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Design of Ethiopia Wolkite Community Family Health Care Monitoring System Using Wireless and Information Communication Technology

Prof.Dr.Eng.PVL Narayana Rao[1], Mr.Eng.PS Abhilash[2],
Mr.Jemal Ahmed Andeta[3], Mr.Habte Lejebo Leka[4]
[1]*Professor of Computer Science Engineering, Dept. of Information System, College of Computing & Informatics, Wolkite University, Ethiopia*
[2]*Staffordshire University, Staffordshire, United Kingdom*
[3]*Dean of the College of Computing and Informatics, Wolkite University, Ethiopia*
[4]*Head of the Dept. of Information Systems, Wolkite University, Ethiopia*

Abstract:- Health monitoring is repeatedly mentioned as one of the main application areas for Pervasive computing.Mobile Health Care is the integration of mobile computing and health monitoring.Mobile devices enable the delivery of accurate medical information anytime anywhere by means of mobile devices. Recent technological advances in sensors, low-power integrated circuits, and wireless communications have enabled the design of low-cost, miniature, lightweight and intelligent bio-sensor nodes.
These nodes, capable of sensing, processing, and communicating one or more vital signs, can be seamlessly integrated into wireless personal or body area networks for mobile health monitoring. This paper, presents a mechanism for estimation of elderly well-being condition based on usage of house-hold appliances connected through various sensing units. Two new wellness functions are defined to determine the status of the elderly persons on performing essential daily activities.
The developed system for monitoring and evaluation of essential daily activities was tested at the homes of four different elderly persons livingalone and the results are encouraging in determining wellness of the elderly.

Keywords:- SMS, GPRS, Zigbee Technology, GSM, RF Communication, Wireless Sensor Network (WSN)

I. INTRODUCTION

The problem found in most hospitals is that the physicianhas to frequently visit the patient and asses his/hercondition by measuring the parameters such astemperature, blood pressure, drip level etc. In case ofemergencies, the nurse intimates the doctor through somemeans of communication like mobile phone. A growingselection of innovative electronic monitoring devices isavailable, but meaningful communication and decisionsupports are also needed for both patients and clinicians.

Health care monitoring systems can help people byproviding healthcare services such as medical monitoring,memory enhancement, medical data access, andcommunication with the healthcare provider in emergencysituations through the SMS or GPRS. Continuous healthmonitoring with wearable or clothing-embeddedtransducers and implantable body sensor networks willincrease detection of emergency conditions in at riskpatients. Not only the patient, but also their families willbenefit from these.

Nowadays, more and more urbanresidents living in the Community and the communitiesbecame ever larger. There is a medical center in a mediumcommunity in general which can provide some treatmentto those common diseases. With the aging society inWolkite, Ethiopia, East Africa more and more elderly will live in urbancommunity. Community health centers can also be afeature that is perfect for the elderly on a regular basis toprovide some basic health care, such as measurement theblood pressure and heart rhythm once a month for theelderly, and keep record of the physical condition forthem.

Meanwhile, the elderly are also looking for this kindof health care, and hope to have a professional to makesome reminders according to his own body status.

Usually the medical center could allocate some medicalstaff to examine on-site for elderly regularly, but withincreased number of older persons in the community, suchon-site service is becoming increasingly costly.

Therefore,we want to design a family telemedicine system, willenable residents examine the health themselves in homewith electronic Sphygmomanometers and other homemedical tools, and coupled with simple operation, theoriginal body health data could transmitted to thecommunity medical center automatically. Replaced thosestaff but improve the efficiency of community medicalcenter services.

II. SYSTEM ARCHITECTURE

The System Architecture has two sections. They are

1. Patient Section
2. Control Room Section

1. Patient section:

Fig.1 represents the patient section. Here patient data isobserved unceasingly by victimization wireless devicenetworks, i.e., Temperature and heart beat of patient. Thisdata is forwarded to the room section by victimization Zigbee technology [3].

