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# Mobile Network Based Telemedicine For Rural Population

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# Why Telemedicine ?

- More than a BILLION population
- High population per physician (around 5000)
- Majority living in RURAL area (> 70%)
- Poor road conditions and transport
- Vast area with varied topography

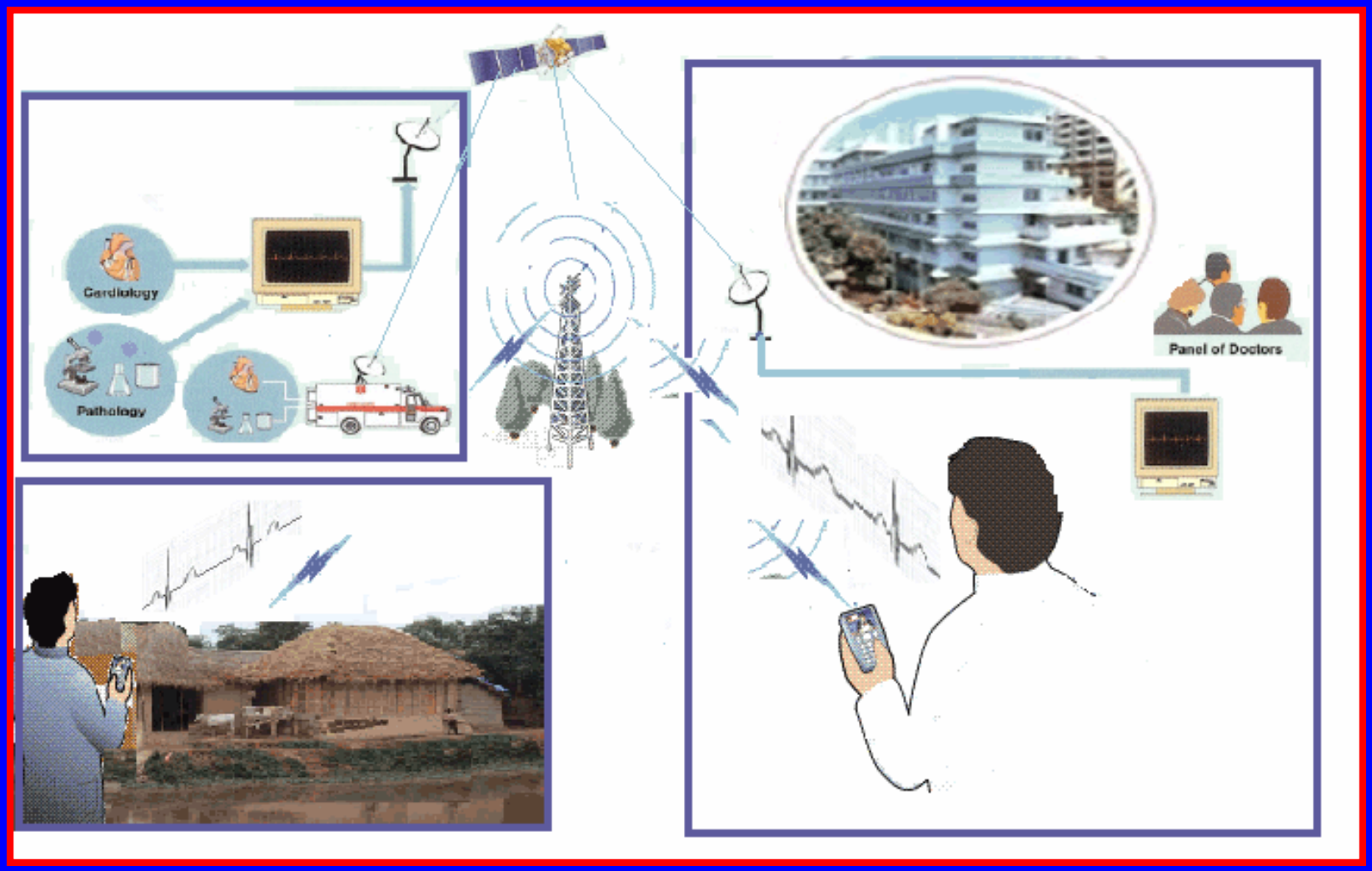
All justify the need for Telemedicine in India.

# Inaccessible areas

# Why mobile network based ?

- Public switched telephone network (PSTN) or integrated services digital network (ISDN) limits communication between fixed locations.
- Wireless Telemedicine built around satellite communication requires expensive equipment, dedicated link and skilled man power.
- Mobile cellular network like GSM or 3G provide worldwide communication and mobile sets are easily affordable.

