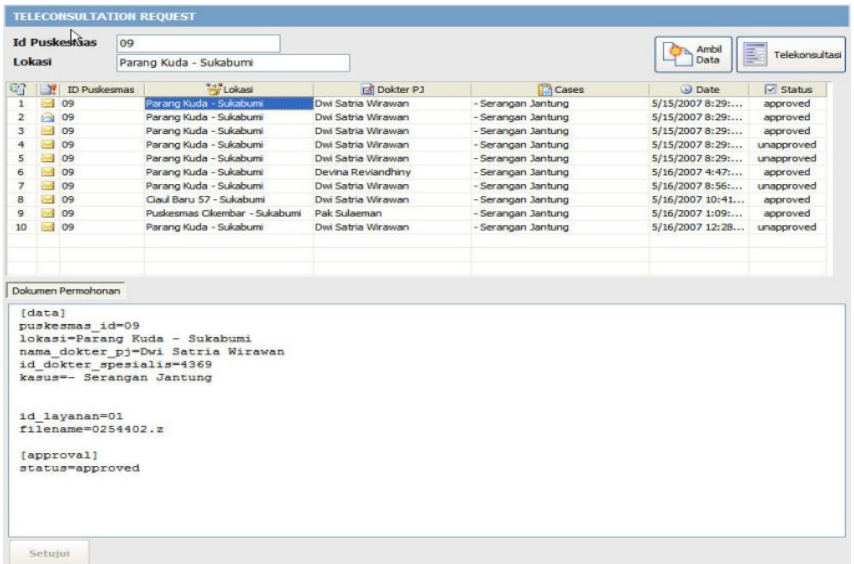
Contoh Tampilan Perekaman Biosinyal



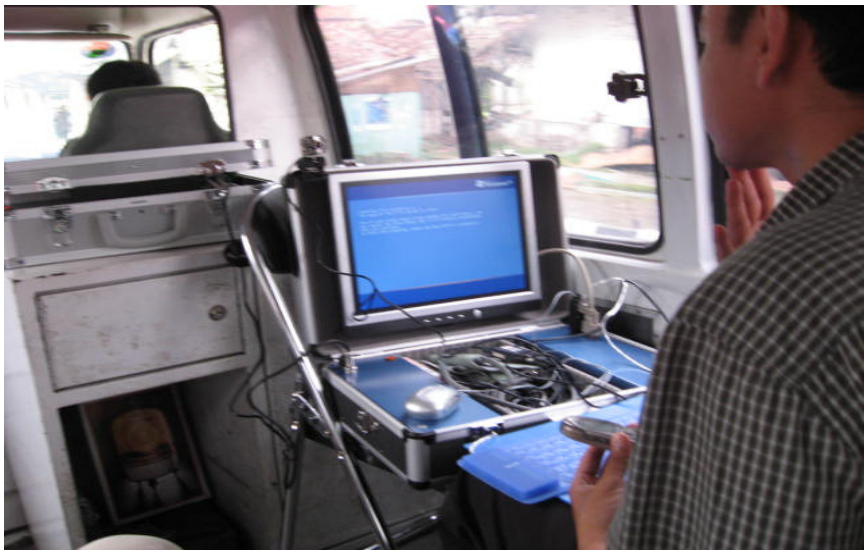
Contoh File Biosinyal Lengkap



Tampilan Permohonan Telekonsultasi di Base Unit



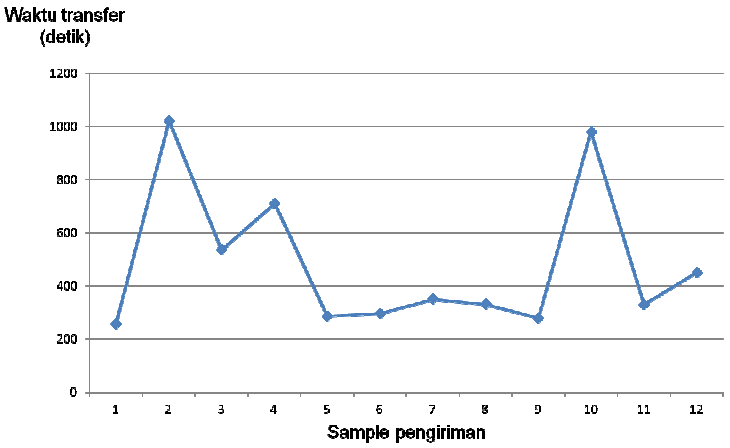
Pengujian Transmisi Data di Ambulan



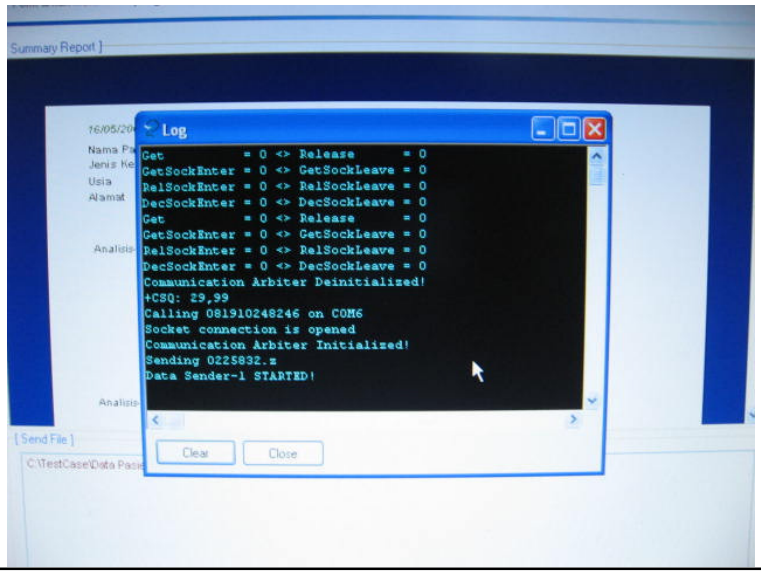
Contoh Hasil Uji Coba Transmisi Data

No.	Type of Signals	Data Size (byte)	Maximum Transmission Time (second)
1.	BP	2322	18
