**A Project Report on**

**DEEP INVENTORY MANAGEMENT SYSTEM**

**Submitted to**

**Jawaharlal Nehru Technological University, Hyderabad**

***in partial fulfillment of requirements for the award of the degree of***

**BACHELOR OF TECHNOLOGY**

**in**

**COMPUTER SCIENCE AND ENGINEERING**

**By**



**S. Mudassir (19BD1A05BG)  
G.Sowmya (19BD1A05AN) K.Sathwik (19BD1A05AV) M.Swetha Tejaswini(19BD1A05B4)**

**Under the guidance of**

**Gaddeboina Suresh**

Assistant professor Department of CSE

#### Department of Computer Science and Engineering KESHAV MEMORIAL INSTITUTE OF TECHNOLOGY

Approved by AICTE, Affiliated to JNTUH

3-5-1206, Narayanaguda, Hyderabad – 500029

**2023**

**KESHAV MEMORIAL INSTITUTE OF TECHNOLOGY**



***(Accredited by NBA & NAAC, Approved By A.I.C.T.E., Reg by Govt of Telangana State & Affiliated to JNTU, Hyderabad)***

**DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING**

**CERTIFICATE**

This is to certify that the project entitled **DEEP INVENTORY MANAGEMENT SYSTEM** being submitted by

 **S. Mudassir (19BD1A05BG)  
 G. Sowmya (19BD1A05AN)**

**K. Sathvik (19BD1A05AV)**

**M. Swetha Tejaswini (19BD1A05B4)**

In partial fulfilment for the award of **Bachelor of Technology** in **Computer Science and Engineering**

affiliated to the **Jawaharlal Nehru Technological University, Hyderabad** during the year 2022-23**.**

##### Internal Guide Head of the Department

**(Gaddeboina Suresh) (Mr. PARA UPENDAR)**

**Submitted for Viva Voce Examination held on**

**External Examiner**

***Unit of Keshav Memorial Educational Society***

#: 3-5-1026 Narayanaguda Hyderabad 500029.

 040-3261407  [www.kmit.in](http://www.kmit.in/) e-mail: [principal@kmit.in](mailto:principal@kmit.in)

**Vision of KMIT**

Producing quality graduates trained in the latest technologies and related tools and striving to make India a world leader in software and hardware products and services. To achieve academic excellence by imparting indepth knowledge to the students, facilitating research activities and catering to the fast growing and ever- changing industrial demands and societal needs.

#### Mission of KMIT

* To provide a learning environment that inculcates problem solving skills, professional, ethical responsibilities, lifelong learning through multi modal platforms and prepare students to become successful professionals.
* To establish industry institute Interaction to make students ready for the industry.
* To provide exposure to students on latest hardware and software tools.
* To promote research based projects/activities in the emerging areas of technology convergence.
* To encourage and enable students to not merely seek jobs from the industry but also to create newenterprises.
* To induce a spirit of nationalism which will enable the student to develop, understand lndia's challenges and to encourage them to develop effective solutions
* To support the faculty to accelerate their learning curve to deliver excellent service to students.

#### Vision & Mission of CSE

##### Vision of the CSE

To be among the region's premier teaching and research Computer Science and Engineering departments producing globally competent and socially responsible graduates in the most conducive academic environment.

##### Mission of the CSE

* + To provide faculty with state of the art facilities for continuous professional development and research, both in foundational aspects and of relevance to emerging computing trends.
  + To impart skills that transform students to develop technical solutions for societal needs and inculcateentrepreneurial talents.
  + To inculcate an ability in students to pursue the advancement of knowledge in various specializations of Computer Science and Engineering and make them industry-ready.
  + To engage in collaborative research with academia and industry and generate adequate resources for research activities for seamless transfer of knowledge resulting in sponsored projects and consultancy.
  + To cultivate responsibility through sharing of knowledge and innovative computing solutions that benefit the society-at-large.
  + To collaborate with academia, industry and community to set high standards in academic excellence and in fulfilling societal responsibilities.

#### PROGRAM OUTCOMES (POs)

1. **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences
3. **Design/development of solutions:** Design solutions for complex engineering problem and design system component or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage:** Create select, and, apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to societal, health, safety. legal und cultural issues and the consequent responsibilities relevant to professional engineering practice.
7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and

write effective reports and design documentation make effective presentations, and give and receive clear instructions.

1. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
2. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

#### PROGRAM SPECIFIC OUTCOMES (PSOs)

**PSO1:** An ability to analyze the common business functions to design and develop appropriate Computer Science solutions for social upliftment’s.

**PSO2:** Shall have expertise on the evolving technologies like Python, Machine Learning, Deep Learning, Internet of Things (IOT), Data Science, Full stack development, Social Networks, Cyber Security, Big Data, Mobile Apps, CRM, ERP etc.

#### PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

**PEO1:** Graduates will have successful careers in computer related engineering fields or will be able to successfully pursue advanced higher education degrees.

**PEO2:** Graduates will try and provide solutions to challenging problems in their profession by applying computer engineering principles.

**PEO3:** Graduates will engage in life-long learning and professional development by rapidly adapting changing work environment.

**PEO4:** Graduates will communicate effectively, work collaboratively and exhibit high levels of professionalism and ethical responsibility

#### PROJECT OUTCOMES

**P1:** Came to know the domain knowledge of Rental Management and interpreting the user Requirements

**P2:** Able to explore different Technologies and determine which technology stack best suits for developing Web Application

**P3:** Able to identify the need of Security and generate solutions to fix them.

**P4:** Understanding different database frameworks and predict best framework that suits the project.

##### LOW - 1

**MEDIUM - 2**

##### HIGH - 3

**PROJECT OUTCOMES MAPPING PROGRAM OUTCOMES**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **PO** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
| **P1** | 3 | 1 |  |  |  |  |  |  |  |  | 2 |  |
| **P2** | 2 |  | 1 |  | 3 |  |  |  |  |  |  | 3 |
| **P3** |  |  |  | 2 |  |  | 1 |  |  |  |  |  |
| **P4** | 2 |  |  |  | 3 |  |  |  | 1 |  | 2 |  |
|  | | | | | | | | | | | | |

**PROJECT OUTCOMES MAPPING PROGRAM SPECIFIC OUTCOMES**

|  |  |  |
| --- | --- | --- |
| **PSO** | **PSO1** | **PSO2** |
| **P1** | 3 |  |
| **P2** |  | 2 |
| **P3** |  | 2 |
| **P4** | 1 |  |



**PROJECT OUTCOMES MAPPING PROGRAM EDUCATIONAL OBJECTIVES**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **PEO** | **PEO1** | **PEO2** | **PEO3** | **PEO4** |
| **P1** |  | 1 |  | 2 |
| **P2** | 2 |  | 3 |  |
| **P3** |  | 2 | 2 |  |
| **P4** |  |  | 1 |  |

We hereby declare that the project report entitled **“DEEP INVENTORY MANAGEMENT SYSTEM ”** is done in the partial fulfillment for the award of the Degree in Bachelor of Technology in Computer Science and Engineering affiliated to Jawaharlal Nehru Technological University, Hyderabad. This project has not been submitted anywhere else.

**S. Mudassir (19BD51A05BG)**

##### G. Sowmya (19BD1A05AN)

**K. Sathwik (19BD1A05AV)**

##### M. Swetha Tejaswini (19BD1A05B4)

We take this opportunity to thank all the people who have rendered their full support to our project work.

We render our thanks to **Dr. Maheshwar Dutta**, B.E., M Tech., Ph.D., Principal who encouraged us to do the Project.

We are grateful to **Mr. Neil Gogte**, Director for facilitating all the amenities required for carrying out this project.

We express our sincere gratitude to **Mr. S. Nitin**, Director and **Professor Dodle Jaya Prakash**, M.Tech., Ph.D, Dean Academics for providing an excellent environment in the college.

We are also thankful to **Mr. Para Upendar**, Head of the Department for providing us with both time and amenities to make this project a success within the given schedule.

We are also thankful to our guide **Gaddeboina Suresh,** for his/her valuable guidance and encouragement given to us throughout the project work.

We would like to thank the entire CSE Department faculty, who helped us directly and indirectly in the completion of the project. We sincerely thank our friends and family for their constant motivation during the project work.

