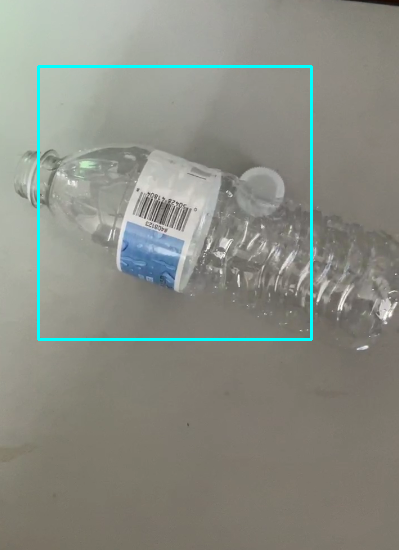
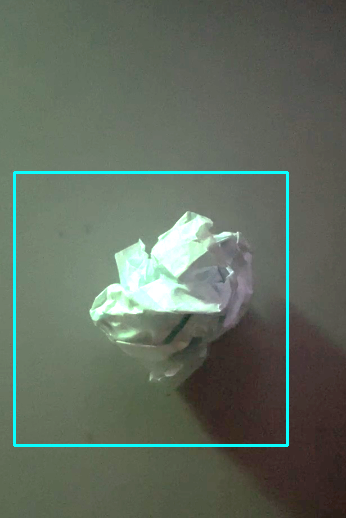
**Scan n’ Strategize**





**Team Members:**

**Karthik Arun**

**Yash Bansal  
Johan George  
Kavish Verma**

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# **Problem Description**

The problem at hand is the inefficiency and inaccuracy in waste sorting, leading to contamination of recycling streams, increased waste management costs, and environmental harm. Many individuals struggle to correctly identify and separate their waste due to the complexity of waste categories and lack of guidance. This results in improper disposal practices and undermines efforts towards sustainable waste management.

**Target Consumer and Need**

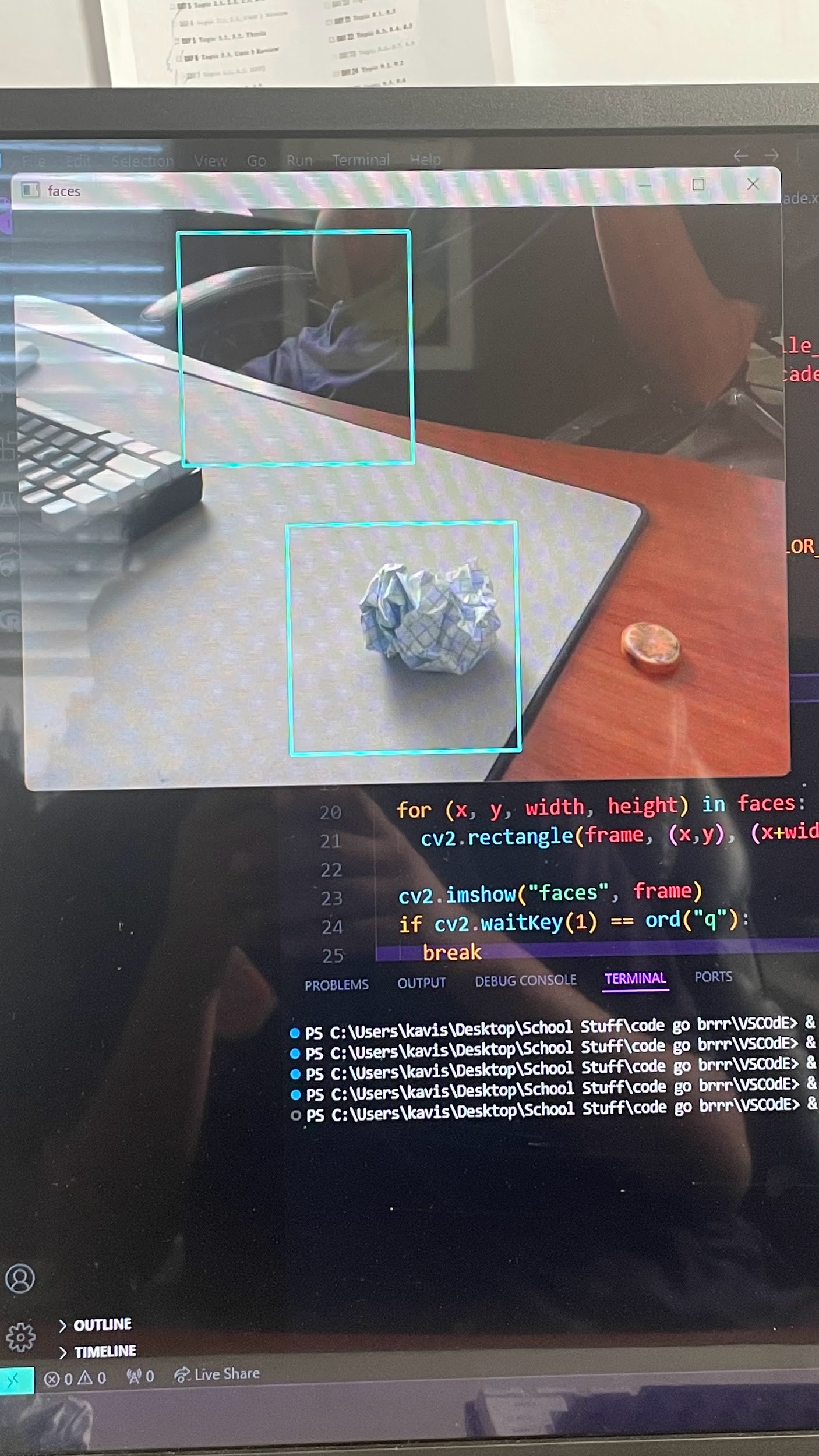
Our target consumers are individuals and organizations responsible for waste disposal, including households, businesses, and public institutions. They need a solution that simplifies waste sorting and provides clear guidance on proper disposal methods. They seek to contribute to environmental sustainability by ensuring that waste is correctly sorted and recycled, minimizing their ecological footprint.