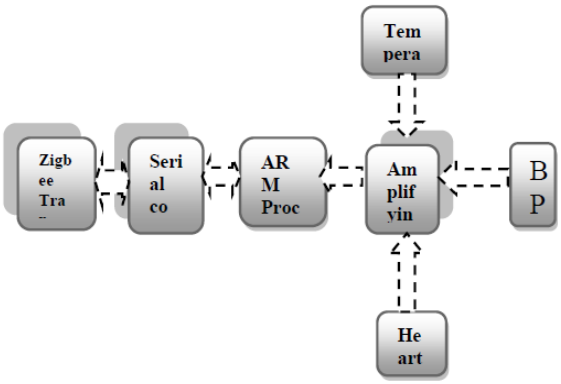


Fig1.Patient Section

2. Control room section:

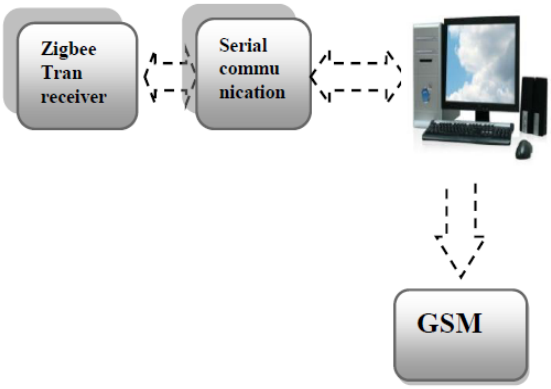


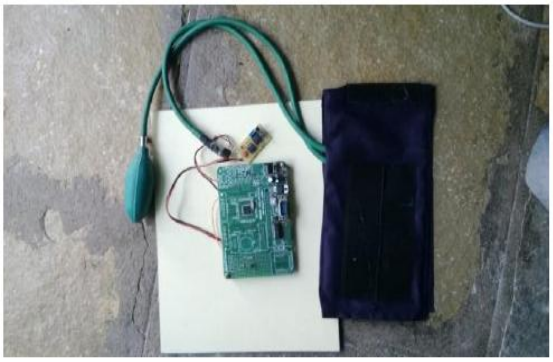
Fig.2 Control Room Section

2. Control room section:

Fig. 2 represents the control room section. Herepatient data from patient section is received by Zigbeereceiver in control room section.

Here system programwill checks the patient information and stores in thedatabase also send this data by GSM technology if anycondition occurs. A real time health monitoring system awearable device. This device will be wearied by thepatient and parameters such as ECG, Temperature andHeart Beat will be continuously transmitted and monitorthrough wireless technology Zigbee[3].

3. ARM Processor:



3. Fabrication Kit

ARM7 Processor as shown in fabrication kit
Fig.3. The ARM7 family includes the ARM7TDMI, ARM7TDMI-S, ARM720T, and ARM7EJ-S processors. The ARM7TDMI core is the industry's most widely used32-bit embedded RISC microprocessor solution.

Optimized for cost and power-sensitive applications, theARM7TDMI solution provides the low power consumption, small size, and high performance needed importable, embedded applications.

The ARM7TDMI core uses a three-stage pipeline to increase the flow of instructions to the processor. This allows multiple simultaneous operations to take place and continuous operation of the processing and memory systems.
(1) Operating modes: The ARM7TDMI core hasseven modes of operation

- User mode is the usual program execution state
- Interrupt (IRQ) mode is used for general purpose
- interrupt handling
- Supervisor mode is a protected mode for the
- operating system
- Abort mode is entered after a data or instruction
- pre fetch abort
- System mode is a privileged user mode for the
- operating system
- Undefined mode is entered when an undefined instruction is executed.

The interrupt settings of ARM support the DHLS toresponse to the interrupt coming from the server section.
(2) Interrupt controller: The Vectored InterruptController (VIC) accepts all of the interrupt request inputsfrom the home server section and categorizes them as FastInterrupt Request (FIQ), vectored Interrupt Request (IRQ),and non-vectored IRQ as defined by programmablesettings. So ASRS system can able to separate thecommand signals and easily will select the speed in the Vehicle.

III. SENSOR NETWORK

A **wireless sensor network (WSN)** consists of spatiallydistributed autonomous sensors to monitor physical orenvironmental conditions, such as temperature, sound,pressure, etc. and to pass their data through the network toa main location. The more modern networks are bidirectional,also enabling *control* of sensor activity. Thedevelopment of wireless sensor networks was motivatedby military applications such as battlefield surveillance;today such networks are used in many industrial andconsumer applications, such as industrial processmonitoring and control, machine health monitoring, and soon.

The WSN is built of "nodes" – from a few to severalhundreds or even thousands, where each node is connectedto one (or sometimes several) sensors. Each such sensornetwork node has typically several parts: a radiotransceiver with an internal antenna or connection to anexternal antenna, a microcontroller, an electronic circuitfor interfacing with the sensors and an energy source,usually a battery or an embedded form of energyharvesting.

