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About OMICS Group Conferences

OMICS Group International is a pioneer and leading science event organizer, which publishes around 400 open access journals and conducts over 300 Medical, Clinical, Engineering, Life Sciences, Pharma scientific conferences all over the globe annually with the support of more than 1000 scientific associations and 30,000 editorial board members and 3.5 million followers to its credit.

OMICS Group has organized 500 conferences, workshops and national symposiums across the major cities including San Francisco, Las Vegas, San Antonio, Omaha, Orlando, Raleigh, Santa Clara, Chicago, Philadelphia, Baltimore, United Kingdom, Valencia, Dubai, Beijing, Hyderabad, Bengaluru and Mumbai.

**Design and Development Of a Knowledge driven
Web Based Remote Cardio Patient
Data Monitoring and Diagnostic Tool**

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Social Impact of Technological Development

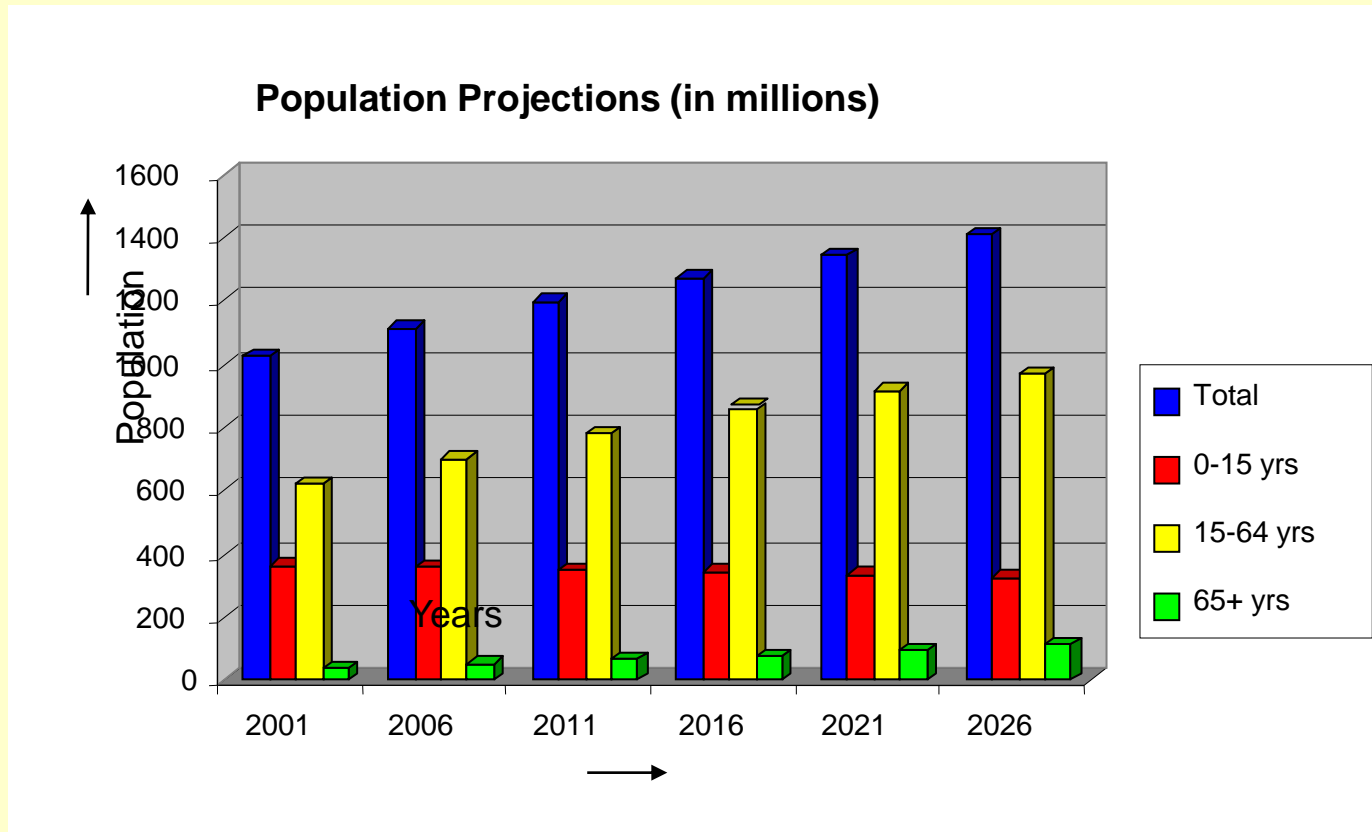
- Human Civilization \leftrightarrow Technology Development : Human civilization has always been greatly affected by the new development in science and technology
- Over the years, there have been significant technological advancement and growth of application oriented products and infrastructure in biomedical, medical, Telecommunication, Biotelemetry and information science.
- These developments could best be utilized to provide quality based and cost effective means of healthcare programs in India, keeping in view its much larger and geographically dispersed population comprising of high percentage of children, woman, and old aged persons.
- Healthcare in the present day time has become the important fundamental need of the human being after food and shelter.

Background

1. Social evils such as abuse of alcohol, use of tobacco and poor and un hygienic living conditions in rural areas and imbalance fatty diets, lack of physical exercises and stress full life style in urban areas have led to cardio vascular and several others similar problems.
2. Technology/Bio-telemetry/ high speed web based internet services are being employed particularly in Assisted living/ hospital environment or monitoring patients in high risk cardiac conditions such as during ambulatory transportation of patients.
3. Smart devices and intelligent technologies are available to take care of the patients and more particularly elderly people enjoying a self determined life in a more preferred environment of their homes and beds without any fear of external invasion of privacy.
4. Described here is a versatile, cost effective and application oriented web based analytical, informative and corrective action taking tool using specially developed graphical user interfaces (GUI's) for acquiring, amplifying and signal conditioning of the biomedical signals of the patients and on detecting an alert stage, a direct connectivity between the patient and specialists is maintained.
5. Benefits are: unbearable cost of caring in private nursing homes/hospitals, the cost and burden of shifting a critical state patient from one hospital to another for specialized treatment or from remote place to a nearby medical center and also the unnecessary expenditure on the living and maintenance of a companion care personnel.

Estimated Population Projections (India ref.)

Shown below are the estimated population projections as per age group.



It concludes that :

There is going to be quite a substantial growth in total population in next two decades. However during the same period a marginal decline in the population of people of age group varying between 0-15 years. The overall population growth is mainly due to the steady growth of population of people between age group 15-64 years and above.

Considerations in Technology choice adoption and Implementation Strategy

- Creating a vision and planning for highly suitable, need based, result oriented scheme for health implementation technology.
- Right choice of technology for defined task keeping in view the aspects of its long term sustainability.
- Its cost effectiveness and managing funds for investments, revenue enhancements and productivity gains.
- Building partners to share the responsibilities for effective implementation and smooth running.

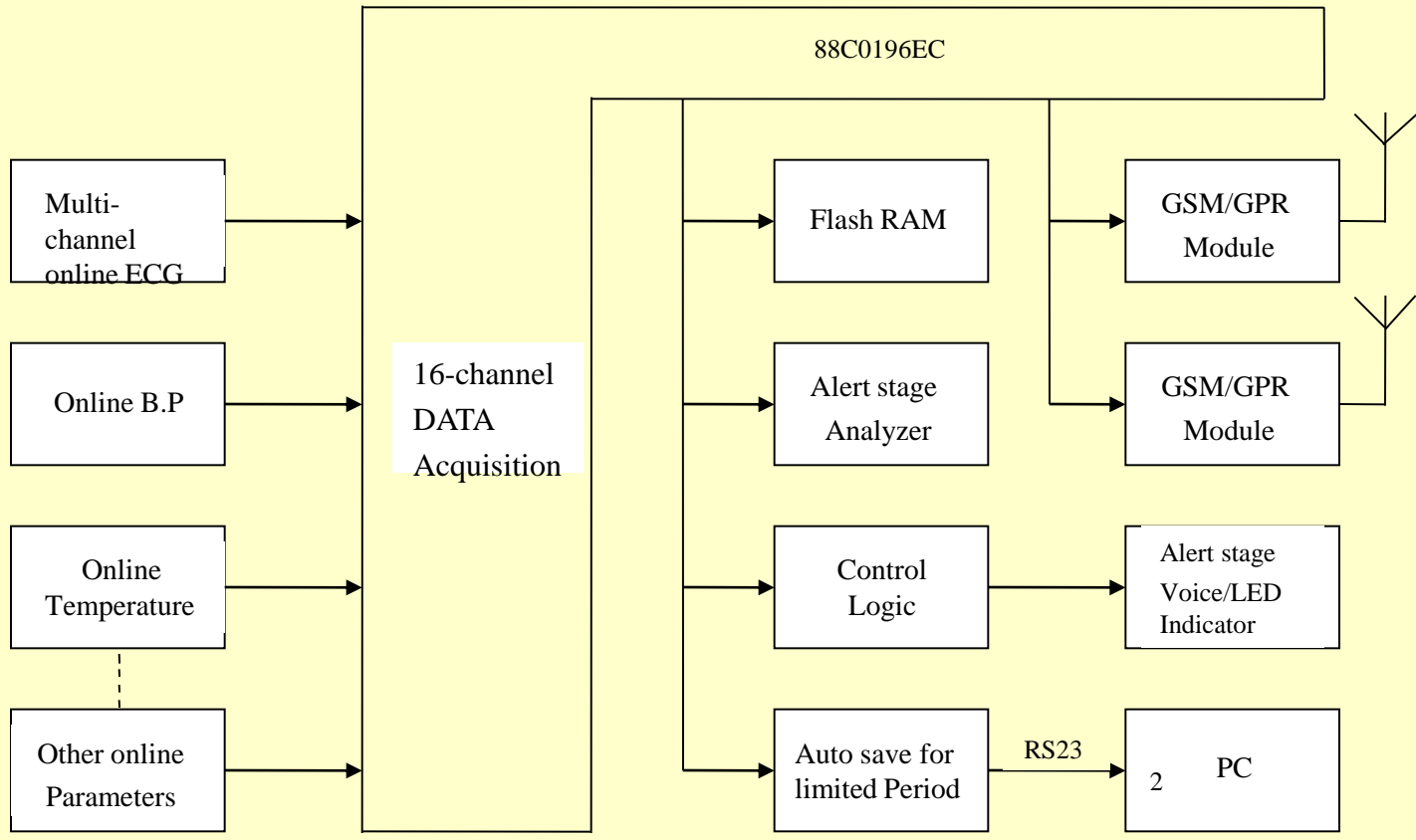
Resources and Infrastructure and their usage

