An Integrated Health Management System Using Control Area Network

Gururajapandi.V\(^1\), Saravanan.V.A\(^2\)
1Communication systems, Department of Electronics and Communication Engineering
2Assistant professor, Department of Electronics and Communication Engineering
Sri Shakthi Institute of Engineering and Technology, Coimbatore

Abstract

In recent time, everything is becoming faster and faster as well as increasingly complex. This applies to multiple areas, including healthcare. Health plans must transform their approach to medical cost management in order to make it effective, and deliver sustained high-quality care at an acceptable cost. The key to this transformation is to employ a more thorough and integrated approach to control health care costs: employing traditional medical management competencies within the context of an end-to-end wellness management lifecycle that includes disease management. In this work a proposal for a new system that consist RTOS with CAN communication. In order to enhance the communication module of the hospital management, some changes to the system which includes the replacement of I2C bus and operating system with CAN bus and RTOS to reduce power consumption, complexity and data loss. In this paper, we propose a prototype, to prolong the network lifetime, to improve the reliability based on the control area network. To cover all the scenarios, we have considered to provide an integrated health monitoring enabled network. The performance metrics will be evaluated using simulation results and hardware implementation.

Keywords: CAN, health management, RTOS communication, reliability.

I. INTRODUCTION

An ageing population and the associated prevalence of human’s disease continue putting increasing demands on medical and healthcare resources. Population is increasing every decade to a large extent. The rapidly growing population has resulted in an increase of irregular maintenance of hospital health care management. The World Health Organization initiates that people who suffer from any disease in hospitals, require a highly effective and efficient provision of care. Thus health care management is necessary for safeguarding the patients. To provide the best quality of care, control of the hospital environment is essential. You need reliable monitoring systems to help prevent infection. Operating room environments that respond instantly to meet strict procedural requirements. And patient rooms that help patients heal. This system excels at delivering precise control for temperature, airflow and humidity—for every part of your facility. That includes positive pressurization in areas like bone marrow transplant patient rooms, and negative pressurization in patient isolation rooms. Working with our parent company, Schneider Electric, and our security partner, Integral Technologies, it can deliver a powerful combination of electrical distribution, security and building management solutions that drive down your costs while maintaining a safe, optimal environment for your patients.

The highly efficient building management systems are easy to install and easier to maintain, helping you get the most out of your capital and operating budgets. It has extensive experience and customized solutions to help maintain ideal environments throughout the hospital. We take great care when it comes to assessing and meeting your needs. Health organizations and hospitals have been active in applying appropriate technologies to improve patient care; however there are still many areas, which can benefit from further improvement. National Institute for Health and Clinical Excellence (NICE).

Medical personnel, nurses in particular, are fundamental to high-quality healthcare, as they have the greatest contact with patients over the twenty-four hour period (Department of Health). Part of this role within the hospital environment is the monitoring of patients, which will include gathering vital signs. Also, the frequency of nurses’ visits depends upon patients’ needs. These are based upon the severity of patients’ conditions judged by nurses, which can be subjective.

Modern Intensive Care Units (ICUs) have employed an impressive array of technologically sophisticated instrumentation to provide detailed measurements of the physiological state of each patient. In order to achieve health care scenarios, different reliable technologies are applied by then, integrated health management systems is proposed using CAN protocol which features patients health monitoring with the application of sensors and thus indicating to monitoring section using CAN.

The implications of this research are expected to contribute directly to hospital management through CAN applications, which will give a comprehensive view of
challenges faced by health monitoring and solutions of these problems. This project is aimed at systematic modelling and optimisation of deployment to provide reliable and robust communications of CAN networks. The main objectives of this projects are summarised as follows: To analyze basic requirements for patient monitoring on hospital. To investigate the suitability and reliability of CAN protocol to support health management. To propose a system framework for integrated health management through CAN bus. To design a prototype to demonstrate the functionalities of the proposed monitoring system[2].

II. RELATED WORK

Various health care-aid devices and services appear to offer a specific support for the elderly in their homes. However, such aids have more focused only on when the elders health is degraded or very specific areas such as tracking health data like blood pressure and calorie in takes. The elderly need comprehensive understanding about their health problems, healthy daily habits and timely interactions with their families and caregivers, in order to keep independent living safely in their places.

Smart Home technology has much potential to support the elders independent living as well as interactions with others. To better understand this, we conducted a user centred design project which looks at the management of the elder’s health enabled by Smart Home technology. The ability to perform autonomous health management and daily living is a key to the elder’s well-being and self-esteem. However, independent living requires the elderly to keep healthy lifestyles as well as fair attain knowledge about their diseases; impairments and the ways which will help improve their health conditions [3].

Technologies such as PHR play an essential role during digital transformation of healthcare in stimulus bill, president obama envisions \"the utilization of a certified electronic personal health record for each person in the united states by 2014.\" however, to realize the potential value of PHR and significant improvements are needed in the areas of privacy, security, and interoperability. In this chapter, to outline the value of PHR and PHR system and give formal definitions of PHR and PHR system for further characterize PHR and PHR system according to their attributes. It provides a short discussion of PHR system and cloud computing. We will see a PHR system becomes more valuable when it connects to more healthcare information system that makes a PHR system more suitable for cloud-based deployment [4].

