**NTCC Report**

On

# Making A Obstacle Avoiding Robot

**Submitted in partial fulfilment of the requirements for the award of the degree of**

**Bachelor of Technology**

in

**Computer Science & Engineering**

By


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AMITY UNIVERSITY UTTAR PRADESH 2023

# DECLARATION

I, UJJWAL KUMAR JHA, student of B.Tech (CSE) hereby declare that the NTCC report entitled "**MAKING A OBSTACLE AVOIDING ROBOT**", submitted by me to the Department of Computer Science and Engineering, ASET, Amity University, NOIDA in partial fulfilment of award of the degree of Bachelor of Technology in Computer Science & Engineering has not been previously submitted for the award of any degree, diploma or other similar title or recognition

Place: NOIDA                                    Ujjwal Kumar Jha

Date:                                    (A2305220632)

# CERTIFICATE

On the basis of the declaration submitted by UJJWAL KUMAR JHA, student of B. Tech Computer Science and Engineering, I hereby certify that the NTCC report entitled “**MAKING A OBSTACLE AVOIDING ROBOT**”, which is submitted to the Department of Computer Science and Engineering, Amity School of Engineering and Technology, Amity University, Noida, Uttar Pradesh in partial fulfilment of requirement for the award of the degree of Bachelor of Technology in Computer Science and Engineering is an original contribution with existing knowledge and faithful record of work carried out by him under my guidance and supervision. To the best of my knowledge this work has not been submitted in part or full for any Degree or Diploma to this University or elsewhere.

Place: NOIDA

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# ACKNOWLEDGEMENT

I take this opportunity to express my profound sense of gratitude and respect to all those who helped me throughout my project. This report acknowledges to the intense driving and technical competence of everyone who have contributed to it. It would have been almost impossible to complete this project without the support of these people.

I would like to express my deep and sincere gratitude to my industry guide Mr. Amit Kumar Pandey, Chief robotics and ai officer, for his able guidance, and whose experiences and expertise motivated me to write and complete my project. His role in helping me in my project work requires no elaboration.

I am grateful to my faculty guide Dr Sanjay Kumar Dubey, Associate Professor, Amity School of Engineering and Technology (ASET) for guiding me and helping me out with the slightest of details in completing this project in the best way possible. I extend thanks and gratitude to him to have imparted me his valuable guidance in all aspects.

I am also grateful to Prof. (Dr.) Sanjeev Thakur, (HoD), Department of Computer Science & Engineering for their regular encouragement and motivation.

Also, I would like to extend my gratitude to my family and friends who helped me and encouraged me to complete this project with utmost sincerity and hard work. Without their encouragement and help, this work would have been an ordeal for me to tackle. Above all, I pay my reverence to the almighty GOD.

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# TABLE OF CONTENTS

# ABSTRACT

This extend depicts approximately an obstacle avoidance robot vehicle which is controlled by ultrasonic sensor. The robot is made utilizing ultrasonic sensor and it is controlled by Arduino microcontroller. Ultrasonic sensor fixed in front parcel of the robot vehicle. The sensor gets the data from encompassing region through mounted sensors on the robot. The sensor is sense the impediment and veer off its way to choose an deterrent free way. The sensor sends data to the control is compared with controller to choose the movement of the robot wheel. The robot wheel development and direction will be based on the detecting of the ultrasonic sensor and also using a wheel encoder. This vehicle is utilized for detecting obstacles and maintaining a strategic distance from the collision.

# CHAPTER 1

# INTRODUCTION

Many robots have been produced in recent years for technology and guidance purposes, including wall tracking robots, edge tracking robots, robot tracking devices, and protective equipment. A defensive robot will avoid issues that arise while pursuing its operational goals. Because of the dependability, productivity, and cost effectiveness of deploying mobile robots in commercial and industrial applications, obstacle-avoiding robots are an important aspect ofthe factory floor.

Unmanned Aerial Vehicles (UAVs), on the other hand, play an essential role in both defence and civil use [1]. Reconnaissance, surveillance, combat damage assessment, and communications are all military applications.

Disaster management, remote sensing, and vehicle tracking are examples of civilian applications. Many drone applications necessitate the ability to navigate urban surroundings or unfamiliar places filled with numerous types and sizes of obstacles. Obstacle detection and avoidance is a critical prerequisite for autonomous drones. This article presents an example of an algorithm for a robot that uses IR and PIR sensors to avoid obstacles and build a robot base. It can be used as a platform for a wide range of applications such as robot design, teaching, research, and industry.

Open source hardware and software make up the Arduino electronic device. Arduino boards may receive inputs like light from a sensor, a user pressing a button, or a tweet and translate them into outputs like starting a motor, turning on an LED, or making an announcement that isn't available online. You give instructions to the board's microcontroller to tell it what to do. You'll need the Processing-based Arduino software (IDE) and the Wiring-based Arduino programming language for this.

