WAREHOUSE AUTOMATON SYSTEM

A MINI PROJECT REPORT

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in partial fulfillment for the award of the degree of

BACHELOR OF TECHNOLOGY

in

INFORMATION TECHNOLOGY

PANIMALAR ENGINEERING COLLEGE,

CHENNAI 600123

(An Autonomous Institution)

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MAY 2023

BONAFIDE CERTIFICATE

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DECLARATION

I hereby declare that the project report entitled "**WAREHOUSE AUTOMATION SYSTEM"** which is being submitted in partial fulfilment of the requirement of the course leading to the award of the 'Bachelor of Technology in Information Technology' in **Panimalar Engineering College, An Autonomous institution Affiliated to Anna University- Chennai** is the result of the project carried out by me under the guidance and supervision of **Mrs. K.MUTHULAKSHMI, M.TECH.,(Ph.D) Associate Professor in the Department of Information Technology**. I further declared that I or any other person has not previously submitted this project report to any other institution/university for any other degree/ diploma or any other person.

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ACKNOWLEDGEMENT

A project of this magnitude and nature requires kind co-operation and support from many, for successful completion. We wish to express our sincere thanks to all those who were involved in the completion of this project.

Our sincere thanks to **Our Honorable Secretary and Correspondent, Dr. P. CHINNADURAI, M.A., Ph.D.,** for his sincere endeavor in educating us in his premier institution.

We would like to express our deep gratitude to **Our Dynamic Directors, Mrs. C. VIJAYA RAJESHWARI and Dr.C.SAKTHI KUMAR, M.E.,Ph.D** and **Dr.SARANYA SREE SAKTHIKUMAR., B.E., M.B.A.,Ph.D** for providing us with the necessary facilities for completion of this project.

We also express our appreciation and gratefulness to **Our Principal Dr. K. MANI, M.E., Ph.D.,** who helped us in the completion of the project. We wish to convey our thanks and gratitude to our head of the department, **Dr. M. HELDA MERCY, M.E., Ph.D.,** Department of Information Technology, for her support and by providing us ample time to complete our project.

We express our indebtedness and gratitude to our staff in charge, **Mrs.K. MUTHULAKSHMI M.Tech.,(Ph.D)** Associate Professor, Department of Information Technology for her guidance throughout the course of our project. Last, we thank our parents and friends for providing their extensive moral support and encouragement during the course of the project.

ABSTRACT

Warehouse automation systems are computer-controlled systems that automate various processes in a warehouse to improve efficiency, accuracy, and productivity. The main goal of a warehouse automation system is to streamline the flow of goods and information throughout the warehouse, from receiving to shipping. A Warehouse automation system can significantly improve the efficiency and productivity of a warehouse and lead to improved business performance.

Warehouse automation is a process of using technology to reduce manual labor and increase efficiency. Bulk QR scanning, geolocation API, and inventory reconciliation are all tools used to automate warehouse operations.The existing system lacks operational efficiency, it does not have inventory visibility and require manual object detection, it also requires additional hardware utilities.The system automates everything, from the moment the goods enter the distribution process till they are delivered, within a specified time. It also focuses on resource utilization, storage analytics, supply chain management, inventory management and Automated real time tracking using Artificial intelligence and other . The Objective is to detect of objects using You Only Look Once (YOLO) approach. This method has several advantages as compared to other object detection algorithms. Aiming at the low degree of automation in production enterprises, real-time tracking and automatic access to warehouses are realized by developing warehouse management software. The algorithm looks the image completely by predicting the bounding boxes using convolutional network and the class probabilities for these boxes and detects the image faster as compared to other algorithms.

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CHAPTER 1
INTRODUCTION

1.1 OVERVIEW

Warehouse automation is a process of using technology to reduce manual labor and increase efficiency. Bulk QR scanning, geolocation API, and inventory reconciliation are all tools used to automate warehouse operations. Bulk QR scanning helps to quickly identify and track items, geolocation API helps to keep track of items within the warehouse, and inventory reconciliation helps to ensure accuracy of the inventory data. Warehouse automation can help to significantly reduce manual labor and increase accuracy. It can also help to reduce costs, boost productivity, and improve customer satisfaction. Warehouse automation can also help to reduce errors, improve inventory accuracy, and provide real-time data for analysis and decision-making. Process automation streamlines a system by removing human inputs, which decreases errors, increases speed of delivery, boosts quality, minimizes costs, and simplifies the business process. It incorporates software tools, people, and processes to create a completely automated workflow. Warehouse management encompasses the principles and processes involved in running the day-to-day operations of a warehouse. At a high level, this includes receiving and organizing warehouse space, scheduling labor, managing inventory and fulfilling orders. The six fundamental warehouse processes comprise receiving, put away, storage, picking, packing, and shipping. Optimizing these six processes will allow you to streamline your warehouse operation, reduce cost & errors, and achieve higher perfect order rate Key warehouse automation benefits are: Efficient labor management, Increased safety on site, Reduced error rate, Optimized handling and storage cost, Fast scale-up, Higher resilience, introduced sustainability practices, Optimized maintenance, Increased customer satisfaction, Higher performance predictability visibility.

1.2 NEED FOR THE PROJECT

Currently, many warehouses use a variety of manual and automated systems to manage their operations. Some of the commonly used systems include:

- Barcode scanning
- Inventory management software
- Automated storage and retrieval systems

There is only centralized warehouse currently and involves manual labor and we are in need for local warehouses. Automation can keep your process in-house, improve process control and significantly reduce lead times compared to outsourcing or going overseas. Automation solutions are based on your unique needs and goals and pay for themselves quickly due to lower operating costs, reduced lead times, increased output and more. Automation can keep your process in-house, improve process control and significantly reduce lead times compared to outsourcing or going overseas. Automation solutions are based on your unique needs and goals and pay for themselves quickly due to lower operating costs, reduced lead times, increased output and more. Optimal inventory management, reduced operational costs, customer satisfaction and more. Let's face it, investing in warehouse automation is expensive, complex and potentially risky.

1.3 OBJECTIVE OF THE PROJECT

This project is to help e-commerce websites and wholesale distributers manage warehouse operations and processes associated with it like receiving goods, storage, maintenance, packaging, and delivery of goods. The system automates everything, from the moment the goods enter the distribution process till they are delivered, within a specified time. It also focuses on resource utilization, storage analytics, supply chain management, inventory management and Automated real time tracking etc. It also includes setting up and renting temporary and local rooftop warehouses to reduce the storage and transportation cost, and to minimize transportation time. Maximize the use of storage space. Ensure optimal organization of the workforce. Leverage handling equipment. Guarantee access to goods when they are requested. The primary goal of warehouse operations is the efficient utilization of space, labor and equipment while meeting customers' expectations. It's a straightforward objective, but the path to achieving it is anything but, requiring complex planning and the ability to adapt to ongoing change. Warehouse automation aims to automate repetitive and tedious manual tasks in warehousing operations. According to a study, the warehouse automation adoption rate was only 8% in 2019; however, it is expected to rise to 45% by 2030. Enabling a seamless link to order processing and logistics management in order to pick, pack, and ship product out of the facility. Tracking where products are stocked, which suppliers they come from, and the length of time they are stored. Companies can control inventory levels and maximize the use of warehouse space. No stockout, especially during special circumstances such as a peak season on a particular month. Alone warehouse management system cannot automate the process. It also involves the combination of business process to be followed along with that system to achieve 100% productivity and accuracy. The objective of warehousing is to keep the inventory level optimized by maintaining the supply with demand. It helps the organizations to determine when to supply and restock. The layout of your warehouse tends to determine the efficient flow of the production process. he primary objective of warehouse is movement of goods. To maintain the flow of goods throughout the system, these goods may be raw materials or finished products. To set up a network of warehouses closest to the customer locations to service markets better and minimize cost. Provide timely customer service. Keep track of items so they can be found readily & correctly. Minimize the total physical effort & thus the cost of moving goods into & out of storage. Provide communication links with customers.

1.4 SCOPE OF THE PROJECT

The use of new technologies and improvements in existing systems can help to improve the efficiency and accuracy of warehouse operations, and to better meet the needs of businesses and customers. Automation can keep your process in-house, improve process control and significantly reduce lead times compared to outsourcing or going overseas. Automation solutions are based on your unique needs and goals and pay for themselves quickly due to lower operating costs, reduced lead times, increased output and more. Minimize stock holding costs Resource anticipation, management and controlling in warehouse. Enhance on-time dispatch and shipment tracking. Warehouse process reaction- times and performance optimization. Improve flexibility in order to response to changing priorities and crises. Seamless multi-site management or multi-activity operations. Automating non-value adding tasks and day to day operations. Enable systematic interactions with partners, couriers, suppliers and clients Ensure quality and shipment tracking at all levels

ADVANTAGES

- Accuracy and speed of data collection
- Integration of systems
- Predictive analytics
- Improved automation

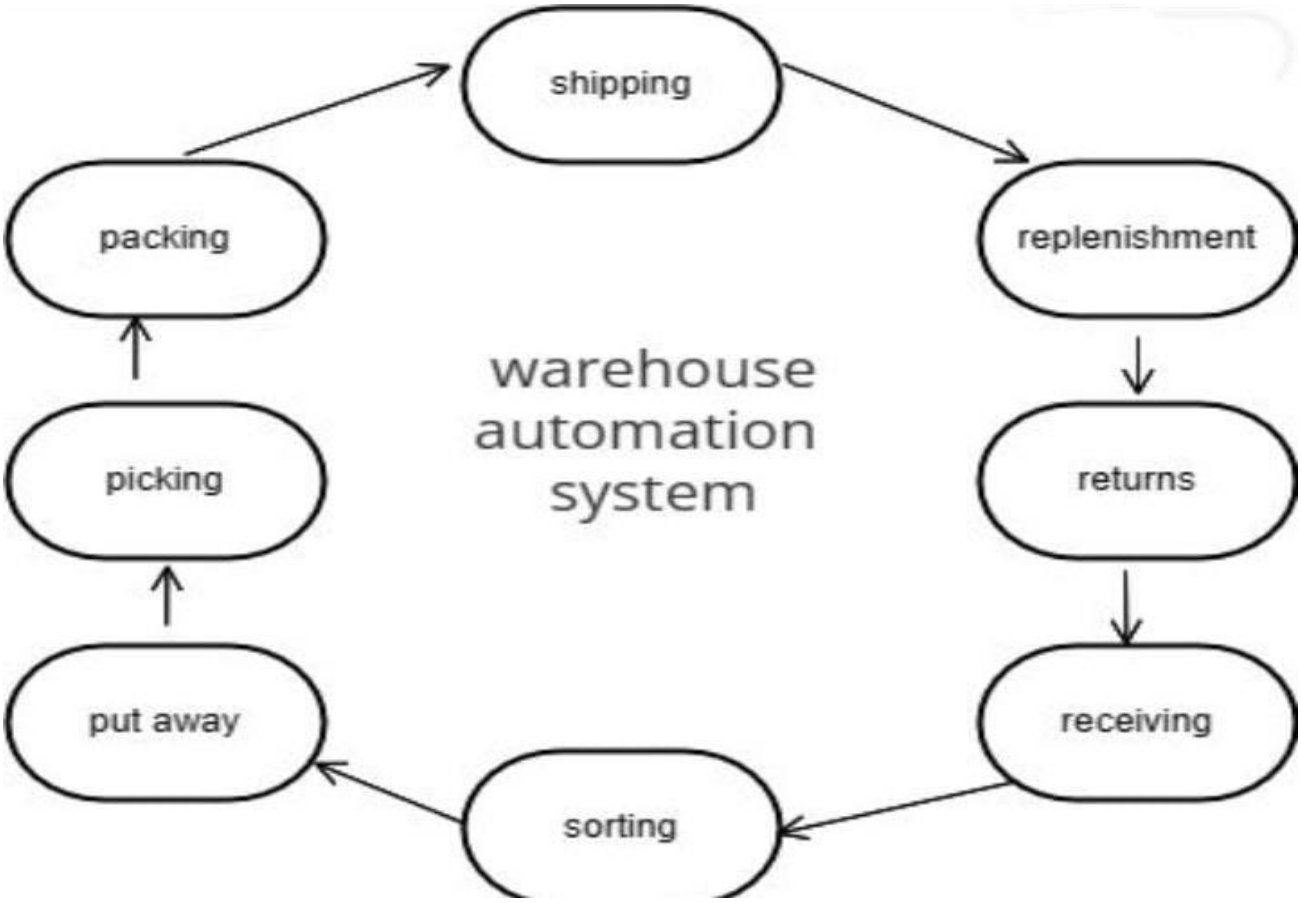


Fig 1.1 Warehouse Automation System Project Flow

CHAPTER 2

LITERATURE SURVEY

II. LITERATURE SURVEY

Chen Chen 1., Warehousing is the top priority in logistics. Intelligent logistics is an important link linking customer, supply chain and manufacturing industry. Warehousing management balances all aspects of logistics operation imbalance, which integrates the whole process of logistics operation. It is the design goal of the warehouse management system (WMS) to find the best solution to solve all kinds of contradictions in the warehouse under certain hard conditions. WMS supports the execution of warehousing and distribution through different functional modules and adapts to changing business strategies, e-commerce, customer needs, modern equipment, order size and structure environment, and improves operational efficiency and resource utilization to reduce logistics costs and enhance management capabilities. Traditional warehouses have several drawbacks such as inefficient space management, damaged material, inefficient operations, over-handling material, and inefficient material handling equipment (e.g., unused expensive forklifts). Traditional warehouses are warehouses that do not operate efficiently and perform many manual tasks that cause inefficiencies. Another paper illustrated designed a data collection unit (DCU) and applied it to the forklifts. Several sensors and devices, such as scale sensor, RFID reader, antenna, and mobile tag, were connected to the forklift. They concluded that this system automates the warehouse and IoT-based data transmitting system is beneficial to smart warehouses. Their focus was not the design of a reference architecture, but the development of an IoT-based system. They implemented a smart warehouse management system that uses optimization algorithms and artificial intelligence techniques. Stock planning, product placement, transferring to pick zones, order picking, transport, and tracking features were realized in this system. Barcodes were attached to the racks, and vehicles were tracked using the GPS module. He proposed an IoT-based warehouse management system that uses computational intelligence techniques for smart logistics. They applied fuzzy logic approach to select the best order picking method and concluded that the use of IoT, Robotics, and Artificial Intelligence is the future research direction for smart warehouses.

