**Project Design Phase-I**

**Solution Architecture**

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| Date | 15 May 2023 |
| Team ID | NM2023TMID13277 |
| Project Name | Intelligent Garbage Classification using Deep learning |

**Solution Architecture:**

Solution architecture is a complex process – with many sub-processes – that bridges the gap between business problems and technology solutions. Its goals are to:

Data Collection and Preprocessing:

Collect a diverse dataset of garbage images, categorizing them into different classes (e.g., plastic, paper, organic waste).

Preprocess the dataset by resizing images, normalizing pixel values, and applying data augmentation techniques to increase variability.

Model Training and Optimization:

Design and implement a deep learning architecture (e.g., convolutional neural network) for garbage classification.

Train the model using the preprocessed dataset, optimizing hyperparameters (e.g., learning rate, batch size) and loss functions.

Use techniques like transfer learning with pre-trained models to improve model performance.

Model Evaluation and Validation:

Evaluate the trained model's performance using a validation dataset, measuring metrics such as accuracy, precision, recall, and F1 score.

Validate the model's ability to correctly classify different types of garbage.

Deployment and Inference:

Deploy the trained model as an API or a service accessible by external systems.

Implement an inference pipeline to preprocess incoming garbage images and classify them using the deployed model.

Ensure real-time or near real-time performance for garbage classification.

User Interface and Interaction:

Develop a user-friendly interface (e.g., web application, mobile app) for users to interact with the garbage classification system.

Allow users to upload images of garbage and receive immediate classification results.

Monitoring and Maintenance:

Implement monitoring mechanisms to track the system's performance, including model accuracy, response time, and resource utilization.

Set up alerts and notifications to detect and address any issues or anomalies in the system.

Regularly update the model using new data to improve accuracy and adapt to evolving garbage classification needs.

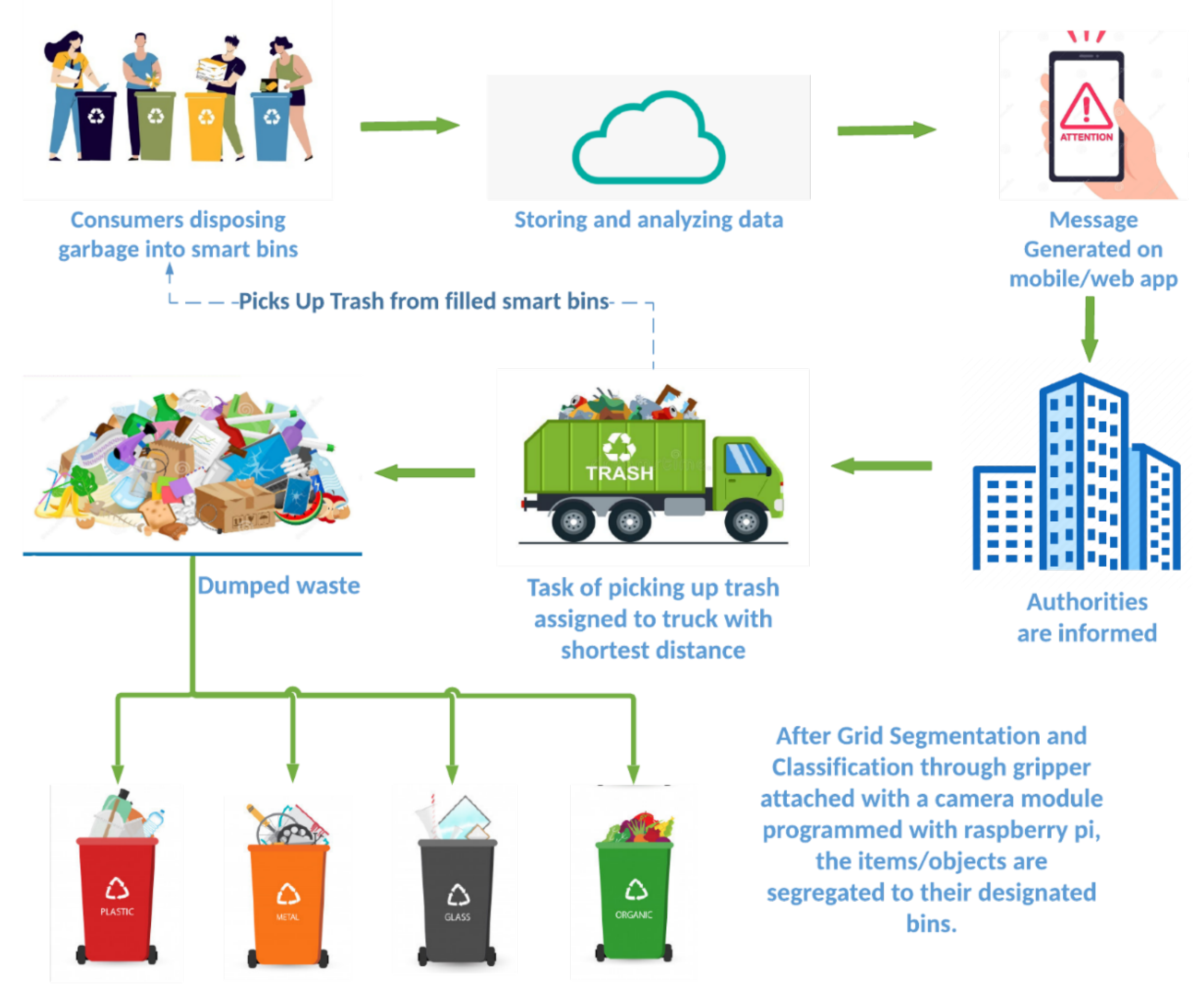
Scalability and Extensibility:

Design the solution architecture to be scalable, allowing for an increasing number of garbage images and user requests.

Implement mechanisms to handle concurrent requests and distribute the workload across multiple servers if needed.

Plan for future enhancements, such as incorporating additional garbage classes or integrating with other waste management systems.

**Solution Architecture Diagram:**

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*Figure 1: Architecture and data flow of Intelligent Garbage Classification using Deep learning*