Over the years, Arduino has inspired thousands of projects, ranging from simple home appliances to sophisticated research instruments.

An enormous amount of practical information among the members of an international community of students, amateurs, artists, professionals, and professionals who have congregated around an open platform can be of tremendous assistance to both beginners andexperts.

At the Ivrea Interaction creation Institute, Arduino was created as a straightforward tool for quick creation geared towards students with no prior experience in electronics or programming. Following their introduction to a larger audience, Arduino boards started to develop to meet new requirements and difficulties, expanding their product line from straightforward 8-bit boards to IoT applications, wearables, 3D printing, and embedded settings.

A defensive robot is an electronic machine that can identify and avoid impediments in its path as it navigates. These robots are intelligent and autonomous, using a combination of sensors, microcontrollers, and motor control. A defensive robot's major goal is to be safe and successful in a dynamic environment where impediments can obstruct movement or lead to collisions.

Robotic obstacle avoidance is a notion that emerged from the necessity to build robots that can function in real-world settings without human assistance. Defensive robots are capable of accurately detecting impediments, analysing their environment, and changing their trajectories as needed thanks to the combination of cutting-edge sensors and clever decision- making algorithms.

They can move around in a range of settings, including indoor, outdoor, and dangerous ones,thanks to their skill.

Defence robot designs and operations can change depending on the particular application and requirements. However, a sub-device with wheels or motion for support, electronics for anti- interference, information processing, sensors, and a microcontroller or microprocessor for making decisions and managing workforces is typically included.

Robots that can avoid obstacles are becoming more and more important in a variety of industries. These robots can boost productivity in industrial automation by automaticallyavoiding obstacles in a factory setting.

They can keep an eye on the region and regulate access in surveillance and security applications while avoiding barriers. Unmanned robots can operate in challenging or damaging conditions, which makes them valuable in fields like environmental monitoring,disaster management, education, and research.

Automation in robotics has been made possible by developments in technology, AI, and robotics. Researchers and designers are always exploring for fresh approaches to enhance decision-making algorithms, problem-solving skills, and navigational capabilities. As this technology develops, it will have a significant impact on the development of robotics, automation, and intelligent machines in the future.

Robots that can avoid obstacles are an important development in the field of robotics that allow for independent movement through challenging terrain. These robots are capable of detecting obstacles, analysing their environment, and changing their trajectories to avoid collisions thanks to sensor technology and clever algorithms. Obstacle-avoiding robots are at the forefront of autonomous robotic systems and have enormous potential for the future thanks to their wide range of applications and ability to improve safety and efficiency.

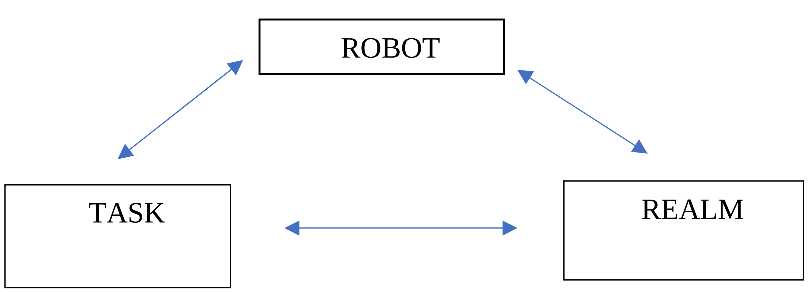


**Figure1. Fundamental component of obstacle avoidance**

# CHAPTER 2

# LITERATURE REVIEW

Robots require a large number of sensors to gather data about their surroundings. The position, speed, acceleration, and many other aspects of the office robot will be controlled with the aid of sensors. The amount of a thing is measured using a variety of sensors. An ultrasonic transducer is among the most often used finders. Additionally, the range, speed, and accuracy of robots are increased when performing challenging and complex jobs usingvision systems.

An undetectable gimbal-equipped defence system was created by Varun et al. [2]. Here, a robot navigates a dynamic environment by using image histograms from a monocular monochrome camera to identify and avoid obstacles. A camera attached to a mobile phone was suggested by Kim et al. [3] as a way to detect movement, particularly human walking.

Using the block-based prediction function, it is examined how to identify moving objects close to the robot. People who are blind or have impaired eyesight can employ a mobile robot guard as a guide, according to Shawal et al. [4]. The mobile robot's motor control receives an electrical signal, and the music helps the blind navigate obstacles. Kumar [5] suggested employing three ultrasonic sensors to create a guard robot that is both affordable and straightforward.

