



FINAL YEAR PROJECT REPORT

A REAL-TIME EVALUATION OF INVENTORY FOR WAREHOUSES

**In fulfillment of the requirement
For degree of
BS (COMPUTER SCIENCES)**

By

SHAHEER IMRAN	70436 (BSCS)
SYADA KISSA BATOOL JAFFRI	70434 (BSCS)
HUZAIFA KODVAVI	70446 (BSCS)

SUPERVISED

BY

DR. SYED SAFDAR ALI RIZVI

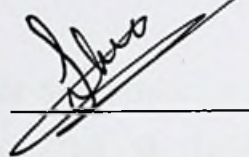
BAHRIA UNIVERSITY (KARACHI CAMPUS)

SPRING-2024

DECLARATION

We hereby declare that this project report is based on our original work except for citations and quotations which have been duly acknowledged. We also declare that it has not been previously and concurrently submitted for any other degree or award at Bahria University or other institutions.

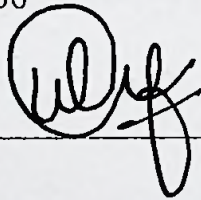
Signature :



Name : Shaheer Imran

Reg No. : 70436

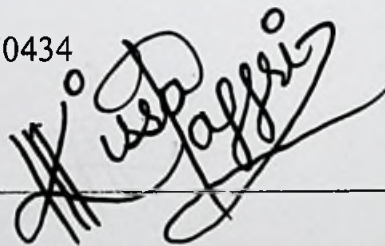
Signature :



Name : Syada Kissa Batool Jaffri

Reg No. : 70434

Signature :



Name : Huzaifa Kodvavi

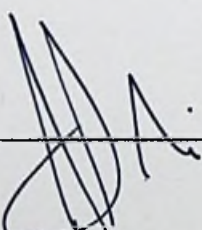
Reg No. : 70446

Date : 20/05/2024

APPROVAL FOR SUBMISSION

We certify that this project report entitled **A REAL-TIME EVALUATION OF INVENTORY FOR WAREHOUSES** was prepared by **SHAHEER IMRAN, SYADA KISSA BATOOL JAFFRI, & HUZAIFA KODVAVI** has met the required standard for submission in partial fulfilment of the requirements for the award of Bachelor of Science in **Computer Science** at Bahria University, Karachi.

Approved by,

Signature :  _____

Supervisor: **Dr. Syed Safdar Ali Rizvi**

Date : 12/06/2024

The copyright of this report belongs to Bahria University according to the Intellectual Property Policy of Bahria University BUORIC-P15 amended on April 2024. Due acknowledgement shall always be made of the use of any material contained in, or derived from, this report.

© 2024 Bahria University. All right reserved.

Specially dedicated to

My beloved grandmother, mother, and father

SHAHEER IMRAN

My beloved grandmother, mother, and father

SYADA KISSA BATOOL JAFFRI

My beloved grandmother, mother, and father

HUZAIFA KODVAVI

ACKNOWLEDGEMENTS

We would like to thank everyone who had contributed to the successful completion of this project. We would like to express my gratitude to my project supervisor, **Dr. Syed Safdar Ali Rizvi** for her invaluable advice, guidance, and her enormous patience throughout the development of the research.

In addition, we would also like to express our gratitude to our loving parents and friends who have helped and given us encouragement.

A REAL-TIME EVALUATION OF INVENTORY FOR WAREHOUSES

ABSTRACT

An inventory management system is a technology solution used to oversee and control the ordering, storage, and use of goods within a business. It tracks inventory levels, orders, sales, and deliveries. An effective inventory management system is crucial for maintaining accurate stock levels, preventing overstocking or stockouts, and ensuring timely restocking. Current inventory management systems often suffer from issues such as limited visibility and responsiveness, usability and security concerns, and inaccuracies in inventory counts. These limitations can lead to inefficient warehouse operations, increased labor costs, and delays in restocking and order fulfilment. The proposed system leverages advanced technologies like computer vision, real-time video processing, and cloud storage to address these limitations. By integrating object detection algorithms and a mobile app interface, the system ensures accurate, real-time inventory tracking and seamless user interaction. This approach enhances visibility, responsiveness, and security, thereby improving overall warehouse management efficiency. The implementation of this real-time inventory management system is expected to significantly improve inventory accuracy, reduce operational inefficiencies, and enhance user satisfaction. By embracing innovative technologies, the system transforms traditional warehouse management practices, preparing the way for more efficient and optimized operations in the digital age.

