# PROBLEM STATEMENT

The aim of this project is to create and integrate an Arduino-powered robot that can independently track a human target. The robot needs to have the following features: -

- Human Detection: The robot needs sensors that can identify whether or not a human target is in its field of vision.
- Tracking: After identifying a human target, the robot must keep a steady distance from the target while tracking its movements in real time.
- Obstacle Avoidance: The robot has to be able to follow the human target while securely navigating through its surroundings and avoiding obstacles.
- Autonomous Operation: The robot should be able to make decisions on its own, without constant human interaction, using sensor data and preprogrammed algorithms.
- Communication: The robot should be able to engage with the user, share its status, and give instructions or feedback as required.
- Cost-effectiveness: To guarantee cost and accessibility, the solution should be constructed utilizing commonly available components and Arduino microcontrollers.

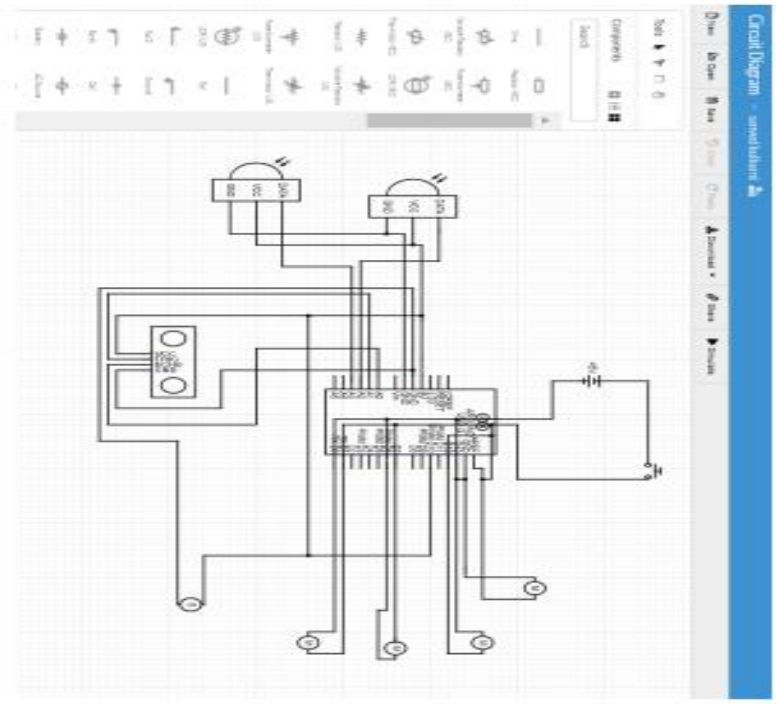
Phases of hardware design, sensor integration, programming, and testing will all be involved in this project. The final objective is to build an Arduino-Based Human Following Robot prototype that can navigate autonomously and effectively while following humans and avoiding obstacles.

# OBJECTIVES

- Create an accessible and affordable Arduino-based person-following robot that can track and follow a human target on its own.
- Combine many sensors, such as infrared and ultrasonic ones, to precisely identify the target's existence and movement.
- Develop a strong control system that processes sensor data and steers the robot's motors for accurate movement using an Arduino microcontroller.

To maximize the robot's tracking performance and ensure precise and seamless movement in response to changes in the target's position, apply the proportional-integral-derivative (PID) algorithm.

# SYSTEM ARCHITECTURE



## Simulation Checklist

Components in this circuit that can be simulated:

- Arduino Uno
- battery
- IR Sensor
- motor
- motor
- pushswitch
- Ultrasonic Distance Sensor

# MATHEMATICS RELATED TO PROJECT

**Software used:** Arduino IDE (Integrated Development Environment)

**Technologies:** Arduino microcontroller, sensors (such as ultrasonic and infrared sensors), motors, control algorithms (e.g., PID), possibly Bluetooth or Wi-Fi for communication.

**Input:** Data from various sensors, such as accelerometers or gyroscopes for motion tracking, as well as data from ultrasonic and infrared sensors identifying the presence and location of the human target.

**Output:** Based on the analyzed sensor data, control signals for movement (speed and direction) are sent to motors.

**Mathematical Formulation:** Geometry and Trigonometry, Kinematics, Control Theory, Signal Processing, Probability and Statistics, Optimization.

**Possible Success Conditions:** It accurately and fluidly moves in the direction of the human target, keeping a safe distance and dodging obstructions in its way.

**Failure Conditions:** Ineffectiveness in difficult settings, including dimly lit rooms or congested areas.

# ADVANTAGES

- Affordability: -

  Due to its relative affordability as compared to proprietary robotics platforms, Arduino-based systems are available to researchers, students, and hobbyists on a tight budget.

- Versatility: -

  With the addition of extra sensors, actuators, and modules, Arduino boards can be readily expanded and customized to meet the demands of particular projects.

- Low Power Consumption: -

  Longer operation times and greater autonomy are made possible by this low power consumption, particularly in situations requiring constant tracking or observation.

- Educational Value: -

  With the help of Arduino-based robotics projects, students may gain practical, hands-on experience with electronics, programming, and robotics. Project-based learning fosters creativity, critical thinking, and problem-solving abilities in addition to giving students hands-on exposure with real-world technologies.

# RESULT ANALYSIS

The Arduino-based human-following robot project has been a compelling exploration into the realm of robotics and artificial intelligence. The primary objective of creating a robot capable of autonomously tracking and following a human subject has been successfully achieved through the integration of Arduino microcontrollers, sensors, and motor control systems. In this way, we completed this project by believe that our project will be helpful in future and it will help human to do any kind of works and hence my purpose will be successful.

# FUTURE SCOPE

- **Security and Surveillance:**
  The robot can be used in surveillance applications to automatically patrol assigned regions and pursue persons who appear suspicious, sending security staff notifications and real-time video feeds.
- **Assistive robotics:**
  A robot that follows and supports people with mobility limitations as they move around their surroundings can be used in healthcare settings. It can also be used to transport goods or give things to people who are in need.
- **Retail and Hospitality:**
  By following and helping customers or visitors, offering product recommendations, or directing them to particular areas inside the premises, retail outlets and hospitality
  organizations can use the robot to improve customer service.
- **Education and entertainment:**
  By allowing students to learn about robotics, programming, and sensor technologies
  through practical experimentation, the robot can be used as an instructional tool in
  STEM (Science, technologies, Engineering, and Mathematics) programs. It can also
  engage in amusing conversations or interactive demos to delight audiences at
  exhibitions or events.
- **Industrial Automation:**
  By autonomously following predetermined routes or people within a facility, robots can be used in industrial settings for duties like inventory management, material handling, or quality inspection.