- Development and use of biomedical sensors and materials for use in developing smart card for holding enormous amount of data information
- Development of imaging and scanning and other kind of electro medical instruments for display process and detect audio video clippings of certain kind of diseases with zooming provisions
- Digital stethoscope, X-rays, high resolution, cameras, ultrasound, ECG cameras, Data compression technique, high resolution scanners, data and image transmission using bio-telemetry.
- New concepts of Health robots, Personnel Digital Assistants (PDA's) and use of Voice Activated Device.
- Independent component Analysis (ICA) based algorithms using mat lab etc to remove noise and artifacts from contaminated Biomedical signals before transmission on the network.
- Transmission of National standards of vital parameters related to biomedical instrumentation for calibration purposes by National Laboratories and other National Measuring Institutions (NMI).
- Making use of the expertise and experiences and huge infrastructure available with national laboratories, institutions and other parts of the health sectors.
- Use of interactive communications between patients, specialists and other associated with health care programs for establishing a live demonstration of the activities in real time. (Video Conferencing)

Technology and New Developments

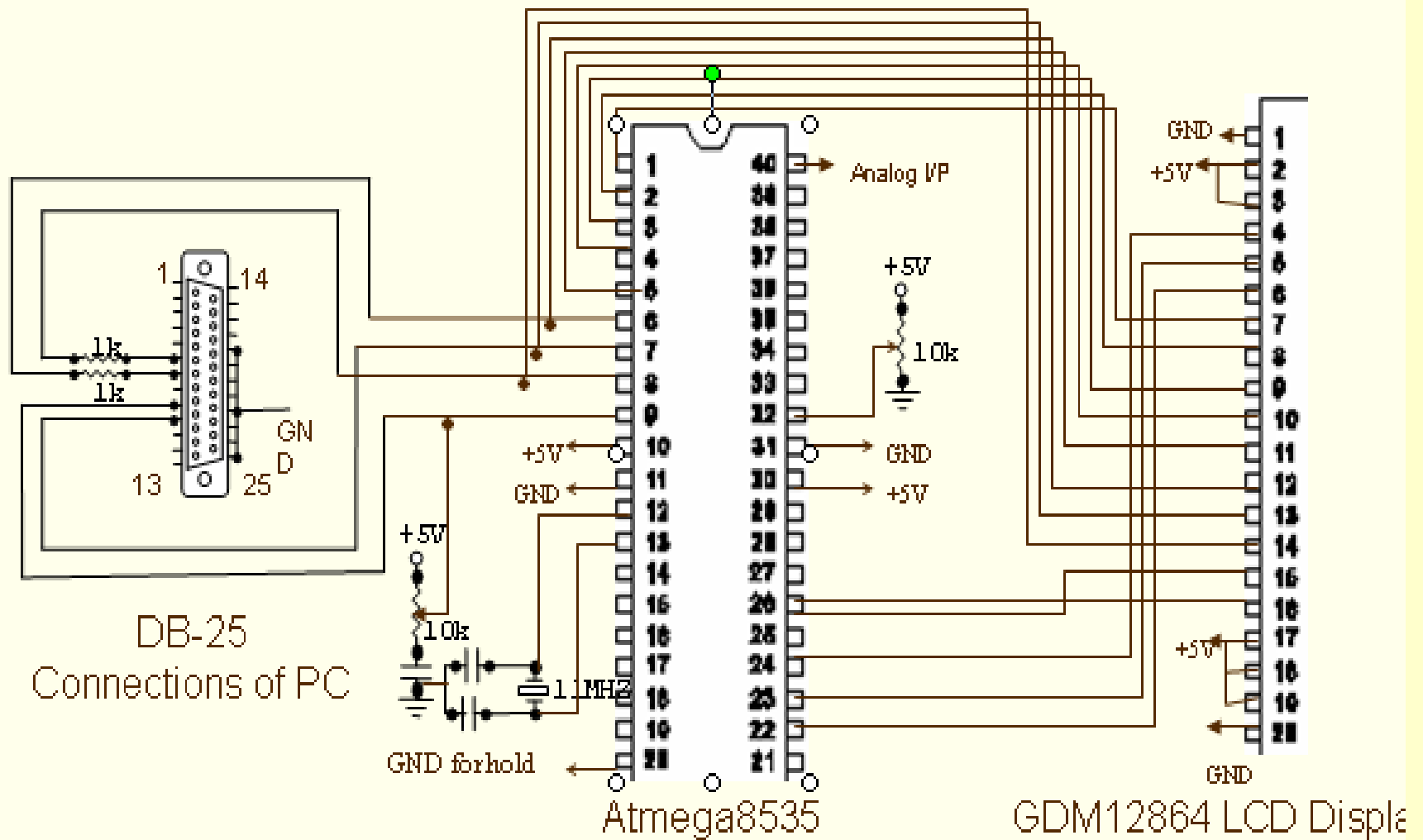
There have been tremendous growth of technology and various kind of support services such as

- New Developments in Instrumentation and Measuring instruments.
- Biotelemetry
- Diagnostic tools, Hardware and software for patient monitoring, telecounseling and telematic process
- Better linkage among the patients, practitioners specialist and peripheral health service providers.
- Development and establishment of information exchanges for sharing ideas and assistance using biotelemetry
- Advent of personal computers, internet and web based provisions and their growing usage.
- Link establishment using phone lines, DSL, Cable, ISDN and satellite technology for remote connectivity, Better care delivery and service providers education
- Information Communication Technology (ICT) and evolution of Telemedicine for deploying in far reaching areas uneven terrain and even inaccessible places and masses
- Finally, considering Health primarily a social science and technology as a support, it is equally important to promote highly affordable, effective and trusted the use and practice of our old traditional alternation approaches of Ayurveda, Homeopathy and Unani medicine in parallel.

