REPORT

ON

MAJOR PROJECT WORK PHASE - I

HOSPITAL BED OCCUPANCY DETECTION USING RFID SYSTEM

Submitted in
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in
Information Technology

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CERTIFICATE

This is to certify that the project work entitled "HOSPITAL BED OCCUPANCY DETECTION USING RFID SYSTEM" is the bonafide project work phase-I carried out by A. Ruthvik Reddy (B19IT008), Ch. Sakshith Reddy (B19IT012), B. Rama Krishna (B19IT063L), D. Sai Subrahmanyam (B19IT026), and K. Veena (B19IT052), in partial fulfillment of the requirements for the award of the degree of the Bachelor of Technology from Kakatiya Institute of Technology and Science, Warangal during the academic year 2022-2023.

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ABSTRACT

Conventional bed occupancy detection methods are being misused by various hospitals for the sake of money laundering. Recent incidents during the Covid-19 pandemic are some best examples. During those situations, many hospitals sold their beds for a higher cost through backdoors which caused a heavy toll on middle-class people. To resolve this issue the solution proposed in the project suggests an electronic device that uses a Radio Frequency Identification (RFID) system for the detection of empty beds and storing the data in a database server like MySQL. The proposed solution is hardware related and is less expensive when carried out as a whole. Once attached to a bed, the device senses the presence of patients using RFID and uploads data to the database.

Keywords: Radio Frequency Identification, MySQL

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CHAPTER 1

INTRODUCTION

1.1 Introduction

The introduction of this project starts from the main cause for the problem which is the requirement for an electronically detecting device.

Hospital bed occupancy estimation is one of the basic works that are carried out by the hospital management staff. In many hospitals, there is a floor incharge for every floor that keeps track of the count of the number of empty and occupied beds. But by observing the incidents during the Covid pandemic, it is found that there is malpractice happening in the case of hospital bed occupancy detection. Let us consider some examples.

Fig 1.1 During the Covid-19 pandemic

In my native state, there were many hospitals that manipulated many patients into buying a bed for a high price. They announced they didn't have empty beds in their hospitals, but in reality, they were selling those beds for a high price to rich patients. To overcome this situation, there is a need for an electronic device that detects empty beds and gives proper information to the patients even without any human intervention.

CHAPTER 2

LITERATURE SURVEY

2.1 History of RFID

A group of young men from the Soviet Union's Young Pioneer Organization gave US ambassador Harriman a ceremonial seal made by hand in the USA in 1945. An antenna inside the seal was turned on by radio waves the Soviets sent in the direction of the US embassy. This functioned as a microphone and replayed personal talks. The seal, also known as "The Thing," would have been examined by the ambassador's security team for electronic bugs and other surveillance gear, but as it lacked batteries or cables, nothing was detected, therefore the seal was put in Harriman's study. For the next seven years, it was easy to overhear private talks at this place.

RFID tags were used to track train cars in the 1970s. Many companies today, including the NHS and major retail chains worldwide, utilise RFID tags to identify assets, manage stock, or regulate quality procedures. These tags can now be used to track nearly anything because to technology improvements made possible by the straightforward concept developed by Theremin decades earlier.

Fig 2.1.1 Uses of RFID

However, Charles Walton's 1983 filing of the first patent containing the word "RFID" marked the official invention of the technology. NFC first gained attention in 2002 and has since continued to advance.

The technology did not, however, take off right once, particularly in the retail sector. Although RFID technology has been around for about 20 years, many businesses didn't understand the worth of investing because of the cost and initial lack of useful data confirming its benefits. The integration of RFID technology into merchants' existing stock management systems and the necessary shift in corporate culture have been further obstacles to the deployment of RFID by retailers.

Retailers including Adidas, Decathlon, John Lewis, Tesco, River Island, and M&S have all implemented RFID into their businesses recently and have seen a return on their investments, with sales growth of up to 5.5% and stock holding declines of up to 13%. RFID is being increasingly used in the retail industry and offers a practical answer to asset monitoring problems in the aviation, industrial, or healthcare sectors.

Fig 2.1.2 RFID Tags on Army soldiers

It is believed that the first time RFID-like technology was employed was during World War II (WWII). Sir Robert Alexander Watson-1935 Watt's invention of radar was used by the German, American, and British militaries. Radar signals used to spot approaching aircraft, however, were unable to distinguish between German and Allied aircraft. To solve this issue, the Germans ordered their pilots to roll their aircraft as they approached their bases. This changed the radar signal and informed the crews that the aircraft was, in fact, a German plane returning. The Identify Friend or Foe (IFF) system, developed by the British, advanced this concept by installing a transmitter on each plane that would broadcast a signal in response to radar.