# MNBT Concept



# BARC's Development

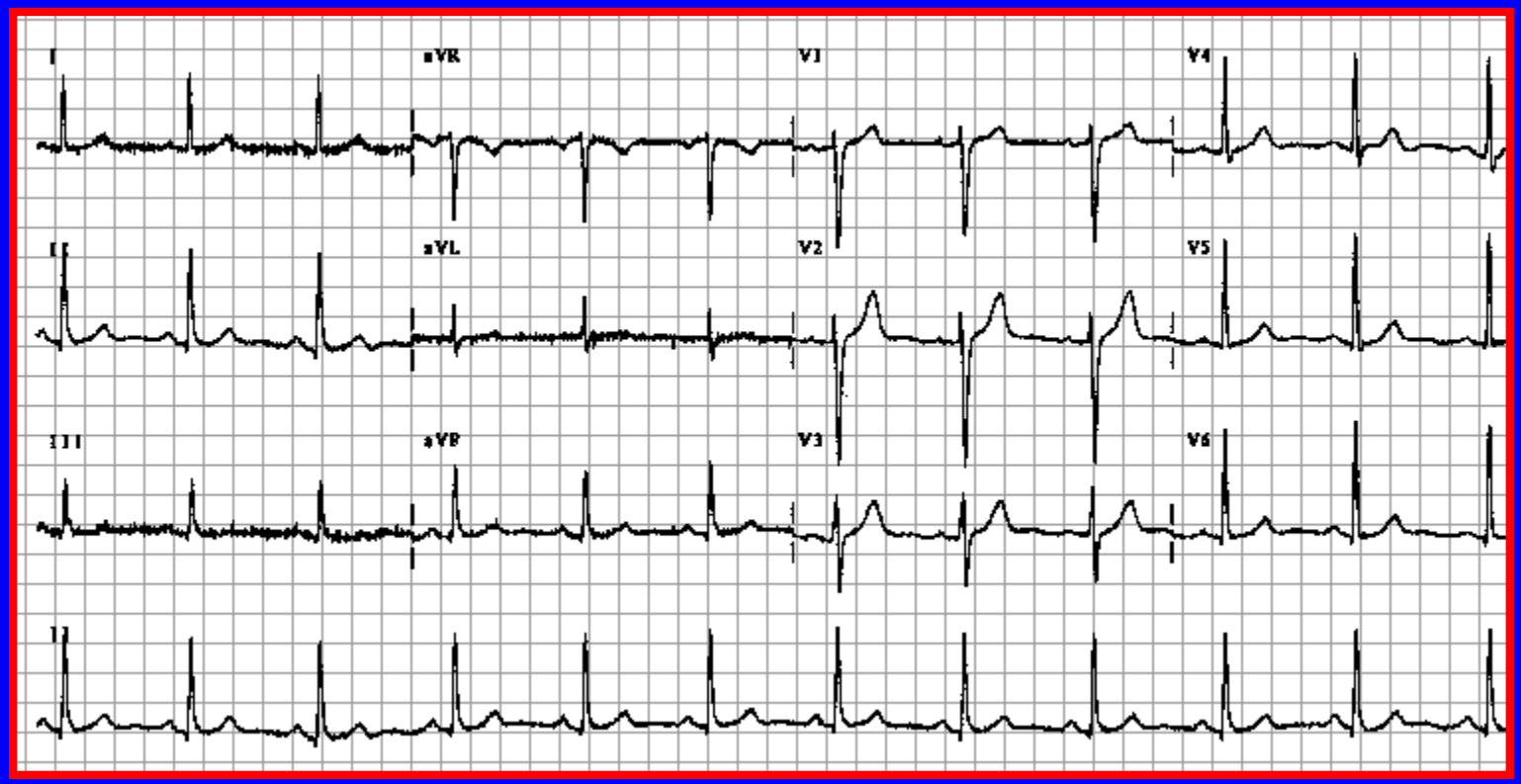
- Development of instrument with Bluetooth interface connecting to mobile phone. (Tele-ECG)
- Bluetooth connectivity to medical imaging devices with mobile phone.

# Why ECG ?

- Maximum mortality due to undiagnosed heart attack in remote areas.

# Normal Sinus Rhythm

How a Normal ECG looks?



# Information given by ECG

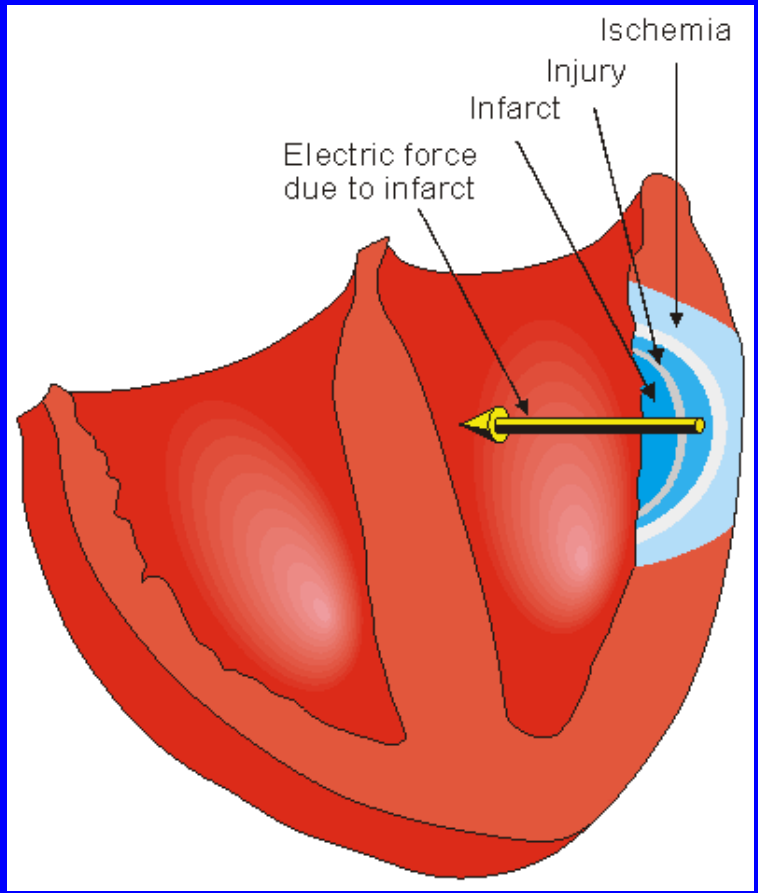
- **Physiological variations ( ANS)**
  - ↑ Rate: Exercise, stress, anxiety
  - ↓ Rate: Sleep, athletes
- **Pathological variations**
  - Changes in Na, K, Ca
  - Blood supply
  - Infections
  - Drugs
  - Metabolic anomalies

# Information given by ECG (contd)

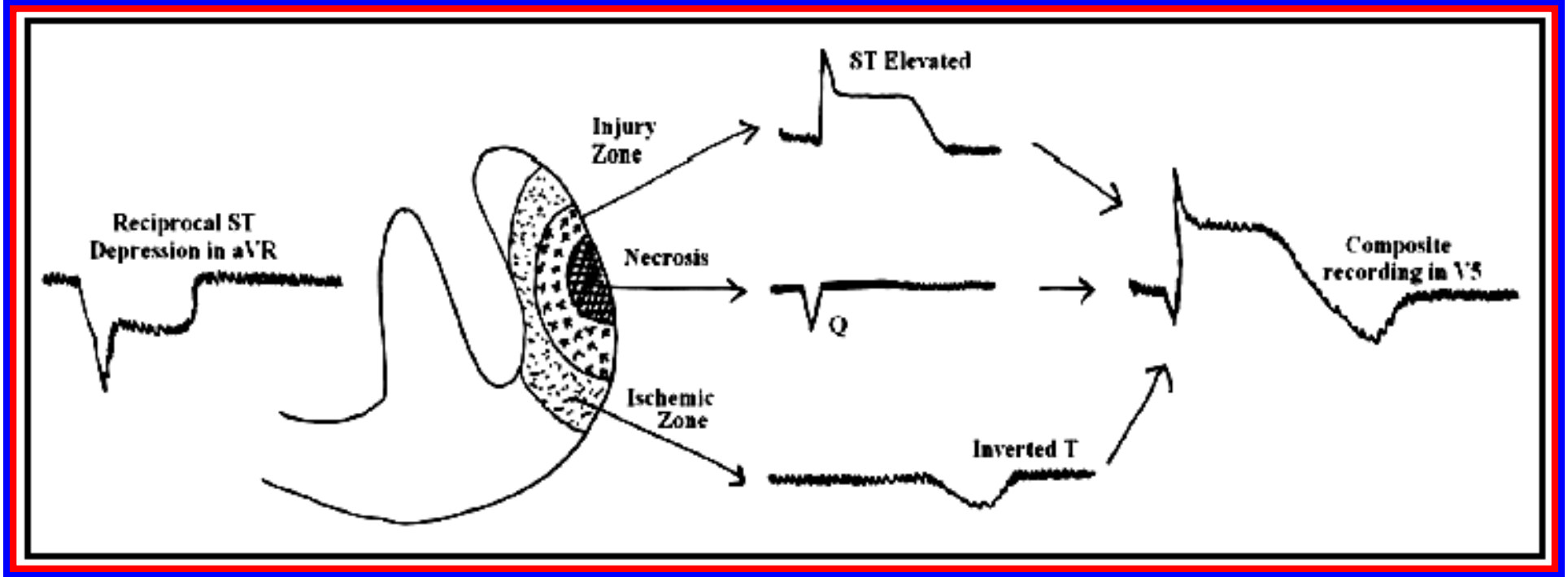
- **Anomalies of Rate**
  - Sinus tachycardia
  - Sinus bradycardia
  - Supra Ventricular Tachy.
  - Ventricular Tachy.
  - Ventricular fibrillation