2.	FHR	6144	173
3.	PIR	96256	309
4.	Still image	23252	88

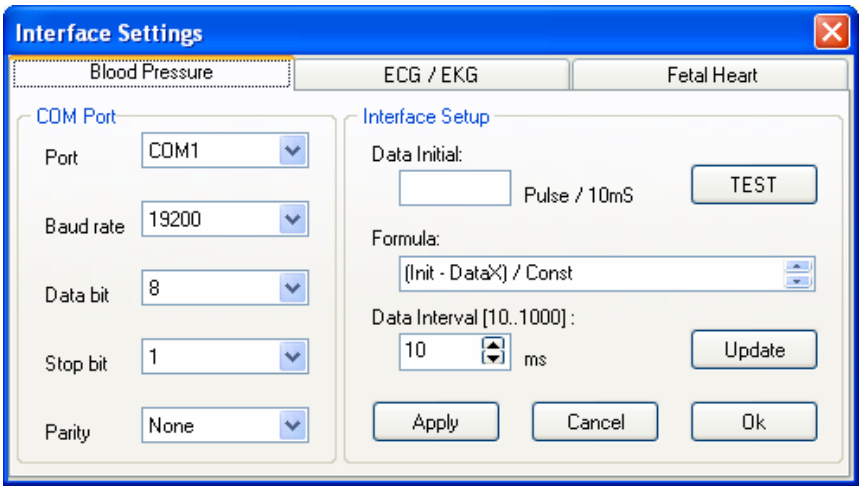
Contoh Hasil Uji Coba Transmisi Data



Pengecekan Transmisi Data

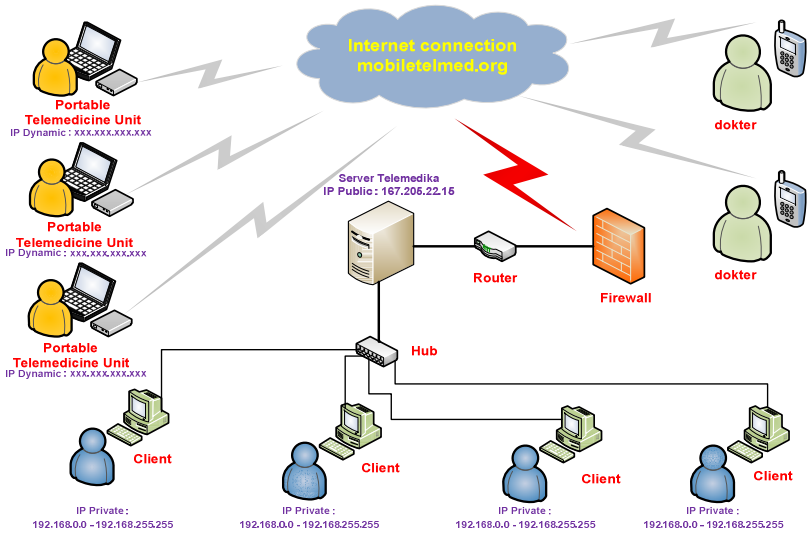


Interface Setting



Lokasi Base Unit

Jaringan STB



Penutup

- Teknologi
- Infrastruktur (Perencanaan & pengembangan)
- Peraturan telekommunikasi
- Sistem pembiayaan
- Licensing and credentialing
- Legal aspek (malpraktek)
- Kerahasiaan
- SDM