Leon Theremin served as the model for the creation of a Soviet spy device using an RFID-like technology in 1946. The static frequency waves that the Theremin produced led to the creation of a musical instrument that could be played without any physical contact. Inspired by this, the Soviet Union included a radio-activated antenna in a ceremonial seal that was presented to the US ambassador. The seal then transmitted audio to the Soviets from its surroundings. The device remained unnoticed in the ambassador's study for seven whole years since it didn't need batteries or connections.

Almost every industry today uses RFID to track products, from biological research to aerospace, engineering, and logistics. It differs from traditional barcodes in several ways, including the ability to store a lot more data and read many tags simultaneously without removing goods from storage. The production of semiconductors using carbon nanotubes has further decreased costs. 5 As RFID technology develops further, it will eventually become less expensive and easier to use, keeping workflows and stocks current and well-managed.

Fig 2.1.3 RFID for Payment

2.2 Reference Paper 1

Title: "Patients tracking and identifying inside hospital: a multilayer method to plan an RFID solution"

The Authors of this paper are Ernesto Iadanz; Fabrizio Dori; Roberto Miniati; Roberto Bonaiuti. In this paper, the authors have discussed the functional requirements, technical constraints, and technical solutions for installing an RFID system. But the proposed solution is used for tracking and not detecting empty beds. They have given clear knowledge about how RFID can be used in the case of patient tracking in hospitals. They have also given a comparison between the technical constraints and constraint types for the RFID system. The recommended multiplayer planning method guarantees coherence between subsequent steps in the various close inspection project steps. It thus offers a technical answer that more than accomplishes the original goals.

	Technical constraints		Constraint type
Tracking system must allow to locate the patient position with a precision of a medium size room.	TC04	An RFID illuminator in each room or equivalent area. Readers in "strategical positions".	Technological - Tracking precision
	TC06	"Area code" associated to each field generator.	Technological - locating technique
	TC24	"Transponder - Illuminator" range ≥ 10 m. "Transponder - Reader" communication range ≥ 20 m.	Technological - range
Functional Requirement FR04	TC26	Tag estimated cost per unit: 30 - 50 €. Illuminator/reader estimated cost per unit: 400 - 900 €. Global cost for a 30 rooms ward (including corridors) with max 320 admissions a day (e.g. emergency room): about 14'100 € - 30'500 €.	Economical

Fig 2.2 Technical Constraints of RFID

2.3 Reference Paper 2

Title: “Development of a Smart Bed Insert for Detection of Incontinence and Occupation in Elder Care”

The Authors of this paper are MORITZ FISCHER, MICHAEL RENZLER, and THOMAS USSMUELLER. In this paper, the authors have discussed a smart bed system where a textile sensor is attached to the bed to detect wetness on the bed. This idea concentrates on the old people who couldn’t go to the washrooms and needed constant care. The primary cause for the proposed method is to help old age people, so it cannot be used for tracking people. This idea uses a textile sensor that will be attached to the bottom of the bed.

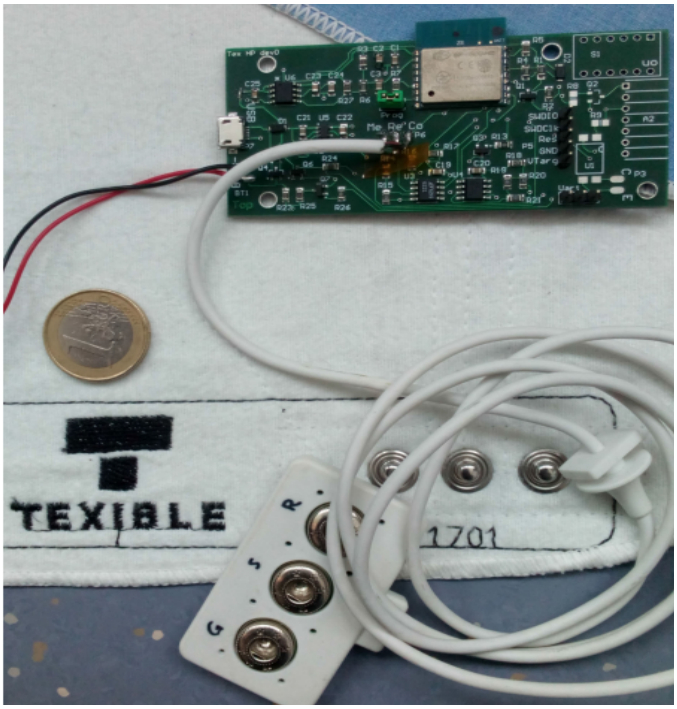


Fig 2.3 Textile Sensor

The disclosed approach uses a textile sensor inside a bed insert as opposed to existing systems that connect sensors to diapers. This gives substantially more convenience for patients and makes it simple to install, rinse, and replace the sensor element. Additionally, the suggested electronics may detect an occupied bed using the same sensor in addition to detecting a wet bed.

