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GPRS and MCU based isolated wireless communication system

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***Abstract*— The Internet and it's applications are considered as one of the pillars of future internet. This paper implements application of GPRS communication system based on embedded system and wireless communication technology. Here I design a real time health monitoring system which becomes major bridge between patient and a doctor. Developing a hardware which will sense heart rate and temperature of patient, using GPRS modem contain simcard, all information lively transmitted to server PC (Doctor's PC). At server the received data compared with standard threshold maximum and minimum value. Normal range of heart rate is 60 to 135 and temperature of patient is between 95 and 104F. If at all the rate increased above maximum or decrease below minimum value then alert is generated which informs doctor that patient is in critical situation. It is able to send parameters of patient in real time. It enables the doctor to monitor patient's parameters in real time using http protocol.**

For transmitting data from simcard to the server using GPRS, here we need to create a website on data will be continuously transmitted from GPRS modem to the website and from website data will be downloaded continuously on the server. Thus the system helps in tracking down the patient without getting the patient into any sort of communication.

***Index Terms*—sensors, ARM7 microprocessor, GPRS UART modem, HTTP protocol.**

I. INTRODUCTION

General:

M2M is about enabling the flow of data between machines and machines and ultimately machines and people. Regardless of the type of machine or data, information usually flows in the same general way - from a machine over a network, and then through a gateway to a system where it can be reviewed and acted on.There are four basic stages that are common to just about every M2M application. Those components are:

1) Collection of data

2) Transmission of selected data through a communication network

3) Assessment of the data

4) Response to the available information

1) Collection of Data:

The process of M2M communication begins with taking data out of a machine so that it can be analyzed and sent over a network. Monitoring a machine may mean directly connecting to and monitoring one or more limit switches or analog outputs. With an intelligent electronic device, it

may be possible to simply connect to the equipment's serial port and ask for the data.

The goal of the M2M hardware is to bridge the intelligence in the machine with the communication network. An intelligent wireless data module is physically integrated with the monitored machine and programmed to understand the machine's protocol (the way it sends and receives data).

If the monitored machine is configured as an intelligent master device, it may treat the M2M device as a simple wireless modem, loading it up with data and then instructing it to transmit that data to the network. If the machine is just a collection of switches and sensors or is an intelligent slave device, the M2M device can act as the master device. In this mode, it takes charge by periodically polling the device by reading the sensors and switches or by sending data requests through the serial port.

2) Transmission of data through a communication network:

There are several good options for transporting data from the remote equipment to the network operation center. The cellular network, telephone lines, and communication satellites are all common solutions.

The telephone may be the best choice if a line is already installed and the cost can be shared with other uses. Its disadvantage is usually the ongoing monthly cost and sometimes the cost and difficulty of installation.

The wide spread coverage of the cellular network is the main reason M2M is getting so much attention these days, and it's usually the method that fits best. There are several methods of sending data over the cellular network. CDMA and GPRS are both widespread in North America today and their coverage areas continue to grow. The advantage of these systems is the ability to send large amounts of data frequently. The costs continue to drop.

3) Assessment of the data:

Data from a company's networked machines usually shows up in one of two places: in an enterprise software application the company already uses, or in a standalone system designed specifically for M2M.

Today's deployments tend to favor standalone systems for applications such as remote monitoring because most M2M application providers specialize in providing these and there can be additional costs involved with integrating new data into existing systems.

4) Response to the available information:

Whether the application is standalone or part of a larger system, the common goal is to automate a business process by automating the flow of data to the people and systems that have a need to know. The technology should enable sending the right data to the right place in the right way depending on the circumstances. It should also present data to individual users based on their specific function in the business process. A modern farmer who has automated irrigation systems operating in different locations can now be constantly aware of their operation based on short messages that are relayed to his pager or cell phone.

One of the major application of M2M is remote patient monitoring and care, wherein a patient wears bio-sensors to record health and fitness indicators such as blood pressure, body temperature, heart rate, temperature and weight.

