

# Designing and Manufacturing a Device of Transmission and Recording Vital Signs through Mobile Phone Network

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**Abstract-** The existing design tries to investigate monitoring system of vital signs using mobile phone network located in Eastern Azerbaijan developing science and technology park center. This system involves vital sign measurement including electro cardiogram, heart beats, blood pressure and body temperature. Moreover it identifies patient's health information which is under the control of their own resident. Initial sample obtained from this system was examined and administered by our team members in research unit of growth center. We have used GPS and GPRS in this system. [1] This experiment provides controlling system development; consequently patient vital signs and his health conditions can be expectant at real controlling time while he is out of hospital. Patients' health information can also be registered. More over number of patients can be determined using this system. In spite of this the system can be developed for more controlling complete health. Accordingly underlined system can be used for industrial production, development and real operation with low cost.

**Index Term--** vital signs, heart beats, blood pressure, body temperature, health controlling, chronic patient.

## I. INTRODUCTION

During past decades different portable medical machines have been designed and manufactured. In future, also, to developed communications through wireless communication methods, exiting ways will be used to control personal electronic hygiene development. For example nowadays in most European countries and specially in United states of America, chronic patients provide services using personal electronic machines to gather and send medical vital data to controlling center or to expert medics. In this procedure physician has also a similar manual machine connected to internet and using completely closed GPRS provides services.

This system has been designed and made easy usage, low cost personal electro cardiography having capability of ECG registration everywhere and every time with professional quality. A system of this kind can receive and analyze heart

signals frequently and start to electrocardiography search with first pointing of patient and save them in memory card installed in ECG personal monitor.

Moreover this system can recognize Enfarctus or Aritmic start at exact time which is dangerous for patient health. And can automatically send an alert message to nearest 24 Hour emergency or cure center along with his ECG and electronic file. More over it can send a short message service to medic. The structure of project has been shown in figure (1).

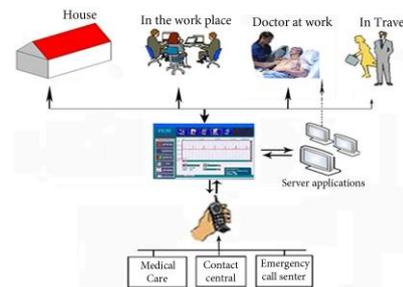


Fig. 1. general view of project structure.

This machine can be used according to need in different conditions including: at home, workplace, or during trip. Depending on alert level or case in which you use it, alerting message along with vital signs including ECG and electronic file is sent to cardiography expert at cure center or controlling center of calls, automatically through an installed GPRS. Input and received data can be transmitted as following to be represented by this device.

- 1-alerting message representing cause and intensity of alarm
- 2-number of patients and recognizing patient place
- 3-ECG signal along with date and time of last ECG
- 4-patient electronic files specially his cardinal record and dangerous elements
- 5- in the case of availability of newest ECG base

6- Clinical symptoms

7-date and time of last ECG

Through counseling with expert medic, center and cardinal expert, in the case of application you can put screen or each type of received data from patient on mobile phone or send received ECG along with related electronic file to cardinal center or to take an action or receive counsel. Regarding medium alarm level (Iskmi doubt or unnatural aritmy) all sent data are saved temporally and represented on screen. Cardiologist or generally medic mobile phone number is saved at patient's memory card call list. Taking patient alarm level into consideration, the related data SMS will provide the considered phone number. The whole structure of this operation along with diagram block can be seen in figure (2).

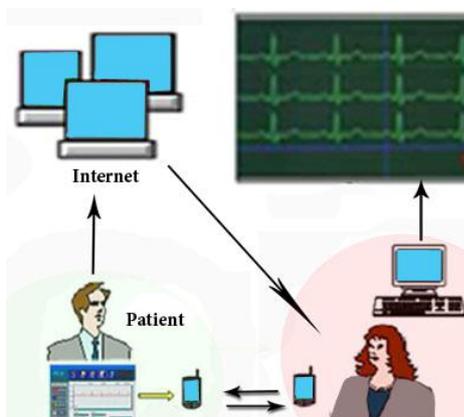


Fig. 2. diagram block of PEM structure

For warning cases, this system sends alert message along with laste date, time and electrocardiography. ECG sends patient's reference and his health electronic file to doctor's workplace and medic will take needed actions automatically regarding server accessibility.

## II. SYSTEM ADMINISTRATION

This system includes heart beat, blood pressure, body temperature, Spo2, ECG. This let's expert medic to visit patient's condition on monitor screen through GPS motor boards.