CHAPTER 3

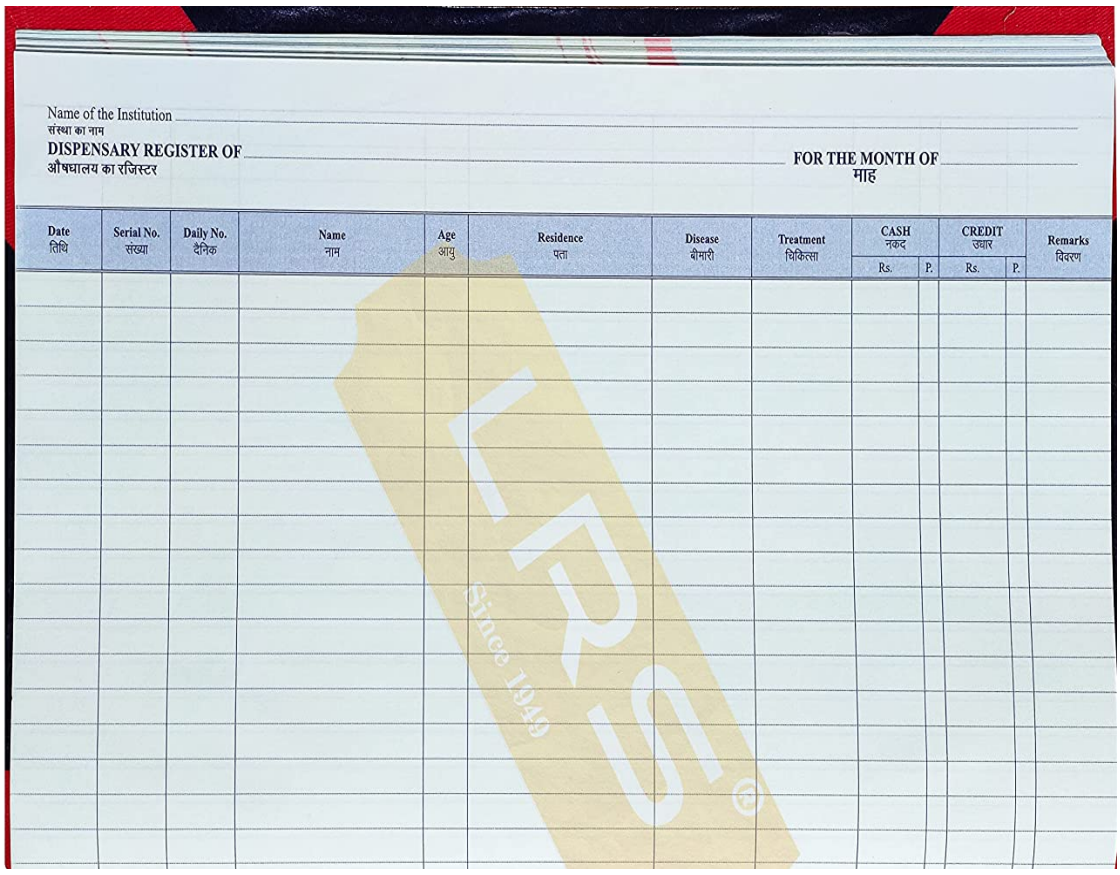
EXISTING SYSTEM

3.1 Conventional Bed Occupancy Detection methods

The existing methods are as follows:

1. Maintaining a Ledger of patients:

In this method, there is usually a ledger prepared for storing the patient data. Using this ledger the count for the number of empty beds or the number of occupied beds can be found. This method is purely offline and outsiders must come inside the hospital to check this.


Name of the Institution
संस्था का नाम
DISPENSARY REGISTER OF
औषधालय का रजिस्टर
FOR THE MONTH OF
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Date तिथि	Serial No. संख्या	Daily No. दैनिक	Name नाम	Age आयु	Residence पता	Disease बीमारी	Treatment चिकित्सा	CASH नकद Rs.	P.	CREDIT उधार Rs.	P.	Remarks विवरण

Fig 3.1.1 Register Book

2. Maintaining an online Website:

Every hospital has its own website where it posts the count of empty beds and occupied beds so that any outsider can know it. This method uses a human to check the count and upload it to the database. There are different websites and mobile applications that arre in use.

