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HEALTH MONITORING SYSYEM USING RFID

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Abstract: *A Radio Frequency Identification (RFID) healthcare management system is a technology-based solution that is designed to improve healthcare service delivery, patient care, and operational efficiency in healthcare facilities. The system uses RFID tags and readers to automatically identify and track patients, medical equipment, and supplies throughout the healthcare facility. The RFID tags are attached to patients' wristbands, medical equipment, and supplies, and are read by RFID readers strategically placed throughout the facility. The system offers real-time data capture and analysis, providing healthcare providers with accurate and timely information about patient care, inventory levels, and equipment utilization. This enables healthcare providers to quickly locate and access medical equipment and supplies, as well as monitor patient movements and interactions, which is particularly important in the current pandemic situation. The system also helps to reduce medication errors, improve patient safety, and enhance the overall patient experience. By automating certain processes, the system reduces the workload on healthcare staff, freeing up their time to focus on patient care.*

Keywords: *RFID Reader, Healthcare, Zigbee, UHF, PIC Microcontroller.*

I. INTRODUCTION

RFID (Radio Frequency Identification) is a technology that allows for automatic identification and tracking of objects using radio waves. In the healthcare industry, RFID technology is increasingly being used for patient identification, medication management, and asset tracking [1].

A RFID healthcare management system is a technology-enabled solution that can improve patient care and reduce operational costs in healthcare facilities. The system consists of RFID tags, readers, and software that work together to collect and manage data about patients, medications, and medical equipment [2]. In such a system, each patient is assigned an RFID tag that contains their medical information, including their name, medical history, and current medication regimen. When a patient enters a healthcare facility, their RFID tag is scanned by a reader, and their information is automatically displayed on a computer screen. This allows healthcare providers to access a patient's medical history quickly and accurately, ensuring that they receive the appropriate care [2][3].

RFID tags can also be attached to medication bottles and medical equipment, allowing for real-time tracking of inventory, and ensuring that supplies are always available when needed. This reduces waste and eliminates the need for manual inventory management, which can be time- consuming and error-prone [3]. Overall, a RFID healthcare management system can help healthcare facilities improve public safety, increase efficiency, and reduce costs. An RFID (Radio Frequency Identification) health care management system is a type of technology-based system that utilizes RFID tags to track medical equipment, supplies, and patients within a health care setting [4].

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II. LITERATURE REVIEW

1. **Bejjam. Babu Rao and G. Ramana R**, "Health Care Monitoring System in IOT by Using RFID"; This system has four (04) layers namely, Sensor, network, internet and service layer. In sensor layer most of necessary sensors such as temperature, EEG, EGC, blood pressure sensors and etc. are embedded into the human body. These sensors monitoring the changes of human body consistently and transfer the changes to next layer. The output of sensor gets the form of analog so ADC used for converting to digital. In network layer there is a microcontroller (ATmega32) [4] pretends as intermediate device which transfers the digital sensor output to RFID. The RFID transfers this signal to Internet. This RFID transfers the signal to Static Node Receiver which passes the signal to base station and then internet. Finally, all services such as Doctor, Emergency Team, Ambulance, and Governance agencies are connected in internet layers. All those services get that signal from patient's and distributes the actions and services according to the signal or problems of patients [6].

2. **Kaleem Ullah et al**, "K-HEALTHCARE"; In this system also, there are four (04) layers being used as same as previous system. But in this system, in- built phone sensor is used for getting human changes in sensor layer. User of the system needs to use some applications in the phone and it will estimate the changes in human body. This application consists of several in-built sensors, such as blood oxygen, pulse, RFID and so on. Here RFID sensor is used for object identification purpose. The sensor of the phone application identifies the signal from human body and passes the signal with the help of Wi-Fi or 3G. Then the signal goes to internet layer via router. The service layer is already connected to internet via smart devices. Thus the patients can get healthcare services [7].

3. **Long Hu et al**, "Enabling RFID technology for healthcare"; The architecture of this system has four (04) components, namely tagged objects; RFID information capture and delivery system; the patient aware contexts querying system; and the medical information central system. The tagged objects have further four objects, namely patients, medical equipment, nurse or physician and medicine. Each of four objects embedded with RFID reader. There are several RFID readers placed for each tagged object and when they use the RFID tags, then the reader reads and sends the signal to RFID information capture and delivery system, which passes that signal to the medical information central system (MICS) via access point. Patients, drugs and other medical relevant information are carried out by MICS. This has been done by inference engine. All information stored in MICS are managed by this engine and it sends notifications to patients, doctors, drugs, and other specific persons in timely manner with the help of engine physical repository. Patient? aware contexts querying system works with distance. In this system all sensors are placed in patient's body and changes of the sensor pass to the MICS through wireless sensor network rapidly and patients get treatments on time [8].