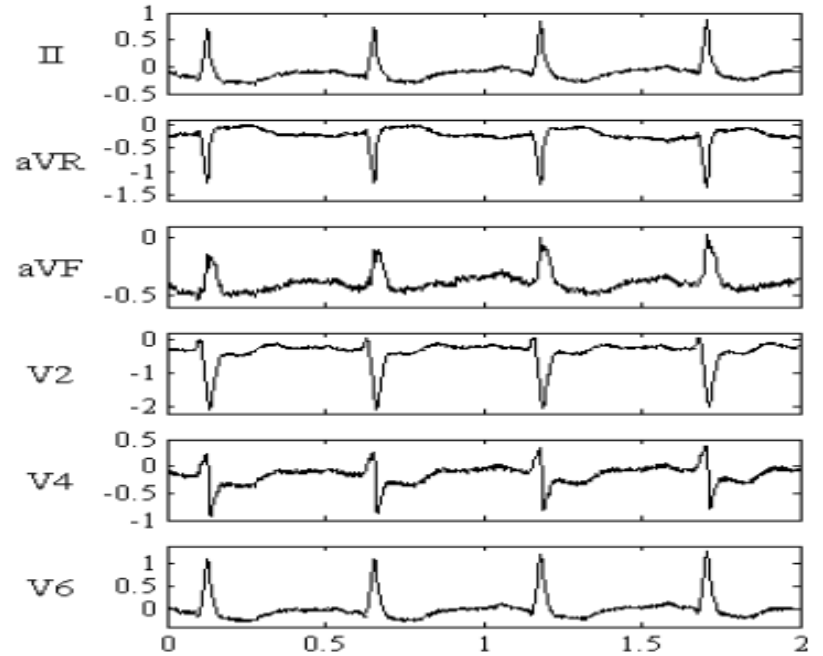
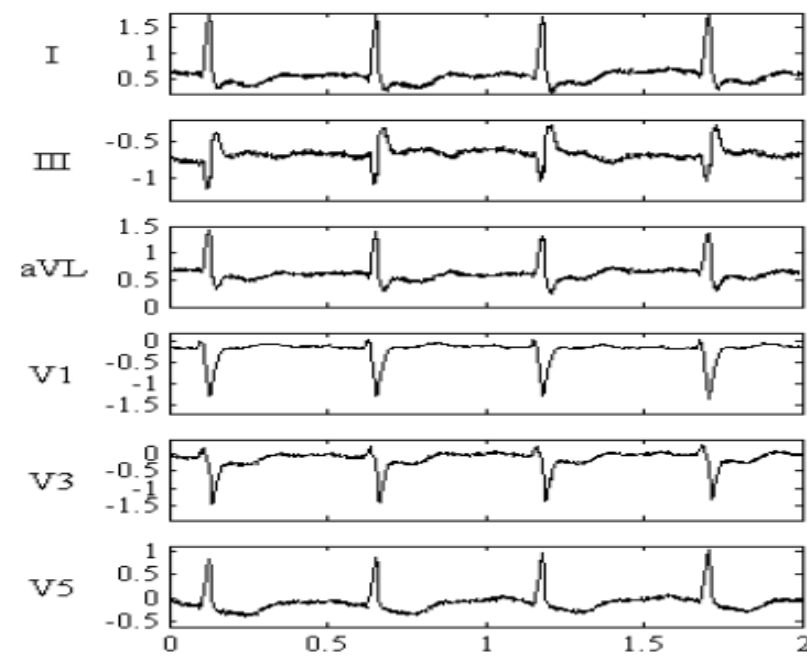
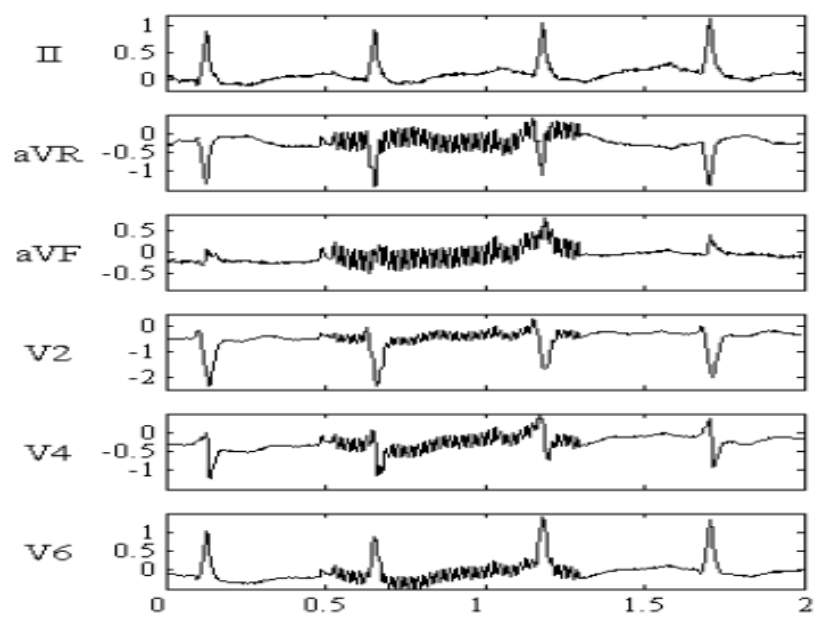
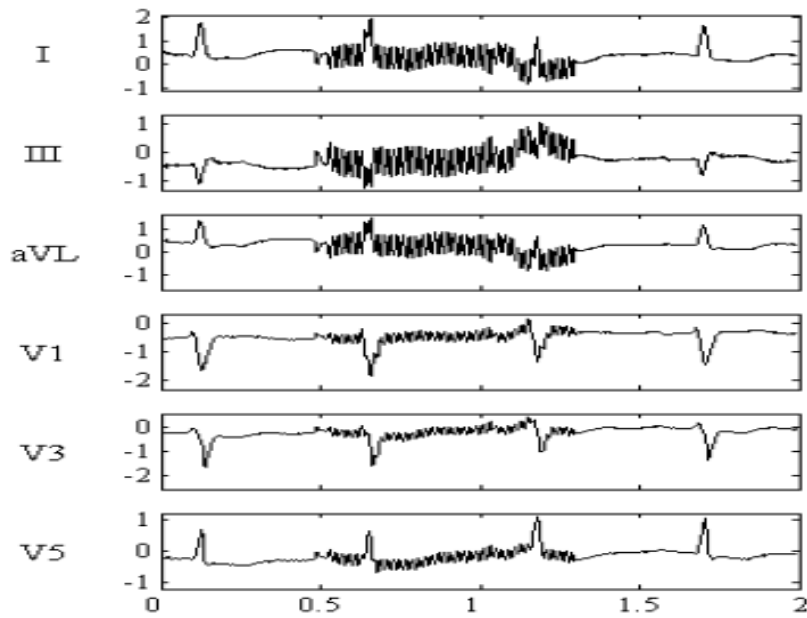