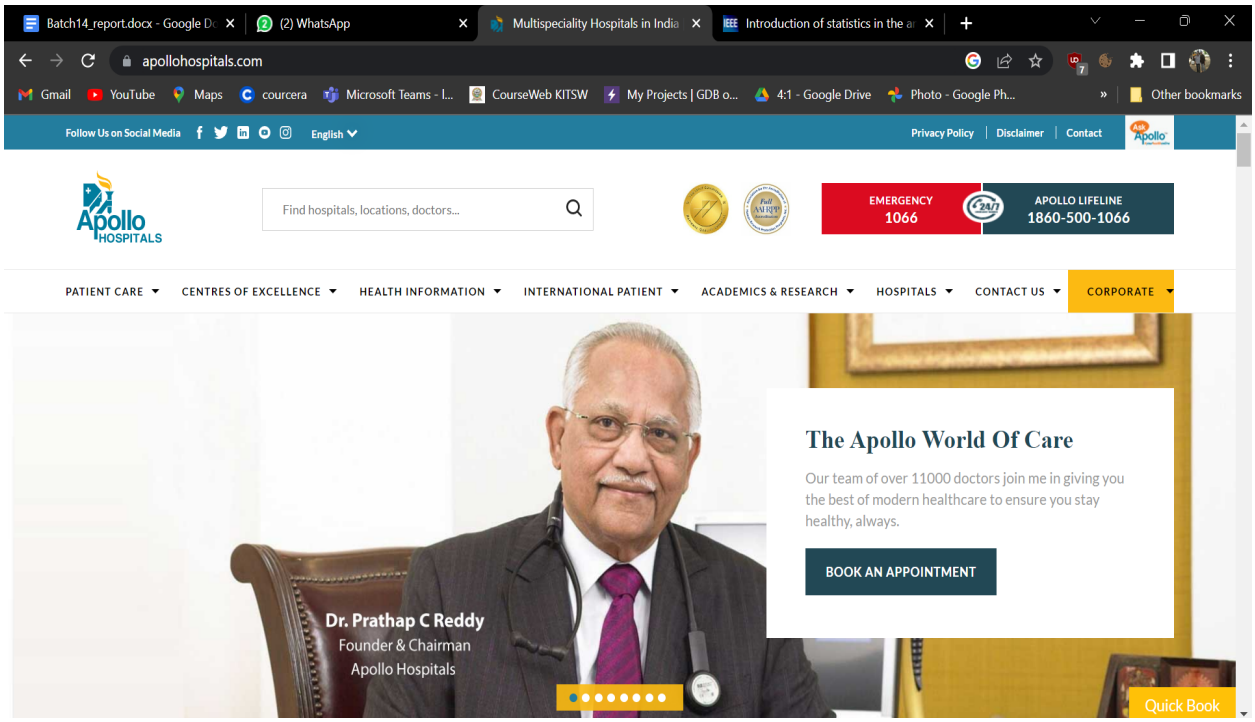

Fig 3.1.2 Apollo Hospital Website

CHAPTER 4

PROPOSED SYSTEM

4.1 Radio Frequency Identification (RFID)

In order to automatically recognize and track tags attached to things, radio-frequency identification (RFID) uses electromagnetic fields. A tiny radio transponder, a radio receiver, and a radio transmitter make up an RFID system. The tag sends digital data, often an inventory identification number, back to the reader when triggered by an electromagnetic interrogation pulse from a close-by RFID reader device. The inventory of products can be tracked using this number.

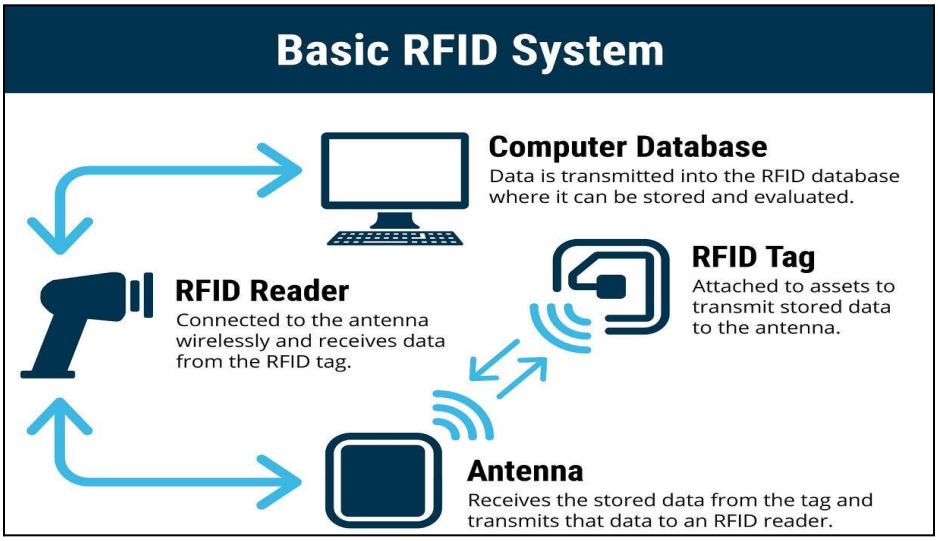

Fig 4.1 RFID System

Each RFID system has three parts: a transmitter, a scanning antenna, and a reader. An RFID reader or interrogator is the term used when the scanning antenna and transceiver are integrated. Fixed readers and mobile readers are the two different categories of RFID readers. The RFID reader is a network-connected gadget that can be carried about or fixed to a surface. It sends signals that turn on the tag using radio waves. After being turned on, the tag returns a wave to the antenna, where it is converted into information.