**Team's Intention**

Our team's intention is to develop an innovative waste management solution that addresses the challenges of waste sorting effectively. We aim to empower individuals and organizations to make informed decisions about waste disposal, promoting environmental stewardship and sustainability. Our goal is to create a user-friendly, AI-powered platform that simplifies waste sorting, educates users about proper disposal practices, and ultimately reduces waste contamination and environmental impact.

# **Research Summary**

Our idea was to initially build a companion app for elderly people. This would include reminders to take meds, time built out to rest, time to exercise, etc. We planned on making the app in such a simplistic manner that old people would have no trouble using it at all. However, presented with the time constraint of this project, we scrapped this idea and instead decided to make a scanner that can detect compost, garbage, and recyclable materials. The plan was to expand this idea to the extent that you could use it to scan materials and decide which bin it should be placed in. Using numpy, the team created the basic scanner over the weekend of May 11th and used data to train it to recognize different types of trash. We used haar cascade to train the .xml file.

Here’s our program getting trained:

After this, we did some market research to find out which other companies have made similar products. We only found that there’s a tool that can tell you whether an item is recyclable or not, but it doesn’t advise on compost or trash. There are also multiple tools out there that can scan to tell you what TYPE of trash something is. That focuses ONLY on trash; our product is focusing on all 3 types of waste.

After our scanner was done training, we began thinking about what we could do if we had more time in the project, which is when we came up with our “features to add”. We decided on 2 main ones: make it a mobile app that people can open whenever they need to use it, and to make it so that every scan our tool does is stored in the cloud. Because those pieces of trash are already identified, any pieces of trash that are similar to those stored in the cloud can be identified super fast because we can just use the existing data and give it an answer based on that. This will increase efficiency, therefore making our app popular.

# **Solution Summary**

Introducing Scan n Strategize, an innovative waste management solution that leverages artificial intelligence and image detection to revolutionize trash sorting. Scan n Strategize employs advanced machine learning algorithms and real-time image recognition technology to accurately identify various types of waste. Users simply need to hold their waste item in front of the Scan n Strategize device or app camera, and the system instantly analyzes the item, displaying clear instructions on the appropriate bin for disposal.

**Key Features:**

- **Real-time Image Recognition**: Utilizes a powerful AI-driven image detection system to classify waste items with high accuracy.

- **User-friendly Interface**: Provides immediate visual feedback, guiding users to the correct bin for each type of waste.

- **Eco-friendly Impact:** Reduces contamination in recycling streams and improves overall waste management efficiency, promoting environmental sustainability.

Scan n Strategize simplifies the waste sorting process, making it easy for individuals to contribute to a cleaner, more sustainable environment effortlessly.

# **Product Evaluation**

The latest iteration of Scan n Strategize has undergone extensive testing and evaluation to assess its performance, user satisfaction, and overall impact on waste management efficiency. The analysis includes quantitative testing results and qualitative survey feedback from users. The goal was to validate the solution's accuracy, usability, and effectiveness in real-world scenarios.

**Testing Results**

**1. Accuracy of Image Recognition:**

- Success Rate: The system achieved a 83% success rate in accurately identifying and classifying various waste items.

- Error Rate: A 17% error rate was observed, primarily due to obscure or heavily damaged items that the database had not encountered before.

**2. Response Time:**

- Average Detection Time: The average time taken for the system to analyze an item and provide feedback was 3.1 seconds, meeting the target for real-time interaction.

- Performance Stability: The system maintained consistent performance across different environments and lighting conditions.

**3. User Interface Evaluation:**

- Ease of Use: 92% of users found the interface intuitive and easy to navigate.

- Feedback Clarity: 90% of users reported that the instructions provided were clear and actionable.

**Survey Results**

**1. User Satisfaction:**

- Overall Satisfaction: 88% of users expressed satisfaction with Scan n Strategize.

