International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

Design And Implementation Of An Anti-Collision Robot Using RFID Technology

NASRUSSAMAD KHAN [1], MD RIJWAN [2]

Born in East Champaran, Bihar, Persuing BTech in Electronics abd communication Engineering From Noida Institute Of Engineering And Technology, Gr Noida, Uttar Pradesh

Born in bihar, Persuing BTech in Electronics and communication Engineering From Noida Institute Of Engineering And Technology, Gr Noida, Uttar Pradesh

ABSTRACT

Now In Recent Times RFID is wireless technology which operates on low power. This technology we use in our day-to-day life through various applications. Radio frequency identification technology is universally used in daily life. It is also used for robot navigation. For various industrial applications, numbers of robots working in the workplace can have chances of physical collision with each other or static objects. The aim of this project is to design and implement an anti-collision robot using RFID technology. The robot is designed to navigate through a designated area while avoiding obstacles and other robots in its vicinity. To achieve this, the robot is equipped with RFID readers and tags that allow it to detect and communicate with other nearby robots, thus preventing collisions. The robot also uses a combination of hardware and software to navigate through the environment, avoiding obstacles and tracking its position. The hardware components of the robot include a microcontroller, RFID readers and tags, and actuators for movement. The software components consist of an algorithm for detecting and communicating with other robots, as well as a control system for movement. The implementation of this anti-collision robot will demonstrate the potential of RFID technology for improving the safety and efficiency of autonomous robots. With RFID technology we are In such cases we have designed and implemented anti-collision robots for avoiding such crashes with the help of RFID Technology and implemented it by using Arduino. The design procedure and simulated results are useful in designing and implementing a practical System.RFID is a low power wireless emerging technology which has given rise to highly promising applications in real life. It can be employed for robot navigation. In multi-robot environment, when many robots are moving in the same workspace, there is a possibility of their physical collision with themselves as well as with physical objects. In the present work, we have proposed and developed a processor incorporating smart algorithm for avoiding such collisions with the help of RFID technology and implemented it by using VHDL. The design procedure and the simulated results are very useful in designing and implementing a practical RFID system. The RTL schematic view of the processor is achieved by successfully synthesizing the proposed design.

INTRODUCTION

The Purpose of this project is to design and implement an anti-collision robot using RFID technology. The robot is designed to navigate through a designated area while avoiding obstacles and other robots in its vicinity. To achieve this, the robot is equipped with RFID readers and tags that allow it to detect and communicate with other nearby robots, thus preventing collisions. The robot also uses a combination of hardware and software to navigate through the environment, avoiding obstacles and tracking its position. The hardware components of the robot include a microcontroller, RFID readers and tags, and actuators for movement. The software components consist of an algorithm for detecting and communicating with other robots, as well as a control system for movement. The implementation of this anti-collision robot will demonstrate the potential of RFID technology for improving the safety and efficiency of autonomous robots. In a multi robot environment, a number of robots are moving in a same work space.The work space may be a closed room or an open space. To ensure these robots do not collide either with each other or with static objects while they are in moving.This work introduces a local collision avoidance approach that deals a.o. with the problems of multiple robots sharing the same workspace with or without humans. An overview of existing (global and local) approaches for human aware navigation shows that the main focus current research is on the comfort, naturalness and sociability of robots in human environments. This usually entailsonly one robot acting in a group of humans, i.e. as a personal assistant. Our approach however, is aimed at a different dis tribution of agents, namely many robots navigating together with many humans in the same shared workspace To complete our daily life and industrial applications even in our absence

- Saving time in this busy life of humans.
- To Avoid collision.
- Basically, to introduce a smart hand of the humans.

