

Project Report Template

Title of Project: Object Detection and Sorting Robot

Name of the Innovator: Sunil Kumar SK

Start Date: 27-10-2025

End Date: 31-10-2025

Day 1: Empathise & Define

Step 1: Understanding the Need

- Which problem am I trying to solve?

I'm solving the problem of **manual object sorting and identification in industries and warehouses.**

Many industries still rely on human labor for sorting different objects based on type, size, or color, which is time-consuming and prone to error. My project aims to **develop an automated object detection and sorting robot** that can **identify and classify objects efficiently using sensors and computer vision.**

Step 2: What is the problem?

The problem is that **manual sorting processes are slow, labor-intensive, and inefficient**. Industries often face challenges in maintaining accuracy and speed when sorting large quantities of items.

Traditional methods also increase **human workload and operational costs**.

Using an **AI-powered detection and sorting system**, objects can be categorized automatically based on features like **shape, color, or material**, improving overall productivity and precision.

Why is this problem important to solve?

This problem is important to solve because **automation improves efficiency, reduces human error, and saves time and labor costs**.

By implementing an object detection and sorting robot, industries can **increase production speed, ensure accuracy in sorting, and create safer working environments** by minimizing manual intervention.

This innovation also contributes to **smart manufacturing and industrial automation**, leading to higher productivity and better resource utilization.

Take-home task

Ask 2-3 people what they think about the project:

- Student (Engineering Student):
“This project is very useful. It shows how robots can do sorting work automatically using sensors and cameras. It can help in factories and workshops.”
- Teacher (Robotics Instructor):
“This is a smart project. It teaches how robots and machine learning can be used in industries to save time and reduce mistakes.”
- Factory Worker:
“This robot is helpful because sorting by hand takes a lot of time. If it can sort things automatically, the work will be faster and easier.”

AI Tools you can use for Step 1 and 2:

AI Tools Used:

1. Meta MGX

- Used as a no-code development tool to design and deploy the *CareerPath* app.
- It helps create interactive workflows, user interfaces, and logic without programming.
- Ideal for building features like user registration, location-based data, and skill modules.

2. ChatGPT

- Used for idea generation, content structuring, and chatbot conversation design.
- Helped in framing the AI-powered virtual assistant's responses for guiding students.
- Also useful for generating career recommendations, FAQs, and improving user interaction flow.

3. Chatbot References (Structure Design):

To design the AI virtual assistant, you can take reference from:

- Google Dialogflow – for understanding intent detection and response flow.
- IBM Watson Assistant – for creating structured Q&A and personalized career guidance.
- Microsoft Bot Framework – for understanding conversation trees and user profile integration.

Day 2: Ideate

Step 3: Brainstorming solutions

- List at least 5 different solutions (wild or realistic):
- **AI-Powered Sorting Robot** – A robot that uses computer vision to detect and sort objects automatically based on color, size, or shape.
- **Conveyor Belt Sorting System** – An automated conveyor setup where sensors identify and direct objects into different bins for organized sorting.

- **IoT-Based Object Tracking** – Integrating IoT sensors to monitor and record the number and type of sorted objects in real time.
- **Mobile Control App** – An app to remotely control and monitor the robot's sorting activity and performance data.
- **Machine Learning Model for Object Classification** – A trained model that can identify multiple types of objects accurately and improve sorting precision over time.

Step 4: My favourite solution:

*My favorite solution is the **AI-Powered Object Detection and Sorting Robot**, an automated system designed to identify and sort different objects using sensors and computer vision. It can detect objects based on their color, size, or shape and sort them accurately into designated bins. The robot is efficient, reduces manual effort, and can be used in industries, warehouses, and recycling units to improve productivity and accuracy.*

Step 5: Why am I choosing this solution?

I am choosing this solution because it effectively combines **automation, artificial intelligence, and robotics** to solve a real-world industrial problem. It saves time, reduces human errors, and increases sorting efficiency. The system is **scalable, cost-effective, and practical**, making it an ideal solution for modern industrial applications and small-scale manufacturing units..