This system enables related expert doctor to comprehend patient condition data which has been represented by GPRS on computer screen. This system is also provided with, so that whenever patient feels distraught, he would apply for emergency help from doctor by pressing bottom. Data and vital signs will be registered at the same time and computer will send data to hospital and expert doctor through mobile GSM and transmitters. Monitoring system and chronic vital

sign data transmit ion in patient house has been represented in figure (3).

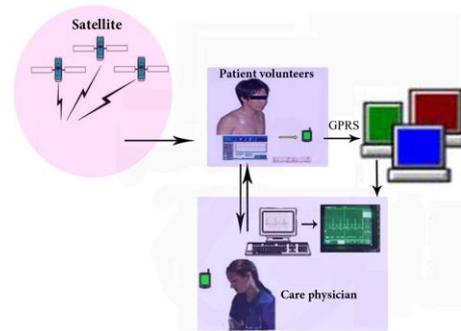


Fig. 3. monitoring System of Vital Signs  
Measurement system of vital signs like: heart beat, blood pressure, spo2 and ECG and body temperature and patient experience is registered in computer memory. After that all vital signs is sent to hospital monitoring center and expert doctor. Vital signs data and files will be arranged in computer and then will be changed to useful information for physicians.

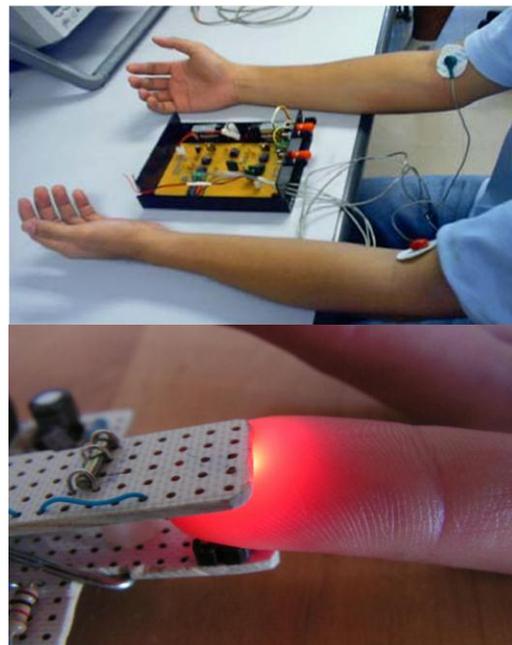


Fig. 4. testing ECG signal sample on a patient

## III. SYSTEM STRUCTURE

The whole structure of system has been shown in figure (4). In fact vital sign monitor is user main board and central monitor is located at hospital. Sending and receiving data between user at home and doctor at hospital is done through designed system and GPS and GPRS. The home has made up of four main units. ECG revealer and transmitter is designed by user body temperature monitor, heart beats monitor and electronic device. Developing vital signs revealers has been performed by research team in our

research center. But monitor is of commercial productions.[4]

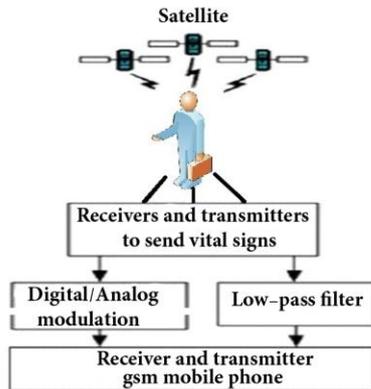


Fig. 5. vital signs and GPS receiver

Used ECG revealer in this system involves ECG amplifiers with Spi output which is transmitted through wireless. Wireless module can transmit ECG signals inside Diameter 1 kilometer. Heart beats monitor was calculated from R-R distance from ECG by computer softwares. And then last data related to measuring last time will be stored at memory card. System monitor involves a GPS antenna for receiving and transmitting signal of user system. There is an input and output port in system number 4. Body temperature degree input, GPRS input, blood pressure input, ECG data input which is initial sample of monitoring system has been shown in figure (3).