**G. Sowmya (19BD1A05AN)**

**K. Sathwik (19BD1A05AV)**

**M.Swetha Tejaswini(19BD1A05B4)**

**M. Muddassir (19BD1A05BG)**

### KESHAV MEMORIAL INSTITUTE OF TECHNOLOGY

***(Accredited by NBA & NAAC, Approved By A.I.C.T.E., Reg by***

***Govt of TelanganaState & Affiliated to JNTU, Hyderabad)***

#### CONTENTS

##### DESCRIPTION PAGE NO.

**ABSTRACT i**

##### LIST OF FIGURES ii

##### CHAPTERS

##### INTRODUCTION 1-3

* + 1. Scope
    2. Objectives
    3. Problem Statement
    4. Proposed solution
    5. Scope of the project
    6. Architecture of YoloV5

##### SOFTWARE REQUIREMENTS SPECIFICATIONS

**4-9**

* + 1. [What is SRS? 5](#_bookmark0)
    2. Role of SRS 5
    3. [Requirements Specification Document 6](#_bookmark1)
    4. [Functional Requirements 6](#_bookmark2)
    5. [Performance Requirements 6](#_bookmark9)

[2.6. Software Requirements 7](#_bookmark10)-8

[2.7. Hardware Requirements 9](#_TOC_250000)

* 1. LITERATURE SURVEY 10-11
     1. [Architecture 1](#_bookmark3)1
  2. [SYSTEM DESIGN 12-14](#_bookmark6)
     1. [Introduction to UML Diagrams 13](#_bookmark7)
     2. Identification of use cases 14
     3. Sequence Diagram

|  |  |
| --- | --- |
|  |  |
| **5. IMPLEMENTATION** | **15-35** |
| 5.1. Code | [16](#_bookmark1) |
|  |  |
| **6.** [**TES**](#_bookmark8)**TING** | **36-45** |
| 6.1 Introduction to Testing | 37 |
| 6.2 Test Cases | 37 |
| **7.** |  |
| **8. SCREENSHOTS** | **51-52** |
| **9. FUTURE ENHANCEMENTS** | **53-54** |
| **10. CONCLUSION**  **11.REFERENCES** | **55-56** |

#### ABSTRACT

An Inventory Management System (or inventory system) is the process by which you track your goods throughout your entire supply chain, from purchasing to production to end sales. It governs how you approach inventory management for your business. The main purpose of Inventory Management is to store a certain number of physical resources for a company or enterprise, which can then be transformed into profits via effective product sale or other operations. Deep learning is used to minimize the factors affecting Inventory Management is a growing trend in many of today’s industries. Using it to improve stock tracking accuracy, optimize inventory storage, and offer transparent supply chain communications are just some of the many ways businesses can take advantage of this new technology. This optimizes the performance of tracking technology in Inventory Management and offers more accurate data to assist in planning for the future. A major requirement for small/medium-sized businesses is Inventory Management since a lot of money and skilled labor has to be invested to do so. E-commerce giants use Deep Learning models to maintain their inventory based on demand for a particular item. The Deep Inventory Management System explains how retailers identify their items and track all available items within the store. For this, we came up with an element i.e., Cool Drinks and it works so simple. By using mobile phones, the merchant tries to scan the items and as soon as they scan, it detects the type of item and enumerates all similar items and updates them to the inventory system. The idea behind this project is for everybody to use this inventory system in their workshops.

i

#### LIST OF FIGURES

Figure Title Page

|  |  |
| --- | --- |
| 1. CSP DARKNET…………………………………………………. | 14 |
| 2. StreamLit……………………………………………………….. | 37 |
| 3. Python………………………………………………… |  |
| 4. SKU-110 Dataset Image……………………………. | 38 |
| 5. SQLite Database…………………………………………… | 38 |
| 6. Architecture Of Inventory Management System…………….. | 39 |
| 7. Project SDLC……………………………………….. | 39 |
| 8. UseCase Diagram……………………………………. | 40 |
| 9. Sequence Diagram…………………………… | 40 |
| 10. Automation Testing……………………………………… | 41 |
| 11. Modes of Inventory Management System | 41 |
| 12. Staff Mode for Inventory Management System…………….. | 42 |
| 13. Object Detection………………………… | 42 |
| 14. Data Captured for the Inventory……………………….. | 43 |
| 15. Action that can be performed on the Inventory…………………. | 43 |
| 16. View Inventory………………………………. | 44 |
| 17. Update Product………………………………………. | 44 |
| 18. Delete Product……………………………………….  19. Create User……………………………………………  20. Generate Report for the Inventory……………………………….  21. Delete User from the Inventory………………………………….. | 45 |