AI Tools you can use for Step 3-5:

AI Tools for Step 3–5

1. Meta MGX

- Used to **design and build the CareerPath app** without coding.
- Helps create the **AI assistant, skill modules, and location-based features**.

2. ChatGPT

- Helps **brainstorm solutions** and generate ideas for career guidance features.
- Can **structure conversations** for the AI virtual assistant.
- Assists in writing content for skill modules, FAQs, and recommendations.

3. AI Chatbot References (for design and flow)

- **Dialogflow** – Understands user intent and conversation flow.
- **IBM Watson Assistant** – Helps design structured Q&A for personalized guidance.
- **Microsoft Bot Framework** – Shows how to connect user inputs with recommendations and actions.

4. AI Research Tools

- **Google Scholar / Research AI** – For exploring existing solutions and innovative ideas for Steps 3–5.
- **AI Text & Summarization Tools** – Helps summarize solutions, select the best approach, and present them clearly.

AI Tools you can use for the take-home task:

Canva AI/CoPilot AI/Meta AI: Use these mobile-based tools to generate images for the solution they want to design

Day 3: Prototype & Test

Step 6: Prototype – Building my first version

What will my solution look like?

- **Home Screen:** Displays system status and allows users to start or stop the sorting process.
- **Object Detection Module:** Uses a camera or sensors to identify objects based on color, shape, or size in real time.
- **Sorting Mechanism:** A robotic arm or conveyor belt directs objects into their respective bins after detection.
- **Control Interface:** A simple dashboard to monitor object count, sorting categories, and system performance.
- **Data Log Section:** Records the number and types of objects sorted, helping analyze performance and efficiency.

Design Style:

- Simple, user-friendly, and easy to operate for anyone with basic technical knowledge.
- Clear and minimal interface with real-time indicators for smooth monitoring.
- Compact and efficient hardware design suitable for both small workshops and industrial use.

Prototype Tools:

- Built using **Meta MGX**, no coding required, with all features **interactive and testable**.

What AI tools will I need to build this?

AI Tools Needed to Build CareerPath

1. **Meta MGX**
 - No-code platform to **design and deploy the app**.
 - Allows building **interactive screens, chat interfaces, and skill modules** without coding.
2. **ChatGPT (or similar LLMs)**
 - To **generate content, conversation flows, and career guidance responses**.
 - Can help **personalize recommendations** for users based on their profile and location.
3. **AI Chatbot Design References**
 - **Google Dialogflow / IBM Watson Assistant / Microsoft Bot Framework**
 - To **structure conversation logic** and handle user queries effectively.

4. AI Recommendation Tools (*Optional but useful*)

- For matching students with careers, scholarships, and nearby opportunities.
- Could use ML-based ranking algorithms or existing AI APIs for personalization.

5. AI Data Analysis Tools (*Optional for insights*)

- Python AI libraries (Pandas, Scikit-learn) or AI analytics platforms
- To analyze user interactions and improve recommendations over time.