These sensors forward their collected data to an M2M device that acts as an information aggregator and forwards the data to the M2M application server in the cloud. The M2M server responds to the collected data by sending alerts and appropriate medical records to medical providers. In emergency situations, an M2M device can directly provide the medical status of a patient en route to the hospital (e.g., in the ambulance), allowing physicians to prepare for treatment in advance of the patient's arrival. This is a scenario where reliable high-speed connectivity such as 4G cellular is required.

A. Background

The internet of Things [2] and it's applications are considered as one of the most important elements of the future Internet. The growing number of interconnected devices as well as increasing volume of exchanged data stands new communication and processing challenges. The M2M concept defines main elements and interactions between them. A classic M2M system consist of devices connected together, a backbone network transferring data between devices and applications in both directions, as well as applications consuming and processing incoming data. In the remote, hazardous, distributed, and external environment, such as radiation source, pollutant source, and pipeline of petrol, water, and gas, it is difficult to collect and send the necessary message in real-time by traditional monitoring ways [3].

B. Motivation

- In previous system the communication takes place through direct wire connection or through internet by using PC.
- In proposed system wireless communication between two machines takes place through GPRS.
- Today's advanced wireless networks are ready to deliver broadband data service at a significantly lower cost than in past.
- Third/Fourth-generation (3G/4G) wireless technologies play central role in M2M. Its high data rate enable high value services.
- M2M represents a future where billions or trillions of everyday objects and the surrounding environment are connected and managed through a range of devices, communication networks and cloud-based servers[4].

II. LITERATURE SURVEY

The 4.9 billion of the total worldwide population already connected through mobile telephony. The market for Human-to-Human (H2H) communication will soon be saturated. The next era for mobile communication will be driven by extending mobile connections to machines. Today only 1% of the total 50 billion machines have connection capability. The commercial market for M2M communication is expected to grow rapidly and remaining 49.5 billion machines will able to communicate in future [1]

Today multiple connectivity options are available to connect M2M device to the server and each other. When many devices are limited in range due to cost/size/power constrains, hierarchical deployments that provide reliable, efficient internetworking between multiple communication protocols will be needed. The M2M device can connect to the M2M server directly through a WAN connection (e.g., cellular 3G/4G) or an M2M gateway. The gateway is a smart M2M device that collects and processes data from simpler M2M devices and manages their functions[4].

A number of proposals starting from simple device status observation to wide area solutions has been presented. Approach presented at [5] aims to create a scalable and extendable solution for integration of different sensors. The proposed solution uses XMPP (Extensible Messaging and presence Protocol) for communication between device gateways and applications. Data sinks are represented as nodes which may be read or written by devices and applications.

Narsingh Sahu, Vashudev Dehalwar implements the smart grid network which can support coexistence of different M2M communication technologies. There is a sub home area network gateway which will acts as a gateway of appliances using particular communication protocol/technology. This particular sub home network gateway collects the data from all appliances using that particular protocol/technology, then they will send data to HAN (Home Area Network) gateway/M2M gateway after applying a proposed function. Sensors attach with the home appliances which are used to sense the consumed voltage by equipment. [6].

The Weiping Liu, Yanwen Liu, Ru Li, Pai Wang proposed GPRS based communication system between PC and Mobile. They implements a GPRS communication system based on embedded systems and wireless communication technology. The PC communicate with the embedded platform through local net and it can control the GPRS wireless communication module which is on the embedded platform. GPRS network communicate with phone for basic voice communications, and and additional text messages and other services [7].

A wireless distributed mobile air pollution monitoring system was implemented using the GPRS public network. The system utilizes city buses to collect pollutant gases such as CO, NO2, and SO2. The pollution data from various mobile sensor arrays is transmitted to a central several that make this data available on the Internet through a Google Maps interface. The data shows the pollutant levels and their conformance to local air quality standards. A. R. Al-Ali, Imran Zualkernan, and Fadi Aloul proposed this system [9].

