

RFID TECHNOLOGY-BASED REMINDER SYSTEM FOR SMART HOME

DR. S M P SAMI¹, A. LASYA², A. SHRAVIKA³, A. MOUNA SRI⁴

PROFESSOR¹, UG SCHOLAR^{2,3&4}

DEPARTMENT OF ECE, MALLA REDDY ENGINEERING COLLEGE FOR WOMEN, HYDERABAD

ABSTRACT

This paper presents the design and development of a RFID based Room Automation using microcontroller. This paper has shown the concept of an automatic Door Access System with Automatic Room Light Controller and Visitor Counter. The concept of access control is brought about using a card, a corresponding card reader and a control panel. The card is a proximity card with a unique identification number integrated in it. The reader reads the data and sends it to the control panel. This controller checks whether he/she is allowed to enter the particular door or not. If the employee is authentic, then he/she is allowed access in the particular entrance. Automatic Room Light Controller with Visitor Counter using Microcontroller is a reliable circuit that takes over the task of controlling the room lights as well as counting number of persons/ visitors in the room very accurately.

INTRODUCTION

RFID i.e. Radio Frequency Identification is a device that refers to the electromagnetic waves having a wavelength suited for use in radio communications. Using RFID, the data can be serially transmitted to communicate. RF is used in many different applications. Such as identification systems, radio, televisions, etc. Earlier Bar code was used to communicate but now RFID came into existence for better communication. RFID and Bar code are similar in concept. Bar code system uses a reader and coded labels that are attached to an item, whereas RFID uses a reader and special RFID devices that are attached to an item. Bar code uses optical signals to transfer information from the label to the reader; RFID uses RF signals to transfer information from the RFID device to the reader [1]. In today's world, with growth in technology, security has also become a major concern for any organization whether it is school, office or home. Earlier, there used to be security personnel at the entrance door to prevent illegal entry. But this system was never adequate for larger organization. This project uses RFID which utilizes radio frequency signals to provide automatic identification. Keeping security as a main concern, we have used RFID for encrypted data transferring and a control panel for door access while

providing room automation. Also for energy saving, we have made automatic room light controller with bidirectional visitor counter. RFID uses a frequency in the range of 50 KHz to 2.5 GHz. RFID technology is an emerging technology used in wide range of applications. RFID technology is fast and reliable means for identification of objects. Primary goal of RFID technology is to automatically identify data that are contained in electromagnetic fields [2]. Radio frequency identification is a technology that allows simultaneous identification in a fully automated manner without the need for a line-of-sight via radio waves. Based on these advantages, RFID is widely spreading in various fields, such as smart card, localization, supply chain management, and so on [3]. For RFID based door access control system, when an authorized person try to enter into a room, a card is to be shown to the RFID receiver and the data is serially transmitted and the data is checked. If the data matches in the control panel i.e. with microcontroller memory, then the name is displayed on the LCD and the door will be opened so that the person will be able to enter into the room. And for energy saving, automatic room light controller with bidirectional visitor counter is implemented. When somebody enters into the room, then the counter is incremented by one and the lights in the room will be switched on automatically. The total number of persons inside the room is displayed on the seven segment display. When anyone leaves the room, the counter will be decremented by one. When the room is empty i.e. no person is inside the room, the lights will be switched OFF automatically so that the energy can be saved even if people forget to switch off the lights. "RFID Based Room Automation" using microcontroller is a reliable circuit that takes over the task of controlling the room lights as well as counting number of persons/ visitors in the room very accurately. Also, it only allows the authorized personnel to enter into the room ensuring security of the organization or home. The project uses AT89S52 microcontroller. The microcontroller receives the signals from the sensors and the signal is operated under the control of software which is stored in ROM. The microcontroller also monitors the infrared sensors continuously. When an object passes through the IR receiver then the IR rays falling on the receiver are obstructed which is sensed by the microcontroller.

EXISTING SYSTEM

As of my last knowledge update in January 2022, there were various RFID technology-based reminder systems for smart homes. These systems typically leverage Radio Frequency Identification (RFID) tags and readers to create a seamless and automated reminder system. In

the existing systems, RFID tags are strategically placed on commonly used objects or in specific locations within the home. Each RFID tag is associated with a particular task, event, or reminder.

The smart home reminder system functions by having RFID readers installed in different areas of the house. When a person carrying an RFID-enabled device, such as a smartphone or a dedicated RFID card, comes into proximity with an RFID tag, the reader detects the tag and triggers a corresponding reminder or action. For example, an RFID tag on a medication bottle might prompt a reminder for the resident to take their medication when the tagged bottle is brought close to the RFID reader.