For those with physical limitations, Borenstein et al. [6] created a mobile robot that is capable of carrying out a variety of duties. The robot avoids collisions with unforeseen objects by using ultrasonic rangefinders for detection and mapping. For use in the military, Satyanarayana et al. [7] created autonomous robots.

It employs planning and problem-solving algorithms, GPS, and magnetic field sensors to adapt its thoughts to its environment. A defence system was created by Banu et al.

[8] for the rotorcraft's low altitude. On the basis of diverse rotorcraft motion restrictions, the needs of the low-flying obstacle detection system are thoroughly examined. Hubali et al.'s[9] discussion on measuring distance with infrared sensors. They concluded from their investigation that the primary drawback of infrared-based sensors is that they can be detectedremotely.

The topic of self-management has undergone a revolution thanks to the convergence of robots and artificial intelligence (AI). Learning the fundamentals of artificial intelligence and robotics is made much easier by building a defensive robot. An overview of current research towards understanding intelligence and robotics through the creation of problem-avoidance robots is given in this survey of the literature. The paper stresses the significance of artificial intelligence and robotics in the development of these systems, which cover thinking, decision-making, planning, and control.

Defensive robots depend heavily on perception since it helps them comprehend and comprehend their surroundings. Sensors are crucial for detection because they enable access to and recognition of visual impacts. To increase knowledge, researchers have looked into various transformation and fusion approaches.

A protection system incorporating ultrasonic sensors, for instance, was suggested by Pan et al. (2019) for indoor robot navigation.

Chen et al. (2017) improved detection and avoidance by combining numerous sensors and applying sensor fusion algorithms.

The decision-making of defence robots heavily relies on AI systems. To analyse sensor data, categorise issues, and forecast their behaviour, machine learning techniques are frequently used. Using a Research-Based Research Methodology to Examine Predictive Defences for Mobile Robots, Ji et al. (2019). The outcomes show improved capacity for making decisions in changing circumstances. The robot was taught the protective mechanism by Zhang et al. (2018) using a modified Q-learning method.

Path Planning: To stop robots from negotiating challenging areas, effective path planning is necessary. To produce smooth pathways, a variety of planning techniques have been investigated. An intelligent protection algorithm based on the advancement of the A* planning approach was proposed by Lee et al. in 2019. Consideration of robot kinematics and issue areas leads to the development of methods. A modified A* approach planning algorithm was presented by Enver et al. (2020) with the intention of guiding non-motorized robots.

Control and Drive: In order to carry out the plan and prevent downtime, it is crucial to control and drive the machine. The researchers investigated various control techniques to maintain precision and stability while preventing interference. A preventive maintenance and planning technique based on PID control was proposed by Ren et al. (2018).

When the system is compromised, it maintains security and performance. Wang et al. (2020) described a novel approach to robotic mobile navigation that employs dynamic adaptive systems for control and optimisation.

# CHAPTER 3

# INVOLVEMENT OF AI AND ROBOTICS

Robotic defence systems heavily rely on artificial intelligence (AI). Anti-aircraft defence equipment can sense the environment, make wise decisions, and manoeuvre safely in challenging and dynamic environments thanks to sophisticated technologies. This chapter focuses on how artificial intelligence can be used to buck the trend and how important it is tocomprehend AI and robotics.

1. Sensing:

Robots can perceive their surroundings thanks to artificial intelligence systems that interpret data from a variety of sensors. Important information about the environment is provided by sensors like cameras, lidar, infrared sensors, and ultrasonic sensors. Robots can now discover and diagnose issues in real time thanks to the analysis and interpretation of this data using artificial intelligence techniques like sensor fusion and computer vision (Chen et al., 2017).

2. Planning and decision-making:

Artificial intelligence algorithms allow robots to make wise decisions based on data. Models are trained using machine learning techniques like deep learning or incremental learning to categorise obstacles, forecast their behaviour, and determine the likelihood of accidents. The robot can design appropriate challenges or guidance based on these predictions in order to avoid obstacles (Ji et al., 2019).

3. Learning and Optimisation:

AI algorithms also aid in the defence system's learning and updating. Robots can learn useful behaviours by interacting with their surroundings and receiving feedback thanks to reinforcement learning algorithms. The robot may gradually enhance its defence system through ongoing learning and adaptation, which also helps it perform better and be more adaptable in various settings (Zhang li et al., 2018).

4. Real-Time Response:

The capacity to make judgements instantly is one of the key advantages of employing artificial intelligence to avoid interference. Robots are able to react swiftly to changes in their surroundings thanks to AI algorithms' ability to process sensor data quickly and produce instant replies. In order to assure security and avoid outages, it is crucial to have a true reaction time (Liu et al., 2018).