Block Diagram of micro-controller based Patient monitoring System

Micro-controller based LCD display for real time ECG display



Noise Reduction

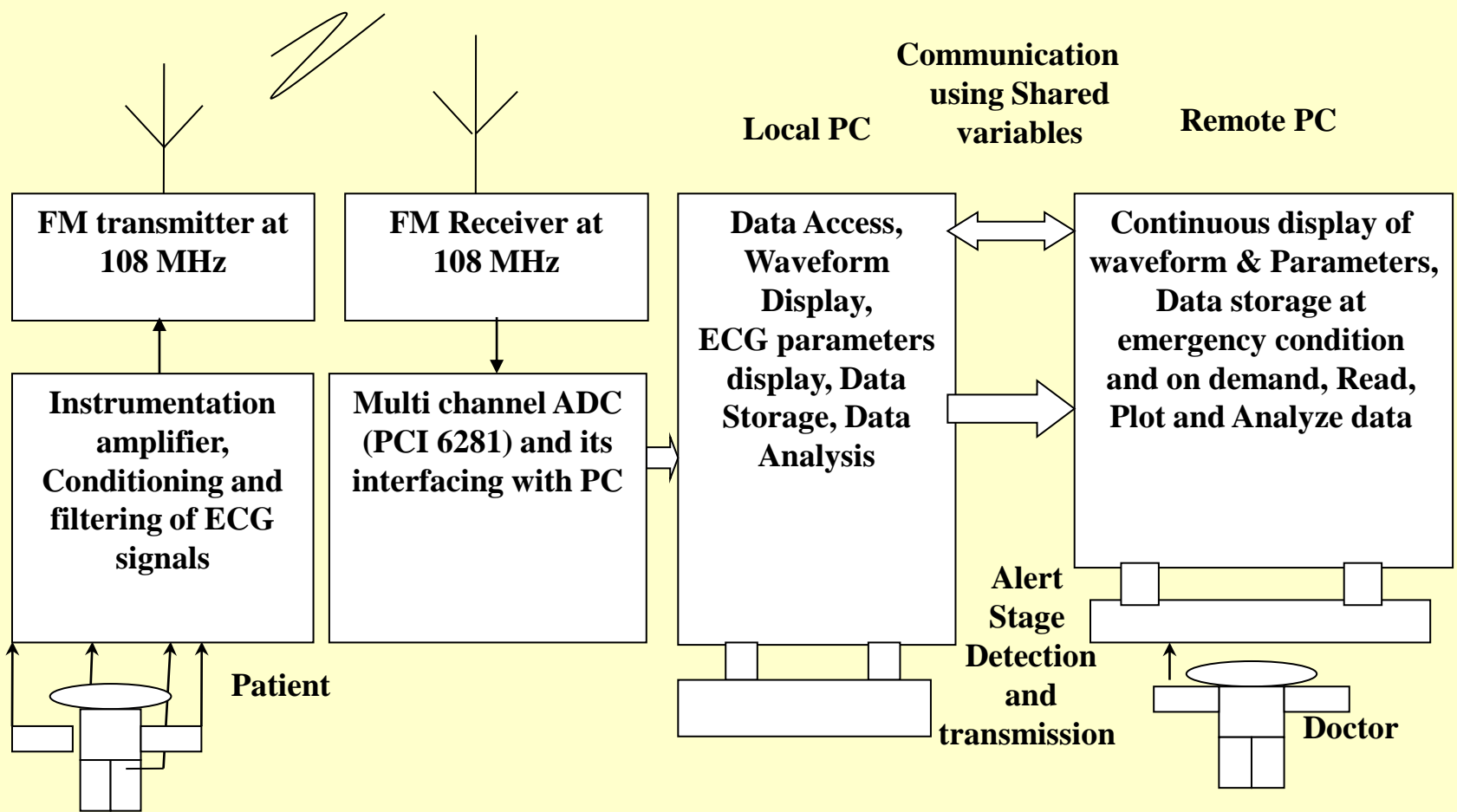


ECG Calibration

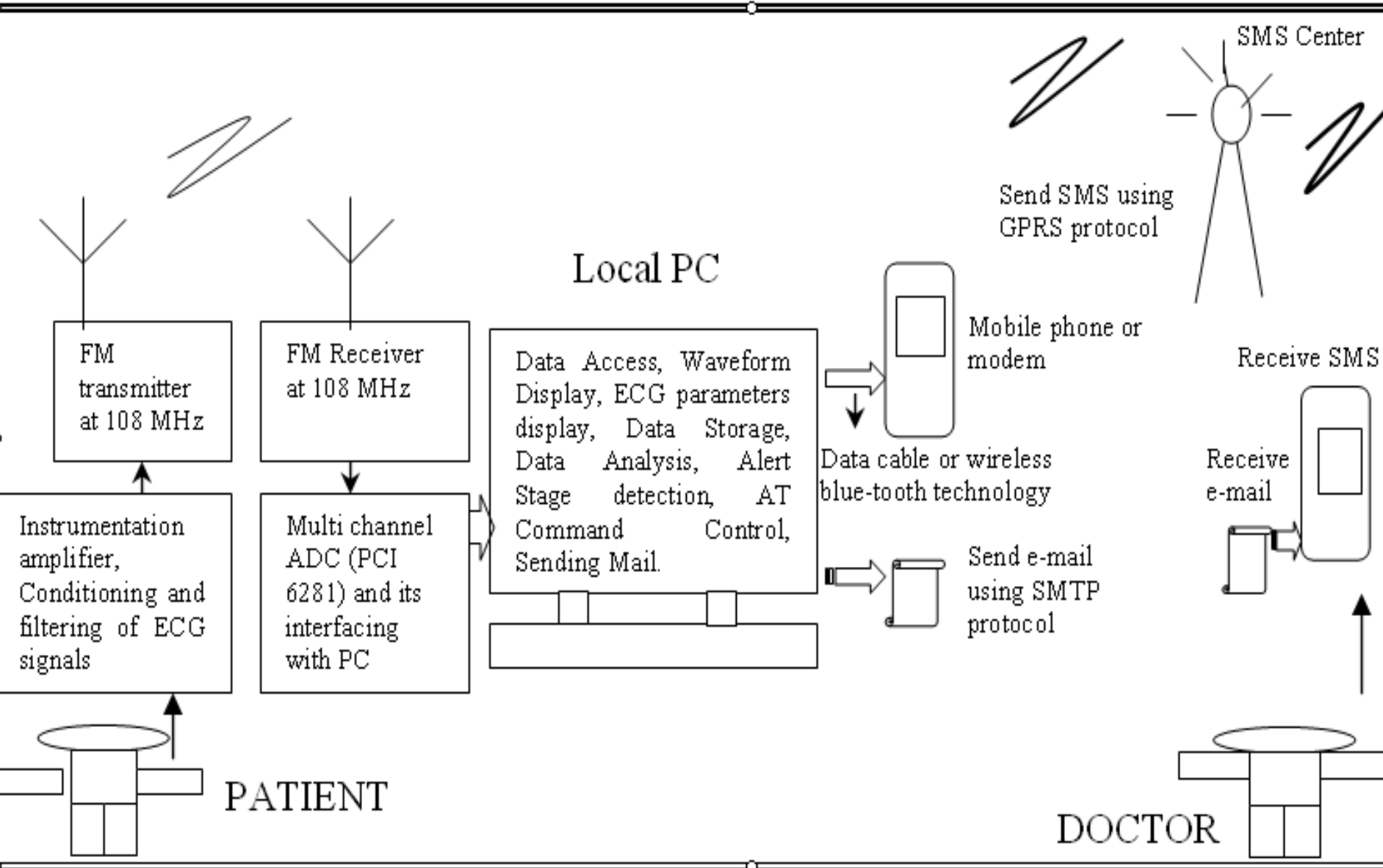
- The standard 1mV signal obtained from a standard reference source is applied to each lead of the ECG machine to be calibrated. The corresponding % drift in voltage and time scale is calculated using mm column ECG graph paper which has also been calibrated against the primary standard source of 1x1 mm.



Block diagram of Lab-view based Tale-monitoring system



Block diagram of Lab-view based Tale-monitoring system (Cont...)



Methodology

1. Data signal such as body temperature, blood pressure, pulse rate and ECG etc. from different sensors and electrodes of the patients are acquired, amplified and properly signal conditioned.
2. Fed to short range (8-10 meters) FM transmitter operating at 108 MHz.
3. Received by FM receiver tuned to the same base frequency.
4. These signals are further acquired by NI Lab View data acquisition card (PCI-6281). Data acquisition card is a high speed multifunction card with 16 analog inputs at 18 bits and on board low pass filter for rejection of high frequency noise and preventing aliasing (Local PC).
5. Upon receiving at local PC, the signals are processed by NI Lab View software to find out vital parameters such as QRS intervals, QT intervals and beat to beat (R-R interval)etc.
6. These parameters and waveforms are displayed in Local PC (Patient side) and remote PC (Doctor PC) as well simultaneously for on line monitoring.

Data Analysis

1. Data analysis can be performed by the specialist at both the ends for quick and efficient diagnosis.
2. The specialist or the care giver at the patient side can analyze the data manually by placing the cursor at appropriate positions.
3. The software calculates the parameters such as heart rate, PR, QRS and QT intervals automatically also.
4. Finding any anomaly in the above parameters it connects the patient to the doctor immediately.
5. Shared variables have been used for online data flow between remote and local PC.
6. Shared variables are configured software items that can send live data between local and remote PC .

Parameters Calculation

- Normally, the heart rate is calculated using peak detector and then calculating
- R-R intervals as follows.
- $HR=60/R-R$ interval (bpm), R-R interval is calculated by measuring time interval between two consecutive peaks.

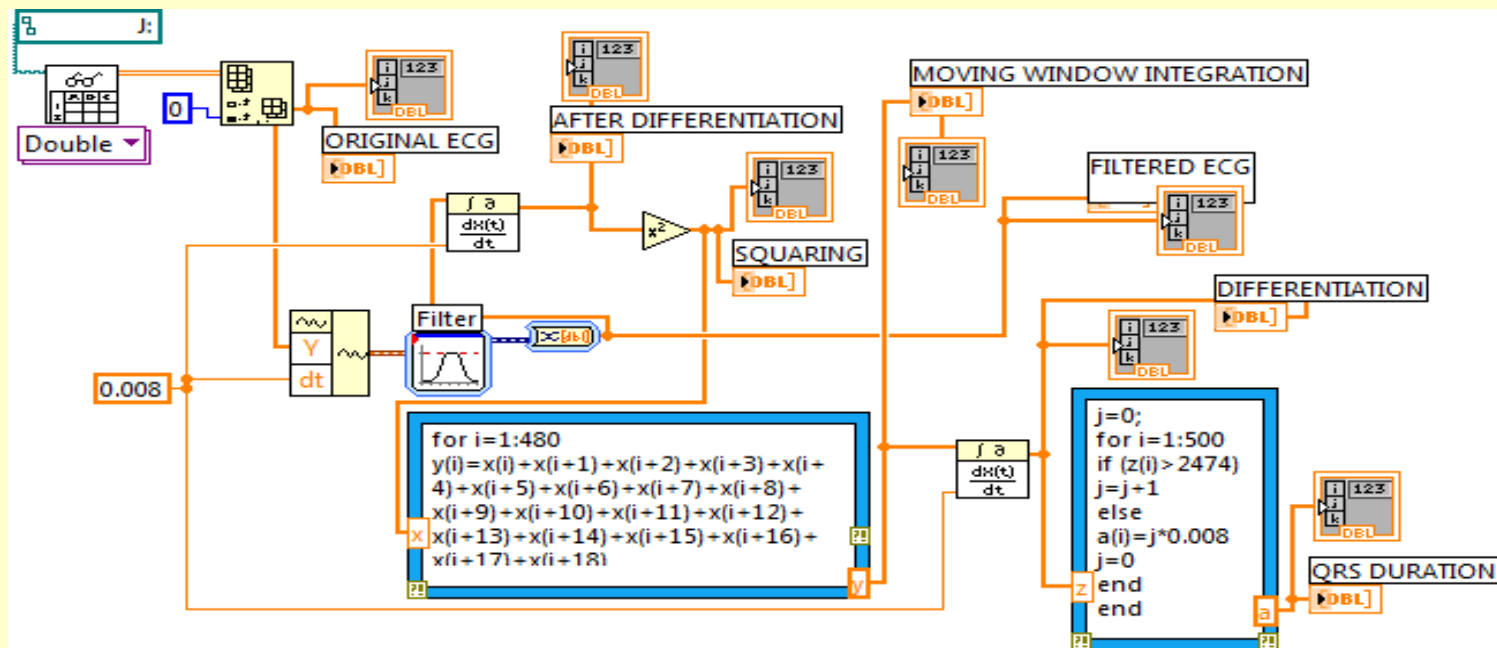
- QRS and QT intervals are calculated on the basis of slope and threshold value of ECG waveforms. A peak detector is used after ECG signal is filtered using Butterworth filter (0.8 to 18Hz) to obtain information about QRS peaks. The signal slope, zero crossing and threshold values are used to determine QRS and QT intervals.

- A window of 500ms after R position is used to determine S & T wave. The T wave peak is assumed to occur at the zero crossing and a window of 200 ms before R position is used to determine Q wave.