A sensor node might vary in size from that of ashoebox down to the size of a grain of dust, althoughfunctioning "motes" of genuine microscopic dimensionshave yet to be created. The cost of sensor nodes isranging from a few to hundreds ofdollars, depending on the complexity of the individualsensor nodes. Size and cost constraints on sensor nodesresult in corresponding constraints on resources such asenergy, memory, computational speed andcommunications bandwidth. The topology of the WSNscan vary from a simple star network to an advanced multichipwireless mesh network. The propagation techniquebetween the hops of the network can be routing orflooding.In this health care monitoring system we are using twosensors

1. Heart Beat Sensor
2. Temperature Sensor

1. Heart Beat Sensor

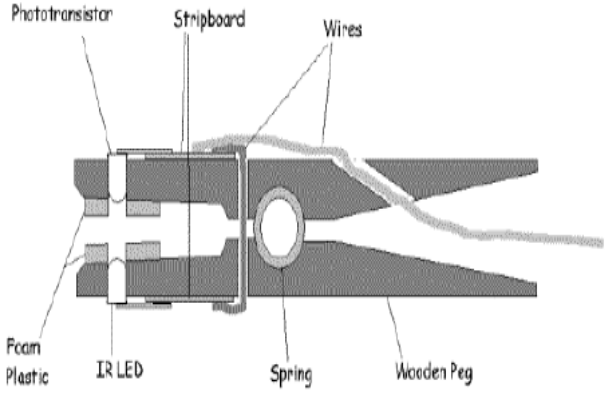


Fig.4 Heart Beat Sensor

The Heart Beat sensor is shown in Fig. 4 consists of a lightsource and photo detector; light is shone through thetissues and variation in blood volume alters the amount oflight falling on the detector. The source and detector canbe mounted side by side to look at changes in reflectedlight or on either side of a finger or earlobe to detectchanges in transmitted light.

The particular arrangementhere uses a wooden clothes peg to hold an infra-red lightemitting diode and a matched phototransistor.

The infra-red filter of the phototransistor reduces interference fromfluorescent lights, which have a large AC component intheir output.

2. Temperature Sensor

The Temperature Sensor is LM35 shown in

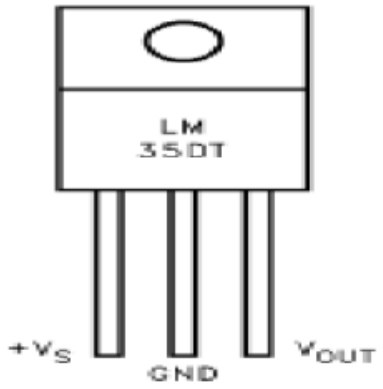


Fig.5 Temperature Sensor

TheLM35 series are precision integrated-circuit temperaturesensors, whose output voltage is linearly proportional tothe Celsius (Centigrade) temperature.

The LM35 thus has an advantage over linear temperaturesensors calibrated in ° Kelvin, as the user is not required tosubtract a large constant voltage from its output to obtainconvenient Centigrade scaling. The LM35 does not requireany external calibration or trimming to provide typicalaccuracies of ±1⁄4°C at room temperature and ±3⁄4°C over
A full −55 to +150°C temperature range. Low cost isassured by trimming and calibration at the wafer level.

The LM35's low output impedance, linear output, andprecise inherent calibration make interfacing to readout orcontrol circuitry especially easy. It can be used with singlepower supplies, or with plus and minus supplies. As itdraws only 60 μA from its supply, it has very low self heating,
less than 0.1°C in still air. The LM35 is rated tooperate over a −55° to +150°C temperature range, whilethe LM35C is rated for a −40° to +110°C range (−10° with

Improved accuracy). The LM35 series is availablepackaged in hermetic TO-46 transistor packages, while theLM35C, LM35CA, and LM35D are also available in theplastic TO-92 transistor package. The LM35D is alsoavailable in an 8-lead surface mount small outline packageand a plastic TO-220 package.

IV. WIRELESS COMMUNICATION

A. **GSM Technology**

Fig.6 represents GSM Modem. The GSM/GPRS Modemcomes with a serial interface through which the modemcan be controlled Using AT command interface. An
antenna and a power adapter are provided.

The basic segregation of the modem is as under:

- Voice calls
- SMS
- GSM Data calls
- GPRS

To achieve important information of cars, one GSMModule is added into the car security system. SiemensTC35I GSM modem can quickly send SMS messages toappointed mobile phone or SMS server. So the owner andthe police can be informed at the first time. If anotherGPRS module is added in, the image data could also sentto information.

