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Automated Patient Monitoring and Hospital Management System Using Embedded Systems

Dr. R. Naveen[1], S. A. Sivakumar[2], M.Cholavendan[3], T. Aswini[4], V. Elango[5], R. Elangovan[6], S. koushika[7]
[1]*Associate Professor,* [2,3]*Assistant Professor,* [4,5,6,7] *UG Scholar, ECE, Info Institute of Engineering, Coimbatore, Tamilnadu.*

Abstract: ***RFID technology helps us to monitor the status of the patient by tracking all the health services given to patients. The health monitoring using RFID aims at building a better means of storing and retrieving data. RFID systems are used for hospital information system and it provide full information about patient identification, token number and medicines. In this paper we proposed electronic based hospital management system .This project uses the hardware kit to get the patient id. It will send the patient id to the serial port of the system. The patient ID can be accessed by the doctor via scanning the RFID card after logging into doctor's account. The doctor can view and update patient's medical records and prescriptions. It mainly deals to monitor the health status of a human body like Blood pressure (BP) and temperature.***
Keywords: ***RFID, Healthcare, Token number, Hospital management system, Blood pressure.***

I. INTRODUCTION

Developed system is a comprehensive, integrated information system designed to manage the administrative, financial and clinical aspects of a hospital. As an area of medical informatics, the aim of the system is to achieve the best possible support of patient care and administration by electronic data processing.

There is a tremendous growth and potential in the application of ICT in medical and health domain. Patient is one of the most important entities in the hospital environment because most of the data revolves around the patient such as admission, status, treatment, follow-up, medication and testing. We have identified the key entities in the smart hospital system and develop the database model by integrating RFID technology.

RFID provides a communication infrastructure at the radio frequencies between a special tag and reader device that can detect the tag, and allows for establishing communication between devices within the system without any physical contact, or even without seeing each other. By using RFID technologies as integrated with patient information systems, it will easily be possible to identify patients with the RFID card that they carry and to rapidly process the previously recorded information about that patient.

The paper is composed of five sections; section two followed by introduction describes RFID technology. Section three discusses the use of RFID in healthcare sector followed by section four i.e. proposed RFID based electronic health management system model and architecture followed by conclusion.

II. EXISTING METHOD WORKING METHODOLOGY

A. RFID technology using Patient Management System

RFID technology can improve the tracking of drug usage throughout the clinical-phase testing protocols. Improved tracking and accountability can improve the reliability and speed of the United States Food and Drug Administration (FDA) drug approval process. Inventory Management Manufacturers and distributors need improved visibility throughout the supply chain to gain an accurate account of inventory. Lack of visibility of customer orders results in increased inventory because healthcare practitioners often keep buffer stocks to avoid stock outs. Increased inventory visibility could reduce buffer stocks by substituting knowledge for inventory, thereby reducing total inventory costs. Hospital and Medical Device Company Applications.

RFID has strong application potential with medical device companies. The FDA requires medical device companies to be able to identify each unit by serial number. Medical device companies need better control of implants on consignment with hospitals because returns can occur more than 50 percent of the time. RFID technology that improves visibility into returns could enable faster redeployment since the company would know sooner when an unused product could be returned. Surgical instruments and other devices must be properly cleaned and packaged between uses. Tags on the instruments and readers on the sterilization chambers and storage cabinets can validate proper cleaning and help locate needed instruments. Since medical devices are often mounted on portable carts, smart tags placed on the devices and readers installed in the doorways can enable personnel to quickly locate a crucial piece of equipment and immediately determine its fitness for use. The System Architecture is shown in fig.1.