Yao et al. (2014) designed an intelligent warehouse control system that has the following components: event-handling system, wireless sensor network system, and intelligent control system. Zigbee technology was used in the wireless sensor network system. The temperature and humidity of the warehouse were monitored and controlled based on this system. He then proposed a web-oriented architecture for communication of objects in the warehouse, and the REST framework was used as the basis of communication between objects. Two components, namely smart warehouse services and RESTful warehouse services, were developed. They explain how RESTful APIs can be integrated into smart warehouse services. ZigBee sensor nodes were used in this system. He found that material handling equipment companies typically do not provide generic interface for third parties (i.e poor versatility or expandability). Also most of companies do not provide flexible user interface (UI), good visibility on the warehouse, and functionality for lifecycle management of equipment. It is considered that maintenance system should provide such capabilities with generic capabilities. Another author proposed a novel online multi-target tracking framework. The framework utilizes features from multiple convolutional layers, and it uses toplevel features to be trained to be target class classifiers and lower-level features to accomplish target matching and associations, with lower layers containing

more details; to avoid the computation cost by online fine-tuning, the frames retrains the historical appearance characteristics for each target, and the depth model is trained through an offline learning strategy.The detection rate is improved without compromising on precision. This approach has been tested on a dataset of complex background scenes. The advantage of this method over other existing methods is that it improves the accuracy of foreground segmentation. This is evident from the results obtained by this method. Object Detection is the most challenging application of computer vision as it require complete understanding of images. In other words object tracker tries to find the presence of object within multiple frames and assigns labels to each object. There might be many problems faced by the tracker in terms of complex image, Loss of information and transformation of 3D world into 2 D image. To achieve good accuracy in object detection we should not only focus on classifying objects but also on locating the positions of different objects that may vary image to image. Computer vision is associate knowledge base field that has been gaining enormous amounts of traction within the recent years and self-driving cars have taken center stage. Another integral part of computer vision is real time object detection. Real time object detection aids in cause estimation, vehicle detection, traffic control, CCTV monitoring etc. For this reason, day to day progress in technology is necessary so that the ability to give vision in computer is possible. So, low-cost technology and learning tools are in requirement. YOLO(You look only once) uses a CNN to detect, track and localize objects in videos. YOLO divides the image into S*S grids and generates anchor boxes for each grid along with a confidence score for each object present in the image. It can process up to 45 fps on Titan X pascal GPU. It uses 2 convolutional layers to perform feature extraction. The network structure of YOLO algorithm is improved and a new network structure YOLO-R was proposed to increase the ability of the network to extract the information of the shallow pedestrian features by adding passthrough layers to the original YOLO network. The YOLO v2 and YOLO-R network models were tested on the test set of the INRIA data set. The experimental results show that the YOLO-R network model is superior to the original YOLO v2 network model. The number of detection frames reached 25 frames/s, basically meeting the requirement of real time performance.

CHAPTER 3

SYSTEM DESIGN

3.1 PROPOSED SYSTEM ARCHITECTURE DESIGN

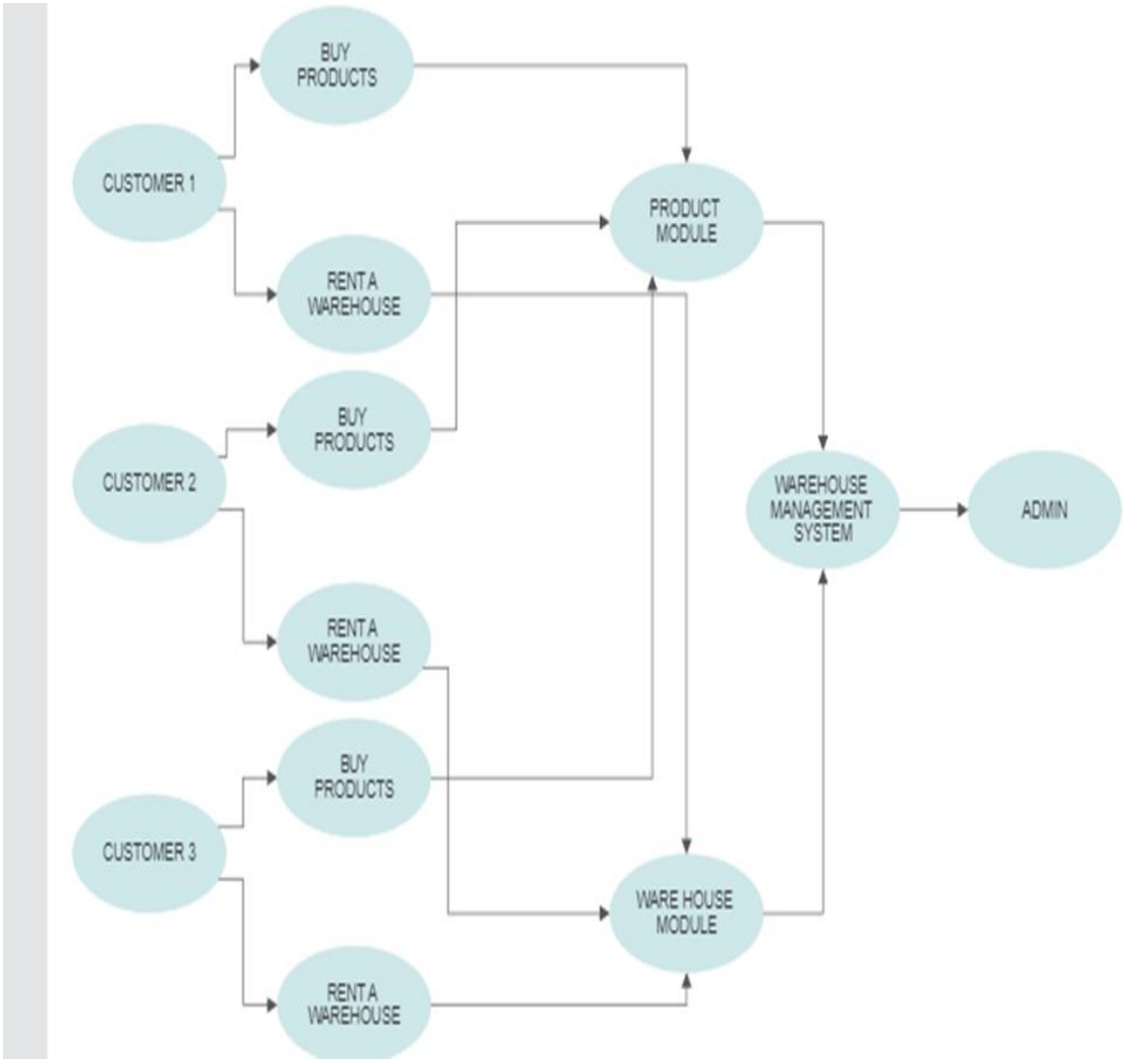


Fig 3.1 Architecture Design

The figure 3.1 consists of Admin who manages the overall WMS website. The customers can either buy products from the admin through cart and order the items and make payment or they can rent a warehouse to the admin through the WMS. The admin processes the product requests and selects the warehouses they want to book to store their goods.

3.2 DATAFLOW DIAGRAM

0 LEVEL DFD

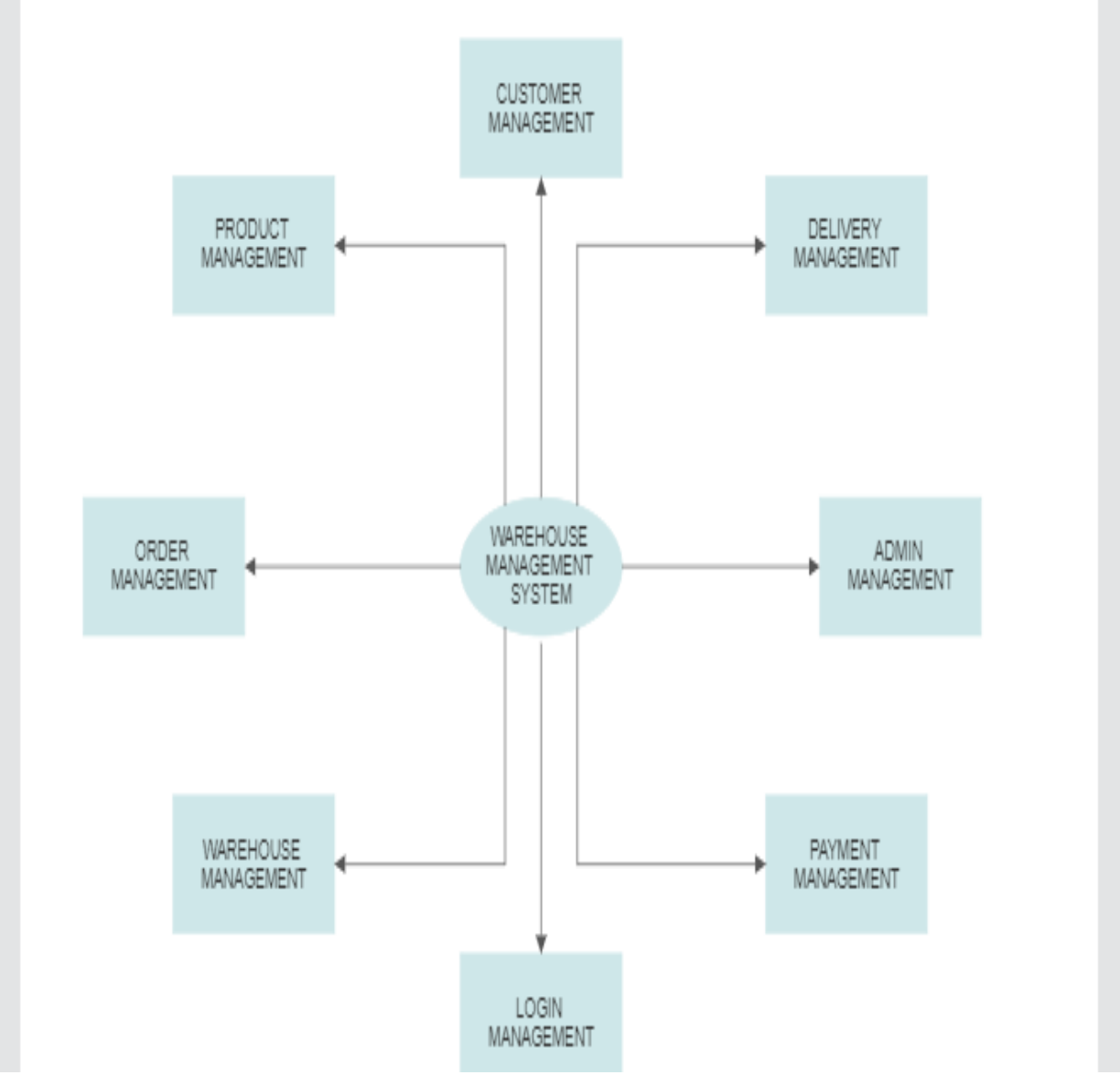


Fig 3.2.1 Dataflow diagram level

The zero level of data flow diagram of Warehouse management system shows the various management levels.