TABLE OF CONTENTS

DECLARATION	ii
APPROVAL FOR SUBMISSION	iii
ACKNOWLEDGEMENTS	vi
ABSTRACT	vii
TABLE OF CONTENTS	viii
LIST OF TABLES	xii
LIST OF FIGURES	xiii
LIST OF APPENDICES	xiv

CHAPTER

1	INTRODUCTION	1
	1.1 Background	1
	1.2 Problem Statement	1
	1.3 Aims and Objectives	2
	1.4 Scope of Project	2
	1.4.1 Core Functionalities:	2
	1.4.2 Project Success Criteria:	3
2	LITERATURE REVIEW	5
	2.1 Introduction	5
	2.2 Traditional Inventory Management	5
	2.3 Machine Vision	5
	2.4 Computer Vision	6
	2.5 Internet Of Things (IoT)	6
	2.6 Object Detection	7
	2.7 Application of Computer Vision in Inventory Management	7
	2.8 Existing Research Papers	9
3	REQUIREMENT SPECIFICATIONS	14
	3.1 Introduction	14

3.2	Existing System	14
3.2.1	Limitations of Visibility and Responsiveness	15
3.2.2	Usability and Security Concerns	15
3.3	Proposed System	16
3.3.1	Enhancing Visibility and Responsiveness:	16
3.3.2	Empowering Data-Driven Decision Making:	17
3.3.3	Improving Usability and Security	17
3.4	Requirements Specification	20
3.4.1	Functional Requirements	20
3.4.2	Non-Functional Requirements	21
3.5	Use Cases	21
3.5.1	Mobile App:	22
3.6	User Flow Diagram	25
4	DESIGN AND METHODOLOGY	26
4.1	Introduction to Development Approach	26
4.1.1	Reasons for Choosing Agile	26
4.2	Project Progress Update	27
4.2.1	User Interface Progress	27
4.2.2	Backend Development Progress	28
4.2.3	External Integration	29
4.3	Development Methodology: Scrum	29
4.3.1	Utilizing Scrum in "RTEIW"	29
4.4	Architecture Overview	30
4.4.1	User Interface Layer	30
4.4.2	Backend Services Layer	30
4.4.3	Database Layer	31
4.4.4	External Interfaces and APIs	31
4.4.5	Continuous Improvement	31
4.5	Technology Stack	32
4.6	User Interface (UI) Design	33
4.7	Module Discussion	37
4.7.1	Consumer Module	37

		x
	4.7.2 Computer Vision Module	37
	4.7.3 Inventory Visualization Module	38
	4.7.4 Notification Module	38
	4.7.5 External Interfaces and APIs	38
	4.7.6 Database Layer Module	38
4.8	Database Schema	38
4.9	Gantt Chart	39
5	SYSTEM IMPLEMENTATION	40
5.1	Introduction	40
5.2	Building a Solid Development Base	40
	5.2.1 Development Environment Configuration:	40
	5.2.2 Programming Language Selection	40
	5.2.3 Teamwork Infrastructure	41
	5.2.4 Development Workstation Configuration	42
	5.2.5 Implementing Automation Strategies	42
	5.2.6 Project Documentation & Knowledge Sharing	42
5.3	Computer Vision Setup & Algorithm Development	43
	5.3.1 Camera Selection and Installation	43
	5.3.2 Data Annotation and Roboflow	43
	5.3.3 Integration of YOLO Algorithm	44
	5.3.4 Integration with the Inventory System	45
	5.3.5 Testing and Validation	46
	5.3.6 Performance Optimization	46
5.4	Database Design and Implementation	46
5.5	System Workflow	48
5.6	Sequence Diagram	50
6	SYSTEM TESTING AND EVALUATION	51
6.1	Introduction to System Testing and Evaluation	51
6.2	Testing Approach	51
	6.2.1 Unit Testing	51
	6.2.2 Integration Testing	51

		xi
	6.2.3 End-to-End Testing	52
	6.2.4 User Acceptance Testing	53
6.3	Testing Techniques	53
	6.3.1 Automated Testing	53
	6.3.2 Load Testing	53
	6.3.3 Regression Testing	54
	6.3.4 Usability Testing	54
6.4	Evaluation Metrics	54
	6.4.1 Performance	55
	6.4.2 Accuracy	55
	6.4.3 Reliability	55
	6.4.4 User Satisfaction	56
7	CONCLUSION	57
	7.1 Unveiling the Future of Inventory Management	57
	7.2 Travelling of the Big Picture to the Pinnacle	57
	7.3 Bridging the Gap: Introduction to Conclusion	57
	7.4 A New Dawn for Warehouses	58
	7.5 Embrace Innovation	58
	7.6 Acknowledgements	58
	REFERENCES	59
	APPENDICES	63
	1. Hardware	63
	2. Realtime Object Detection Snapshots	64
	3. Stock Sync App Snapshots	65