International Journal of Science and Research (IJSR)
ISSN: 2319-7064
Impact Factor (2018): 7.426

Physiological Parameter Monitoring using RFID and GSM based Automated Alert System

K Ramya Krishnaveni[1], S Swathi[2]

Abstract: ***This abstract states that community-based healthcare is increasingly important for the well-being of inhabitants of emerging economies. Here we are taking in account of the student's health analysis. This Project is to escalate the existing Indian education system to the next level by means of smart card and smart band technology, which will digitalize, monitor and record student's health parameters such as body temperature, pulse rate, in a student's database, which could be accessed by a single Smart Identity Card system using smart band. The vital information such as the history of academic and accounting details, health related issues, basic details of the student will be stored in a database. If any abnormality in the student health parameter is said to be found, then the notification is sent to the institutions medical center, management and as well as parents. These parameters will be used to study the health change of the student. All these actions are linked with the student's Identity card. The RFID tag used in the ID card will grant the database access. The goal of an RFID-backed healthcare solution is to enable easy and reliable identification of individual patients, maintain more accurate medical records, facilitate better healthcare, and enhance the quality of life that are remote from a central medical facility. This can also reduce the workload of the hospital facilities. It may also help to improve the efficiency of the central medical facility, allowing it to focus resources on cases that require attention that is more specialized and care.***

1. Introduction

The rise in life expectancy and the consequent progressive aging of the population, with a prevalence of certain diseases, trigger a careful thinking on the role of life, without imposing traumatic changes of habits and domestic environment. The remote monitoring and support thus become strategic tools to implement social policies over the long term. In this sense, the ability to pervasively, discreetly, and generally uncooperatively quantify the health conditions and the human interactions with the environment is the first step to provide all the information required to adapt already established healthcare protocols to new needs. The emerging paradigm of GSM and a wide variety of increasingly cheap sensors (wearable, implanted, and environmental) have the potential to put in place personal Smart-Health systems hosting new interconnections between the natural habitat of the person, his body, and the Internet at the purpose to produce and manage "participatory" medical knowledge. By displacing wireless sensors inside the home, on clothes and personal items, it becomes possible to monitor, in a way that preserves the privacy, the macroscopic behavior of the person as well as to compile statistics, to identify precursors of dangerous behavioral anomalies, and finally to activate alarms or prompt for remote actions by appropriate assistance procedures. Among the various technologies that potentially converge to this scenario, RF identification (RFID) systems may represent a strategic enabling component thanks to the energy autonomy of battery-less tags. Furthermore, their low cost is compatible with a widespread distribution and disposable applications.

A passive RFID system is composed of a digital device called tag, embedding an antenna and an IC-chip with unique identification code (ID), and a radio scanner device, called reader. The RFID technology is used for extracting physical information about tagged objects through low-level processing of electromagnetic signals received and backscattered by the tags. RFID systems could permit to implement, in a simple and efficient way, the last few meters of the IoT concerning the pervasive quantification of the person's interaction with the environment. The survey will cover passive (i.e., battery-less) devices in the UHF band (860–960 MHz) which are capable to provide services and read ranges to implement a network of sensors for tracking the human health and monitoring the quality of the environment. The discussion will cover both the physical issues and the signal processing, up to the application level.

2. Hardware

Hardware system is constructed with power supply unit,

Microcontroller –AT Mega 8A which is High Performance, Low Power AVR, Advanced RISC Architecture and High Endurance Non-volatile Memory segments.

Temperature Sensor- The LM35 thus has an advantage over linear temperature sensors calibrated in ° Kelvin, as the user is not required to subtract a large constant voltage from its output to obtain convenient Centigrade scaling. The LM35 does not require any external calibration or trimming to provide typical accuracies of ±¼°C at room temperature and ±¾°C over a full -55 to +150°C temperature range.

Heart beat Sensor- The Pulse Sensor Amped is a plug-and-play heart-rate sensor for Arduino. It can be used by students, artists, athletes, makers, and game & mobile developers who want to easily incorporate live heart-rate data into their projects. Combination of simple optical heart rate sensor with amplification and noise cancellation circuitry making it fast and easy to get reliable pulse readings. Also, it sips power with just 4mA current draw at 5V so it's great for mobile applications.