FIRST LEVEL DFD

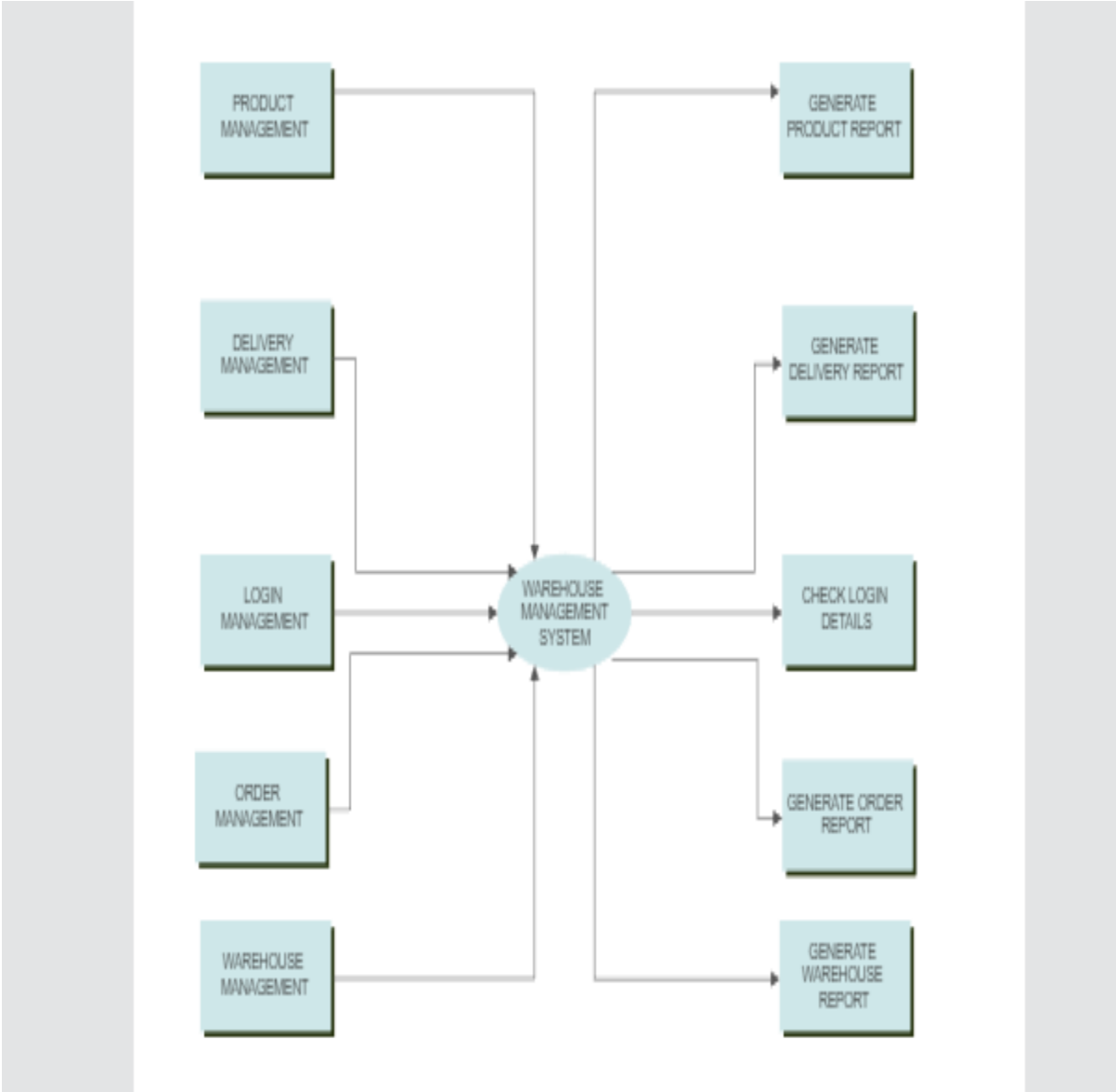


Fig 3.2.2 Dataflow diagram level 1

The first level of data flow diagram of Warehouse management system shows various management levels and their corresponding reports.

SECOND LEVEL DFD

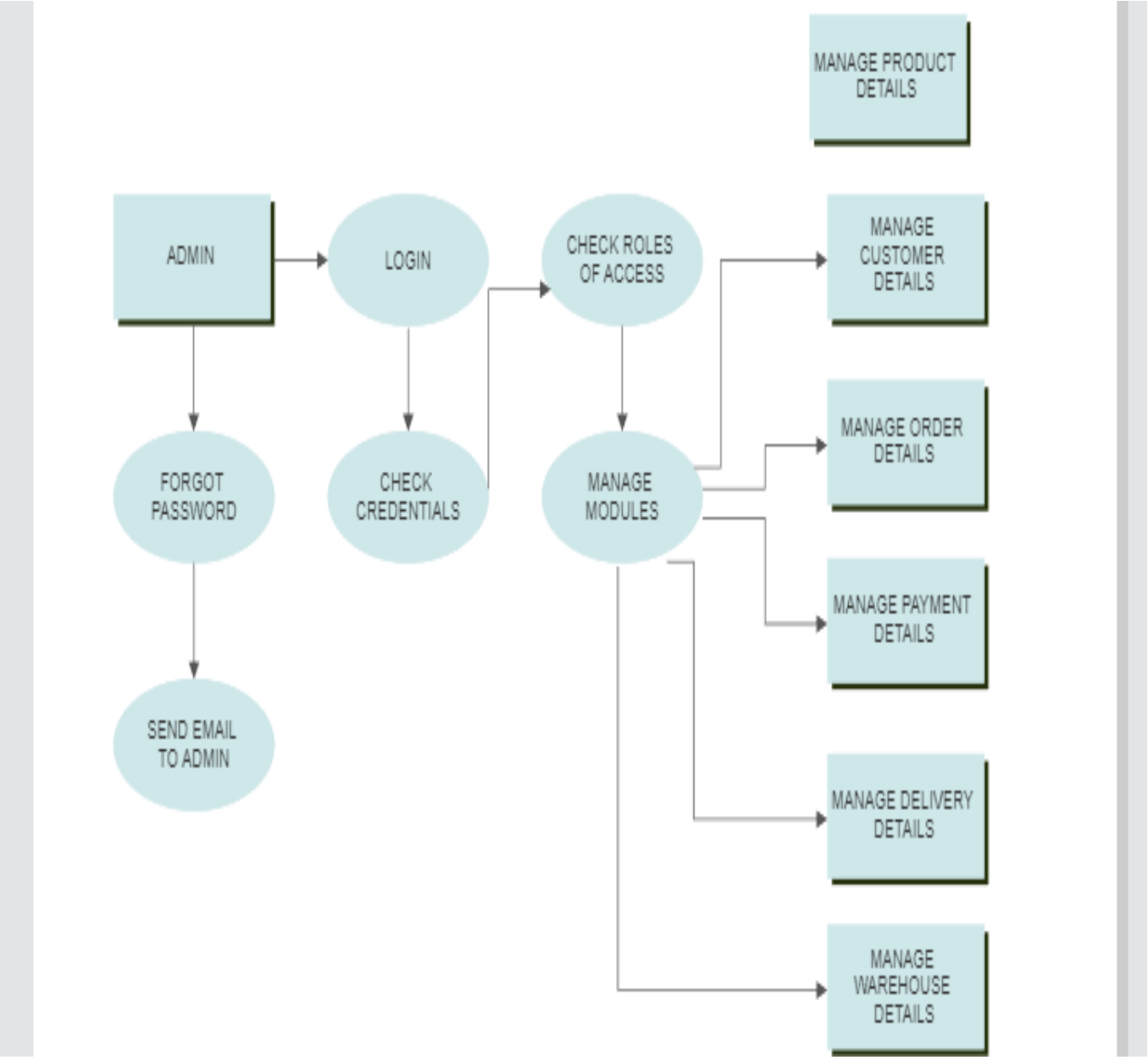


Fig 3.2.3 Dataflow diagram level 2

The second level of data flow diagram of Warehouse management system shows the various details of actions.

3.3 MODULE DESCRIPTION:

The WMS has 2 types of users:

1.Client user: Client user have the 3 modules

3.3.1 Rent warehouse module:

The customer will we able to rent out the their warehouse by selecting the type of warehouse, by entering the address of warehouse and selecting the renting period of the warehouse. Selecting the capacity of the Warehouse.

- Select type of warehouse
- Select address of warehouse
- Select rent period
- Select capacity

3.3.2 My cart module:

He also can add any products to his cart in warehouse By adding items to Cart ,Remove items from the cart,He can also increase and decrease the Quantity in the cart

- Add items to cart
- Remove items from cart
- Increase/decrease quantity

3.3.3 Object Detection module:

The Object detection Module Can be used by the customer to detect products and Add products to his warehouse.

- Detect products
- Add products to Warehouse

1.Admin user: Admin user have 2 modules

3.3.4 All warehouses module:

Admin will be able to view all the warehouses and view details of the warehouse

- View all warehouses available
- View details of warehouses

3.3.5 Send Goods module:

The Admin will be able to send Products to Warehouses and make payment to the warehouses to the customers

- Send Products to warehouse

- Make payment

3.4 DATA DICTIONARY

This is normally represented as the data about data. It is also termed as metadata some times which gives the data about the data stored in the database. It defines each data term encountered during the analysis and design of a new system. Data elements can describe files or the processes. Following are some rules, which defines the construction of data dictionary entries:

1. Words should be defined to understand for what they need and not the variableneed by which they may be described in the program.

2. Each word must be unique. We cannot have two definition of the same client.

3. Aliases or synonyms are allowed when two or more enters shows the samemeaning. For example, a vendor number may also be called as customer number.

4. A self-defining word should not be decomposed. It means that the reduction ofany information in to subpart should be done only if it is really required that is it is not easy to understand directly.

Data dictionary includes information such as the number of records in file the frequency a process will run, security factor like password which user must enter to get excessto the information.

3.4.1 LOG IN TABLE

COLUMN NAME	DATA TYPE	DESCRIPTION	CONSTRAINT
NAME	VARCHAR	NAME OF THE USER	NOT NULL
PASSWORD	VARCHAR	PASSWORD OF THE USER	NOT NULL
FORGOT PASSWORD	VARCHAR	NEW PASSWORD	NOT NULL

3.4.1 Log in table for WMS

3.4.2 SIGN UP TABLE

COLUMN NAME	DATA TYPE	DESCRIPTION	CONSTRAINT
NAME	VARCHAR	NAME OF THE USER	NOT NULL
PASSWORD	VARCHAR	PASSWORD OF THE USER	NOT NULL

3.4.2 Sign up table for WMS

3.4.3 ADD PRODUCT TABLE

COLUMN NAME	DATA TYPE	DESCRIPTION	CONSTRAINT
CATEGORY	VARCHAR	CATEGORY OF THE PRODUCT	NOT NULL
PRODUCT NAME	VARCHAR	NAME OF THE PRODUCT	NOT NULL
PRODUCT ID	INTEGER	ID OF THE PRODUCT	NOT NULL
PRODUCT DESCRIPTION	VARCHAR	DESCRIPTION OF THE PRODUCT	NONE
PRICE	NUMBER	PRICE OF THE PRODUCT	NOT NULL

3.4.3 Add product table for WMS

3.4.4 ADD WAREHOUSE TABLE

COLUMN NAME	DATA TYPE	DESCRIPTION	CONSTRAINT
WAREHOUSE ID	INTEGER	ID OF WAREHOUSE	NOT NULL
WAREHOUSE TYPE	VARCHAR	TYPE OF WAREHOUSE	NOT NULL
RENT PERIOD	INTEGER	RENT PERIOD OF WAREHOUSE	NOT NULL
AVAILABLE CAPACITY	INTEGER	CAPACITY OF WAREHOUSE	NOT NULL
COST	INTEGER	PRICE OF THE WAREHOUSE	NOT NULL

3.4.4 Add Warehouse table for WMS

CHAPTER 4
REQUIREMENT SPECIFICATION

4.1 SOFTWARE REQUIREMENT

- Windows 10
- HTML
- CSS
- Java
- JSP
- MYSQL
- Eclipse
- Open CV

4.2 HARDWARE REQUIREMENT

- Processor: Minimum 1 GHz
- Memory (RAM): 4 GB
- Hard Drive: 32 GB
    - Internet Connection

4.1.1 Features of Windows 10:

Windows has great security features. Windows has a great battery life, which is crucial for when you are coding. Windows 10 supports a huge range of programming languages. The price you pay for Windows 10 helps keep your data and system safe from viruses and malware. Windows 10 supports universal apps, an expansion of the Metro-style first introduced in Windows 8. Universal apps can be designed to run across multiple Microsoft product families with nearly identical code—including PCs, tablets, smartphones, embedded systems, Xbox One, Surface Hub and Mixed Reality. The Windows user interface was revised to handle transitions between a mouse-oriented interface and a touchscreen-optimized interface based on available input devices—particularly on 2-in-1 PCs. Both interfaces include an updated Start menu which incorporates elements of Windows 7's traditional Start menu with the tiles of Windows 8. Windows 10 also introduced the Microsoft Edge web browser, a virtual desktop system, a window and desktop management feature called Task View, support for fingerprint and face recognition login, new security features for enterprise environments, and DirectX 12.