The factor that influence Detectibility of the mobile RFID tags with fixed RFID reader includes Reader Type

Content of the object
Position type and direction of tag
Moving speed of mobile tags
Angle of antenna

LITRETURE REVIEW

In Recent years Researchs, The development of anti-collision robots has Attained significant attention due to the increasing demand for automation in various industries. Anti-collision robots are designed to prevent collisions between robots and other objects, such as humans, walls, or other robots, in order to ensure safety and efficiency. The implementation of anti-collision robots requires the integration of various technologies, including sensors, actuators, and communication systems. One of the most commonly used technologies for anti-collision robots is Radio Frequency Identification (RFID) technology. RFID technology has been widely used in various applications, such as object tracking, inventory management, and access control. RFID technology operates by using a reader to communicate with an RFID tag attached to an object. The reader can obtain information from the RFID tag, such as its identification number, and use this information to determine the location and movement of the object. Several studies have been conducted to implement anti-collision robots using RFID technology. For example, a study by Lee et al. (2017) proposed an anti-collision system for a mobile robot that uses RFID technology to detect and avoid obstacles. The system was implemented by installing RFID readers on the robot and RFID tags on obstacles. The robot was able to detect obstacles and adjust its movement based on the information obtained from the RFID tags. The results showed that the system was effective in preventing collisions and maintaining a safe distance between the robot and obstacles. Another study by Dong et al. (2019) proposed an anti-collision system for industrial robots based on RFID technology. The system was designed to detect and avoid collisions between robots and other objects in an industrial environment. The system was implemented by using RFID readers and tags to detect the position of robots and obstacles. The results showed that the system was able to detect and avoid collisions between robots and obstacles in real-time, ensuring the safety and efficiency of industrial robots. A study by Chen et al. (2018) proposed a multi-robot anti-collision system based on RFID technology. The system was designed to prevent collisions between multiple robots operating in a shared environment. The system was implemented by using RFID tags to detect the position of robots and avoid collisions. The results showed that the system was able to prevent collisions between multiple robots in real-time, ensuring the safety and efficiency of the robots.In conclusion, the literature review suggests that RFID technology can be effectively used for the design and implementation of anti-collision robots. RFID technology can be used to detect and avoid obstacles, ensuring the safety and efficiency of robots in various environments. The literature suggests that RFID-based anti-collision systems are effective in preventing collisions and ensuring the safety and efficiency of robots.

EXPECTED SCHEME

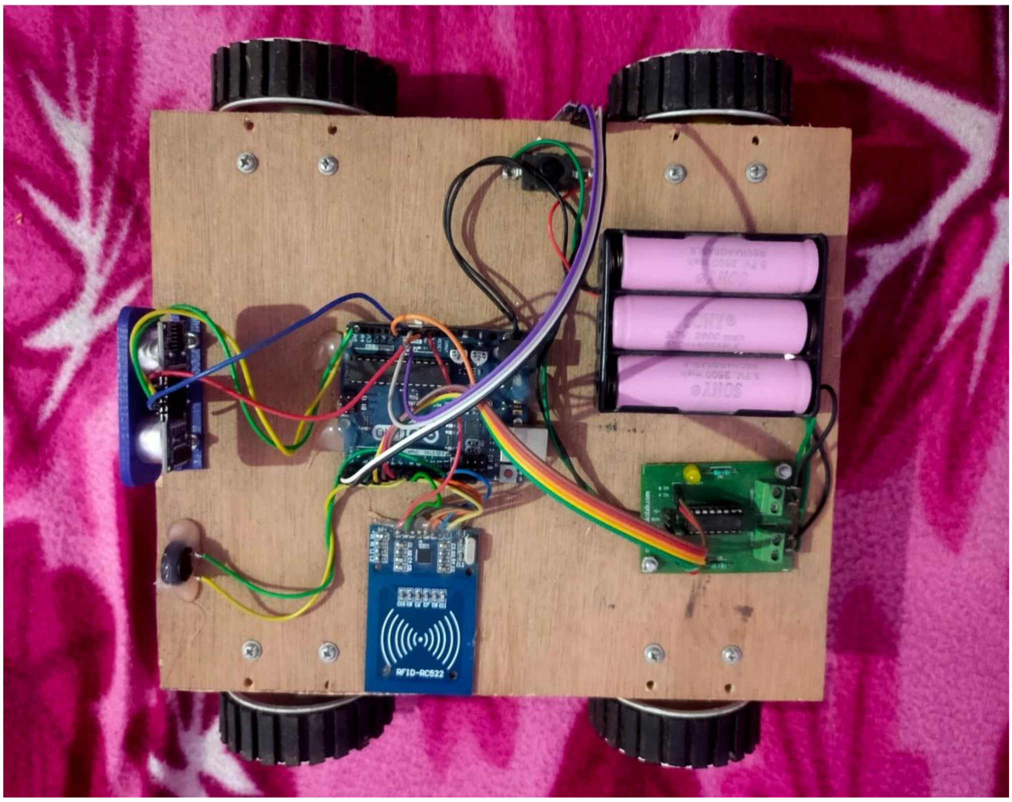
In a multi robot environment, a number of robots are moving in a same work space. The work space may be a closed room or an open space. To ensure these robots do not collide either with each other or with static objects while they are in moving. Different types of robot processor are commercially available, but our aim is to modify the design effectively combining the merits of VLSI design with the RFID technology which detects tagged item within a fraction of second and without line of sight Designing and implementing an anti-collision robot using RFID technology requires the following steps:

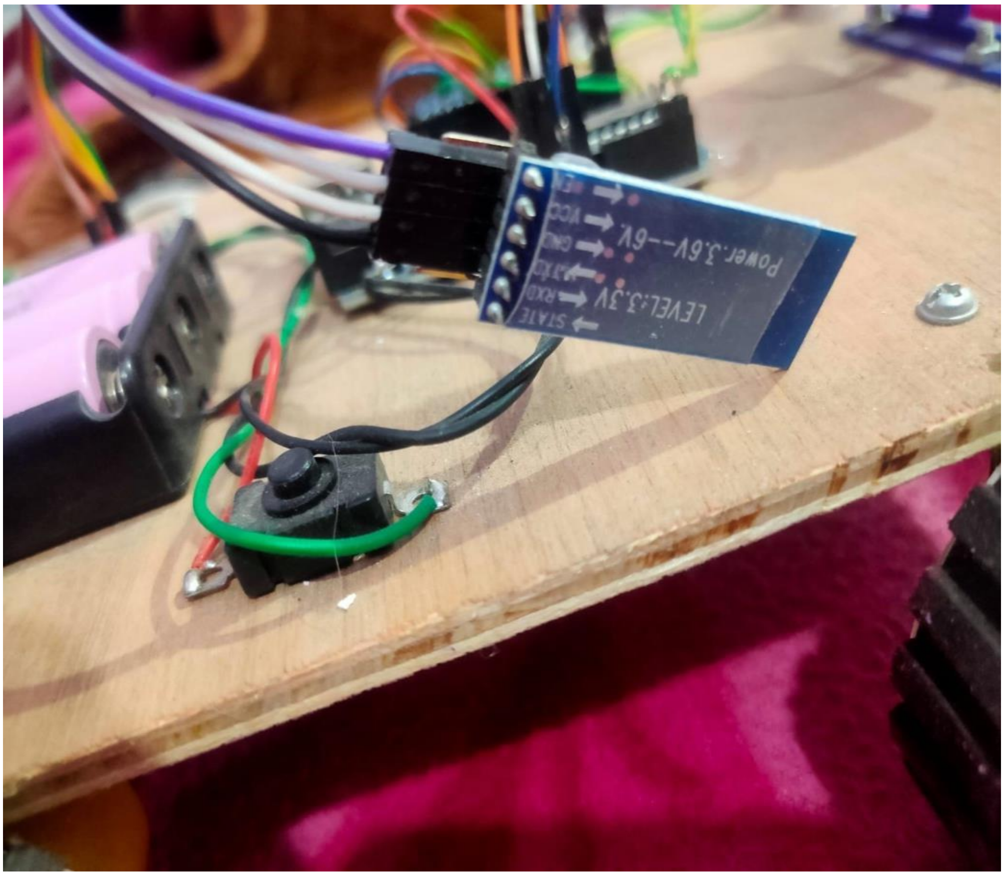
Define the requirements and specifications of the robot: Before starting the design and implementation of the robot, it is important to define the requirements and specifications of the robot. This includes the type of RFID technology to be used, the range of the RFID reader, the type of movement of the robot, the number of sensors to be used, the power source, and the communication protocol to be used.