DEEP INVENTORY MANAGEMENT SYSTEM

# CHAPTER -1

**LIST OF TABLES**

|  |  |  |
| --- | --- | --- |
| **NO** | **LIST OF TABLES** | **PAGE NO** |
|  |  |  |
| **1.** | **TABLE 1** | **28** |
|  |  |  |
| **2.** | **TABLE 2** | **44** |
|  |  |  |



1. **INTRODUCTION**

**1.1 Purpose of Project**

Nowadays, in an era that has advanced technology and a place in the world. Everything can be linked only at your fingertips in the times of rapidly developing with the sophisticated technology of today. Therefore, an inventory system is also not lagging behind in introducing a method of keeping an inventory data systematically and safely. The system plays a very important role in improving the competitiveness of a business. Usually, organizations today face too many challenges to achieve the cost, speed and reliability. The purpose of Inventory Management System is to ensure there is enough goods or materials to meet demand without creating overstock, or excess inventory. Efficient inventory system really helps in order to make sure the store’s performance and data record is always in good condition and secured from abusers. Inventory Management is a process of ordering, storing, and using inventories. This stock management includes generating the lead on raw materials, components, and finished products, along-side warehousing and processing of such items in your company. An Inventory can be any item that a business holds to receive the goal of resale or repair. The main purpose of inventory management is to store a certain number of physical resources for a company or enterprise, which can then be transformed into profits via effective product sale or other operations. As explained, the inventory management is a core part of the supply chain management process, which is now becoming a vital focus of many enterprises and companies. The Web application helps managing inventory systems using PC. The mobiles displays the streaming of items in the front-end.Deep learning model detects the items and automatically the number of items in the inventory gets updated and the updated inventory list will be shown in the front-end.

**1.2 OBJECTIVES**

The main aim of an inventory management system is to keep the stock in such a way that it is neither overstock nor understock. The overstock condition will reduce the other production processes and understock will lead to stoppage of work. The objectives of inventory management are operational and financial. In operational, materials and stock should be available in sufficient amount whereas, in functional, the minimum working capital should be locked in. The objectives of inventory management are as follows:

1. To ensure a continuous supply of materials and stock so that production should not suffer at the time of customer’s demand.
2. To avoid both overstocking and under-stocking of inventory.
3. To maintain the availability of materials whenever and wherever required in enough quantity.
4. To maintain minimum working capital as required for operational and sales activities.
5. To optimize various costs indulged with inventories like purchase cost, carrying a cost, storage cost, etc.
6. To keep material cost under control as they contribute to reducing the cost of production.
7. To eliminate duplication in ordering stocks.
8. To minimize loss through deterioration, pilferage, wastages, and damages.
9. To ensure everlasting inventory control so that materials shown in stock ledgers should be physically lying in the warehouse.
10. To ensure the quality of goods at reasonable prices.
11. To facilitate furnishing of data for short and long-term planning with a controlled inventory.
12. To supply the required material continuously.
13. To maintain a systematic record of inventory.
14. To make stability in price.

**1.3 Problem Statement**

The problem faced by the company is they do not have any systematic system to record and keep their inventory data. It is difficult for the admin to record the inventory data quickly and safely because they only keep it in the logbook and not properly organized. The company now using is a manual system. The company problem is they using chaos system and it is difficult for the admin to estimate their profit. With the new system developed, the company can manage their inventory data easily, quickly and more secured. To record the inventory data will cost a time. Admin of the company only one person so he needs to record every stock detail clearly or else it may lead to lack information about the data. The company do not have any secure system for their inventory system.