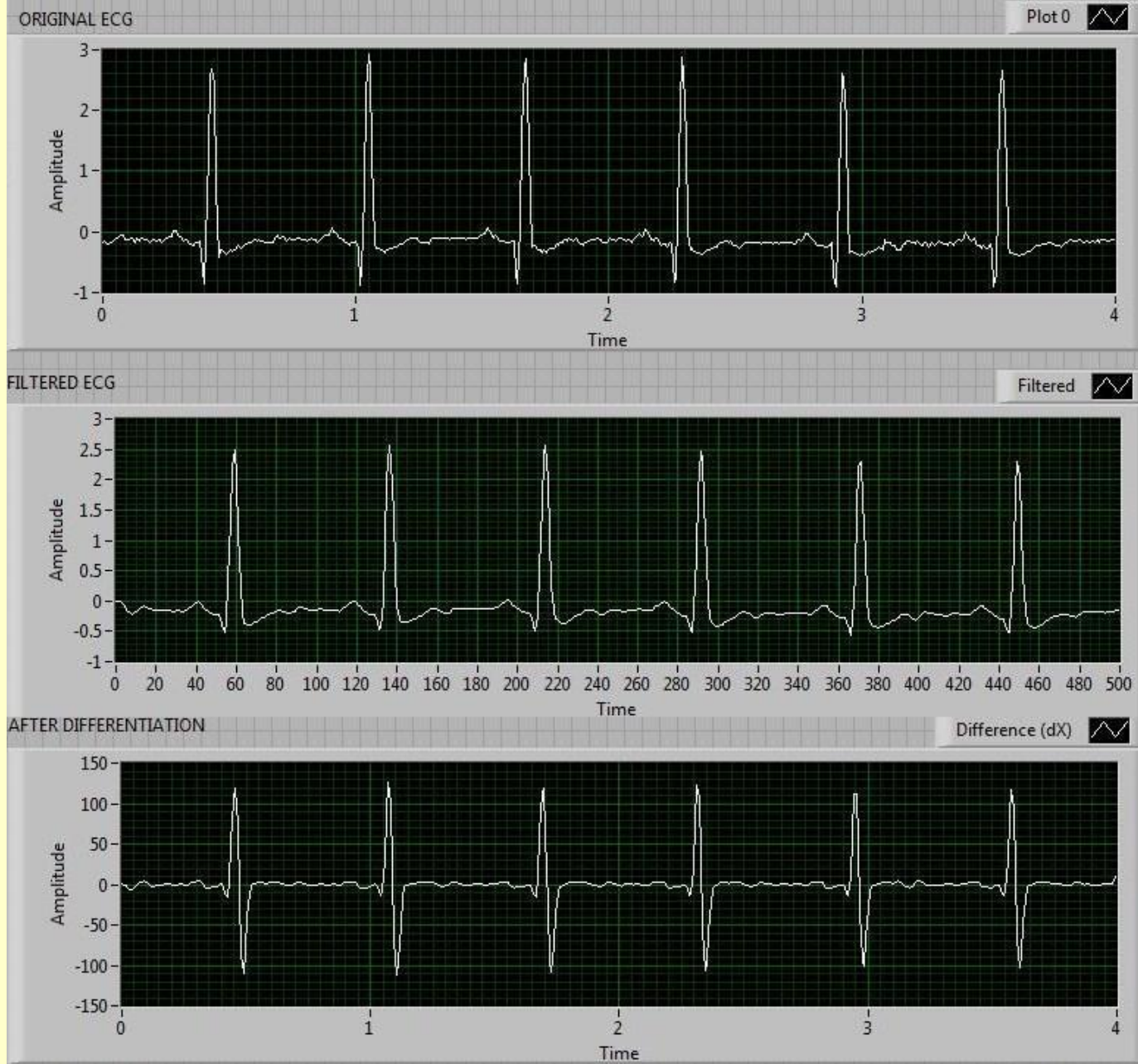
- If the difference between two consecutive heart beat is found more than 100 bpm or less than 60 bpm, an alert condition is sounded on the remote PC for the attention of the doctor. Provision for calculating several other important parameters like QS and QT interval etc. have also been incorporated in auto mode as well as direct display of these parameters on remote PC for the convenience of the doctor to arrive at quick diagnostic conclusion.

QRS Detection

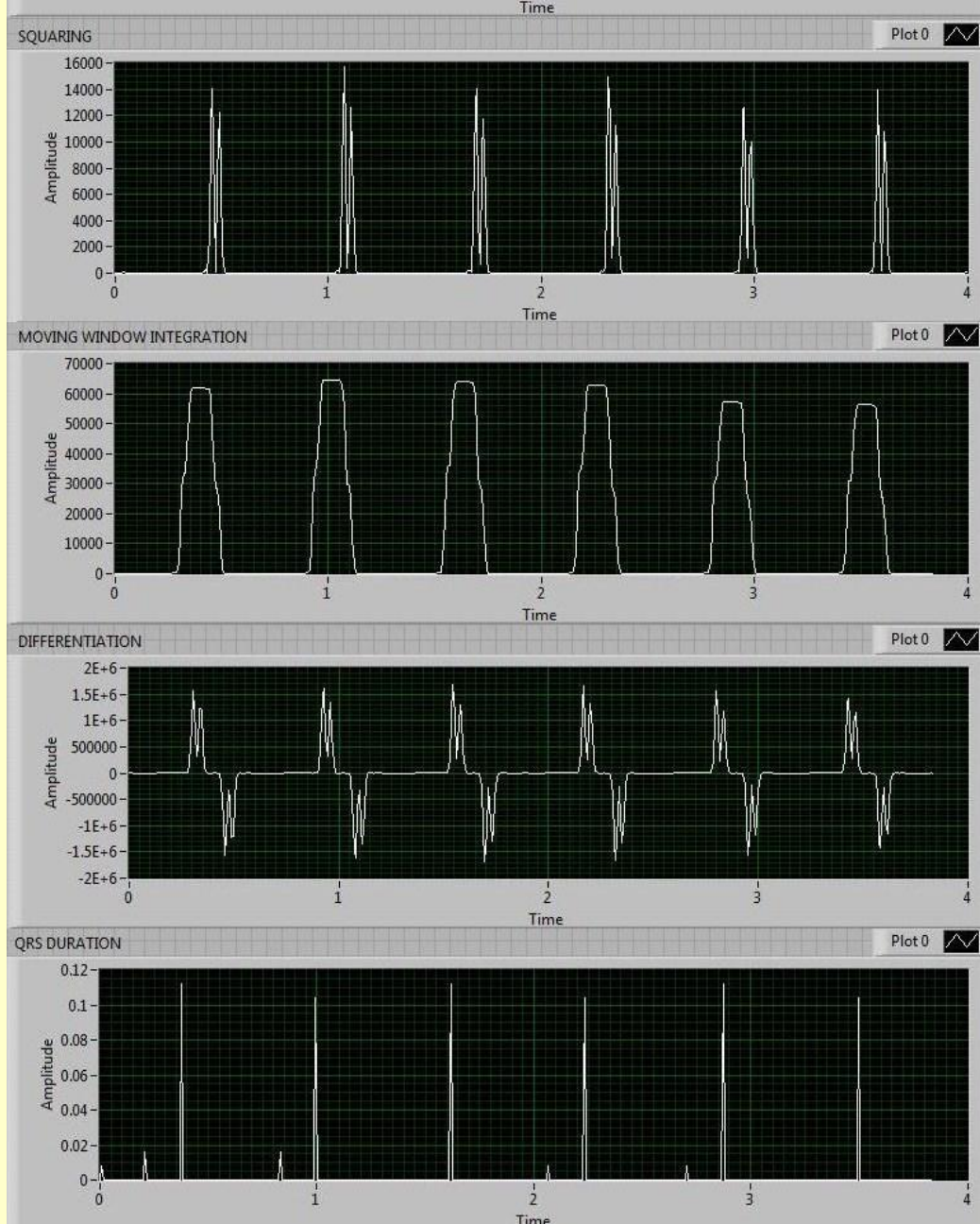
- Lab-VIEW based program was developed to detect QRS complexes using Pan Tompkins method . The program takes on the characteristics features of slope, width and amplitude of the signal. The ECG signal is passed through a band pas filter with upper and lower cut-off frequencies at 12 and 5 Hz respectively to reduce the influence of muscle and 60 Hz interferences, baseline wandering etc. using low thresholds. The results evaluated on samples from MITBIH database show sensitivity of high order. A block diagram implementing the Pan Tompkins algorithm using Lab-VIEW programming is shown in Figure for QRS detection.