5. Intelligent Path Planning:

The AI-based obstacle avoidance system is capable of developing intelligent path planning methods that take into account a number of variables, including the location of the obstacle, the robot's kinematics, and the environment's restrictions. The robot can travel around the environment effectively while dodging obstacles by optimising these conditions (Li et al., 2019). while avoiding obstacles Robots' use of AI displays its strength and potential.By enabling robots to comprehend their surroundings, make wise judgements, and walk independently, it advances the development of autonomous systems.

Robotics helps to prevent conflicts by giving the resources and technology required to put sensible navigational plans into action. This chapter focuses on the significance of robots in upholding security and their capacity to prevent interference in the context of comprehending artificial intelligence and robots through the development of defensive robots.

1. Mechanical Engineering:

The robot's capacity to avoid obstacles is greatly influenced by its mechanical design. The robot's body structure, motion system, and propulsion system should be created

with smoothnavigation and manoeuvrability in a variety of situations in mind.
For example, robots with wheels or legs have different advantages in different situations(Correll et al., 2016).

2. Integration of Sensors

Robotic systems use sensors to view their surroundings and recognise impediments. Robots that avoid obstacles frequently use sensors including cameras, lidar, ultrasonic sensors, and infrared sensors.
These sensors are built into the robot's body to offer real-time data about its surroundings, enabling it to comprehend issues and react to them more effectively (Borenstein et al., 1996).

3. Drive and Control:

For anti-defense activities, the robot's drive and control are essential. Robotic mobility and force are provided by actuators like electric motors, servos, or pneumatics, allowing the machine to walk and avoid obstacles.
Robots are capable of adjusting their motion in response to sensor inputs and needs thanks tocontrol algorithms, such as PID control or motion control algorithms.

**4. Localization and Mapping:**

Robotic systems often use localization and mapping techniques to accurately understand their location and environment. Localization algorithms such as simultaneous localization and mapping (SLAM) enable the robot to create a map of its environment and determine its position on that map. This information helps to track the progress of the project. according to the purpose according to the purpose according to the purpose according to the purpose according to the purpose according to the purpose according to the purpose for the purpose, the text of the fabric is deleted, the information is deleted.

**5. Software and Algorithms:**

software plays an important role in the integration and effective protection of robotic devices. AI algorithms, route planning algorithms, and control algorithms are all used by the software to make smart decisions and efficient operations. These algorithms are designed to analyze sensor data, create an error-free system, and control the robot's motion in real time (LaValle, 2006). Integrating robots into anti-interference systems provides the physical infrastructure

and control systems needed to implement intelligent navigation strategies. By understanding the role of robots in conflict avoidance, the practical use and integration of hardware and software in systems can be understood as poor work.

## 3.1 SOFTWARE REQUIREMENTS

1. **Operating system:** Select an appropriate operating system for the robot, such as Linux, Windows IoT, or real-time operating system (RTOS). The choice depends on factors such as hardware compatibility and programming language preference.

2. **Programming language:** Use a programming language suitable for robots such as Python, C++ or Arduino programming language. The choice depends on the hardware platform and available libraries/framework for sensor integration and algorithm implementation.

3. **Robot Framework/Library:** Use Robot Framework or libraries to simplify robot control and integration. Popular options include ROS (Robot Operating System), OpenCV (for computer vision), TensorFlow (for machine learning), and PyRobot.

4. **Sensor API:** Depending on the sensors used for problem detection, you may need certain software APIs or libraries to interact with the sensors and collect data. For example, if you are using an ultrasonic sensor, you will need a library that provides distance measurement.

5. **Artificial intelligence algorithms:** Apply artificial intelligence algorithms such as machine learning or deep learning models to analyze and make decisions. Frameworks such as TensorFlow, PyTorch, or scikit-learn can be used to train and deploy AI models.

### 3.1.1 Software Specifications for Building an Obstacle Avoidance Robot:

Building an obstacle avoiding robot involves creating and implementing software that allows the robot to see its surroundings, make intelligent decisions, and navigate safely. This chapter focuses on key software features required to build an effective robot defense system.

1. **Sensor integration:** The software should facilitate the integration and processing of sensor data from various sensors such as ultrasonic sensors, infrared sensors, lidar or cameras. This includes the use of algorithms to collect and analyze sensor data, allowing robots to detect and identify problems in real time (Pan et al., 2017).

2. **Perception and Object Detection:** Software features should include computer vision algorithms for object detection and recognition. These algorithms analyze sensor data to identify obstacles, estimate their location and size, and classify them into groups. Techniques such as image processing, extraction and machine learning-based search algorithms can be used for visualization (Redmon et al., 2017). **Path Planning and Navigation:** Software must include path planning and navigation algorithms to create seamless robots. These algorithms take into account the current location of the robot, its environment and detect problems to determine the optimal solution. A planning method such as A*, Dijkstra's algorithm or potential centers can be used to calculate efficiency while avoiding interference (Latombe, 2012).