**1.4 Proposed Solution**

The project aims at providing an efficient interface to the sellers for managing their grocery inventory based on each item sold. The basic idea involved here is that each item is linked to its products which are stored in a database. At the end of each day, the system analyzes the total sale of menu items and proportionately deducts appropriate amount from the resource database. Then it compares the current available resources with the threshold level of each ingredient. If it finds that certain stock is below the threshold, it will generate a purchase order for those item(s) and send it to the manager (admin) for approval. The product also aims to keep track of the shelf life of resources. If any resource nears the end of its shelf life, it would intimate to the manager (admin) the details of the quantity that is near its expiration date. The restaurant must function efficiently, the groceries must be tracked correctly, timely orders must be sent out to the vendors, and the inventory must be maintained and updated at all times. ****

**1.5 Scope of the Project**

This Inventory management tracks the products in the Shops. This includes all the inventory management until it reached to the final consumer. it includes finished products manufactured by the company and the raw material which may be required for production on finished goods.

* **Manage Inventory**: Inventory management helps to manage the stock of the company. it provides proper details of the products what kind of raw material, what are the sizes we require and etc. to the purchasing department.
* **Less Storage**: When the inventory management provides proper information to management, they buy according to them which helps the company to store fewer products.
* **Improve Productivity:** Inventory management helps to improve the productivity of the machines and manpower. Employees are aware of stocks and the quantity that require to produce.
* **Increase Profits:**Inventory management helps to improve the profits of the company. It helps to provide proper information about stocks, that saves the unnecessary expenses on stocks.

* 1. **Architecture of YoloV5:**

YOLO v5 is a family of object detection architectures and models pretrained on the COCO dataset. YOLO divides an image into a grid system, and each grid detects objects within itself. They can be used for real-time object detection based on the data streams. They require very few computational resources. As YOLO v5 is a single-stage object detector, it has three important parts like any other single-stage object detector.

1. Model Backbone
2. Model Neck
3. Model Head

**BACKBONE:**

Model Backbone is mainly used to extract important features from the given input image. In YOLO v5 the **CSPDarkNet** (CSP — Cross Stage Partial Networks) are used as a backbone to extract rich in informative features from an input image. CSPDarknet-53 is a convolutional neural network and backbone for object detection that uses DarkNet-53. It employs a CSPNet strategy which partition the feature map of the base layer into two parts and then merges them through a cross-stage hierarchy. The use of a split and merge strategy allows for more gradient flow through the network. Darknet is an open-source neural network framework written in C and CUDA. It is fast and highly accurate which are the key requirements for the YOLO family.

**NECK:**

PANet (Path Aggregation Network) is used as a neck in YOLO v5 to get feature pyramids. Feature pyramids are a basic component in recognition systems for detecting objects at different scales. Feature pyramids are quite beneficial in assisting models to perform effectively on previously unseen data. The model’s neck role is to collect features from different stages. The neck is composed of several top-down paths and several bottom-up paths. PANet uses features from all the layers, and decides which ones are useful It performs ROI operation on each feature map to extract the features for the object. This is followed by an element-wise max fusion operation to enable the network to adapt new features.

**HEAD:**

YOLO Layer is used as head. The model Head is mostly responsible for the final detection step. It uses anchor boxes to construct final output vectors with class probabilities, objectness scores, and bounding boxes. The head is responsible for:

* 1. the objectness score (the probability an object is within the anchor)
  2. the class (a number i.e. 1 which corresponds to a class e.g. a person)
  3. the class confidence (the chance that the above class is correct)
  4. the bounding box coordinates i.e. [x, y, w, h] [120, 300, 200, 400]

The input is first passed to CSPDarknet for feature extraction, and then fed to PANet for feature fusion (Feature Pyramid). Finally, Yolo Layer outputs detection results (class, score, location, size).