Windows 10 is the final version of Windows that supports 32-bit processors (IA-32 and ARMv7-based) and devices with BIOS firmware. Its successor, Windows 11, requires a device that uses UEFI firmware and a 64-bit processor in any supported architecture (x86-64 for x86 and ARMv8 for ARM). Windows 10 makes its user experience and functionality more consistent between different classes of device, and addresses most of the shortcomings in the user interface that were introduced in Windows 8.

4.1.2 Features of Java Programming language

Java is a high-level and purely object oriented programming language. It is platform independent, robust, secure, and multithreaded programming language which makes it popular among other OOP languages. It is widely used for software, web, and mobile application development, along with this it is also used in big data analytics and server-side technology. Before moving towards features of Java, let us see how Java originated.

This time the latest release of Java is JDK 17.0 (September 2021). Now Java is being used in Web applications, Windows applications, enterprise applications, mobile applications, etc. Every new version of Java comes with some new features. The first and **foremost reason is the platform-**independent feature of Java. Platform independence means programmers who developed their software in one platform can execute it on any platform or operating system regardless of underlying configuration, because of Java Virtual Machine**.**

4.1.3 Features of JSP

JSP technology is used to create dynamic web applications. JSP pages are easier to maintain then a Servlet. JSP pages are opposite of Servlets as a servlet adds HTML code inside Java code, while JSP adds Java code inside HTML using JSP tags. Everything a Servlet can do, a JSP page can also do it.

JSP enables us to write HTML pages containing tags, inside which we can include powerful Java programs. Using JSP, one can easily separate Presentation and Business logic as a web designer can design and update JSP pages creating the presentation layer and java developer can write server side complex computational code without concerning the web design. And both the layers can easily interact over HTTP requests and servlets typically work together, especially in older Java web applications. From a coding perspective, the most obvious difference between JSP and servlets is that with servlets you write Java code and then embed client-side markup (like HTML) into that code. With JSP, you start with the client-side script or markup, then embed JSP tags to connect your page to the Java back end.

Think of JSP as a way to write markup with superpowers for interacting with the back end. Usually, markup like HTML is sent to the client where it interacts with the back-end server via JavaScript. JSP pre-processes the HTML with special commands to access and use server capabilities, then sends that compiled page to the client. Coding in JSP is easy :- As it is just adding JAVA code to HTML/XML.
Reduction in the length of Code :- In JSP we use action tags, custom tags etc.
Connection to Database is easier :-It is easier to connect website to database and allows to read or write data easily to the database.
Make Interactive websites :- In this we can create dynamic web pages which helps user to interact in

real time environment.
Portable, Powerful, flexible and easy to maintain :- as these are browser and server independent.
No Redeployment and No Re-Compilation :- It is dynamic, secure and platform independent so no need to re-compilation.
Extension to Servlet :- as it has all features of servlets, implicit objects and custom tags
The JSP pages follow these phases:

I. Translation of JSP Page
II. Compilation of JSP Page
III. Classloading (the classloader loads class file)
IV. Instantiation (Object of the Generated Servlet is created).
V. Initialization (the container invokes jspInit() method).
VI. Request processing (the container invokes _jspService() method).
VII. Destroy (the container invokes jspDestroy() method).

4.1.4 Features of Eclipse IDE

Eclipse IDE is written in Java. It mainly consists of a base 'Workspace' and a plug-in system so that we can add more features to it through plugins and extend the functionality of the IDE. Eclipse works on all the major platforms including Windows, Mac OS, Linux, etc. and boasts of powerful features that can be used to develop full-fledged projects. Almost everything in Eclipse is a plugin. We can extend the functionality of Eclipse IDE by adding plugins to the IDE, maybe for additional programming language or version control system or UML.Supports various source knowledge tools like folding and hyperlink navigation, grading, macro definition browser, code editing with syntax highlighting. Provides excellent visual code debugging tool to debug the code. Eclipse has a wonderful user interface with drag and drop facility for UI designing. Supports project development and administered framework for different toolchains, classic make framework, and source navigation. Java Eclipse IDE has a Javadoc facility using which we can automatically create documentation for classes in our application.

4.1.5 Features of Open CV

OpenCV (Open Source Computer Vision Library) is an Application Programming Interface (API) developed by Intel which can be used for many image processing and computer vision applications. OpenCV officially launched in 1999 and the project was initially an Intel Research initiative to advance CPU-intensive applications. OpenCV library is a collection of algorithms and C/C++ functions and few classes that implement some Image processing and computer vision algorithms. There is active development on interfaces for C, C++, Python, Ruby, MATLAB and other languages. OpenCV was designed for computational efficiency and with a strong focus on real time applications. OpenCV is written in optimized C and can take advantage of multicore processors. OpenCV contains over 500 function that span many areas in vision, including factory product inspection, medical imaging, security, user interface, camera calibration, stereo vision and robotics. The principles behind the creation of the library is to aid commercial uses of computer vision in human computer interface, robotics, monitoring, biometrics, and security by providing a free and open infrastructure where the

distributed efforts of the vision community can be consolidated and performance optimized. OpenCV support for vision is extensively including routine support for input, display, and storage of movies and single images One of the OpenCV goals is to provide a simple-to-use computer vision infrastructure that helps people build fairly sophisticated vision applications quickly. There are several goals of OpenCV in outset which are following: By giving not only open but also optimized code for basic vision infrastructure, advanced vision research can be advanced. Disseminate vision information by providing a standard architecture for developers to build on, resulting in more legible and transferrable code. Commercial applications based on advanced vision were made free by making portable, performance-optimized code available under a license that did not require commercial programs to be open or free. OpenCV is a collection of image processing and computer vision applications.

Image-Processing

Image processing is a method to perform some operations on an image, in order to get an enhanced image and or to extract some useful information from it.

If we talk about the basic definition of image processing then "Image processing is the analysis and manipulation of a digitized image, especially in order to improve its quality".

Digital-Image :

An image may be defined as a two-dimensional function f(x, y), where x and y are spatial(plane) coordinates, and the amplitude of fat any pair of coordinates (x, y) is called the intensity or grey level of the image at that point.

In another word An image is nothing more than a two-dimensional matrix (3-D in case of coloured images) which is defined by the mathematical function f(x, y) at any point is giving the pixel value at that point of an image, the pixel value describes how bright that pixel is, and what colour it should be.

Image processing is basically signal processing in which input is an image and output is image or characteristics according to requirement associated with that image.

Image processing basically includes the following three steps:

I. Importing the image
II. Analyzing and manipulating the image
III. Output in which result can be altered image or report that is based on image analysis

There are lots of applications which are solved using OpenCV, some of them are listed below

I. face recognition
II. Automated inspection and surveillance
III. number of people – count (foot traffic in a mall, etc)

IV. Vehicle counting on highways along with their speeds
V. Interactive art installations
VI. Anomaly (defect) detection in the manufacturing process (the odd defective products)
VII. Street view image stitching
VIII. Video/image search and retrieval
IX. Robot and driver-less car navigation and control
X. object recognition
XI. Medical image analysis
XII. Movies – 3D structure from motion
XIII. TV Channels advertisement recognition

CHAPTER 5

IMPLEMENTATION

YOLO ALGORITHM

Object detection is a computer vision task that involves identifying and locating objects in images or videos. It is an important part of many applications, such as surveillance, self-driving cars, or robotics. Object detection algorithms can be divided into two main categories: single-shot detectors and two-stage detectors.

You Only Look Once (YOLO) proposes using an end-to-end neural network that makes predictions of bounding boxes and class probabilities all at once. It differs from the approach taken by previous object detection algorithms, which repurposed classifiers to perform detection.

Following a fundamentally different approach to object detection, YOLO achieved state-of-the-art results, beating other real-time object detection algorithms by a large margin.

While algorithms like Faster RCNN work by detecting possible regions of interest using the Region Proposal Network and then performing recognition on those regions separately, YOLO performs all of its predictions with the help of a single fully connected layer.

Methods that use Region Proposal Networks perform multiple iterations for the same image, while YOLO gets away with a single iteration.

Several new versions of the same model have been proposed since the initial release of YOLO in 2015, each building on and improving its predecessor. Here's a timeline showcasing YOLO's development in recent years.

How does YOLO work? YOLO Architecture
The YOLO algorithm takes an image as input and then uses a simple deep convolutional neural network to detect objects in the image. The architecture of the CNN model that forms the backbone of YOLO is shown below.

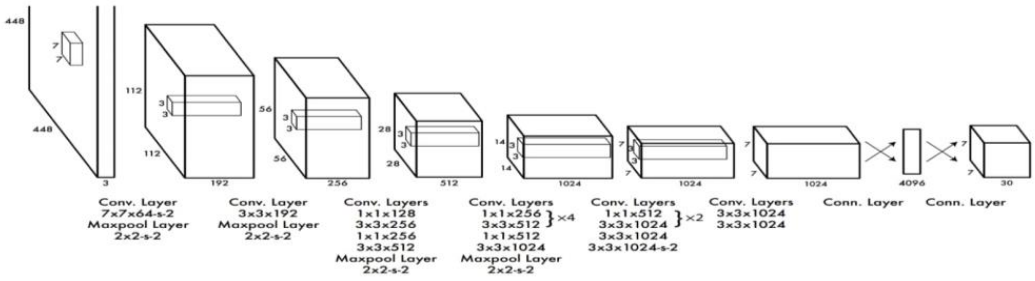


Fig 5.1.1 Yolo Architecture

The first 20 convolution layers of the model are pre-trained using ImageNet by plugging in a temporary average pooling and fully connected layer. Then, this pre-trained model is converted to perform detection since previous research showcased that adding convolution and connected layers to a pre-trained network improves performance. YOLO's final fully connected layer predicts both class probabilities and bounding box coordinates.

$$P_r\left(Object\right) * IOU_{pred}^{truth}$$

In the absence of any objects in the grid, the assurance score should be 0. A confidence score should equal (equal to) the IoU between ground truth and predicted boxes when an object is present in the image. There are five predictions in each bounding box: x, y, w, and h, followed by a confidence or assurance score. Based on the bounds of the grid cell, (x, y) coordinates represent the box's centre. A bounding box's h, w coordinates represent its height, width relative to its (x, y) position. In the bounding box, an assurance score or confidence score indicates an object's existence. Moreover, each grid detects the conditional class probability, Pr (Class i | Object).

YOLO divides an input image into an S × S grid. If the center of an object falls into a grid cell, that grid cell is responsible for detecting that object. Each grid cell predicts B bounding boxes and confidence scores for those boxes.

$$P_r\left(Class_i|Object\right) * P_r\left(Object\right) * IOU_{pred}^{truth} = P_r\left(Class_i\right) * IOU_{pred}^{truth}$$

These confidence scores reflect how confident the model is that the box contains an object and how accurate it thinks the predicted box is.YOLO predicts multiple bounding boxes per grid cell. At training time, we only want one bounding box predictor to be responsible for each object. YOLO assigns one predictor to be "responsible" for predicting an object based on which prediction has the highest current IOU with the ground truth. This leads to specialization between the bounding box predictors. Each predictor gets better at forecasting certain sizes, aspect ratios, or classes of objects, improving the overall recall score.

One key technique used in the YOLO models is **non-maximum suppression (NMS)**. NMS is a post-processing step that is used to improve the accuracy and efficiency of object detection. In object detection, it is common for multiple bounding boxes to be generated for a single object in an image. These bounding boxes may overlap or be located at different positions, but they all represent the same object. NMS is used to identify and remove redundant or incorrect bounding boxes and to output a single bounding box for each object in the image.By adding batch normalization to the architecture we can increase the convergence of the model that leads us for faster training. This also eliminates the need for applying other types of normalization such as Dropout without overfitting. It is also observed that adding batch normalization alone can cause an increase in mAP by 2% as compared to basic YOLO.The previous version of YOLO uses 224 *224 as input size during training but at the time of detection, it takes an image up to size 448*448. This causes the model to adjust to a new resolution that in turn causes a decrease in mAP.The YOLOv2 version trains on higher resolution (448 * 448) for 10 epochs on ImageNet data. This gives network time to adjust the filters for higher resolution. By training on 448*448 images size the mAP increased by 4%.YOLO uses fully connected layers to predict bounding boxes instead of predicting coordinates directly from the convolution network like in Fast R-CNN, Faster R-CNN. In this version, we remove the fully connected layer and instead add the anchor boxes to predict the bounding boxes.