3. **Control and Operation**: Software specification requires control algorithms that translate the plan into robot motion. These algorithms generate control signals for robotic actuators such as motors or servos to do what is needed. Control systems, including PID control or standard control, can be used to provide precise and responsive motion (Khatib, 1986).

4. **Real-time determination:** Software must be able to determine time based on observed data. Artificial intelligence algorithms such as machine learning or artificial intelligence can be used to analyze sensor input, predict relevant behavior and make smart decisions about robot actions. Real-time response is important to ensure timely and effective response to avoid disruptions (Ji et al., 2019).

5. **Visualization and User Interface**: Software specification should include visualization tools and user interfaces to help monitor and interact with the robot guard system. Sensor data, problem maps, and graphical representations of robot movements can help you understand robot behavior and performance. The user interface can provide control input to the operator and display relevant information (Garcia et al., 2019).

Building a defense robot requires the development and integration of software capable of awareness, decision making, planning and management. By integrating this proprietary software, the robot can efficiently navigate around while avoiding obstacles.

## 3.2 HARDWARE REQUIREMENTS

1. **Microcontroller/Single Board Computer (SBC):** Choose a microcontroller or SBC that suits your robot's needs. Popular options include Arduino boards (eg Arduino Uno, Arduino Mega) or Raspberry Pi boards.

2. **Sensor:** Select an appropriate sensor such as ultrasonic sensor, infrared sensor, LIDAR (Light Detection and Range Shifting) or camera to detect problems. The number and type of sensors depend on the complexity of the environment and the level of requirements.

3. **Actuators:** Actuators that help robots move and navigate, such as motors (DC motors or servo motors) or stepper motors. The choice of actuator depends on the size, weight and required movement of the robot.

4. **Power supply:** Provide the robot with the necessary power so that it can meet the power needs of the microcontroller, sensors and actuators. This may include batteries, power supplies or electrical connections.

5. **Chassis and Mechanical Components:** Build or purchase a suitable chassis or frame for your robot. Also consider mechanical equipment such as wheels, gears and other equipment required for movement and shock protection.

6. **Communication modules:** If related to IoT functionality, include communication modules such as Wi-Fi or Bluetooth for data exchange, remote control or integration with other equipment.

7. **Additional equipment:** Depending on the specific needs of your robot, you may need additional equipment in the circuit for setup and control, such as motor controllers, drives, electronic controllers, or mounting boards. It's worth noting that these rules will vary based on the robot's difficulty, abilities, and available resources. Evaluation of specific plans and parameters is recommended to determine the most suitable software and hardware for building a robot protection system.

### 3.2.1 Hardware Specifications for Building an Obstacle Avoidance Robot:

Building an obstacle avoidance robot requires careful consideration of hardware specifications for vision, guidance, and control. This section outlines the key hardware components needed to build a robotic defense system.

1. **Sensor Equipment:** The defense robot needs a combination of sensors to be able to see its surroundings. Commonly used sensors include ultrasonic sensors, infrared sensors, LiDAR (Light Detection and Range) or cameras. These sensors provide basic information about obstacles, distance, and location in the environment, allowing the robot to detect and avoid obstacles (Borenstein et al., 1996).

2. **Actuators:** Actuators are responsible for providing movement to the robot. Actuators

may include motors, servos or pneumatics, depending on the robot's design and needs. Actuators allow the robot to move its wheels, legs or other movements to navigate the environment and avoid obstacles (Correll et al., 2016).

3. **Power source:** A reliable power source is required for the continuous operation of the defense robot. The power source may be a rechargeable or non-rechargeable battery or an external power source. The electrical equipment must be able to meet the power requirements of the robot and ensure that the operation of the robot is not interrupted during operation against interference.

4. **Processing unit:** Processing unit is responsible for executing software algorithms for interference detection, decision making and control. It can be a microcontroller like Arduino or Raspberry Pi or a single board computer (SBC). The processing unit must have sufficient computing power and memory capacity to process the sensor data and execute the required processing in real time (Borenstein et al., 1996).

5. **Communication interface:** The communication interface makes it possible for the robot to interact with external devices or systems. It may include wireless modules (for example, Wi-Fi or Bluetooth) or connectivity (for example, wired).

, USB or Ethernet). Networking facilitates data exchange, remote control, or integration with other systems for monitoring or coordination (Correll et al., 2016).

6. **Mechanical Structure:** The mechanical structure of the robot provides a physical framework for the integration of hardware components.

Material selection, chassis design and mechanical stability are important for the performance and longevity of the robot. Mechanical models should accommodate sensors, actuators and other hardware while ensuring the robustness and stability of the robot (Correll et al., 2016).