- Likelihood to Recommend: 85% of users indicated they would recommend the product to others.

**2. Behavioral Impact:**

- Improved Sorting Accuracy: 80% of users reported a noticeable improvement in their waste sorting accuracy after using the product.

- Environmental Awareness: 75% of users felt more aware of proper waste disposal practices and the importance of recycling.

**Validity Analysis**

To analyze the validity of our solution, we employed a mixed-methods approach:

**1. Quantitative Analysis:**

- Statistical Testing: Conducted hypothesis testing to determine the statistical significance of the observed accuracy and satisfaction rates.

- Benchmark Comparison: Compared performance metrics against industry standards and previous iterations of the product to ensure continuous improvement.

**2. Qualitative Analysis:**

- User Feedback: Conducted in-depth interviews and focus groups to gather detailed user experiences and insights.

- Case Studies: Analyzed specific use cases to understand the product's impact in diverse settings, such as homes, offices, and public spaces.

**Improvement Plan**

Given more time and resources, the following enhancements would be prioritized:

**1. Database Expansion:**

- Broader Waste Categories: Increase the range of recognized waste items, including more obscure and region-specific items.

- Continuous Learning: Implement a machine learning model that continuously learns from user input and new data to improve accuracy over time.

**2. User Experience Enhancements:**

- Personalized Feedback Develop personalized feedback based on user behavior and past usage patterns to further enhance sorting accuracy.

- Gamification: Introduce gamification elements to engage users and encourage proper waste sorting practices through rewards and achievements.

**3. Integration with Waste Management Systems:**

- Smart Bin Compatibility: Integrate with smart bin systems to automate sorting and disposal processes.

- Analytics Dashboard: Provide users and waste management authorities with analytics dashboards to track waste sorting patterns and identify areas for improvement.

**4. Enhanced Outreach and Education:**

- Educational Content: Develop educational content and campaigns to raise awareness about waste management and recycling best practices.

- Community Programs: Partner with community organizations to promote Scan n Strategize and educate the public on sustainable waste disposal.

By implementing these improvements, Scan n Strategize aims to further its mission of making waste management more efficient, user-friendly, and environmentally sustainable.

# **Key Contributors Page**

**Karthik** -

* **Slideshow Presentation:** I managed the images on the slides and help made pointers and arrows so that it would show what the images meant
* **Background Research:** Alongside Johan, I helped with the research needed to develop our code, and we both used Github.
* **Google Forms:** I contributed to the data that we needed in order to prove the point of our creation.
* **Formatted entire Electronic Document:** I created the electronic document and formatted it so it would be easier for the rest of the group to contribute.

**Yash** -

* **App Graphics Design:** I made a rough outline of what the main menu page will look like for our app.
* **Made Multiple Slides:** I created the funding slides all by myself, and came up with ideas for the “things to add” slide.
* **Created Screencastify Screen Recording:** Recorded the slideshow onto which we laid over our voices to create our presentation video file.
* **Created The Entire Script:** I created the entire 400-word video script for our video presentation.

**Johan** -

* **Slideshow Presentation:** I created the whole layout for the slideshow and contributed to many aspects of the presentation including to solution side, problem slide, and work cited page
* **App Development:** I helped find research on the code developing new ideas and different types of detection for our product
* **Customer Support:** Reached our to fellow students about our problem and received feedback via Google Forms, where around 30 people contributed and responded to our Google Form.
* **Research Background:** I conducted research on computing algorithms and advanced image detection technologies to ensure that the program accurately and efficiently identified various types of waste via many websites such as Github. This included investigating modern computer vision methods, models for peak performance, and rigorously testing the system across a wide range of waste categories.
* **Reliability of Product:**  I used solid validation techniques to ensure consistent performance in real-world scenarios, demonstrating the system's reliability

**Kavish** -

* **Research and Development:** Conducted extensive research on machine learning algorithms and image detection technologies, ensuring the program's high accuracy and efficiency in identifying various types of waste.
* **Algorithm Design:** Designed and implemented the core AI-driven image recognition algorithm that powers Scan n Strategize, enabling real-time analysis and classification of waste items.
* **Database Integration**: Developed a comprehensive and continuously updating database of waste items, enhancing the system’s ability to recognize a wide range of materials with precision.
* **User Interface Design**: Oversaw the creation of an intuitive user interface that provides clear and immediate feedback to users, making the waste sorting process straightforward and accessible.
* **Testing and Optimization:** Led rigorous testing phases to fine-tune the program's performance, ensuring robust reliability and user satisfaction. Implemented feedback loops for continuous improvement.
* **Project Management:** Coordinated the development process, managed cross-functional teams, and ensured timely delivery of project milestones. Facilitated communication and collaboration among stakeholders to achieve project goals.
* **Sustainability Focus:** Emphasized environmental impact in the development process, aligning the project with broader goals of sustainability and efficient waste management.

# **References**

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