Block Diagram of QRS detection



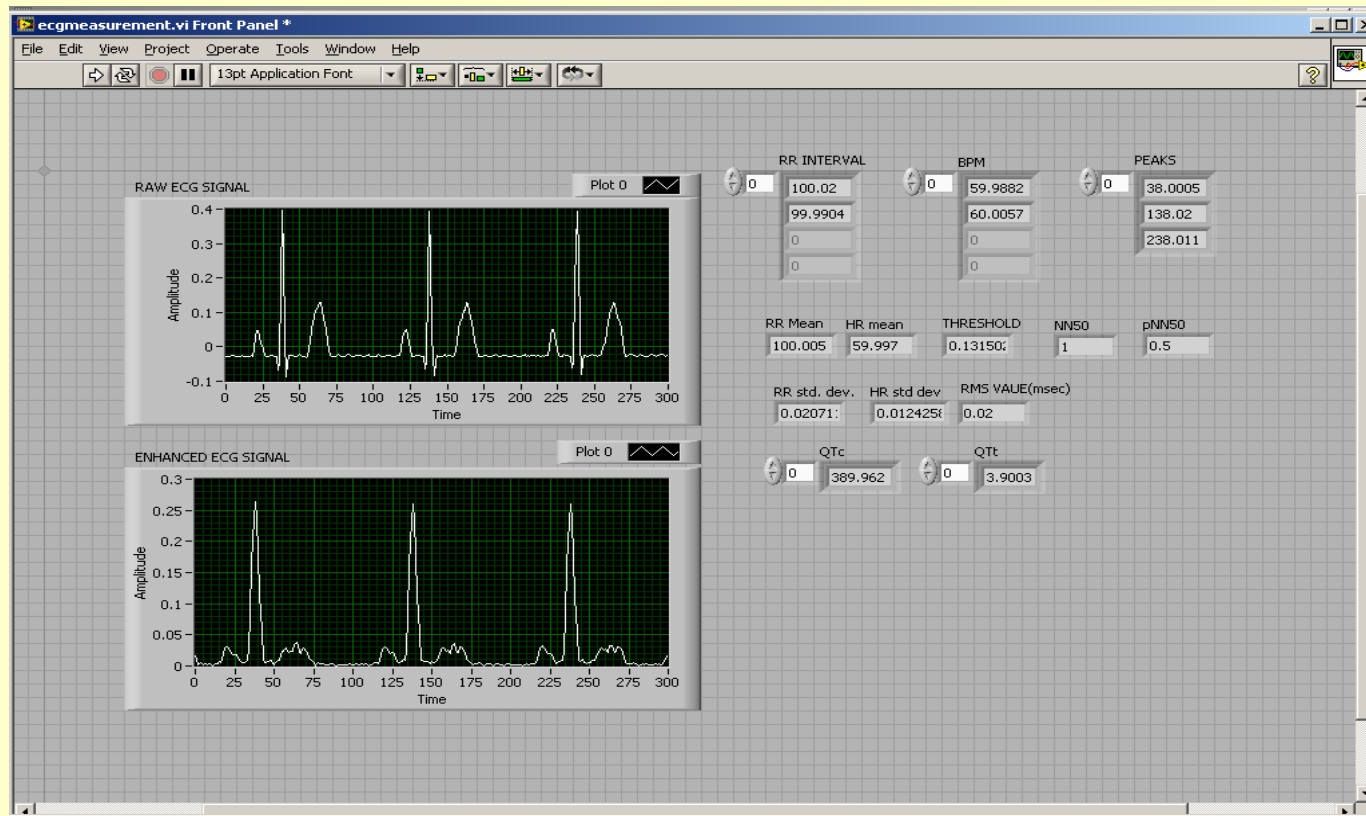
Inputs and Output waveform for Normal Sinus Rhythm (Part 1)

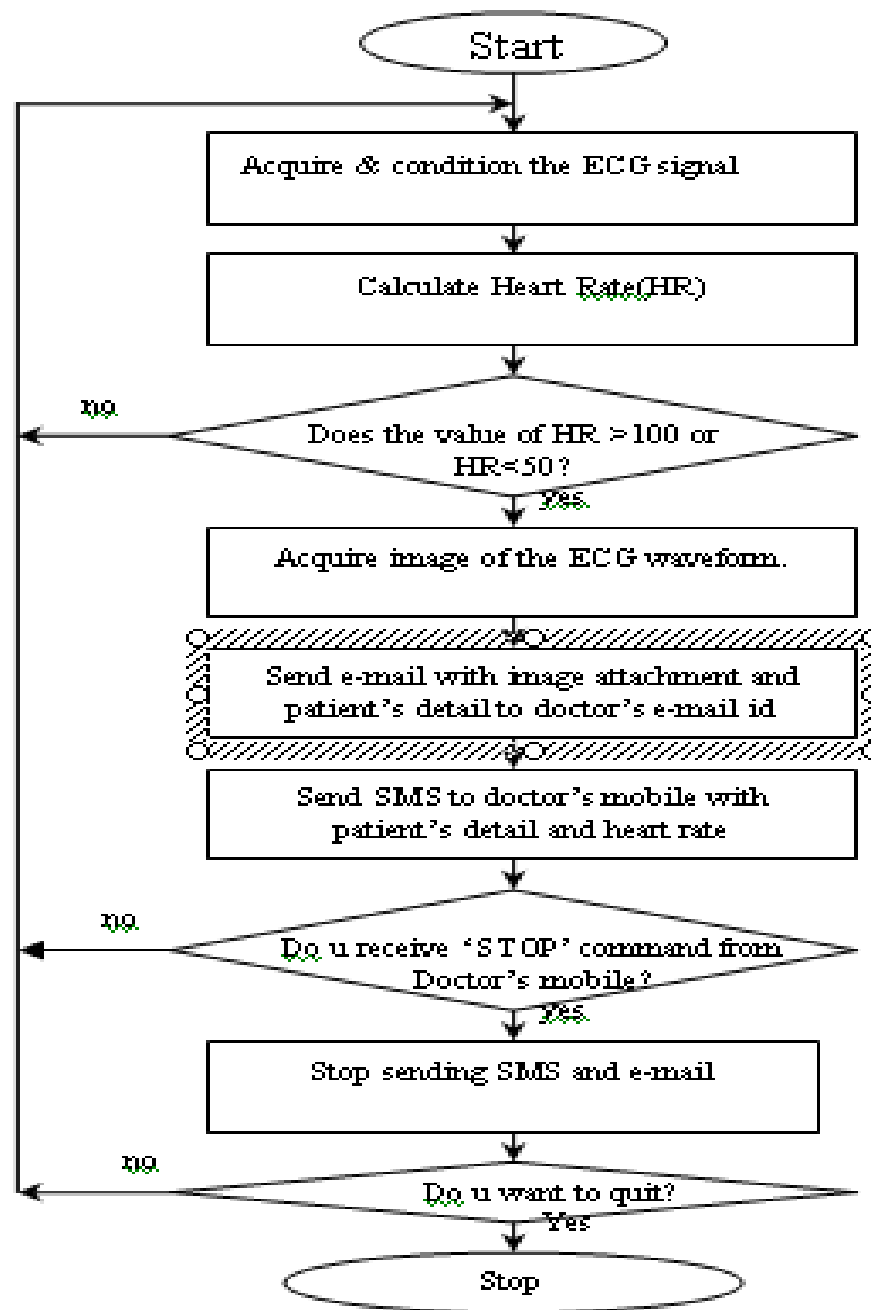


Inputs and Output waveform for Normal Sinus Rhythm (Part 2)

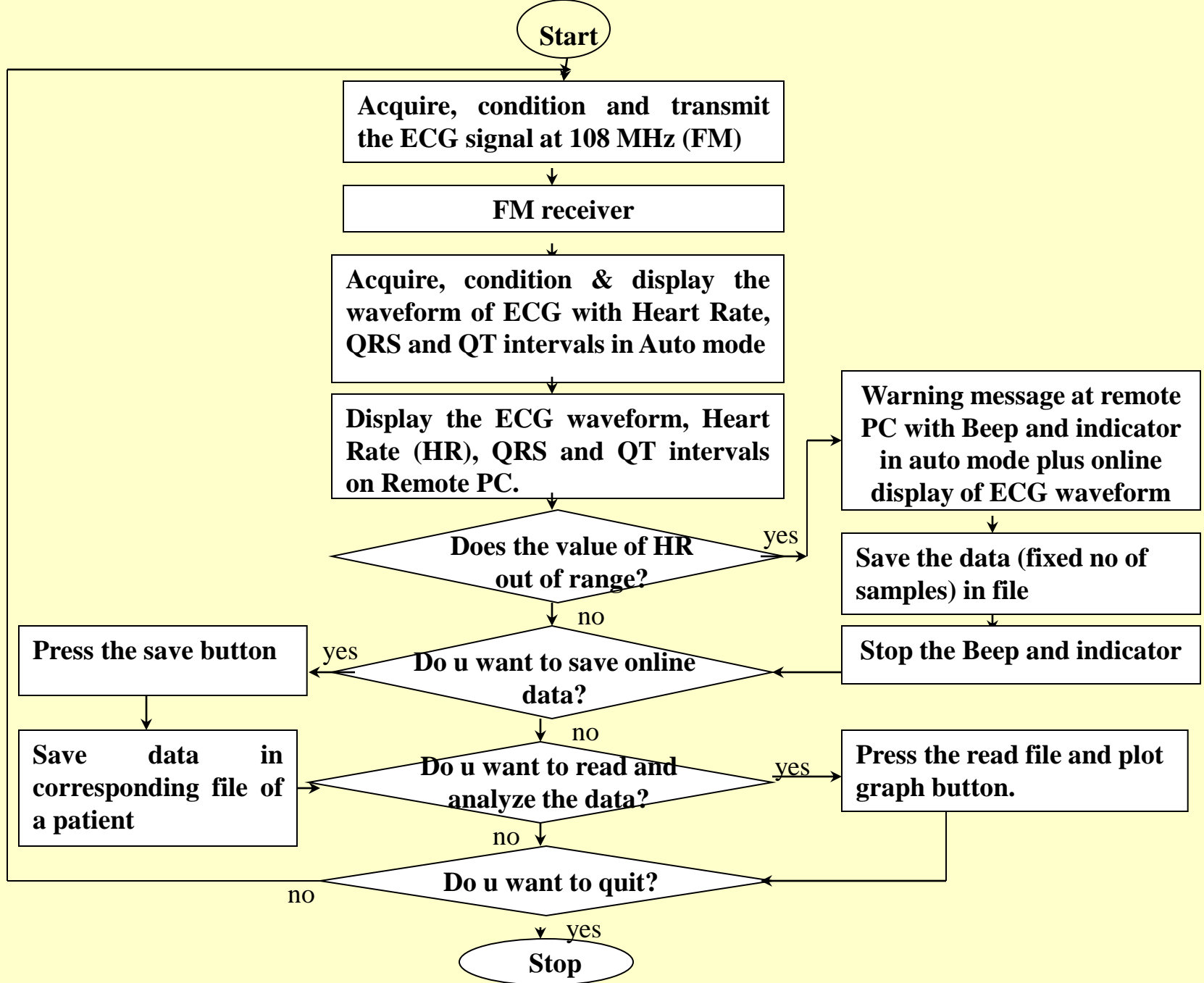
HRV Analysis

The derivative of the signal acquired after filtering and base line wandering elimination using median filter is taken on which Hilbert transform is performed. The reason Hilbert transform is used for these measurements is to turn the ECG signal to an analytic signal, which gives a better peak to detect. This process will give an enhanced ECG signal as compared to raw ECG signal first obtained. Peakdetection.vi algorithm is developed to find all the peaks and their locations by setting appropriate threshold parameters. The RR intervals are extracted by measuring the time interval between two consecutive peaks. Figure shows the RR interval, Peak detection and HRV parameters of ECG Signal