Considering these unique components, a defense robot can be designed with the necessary components to understand the environment, make smart decisions, and navigate safely without distractions.

# CHAPTER 4

# ARDUINO AND ULTRASONIC SENSOR

When building a defense robot, the Arduino platform and ultrasonic sensors are widely used, as they are versatile, easy to use and efficient. This section discusses the role of Arduino and ultrasonic sensors in the implementation of interference suppression and avoidance.

## 4.1 Arduino:

Arduino is an open source hardware and software platform widely used in robotics and electronics projects. It provides a microcontroller board and development environment that is easy to use and interfaces with various hardware devices.

Arduino boards such as the Arduino Uno or Arduino Nano are often chosen for theiraccessibility, simplicity and community support (Banzi, 2011).

Arduino board functions as the core function of protecting the robot, running control algorithms, processing sensor data and generating control signals for robot actuators. They provide a programmable platform for integrating sensor inputs, executing problem detection algorithms, and making decisions based on detected problems (Borenstein et al., 1996).

## 4.2 Ultrasonic Sensor:

Ultrasonic Sensor is mainly used in defense robots to measure distance and detect objects around the robot. They work by emitting ultrasonic waves and measuring how long it takes for the wave to return after hitting an object.

The ultrasonic sensor consists of a transmitter and a receiver. The transmitter emits ultrasonic waves and the receiver catches the ultrasonic reflection of obstacles. The sensor can calculate the distance to obstacles by measuring the time between emittingand receiving the wave.

Ultrasonic sensors are popular because of their simplicity, cheapness, and reliability in identifying problems in the environment. They allow robots to navigate and avoid collisions by providing distance measurements that can be used to determine the presence and proximity of obstacles (Borenstein et al., 1996).

# CHAPTER 5

# METHODOLOGY

The Methods section describes the steps to create and train a defensive robot. Data collection process, sensor calibration, algorithm implementation and integration are explained. This section also discusses some test setups or tests used to evaluate the performance of robots.

**Ways to Build a Defense Robot Using Artificial Intelligence and Robotics:Define Project Objectives:**

Clearly define the objectives of the defensive robot. Identify specific needs, limitations, anddesired outcomes.

How to Build a Defense Robot Using Arduino, L293D Drivers and Ultrasonic Sensors: The development of a Defense Robot will include the Arduino platform, the L293D body has power drivers and ultrasonic sensors to create a functional anti-interference and protection system. This section describes the techniques used to construct and operate such robots.

**1. Hardware Installation:**

a. Connect the Arduino board: Connect the Arduino board to the computer and install the Arduino IDE. This allows the board to be programmed and the code to be loaded.

b. Connect L293D Driver: Connect L293D Driver to Arduino board. The motor of the driverhelps to control the driver.

c. Connect Ultrasonic Sensor: Connect the ultrasonic sensor to the Arduino board. Thissensor provides distance measurement for visual problems.

**2. Motor control:**

a. Programming Arduino: Write code in the Arduino IDE to control the motor connected to the L293D motor. The code should contain functions that control the forward, backward, leftand right movement of the robot.

b. Configuring Motor Pins: Define the appropriate pins on the Arduino board for motorcontrol and configure it with code.

c. Perform Diagnostic Tests: Integrate an ultrasonic sensor into the system to detect problems. Use the remote sensor to move the robot or stop the robot when it detects aproblem.

**3. Obstacle Avoidance Algorithm:**

a. Develop an algorithm that combines ultrasonic sensor data and motor control functions to achieve obstacle avoidance. The algorithm should include a decision to determine the robot's movement based on the location and distance of detected obstacles.

b. Using Algorithms in Arduino Code: Write the required code in Arduino IDE to enable interference suppression. This includes custom and motor control based programming statements based on sensor input.

**4. Test and Repeat:**

a. Upload Code: Upload Arduino code to Arduino board and connect hardware according tospecified connections.

b. Test the robot: Place the robot in a dynamic environment and observe its behavior. Make sure the robot detects problems and corrects its movement to avoid collisions.

c. Iterate and fix: Check the robot's performance, make any necessary changes to the code or hardware connection, and repeat the evaluation process until satisfactory protection success isachieved.

Following this method, a security robot that will act autonomously when there is no light problem can be built and programmed using Arduino, L293D motor driver and ultrasonic sensors.

# CHAPTER 6

# WORKING

A defensive robot is a driver that can navigate around while avoiding obstacles in its path. These robots often use a combination of sensors, actuators and control algorithms to detect problems and adjust their movements. Here is an overview of how a defensive robot works:

**Sensing:** The robot is equipped with several sensors to see its surroundings. The most common types of sensors used to detect problems are:

**Ultrasonic Sensors:** These sensors emit ultrasonic waves and measure the time it takes for ultrasonics to bounce off a problem. The robot can estimate the distance between obstacles based on the time delay.