4. **Toni Adame et al**, "CUIDATS"; An RFIDWSN hybrid monitoring system for smart healthcare environments". Patient of the system needs to wear the wristband. Temperature, pulse and position sensors embedded into that and a RFID tag maintains those sensors. The sensors read the signal of patient and it passes to the RFID gateway which is the combination of RFID reader and WSN (Wireless Sensor Network) beacon. RFID gateway transfers the gathered signal to another gateway until it goes to internet. The data is stored in Data Application Server with help of middleware. Patients could be monitored from DAS by an authorized individual. Normally WSN give high distance of coverage area thus it minimizes gap of

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monitoring of patients from anywhere round the globe which is one of the positive advantages of this system [9].

5. **Debiao He and Sherali Zeadally**, "RFID Authentication Schemes for Internet of Things in Healthcare"; This system has three (03) parts, namely Tagged objects, RFID-Enable health care system and server part. In each tagged object (patients, drug container, Assets and medical supplies) RFID tags are embedded. The RFID reader can be placed in short distance which has accessible by tag and it connected with a terminal. Whenever changes happen in patients or other tag objects then reader reads and sends the signal to terminal and it passes that to a data sever and eventually it moves to the Hospital legacy system. RFID-Enable Healthcare System (RFIDEHS) consist of assets tracking system, patient identification system, Drugs administrating system and Access control system. The RFID- EHS connects the server and Hospital Legacy System via internet and gives support to the patients in case of emergency. The communication channel that has been used in the RFID reader and RFID tag are not secured since adoption of wireless transaction and it could be intercepted easily but the communication of RFID reader is secure. In order to increase the security "elliptic curve cryptography (ECC)-based RFID authentication schemes" is used and extends better solution to the patients [10].

6. **Horng-Lin Shieh et al**, "Emergency care system using RFID and Zigbee"; The purpose of this system is assigning nurse to a patient in case of emergency in accurate and timely manner. In this system the RFID tag is equipped with ZigBee and cell for wireless communication with the ZigBee positioning reader. This positioning reader is placed in a small range from the patients. When it is read the signal from Tag, it passes the signal to monitor host via RS232 wireless interface. In monitoring host, there is a GUI application which has been created and the patients' all information monitoring there from when patients used the tag. In case a patient is in emergency he or she can press an emergency button which is placed in RFID tag, produces alert signal in monitoring host thereby a nurse can be allocated that specific patient [11].

7. **Neeraj Kumar et al**, "An intelligent RFID- enabled authentication scheme for healthcare applications in vehicular mobile cloud"; This system specially developed for provide smart healthcare services while travelling. The patient who is in travelling uses a RFID wrist band which identifies the temperature, pressure, pulse, etc. from wireless body network. The vehicle equipped with RFID reader and the wrist signal send by the reader using Wi-Fi or Bluetooth. In case of Accident, Damage, Unavailability, changes in patients body the reader passes the signal to Road Side Units (RSUs) using ultra high frequency (UHF) Radio wave interface (It take range of road up to 12 meters). Then RSU passes the particular signal to cloud using gateways.

   The services from clouds check the past history of patients, alert message in emergency situation, check the availability of doctors, suggesting medication, check the nearby hospital and so on. Here the cloud acts as central sever and it synchronized with every hospital which use the cloud thus patients' information will be passed to the nearby hospital where staff is available in real time and also it uploads all past information of patient to the particular doctor so he or she could take necessary measures for treatment when patient arrives to the hospital. Also, in case of emergency it will send the alarm to nearest hospital hence the ambulance services reached place timely manner. An authentication scheme is added to this system in addition. In case of communication between RFID tag and reader is not secure (is happening in wireless) elliptical curve cryptography (ECC)-based key generation mechanism is being used to fill this security gap [12].

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8. **K. Seungcheon**, "Smart Health Care System Using Internet of Things"; This system contains three layers such as smart medical service layer, medical resource management layer and sensor data collecting layer. All medical facilities are maintaining in SMS layer such as hospitals, emergency centers, and medicine supply chain. From this layer doctor can check the all-medical history of the patients, doctors can be allocated for number of patients, emergency services can be done through this layer as well as doctor can Monitor the patients in real time. In this layer there is a software application placed for doing all these actions. The MRM layer acts as intermediate layer which connects the SMS layer and SDC layer with the help of cloud facilities. In SDC layer all changes of human body like as temperature, pulse, pressure and other relevant factors are collected with help of android phone sensor or Raspberry pi. The sensed signal is transferred to the MRM layer with the help of RFID, Bluetooth, Zigbee and 3G/4G network. According to the sensed signal SMS layer will give the feedback to the patients [13].