Select the RFID technology: Select the type of RFID technology that suits the requirements of the robot. There are various types of RFID technologies available such as low frequency (LF), high frequency (HF), and ultra-high frequency (UHF). Choose the RFID technology based on the range and accuracy required for the robot.

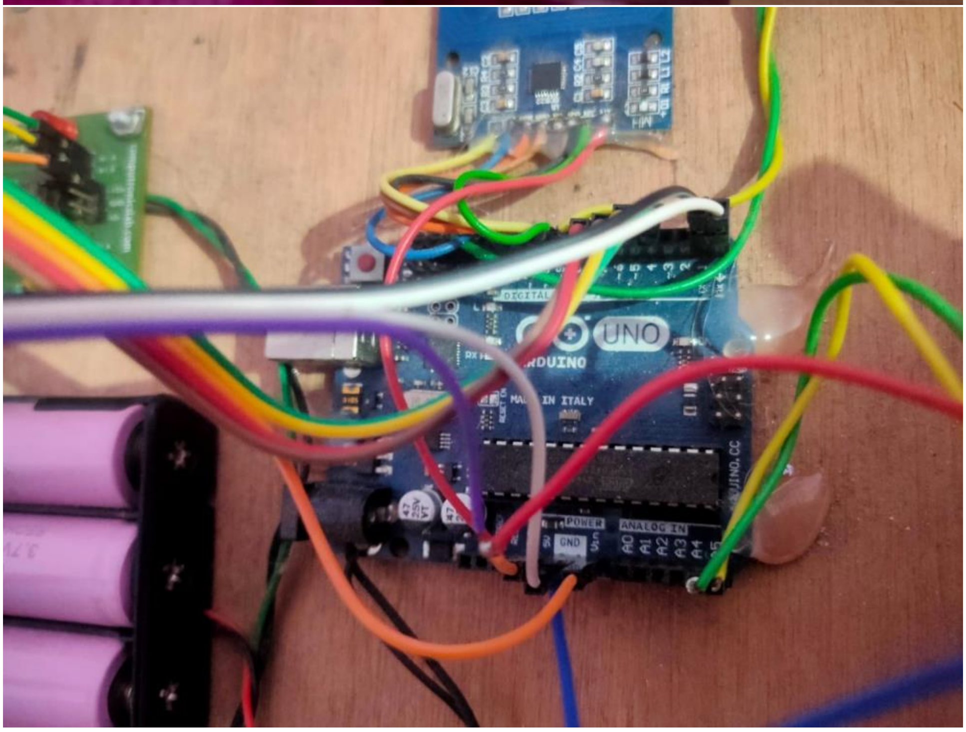
Develop the hardware: Develop the hardware for the robot including the RFID reader, antenna, sensors, and motor control unit. The RFID reader will be used to detect the presence of other RFID tags in the vicinity of the robot. The antenna will be used to increase the range of the RFID reader. The sensors will be used to detect obstacles and prevent the robot from colliding with them. The motor control unit will be used to control the movement of the robot.