SMS and Email Configuration



Flow Chart for Alert Detection and Delivery

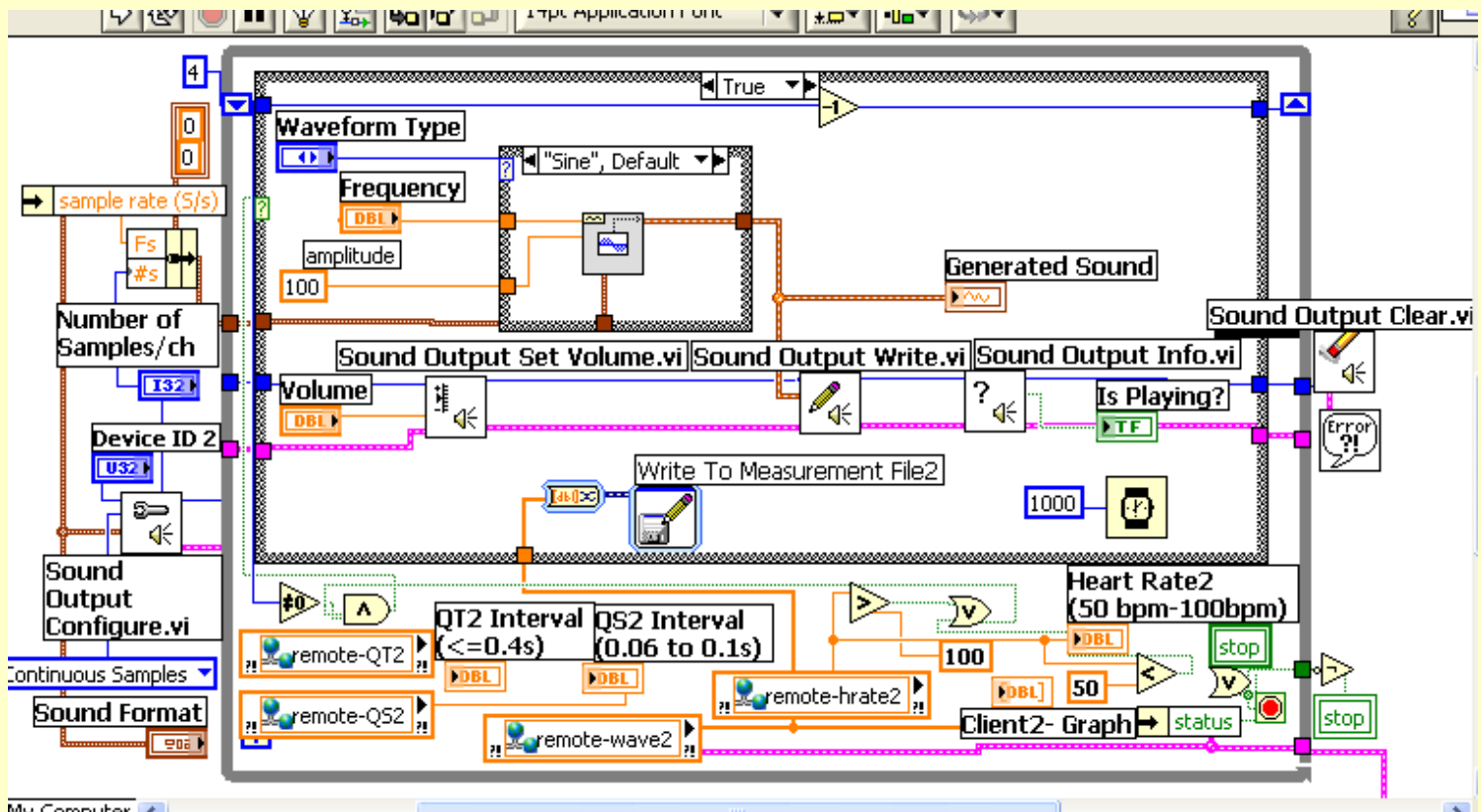
Brief Insight into Lab-View Software

Lab-View Program are called Virtual Instruments or VI's. It contains three components eg. The front panel, the block diagram and the connector plane.

Front panel includes Controls and Indicators.

Block diagram includes wires, front panel icons, functions, possibly Sub VI's and other Lab View objects.

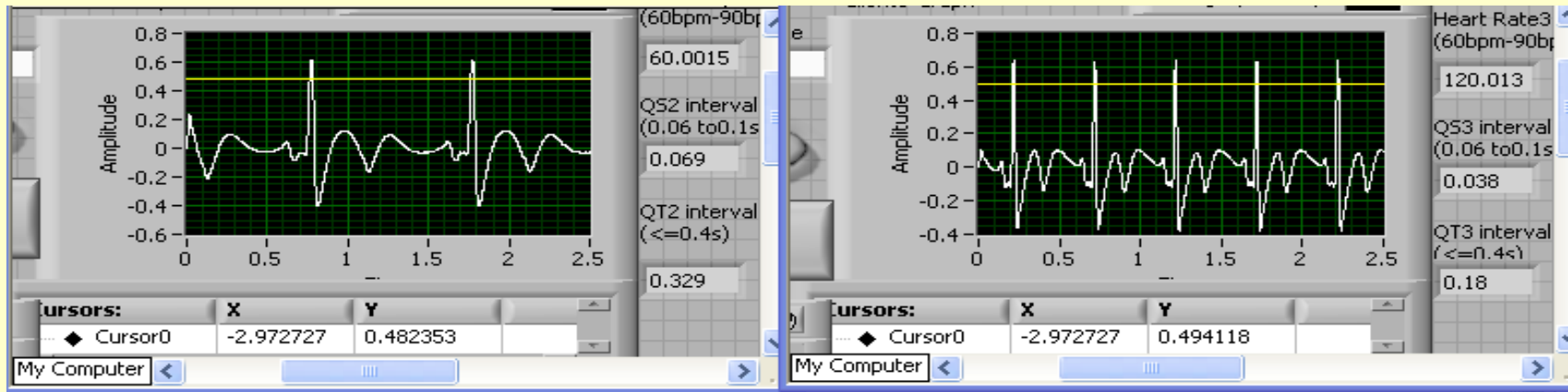
A VI within other VI is called Sub VI, shown below is a block diagram for display and calculating ECG waveform and parameters



Block Diagram for display and calculating ECG waveforms and parameters

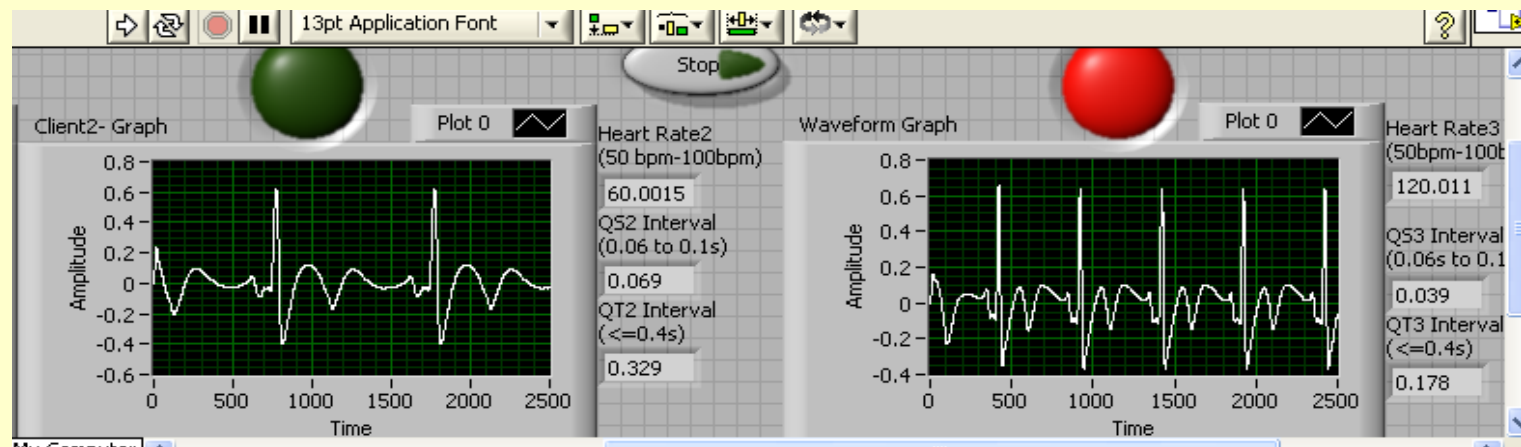
Multifunction Graphical User Interface (GUI's)