In addition to identifying and finding things instantly and automatically at every point in the supply chain where they are, RFID technology can assist a warehouse to save labor costs.

However, from a logistical perspective, RFID technology has much more to offer:

- Agility. With the usage of the conventional barcode, this is a crucial feature that is difficult to understand. The efficiency of a warehouse can be increased by implementing RFID technology.
- Traceability. Utilizing RFID technology ensures accurate traceability because the products are always in our control.
- Inventory. Our improved inventory management results in less stock breakage, which enhances customer service.
- Location and resupply. RFID technology makes it easy to determine when a product is out of stock and has to be replenished as well as when it has been placed in the incorrect spot (picking).
- Savings. Monitoring of assets like trucks, pallets, or boxes is also established with RFID technology. As a result, we may examine how those resources are used and develop, for instance, pathways inside the warehouse that reduce staff effort and fuel use.

The following key elements are necessary in order to implement RFID technology in a warehouse:

- RFID tags: We can locate active, passive, and semi-passive RFID tags. You may learn everything there is to know about RFID tags in this article.
- RFID devices are used to read the data on goods that are included in tags.
- RFID software is a platform that manages all the data gathered by the devices used throughout the supply chain in real-time. It is also completely connected with the ERP or WMS system of the business, allowing for access to all the data at any time, anywhere.

To Successfully deploy an RFID System:

1) Select the Right RFID System for your Business

Any organisation must make a serious judgement before installing an RFID system. It might be challenging to choose the best vendors and solutions for your business because there are so many options available. You may position your company for success by taking the time to select the ideal RFID system. Find a solution that fits your needs and budget by working with your team to take into account all of the aforementioned variables. You may streamline your operations and benefit from everything that RFID technology has to offer by putting the correct RFID solution in place.

2) Develop an RFID Implementation Project Plan

After choosing the appropriate RFID technology, you must have a clear knowledge of how you intend to use it. This entails working with your RFID service provider to map out your business operations, do a site survey, and identify areas where the RFID system might increase accuracy or efficiency. Once a detailed plan has been created, the required resources must be allocated to ensure that the implementation is successful. This entails making sure you have the appropriate personnel in place to handle the project and the funding to cover the price of the RFID system and its implementation. You may increase your chances of having a successful RFID implementation by carefully planning ahead.

3) Consider Implementing Your RFID System Gradually

Any company wishing to use an RFID system must be careful to do so gradually. The success of the system may be hampered by technical issues and user resistance as a result of a hurried or haphazard rollout. Businesses should instead adopt a phased strategy, beginning with a pilot project to iron out any issues before extending the system. This will give workers some time to adjust to the new technology and aid in the seamless and successful deployment of the RFID system.

4) Provide Proper Training on your RFID System to Employees

Employee training is one of the key success factors in the adoption of RFID systems. A workforce that isn't properly taught might rapidly result in an RFID system that isn't being utilised properly or, worse still, not being utilised at all. Together, the project manager and your RFID system champion must make sure that staff members receive the necessary instruction in using the system. This includes being able to identify and fix faults as well as comprehending how the system functions. A successful deployment of an RFID system is unlikely without adequate training.

4.2 Proposed Solution

The Proposed solution has 4 parts:

1. When the patient gets admitted he will be given an RFID tag and a bed number so that he/she can use that bed till they are discharged from the hospital.
2. The RFID reader will be attached to the bed and has a special code written in it so that it identifies the unique tag assigned to it and will not consider other tags.
3. After Recognizing the tag, it will send a signal to the MySQL server that the bed is occupied.
4. Finally the data from MySQL is displayed on a screen.

In this order, we are going to implement the project.