Blood Pressure Sensor-The blood pressure sensor provides a simple way to study the heart's function. This sensor monitors the flow of blood through finger. As the heart forces blood through the blood vessels in the finger, the amount of blood in the finger changes with time. The emission of light from the sensor transmits (small high bright LED) through the ear and measures the light that is transmitted to light dependent resistors.

RFID- Radio frequency identification (RFID) is a technology that uses radio waves to transfer data from an electronic tag, called RFID tag or label, attached to an object. Some RFID tags can be read from several meters away and beyond the line of sight of the reader.

GSM- GSM/GPRS Modem-RS232 is built with Dual Band GSM/GPRS engine- SIM900A, works on frequencies 900/ 1800 MHz. The Modem consists of RS232 interface, which allows you connect PC as well as microcontroller with RS232 Chip (MAX232). The baud rate is configurable from 9600-115200 through AT command. The GSM/GPRS Modem is having internal TCP/IP stack to enable you to connect with internet via GPRS, which is used for sharing SMS, Voice as well as DATA transfer application in M2M interface.

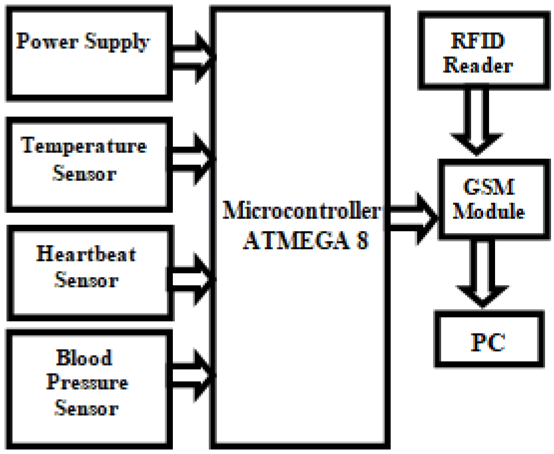
3. Software

Platform - AVR STUDIO -Flash, EEPROM, and SRAM are all integrated onto a single chip, removing the need for external memory in most applications. Devices with a parallel external bus option allows adding additional data memory or memory-mapped devices (except the smallest TinyAVR chips) have serial interfaces, which can be used to connect larger serial EEPROMs or flash chips.

In System Programmer– ProgISP 172- The Atmel Dragon is an inexpensive tool, which connects to a PC via USB. Dragon can program all AVRs via JTAG, HVP, PDI, or ICSP. The Dragon also allows debugging of all AVRs via JTAG, PDI, or Debug Wire; a previous limitation to devices with 32 kB or less program memory has been removed in AVRstudio. The Dragon has a small prototype area, which can accommodate an 8, 28, or 40-pin AVR, including connections to power and programming pins. There is no area for any additional circuitry, although this can be provided by a third-party product called the "Dragon Rider".

JTAGICE mkI - The JTAG In Circuit Emulator (JTAGICE) debugging tool supports on-chip debugging (OCD) of AVRs with a JTAG interface. The original JTAGICE mkI uses an RS-232 interface to a PC, and can only program AVR's with a JTAG interface. The JTAGICE mkI is no longer in production, however it has been replaced by the JTAGICE mkII.

Compiler – Win AVR- Micro Vision must be instructed to generate a HEX file upon program compilation. A HEX file is a standard file format for storing executable code that is to be loaded onto the microcontroller. In the "Project Workspace" pane at the left, right–click on "Target 1" and select "Options for 'Target 1' ".Under the "Output" tab of the resulting options dialog, ensure that both the "Create Executable" and "Create HEX File" options are checked. Then click "OK".Next, a file must be added to the project that will contain the project code. To do this, expand the "Target 1" heading, right–click on the "Source Group 1" folder, and select "Add files…" Create a new blank file (the file name should end in ".asm"), select it, and click "Add." The new file should now appear in the "Project Workspace" pane under the "Source Group 1" folder. Double-click on the newly created file to open it in the editor. All code for this lab will go in this file. To compile the program, first save all source files by clicking on the "Save All" button, and then click on the "Rebuild All Target Files" to compile the program as shown in the figure below.