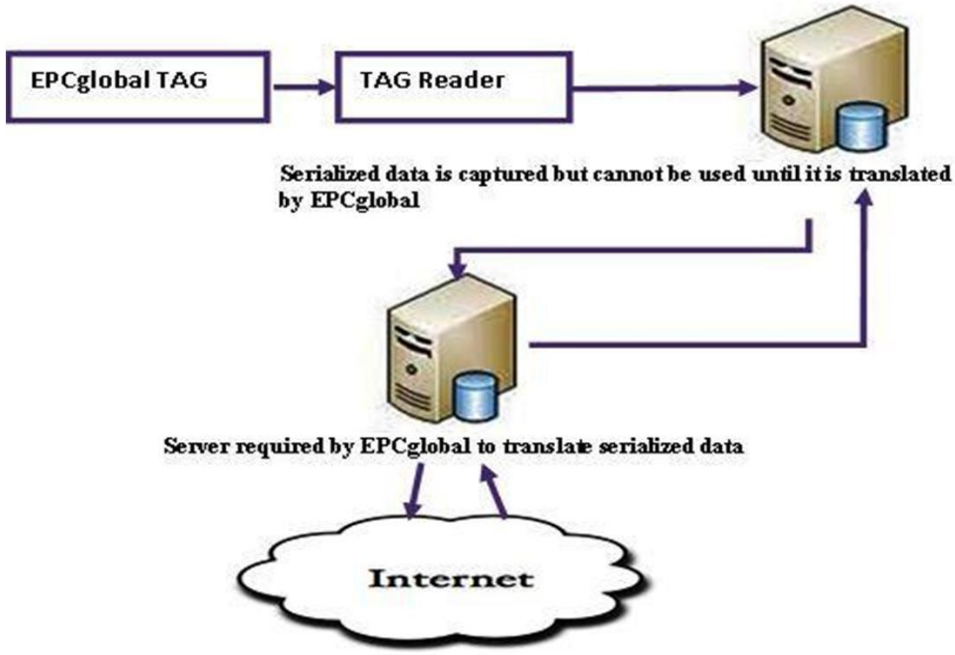

Fig.1 System Architecture

B. Intelligent Agent based System for Monitoring and Control of Hospital Management System

1) *Expert Agent:* Expert agent has the decision making ability based on the response of other agents. Now we define the input and out module for expert agent. Expert system can receive the input from patient agent, doctor agent, environmental agent, reception agent as well as the nurse agent. Whenever expert agent receives an input it compares either it is request or information. If data is information then it is stored in the databases otherwise it is processed according to content. If different agents send their response simultaneously then expert system uses a queue to handle the request. The Proposed Architecture is shown in fig.2.

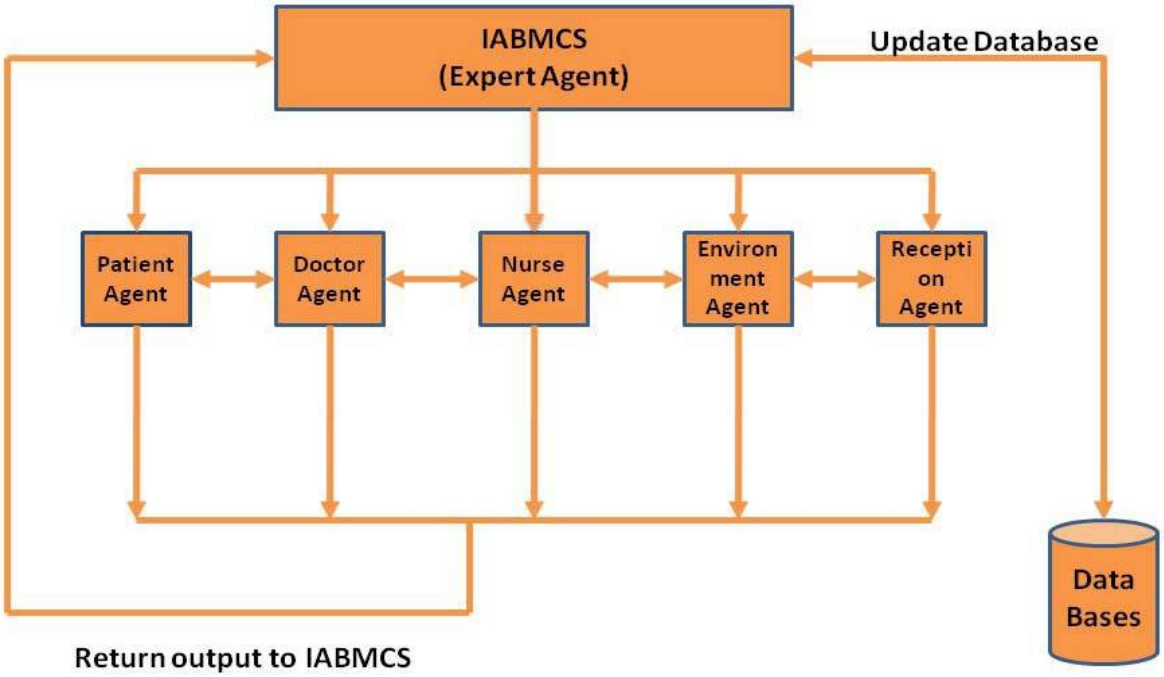

Fig.2 Proposed Architecture for IABMCS

C. Patient Agent

Patient agent is directly related to patient. It directly receives the inputs from the patient and assigns a unique id to each patient. Patient tells the agent a brief history (disease symptoms, time spam how many days patient have been affected from that disease). Basic task of patient agent is information gathering, after requirement elicitation agent will make a report and forward it to expert system.