Fig 5.1.2 Yolo Bounding Box

Image-Processing

Image processing is a method to perform some operations on an image, in order to get an enhanced image and or to extract some useful information from it.
If we talk about the basic definition of image processing then "Image processing is the analysis and manipulation of a digitized image, especially in order to improve its quality".
Digital-Image:
An image may be defined as a two-dimensional function f(x, y), where x and y are spatial(plane) coordinates, and the amplitude of fat any pair of coordinates (x, y) is called the intensity or grey level of the image at that point.
In another word An image is nothing more than a two-dimensional matrix (3-D in case of coloured images) which is defined by the mathematical function f(x, y) at any point is giving the pixel value at that point of an image, the pixel value describes how bright that pixel is, and what colour it should be.
Image processing is basically signal processing in which input is an image and output is image or characteristics according to requirement associated with that image.
Image processing basically includes the following three steps:

1. Importing the image
2. Analysing and manipulating the image
3. Output in which result can be altered image or report that is based on image analysis

DATASET:
Whenever we are working on any object detection algorithm the two main characteristics that we are looking
at is detection and localization. Detecting any object has to state whether object belongs to a particular class or not.
Localization refers to the bounding box around every object as location of object may vary for every image. Using Challenging datasets helps to set the benchmark for comparing the performance of different algorithms in same application. For testing the performance of algorithms for our problem statement we have used Microsoft common objects in context (MS COCO) . COCO as the name suggest has taken all its images from the common scenes in context with the objects and can be

downloaded from its
original website. . There are total 330K images with 91 categories out of which 82 categories are labelled. The

COCO dataset has fewer categories but more number of instances on particular object which makes machine learn more accurately. COCO dataset deals with small objects in very effective manner.
Dimensionality clusters:

We need to identify the number of anchors (priors) generated so that they provide the best results. Let's take as K for now. Our task is to identify the top-K bounding boxes for images that have maximum accuracy. We use the K-means clustering algorithm for that purpose. But, we don't need to minimize the Euclidean distance instead we maximize the IOU as the target of this algorithm.
YOLO v2 uses K=5 for the better trade-off of the algorithm. We can conclude from the graph below that as we increase the value of K=5 accuracy doesn't change significantly.
IOU based clustering on K = 5 gives mAP of 61%

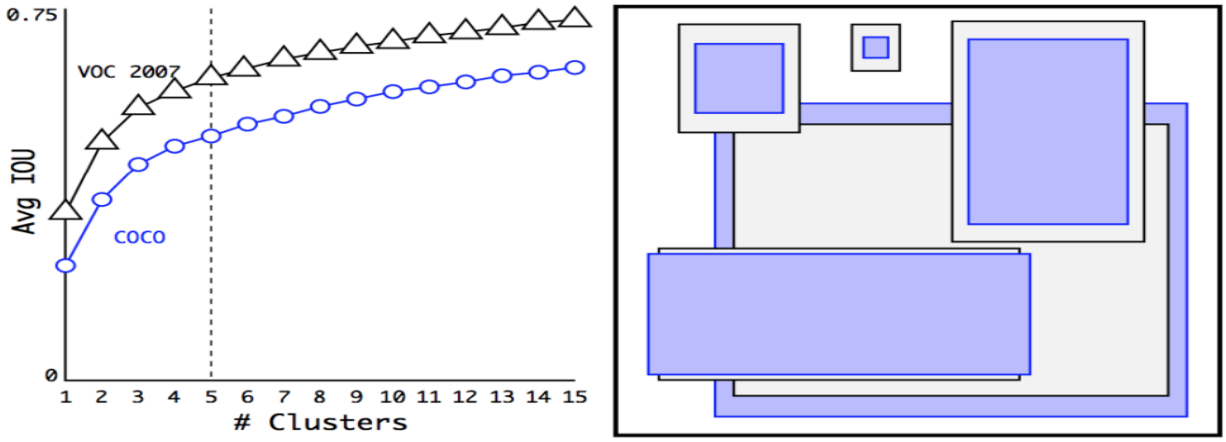


Fig 5.1.3 Cluster Formation

Direct Location Problem:
The previous version of YOLO does not have a constraint on location prediction which makes it unstable on early iteration. YOLOv2 predicts 5 parameters (t_x, t_y, t_w, t_h, t_o (objectness score)) and applies the sigma function to constraint its value falls between 0 and 1.

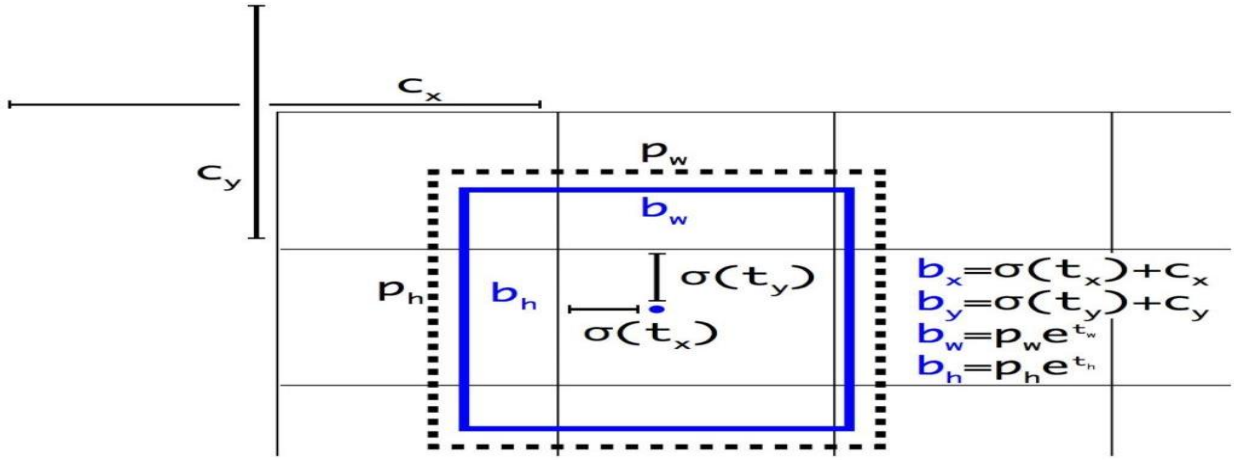


Fig 5.1.4 Direct Location Problem

$$
\begin{aligned}
b_x &= \sigma(t_x) + c_x \\
b_y &= \sigma(t_y) + c_y \\
b_w &= p_w e^{t_w} \\
b_h &= p_h e^{t_h} \\
Pr(\text{object}) * IOU(b, \text{object}) &= \sigma(t_o)
\end{aligned}
$$

where

t_x, t_y, t_w, t_h are predictions made by YOLO.

c_x, c_y is the top left corner of the grid cell of the anchor.

p_w, p_h are the width and height of the anchor.

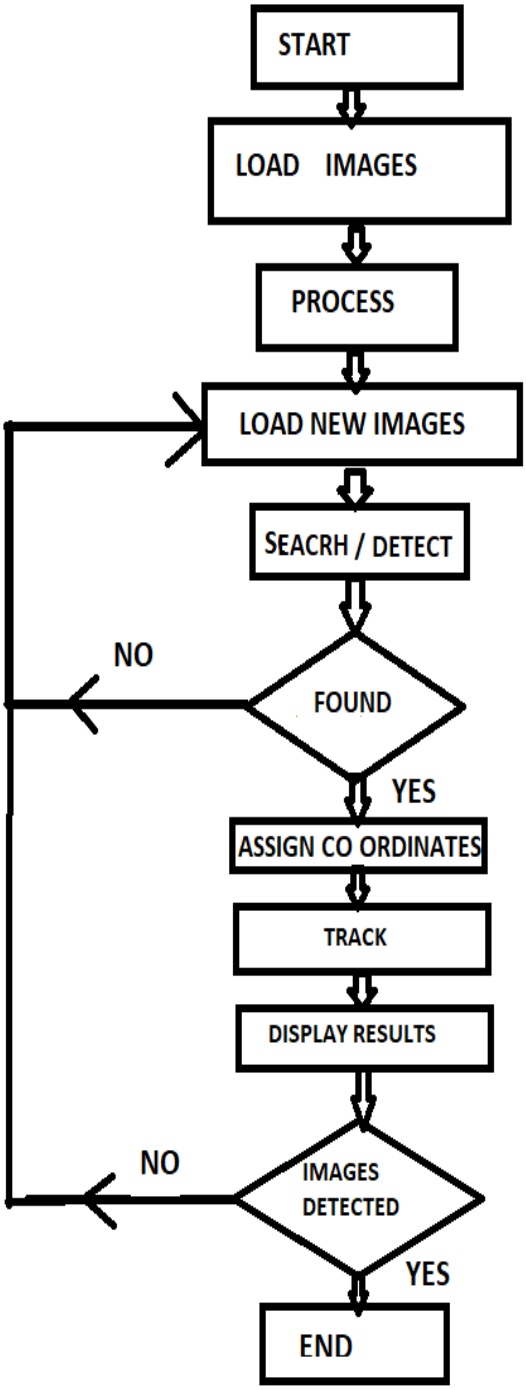
c_x, c_y, p_w, p_h are normalized by the image width and height.

b_x, b_y, b_w, b_h are the predicted boundary box.

$\sigma(t_o)$ is the box confidence score.

This direct location constraint increases the mAP by 5%.

FLOWCHART



STEP 1

STEP 2

STEP 3

STEP 4

STEP 5

STEP 6

STEP 7

STEP 8

5.1 CODING:

5.1.1 Object Detection

Yolo.java

```
package project;
import org.opencv.core.Core;
import org.opencv.core.Core.MinMaxLocResult;
import org.opencv.core.Mat;
import org.opencv.core.Point;
import org.opencv.core.Scalar;
import org.opencv.imgcodecs.Imgcodecs;
import org.opencv.imgproc.Imgproc;

public class yolo {
        public static void main(String[] args) {

            System.loadLibrary(Core.NATIVE_LIBRARY_NAME);
            Mat source=null;
            Mat template=null;
            String filePath="D:\\opencv\\";
            source=Imgcodecs.imread(filePath+"crt.jpg");
            template=Imgcodecs.imread(filePath+"crow.jpg");

            Mat outputImage=new Mat();
            int machMethod=Imgproc.TM_CCOEFF;

    Imgproc.matchTemplate(source, template, outputImage, machMethod);


    MinMaxLocResult mmr = Core.minMaxLoc(outputImage);
    Point matchLoc=mmr.maxLoc;

    Imgproc.rectangle(source, matchLoc, new Point(matchLoc.x + template.cols(),
        matchLoc.y + template.rows()), new Scalar(255, 255, 255));

    Imgcodecs.imwrite(filePath+"final.jpeg", source);
    System.out.println("detected");
```

```
        }

}
```

5.1.2 Send Goods

sendGoods.jsp

```
<%@ page import="project.ConnectionProvider" %>
<%@ page import="java.sql.*" %>
<%

String product_id=request.getParameter("id");
String warehouse_id=String.valueOf(session.getAttribute("wid"));
int quantity=1;
int product_price=0;
int product_total=0;
int good_total=0;
int z=0;

try
{
        Connection con=ConnectionProvider.getCon();
        Statement st=con.createStatement();
        ResultSet rs=st.executeQuery("select * from product where
id='"+product_id+"'");
        while(rs.next())
        {
                product_price=rs.getInt(4);
                product_total=product_price;

        }
        ResultSet rs1=st.executeQuery("select * from goods where
p_id='"+product_id+"' and w_id='"+warehouse_id+"'");
        while(rs1.next())
        {
                good_total=rs1.getInt(5);
                good_total=good_total+product_total;
                quantity=rs1.getInt(3);
```

```
                quantity=quantity+1;
                z=1;

        }
        if(z==1)
        {
                st.executeUpdate("update goods set
total='"+good_total+"',quantity='"+quantity+"' where p_id="+product_id+" and
w_id='"+warehouse_id+"'");
           response.sendRedirect("allWarehouses.jsp?msg=exist");
        }
        else
        {
                PreparedStatement ps=con.prepareStatement("insert into
goods(w_id,p_id,quantity,price,total) value(?,?,?,?,?)");
                ps.setString(1,warehouse_id);
                ps.setString(2,product_id);
                ps.setInt(3,quantity);
                ps.setInt(4,product_price);
                ps.setInt(5,product_total);
                ps.executeUpdate();
                response.sendRedirect("allWarehouses.jsp?msg=added");



        }
}
catch(Exception e)
{
        out.print(e);
        response.sendRedirect("allWarehouses.jsp?msg=invalid");
}
%>
```

5.1.3 Rent Warehouses

RentWarehousesAction.jsp

```
<%@ page import="project.ConnectionProvider" %>
<%@ page import="java.sql.*" %>
<%
String email=String.valueOf(session.getAttribute("email"));
String id=request.getParameter("id");
String type=request.getParameter("type");
String address=request.getParameter("address");
String period=request.getParameter("period");
String capacity=request.getParameter("capacity");
String category=request.getParameter("category");
String active=request.getParameter("active");

try
{
        Connection con=ConnectionProvider.getCon();
        PreparedStatement ps=con.prepareStatement("insert into warehouses
values(?,?,?,?,?,?,?,?)");
        ps.setString(1,id);
        ps.setString(2,email);
        ps.setString(3,type);
        ps.setString(4,address);
        ps.setString(5,period);
        ps.setString(6,capacity);
        ps.setString(7,category);
        ps.setString(8,active);

        ps.executeUpdate();
        response.sendRedirect("addNewWarehouse.jsp?msg=done");
}
catch(Exception e)
{
        out.println(e);
```

```
        response.sendRedirect("addNewWarehouse.jsp?msg=invalid");
  }
%>
```