9. **Yeong-Lin Lai et al**, "An intelligent IoT emergency vehicle warning system with the combination of RFID and Wi-Fi technologies for emergency medical services"; The major purpose of this system is to prevent the ambulances from collision in case of emergency situation. This system has three parts. First part includes a system trigger tag on a utility pole about 300 m from an intersection. Second part is RFID system embedded in ambulances which RFID system consist of controller, UHF RFID reader, UHF ID Antenna, Antenna and Wi-Fi module. The controller communicates with the UHF RFID reader module through universal asynchronous receiver/transmitter (UART) interface and with the Wi-Fi module through an Ethernet interface. Third part is RFID system is at intersection which RFID system consist of same components with additionally an LED module. Whenever an ambulance goes to the road an emergency situation with this structure The RFID reader reads the signal of trigger tag from pole it gives a signal when there is a vehicle straight at 300m. In case of RFID system intersection if there is any ambulance come to that way it read the RFID signal and give a LED Emergency vehicle warning thereby other vehicles stop in some moment for ambulance services. So that the services of ambulance reached the hospital without any collisions [14].

10. **Chun-Hung Cheng and Yong-Hong Kuo**, "RFID Analytics for Hospital Ward Management"; Intension of this system is to improve the patient's safety. In this system a RFID tag is attached with medical equipment. There is a RFID wristband is placed in patient and staff's hand for identify the availability of staffs, emergency situation of patients. There is a RFID reader maintain in between the readable range of RFID tag. And also, there is a middleware can maintaining in this system for transferring the RFID tag signal to ward management system from RFID reader. All staff of the hospital system can be used ward management system information and follow the necessary action in required places. It manages to minimize the unnecessary time allocation and time wastage, changes of drugs by mistakes, and it improves the accuracy of allocating the staffs to the patients in a correct manner, provide better protocol in case of emergency and so on [14].

III. IMPLEMENTATION

Modules:

1. Login Module:

- The login module allows users to access the system using their email address and password. The following steps can be taken to design the login module:

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- The login page should prompt the user to enter their email address and password.
- The system should validate the user's credentials by comparing them with the ones stored in the database.
- If the user's credentials are valid, the system should grant access to the dashboard where the user can access the RFID healthcare management system.

2. Registration Module:

- The registration module allows users to create a new account in the system. The following steps can be taken to design the registration module.
- Collect User Information: The registration form should collect the user's name, email address, password, and any other required information.
- Validate User Input: The input provided by the user must be validated to ensure that the email address is in the correct format, and the password is strong enough.
- Store User Information: Once the user input is validated, the information should be stored in the database for future use.

3. Dashboard:

- The RFID healthcare management system dashboard module is designed to provide healthcare professionals with an efficient way to manage patients' healthcare data using RFID technology. This module allows healthcare professionals to search for RFID tags, search for patients, and view patient information.

Block Diagram:

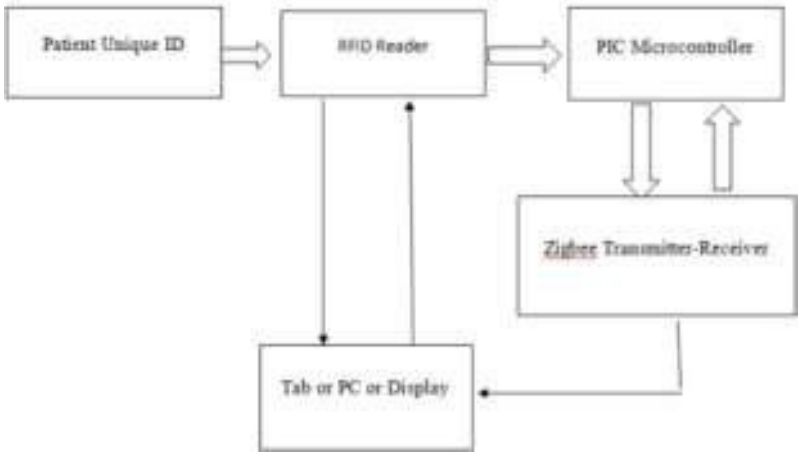

Figure 1: Block Diagram

- A PC in patients ward which will have an application running for entering patient details (medicines prescribed, test recommended, etc.) by the doctor.
- At patient side Embedded kit blocks which will have an RFID Reader, a PIC microcontroller, Zigbee transmitter and receiver, PC or Laptop or Tab as display, etc.
- An RFID Tag for patient.
- At server side Zigbee transmitter and receiver and a PIC microcontroller.