D. Doctor Agent

Doctor agent keeps the record of all doctors working in that hospital. It can receive the inputs from patient agent, nursing agent as well as expert agent. It suggests the best doctor for patient treatment and keeps the record of doctors rating. Doctor agent sends it result to the expert agent.

E. Nurse Agent

Nurse agent act like a nurse, it helps the doctor in various decisions. It helps the doctor agent by providing the information about the available equipment of treatment, coordination process during surgery and periodic health report to the doctors. It also keeps and manages the record of all nurses working in that hospital. Nurse agent sends their results to the expert agent.

F. Environmental Agent

As the name indicates environment agent is responsible to manage the environment of hospital. It keeps the record of all rooms in a ward, beds that are allocated to the patient and vacant beds.

G. Reception Agent

Reception agent tells the visitor exact location of patient. It is necessarily to know the Id of patient which was assigned by patient agent. It receive the id as an input and update the requester about ward no, room no as well as patient bed no. It also keep the record either patient has been discharged or not. The Graphical view of All Agents in HMS is shown in fig.3.

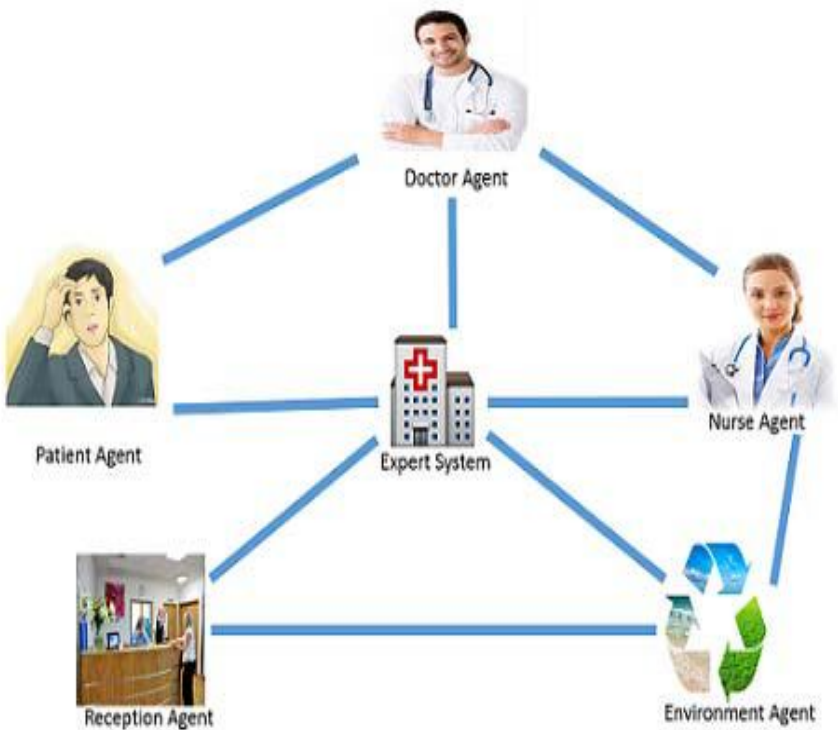

Fig.3 Graphical view of All Agents in HMS

H. Independent Role of Each Agent

To understand the individual role and interconnection with other agents we define algorithm for each agents. With the help of algorithm we can easily state the input, output and functional state of each agent.

The Communication Diagram of All Agents is shown in fig.4.