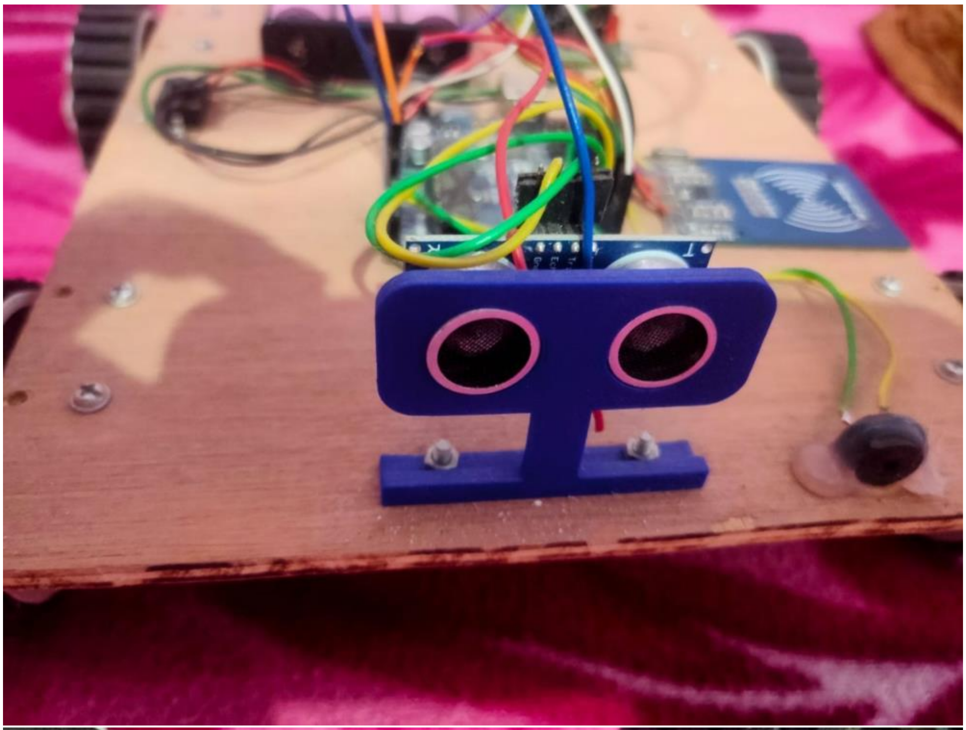
Develop the software: Develop the software to control the robot's movement and to process the RFID data. The software will also control the sensors and the motor control unit. The RFID data will be used to detect the presence of other RFID tags and to prevent the robot from colliding with them.
Test and optimize the robot: Test the robot in a controlled environment to ensure that it meets the specifications and requirements. Optimize the robot to ensure that it performs efficiently and effectively. Deploy the robot: Deploy the robot in the desired environment and monitor its performance. Make necessary adjustments if required. In summary, designing and implementing an anti-collision robot using RFID technology requires careful consideration of the requirements and specifications, the selection of appropriate RFID technology, the development of hardware and software, testing and optimization, and deployment.