4. Application Instruction

Health monitoring applications of wearable systems most often employ multiple sensors that are typically integrated into a sensor network either limited to body-worn sensors or integrating body-worn sensors and ambient sensors. In the early days of body-worn sensor networks (often referred to as "body sensor networks"), the integration of wearable sensors was achieved by running "wires" in pockets created in garments for this purpose to connect body-worn sensors. An example of this technology is the MIThril system. Such systems by design were not suitable for long-term health monitoring. Recently developed wearable systems integrate individual sensors into the sensor network by relying on modern wireless communication technology. During the last decade, we have witnessed tremendous progress in this field and the development of numerous communication standards for low-power wireless communication. These standards have been developed keeping in mind three main requirements: 1) low cost, 2) small size of the transmitters and receivers, and 3) low power consumption. With the development of IEEE 802.15.4/ZigBee and Bluetooth, tethered systems have become obsolete. The recently developed IEEE 802.15.4a standard based on Ultra-wide-band (UWB) impulse radio opens the door for low-power, low-cost but high data rate sensor network applications with the possibility of highly accurate location estimation.

Most monitoring applications require that data gathered using sensor networks be transmitted to a remote site such as a hospital server for clinical analysis. This can be achieved by transmitting data from the sensor network to an information gateway such as a mobile phone or personal computer. By now most developed countries have achieved almost universal broadband connectivity. For in-home monitoring, sensor data can be aggregated using a personal computer and transmitted to the remote site over the Internet. Also, the availability of mobile telecommunication standards such as 4 G means that pervasive continuous health monitoring is possible when the patient is outside the home environment.

Mobile phone technology has had a major impact on the development of remote monitoring systems based on wearable sensors. Monitoring applications relying on mobile phones. Smart phones are broadly available. The global smart phone market is growing at an annual rate of 35% with an estimated 220 million units shipped in 2010. Smart phones are preferable to traditional data loggers because they provide a virtually "ready to use" platform to log data as well as to transmit data to a remote site. Besides being used as information gateways, mobile devices can also function as information processing units. The availability of significant computing power in pocket-sized devices makes it possible to envision ubiquitous health monitoring and intervention applications.

Advantages

Staying Connected: Wearables can alert you of messages, incoming calls, emails, and much more without having to constantly be checking your phone. It can help you locate your phone when it is lost, or even connect to IoT enables devices in your home (such as switching on the lights or controlling the a/c temperature). The possibilities for increased convenience and connectivity with wearable's are endless.

Data Accuracy: Wearables enable convenient tracking of your data, health, and exercise habits for your overall well-being. This is bound to result in a healthier you, but many health insurance companies are also starting to offer added benefits for those who wear fitness trackers and health monitors. Moreover, employees with higher-risk roles, such as firefighters, mining, oil & gas employees, and others are now able to wear devices that can detect oncoming dangers, such as heart attacks or falls, and immediately send this data to an outside manager or technical specialist for assistance.

Efficiency: Wearable are set to make our lives safer and more efficient. For example – staff in packaging warehouses can now wear wearables that will assist in streamlining their packaging duties and tracking goods that are being transported, or wear GPS tags that can automatically tell them the most efficient route. Or, imagine that pacemakers, detectors, and other medical wearable devices can simply be connected through the internet to alter proper response teams when an accident or something dangerous has occurred.

5. Future Research

The above survey has drawn a possible synthesis of existing RFID research and technology for application to student personal healthcare environment. Nevertheless, many issues are still open and even challenging, especially concerning the reliability of the sensors and the true autonomy of the reader's node. Moreover, many other possible research paths may be currently envisaged, based on the fruitful synergy between the Material Science, the Neuroscience, and the Sociology with potentiality to develop, in the next years, new devices and new knowledge.

A. Stability, Accuracy, and Reproducibility of Environmental Sensors

Sensors still require to be mastered to gain a full reproducibility of deposition, stability of performance and resistance over time. So far, only a few CIMs have been characterized within the UHF band and hence a dedicated research activity, involving a strong interactions with chemical engineers, is required to setup a more standardized procedure to characterize CIMs at radiofrequency, in order to provide a more extensive database of useful chemical receptors and their sensitivity to a meaningful set of volatile compounds. Concerning the fabrication, ink-jet printing of both the antenna and the CIM could provide a uniform and large-scale replicable manufacturing solution, even if, at time being, the price of ink-jet processes is still prohibitive. Moreover, it is currently unknown if the CIM-based RFID sensors would provide meaningful data set in case of placement into real environments. They are exposed to dust and dirty and to random and unpredictable change of environmental parameters such as temperature and humidity as first. Further theoretical and experimental efforts are hence required to make data retrieval and processing more robust. Current data-gathering procedures involve turn-on and/or backscattered power measurements. Nowadays available low cost readers also provide phase retrieval, which generally exhibit a larger dynamic range than power measurements. New data processing algorithms are thus possible provided that both amplitude and phase measurements are exploited at the purpose of more accurate data-inversion procedures. Finally, beside technological issues, extensive experimental campaigns should be planned over medium scale against reference dataset to compute statistics and estimate the overall accuracy and resolution of this class of sensors.