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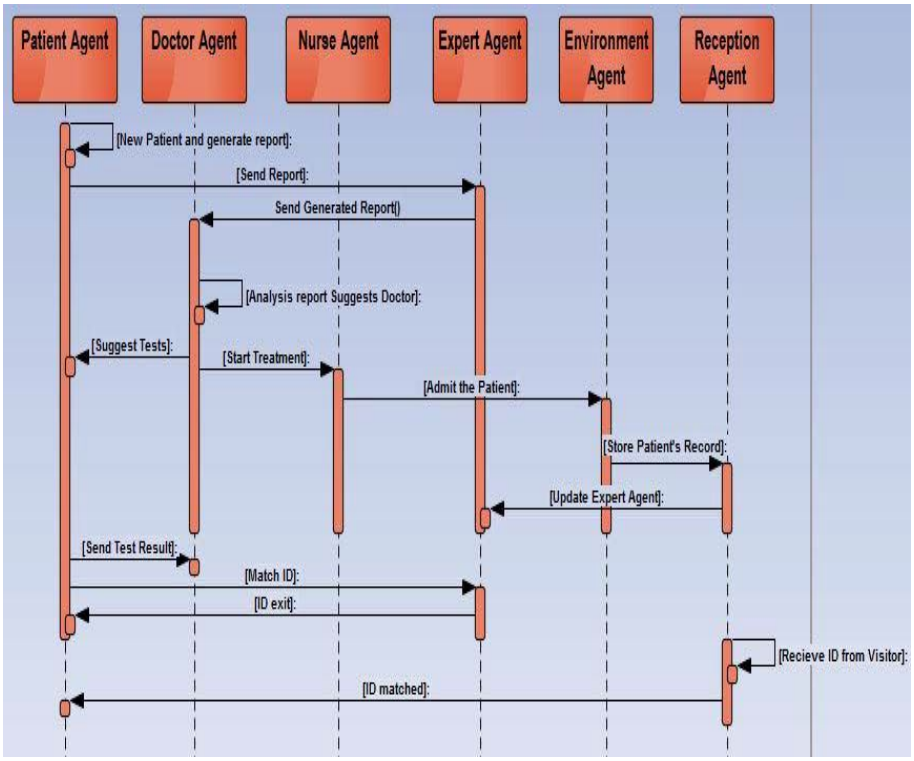


Fig.4. Communication Diagram of All Agents

I. Case Study to validate Architecture

Validation of architecture is very important. There are two ways to validate architecture. One is known as proto type based validation and other is known as scenario based validation. Prototype based validation is used to check the actual response of the system e.g. if we want to check the system response or execution time then it best to use the prototype based validation instead of scenario based validation. Scenario based validation is used when we have complex interaction among different subsystem.

III.PROPOSED SYSTEM WORKING METHODOLOGY

The proposed RFID technique is focused on reduction in time consumption and improves security performance over the existing technique. RFID R/W is the special type wireless card. The inbuilt embedded chip represents the 12 digit card number. In the R/W card we can read as well as write the information on the card. R/W reader is the circuit which generates 125KHZ magnetic signal. The magnetic signal is transmitted by the loop antenna connected along with this circuit which is used to read and write the information on the RFID card.

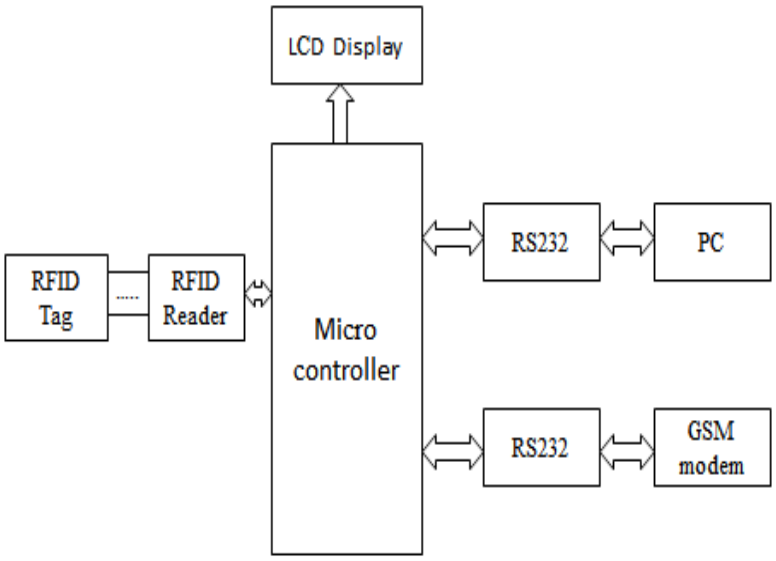
The RS232 is used to convert TTL logic to RS232 logic. When the holder shows the RFID R/W card in the reader, the reader will read the card number and other information from the card and send to microcontroller. Then the card is valid the microcontroller transfer the card information to PC. Through PC we can access the application which will display the information about that person. The information held by the chips is the same as that on the first page of a patient health condition, via name, date-of-birth, gender, place-of-birth, date-of-issue and treatment already done.

If the patient token number near than the microcontroller give intimation to patient through GSM modem SMS. At the same each hospital we fixed pulse sensor regularly find patient current condition. The Heart Beat sensor is used to measure the heart beats of the patients then the output signal is given to signal conditioning unit in which the signal is conditioned. Then the signal is given to pulse shaping circuit. Here the signal is converted into square pulse. The converted square pulse signal is given to microcontroller.