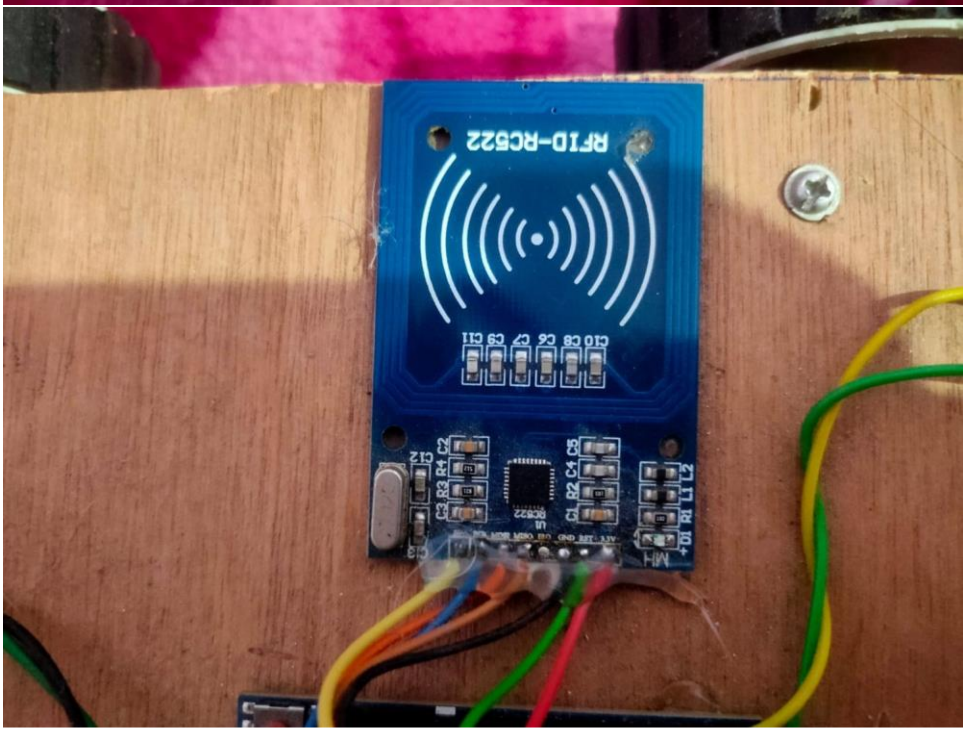

RFID-RC522


VCC
GND
TXD
RXD
STATE
Power:3.6V--6V
LEVEL:3.3V


SONY®
3.7V. 2800 mah
RECHARGEABLE
SONY®
3.7V. 2800 mah
RECHARGEABLE
SONY®
3.7V. 2800 mah
RECHARGEABLE


DIGITAL
UNO
MADE IN ITALY
POWER
GND
ANALOG IN
A0 A1 A2 A3 A4





APPLICATIONS OF OUR PROPOSED SCHEME

The anti-collision robot using RFID technology can be applied in various industries such as warehouses, factories, and ports. The robot can be designed to move around the facility, scan for any incoming vehicles or workers, and alert them of its presence. This can help prevent accidents and minimize the risk of collision between workers and vehicles.

The implementation process of the anti-collision robot starts with the design and development of the robot, which should be compact and lightweight so that it can easily maneuver around the facility. The robot should be equipped with a high-resolution camera and RFID reader to scan for any incoming workers or vehicles. The robot should also be equipped with warning lights, horns, and alarms to alert workers of its presence.

The next step is to install RFID tags on all vehicles and workers in the facility. These RFID tags will help the robot to track their movements and alert them of any potential collisions. The robot can be programmed to navigate the facility using a predetermined path or can be programmed to move in response to workers and vehicles.

Once the robot is fully operational, it can be monitored and maintained remotely. The robot can be programmed to send notifications and reports to management about any potential collisions and near-misses. The robot can also be updated with new software and firmware to improve its functionality and performance.

In conclusion, the anti-collision robot using RFID technology can significantly improve safety in warehouses, factories, and ports. The robot can help prevent accidents and minimize the risk of collision between workers and vehicles. The implementation process of the anti-collision robot involves the design and development of the robot, installation of RFID tags, and monitoring and maintenance of the robot. There are manifold applications of this scheme since it helps to create a multiple robot environment which is completely collision free. Due to its flexible nature it finds in numerous applications. A few of the application area are:

Ware House: In ware houses, if each of the goods carrier are robots then the proposed system can be adopted to make sure that there are no possibilities of collision between two robots, one robot and boundary, and between a robot and obstacle. Even if there increases the numbers of robots or obstacles, collision can be prevented by slightly modifying the original database. The address of a specific item in the stock can be easily detected by its tag number.

Super Market: In super markets we find numerous products which are placed in different locations. The proposed scheme can be efficiently used in transporting goods to it's corresponding stalls in the shortest path without any collision from other robots.

Institution for Visually Challenged Persons: Institutions for visually challenged people are also a domain where application of this scheme can create a safe and accident free zone. Smart wheelchairs, having this technology can carry patients to their predefined destinations in a safe and collision free.