These systems often offer customizable features, allowing users to associate specific reminders with RFID tags and set preferences for notifications. Additionally, some systems integrate with smart home platforms, enabling users to control other connected devices based on RFID triggers, such as adjusting lighting or temperature settings.

Furthermore, advancements in these systems may include the incorporation of machine learning algorithms to adapt to users' routines and preferences over time, providing a more personalized and intelligent reminder experience. It's important to note that the landscape of smart home technologies, including RFID-based systems, evolves rapidly, and new developments may have occurred since my last update.

PROPOSED SYSTEM

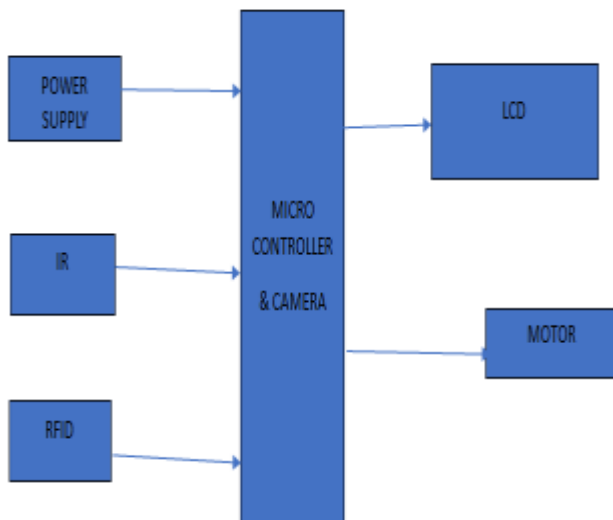
The proposed system for a smart home is an RFID technology-based reminder system designed to enhance the efficiency and convenience of daily tasks for residents. Leveraging Radio-Frequency Identification (RFID) technology, the system aims to seamlessly integrate into the smart home ecosystem. Each resident will be assigned RFID tags, which can be attached to personal belongings such as keys, wallets, or mobile devices. These RFID tags will act as unique identifiers, allowing the system to track the location of these items within the home.

The core functionality of the system lies in its ability to generate reminders based on the proximity of RFID-tagged items. For instance, if a resident is about to leave the house without their keys, the system will detect the absence of the RFID signal and trigger a reminder. Similarly, if a user needs a specific item for a task, the system can provide timely reminders when the associated RFID-tagged item is not within reach. This intelligent reminder system is not only designed to prevent forgetfulness but also to streamline daily routines by anticipating the user's needs.

Moreover, the RFID technology-based reminder system can be integrated with other smart home devices and applications. For example, it can communicate with the home's central control system to adjust lighting, temperature, or security settings based on the detected location of residents and their belongings. The system could also send notifications to the user's smartphone or smartwatch, ensuring that reminders are accessible even when they are not physically present in the home.

In terms of user customization, residents can easily configure the system through a user-friendly interface to set preferences, adjust reminder frequencies, and prioritize specific items. The proposed system aims to create a more intelligent, responsive, and user-centric smart home environment by harnessing the capabilities of RFID technology to enhance the overall quality of daily life.

BLOCK DIAGRAM



SURVEY

S. I. Bakhtar, R. S. Dhekekar, "Use of RFID for Safety at School/Hospital Campus", International Journal of Scientific and Research Publications, Volume 2, Issue 5, May 2012, ISSN 2250-3153.

This paper presents the design and development of a RFID based Room Automation using microcontroller. This paper has shown the concept of an automatic Door Access System with Automatic Room Light Controller and Visitor Counter. The concept of access control is brought