# Myocardial Ischemia and Infarction

- Oxygen depletion to heart can cause an oxygen debt in the muscle (ischemia)
- If oxygen supply stops, the heart muscle dies (infarction)
- The infarct area is electrically silent and represents an inward facing electric vector…can locate with ECG



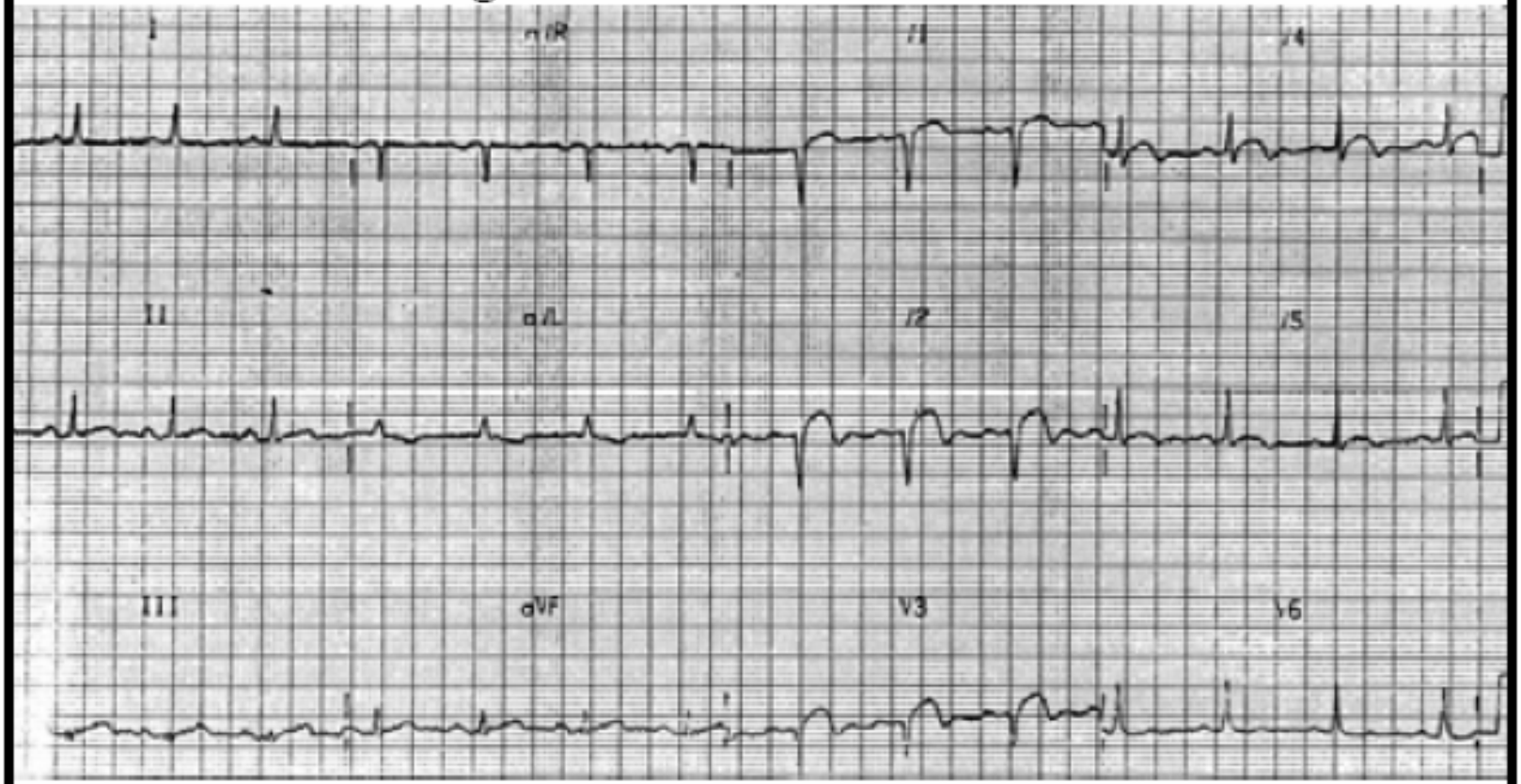
# Abnormal Waves in ECG



# Acute Antero-septal MI

78 y.o. male BIBA with C-spine immobilization secondary to syncope. Now no complaints and A & O x 3. Has abrasion over right brow.