Military and Space: Networked robots are frequently required to be deployed in military applications such as battlefield and during disaster rescue operations such as nuclear leakages. In such situations, collisions among robots can have catastrophic consequences

FUTURE OF ANTI-COLLISION ROBOTS BASED ON RFID TECHNOLOGY

The future of anti-collision robots using RFID technology is promising. With advancements in technology and increased demand for automation, the implementation of anti-collision robots will only continue to grow. One potential future application is in warehouses and distribution centers where robots will be utilized to move and transport goods. RFID technology will allow the robots to communicate with each other and avoid collision, reducing the risk of accidents and increasing efficiency. Another area where anti-collision robots using RFID technology can be utilized is in the manufacturing industry. These robots can be programmed to navigate complex environments and avoid collisions with other robots and objects, improving safety and productivity. Design of these robots will also continue to improve, becoming smaller, faster, and more agile. The RFID technology used in these robots will also become more advanced, allowing for increased accuracy and improved data transfer. Overall, the future of anti-collision robots using RFID technology is bright, with potential for significant advancements in both design and implementation. These robots have the potential to revolutionize various industries, improving safety and efficiency. As RFID technology continues to improve, it will enable robots to identify and avoid obstacles with greater precision and efficiency. Additionally, the integration of other advanced technologies such as computer vision, machine learning, and 5G connectivity will further enhance the capabilities of anti-collision robots, enabling them to navigate complex and dynamic environments with greater ease and safety. As a result, we can expect to see widespread adoption of anti-collision robots in various industries, including manufacturing, logistics, healthcare, and more. The design and implementation of these robots will likely involve more advanced sensors and algorithms to improve accuracy and reliability, as well as the integration of artificial intelligence to enable the robots to make more informed decisions. Additionally, the use of cloud computing and other advanced technologies may allow for more efficient and scalable deployment of these robots in a variety of industries.

CONCLUSION

In conclusion, the design and implementation of an Anti-collision Robot using RFID Technology has proven to be an effective solution for navigating in crowded environments. The use of RFID technology has provided the robot with the ability to detect and avoid obstacles, making it an ideal solution for applications in warehouses, factories, and other similar environments. The implementation of the robot's control system, using a microcontroller, has ensured the efficient functioning of the robot and has improved its reliability. Furthermore, the use of sensors and actuators has ensured the robot's ability to avoid collisions and maintain its path, making it a safe and efficient solution for use in crowded environments. In future, the development of this technology can further improve the accuracy and reliability of the robot and make it an essential tool for industrial and commercial applications.

ACKNOWLEDGEMENT

we would like to express our sincere appreciation and gratitude to the individuals who have contributed to the successful design and implementation of the Anti-collision Robot RFID Technology. Their dedication, hard work, and expertise have been instrumental in the development of this innovative system.

we would like to thank [**Amit kumar yadav sir**], for their valuable contributions in designing and implementing the system. Their commitment and collaboration have been essential to the project's success.