about using a card, a corresponding card reader and a control panel. The card is a proximity card with a unique identification number integrated in it. The reader reads the data and sends it to the control panel. This controller checks whether he/she is allowed to enter the particular door or not. If the employee is authentic, then he/she is allowed access in the particular entrance. Automatic Room Light Controller with Visitor Counter using Microcontroller is a reliable circuit that takes over the task of controlling the room lights as well as counting number of persons/ visitors in the room very accurately. Radio frequency identification is a technology that allows simultaneous identification in a fully automated manner without the need for a line-of-sight via radio waves. Based on these advantages, RFID is widely spreading in various fields, such as smart card, localization, supply chain management, and so on [3]. For RFID based door access control system, when an authorized person try to enter into a room, a card is to be shown to the RFID receiver and the data is serially transmitted and the data is checked. If the data matches in the control panel i.e. with microcontroller memory, then the name is displayed on the LCD and the door will be opened so that the person will be able to enter into the room. And for energy saving, automatic room light controller with bidirectional visitor counter is implemented. When somebody enters into the room, then the counter is incremented by one and the lights in the room will be switched on automatically. The total number of persons inside the room is displayed on the seven segment display. When anyone leaves the room, the counter will be decremented by one. When the room is empty i.e. no person is inside the room, the lights will be switched OFF automatically so that the energy can be saved even if people forget to switch off the lights. "RFID Based Room Automation" using microcontroller is a reliable circuit that takes over the task of controlling the room lights as well as counting number of persons/ visitors in the room very accurately. Also, it only allows the authorized personnel to enter into the room ensuring security of the organization or home. The project uses AT89S52 microcontroller. The microcontroller receives the signals from the sensors and the signal is operated under the control of software which is stored in ROM. The microcontroller also monitors the infrared sensors continuously. When an object passes through the IR receiver then the IR rays falling on the receiver are obstructed which is sensed by the microcontroller.

M. Patil, S.R.N. Reddy, “Comparative Analysis of RFID and Wireless Home/Office Automation”, International Journal of Soft Computing and Engineering (IJSCE), ISSN: 2231-2307, Volume-3, Issue-3, July 2013.

Wireless Sensor Network (WSN) is most widely used wireless technology in different applications. Home automation makes day to day life of people easier. WSN provides flexible management of lighting, heating, cooling and security from anywhere in the home/office [20]. In this project we propose use of both wired and wireless technology for home/ office automation. RFID technology is used for automatic door opening & closing. We also propose use of wireless sensor network for temperature, lighting, smoke detection and automatic door opening & closing. GSM technology is used in this project to monitor and control various devices from outside the home/office. The goal of this project is to develop home automation system using RFID, Wireless Sensor Network (ZigBee) technology and GSM. ZigBee is low power wireless technology used for monitoring and controlling various devices [11]. One purpose of this project is to allow users to be identified securely without being intruded by anyone. Automatic door opening and closing implemented by using RFID technology. More secure door opening system implemented by using wireless sensor network. Transmission of data in long distances to control the opening of magnetic sensor doors using ZigBee. The door which is far away can be controlled by anyone inside the house. User can place his or her RFID card on RFID reader placed inside the house, thus opening and closing the door. We will develop a secure and effective transmission of data using wireless sensor network ZigBee. RFID technology is an emerging technology used in wide range of applications. RFID technology is fast and reliable means for identification of objects. RFID is composed of two main components RFID reader and RFID tag. In RFID system RFID tags are interrogated by RFID reader. Primary goal of RFID technology is to automatically identify data that are contained in electromagnetic fields. RFID tags are inexpensive and small. RFID tags derive its power from the signal produced by RFID reader. Wireless Sensor Networks are being gradually introduced in different application scenarios. ZigBee is one of the most widely used transceiver standard in wireless sensor networks. ZigBee over IEEE 802.15.4., defines specifications for low data rate WPAN (LR-WPAN) to support low power monitoring and controlling devices. This paper presents a comparative study of different wireless standard and its application for home/office automation.

M. Kim, K. Kim, “Automated RFID-Based Identification System For Steel Coils”, Progress In Electromagnetics Research, Vol. 131, 1-17, 2012.