## Complication of AMI

- DEATH
- Cardiogenic Shock
- Heart Failure
- Arrhythmias

## Management

- Drug therapy
- Thrombolytic Therapy
- Percut. Coron. Intv.
- Emerg. CABG

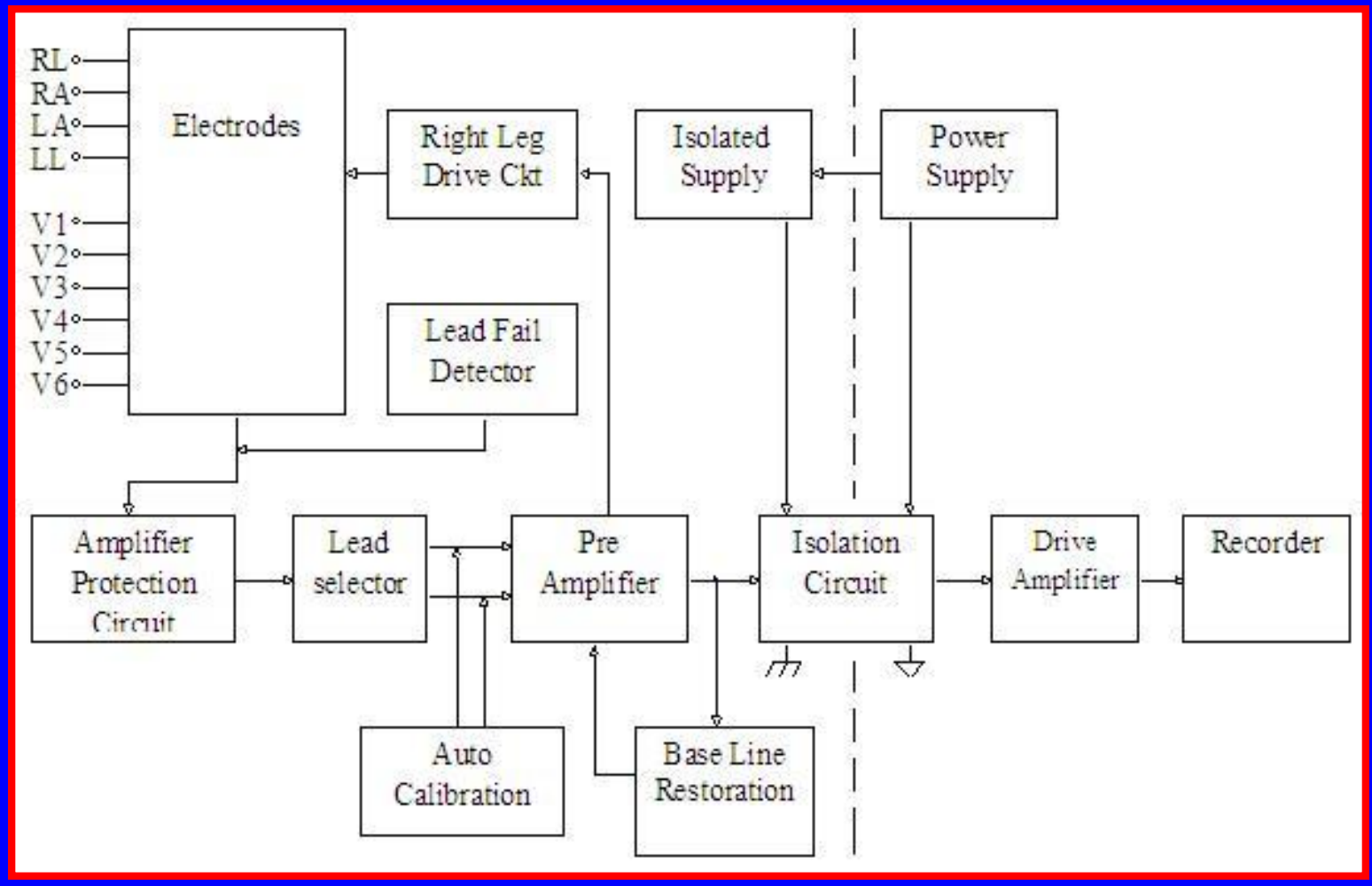
**‘Golden Hour’ 30 mins - 2 hrs**

# Timing of reperfusion therapy by prehospital versus in-hospital ECG utilization

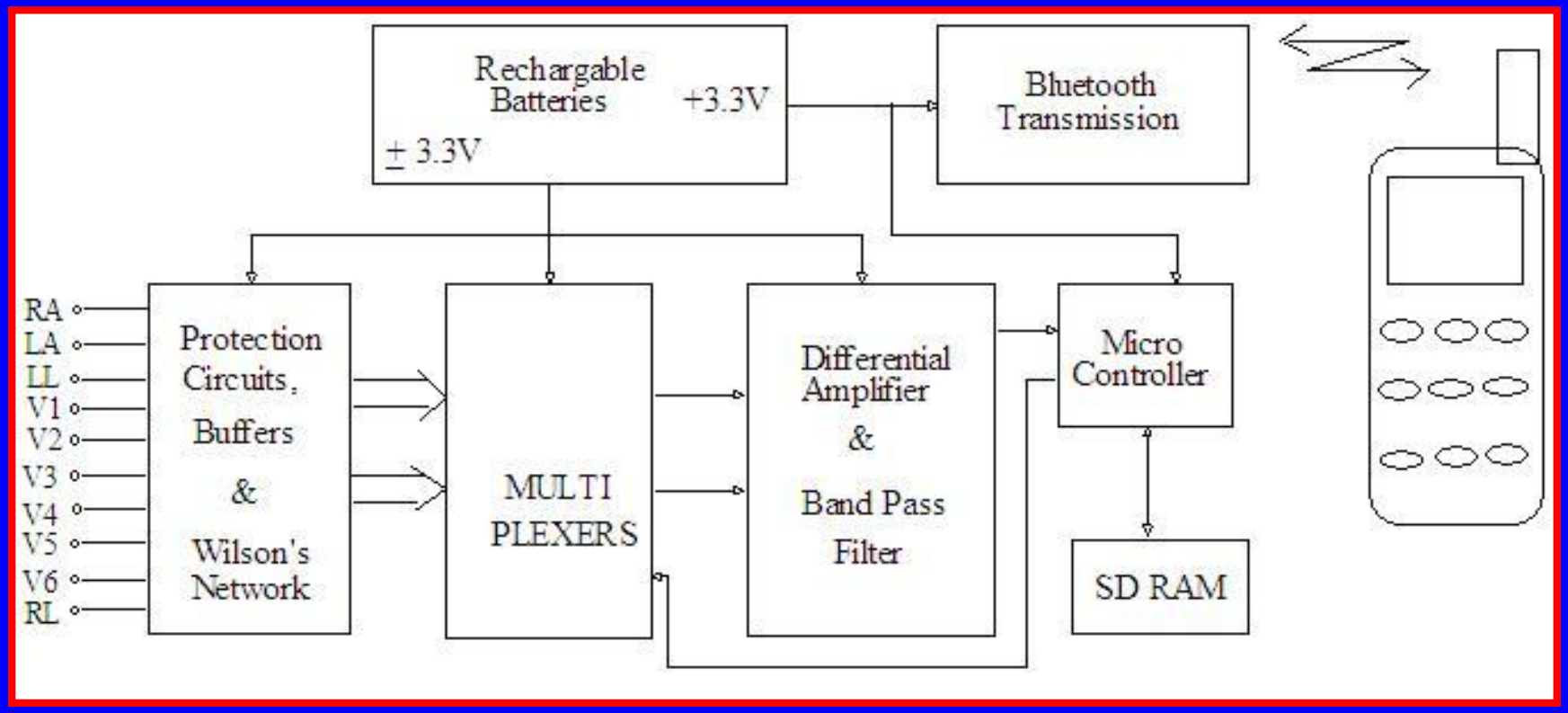
| Reperfusion times | Overall | Prehospital ECG | In-hospital ECG | p |
|---|---|---|---|---|
| Fibrinolytic agents | n=239 | n=72 | n=167 | |
| •Door-to-needle time (min) | 26 | 19 | 29 | 0.003 |
| Primary PCI | n=5117 | n=1501 | n=3563 | |
| •Door-to-balloon time (min) | 71 | 61 | 75 | <0.0001 |