The privacy and security aspects of PHR system, unique privacy issues arise in relation to PHR systems ordered by third parties, including some emerging cloud-based service that warehouse and mine personal health data for secondary uses. The individual project is perhaps the most famous inversion of the current approach to PHR, in that the record resides with the patients and the patients grant permissions to institutions, clinicians, researchers, and other users of medical information. Nevertheless, the individual, built to public standards, enable us to quickly create and integrate our cryptographic implementation into patients' online records.

III. EXISTING SYSTEM

In the existing system it consists of a I2C bus a wired network. In terms of hardware implementation, this scheme is not suitable for wired network systems with various microprocessors and sensors as it is difficult to perform clear node assessment on the transmission channel. Due to complex structure of the I2C bus with bunch of cables gives the probability of data transmission error and miss-detection can be high. The complexity of the above mentioned bus results in the low data rate and missing of data during the transmission.

The requirement of components used in the implementation of wired network through I2C bus results in high cost and high power consumption. The operating system used in the existing system is not suitable for the integrated health management. When the network traffic increases, collision occurs due to complexity, transmission of pulses which adversely affect data delivery capability in the network. Operating system of the network requires manual intervention with the sensor nodes.

It also has to occupy different receiver nodes for each patient, since different pulse repetitive frequencies are being used to identify different users. A node is only allowed to start its data transmission if it has sensed an idle medium after the transmission of the last back-off preamble. Due to these problems and the collision occurrences in the network it affected the network life time, increased the latency and more amount of power is consumed. Today’s hospital management contain many distributed electronic circuits.

IV. PROPOSED SYSTEM

To analyse the performance of a CAN protocol based on a physical layer technology for sensor nodes. The proposed CAN protocol in this work is unique in the sense that it is developed to enhance the performance of
a health management using the high data rate offered by the transmission while using to avoid the complexities given by a receiver. In the proposed CAN protocol herein, priority of data is taken into consideration and a guaranteed delivery mechanism is utilized to transfer data with high priority[1]. A new trend for Hospital Environment that consist combination of RTOS (Real time operating System) and CAN (Control area network) communication. Normally Hospital consist number of ECU (Electronics control unit), Sensors and Motor Control unit. All are interconnected with wiring. This very difficult to read data from device, so we are proposing new system that consist RTOS with CAN communication. Due to this system we will read the data from sensors at a time, because RTOS consist Multitasking with Kernel and we can give the information to Driver using CAN communication. It is a high Speed communication bus and by using this we can do the communication between High power Device (like AT89C51, ARM,PIC…etc).

A).System design

The main objective of system is EDR (Event data reader). In my project we are implementing TWO sections as prototype, the first one runs with RTOS and LPC2148 as a Master node and Second one is Data acquisition node to which sensors are connected.

V. SIMULATION RESULTS

The fault identification is done using the parameters are measured through the CAN interface module the monitored data is analysed using the network. The location and the type of faults are analysed before it occurs and are transmitted from Patient to the control centre through CAN bus and SMS is sent to the technical person to rectify the fault. The output of parameter measurement such as Temp, HB, BP, Orientation. The effect of harsh condition and the nature of large electromechanical system are the causes of fault to be occurred in the Patient. It is very important perform the monitoring and fault diagnosis of Patient parameters[6].

Fig.1 Block diagram of data acquisition node

Fig.2 block diagram of master node

Fig.3. Hardware implementation of integrated health management
Fig 4. LCD display

The snapshot shows the hardware implementation of an integrated health management. The hardware implementation gives the function of data acquisition from the sensors which we used for the monitoring process. In this hardware section, there are four types of sensors are used to sense the activity of the patient in the way of monitoring the health of the patient. The data acquisition is made through the ARM processor with the interface of CAN bus.

VI. CONCLUSION

Control area networks are mainly designed for application requiring very low power consumption and reliable communication by the higher data rate. In this paper effectiveness of control area networks supporting health management applications were investigated to obtain the better monitoring process using simulation and implementation of hardware components. Energy efficient CAN protocol have been proposed. The CAN protocol which is used for serial communication will provide high data transmission rate and reliability. Therefore in this paper, the design of a remote monitoring and fault diagnosis system based on CAN is implemented using the SMS sent regarding the particulars of patients and the type of fault is proposed. Finally the system performance and the efficiency are effective and reliable. To optimize the operation and maintenance of the Patient, additional information is needed from the Patient structure which needs to be smarter. One technology that may provide this intelligence is structural health monitoring.

ACKNOWLEDGEMENTS

First of all we sincerely thank the almighty who is most beneficent and merciful for giving us knowledge and courage to complete the project work successfully. We also express our gratitude to all the teaching and non-teaching staff of the college especially to our department for their encouragement and help done during our work. Finally, we appreciate the patience and solid support of our parents and enthusiastic friends for their encouragement and moral support for this effort.

REFERENCES