5.1.4 Make Payment

addWarehouses.jsp

```
<%@ page import="project.ConnectionProvider" %>
<%@ page import="java.sql.*" %>
<%@ include file="header.jsp" %>
<%@ include file="../footer.jsp" %>
<html> <head>
<link rel="stylesheet" href="css/addNewProduct-style.css">
<title>Add New Warehouse</title></head>
<body>
<% String msg=request.getParameter("msg");
if("done".equals(msg)) {%>
<h3 class="alert">Warehouse Added Successfully!</h3><% } %>
<% if("invalid".equals(msg)) { %>
<h3 class="alert">Some thing went wrong! Try Again!</h3><% } %>
<% intid=1;
try{ Connection con=ConnectionProvider.getCon();Statement
st=con.createStatement();
ResultSet rs=st.executeQuery("select max(id) from warehouses");
while(rs.next()){
id=rs.getInt(1);id=id+1; } }
catch(Exception e){ } %>
<form action="addNewWarehouseAction.jsp" method="post">
<h3 style="color: yellow;">Warehouse ID: <%out.println(id); %> </h3>
<input type="hidden" name="id" value="<%out.println(id);%>">
```

<h3>Enter Type of Warehouse</h3>

<input class="input-style" type="text" name="type" placeholder="Enter typeof Warehouse" required>

<hr>

<h3>Enter Address</h3>

<input class="input-style" type="text" name="address" placeholder="Enteryour Warehouse Address" required><hr>

<h3>Enter Period of rent</h3>

<input class="input-style" type="number" name="period" placeholder="Enterperiod of rent(in months)" required> <hr>

<h3>Enter the capacity</h3>

<input class="input-style" type="number" name="capacity" placeholder="Enter capacity(in dimension)" required><hr>

<h3>Enter Category Of product</h3>

<input class="input-style" type="text" name="category" placeholder="Entercategory of Products" required><hr>

<h3>Active</h3>

<select class="input-style" name="active">

<option value="Yes">Yes </option>

<option value="No">No </option></select><hr>

<button class="button">Save </button> </form> </body>

</body></html>

INPUT:

FIG 5.2.1 SOURCE INPUT IMAGE

FIG 5.2.2 OBJECT TO BE DETECTED

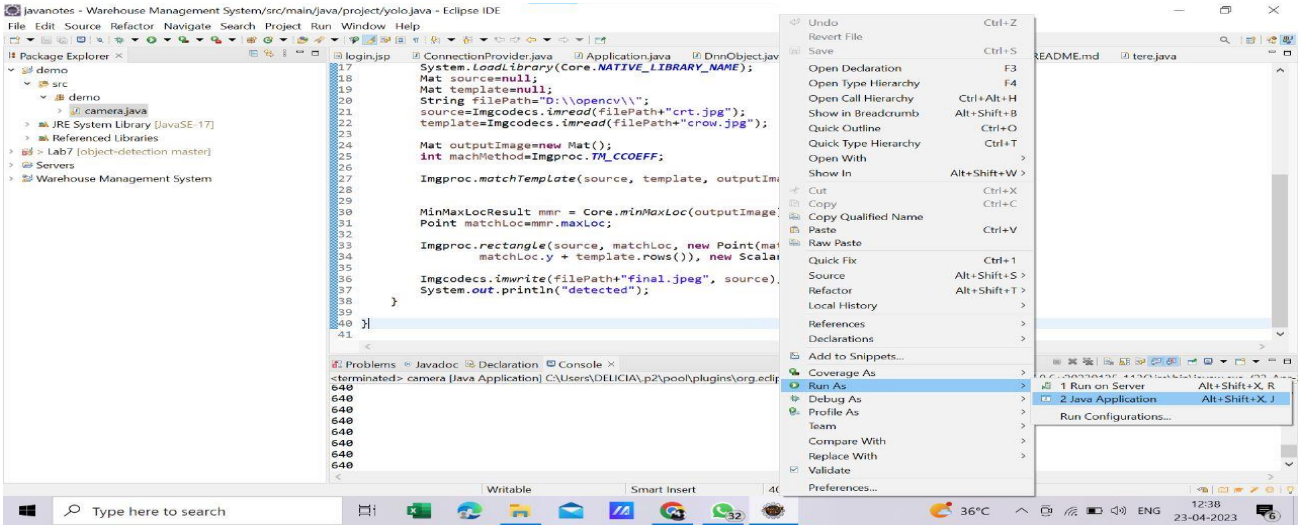


FIG 5.2.3 SAMPLE SCREENSHOT

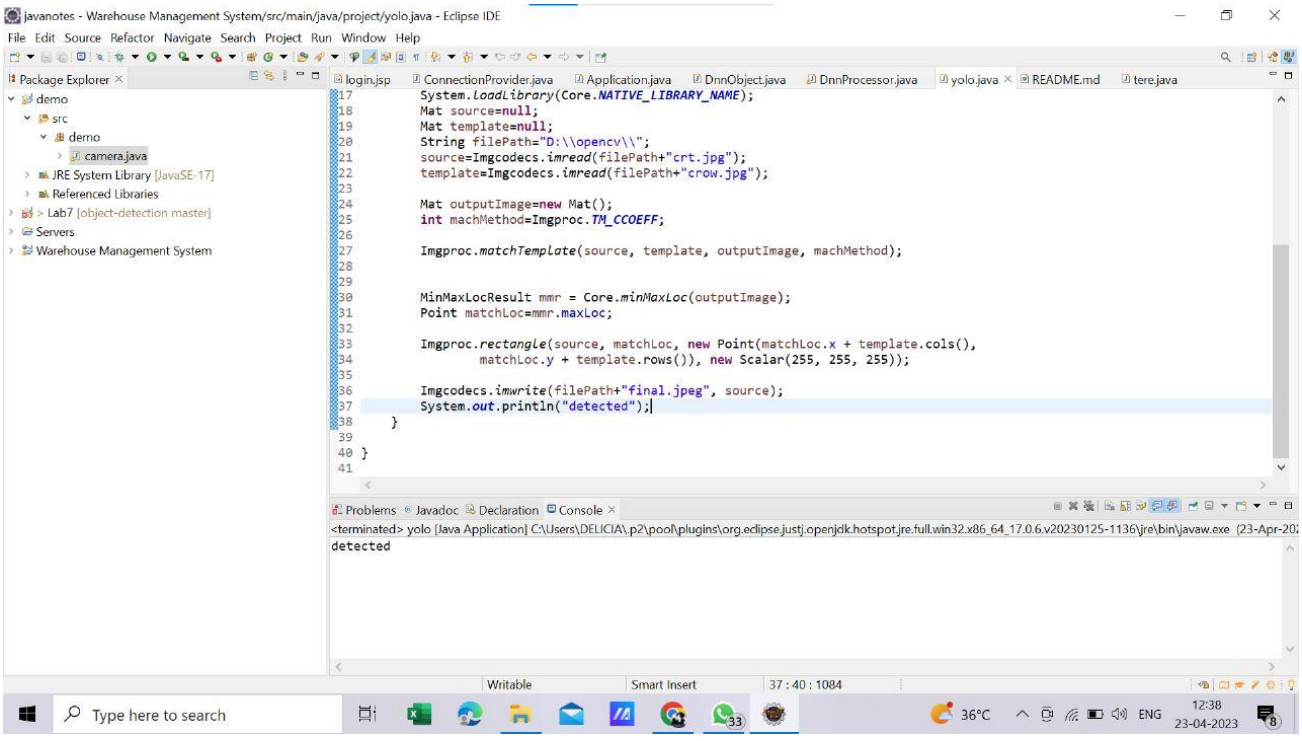


FIG 5.2.4 SAMPLE SCREENSHOTS

OUTPUT:

FIG 5.2.5 OUTPUT

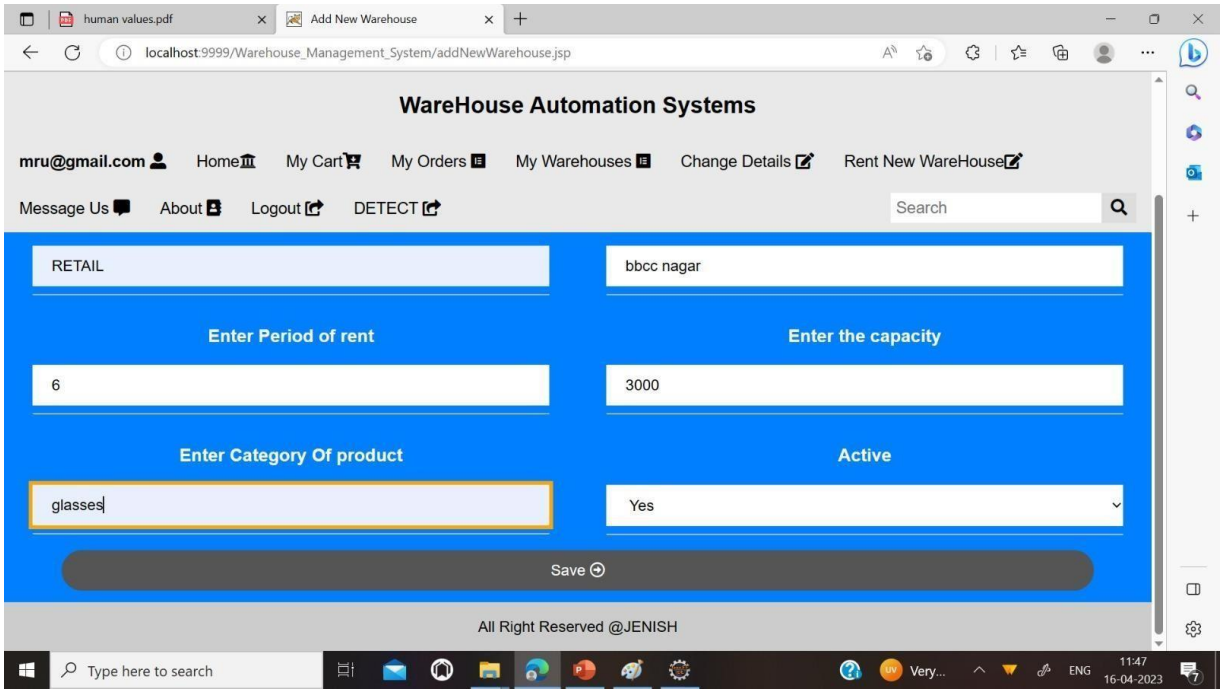


FIG 5.2.6: RENT A WAREHOUSE PAGE

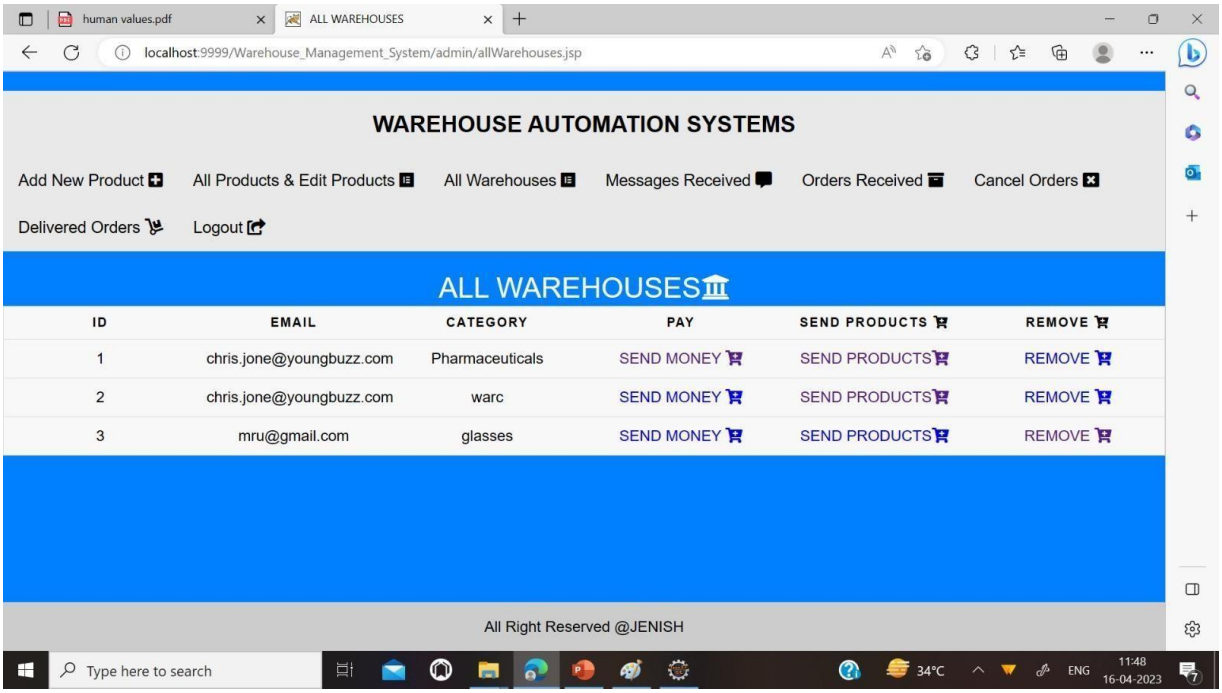


FIG 5.2.7: ALL WAREHOUSE PAGE

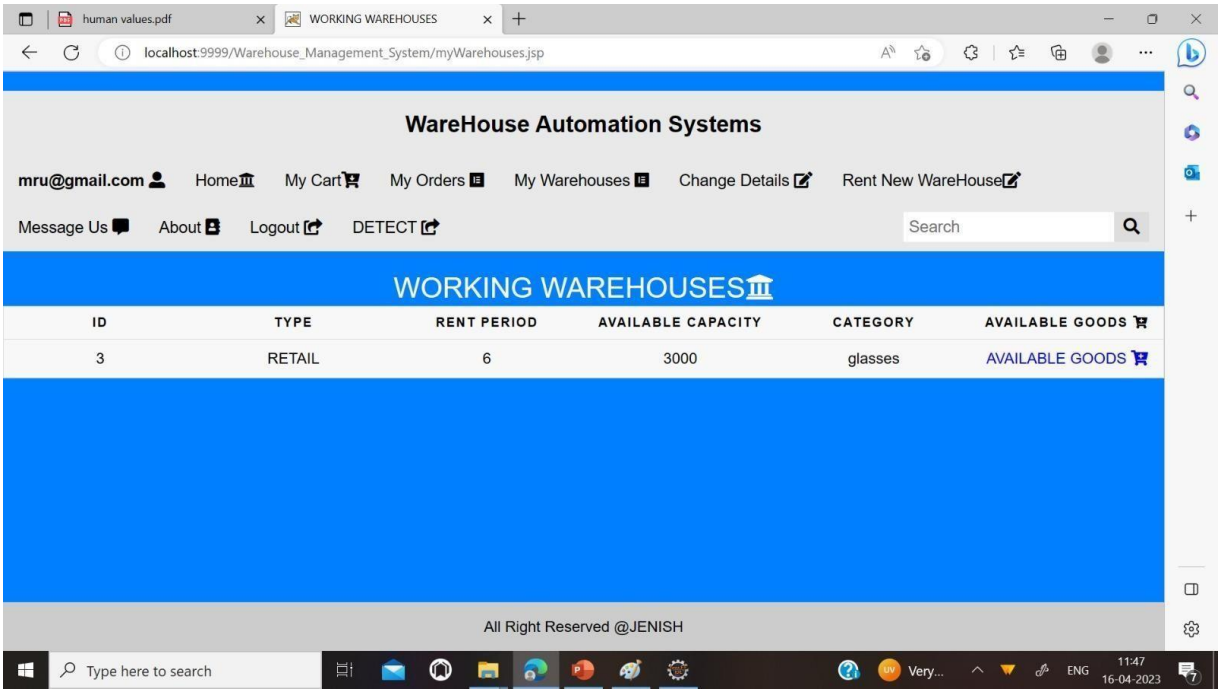


FIG 5.2.8 WORKING WAREHOUSES PAGE

CHAPTER 6

6.1 CONCLUSION

A Warehouse management system can significantly improve the efficiency and productivity of a warehouse and lead to improved business performance. It also reduces manual labor and increase accuracy. It helps to reduce costs, boost productivity, and improve customer satisfaction. Warehouse automation can also help to reduce errors, improve inventory accuracy, and provide real-time data for analysis and decision-making. Retail units in warehouses are a type of retail business space that is located within a warehouse building commercial units in warehouses offer businesses a unique opportunity to sell out their products directly to consumers in a large open-concept units that is typically less expensive and more flexible than traditional commercial spaces retail units. These businesses can benefit from the large open-concept space that a warehouse provides as it allows consumers to see and interact with their goods in a real-world setting retail units in warehouses can also be a cost-effective solution for businesses that are just starting out or that are looking to expand their retail presence the cost of rent and overhead expenses is typically lower in a warehouse setting than in a traditional commercial retail space making it a more affordable option for businesses that are just starting out or that are looking to expand when considering a retail unit in a warehouse businesses need to take into account the location and accessibility of the warehouse as well as the size and layout of the unit they also need to consider the services and amenities offered by the warehouse .

6.2 FUTURE ENHANCEMENTS:

1. Shall host the platform on online servers to make it accessible worldwide.
2. Can include AI for Automatic Object Detection.

The above mentioned are the future enhancements that can be done to make this project much more dynamic. The future of warehouse management and organizations is to be steady with the current scenario and trend. The current trend will help companies immensely to distribute their workforce and resources efficiently and increase productivity with all the latest technologies in the market. At the end of the day, the higher the productivity, the higher the profits. Thus, it is crucial to stay in the loop and learn the latest trends, understand the ones which will benefit the company, and implement them. Warehouse Management Robots is a classic example of automated systems, and they ease laborious jobs to a great extent. From transporting goods from one panel to another to streamlining the warehouse operations, the warehouse management robots can do it all.! Thus, it is safe to say that you save on time, energy, and human error. It helps increase efficiency and productivity by doing the same job a little quicker and more organized than the human workforce.

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Md. Bahar Ullah " CPU Based YOLO : A Real Time Object Detection Algorithm" (TENSYMP),5-7 June 2020.

2.)Yong Li,Can Lv SS-YOLO : "An Object Detection Algorithm based on YOLOv3 and ShuffleNet" ITNEC 2020.

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Submission date: 15-Mar-2023 04:32PM (UTC+0000)
Submission ID: 199447522
File name: finake.pdf (1M)
Word count: 3487
Character count: 19792

DEPOSITORY SYSTEMATIZATION-PRODUCT RECOGNITION IN MATERIALS DEPOSITORY USING YOLO ALGORITHM TECHNIQUE

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***Abstract*—To help e-commerce websites and wholesale distributors rent and manage warehouses as well as their processes like receiving goods storing them, maintaining them and delivering them. The software automates everything, additionally it focuses on resource utilization, storage analytics flow chain balance with tracking control by the use of AI(Artificial intelligence) from moment the goods enters the distribution process until they are delivered within a specified time frame. To minimize transportation costs and storage utilization we set up and rent temporary rooftop warehouses locally.**

I . INTRODUCTION

The Warehouse Automation System automates daily warehouse operations and local storage facilities from the moment goods and materials enter a distribution until the moment they delivered. Manage the issues like packing processes, resource utilization, storage analytics, sales analytics, Monitor productivity, supply chain management, Document Label processing ,inventory management and real time tracking in automated manner. System helps in setting up and renting local warehouses from the people for fastest transportation services and reduced transportation cost and local warehouse can act as retail units for improved business opportunities. Detecting the goods and materials using Artificial Intelligence without requiring manual processes (Automatic Product Recognition) . Choosing optimal location and renting local warehouses for the fastest delivery possible.

Keywords – Artificial Intelligence, Object detection, Supply chain management, Inventory Management, Warehouse Control.

II. LITERATURE SURVEY

A. RELATED WORKS

1.Chen Chen-(Design of automated warehouse system)Warehousing-In order to integrate the entire logistics operation, warehouse management balances all aspects of logistic operations. MATEC Web of Conferences 232, 03049 (2018) EITCE 2018.

2.Kamali-(design of a reference architecture for developing a smart warehouse in industry 4.0.Traditional warehouses-The traditional warehouse performs many manual tasks that contribute to inefficiency and poor performance.Article history: Received 20 March 2020,Received in revised form 19 August 2020,Accepted 20 October 2020.

3. Hadas Kress-Gazit-(Warehouse Automation in a Day: From Model to Implementation with Provable Guarantees)2020 16th IEEE International Conference on Automation Science and Engineering (CASE),August 20-21, 2020, Automated warehouse-Any automated system deployed in a warehouse with people walking and driving forklifts must take safety considerations into consideration

4.Design of Warehouse Control System For Automated Warehouse Environment(2016 5th IIAI International Congress on Advanced Applied Informatics).Dong Woo Son-Warehouse Control System-A number of material handling equipment can be integrated with WCS through an integrated interface. Equipment in the warehouse can be managed and controlled with it.

5.Multitracking-Computer vision and related fields, such as smart monitoring, human-computer interaction, and virtual reality, require multi-target tracking. By locating and finding the most similar candidate target areas, multiple targets can be tracked efficiently in an image sequence. Xu Dong-2018 11th International Congress on Image and Signal Processing, Bio Medical Engineering and Informatics (CISP-BMEI 2018) .A Multiple Object Tracking Algorithm Based on YOLO Detection

6.Real time: An early detection of an object in real time can be helpful in determining the cause, detecting vehicles, traffic control, CCTV monitoring, etc. The ability to give vision to a computer therefore depends on day-to-day progress in technology. So, low-cost technology and learning tools are in high demand .Md. Bahar Ullah :CPU Based YOLO: A Real Time Object Detection .Algorithm(2020 IEEE Region 10 Symposium (TENSYMP), 5-7 June 2020, Dhaka, Bangladesh)

7.Object detection:Various image processing applications are used by object detection algorithms to extract the portion of an object that a user wants to view. Images are commonly retrieved, security is provided, medical care is provided, and defence is provided with it. Apoorva Raghunandan: International Conference on Communication and Signal Processing, April 3-5, 2018, India Object Detection Algorithms for Video Surveillance Applications .

8.Behavior-Object behaviour is characterised by behaviour subtraction, especially in dynamic events. A spatio-temporal signature is a collection of moving objects that define an event. A stationary random process was used to model these events.

9.Yolo and shuffle Net: A common GPU can be used to detect Yolo v3 Tiny in real-time, but the accuracy is not the best. It improves accuracy while increasing speed by using SS YOLO's feature extraction network that is based on the Shuffle Net structure. Yong Li1,2, Can Lv1,2:2020 IEEE 4th Information Technology, Networking ,Electronic and Automation Control Conferences-YOLO: An Object Detection Algorithm based on YOLOv3 and ShuffleNet

10.Deep learning: As a result of deep learning being applied to these kinds of problems and revolutionizing the domain of computer vision since 2012, this field is booming today. Real Time Object Detection with Audio Feedback using Yolo vs. Yolo_v3 Mansi Mahendru1, Sanjay Kumar Dubey2 2021 11th International Conference on Cloud Computing, Data Science & Engineering (Confluence)

II OBJECTIVES

1.Detecting the goods and materials using Artificial Intelligence without requiring manual processes.

2.Realtime tracking of goods using geolocation API.

3.Monitor and report productivity and sales analytics.

4.Automate daily based warehouse operations.

5.Choosing optimal location and renting local warehouses for the fastest delivery possible.

6.In some locations the warehouse can acts a both storage unit and retail stores for developing business opportunities

WAREHOUSE COMMUNICATION

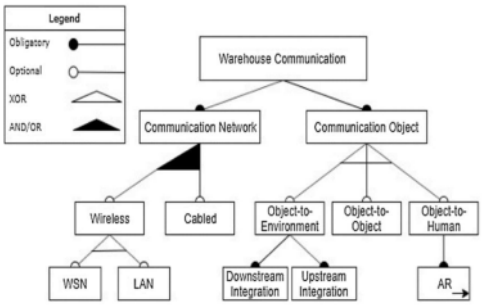


Figure 1

WAREHOUSE ARCHITECTURE DIAGRAM:

Figure 2

YOLO ALGORITHM:

(YOU ONLY LOOK ONCE)

A new model of product recognition, Yolo, was introduced in 2015. YOLO is capable of diagnosing objects at the rate of 150 frames per second. To determine the final result, only one forward pass through the network is required. While Fast R-CNN was the state-of-the-art model at the time, it posed a number of unique challenges including the fact that it took 2-3 seconds to predict an image, and therefore could not be used in real time.

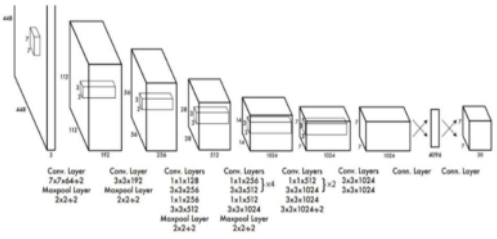


Figure 3

In this construction, the input image is resized to 448x448 while maintaining the aspect ratio. To reduce the number of channels, we take 1*1 convolution that is trailed by 3*3 convolution. YOLOv1 detects a cuboidal output on its last channel. A fully joined channel (1, 1470) is generated from

a final fully joined channel and reshaped to size (7, 7, 30). Model adjustment by batch normalization. Overfitting can be avoided by using the dropout technique. Leaky ReLU is used as the reinvigorating function in this construction, with the exception of the final layer which uses linear functions.