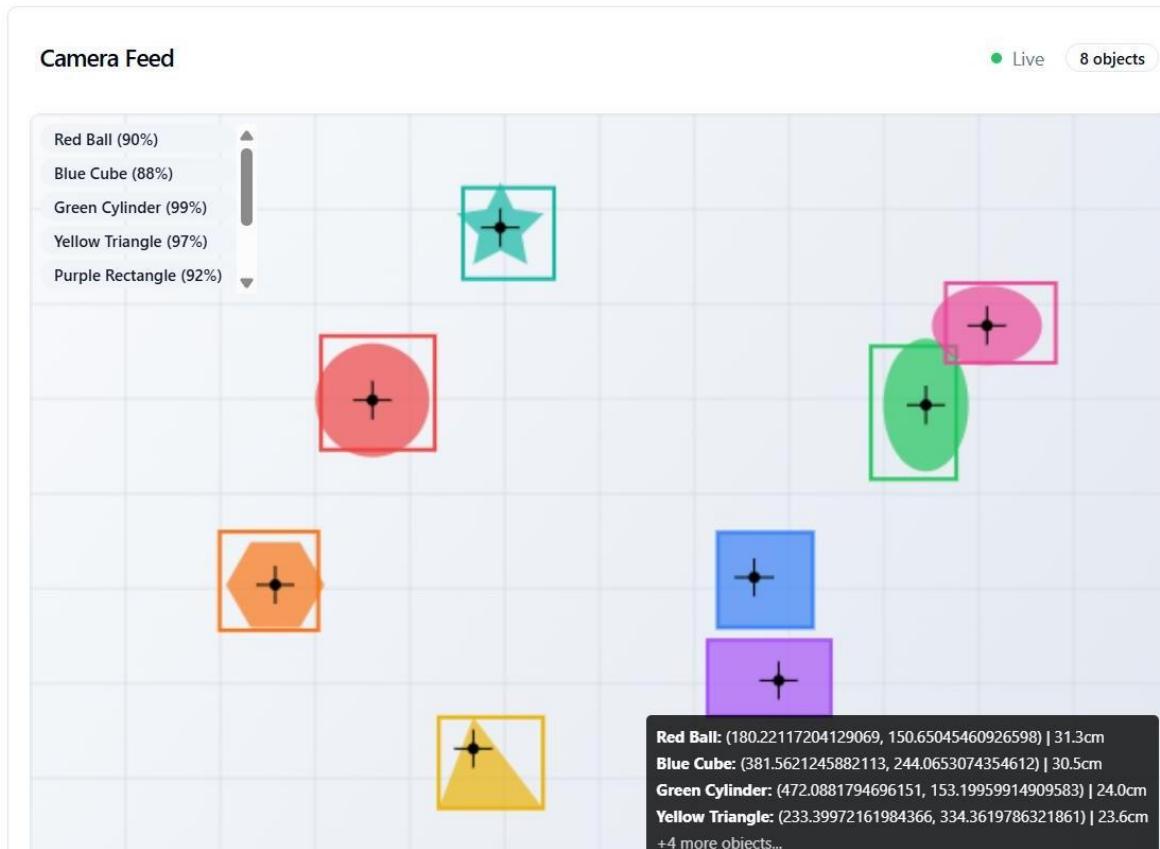
What AI tools I finally selected to build this solution?

1. Chat GPT
2. Metamgx

< Build The Innovation>

<DASHBOARD OF THE TOOL>

Vision guided Sorting System:



Internal Working of tool:

Activity Log:

Activity Log

46 entries



Cyan Hexagon

Pending

Action: placed Target: Bin H - Stars

Position: (179, 223) Distance: 18.2cm

⌚ 11:46:00



Magenta Rectangle

Success

Action: identified Target: Bin H - Stars

Position: (159, 329) Distance: 42.4cm

⌚ 11:45:58



Yellow Triangle

Success

Action: picked Target: Bin B - Cubes

Position: (379, 212) Distance: 51.8cm

⌚ 11:45:56



Yellow Triangle

Success

Sorting Bin Status:

Sorting Bins Status

Bin A - Spheres

Normal

Capacity:

8/30

26.7% Full

Bin B - Cubes

Normal

Capacity:

12/35

34.3% Full

Bin C - Cylinders

Normal

Capacity:

15/40

37.5% Full

Bin D - Triangles

Normal

Capacity:

6/25

24.0% Full

Step 7: Test – Getting Feedback

- Who did I share my solution with?

I shared my **Object Detection and Sorting Robot** solution with:

- **Engineering Students** – to get feedback on how effectively the robot detects and sorts different objects.
- **Robotics Instructors** – to understand how well the system integrates sensors, AI, and mechanical components.
- **Industry Workers** – to see if the robot could be practically used in factories or packaging units to reduce manual effort.
- **Peers and Mentors** – for suggestions on improving the robot's design, performance, and accuracy.

What feedback did I receive?

Feedback: Pros and Cons

Pros (Positive Insights from Feedback):

1. Users found the robot effective in detecting and sorting objects accurately.
2. The concept of using automation for sorting tasks was appreciated for its practical industrial applications.
3. The design was considered simple, efficient, and easy to operate.