A GSM modem can be an external deviceor a PC Card / PCMCIA Card. Typically, an externalGSM modem is connected to a computer through a serialcable or a USB cable. A GSM modem in the form of a PCCard / PCMCIA Card is designed for use with a laptopcomputer. It should be inserted into one of the PC Card /PCMCIA Card slots of a laptop computer. Like a GSMmobile phone, a GSM modem requires a SIM card from awireless carrier in order to operate. As mentioned inearlier sections of this SMS tutorial, computers use ATcommands to control modems. Both GSM modems anddial-up modems support a common set of standard ATcommands. You can use a GSM modem just like a dial-upmodem.

Fig.6 GSM Modem

GSM modems support an extended set of AT commands.These extended AT commands are defined in the GSMstandards. With the extended AT commands, you can dothings like

- Reading, writing and deleting SMS messages.
- Sending SMS messages.
- Monitoring the signal strength.
- Monitoring the charging status and charge level
- Of the battery.
- Reading, writing and searching phone bookentries.

B. Zigbee module

Fig.7 Zigbee Module

Fig.7 represents the Zigbee module. TheXbee/Xbee-PRO RF Modules are designed to operatewithin the ZigBee protocol and support the unique needsof low-cost, low-power wireless sensor networks. Themodules require minimal power and provide reliabledelivery of data between remote devices. The modulesoperate within the ISM 2.4 GHz frequency band and arecompatible with the following:

- XBee RS-232 Adapter
- XBee RS-232 PH (Power Harvester) Adapter
- XBee RS-485 Adapter
- XBee Analog I/O Adapter
- XBee Digital I/O Adapter
- XBee Sensor Adapter
- XBee USB Adapter
- XStick
- Connect Port X Gateways
- XBee Wall Router.

The XBee/XBee-PRO ZB firmware release can beinstalled on XBee modules. This firmware is compatiblewith the ZigBee 2007 specification, while the ZNet 2.5firmware is based on Ember's proprietary "designed forZigBee" mesh stack (EmberZNet 2.5). ZB and ZNet 2.5firmware are similar in nature, but not over-the-aircompatible. Devices running ZNet 2.5 firmware cannottalk to devices running the ZB firmware [5].

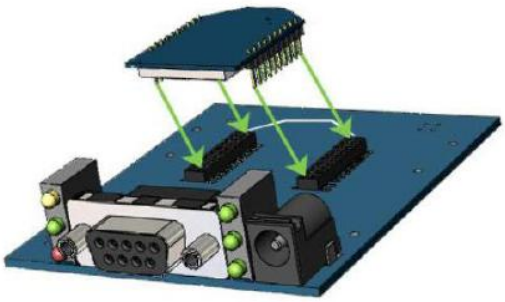


Fig.8 Zigbee Module mounting to an RS232 Interface Board

The XBee modules were designed to mount intoa socket and therefore do not require any soldering whenmounting it to a board is shown in fig .8.

Medical Section

The patient data from patient section is receivedto the monitoring section by RF communication. ThisRFcommunication consists of two types.

1. RF Transmitter
2. RF Receiver

1. RF Transmitter:

The TWS-434 extremely small, and are excellent forapplications requiring short-range RF remote controls.
The TWS-434 modules do not incorporate internalencoding.

If simple control or status signals such as buttonpresses or switch closures want to send, consider using anencoder and decoder IC set that takes care of all encoding,error checking, and decoding functions.

The transmitter output is up to 8mW at 433.92MHz witha range of approximately 400 foot (open area)outdoors. Indoors, the range is approximately 200 foot,and will go through most walls.

T he TWS-434 transmitteraccepts both linear and digital inputs can operate from 1.5to 12 Volts-DC, and makes building a miniature hand-heldRF transmitter very easy.

2. RF receiver:

RWS-434: The receiver also operates at 433.92MHz, andhas a sensitivity of 3uV. The WS-434 receiver operatesfrom 4.5 to 5.5 volts-DC, and has both linear and digital
outputs.

A 0 volt to Vcc data output is available on pins. Thisoutput is normally used to drive a digital decoder IC or amicroprocessor which is performing the data decoding.

The receiver's output will only transition when valid datais present. In instances, when no carrier is present the output will remain low. The RWS-434 modules do notincorporate internal decoding.

If you want to receiveSimple control or status signals such as button presses orswitch closes, you can use the encoder and decoder IC setdescribed above.

Decoders with momentary and latched outputs are available.