In these particular sensors if any one used mean than the corresponding output of the microcontroller is given PC through Zigbee transceiver. In PC, we can monitor those parameters using database with date and time. It is very useful doctor to identify the patient health condition. The propose system is if the any one monitored parameter is more critical, then the intimation for text to doctor PC and relation is given through Zigbee modem. The block diagram of hospital and patient side is shown in fig.5 and fig.6 respectively.

BLOCK DIAGRAM

HOSPITAL SIDE:



HOSPITAL SIDE

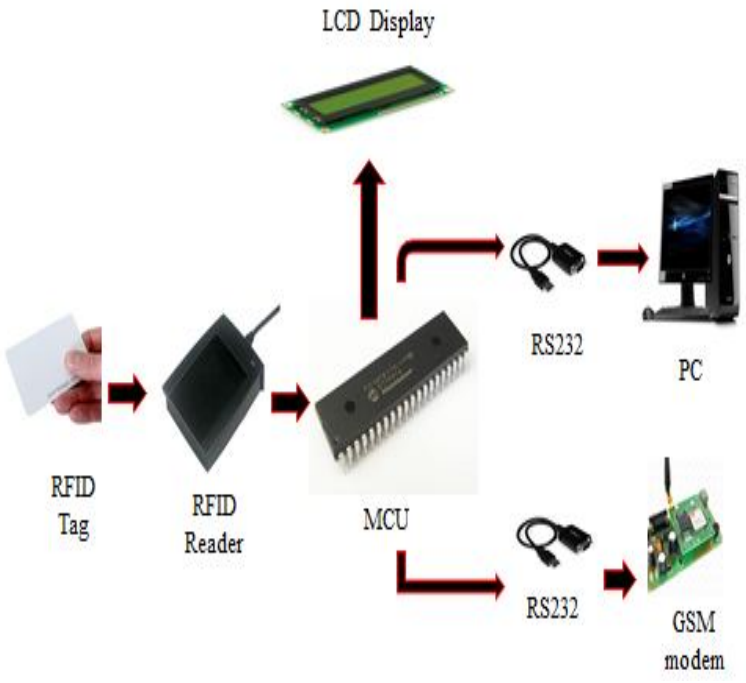


Fig.5. Hospital side

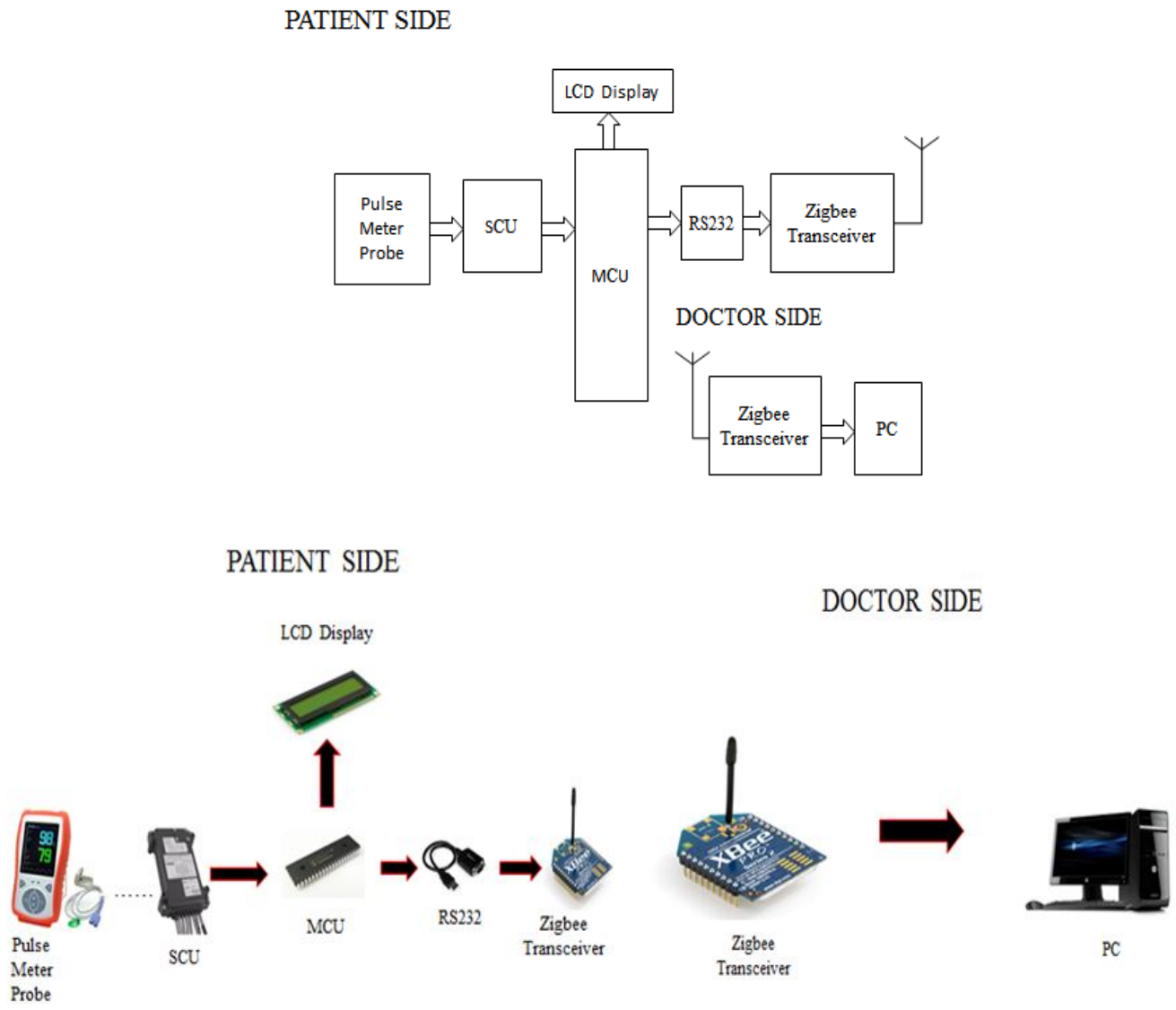


Fig.6. Patient side

IV. MATERIALS&METHODS

A. RFID Tag

1) Compatible with parallax Serial RFID Reader / Writer Module
2) EM Microelectronic-Marin SA EM4x50 family.
3) Activating frequency: 125KHz.
4) Both sides are printable with offset, thermo-transfer and dye sublimation printing.
5) Each tag contains a unique, read-only serial number.
6) 116 bytes data stored in non-volatile EEPROM. The RFID tag is shown in fig.7.

Fig.7.RFID tag

B. RFID Reader

1) R/W reader is the circuit which generates 125KHZ mangnetic signal.

2) The magnetic signal is transmitted by the loop antenna connected along with this circuit which is used to read and write the information on the RFID card. The RFID reader is shown in fig.8.

Fig .8. RFID Reader

C. RS-232 converter

1) RS-232 stands for Recommend Standard number 232.

2) The RS232 is used to convert TTL logic to RS232 logic.

3) When the holder shows the RFID R/W card in the reader, the reader will read the card number and other information from the card and send to microcontroller. The RS-232 Converter is shown in fig.9.