**Infrared (IR) sensor:** emits infrared light and measures the intensity of visible light. By analyzing the density, the robot can identify the potential impact and estimate their proximity.

**Camera or Vision Sensors:** Some advanced robots use cameras or vision sensors to take images or videos of the environment. They can then use computer vision techniques to identify problems based on imaging and analysis.

**Process:** Sensor data is processed by the robot via a microcontroller or computer. The office evaluates the sensor readings and makes decisions based on preset or operational instructions.

**Obstacle Detection and Mapping:** The robot's software algorithms interpret the sensor data to identify obstacles in the robot's path. This will include analyzing the sensor readings, comparing them to the initial settings, and determining the size, distance and direction of the problem.

**Path Planning:** When problems are detected, the robot control system determines alternative ways to avoid them. Planning algorithms calculate the safety of the safety or decide on the appropriate action such as turning, stopping or changing direction.

**Actuation:** The robot's actuators (usually motors or servos) make plans based on control signals received from the work unit. For example, if the robot sees a problem on the right, itwill start the left motor to turn the robot left and avoid the problem.

**Guidance and feedback:** The recognition, action, obstacle detection and path planning steps are repeated as the robot moves around the environment. It can travel autonomously by constantly updating its sensor data, adjusting the power, and deciding when to avoid trouble. It is worth noting that the specific use and equipment of the defense robot will vary depending on the design, complexity and purpose of the robot.

## 6.1 Research and Design:

Do a literature review to learn about the latest developments in artificial intelligence, IoT connectivity, and defense robotics. Identify the hardware components required for robots, including sensors, actuators, microcontrollers, and communication modules. Design the mechanical structure of the robot for stability, mobility and flexibility.

## 6.2 Sensor Integration:

The selects and integrates sensors suitable for detecting problems such as ultrasonic sensors, infrared sensors or cameras. Ensure compatibility with selected hardware. Japan calibrate and configure sensors to ensure accurate measurement and reliable problem detection.

## 6.3 AI Algorithm Development:

Choose appropriate AI algorithms for search and decision making, such as machine learningor deep learning. Collect and process preliminary data to train skill models.
This will include the creation of a database of relevant topics, including various shapes, sizes and distances. Use collected data to train AI models, improving their performance and accuracy. Follow the training AI model on the robot's microcontroller or onboard computer.

## **<u>6.4</u>** **<u>Robot Integration:</u>**

The integrates hardware components such as sensors, actuators, and microcontrollers into therobot's mechanical structure.
Bay creates controls that enable robots to process sensor data, perform cognitive processes, and make real-time decisions. Use a motor control system that allows the robot to move, steerand walk.

## **<u>6.5</u>** **<u>Rating and Documentation:</u>**

Conduct successful tests to evaluate the effectiveness of anti-robot protection.
Bay tests the robot on a variety of obstacles and environments to evaluate its accuracy, performance and robustness. Analyze results and iterate over designs and algorithms to improve robot performance.
Section lists the entire development process, including specific equipment, software code,and design.

Japan prepares user manuals and instructions for the operation and maintenance of the robot protection system. Place the robot protection device in the application or environment that requires it, ensure correct installation and configuration.

# CHAPTER 7

# ADVANTAGES AND DISADVANTAGES

**Advantages:**

1. Improved safety: Robots that avoid obstacles increase safety and reduce the risk of accidents or collisions by controlling and avoiding obstacles (Krajník as al., 2017).
2. Increased productivity: By autonomously and avoiding distractions, these robots can operate more efficiently in complex environments, saving time and resources (Ridley et al.,2017).
3. Multifunctional applications: Obstacle avoiding robots have many uses, including agriculture, manufacturing, medicine, search and rescue (Torres-Treviño et al., 2018).
4. Real-time decision making: The integration of intelligent algorithms enables destructive avoidance robots to make intelligent decisions in real time by switching to dynamic environments (Sebastian and Rao, 2019).
5. Integration with IoT: IoT connectivity improves the performance and scope of robotic protection by enabling remote monitoring, control and data exchange (Xu et al., 2020).

**Disadvantages:**

1. Limited accuracy: Robots dodging obstacles may have limitations in avoiding and correcting obstacles, resulting in false detection or insufficient obstacle avoidance (Said et al.,2021).
2. The complexity of the dynamic environment: a dynamic or dispersed environment can cause robots to avoid obstacles, affecting their walking and decision-making abilities (Razaliet al., 2019).
3. Adaptability: Obstacle avoiding robots may have difficulty adapting to different situations or dealing with unknown problems, which may affect their overall

performance (Boukhriss etal., 2020).