4.3 Proposed Solution Data Flow Diagram (DFD)

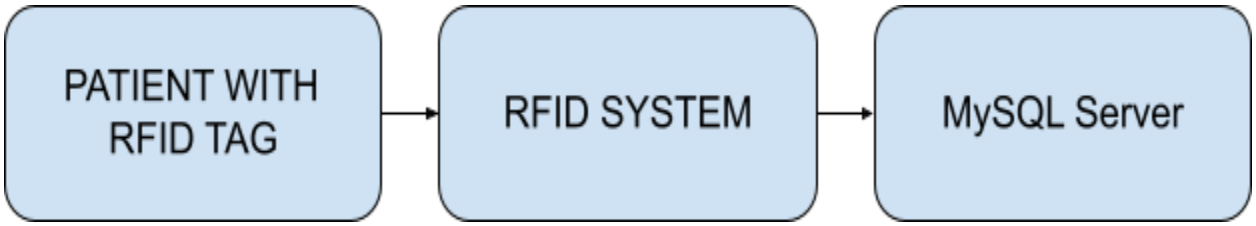

Fig 4.3 UML Diagram

4.4 Prototype of Proposed Method

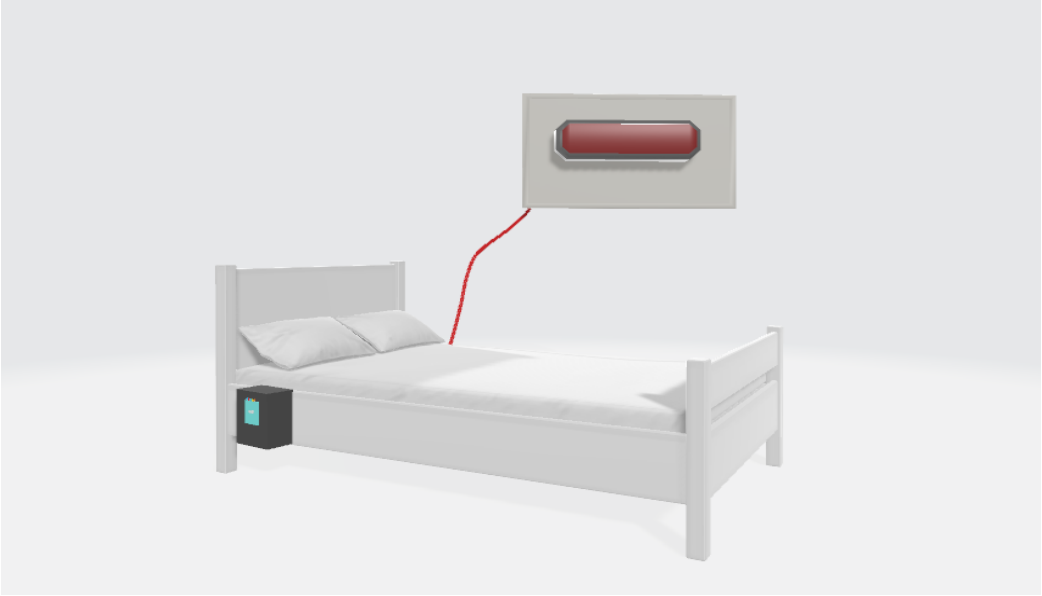

Fig 4.4 Prototype of Project

4.5 Hardware Components

The prototype for the project has the following components:

1. Arduino Board:

Fig 4.5.1 Arduino UNO Board

2. RFID System:

Fig 4.5.2 RFID Reader and Tag

3. Bread Board

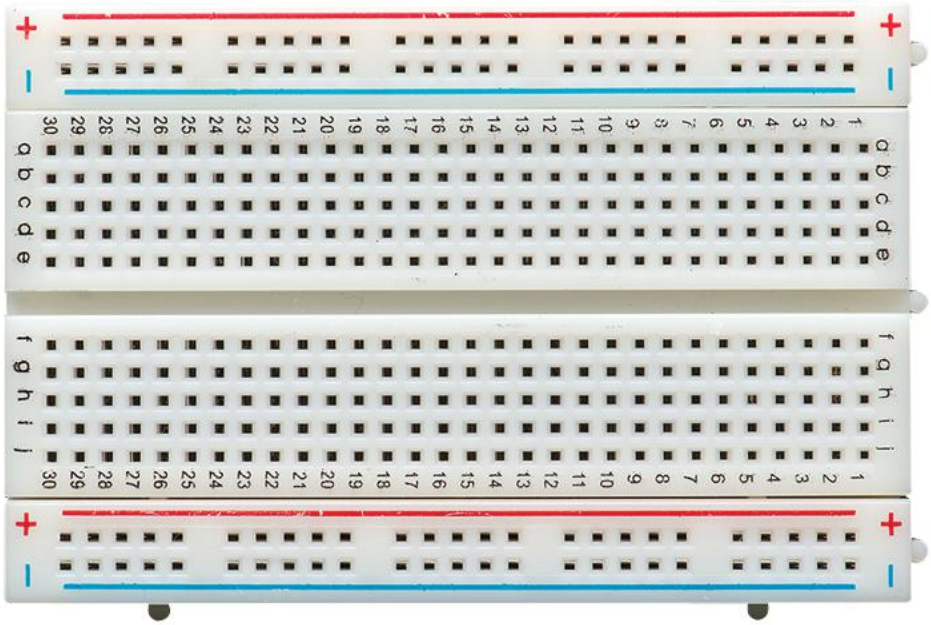

Fig 4.5.3 Bread Board

4. Jumper Wires:

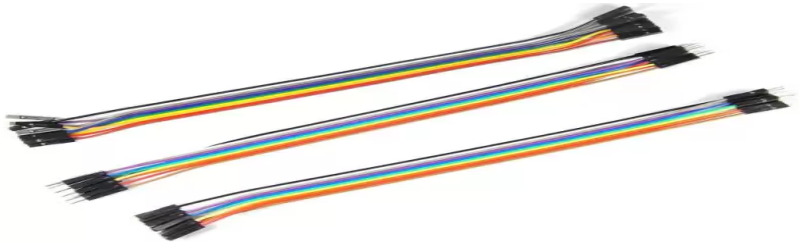

Fig 4.5.4 Jumper Wires

5. LEDs:

Fig 4.5.5 LED

6. 9V Battery:

Fig 4.5.6 9V BATTERY

4.6 Proposed Method Hardware Connection

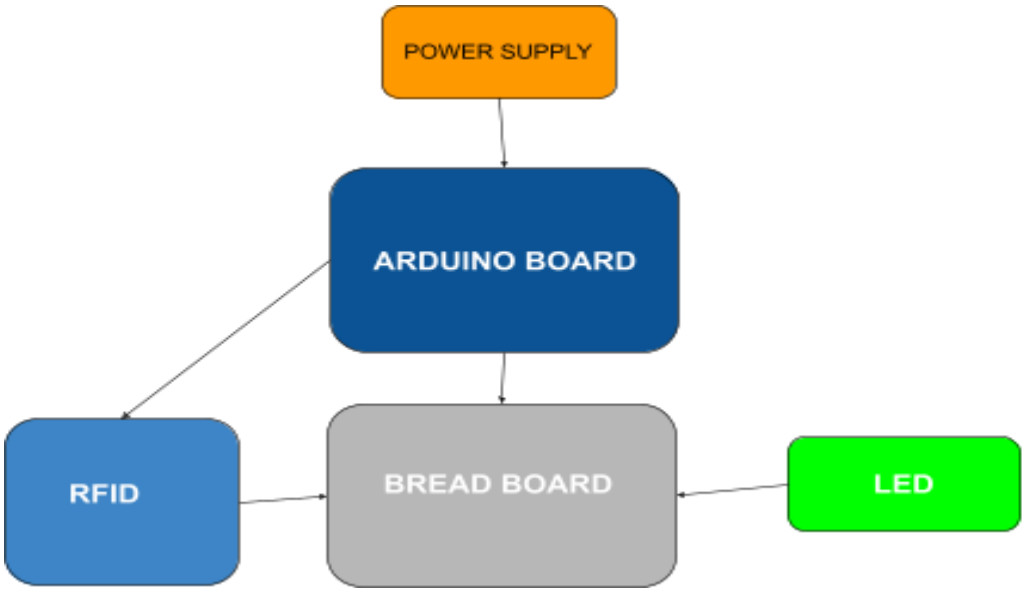

Fig 4.6 Hardware Connection

CHAPTER 5

RESULTS AND DISCUSSION

5.1 Hardware Results

1. When any other patient other than the patient comes near the sensor. The LED on the left gives a signal. This indicates there will be no action.