Fig .9. RS-232 Converter

D. Zigbee Module

1) Zigbee is a high-level communication protocols.
2) Zigbee networks are secured by 128 bit symmetric encryption keys.
3) ZigBee is a wireless networking standard that is aimed at remote control and sensor. The zigbee module is shown in fig.10.

Fig.10. ZIGBEE MODULE

E. GSM

1) GSM digitalize and compresses data, and then send it down a channel with two other channels of user data, each on its own time slot.
2) It operate at 900 MHz or 1800 MHz frequency band. The GSM module is shown in fig.11.

Fig.11. GSM module

F. PIC

1) The microcontroller that has been used for this project is from PIC series.
2) PIC microcontroller is the first RISC based microcontroller fabricated in CMOS that uses separate bus for instruction and data allowing simultaneous access of program and data memory.
3) Various microcontrollers offer different kinds of memories.
4) EEPROM, EPROM, FLASH etc. are some of the memories of which FLASH is the most recently developed. Technology that is used in pic16F877 is flash technology, so that data is retained even when the power is switched off. The PIC Controller is shown in fig.12.

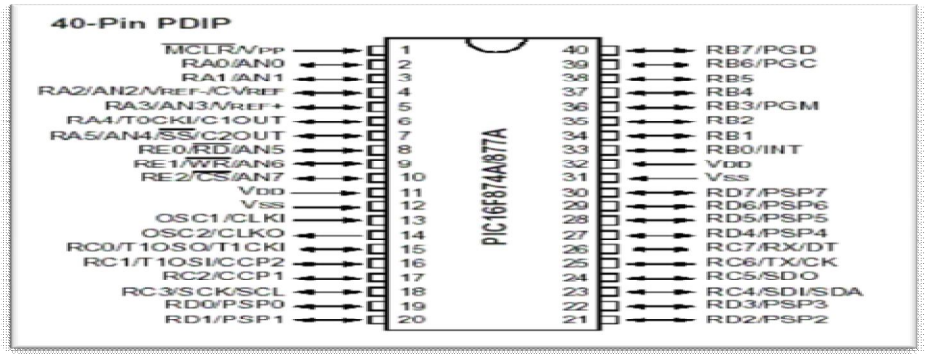


Fig .12. PIC Controller

G. Pulse Sensor

1) The Pulse Sensor can be connected to a PCB (printed circuit board)board .The front portion of the sensor is the pretty side with the Heart logo

2) This is the side where it makes contact with the body. On the front there is a small round hole, where the LED shines through from the back, and there is also a little square just under the LED.