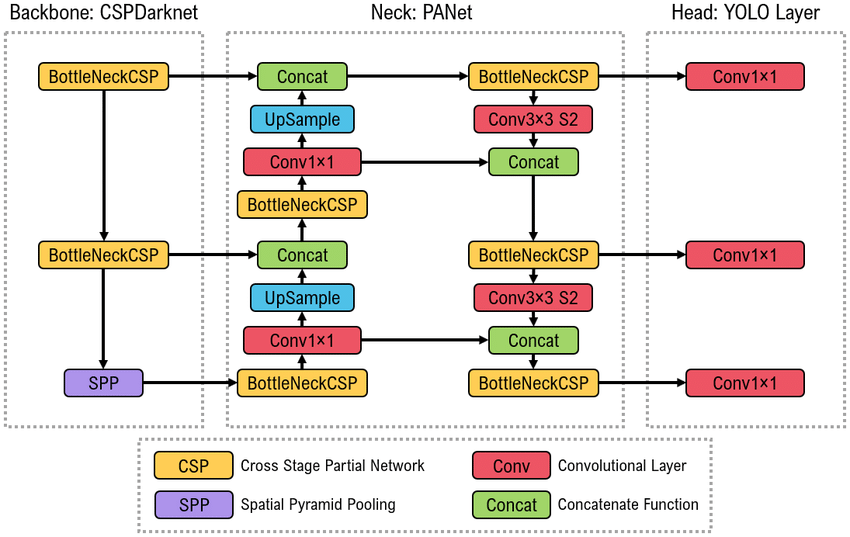


Figure 1 : CSP Darknet

Spatial Pyramid Pooling - removes fixed size constraint on the input image.

Concatenate Function - It does stack operation.

**2 SYSTEM REQUIREMENT SPECIFICATIONS**

**2.1 What is SRS?**

Software Requirement Specification (SRS) is the starting point of the software developing activity. As system grew more complex it became evident that the goal of the entire system cannot be easily comprehended. Hence the need for the requirement phase arose. The software project is initiated by the client needs. The SRS is the means of translating the ideas of the minds of clients (the input) into a formal document (the output of the requirement phase.)

The SRS phase consists of two basic activities:

**Problem/Requirement Analysis:**

The process is order and more nebulous of the two, deals with understand the problem, the goal and constraints.

**Requirement Specification:**

Here, the focus is on specifying what has been found giving analysis such as representation, specification languages and tools, and checking the specifications are addressed during this activity.The Requirement phase terminates with the production of the validate SRS document. Producing the SRS document is the basic goal of this phase.

**2.2 Role of SRS**

The purpose of the Software Requirement Specification is to reduce the communication gap between the clients and the developers. Software Requirement Specification is the medium though which the client and user needs are accurately specified. It forms the basis of software development. A good SRS should satisfy all the parties involved in the system.

**2.3 Requirements Specification Document**

A Software Requirements Specification (SRS) is a document that describes the nature of a project, software or application. In simple words, SRS document is a manual of a project provided it is prepared before you kick-start a project/application. A software document is primarily prepared for a project, software or any kind of application.

There are a set of guidelines to be followed while preparing the software requirement specification document. This includes the purpose, scope, functional and non-functional requirements, software and hardware requirements of the project.

The purpose of SRS document is to describe the external behavior of the application developed or software. It defines the operations, performance and interfaces and quality assurance requirement of the application or software. This section introduces the requirement specification document for Smart Bin which enlists functional as well as non-functional requirements.

**2.4 Functional Requirements**

For documenting the functional requirements, the set of functionalities supported by the system are to be specified. A function can be specified by identifying the state at which data is to be input to the system, its input data domain, the output domain, and the type of processing to be carried on the input data to obtain the output data. Functional requirements define specific behavior or function of the application. Following are the functional requirements:

FR1) The ability to collect and store data from Inventory.

FR2) The ability to extract relevant features from Cool Drinks data that can be used to detect the different types of cool drinks.

FR3) The ability to use the trained model to detect the cool drinks from the dataset.

**2.5 Non-Functional Requirements**

A non-functional requirement is a requirement that specifies criteria that can be used to judge the operation of a system, rather than specific behaviors. Especially these are the constraints the system must work within. Following is the non-functional requirements:

NFR 1) Must be able meet all its Objectives.

NFR 2) Should not be any lag in the answer.

NFR 3) Must be easy to easy to use.

NFR 4) Should be easily modifiable if needed for bug fixes or for to add any new functionality.

NFR 5) Should give consistent and accurate results.