B. Autonomous RFID Nodes and Data Processing

The readers are currently a serious bottleneck in the massive adoption of RFID in IoT Healthcare since most of available models are oriented to logistics, e.g., to provide the ID of the tag rather then to produce stable power and phase signals with high resolution. Furthermore, they exhibit high cost and usually require a PC-network infrastructure to work with. A true integration of RFID technology into an IoT domestic infrastructure would instead require a full RFID node with autonomous computation power and wireless data connectivity toward the cloud. Hand-held, fully autonomous readers are already available, but they are nevertheless still overpriced. Even tethered low-cost readers are 3–4 times more expensive than a Wi-Firouter, that should be considered as a cost target. Possible solutions could exploit the integration of low-cost embedded systems such as Arduino and Raspberry Pi, but specific research effort should be devoted to identify processing architectures and common interfaces. Finally, in spite of the EPC as a standard protocol, the proprietary software libraries for the control of readers are heavily manufacturer-dependent so that a general purpose, and possibly open-source development framework could really simplify the design and implementation of high-level applications.

C. RFID Synergy with Epidermal Electronics

Body-centric RFID systems could greatly benefit from the synergy of the RFID communication and sensing background with the emerging epidermal electronics research. In Biomaterial engineering, a rich variety of tattoo-like thin surface electronic devices have been experimented in the last three years, with promising application to the human body. These devices are fully biocompatible and self-dissolvable or restorable within a specific timeline and hence they could be used as temporary wireless wearable sensors. Anyway, since they are placed in direct contact with the human skin, they will offer a significant challenge to the electromagnetic. Numerical estimation of electric field and SAR.

a) Electric field distribution in a conventional sleeping room with a reader antenna placed 1.5 m far from the body (simplified parallelepiped muscle model), emitting 3.2 W EIRP with a duty cycle of 20% (an interrogation per second).
b) Peak electromagnetic field and SAR inside the human body when exposed to radiation from a reader-like antenna emitting 3.2 W EIRP with unitary duty-cycle versus mutual distance. Antenna research, therefore, has to be advanced to achieve roomcompliant read distances.

D. Electromagnetic Social Interactions

As novel pervasive autonomous wireless sensors begin to be available, new classes of high-level applications will be feasible throughout the processing of heterogeneous data and the extraction of behavioral patterns. Natural ambient electromagnetic backscattering modulation, produced by the interaction of one or more users with an embedded network of RFID readers and tags, will enable augmented perception of the local environment. The positive contaminations among researches in contiguous engineering fields, such as the Passive Radars (involving sources of opportunity) and the machine learning, and completely different disciplines such as the neuroscience and sociology, are expected to produce new knowledge tools aimed at better understanding groups' dynamics and quantify human relationships. There will be margin to facilitate the social integrations of users inside classrooms, elders in rest house and improve the interchange of information and skills in working teams and to support visually impaired people.

6. Conclusion

The reviewed RFID technology for student Healthcare and the personal experience of the authors tell a story of mixed opportunities and fragmentation. Worldwide university laboratories are now researching and making prototypes of RFID sensors, both passive and semi-active that can be interrogated from a distance compatible with the interaction with a network infrastructure. On the other side, only few products are commercially available for large-scale applications. A very focused effort is, therefore, needed to manage the conversion from experiments to the real use and mass production within a so potentially fast growing market. The overcoming of the slowing factors demands a coordinated activity of the featured community to stimulate interest in potential final users and, in parallel, to boost the evolution of readers, software, and devices toward a more interconnected perspective.