4. Energy efficiency: Real-time use of problem detection and avoidance algorithms increasesenergy consumption and reduces robot time (Shojaei et al., 2017)

5. Cost and affordability: The integration of artificial intelligence, robotics and IoT technologies can make disruptive robots costly, limiting their availability and adoption (El-Khamy et al., 2020).

# CHAPTER 8

# CONCLUSION

Although impact avoidance robots have great potential, their shortcomings and limitations must be acknowledged. Solving these challenges through continuous research and innovation will pave the way for more efficient and multi-hit-avoiding robots in the future. Making a defense robot using

Arduino is a nice and useful project. Thanks to the integration of Arduino, L293D motor driver and ultrasonic sensor, the machine has the ability to detect and avoid interference. The uses Arduino as its operating system, providing a versatile and accessible platform forprogramming and hardware integration.

Its advantages, ease of use and widespread support in the community make it ideal for thedevelopment of defense robots (Banzi, 2011).

The L293D motor driver provides control of the robot's motor for racing and precision. Improves robot performance and performance during anti-theft operations (L293D DriverInformation).

The integration of the ultrasonic sensor provides real-time feedback. The robot can determine the distance between obstacles by emitting ultrasonic waves and measuring the time it takes for the wave to return.

This information enables the robot to make informed decisions and adjust its movement toavoid collisions (Ultrasonic Sensor HC-SR04 Datasheet).

There are many advantages to building a defense robot using Arduino, L293D motor and ultrasonic sensors. It provides best solutions, easy startup, extensive customization and real problem detection. Additionally, it has educational value and benefits from good support and resources in the Arduino community (Banzi, 2011; L293D Driver Datasheet; Ultrasonic Sensor HC-SR04 Datasheet).

By following the methods outlined in this report, individuals interested in technology and skills can gain hands-on knowledge and experience in design and operation against robots. This project laid a good foundation for further research and experimentation in the field ofrobotics.

In a nutshell, a defense robot designed using Arduino demonstrates the potential of combining hardware and software to create smart machines capable of tracking rough terrain. The integration of Arduino with the L293D motor driver and ultrasonic sensor provides a cost-effective, practical and versatile platform for building problem-avoiding robots.

# CHAPTER 9

# FUTURE SCOPE

Obstacle avoidance robot using Arduino offers many opportunities for future development and expansion. The successful development of these robots has laid the groundwork for further development and progress in the field of robotics. This section discusses the futurepotential of building defensive robots using Arduino.

1. Improved sensor integration: When ultrasonic sensors are effective in detecting problems,future scope will integrate more sensors to improve perception.

For example, additional infrared sensors or LiDAR (Light Detection and Distance Shifting) sensors provide accurate and detailed information about the robot's environment, again avoiding potential problems (Rusu et al., 2008).

2. Machine learning and artificial intelligence technology: Combining machine learning with Artificial Intelligence (AI) algorithms can improve robots' decision-making and conflict resolution. By training the robot in various situations, it can learn to adjust its behavior and optimize its direction according to different environmental conditions (Russell & Norvig, 2016).

3. Path Planning Algorithms: Advanced path planning can allow robots to navigate more complex environments. Algorithms such as A* (A-star), D* (D-star) or RRT (Rapid Exploring Random Tree) can be used to create an efficient way of determining interferenceavoidance and execution time (LaValle, 2006).

4. Wireless communication and IoT integration: Integration of wireless communication such as Bluetooth or Wi-Fi can control and monitor robots against interference effect

In addition, connecting robots to the Internet of Things (IoT) offers possibilities for intelligent data sharing, remote updates, and integration with other products (Atzori et al.,2010).

5. Autonomous swarm robot technology: The future scope includes the swarm robot technology research concept, where many obstacle avoiding robots will work together to complete tasks. By collaborating and sharing information, swarm robots

can provide betterprotection and cover larger areas (Sahin, 2005).

6. Real-Time Mapping and Localization: The use of simultaneous mapping and localization (SLAM) technology allows a robot to create a map of its environment while determining its own position in the field report. The combination of SLAM algorithm and sensor fusion technology can provide real-time accuracy and local capability (Thrun et al., 2005).

7. Integration with Human-Machine Interaction: A future development will include the integration of defense robots with human-computer interaction. This enables interaction between humans and robots by allowing intuitive controls such as commands or gesturerecognition (Goodrich & Schultz, 2007).

Future developments and advances in defense robots using Arduino will strengthen their capabilities, intelligence and adaptability. The integration of advanced sensors, artificial intelligence, route planning algorithms, wireless communication and human-robot interaction will facilitate the development of many jobs and various robots.

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