Diercks DB et al. *J Am Coll Cardiol* 2009; 53:161-166.

# BARC's Tele-ECG Front-End Schematic



# BARC's Tele-ECG Full Schematic



# ECG Specification

- 12 Leads
- Input Impedance > 10 MΩ
- Gain:1000/500 (selectable) Frequency
- Response: 0.05 Hz to 150 Hz (3dB)
- Common Mode Rejection Ratio > 80dB
- Patient Isolation > 10 MΩ
- Interfaces: Bluetooth & USB
- ARM 9 Processor
- Can run on any mobile with J2ME support

# BARC's Tele-ECG Embedded Control

- ARM 9 Processor
- C for Application Software
- External Request can come from PC/ Laptop/ Mobile via Bluetooth
- MicroSD interface for data files

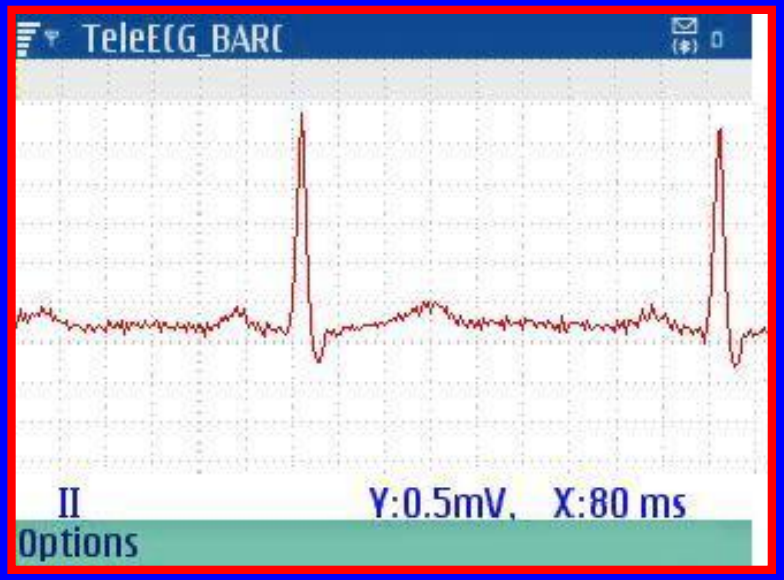
# BARC's Tele-ECG
# Mobile Based Control

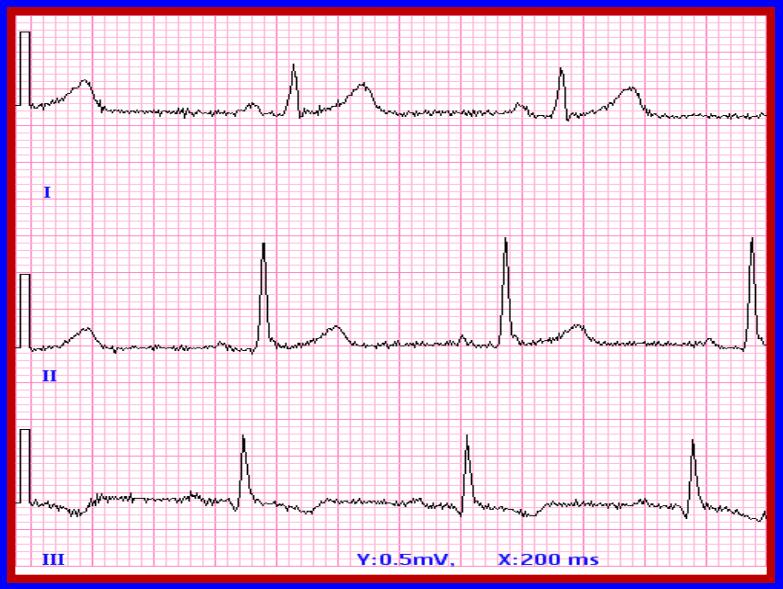
- Any Mobile with Bluetooth and Java support
- Control by key strokes (1 for start/stop and 2 for change of lead )
- Application software for the Mobile under J2ME
- Can run on any mobile with J2ME support

# BARC's Tele-ECG

# Screen Shots of Tele ECG Midlet





# Tele-ECG for Hospitals

- A hospital with a Local Area Network running through Different Wards
- ECG Machines deployed in several wards
- Cardiologist May be only in ICCU or will be of limited availability


ECG Report
Name Ashoke
Disp 10
S.No 12345
Date 01-15-2009
Age 25
Sex MALE
Send Report to ICCU
Print Report
Diagnosis In
Acknowledge
X : 200ms/div
Y : 1 mv/div
Diagnosis
Normal
Recommendation
Normal ECG, No further Action Required
Exit

Ward


ECG REPORT (ICCU)
Data Received
Connect
Casuality
Fresh ECG
Acknowledge
Send Diagnosis
Print Report
Name Ashoke
Age 25
X : 200ms/div
Y :1 mv/div
Enter Diagnosis
Normal
Recommendation
Normal ECG, No further Action Required
Exit