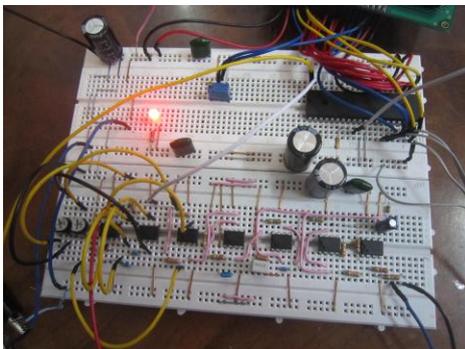


Fig. 6. Signal amplifier circuit ECG

Data stream monitoring is represented on doctor computer screen. Figure (5) shows the time of receiving vital sign data monitor. This data is shown digitally for the first time, then digital vital signs like represented ECG data are processed by a processing algorithm and arithmetic analysis to be changed to analogue data. If there exist any kind of disorder here, then online arithmetic analysis algorithm would not know seven of these disorders officially. Predetermined alarms' threshold for user is in the way that where analyzed data abnormalities are more than alert ring threshold, then the ECG procedure for transmitting data starts. This procedure has arranged data packs in an identified format and data transmit ion starts with modem. These data packs are sent to hospital center through mobile phone to be controlled. For controlling heart beats calculated R-R

distance sent to hospital and at the same time body temperature and blood pressure was sent to control center. To control data , after receiving both data of heart beats and body temperature we determined data in a unified format and then sent them to the hospital . To change operating condition of monitor, patient can do it through pressing underlined bottom.[2]

#### IV. GPS CONDUCTOR SYSTEM

GPS conductor system is made of four sections:

1-GPS receiver motor board

2-Digital to Analog conductor (DAC)

3- Watch circuit for digital to analog conductor (DAC)

4-908 sim circuit to transmit GPRS data

Module is the mediator used in GPS 82-5722 system and has been used with microcontroller to obtain geographical position data. For example geographical width id (N) and geographical length is (E). This module can receive data from 20 satellite channels.[6]

Communicative protocol for communicating with microcontroller and GPS 825722 module output data from geographical width (N) and geographical length (E) is as following:[5]

The used receiver of GPS motor board in this system is commercial product. Used frequency is almost 1.6 GHz which is in extremely high band frequency. GPS receiver can receive satellite position 3 satellite from 1 meter. GPS receiver portable motor was shown in previous figure. GPS motor board output involves wavy shape digital voltage from MAX232 IC and standard voltage RS232. This shape receives the wave resulted from converting digital to analog and converts it to analog. We can transmit analog signal directly or simultaneously can observe it in host system or can save it in memory to analyze them next times.

Clock signals which are digital derives to analog are producing considerable signals and frequencies of side sounds. Sound depends on crystal type and hour frequency can be used with tolerance range of 4 MHz this can be done due to higher frequencies and hour frequency along with signal. Capacitor effect can reduce downfall still there exist more or less.GPS transmitter system structure has been shown in figure (9). GPS board receiver antenna is for receiving position signal from satellite and transmitting signal to hospital controlling system. Before transmitting GPS signal, this signal is digital initially, then digital data positions from converting digital to analog signals by AVR microcontroller and repeated change of digital data to send to mobile phone GSM is always performed.[2]