REFERENCES

1. Joyashree Bag, Rajanna K M and Subir Kumar Sarkar, “International Journal of VLSI design & Communication Systems”(VLSICS) Vol.3, No.6, December 2012
2. C.M.Roberts, “Radio frequency identification (RFID)”, Computers and Security 25(2006) 18--26.
3. Konstantinos Domdouzis, Bimal Kumar and Chimay Anumba,Radio-frequency Identification (RFID) applications: A briefintroduction, Advanced Engineering informatics 21(2007) 350—355.
4. L. Peters, M. Pauly, and K. Beck, “Servicebots mobile robots in cooperative environments,” in ERCIM News, no. 42, July2000.
5. [4] J. Borenstein, H. R. Everett, L. Feng, and D. Wehe, “Mobile robot positioning: Sensors and techniques,” Robotic Systems.J, vol. 14, no. 4, pp. 231–249, April 1997.
6. G.N.Desouza and A.C.Kak “Vision for Mobile robot navigation: A survey”, IEEE trans.Pattern Analysis and MachineIntelligence,vol.24, no.2, pp-237-267, February 2002.
7. P.Rusu, E.M.Petriu,T.E.Whalen, A.Cornel and H J W Spoilder, “Behavior-based neuro fuzzy controller for mobile robotnavigation”, IEEE Trans. Instrumentation and Measurement, vol 52, no.4, pp-1335-1340, August-2003.
8. Hallmann and B. Siemiatkowska, “Artificial landmark navigation system,” in Int. Sym.. Intelligent Robotic Systems, July2001.
9. L.Ojeda, D. Cruz, G. Reina, and J. Borenstein, “Current-based slippage detection and odometry correction for mobile robotsand planetary rovers,” IEEE Trans. Robotics, vol. 22, no. 2, pp. 366–378, April 2006.
10. Bing Jiang, Kenneth P. Fishkin, Sumit Roy and Matthai Philipose, “Unobtrusive Long-Range Detection of Passive RFID TagMotion”, IEEE Trans. Instrumentation and Measurement, Vol. 55, No. 1, February 2006.
11. Myungsik Kim and Nak Young Chong, “Direction Sensing RFID Reader for Mobile Robot Navigation”, IEEE Trans.Automation science and Engineering, vol. 6, no. 1, january 2009.
12. Sunhong Park and Shuji Hashimoto, “Autonomous mobile robot navigation using passive RFID in indoor environment”,IEEE Trans. Industrial Electronics, vol. 56, no. 7, july 2009,pp 2366-2373.
13. Todd M. Ruff and Drew Hession-Kunz, “Application of Radio-Frequency Identification Systems to Collision Avoidance inMetal/Nonmetal Mines”, IEEE Trans. Industry Applications, vol.-37, no.-1, January/February 2001.
14. Toshihiro Hori, Tomotaka Wada,Yuuki Ota, Norie Uchitomi, Kouichi Mutsuura, Hiromi Okada, “A Multi-Sensing-RangeMethod for Position Estimation of Passive RFID Tags”, IEEE Int. Conf. Wireless and Mobile Computing Networking and Communications (2008),pp. 208-213.
15. Hyung Soo Lim, Byoung Suk Choi and Jang Myung Lee, “An Efficient Localization Algorithm for Mobile Robots based onRFID System”, Int. Jt. Conf. SICE-ICASE, Oct. 18-2 1, 2006,Bexco, Busan,Korea. pp:5945-5950.
16. Md. Suruz Miah and Wail Gueaieb, “RFID-Based Robot Navigation System with a Customized RFID Tag Architecture”,IEEE Trans. Automation Science and Engineering , Jan. 2009 ,pp.44-54.
17. Yu Song-sen, Zhan Yi-ju, Wang Yong-hua, ”RFID Anti-collision algorithm Based on Bi-directional Binary ExponentialIndex”, IEEE Int. Conf. Automation and Logistics, 2007, 18-21 Aug. 2007,pp. 2917 – 2921.
18. Narek Pezeshkian, Hoa G. Nguyen, Aaron Burmeister, “Unmanned ground vehicle radio relay deployment system for nonline-of-sight operations”, Proc. 13th IASTED Int. Conf. Robotics and Applications.2007,pp. 501-506.
19. J.Bhasker: A VHDL synthesis Primer, BS Publication
20. Wayne Wolf :Modern VLSI Design; 4th edition; PHI Learning Private Limited
21. Stephen Brown and Zvonko Vranesic: Digital Logic design; Tata McGraw Hill Publication.
22. S. M. A. Motakabber, Mohd Alauddin Mohd Ali, Nowshad Amin:“VLSI Design of an Anti-Collision Protocol for RFIDTags”: European J.Scientific Research ISSN 1450-216X Vol.28 No.4 (2009), pp.559-565 .
23. www.vhdl.org
24. www.edaboard.com
25. Liu Jing and Po Yang , “A Localization Algorithm for Mobile Robots in RFID System” IEEE Int. Conf. WirelessCommunications Networking and Mobile Computing (2007),pp. 2109-2111.
26. Minho Jo, Chang-Gyoon Lim, Emory W. Zimmers, “RFID tag detection on a water content using a back-propagationlearning machine”, KSII Transactions on Internet and Information Systems / Dec, 2007.
27. Minho Jo, Hee Yong Youn, Si-Ho Cha and Hyunseung Choo, “Mobile RFID Tag Detection Influence Factors and Predictionof Tag Detectability”, IEEE SENSORS JOURNAL, VOL. 9, NO. 2, FEBRUARY 2009,pp.112-119.