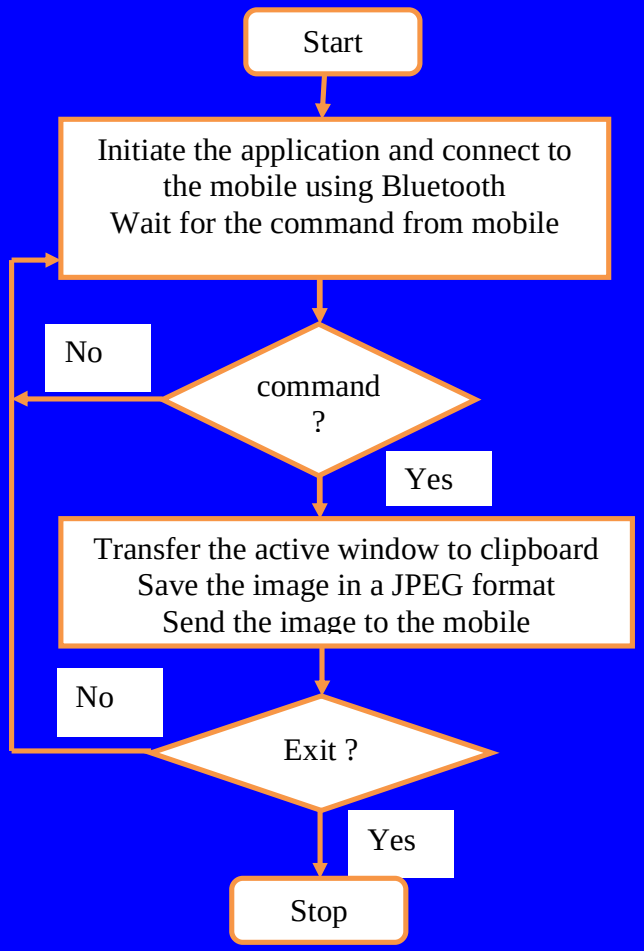
ICCU

# MNBT Utility

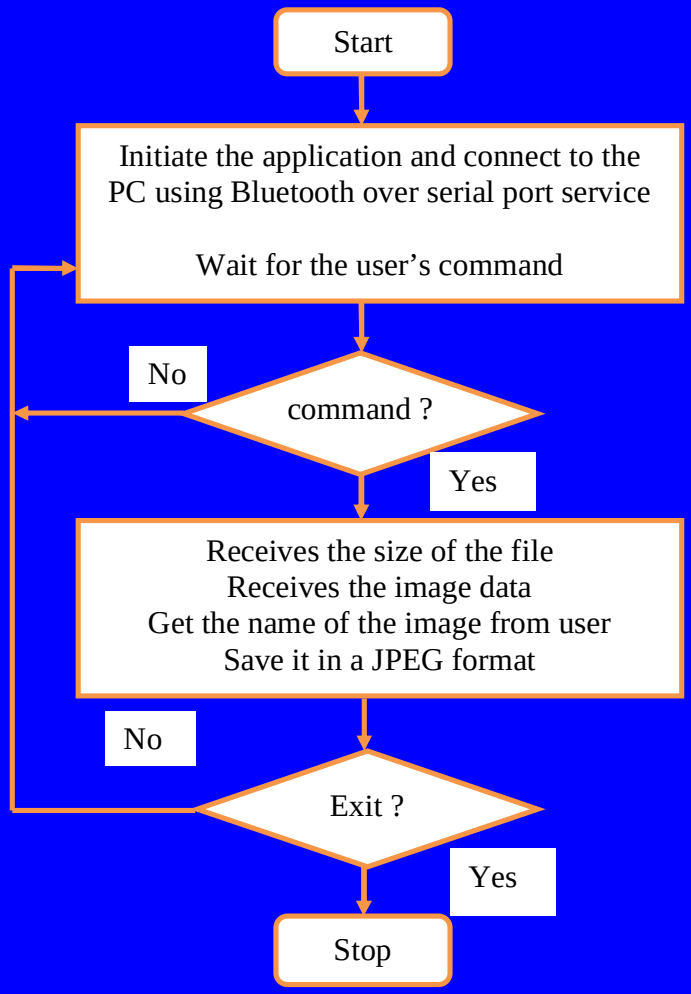
After successful deployment of Tele-ECG unit in various hospitals for clinical validation,

MNBT utility has been developed to capture any medical data from an instrument or PC onto a mobile phone for onward transmission to expert.

