AN INTERNSHIP REPORT

Submitted by

Siddharth M 113222072094

in partial fulfillment for the award of the degree of

BACHELOR OF TECHNOLOGY

IN

ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

VELAMMAL ENGINEERING COLLEGE, CHENNAI-66.

(An Autonomous Institution, Affiliated to Anna University Chennai)

2024-2025

VELAMMAL ENGINEERING COLLEGE

CHENNAI - 66

BONAFIDE CERTIFICATE

Certified that this internship report **"SOFTWARE DEVELOPMENT"** is the Bonafide work of **"Siddharth M" 113222072094** carried out at **"Inzpire-Solutions"** during December 2024 to January 2025.

INTERNAL GUIDE,

Mrs. S. DEEPA,

Assistant Professor,

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Chennai – 600066.

HEAD OF THE DEPARTMENT,

Dr P. VISU,

Professor and Head,

Department of Artificial Intelligence and Data Science,

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CERTIFICATE FROM INDUSTRY

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TO WHOM IT MAY CONCERN

January 2, 2025

This is to certify that **SIDDHARTH M** has successfully completed an internship at **Inzpire Solutions** from **27-Nov-2024 to 31-Dec-2024** as a **Software Developer Intern – AI and ML**.

During this period, **SIDDHARTH M** actively contributed to the following tasks and responsibilities:

- Assisting in the development of machine learning models and algorithms for real-world applications.
- Conducting data preprocessing, feature engineering, and exploratory data analysis on various datasets.
- Implementing and testing AI and ML solutions using programming languages and frameworks.
- Collaborating with team members to integrate machine learning models into existing software systems.
- Preparing comprehensive documentation for implemented solutions, including methodologies and results.

Throughout the internship, **SIDDHARTH M** demonstrated a strong aptitude for learning, analytical thinking, and a proactive approach to problem-solving.

In recognition of their commendable performance and enthusiasm for the field, we are pleased to extend their internship further, starting from **2nd Jan 2025**. We believe **SIDDHARTH M** will continue to enhance their skills and contribute significantly to our projects in the domain of AI and ML.

We look forward to their continued association with **Inzpire Solutions**.

Sincerely,

For INZPIRE SOLUTIONS

Partner

Balaji G
Co-Founder

Plot No. 56, Flat F1, Amudhan Flats, kuberan nagar, 1st street, urapakkam, Chennai - 603210

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CERTIFICATE OF EVALUATION

COLLEGE NAME: VELAMMAL ENGINEERING COLLEGE

BRANCH: ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

SEMESTER: V

Sl. No	Name of the student who has done the Internship	Title of the Internship	Name of Faculty Coordinator with designation
1	SIDDHARTH M	SOFTWARE DEVELOPMENT	Mrs. S Deepa Asst professor, AI & DS

This report of internship work submitted by the above student in partial fulfillment for the award of Bachelor of Technology Degree in Anna University was evaluated and confirmed to be reports of the work done by the above student and then assessed.

Submitted for Internal Evaluation held on.....

Examiner 1 **Examiner 2** **Examiner3**

ABSTRACT

The internship involved the development of a comprehensive system for object detection and classification using deep learning models and web technologies. The primary objective was to automate an inspection process to ensure operational standards in a specific domain. The system was designed to detect objects in images, classify them into categories, and organize results for efficient retrieval.

The project employs an object detection model and a secondary classification model to assess attributes. The workflow includes image preprocessing, model training, and API development to enable user interaction. By automating these processes, the system reduces manual effort and enhances operational efficiency. The outcomes underscore the potential of deep learning in improving industrial standards. Furthermore, the project emphasizes the importance of secure and scalable systems in practical applications.

ABOUT THE COMPANY

At Inzpire Solutions, they offer a comprehensive suite of technology solutions tailored to meet the diverse needs of businesses worldwide. From cutting-edge software and embedded product development to expertly crafted web, mobile, desktop, and embedded applications, they provide innovative solutions that drive efficiency, productivity, and growth.

Fig no. 1: Company Logo

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CHAPTER 1
INTRODUCTON

Maintaining high standards in operational processes is essential for efficiency and customer satisfaction. This project aims to develop an intelligent system to automate inspections using advanced computer vision and deep learning techniques. The core objective is to leverage artificial intelligence to improve operational workflows and ensure reliability in a target domain.

The solution integrates two primary components:

1. **Object Detection**: Utilizing an object detection model to detect objects in images with precision and speed.
2. **Classification**: Employing a dedicated deep learning model to classify detected objects based on specific attributes.

The workflow allows users to upload images via an API, process them through the system, and retrieve organized results. The dataset was prepared using manual collection, preprocessing, and annotation to ensure high-quality inputs for training. By automating the inspection process, the system addresses inefficiencies and promotes adherence to standards, contributing to a reliable operational environment.