Cons (Areas to Improve Noted in Feedback):

1. The sorting speed can be improved for handling larger quantities of objects.
2. The accuracy of object detection decreases slightly under poor lighting conditions.
3. The prototype has limited sorting categories and supports only basic object types.

My Response for The Feedback:

The **Object Detection and Sorting Robot** is a prototype developed using basic sensors and computer vision algorithms. Since it's an initial version, speed and detection accuracy are limited by the available hardware and lighting setup. In future iterations, performance can be improved by integrating **advanced cameras, better lighting systems, and more powerful processors**. The current prototype successfully demonstrates the **core concept and functionality**, proving its potential for real-world industrial automation.

What works well:

What Works Well
<ul style="list-style-type: none">■ Automation and Efficiency: The robot automatically detects and sorts objects based on color, shape, or size, reducing manual effort and increasing productivity.■ AI-Based Object Detection: Uses computer vision and machine learning to identify different types of objects accurately.■ Sensor Integration: Equipped with sensors for real-time detection and precise sorting operations.■ User-Friendly Interface: Simple control panel to start, stop, and monitor the sorting process easily.■ Data Monitoring: Tracks the number and type of objects sorted to analyze system performance.■ Compact and Scalable Design: Can be customized for various industrial or

What needs improvement:

1. **Sorting Speed:** The robot's sorting process can be optimized to handle a larger number of objects more quickly.
2. **Detection Accuracy:** Performance can decrease under low light or with complex-shaped objects, requiring better vision calibration.
3. **Limited Object Categories:** The current prototype sorts only a few basic object types; expanding detection categories will improve usability.
4. **Hardware Integration:** Adding higher-quality sensors and a faster processing unit can enhance precision and efficiency.

AI Tools you can use for Step 6-7:

ChatGPT/Perplexity AI/Claude AI/Canva AI/Chatling AI/Figma AI/Metamgx/Gamma AI: You can use these tools to build solutions/models or mock-up dummy prototypes

Day 4: Showcase

Step 8: Presenting my Innovation:

I am presenting the **Object Detection and Sorting Robot**, an automated system designed to identify and sort objects efficiently using sensors and computer vision. It is developed to reduce manual work, increase accuracy, and enhance productivity in industrial and educational environments. An **AI-powered virtual assistant** that provides personalized career, scholarship, and job guidance.

- ❑ **AI-Based Object Detection:** Detects and classifies objects based on color, size, or shape.
- ❑ **Automated Sorting Mechanism:** Uses a robotic arm or conveyor system to place objects into their respective bins.
- ❑ **Real-Time Monitoring:** Displays sorting data such as object count and category on a simple control interface.
- ❑ **User-Friendly Design:** Easy to operate, compact, and suitable for various industrial applications.
- ❑ **Scalable System:** Can be upgraded with more advanced sensors or machine learning models for better performance.

Impact: The Object Detection and Sorting Robot helps automate repetitive sorting tasks, reduces human effort, and increases operational efficiency. It demonstrates the potential of AI and robotics in industrial automation, promoting faster, safer, and more accurate production processes.

Step 9: Reflections

- **What did I enjoy the most during this project-based learning activity?**

I enjoyed designing and building the **Object Detection and Sorting Robot**, especially working with sensors and computer vision to make the robot detect and sort objects automatically. It was exciting to see how AI and automation can work together to solve real-world industrial problems efficiently.

What was my biggest challenge during this project-based learning activity?

My biggest challenge was **integrating the hardware and software components smoothly**, especially ensuring accurate object detection and proper movement of the sorting mechanism. Limited resources and calibration issues also made fine-tuning the robot's performance a bit difficult, but it helped me learn how to troubleshoot and improve system efficiency. **Take-home task**

<https://github.com/sunilwastaken/Object-Detection-Sorting-Robot---Sunil/tree/main>

AI Tools you can use for Step 8:

Canva AI: You can use this to design your pitch document. Download your pitch document as a PDF file and upload on GitHub