III. IMPLEMENTATION AND DESIGN

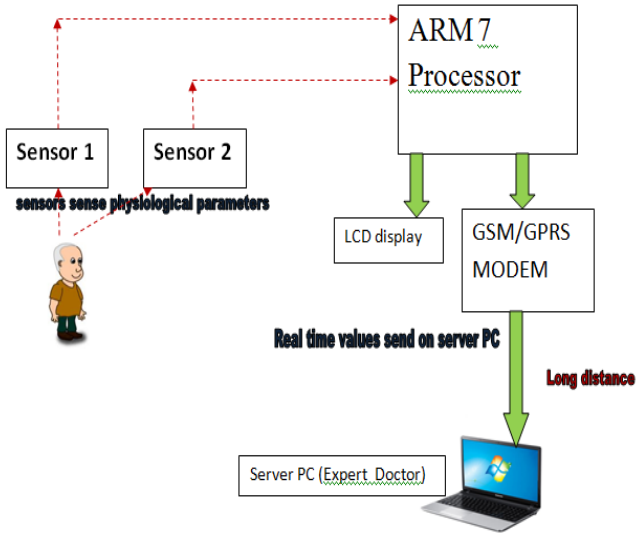

Fig. 1. Implementation Diagram

The above block diagram in Fig. 1 is the implementation design of the proposed system. The different hardware components used are as follows:

- GSM/GPRS Modem :
  We uses the SIM900-GPRS module. The modem is having internal TCP/IP stack to enable to connect with internet through GPRS. This module connects to specific application and air interface. It is integrated with HTTP protocol. The data can be send and receive using SIM card.

- ARM 7:
  It is general purpose 32 bit microprocessor. It has high performance and very low power consumption. The LPC 2148 ARM-7 IC is used here. It is based on principle Reduced instruction set computer (RISC). This IC programmed to GPRS modem and LCD. Keil embedded C software is used for the programming.

- Heart beat sensor:
  It consist of super bright red LED and light detector. The variation in each heart beat detector signal is converted into electrical signal.

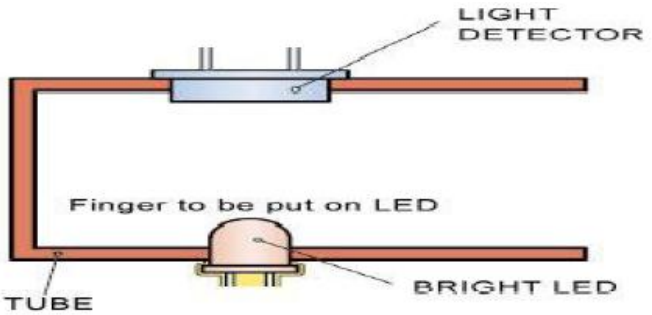

Fig. 2 Heart beat sensor

- Power Supply:
  Step Down transformer has been used with input voltage of 230 V ±50 Hz. The output is 15 V AC. The range of Transformer is 250mA. The LM 7805 regulator convert (regulate) 15V supply to 5V. LM317 regulate 3.3V (Fixed) supply forARM-7 IC.

- Temperature sensor:
  IC LM 35 is used as temperature sensor having 3 pins- VCC, Output and Ground. The temperature value is display in degrees.

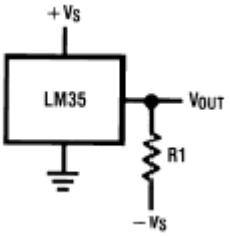

Fig. 3 Temperature sensor

- Server PC:
  The real time values of temperature and heart beat are display on server PC. It compare these values with predefined values and if exceeds alert is generated.

IV. DISCUSSION

The design discussed in earlier section has following key parts – 32 bit ARM 7 TDMI Processor,Heart beat sensor, LM 35,GSM/GPRS modem and power supply with 3.3 V output. Sensors are connected to ARM 7 (LPC 2148) through UART . Another UART of ARM 7 is connected to GPRS/GSM modem. GPRS Modem is programmed to communicate with server PC. The software is under development which uses VB.net & Embedded C. Embedded C programing is being used for ARM 7 configuration.

V. RESULTS

The setup was created using the component mentioned in discussion section.

Fig. 4 Transmitter Unit

VI. CONCLUSION

From the above designed project I can conclude that we are able to transmit the data which is sensed from various sensors to the server machine by establishing http communication to server via GPRS. The data is transmitted to server in real time, but if there is any network error or GPRS error, the data might be delayed. The real values are compare with predefined values to check respective person's physical condition.

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