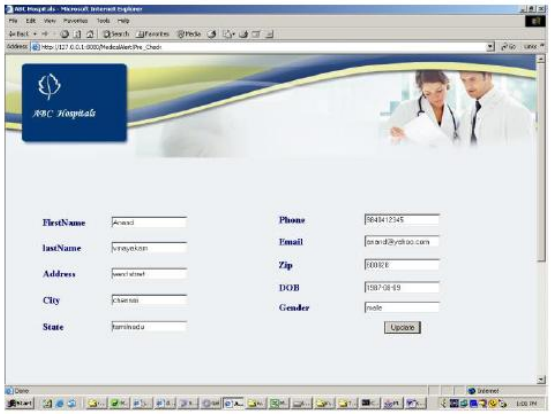


Fig.9 Medical observations

Fig.10 Medical observations

Fig.9 represents the patient health conditions ofhis body Temperature, Blood Pleasure and Heart Beat,which are stored in the data base by using visual basicsand also every time we can monitor the patientinformation.

V. CONCLUSION

This paper illustrates an approach of how to design andimplement an ARM-based embedded system, which issimple, stable, very easy to use at home for the elderlypersons in a community and also very convenient to all ofthe community residents.

The system has a goodscalability. The residents can access the community serverto check themselves' health information without otherssoftware but a computer with IE.

Doctors can review apatient's former health information via internet too whenthey diagnose the patient.

As a result, this system wouldhave a widely use in future.

REFERENCES

[1] " International Conference on Information andNetwork Technology", IPCSIT vol.4 [2011] IACSITPress, Singapore.

[2] Zhou Xiao, Li Jiaming, Pu Junjia, Yang HI, " Thedesign and implement of Mobile Remote Medical WardSystem." Computer Engineering. 2010.

[3] Sahandi, R., Noroozi, S., Roushanbakhti, G., Heaslip,V. & Liu, Y., 2010. "Wireless technology in theevolution of patient monitoring on general hospitalwards". Journal of Medical Engineering and Technology,34[1], 51-63 pages.

[4] Wu Xingyong, Zhao Jiasong, Wu Wendou, Zhou Bing,Wu Xingyu, "The research of country remote medicalplatform base on component," 2010.

[5] Krejcar, O., Janckulik, D., Motalova, L., Kufel, J.,"Mobile Monitoring Stations and Web Visualization ofBiotelemetric System - Guardian II", Europe Comm 2009,LNICST vol, 16, pp. 284-291. R. Mehmood, et al. (Eds).Springer, Heidelberg [2009].

[6] Safaric S., Malaric K., "ZigBee wirelessstandard",Multimedia Signal Processing andCommunications, 48th International Symposium ELMAR-2006, Zadar, Croatia, June 2006.

BIOGRAPHIES

PVL Narayana Raowas born in Vijayawada, Krishna District, Andhra Pradesh, India. He completed M.Tech. from Sam Higginbottom Institute of Agriculture, Technology and Sciences Deemed Universiity (Formerly Allahabad Agricultural Institute),UP, India and PhDin Computer Science Engineering from Lingaya's University, Faridabad, Haryana State, India. He has 21 years of teachingexperience in reputed India Post Graduation Engineering Colleges, Teaching experience in different Universities of Foreign Country and 4 years Industrial Experience in India as a System Analyst, Systems Developer. He ispresently working as Professor (CSE), Wolkite University, SNNPR, Wolkite, Ethiopia, and East Africa. He is a member of various professionalsocieties likeWASET,USA, IAEng, Hongkog and CSE, Ethiopia. He has various publications in theNational and International Journals. His email id is **prao9039@gmail.com** and alternative email id is: **raopvlnr2004@yahoo.co.uk.**

PS ABHILASHwas born in Vijayawada, Krishna District, Andhra Pradesh, India. He completed M.S in Tele Communication Engineering from Staffordshire University, Staffordshire, United Kingdom in 2013. He has various publications in the International Journals. His email id is **sivaabhilash474@gmail.com**

JEMAL AHMEDANDETAwas born in Arekite, SNNPR, Ethiopia, and East Africa. He completed his graduation in Information Science from Haremaya University, Ethiopia, East Africa and presently working as the Dean of the college of Computing and Informatics in Wolkite University, Wolkite, Ethiopia.His email id is **jaaselam2000@gmail.com.**

HABTE LEJEBOLEKAwas born in Arba Minch, SNNPR, Ethiopia, and East Africa. He completed his graduation in Information System from Addis Ababa University, Ethiopia and now he is working as Head of the Department of Information System in Wolkite University, Wolkite, Ethiopia. His email id is **lejebohabte@gmail.com.**