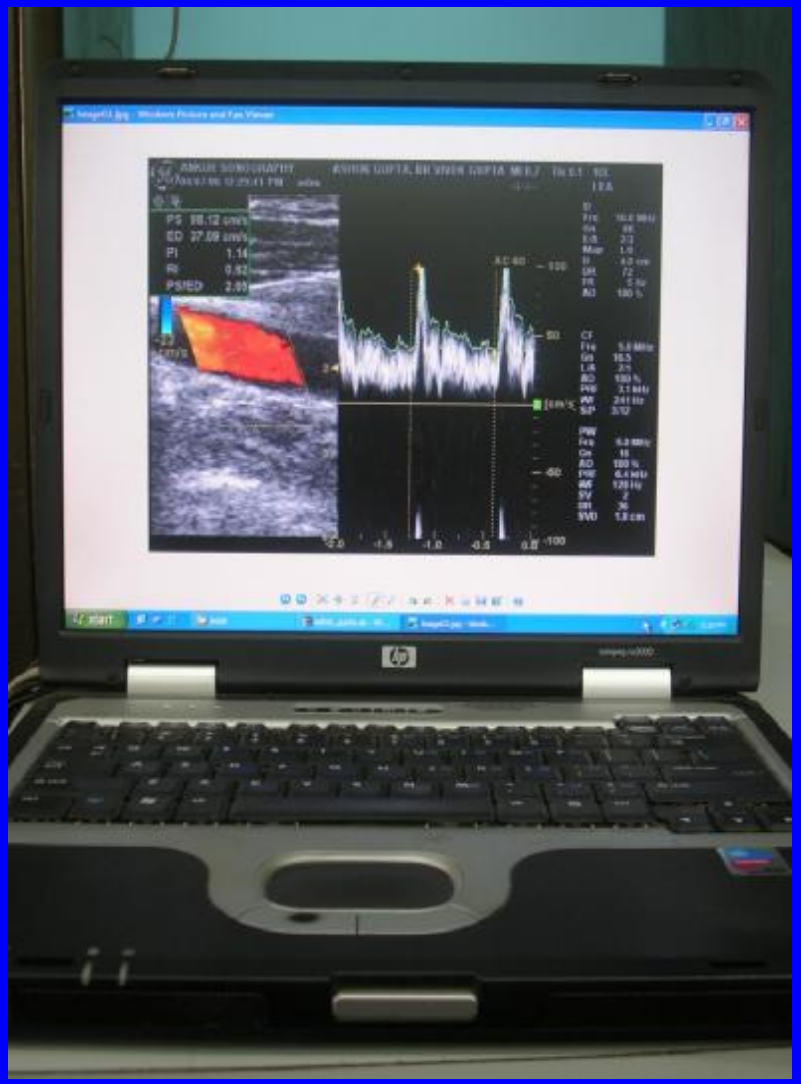
# PC Application

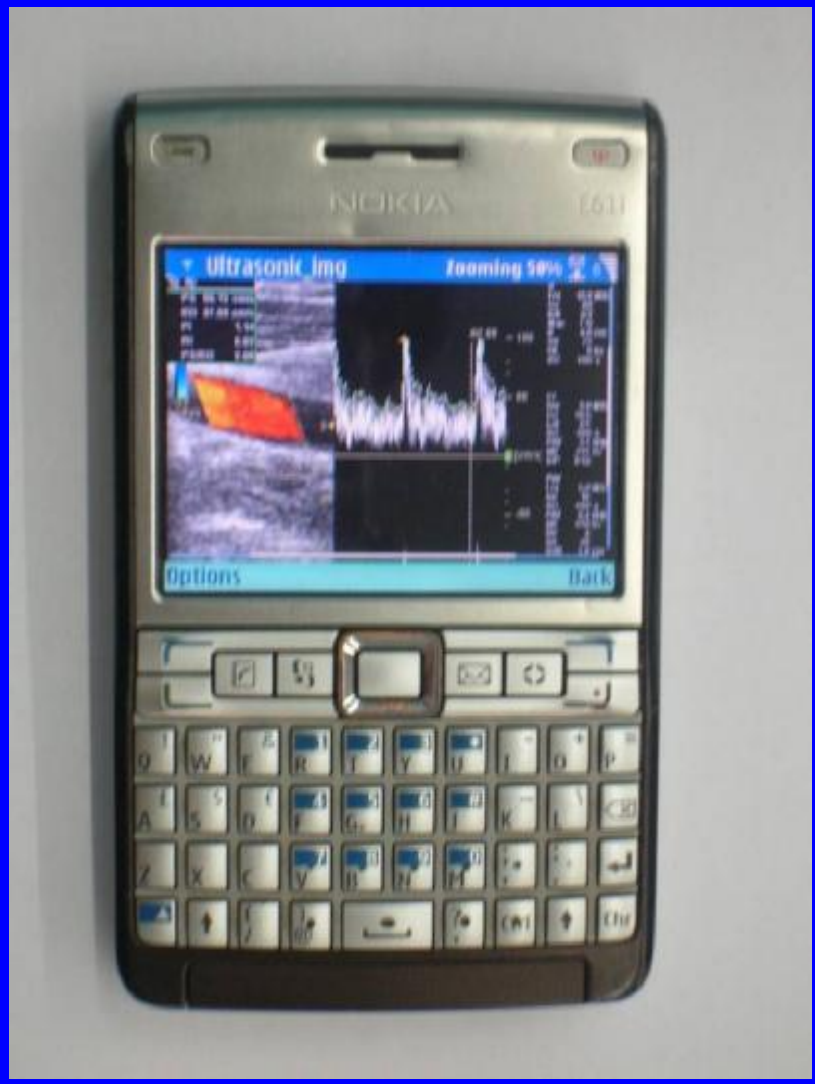



# Mobile Application



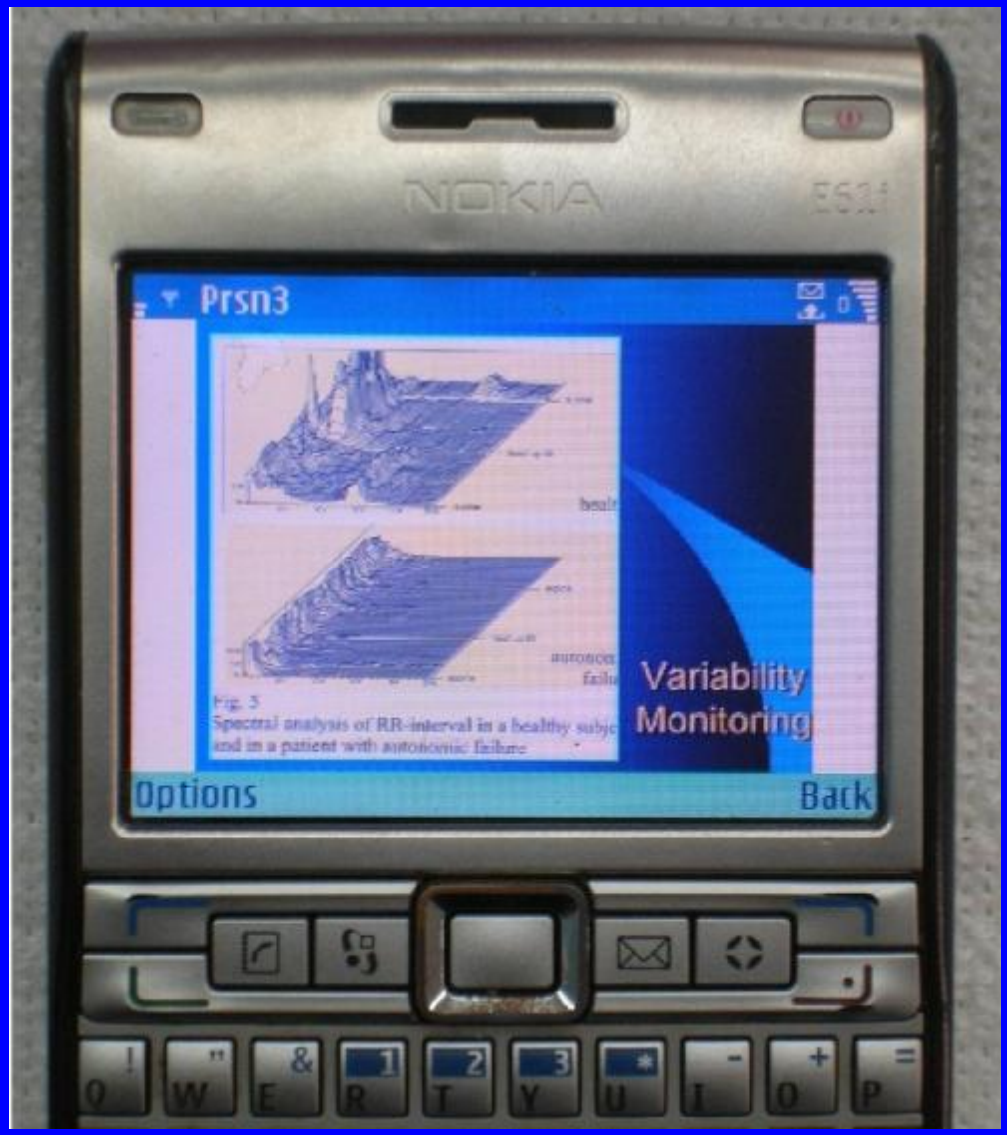