3) The square is an ambient light sensor, exactly like the one used in cellphones, tablets, and laptops, to adjust the screen brightness in different light conditions. The pulse sensor is shown in fig.13.

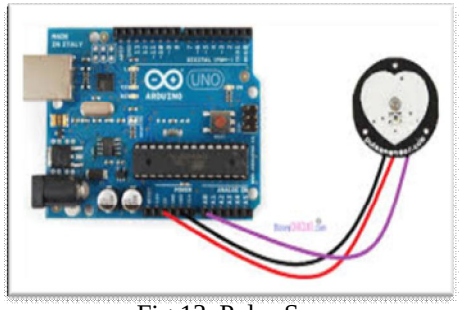


Fig.13. Pulse Sensor

V. HARDWARE OPERATION & RESULTS

The magnetic signal is transmitted by the loop antenna connected along with this circuit which is used to read and write the information on the RFID card. Then the card is valid the microcontroller transfer the card information to PC. Through PC we can access the application which will display the information about that person. The information held by the chips is the same as that on the first page of a patient health condition, via name, date-of-birth, gender, place-of-birth, date-of-issue and treatment already done.
If the patient token number near than the microcontroller gives intimation to patient through GSM modem SMS. At the same each hospital we fixed pulse sensor regularly find patient current condition. The Heart Beat sensor is used to measure the heart beats of the patients then the output signal is given to signal conditioning unit in which the signal is conditioned. Then the signal is given to pulse shaping circuit. In these particular sensors if any one used mean than the corresponding output of the microcontroller is given PC through Zigbee transceiver. In PC, we can monitor those parameters using database with date and time.It is very useful doctor to identify the patient health condition. The propose system is if the any one monitored parameter is more critical, then the intimation for text to doctor PC and relation is given through Zigbee modem. The hardware of the proposed system is shown in Fig.14.

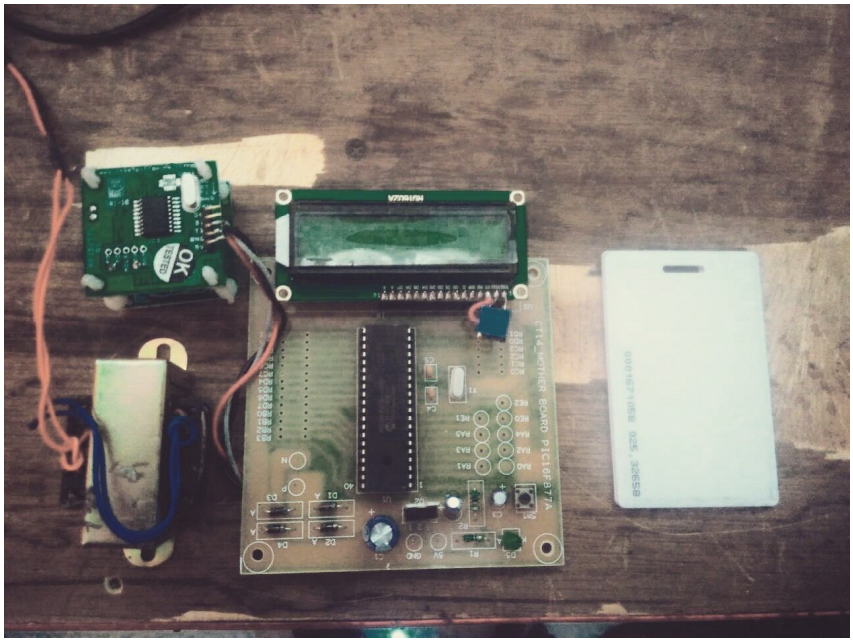


Fig.14. Hardware of the Proposed System

VI. CONCLUSIONS

RFID tags are today placed in both supply chain and in hospitals and other medical facilities. An interactive medicine cabinet can be constructed and connected with user views and a database to be a reminder system for patients as well as being an asset to both caregivers and researchers. We can Possible to get the details, using patient's RFID such as patient's early medical and medicines advised by the doctor. Usage of RFID helps the patient to visit the doctor at a in the way of using GSM, which is linked with the RFID. This analysis is also be implemented and extended to particular time instead of waiting for long time. It is just possible by giving alert to the particular patient by means of massage ongoing research and will include further for experimentation to assess. E-Health Monitoring the health status of a human body from the harmful sickness and illness. In this paper we also insure the patient privacy because only expert agent can access the data base, other agent can only update the database via expert agent. Expert agent can directly suggest the treatment without involving the doctor if patient initial report fully matched with database. Patient doesn't need to keep the record of his/her report. They just need to remember the allocated id (patient id). All records of patients are digitally managed in secure way.