CHAPTER 2

SYSTEM REQUIREMENT

Tools and Platforms Used:

- **Programming Language:** Python
- **Frameworks:** Flask for API development, object detection models, annotation tools
- **Development Tools:** Visual Studio Code, Postman for API testing
- **Operating System:** Cross-platform compatibility (Windows/Linux/MacOS)
- **Database:** File-based storage for organized results
- **Deployment:** Localhost or cloud-based hosting for scalability

CHAPTER 3
FEASIBILITY STUDY

Technical Feasibility:

The integration of object detection models and Flask for API development ensures the technical viability of the system. These tools are capable of processing large datasets and analyzing images efficiently.

Operational Feasibility:

The system is designed to be user-friendly, with an API workflow that enables seamless interaction. Users can upload images and retrieve organized results effortlessly. The solution is scalable to accommodate diverse operational needs.

Economic Feasibility:

The project utilizes open-source tools and frameworks, reducing development costs while maintaining high performance. This makes the solution economically viable for both small and large-scale implementations.

Market Feasibility:

With increasing demand for automated solutions in various industries, this system has significant market potential. Its modular design allows for customization, making it adaptable to diverse operational environments.

Legal and Regulatory Feasibility:

The project adheres to data protection regulations and industry standards. By securely processing and storing images and outputs, it ensures compliance with legal and regulatory requirements.

CHAPTER 4
SYSTEM DESIGN AND DEVELOPMENT

Dataset Preparation:

- Image Collection: Images were sourced from various repositories.
- Preprocessing: Techniques like rotation, brightness adjustments, and cropping were applied to enhance the dataset.
- Annotation: Bounding boxes were labelled manually using annotation tools, ensuring data quality for model training.

Model Training:

1. Detection Model: An object detection model was trained on annotated images to detect objects with precision.
2. Classification Model: A separate model was trained to classify objects based on defined attributes.

API Development:

Flask was utilized to develop a user-friendly API. The API accepts images as input and returns detailed results, including detected objects, classifications, and organized metadata.

Output Organization

Processed images and their metadata are systematically stored and categorized. This enables efficient tracking and reporting, enhancing operational transparency.

CHAPTER 5
OUTPUT SCREENSHOTS

Below picture depicts the Glass Classification:

Fig no. 5.1 Sample output screenshots

CHAPTER 6

CODING

THE SCRIPT FOR THE GLASS DETECTION AND CLASSIFICATION ENDPOINT

Initialize Application
Initialize a web application framework
Set base directory for output images
Define a list of valid branch names

Define Endpoint for Glass Sanitation Detection
Create an endpoint that accepts HTTP POST requests

Handle Input Data
Parse input data from the request:
- Extract image file path
- Extract branch name

Validate the branch name against allowed branches
Check if the image file exists

Load Detection and Classification Models
Load detection model
Load classification model

Generate Unique Identifier
Generate unique ID using branch name and timestamp

Create Directory Structure
Create directories for:

- Detected images
- Cropped images
- Clean images
- Dirty images

Process the Input Image

Load the input image

Run detection model to identify objects

Create a copy of the image for annotations

Iterate Through Detected Objects

For each detected object:

- Extract bounding box coordinates
- Crop the object from the image
- Increment count of detected objects
- Annotate the original image with bounding boxes and labels
- Save the cropped image

- Classify the cropped object using classification model
  - Determine predicted class and confidence score
  - Annotate cropped image with classification results
  - Save cropped image to appropriate directory (clean/dirty)

Save the Annotated Image

Save the annotated image with all bounding boxes and labels

Return Results

Prepare a JSON response containing:

- Input image path
- Path to annotated image
- List and count of dirty images
- Count of clean images
- Total objects detected

- Branch name and date

Return the response

Handle Errors

Catch and return appropriate error messages for:

- Invalid inputs
- System failures

Run the Application

Start the application in debug mode

CHAPTER 7
SECURITY TESTING

- **Data Validation:**
  Inputs for the API are validated to ensure only proper image files are accepted for processing.
- **Authentication and Authorization:**
  API access can be secured in future iterations using token-based authentication to restrict unauthorized usage.
- **Error Handling:**
  Robust error messages and HTTP status codes ensure that invalid operations do not expose sensitive system details.
- **Testing Tools:**
  Security testing was conducted using manual penetration tests and tools like OWASP ZAP to identify and address vulnerabilities.

CHAPTER 8
CONCLUSION

This internship provided an opportunity to explore the practical applications of deep learning in automating inspection processes. The developed system demonstrates the effectiveness of combining object detection and classification models to streamline operations. Through this project, valuable insights into dataset preparation, model training, and secure API development were gained, emphasizing the importance of robust systems in AI applications.

The experience also highlighted challenges such as handling diverse datasets and optimizing model performance. Addressing these challenges enhanced problem-solving and technical skills, preparing for future roles in artificial intelligence and software development.

Overall, this project illustrates the transformative potential of AI in improving operational standards, making it a meaningful contribution to industrial automation.