# Ultrasonic Image



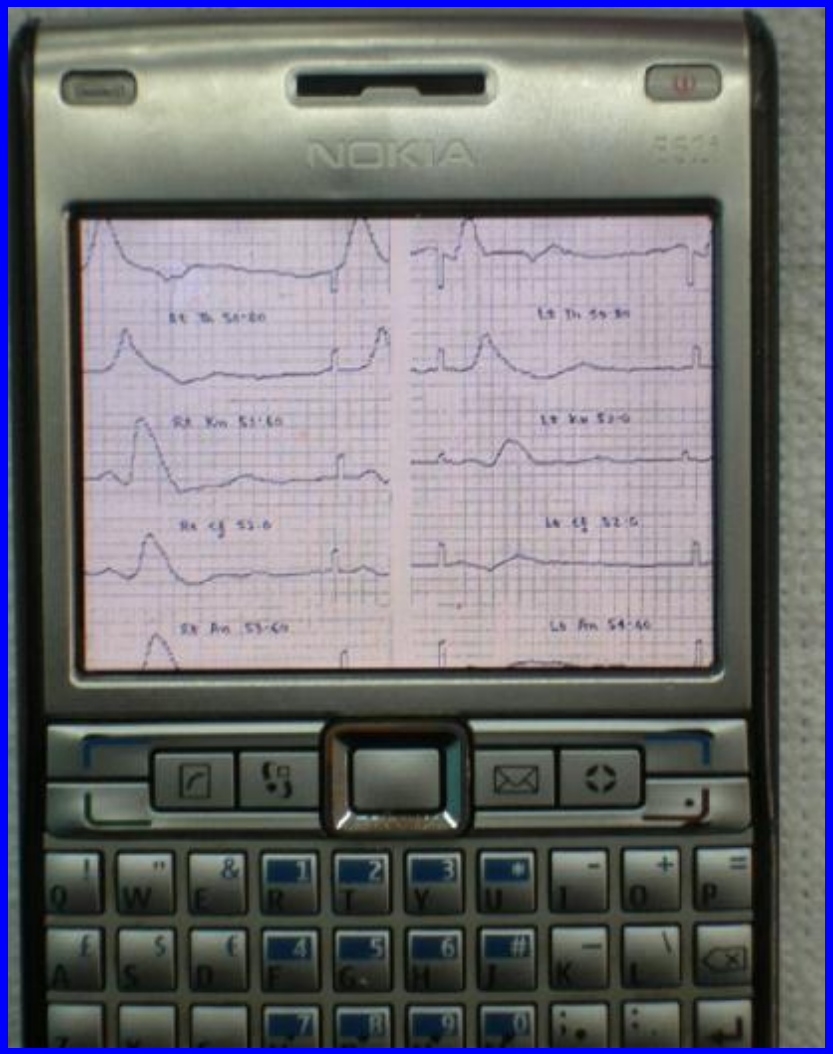


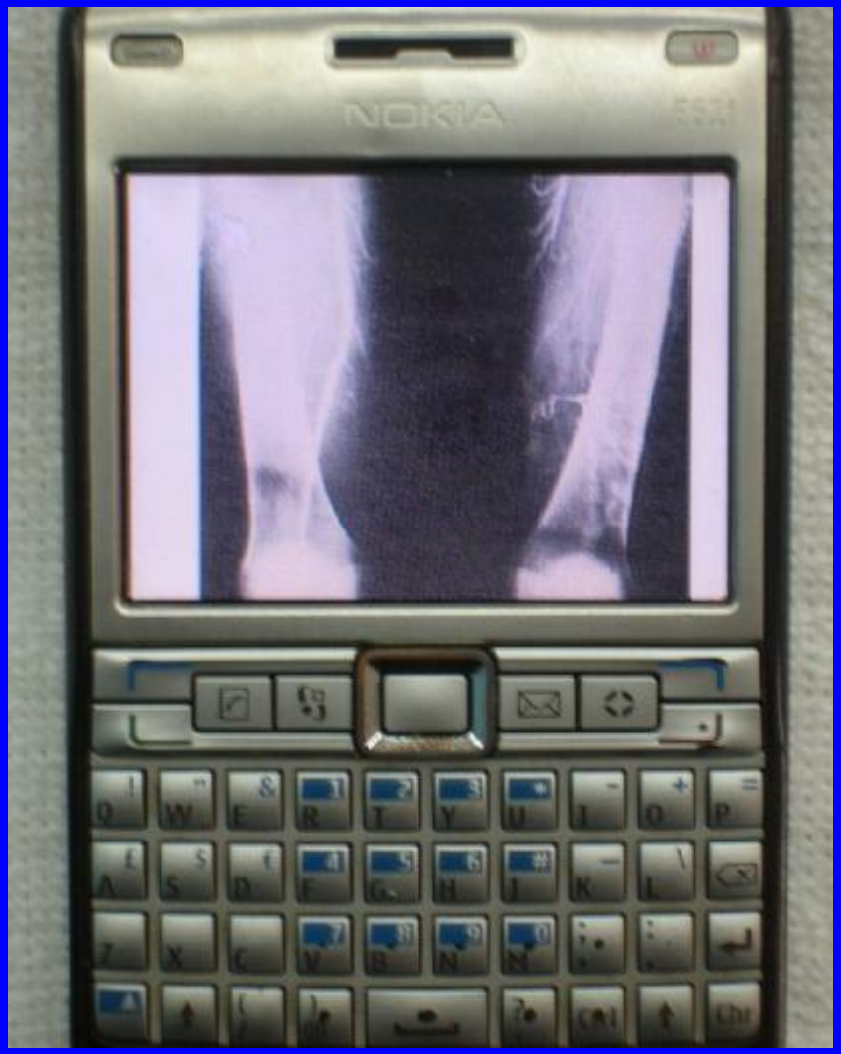
# Venogram Images

# Variability Data



# IPG Data and Aortogram





# Thanks