VII. ACKNOWLEDGMENT

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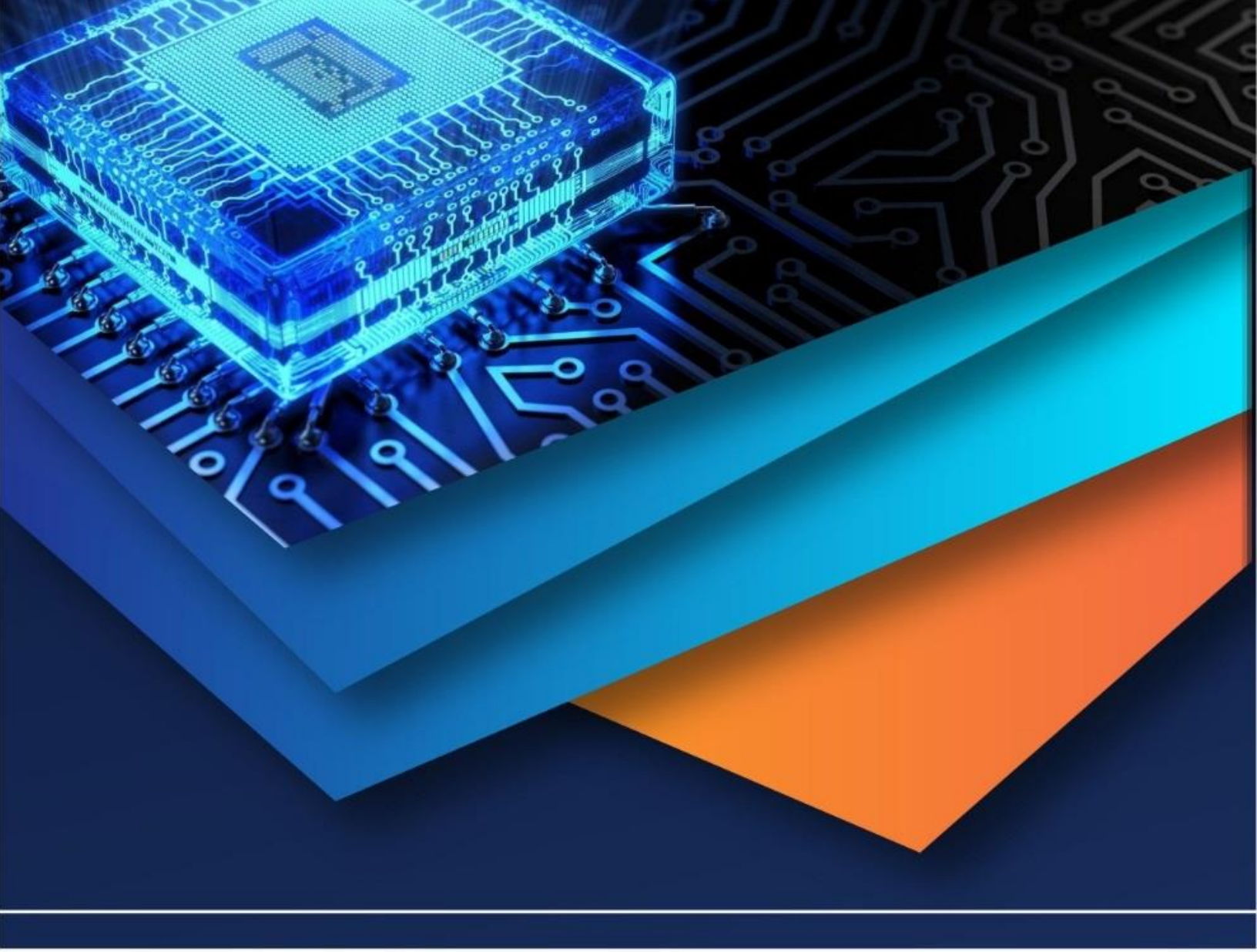

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