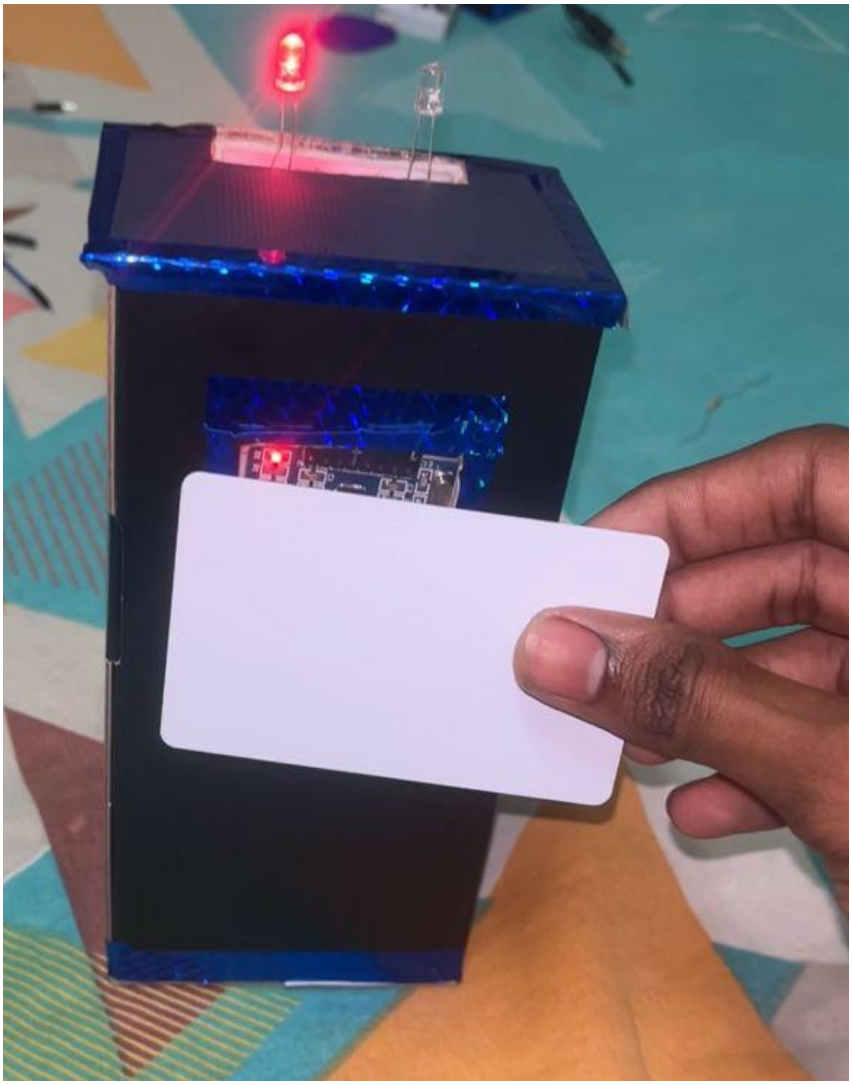

Fig 5.1 Output 1 - Unknown Patient

2. When a particular patient comes in contact with the sensor. The LED on the right will give a signal that the particular patient assigned to the bed has come and it will send a signal to the MySQL server.

Fig 5.2 Output 2 - Known Patient

5.2 Software Results

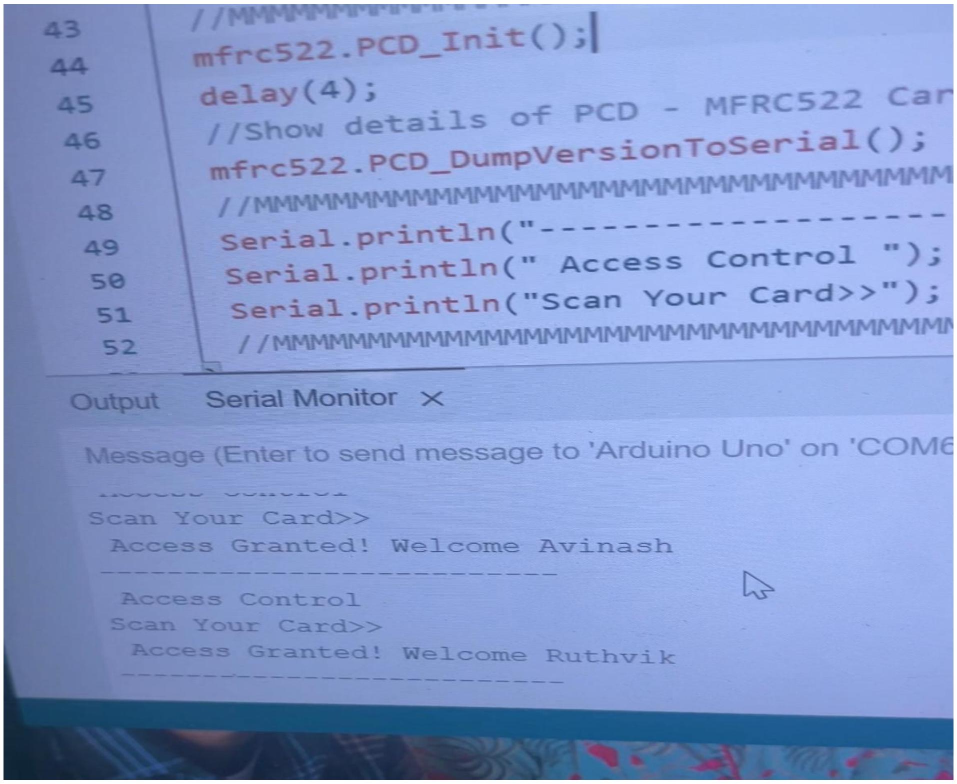

Fig 5.3 Output 3 - Arduino Output Screen

CHAPTER 6

CONCLUSION AND FUTURE ENHANCEMENTS

6.1 Conclusion

Till now a major portion of the project is finished and there is only the software part left. With this, we conclude that this project is less expensive and can be affordable. The software work that is unfinished is the MySQL connection.

6.2 Future Enhancements

The Future enhancements for the project are

1. Multiple RFID Devices
2. MySQL connection
3. Wearable and portable hardware

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