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- Initially ID of the patient that are generally RFID passive tags will be read by RFID or NFC reader when ID is brought in close proximity to the reader. RFID Tag has memory that has unique number stored in it. Reader reads this number and transmits the RFID value to PIC18F4520 microcontroller [5].
- PIC microcontroller decodes that value toa value that can be read by the PC or the application running on PC and PC transmits this value to the ZIGBEE transmitter.
- ZIGBEE transmitter transmits the unique number to the Hospital server. The ZIGBEE Receiver at the Hospital server room receives the data and transmits the number to the server room PC.
- The server room PC validates the number and after validating provides access to the user on the patient side to operate on the data space created for the particular ID. The user on patient side can also fetch data of the patient stored in the hospital database. Patients Unique ID RIFD or NFC reader PIC Microcontroller Zigbee.
- Transmitter Receiver TAB or PC as Display Hospital Database Server room PC Zigbee Transmitter [3].
- In the above case, the PC after validating the ID number, fetches the data of that ID number and transmits it to the server side ZIGBEE transmitter [11]. The ZIGBEE transmitter transmits the data of the patient to the patient side and the ZIGBEE receiver at that side receives the data. The ZIGBEE receiver after receiving the data will transmit the data to the patient side PC where the data of the patient is displayed and can be seen by the user or the doctor.

Flowchart:

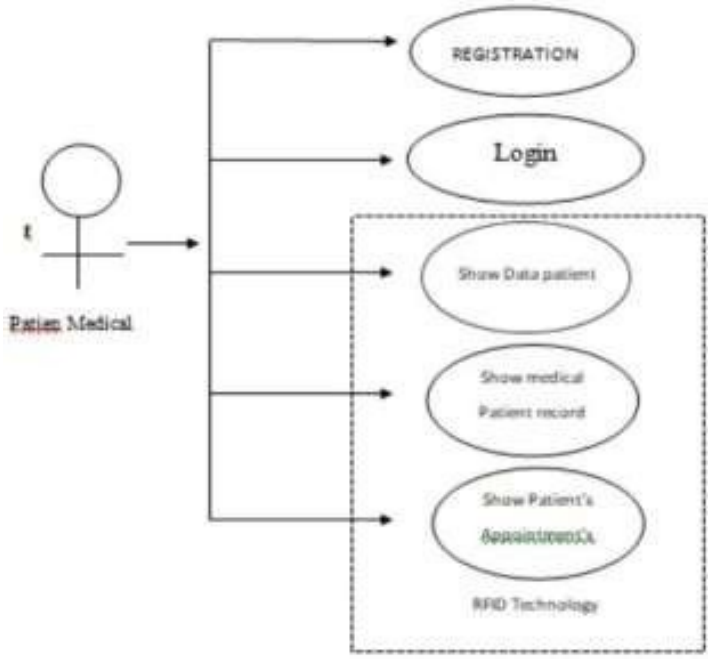

Figure 2: Flowchart

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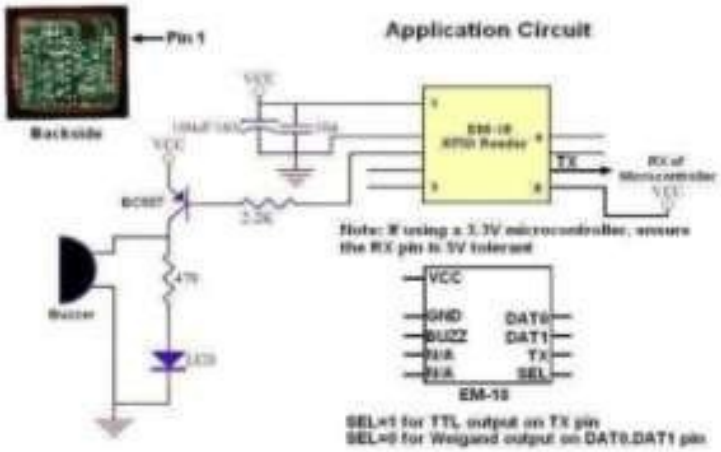
Circuit Diagram:



IV. CONCLUSION

RFID (Radio Frequency Identification) technology has shown great potential in improving healthcare systems by increasing efficiency, reducing errors, and improving patient safety. The use of RFID tags on patients and medical equipment allows for real- time tracking and monitoring of their movements, ensuring that they are in the right place at the right time. This can help prevent errors such as incorrect medication or treatment being given to a patient. In addition, RFID can also help reduce costs associated with lost or misplaced equipment by enabling quick and easy tracking of items. This can help hospitals save money and improve patient care by ensuring that the necessary equipment is always available when needed.

FUTURE SCOPE

Another research study by Precedence Research highlights that the global RFID in healthcare market size will reach around US$ 12 billion by 2027 and the market will grow at a CAGR of 21% during forecast period 2020 to 2027.

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