References

[1] C. Storni, "Report in the reassembling health workshop: Exploring the role of the Internet of Things," J. Particip. Med. Conf., vol. 2, Sep. 2010.
[2] E. Di Giampaolo, F. Fornì, and G. Marrocco, "RFID-network planning by particle swarm optimization," Appl. Comput. Electromagn. Soc. J., vol. 25, no. 3, pp. 263–272, Mar. 2010.
[3] C. Occhiuzzi, A. Rida, G. Marrocco, and M. Tentzeris, "RFID passive gas sensor integrating carbon nanotubes," IEEE Trans. Microw. Theory Techn., vol. 59, no. 10, pp. 2674–2684, Oct. 2011.
[4] S. Manzari, C. Occhiuzzi, S. Newell, A. Catini, C. Di Natale, and G. Marrocco, "Humidity sensing by polymer-loaded UHF RFID antennas," IEEE Sens. J., vol. 12, no. 9, pp. 2851–2858, Sep. 2012.
[5] S. Manzari and G. Marrocco, "Modeling and applications of a chemicalloaded UHF RFID sensing antenna with tuning capability," IEEE Trans. Antennas Propag., vol. 62, no. 1, pp. 94–101, Jan. 2014.
[6] J. Virtanen, L. Ukkonen, T. Bjorninen, A. Z. Elsherbeni, and L. Sydnheimo, "Inkjet-printed humidity sensor for passive UHF RFID systems," IEEE Trans. Instrum. Meas., vol. 60, no. 8, pp. 2768–2777, Aug. 2011.
[7] J. Siden, G. Jinlan, and B. Neubauer, "Microstrip antennas for remote moisture sensing using passive RFID," in Proc. Asia–Pacific Microw. Conf., Singapore, Dec. 2009, pp. 2375–2378.
[8] S. Manzari, A. Catini, R. Paolesse, G. Marrocco, and C. di Natale, "Chemical-loaded passive UHF-RFID array for ambient sensing," in Proc. Int. Symp. Olfaction Electron. Nose (ISOEN), Jul. 2013.
[9] L. K. Fiddes and N. Yan, "RFID tags for wireless electrochemical detection of volatile chemicals," Sens. Actuators B, vol. 186, pp. 817–823, 2013.
[10] S. Manzari, A. Catini, R. G. Marrocco, and C. di Natale, "Chemically sensitive passive UHF-RFID array," in Proc. Int. Meeting Chem. Sens. (IMCS), 2014.
[11] R. Bhattacharyya, C. Floerkemeier, and S. Sarma, "RFID tag antenna based temperature sensing," in Proc. IEEE Int. Conf. RFID, 2010, pp. 8–15.
[12] A. Babar, S. Manzari, L. Sydanheimo, A. Elsherbeni, and L. Ukkonen, "Passive UHF RFID tag for heat sensing applications," IEEE Trans. Antennas Propag., vol. 60, no. 9, pp. 4056–4064, Sep. 2012.
[13] S. Caizzone, C. Occhiuzzi, and G. Marrocco, "Multi-chip RFID antenna integrating shape-memory alloys for detection of thermal thresholds," IEEE Trans. Antennas Propag., vol. 59, no. 7, pp. 2488–2494, Jul. 2011.
[14] J. Virtanen, L. Ukkonen, T. Bjorninen, L. Sydanheimo, and A. Elsherbeni, "Temperature sensor tag for passive UHF RFID systems," in Proc. IEEE Sens. Appl. Symp. (SAS), Feb. 2011, pp. 312–317.
[15] EM4325 IC datasheet. Available: http://www.emmicroelectronic.com
[16] IDSSL900A IC datasheet. Available: http://www.ids.si/prod4_IDSSL900A.htm
[17] P. S. Hall and Y. Hao, Antennas and Propagation for Body-Centric Wireless Communications, 2nd ed. Norwood, MA, USA: Artech House, 2012.

[18] G. Marrocco, "RFID antennas for the UHF remote monitoring of human subjects," IEEE Trans. Antennas Propag., vol. 55, no. 6, pp. 1862–1680, Jun. 2007.
[19] T. Kellomaki, "On-body performance of a wearable single-layer RFID tag," IEEE Antennas Wireless Propag. Lett., vol. 11, pp. 73–76, Jan. 2012.
[20] C. Occhiuzzi, S. Cippitelli, and G. Marrocco, "Modeling, design and experimentation of wearable RFID sensor tag," IEEE Trans. Antennas Propag., vol. 58, no. 8, pp. 2490–2498, Aug. 2010.