To overcome the attenuation due to signal distortion in the telex model antenna transmitter, the copper and silver coil loading materials for gain have been tested. The parameters include standing wave ratio (SWR) value ≈ 1 , the antenna impedance (Z_L), return loss (RL), reflection coefficient (ρ) which measured the bandwidth (BW) and quality factor (Q). In this experiment a telex model ground antenna is used, a coaxial feeder cable with 50Ω and an operating frequency of 144.280 MHz was used. The feeder cable is tuned to approximate pure resistive with minimum impedance to reach maximum resonance frequency. The field strength effective radiated power (ERP) is measure based on 4 measurement points which has different distances within 100 km areas. The results show that the antenna based on copper loading coil (CLC) has a bandwidth is $BW=5.166$ MHz and $Q=27.929$, moreover, the silver loading coil (SLC) antenna the bandwidth is $BW=4.500$ MHz and $Q=32.062$. Therefore, SLC material could provide a good reduction in attenuation of signal distortion when signal radiation occurs from the antenna to the air. The antenna is a transitional device between the transmission line and free space and vice versa. Antennas are made of metal in the form of rods or wires and function to transmit or receive radio waves [1]– [6]. Antennas have various types of circuits and models, when an antenna is used it has two uses, namely emitting electromagnetic wave signals and receiving electromagnetic wave signals. The guide wave travels along the transmission line, then is radiated into a free space waves [7]–[9]. To overcome attenuation due to long distances and large signal distortion, loading coils have been used for decades [10]–[14]. In a radio telecommunication system, this part is very important and requires more handling because many factors can affect the level of reception and transmission, including the voltage standing wave ratio (SWR) value, the type/model of the antenna, the physical dimensions of the antenna, the effectiveness or antenna gain, and directives [16], [17]. Good antenna transmission is the radio output power has minimal power reach the transmission distance as far as possible so that it will save electricity consumption besides that the radio device will also last longer [2], [5]. Loading coils are inductors that are inserted into an electronic circuit to increase their inductance which is used to prevent signal distortion in long-distance telegraph transmission cables. It is also used in radio antennas, or between an antenna and its feeder, to shorten the resonance of an antenna

electrically at its operating frequency [15]. Ground plane antenna [18]–[22], telex model includes this type of antenna which is widely used in radio telecommunications in the amateur radio community, the police, the Indonesian red cross, disaster management agencies, and volunteers [22]–[25]. The working frequency is usually in the high frequency (HF), very high frequency (VHF) and ultra high frequency (UHF) bands. This antenna construction consists of 2 rods of $5/8 \lambda$ size between the loading coil and 2 groups of multilevel radial arrangement (pseudo ground) each consisting of 4 rods measuring $1/4 \lambda$ [26]–[28]. The rod material usually uses aluminum and for loading coil using copper wire. Loading coil with a DC ground system is attached to a connector as the power input point of the transmitter amplifier via the coaxial feeder cable.

T. N. Padmaja, T. Renuka, A. S. Srilakshmi, “Design Of GSM Based Smoke Detection And Temperature Monitoring System”, International Journal of Engineering Research & Technology (IJERT), Vol. 2, Issue 4, April 2013, ISSN: 2278-0181.

This paper presents the design and development of a RFID based Room Automation using microcontroller. This paper has shown the concept of an automatic Door Access System with Automatic Room Light Controller and Visitor Counter. The concept of access control is brought about using a card, a corresponding card reader and a control panel. The card is a proximity card with a unique identification number integrated in it. The reader reads the data and sends it to the control panel. This controller checks whether he/she is allowed to enter the particular door or not. If the employee is authentic, then he/she is allowed access in the particular entrance. Automatic Room Light Controller with Visitor Counter using Microcontroller is a reliable circuit that takes over the task of controlling the room lights as well as counting number of persons/ visitors in the room very accurately. RFID i.e. Radio Frequency Identification is a device that refers to the electromagnetic waves having a wavelength suited for use in radio communications. Using RFID, the data can be serially transmitted to communicate. RF is used in many different applications. Such as identification systems, radio, televisions, etc. Earlier Bar code was used to communicate but now RFID came into existence for better communication. RFID and Bar code are similar in concept. Bar code system uses a reader and coded labels that are attached to an item, whereas RFID uses a reader and special RFID devices that are attached to an item. Bar code uses optical signals to transfer information from the label to the reader; RFID uses RF signals to transfer information from the RFID device to the reader [1].