Performs a number of tasks such as data acquisition, analysis, send data, receive data, report generation and sounding beep with red/green indicator or remote PC as shown below:



(a)

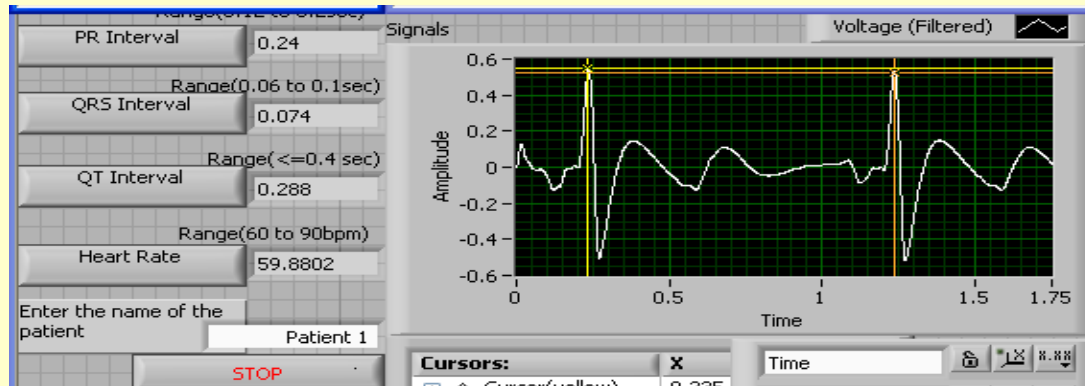
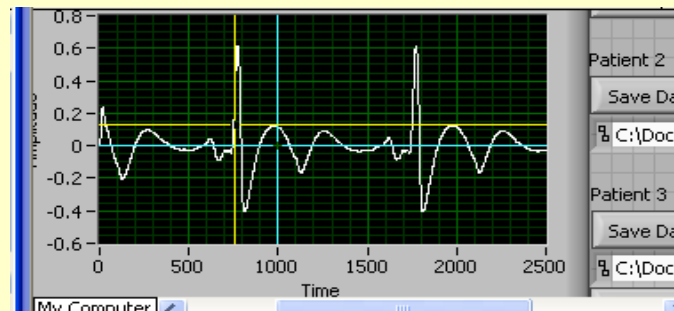
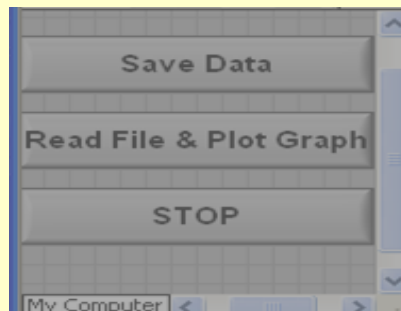
(b)



(c)

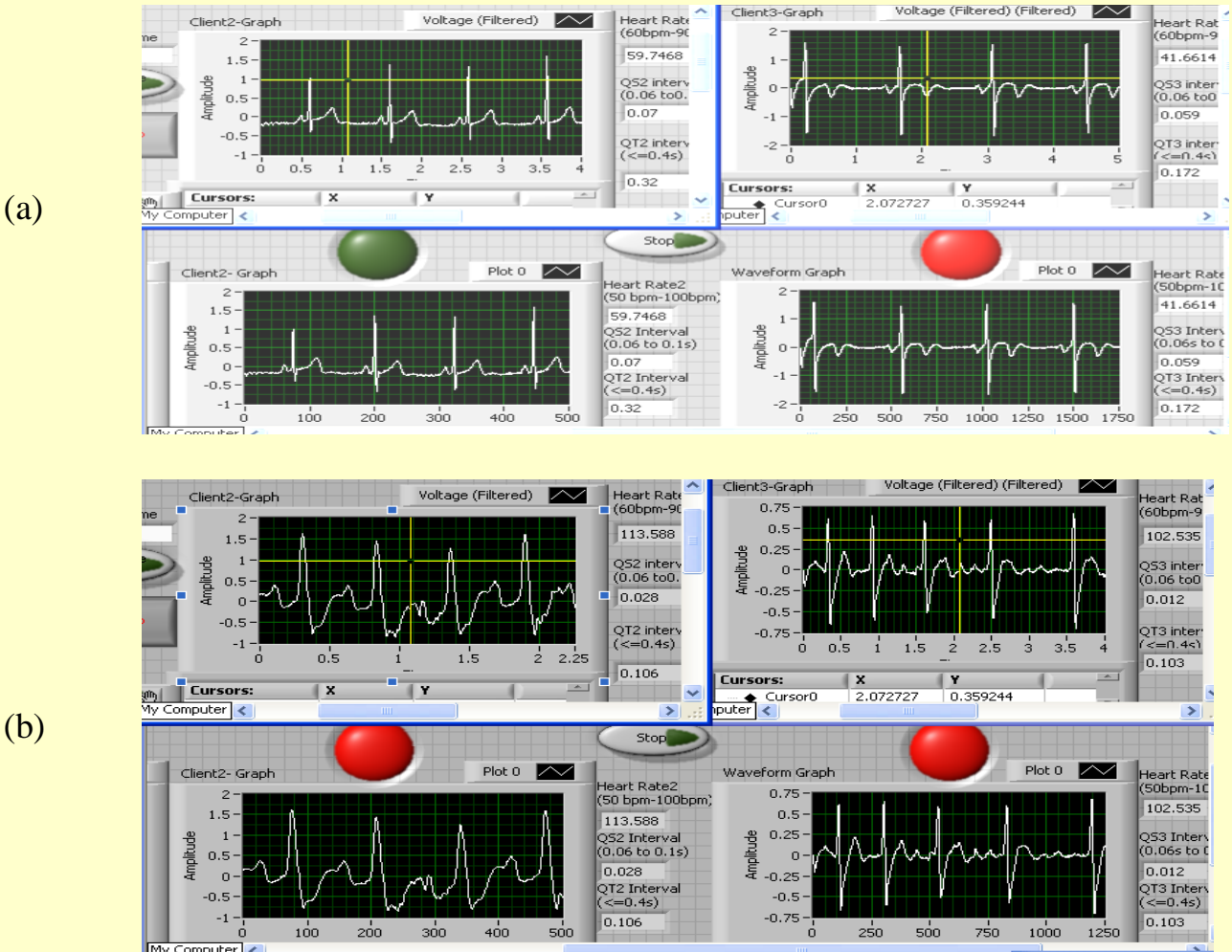
Read File, Plot Graph and Auto Save

- The system records live data for a limited period in auto mode until the doctor attends the patient on remote PC
- The data can also be saved on demand on both PC's by pressing Save Data button on main VI.
- These data files can be downloaded into the remote PC and can be read and plotted back by pressing Read File Plot Graph button on main VI.



Performance Evaluation: A Case Study

- Results of a case study conducted on two different patients with normal heart rate, abnormal heart rate and irregular rhythm are displayed in the following figures.



ECG recording with normal and below normal HR on Local & Remote PC (a)
ECG recording with above normal and irregular rhythm Local & Remote PC (b)

AT Commands

- Computers use AT commands/instructions to control modems. Besides this common AT commands set, GSM/GPRS modems and mobile phone support an AT command set that is specific to the GSM technology, which include SMS-related commands like AT + SMGS (Send SMS message), AT+ CMGS (Send SMS message from storage), AT+ CMGL (List SMS message) and AT+CMGR (Read SMS message).

AT command	Description
AT+CMGF=1	Initiates text mode in mobile phone
AT+CSCA="'+91xxxxxxxxxx'"	Sets the message centre number in mobile phone
AT+CMGS="'+91xxxxxxxxxx'"	Sets the phone number to which SMS is sent
Message	The message to be sent
End of line character	Terminate message and initiate sending

Wait State Active ●

VISA resource name
COM1

message centre no. in +91xx.. format
+919823794241

doctor's mobile no. in +91xx.. format
+918723554778

Message Sent ■

74M 120 Mr Antony De Selva 2008P12 Lilavati

Client 2

Cursors:	X	Y
Cursor0	1.076087	0.897479

Voltage

Patient's Name
Mr Antony De Selva

Id No.
2008P12

Gender
MALE

Age
74

Hospital's Name
Lilavati

Subject of mail
URGENT!!! ECG of a Patient !!!

path to JPEG file
c:\image.jpg

Mail Server Address
mail.nplindia.ernet.in

Sender's Address
singhm@mail.nplindia.ernet.in

Doctor's Email Address
manjus.10@gmail.com

Mail Sent ■

74M 120 Mr Antony De Selva 2008P12 Lilavati

Wait Active State ●

STOP

Heart Rate2 (60bpm-90bpm)
120.005 ●●

Q52 interval (0.06 to 0.1s)
0

QT2 interval (<=0.4s)
0

Sending SMS

Date: Wed, 15 Oct 2008 10:49:41 -0700 

From: manjus.10@gmail.com  

To: singhm@mail.nplindia.ernet.in

Subject: URGENT!!! ECG of a Patient !!!

74M 120 Mr Antony De Selva 2008P12 Lilavati

--

This message has been scanned for viruses and dangerous content by MailScanner, and is believed to be clean.

Attachment 1: image.jpg (32KB) [Delete](#) [WebDisk](#)



Sending Email

Scope for further Research

- Data Compression techniques to be implemented for saving storage space.
- Data security needs to be implemented during data transfer over the network.

Thanks' for your kind attention!!!!!!



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