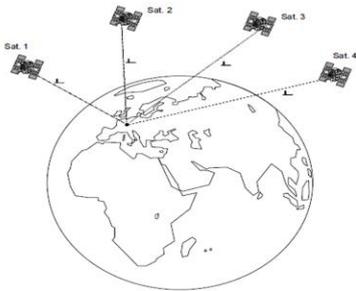


Fig. 7. the relation and GPS position

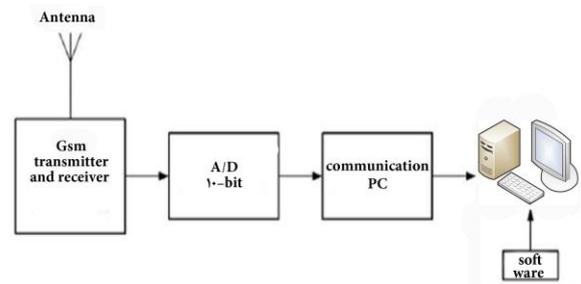


Fig. 10. transmitter and receiver to represent vital signs data

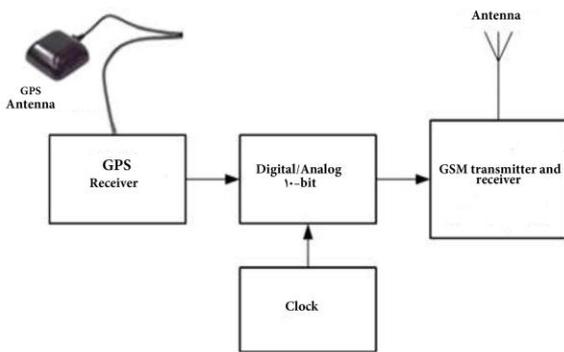


Fig. 8. receiver diagram block in controlling center

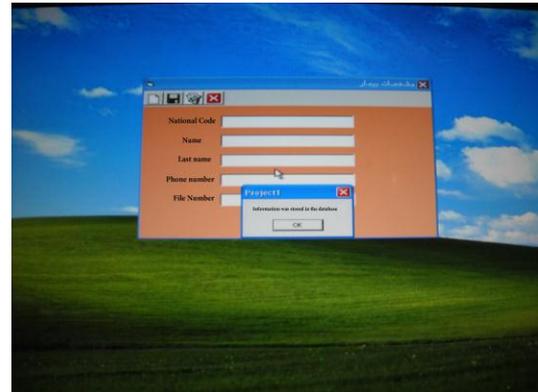


Fig. 11. a sample of vital signs monitoring system test

Receiver rout diagram block in hospital controlling center has been shown in figure (8) this receiver includes mobile phone GSM with analog to digital convertor, AVR microcontroller, mediator between IC and personal computer port cereal.



Fig. 9. experimental sample of micro board and GPRS

V. COMPUTER SOFTWARE STRUCTURE

Computer software is to represent vital sign data (including patient position) in three stages:

- 1-receiving all vital sign data and representing them on doctor computer screen and central hospital monitor
- 2-the device data including geographical length and width position and correcting GPS information
- 3-patient position plan is represented on computer screen.

[7]

VI. DISCUSSION

To convert needed medical data and transit local data to the system located at home, a complete circuit has been considered. Vital signs wireless data has work. Permitted users (medical personnel) will be able to visit and edit installed software on system windows. Representing medical data, medical care tables, used medicine and critical limit file to announce danger is of represented data. And unusual data monitoring is announced automatically. If trigger agent is high in level warning ring will start to perform and it will be represented to medical personnel. [10] Having a system of this kind can not only enable us to have control of patients but also it can reduce medical care costs. More over it gives more relaxation to patient's family members. Although different kinds of long term disease have been increased and chronic patients' physical condition is totally different from other patients, our coming view is to design and make different types of advanced systems on the field of different types of long term chronic disease. Figure (12) indicates direct measurement ratio of current data related to vital signs. Weak condition indicated modulation time of receiver and suitable system condition represents using time of computer software to edit information.

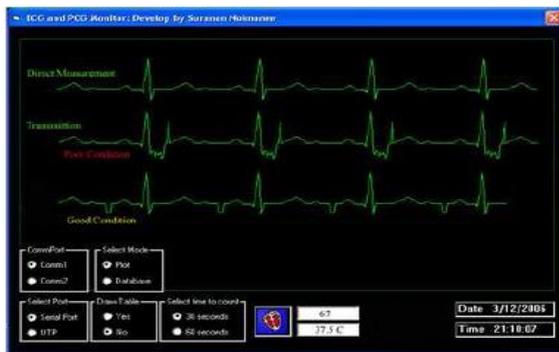


Fig. 12. direct measurement of current data related to vital sign

To facilitate ECG signs analysis and making good decisions, we have installed ECG multi plate to process it. Figure (13) indicates GPS leading plan module on expert doctor's central monitor screen. This system involves mobile phone GSM, system receiver and computer monitor. Figure (14) indicates GPS conductor small plan on medic monitor screen. More over this plan shows patient position in his resident place.



Fig. 13. GPS leading map on monitor screen.



Fig. 14. Typical devices made

## VII. CONCLUSION

Wireless system provides a solution and usual method to measure patient vital sign. This system has been developed to patient condition monitoring from far distance and has different advantages for both patient medic. Although current system cannot monitor the exact time of vital signs, reliable wireless communication and suitable communicative devices have been used in it. And presently

the obtained results paves the way to design and make and finalize monitoring system in our country using wireless network and this indicates an efficient system which can be more useful and have enormous advantages. After one decade of development in wired communication and using far distance communication systems in private hospitals and medical informatics professional hygiene and providing new electronic hygiene specially in home care area and self care through medical computers it can be estimated that citizens and patients will use new technology and scientific and genius research to produce or transmit or find the access to data everywhere and every time. More importantly it will be guarantee for consumer's health and they will be able to perform medical test and vital signs transmit ion at initial stage without expert personnel interference.

In all software structures mobile genius factor is used to facilitate far distance communication. And updating data base memory, patient data and new data gathering at home or reserved mobile areas are registered in XML format. Retrieving efficient and effective data for electronic investigation people health is being done at the moment.

## ACKNOWLEDGMENT

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