In today's world, with growth in technology, security

has also become a major concern for any organization whether it is school, office or home. Earlier, there used to be security personnel at the entrance door to prevent illegal entry. But this system was never adequate for larger organization. This project uses RFID which utilizes radiofrequency signals to provide automatic identification. Keeping security as a main concern, we have used RFID for encrypted data transferring and a control panel for door access while providing room automation. Also for energy saving, we have made automatic room light controller with bidirectional visitor counter. RFID uses a frequency in the range of 50 KHz to 2.5 GHz. RFID technology is an emerging technology used in wide range of applications. RFID technology is fast and reliable means for identification of objects. Primary goal of RFID technology is to automatically identify data that are contained in electromagnetic fields [2]. Radio frequency identification is a technology that allows simultaneous identification in a fully automated manner without the need for a line-of-sight via radiowaves. Based on these advantages, RFID is widely spreading in various fields, such as smart card, localization, supply chain management, and so on [3]. For RFID based door access control system, when an unauthorized person try to enter into a room, a card is to be shown to the RFID receiver and the data is serially transmitted and the data is checked. If the data matches in the control panel i.e. with microcontroller memory, then the name is displayed on the LCD and the door will be opened so that the person will be able to enter into the room. And for energy saving, automatic room light controller with bidirectional visitor counter is implemented. When somebody enters into the room, then the counter is incremented by one and the lights in the room will be switched on automatically. The total number of persons inside the room is displayed on the seven segment display. When anyone leaves the room, the counter will be decremented by one. When the room is empty i.e. no person is inside the room, the lights will be switched OFF automatically so that the energy can be saved even if people forget to switch off the lights. "RFID Based Room Automation" using microcontroller is a reliable circuit that takes over the task of controlling the room lights as well as counting number of persons/ visitors in the room very accurately. Also, it only allows the authorized personnel to enter into the room ensuring security of the organization or home. The project uses AT89S52 microcontroller. The microcontroller receives the signals from the sensors and the signal is operated under the control of software which is stored in ROM. The

microcontroller also monitors the infrared sensors continuously. When an object passes through the IR receiver then the IR rays falling on the receiver are obstructed which is sensed by the microcontroller.

CONCLUSION

This system can replace the conventional system of security access in near future for home or office. The project showed the concept of an automatic door access system with automatic room light controller along with visitor counter. The control system was brought by using a card, a corresponding card reader and a control panel. This project used a proximity card on which a unique identification number was integrated on it. The RF card reader reads the data and sends the read data to the control panel, which is microcontroller in this case. The controller checks if the person is authorized to enter the gate or not. If the person was authorized then the door opened and the person was allowed to access in that room but if he/she was not authentic, the door did not open. On the other hand, automatic room light controller with visitor counter was also successfully implemented. It used another microcontroller to control the light of a room based on the number of person entering or leaving a particular room. The visitor counter successfully counted the number of person entering or leaving the room. When a person entered the room, the counter was incremented by one and the light in the room was switched ON automatically. But, when a person left the room, the counter was decremented by one. And when all the persons left the room, the lights turned OFF automatically. It was noted successfully, that the counter returned to zero when there was no one left in the room and lights went OFF automatically. The total number of persons inside the room was displayed on the LCD. This system is suitable when there are a large number of users where security is essential but difficult to provide. The implemented project is simple to operate, user-friendly, and flexible. The project can easily be modified by changing the program in the microcontroller according to our need. So, this project has a wide variety of application in security access control systems.

REFERENCES

[1] S. I. Bakhtar, R. S. Dhekekar, "Use of RFID for Safety at School/Hospital Campus", International Journal of Scientific and Research Publications, Volume 2, Issue 5, May 2012, ISSN 2250-3153.

- [2] M. Patil, S.R.N. Reddy, “Comparative Analysis of RFID and Wireless Home/Office Automation”, International Journal of Soft Computing and Engineering (IJSCE), ISSN: 2231-2307, Volume-3, Issue-3, July 2013.
- [3] M. Kim, K. Kim, “Automated RFID-Based Identification System For Steel Coils”, Progress In Electromagnetics Research, Vol. 131, 1-17, 2012.
- [4] T. N. Padmaja, T. Renuka, A. S. Srilakshmi, “Design Of GSM Based Smoke Detection And Temperature Monitoring System”, International Journal of Engineering Research & Technology (IJERT), Vol. 2, Issue 4, April 2013, ISSN: 2278-0181.
- [5] M. M. Ali, “The 8051 Microcontroller and Embedded Systems: Using Assembly and C”, Pearson Education India, Second Edition.
- [6] <http://www.talkingelectronics.com/projects/H-Bridge/H-Bridge-1.html>. (Accessed on August 31).
- [7] N. Rivera, R. Mountain, L. Assumpcao, A. A. Williams, A.B. Cooper, D. L. Lewis, R. C. Benson, J. A. Miragliotta, M. Marohn, R. H. Taylor, “ASSIST - Automated System for Surgical Instrument and Sponge Tracking”, 2008 IEEE International Conference on RFID, The Venetian, Las Vegas, Nevada, USA, April 16-17,2008.
- [8] V. Ramya, B. Palaniappan, K. Karthick,” Embedded Controller for Vehicle In-Front Obstacle Detection and Cabin Safety Alert System”, International Journal of Computer Science & Information Technology (IJCSIT), Vol. 4, No. 2, April 2012.