The YOLO algorithm employs the following three methods:

1. Blocks left over from previous processes
2. Regression with bounding boxes
3. Union Over Intersection (IOU)

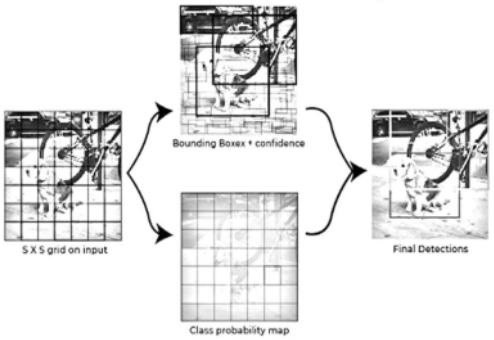
Detection: With this construction, an image is divided into a grid of SIZE*SIZE. Using the assurance score of neighbouring boxes, each grid discovers their neighbours. Assurance scores indicate how authentic it is that the bounding box detected includes an object and how accurate it is in detecting the bounding box coordinates. The grid is answerable for detecting the object if the centermost point of the bounding box lies within it.

Multiply the conditional class probabilities and the individual box assurance predictions during test time.
$P_r\,(Object) * IOU_{pred}^{truth}$

In the absence of any objects in the grid, the assurance score should be 0. A confidence score should equal (equal to) the IoU between ground truth and predicted boxes when an object is present in the image. There are five predictions in each bounding box: x, y, w, and h, followed by a confidence or assurance score. Based on the bounds of the grid cell, (x, y) coordinates represent the box's centre. A bounding box's h, w coordinates represent its height, width relative to its (x, y) position. In the bounding box, an assurance score or confidence score indicates an object's existence. Moreover, each grid detects the conditional class probability, Pr (Class i | Object).

$$P_r\,(Class_i|Object) * P_r\,(Object) * IOU_{pred}^{truth} = P_r\,(Class_i) * IOU_{pred}^{truth}$$

Li et al. released YOLO v6 in 2022 as an upgrade above all prior iterations and a step forward from all prior iteration.



ns.

Figure 4

Detection Frameworks	Train	mAP	FPS
Fast R-CNN [5]	2007+2012	70.0	0.5
Faster R-CNN VGG-16[15]	2007+2012	73.2	7
Faster R-CNN ResNet[6]	2007+2012	76.4	5
YOLO [14]	2007+2012	63.4	45
SSD300 [11]	2007+2012	74.3	46
SSD500 [11]	2007+2012	76.8	19
YOLOv2 288 × 288	2007+2012	69.0	91
YOLOv2 352 × 352	2007+2012	73.7	81
YOLOv2 416 × 416	2007+2012	76.8	67
YOLOv2 480 × 480	2007+2012	77.8	59
YOLOv2 544 × 544	2007+2012	**78.6**	40

III Existing Methodology:

The existing system lack operational efficiency which does not have inventory visibility and require manual process for object detection and requires additional hardware utilities. The existing system have central warehouse and not local warehouses which make services time delay. Existing system could run out of supply of a critical(demand)item if inventory is not properly managed. Counting each pair of stocks by hand will almost certainly result in a mistake and tedious process. The risk of human error can be reduced by using an automated system. Existing system does not aid in the Realtime tracking of goods and not provide information regarding revenues sales and storage analytics. Due to lack of time management in current system the groceries and pharmaceuticals are not delivered within the due time. Document label processing and Sorting of materials requires assistance from warehouse workers in the existing system. Some of the commonly used systems include Barcode scanning which involves using barcode scanners to scan barcodes on items and pallets to track their movements and to manage inventory.

Inventory management software:

Software is used to handle inventory control tracking loads and other inventory related tasks like fulfillment and shipping. Warehouse management system: this is used to manage the entire warehouse operation from receiving goods to ship them. Automated storage and retrieval systems (AS/RS): These are the systems for storing and retrieving stuff from warehouses by doing operations that should be more effective and efficient

Despite these systems, many warehouse operations still need to be improved

IV PROPOSED SOLUTION:

For fast with efficient working of warehouse operations we are building a application integrated hands off artificial intelligence for object detection and product recognition this application allows e-commerce website to rent locally available storage areas and this application automates daily warehouse operations like supply chain management this application provides automated document and label processing automated sorting system for materials it also provides sales analytics productivity data and available capacity of each warehouse local warehouse units can be constructed in terrace and rooftops for storage purposes bulk QR code scanning allows quick processing of goods new business opportunities will be created when local warehouses act as commercial retail stores accuracy and speed of data collection there is a need for more accurate and faster methods of data collection such as bulk qr scanning and automatic object detection which improve warehouse operations.

Integration of systems: The interface software needs to improved in order to make them unified with new undertaken resource planning structure. Real-time tracking: The interface with the warehouse management software wants to be improved with the order to make more easily for integrated with enterprise resource planning software.. Predictive analytics. : Predictive analytics are required to improve forecasting and demand planning in order to reduce overstocking stockouts and reduce the number of workers in the warehouse and upgrade its all efficiency.Robotic pick and packing are one example of warehouse operations could be automated further to reduce manual labour and increase effective. By using new technologies and upskill existing systems warehouse operations could be made more efficient and accurate and businesses and customers can be better served.

V. OBJECT DETECTION:

The computer vision and image processing technique called automatic object detection identifies objects in digital pictures it uses algorithms and computer programs

to identify and classify objects based on the characteristics of images.

In a warehouse setting automatic object detection could be applied to identify and track goods to monitor the flow of goods and to improve the accuracy of the supplementary management.

The basic process of automatic object detection involves the following steps1. This include finding image of the objects from the source this says about conclusion the image for analysis.2. This step uses computer programs which automatically specify the goods in image then checks to locate these within specification. 3. these includes classifying the objects based on their characteristics like their shape size color or texture tracking. 4.this involves tracking them as they move to the image and updating about the location and characteristics over time. Automatic object detection technologies have advanced significantly in recent years and can now accurately detect and classify objects even in complex scenes however the accuracy of automatic object detection can be affected by factors like lighting conditions object orientation and the presence of occlusions or distractions in the image. YOLO v2 algorithm is the use of batch normalization, which tends to increase the accuracy and stability of the model . YOLO uses multi-scale training strategy, which involves training the model on images at multiple scales and then averaging the predictions.

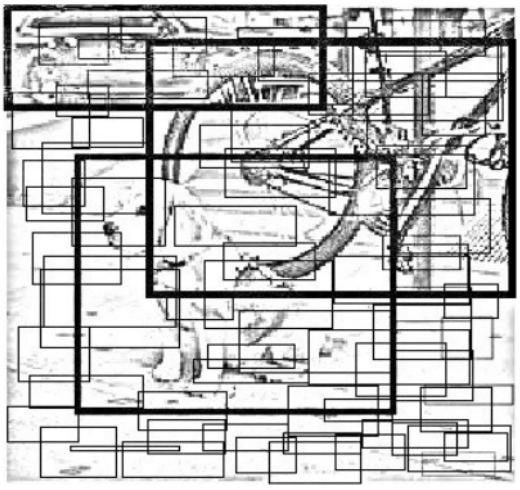


Figure 5

VI .RENTING TEMPRORARY WAREHOUSES:

Renting or leasing temporary warehouses is a common practice for e-businesses and wholesalers need additional storage space on a short term basis temporary warehouses can be rented for a variety of reasons including seasonal storage and retail unit functionalities businesses may need additional storage space during peak seasons such as holidays or demand times or the summer to store excess products inventory overflow may happen businesses may need increased storage space when their regular central warehouse is full or when they have received a large shipment of goods that they are unable to stack in their regular warehouse disaster recovery businesses may need to rent a short term storage facility warehouse to store their inventory in the event of a disaster such as a fire or a flood that affects their regular warehouse expansion businesses may need to rent a short term storage facility warehouse to store their inventory while they are expanding their regular warehouse or building a new warehouse temporary storage during relocation businesses may need to rent a temporary warehouse to store their inventory during a relocation of their business or warehouse when renting a temporary warehouse businesses need to consider several factors including the location size and cost of the warehouse as well as the services and amenities offered by the warehouse provider some temporary warehouse providers may offer additional services such as loading and unloading order fulfillment and transportation management to help businesses manage their operations while using the temporary warehouse having a local warehouse can be beneficial for businesses as it allows them to store their inventory close to their customers reducing transportation time and costs and improving their ability to respond quickly to customer needs thus renting a temporary warehouse can be a flexible and cost-effective solution for businesses and wholesalers that need increased storage space on a short-term basis by carefully considering their needs and the services offered by warehouse providers businesses can ensure that they choose a temporary warehouse that meets their needs and helps them to manage their operations effectively

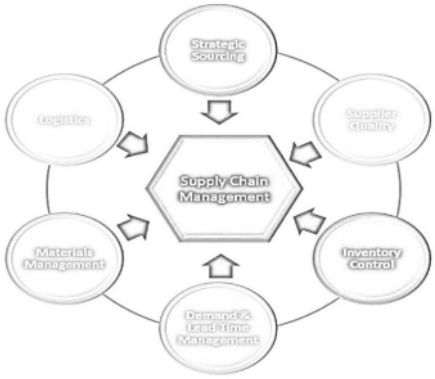


Figure 6

VII . SUPPLY CHAIN MANAGEMENT:

Order maintenance involves picking and packing, and shipping orders to customers.It manages the flow of goods between the warehouse. Transportation involves co-ordinating the movement of goods between the warehouse and other parts of the supply chain, including the selection of carriers, and the tracking of deliveries.This involves having visibility into the movement of materials throughout the distribution, from the raw materials stage to the end customer.Effective Inventory management aims to ensure that goods are delivered on time and in good condition, and that inventory levels are optimized to meet the needs of businesses requirements.

VIII . ROOFTOP WAREHOUSES:

A rooftop warehouse is a type of warehouse that is built on top of a building rather than on the ground rooftop warehouses are becoming increasingly popular in urban areas where land is scarce and expensive and where businesses need additional storage space the main advantage of rooftop warehouses is that they can provide businesses with additional storage space without taking up valuable ground-level real estate they also provide businesses with the opportunity to make use of unused or underutilized rooftop space rooftop warehouses can be constructed using a variety of materials including steel concrete and wood depending on the load-bearing capacity of the buildings roof and the specific needs of the business they can also be designed to meet a wide range of storage and operational requirements including climate control access control and security when considering a rooftop warehouse businesses need to consider the load-bearing capacity of the buildings rooftop and ensure that it is suitable for the weight or mass of the goods that will be stored in the warehouse they also need to consider the accessibility of the rooftop warehouse as well as the cost of construction and maintenance in conclusion rooftop warehouses can provide e-businesses with a flexible and cost-effective solution for their storage needs particularly in urban areas where ground-level real estate is scarce and expensive

Figure 7

IX. CONCLUSION

Retail units in warehouses are a type of retail business space that is located within a warehouse building commercial units in warehouses offer businesses a unique opportunity to sell out their products directly to consumers in a large open-concept units that is typically less expensive and more flexible than traditional commercial spaces retail units in warehouses are often used by businesses that sell products and services that are too large or bulky to be sold in traditional commercial retail spaces such as furniture stores building supplies these businesses can benefit from the large open-concept space that a warehouse provides as it allows consumers to see and interact with their goods in a real-world setting retail units in warehouses can also be a cost-effective solution for businesses that are just starting out or that are looking to expand their retail presence the cost of rent and overhead expenses is typically lower in a warehouse setting than in a traditional commercial retail space making it a more affordable option for businesses that are just starting out or that are looking to expand when considering a retail unit in a warehouse businesses need to take into account the location and accessibility of the warehouse as well as the size and layout of the unit they also need to consider the services and amenities offered by the warehouse such as loading and unloading order-fulfillment and satisfaction and transportation management and co-ordination in conclusion retail commercial units in warehouses can provide businesses with a unique and cost-effective opportunity to sell their products directly to consumers in a large open-concept space by carefully considering their needs and the services offered by the warehouse e-businesses can ensure that they choose a retail unit that meets their needs and helps them to grow their retail presence effectively

X. FUTURE ENHANCEMENTS:

The Warehouse Automation System can be further developed in future by introducing Blockchain item tracking which provides warehouse managers with instant visibility into how well the product is selling and track its physical location. This solution mainly helps in the Security of the Warehouse and detect theft and improves warehouse related decision making. The most challenging thing in warehouse for staff is moving around the warehouse. An staff would need a ladder to reach high shelves, to reduce such inconveniences Drones come into play in warehouse management. With IoT warehouse devices will be able to instantly record its location, and monitor it in real time. Guided robots and Autonomous vehicles are used in shipping which in turn reduces workplace accidents. A robust IoT network will enable easier control of the entire warehouse remotely. It will save costs and time on tasks such as locating materials across a warehouse, keeping stock of the inventory, and monitoring stock movements.

Challenges of Implementing Warehouse Automation System

1.High initial investment
2.Technical knowledge and expertise required
3.Integration with existing systems
4.Resistance to change from employees

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