**2.6 Software Requirements**

|  |  |  |
| --- | --- | --- |
| Front-end | : | Streamlit |
| Back-end | : | Python |
| Database | : | SQLite |
| Model used | : | YOLOv5 |
| Dataset | : | SKU-110K |



**2.8 REQUIREMENTS**

**2.8.1 STREAMLIT**

Streamlit is a free and open-source framework to rapidly build and share beautiful machine learning and data science web apps. It is a Python-based library specifically designed for machine learning engineers. Data scientists or machine learning engineers are not web developers and they're not interested in spending weeks learning to use these frameworks to build web apps. Instead, they want a tool that is easier to learn and to use, as long as it can display data and collect needed parameters for modeling. Streamlit allows you to create a stunning-looking application with only a few lines of code.



**FIG 2: StreamLit**

**2.8.3 Python**

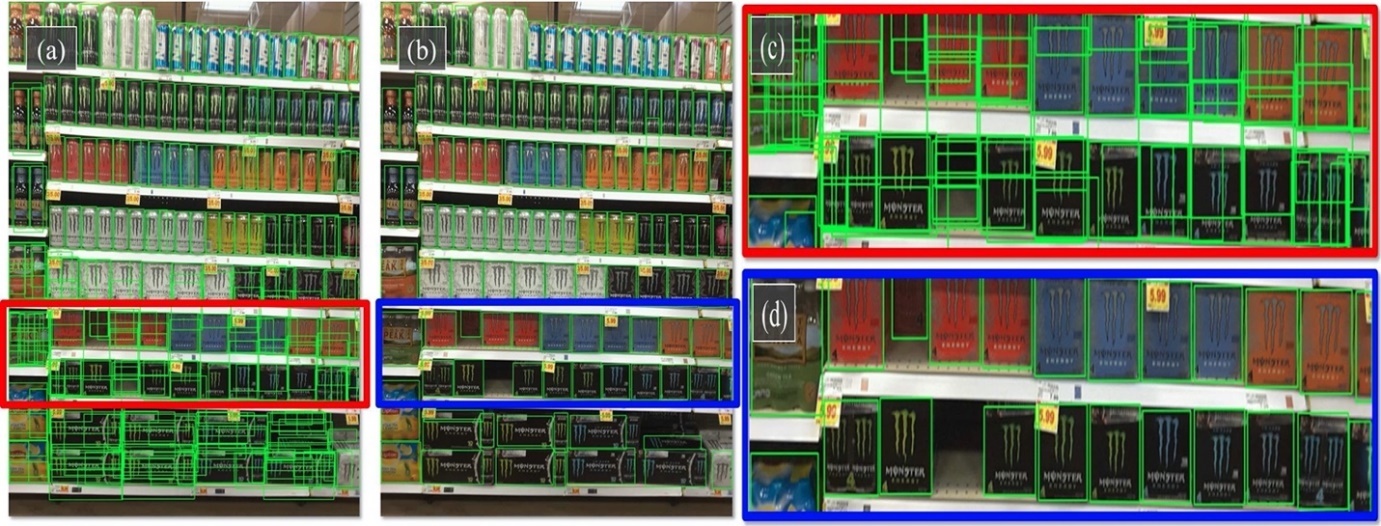
**** Python is a very popular general-purpose interpreted, interactive, object-oriented, and high-level programming language. Python is dynamically-typed and garbage-collected programming language. It was created by Guido van Rossum during 1985- 1990. Like Perl, Python source code is also available under the GNU General Public License (GPL). Python supports multiple programming paradigms, including Procedural, Object Oriented and Functional programming language. Python design philosophy emphasizes code readability with the use of significant indentation.



**FIG 3: Python**

**2.8.4 SKU-110K**

****The Sku110k dataset provides 11,762 images with more than 1.7 million annotated bounding boxes captured in densely packed scenarios, including 8,233 images for training, 588 images for validation, and 2,941 images for testing. There are around 1,733,678 instances in total. The images are collected from thousands of supermarket stores and are of various scales, viewing angles, lighting conditions, and noise levels. All the images are resized into a resolution of one megapixel. Most of the instances in the dataset are tightly packed and typically of a certain orientation in the rage of [−15∘, 15∘].



**FIG 4: SKU-110K Dataset Image**

**2.8.5. SQLite:**

SQLite is a self-contained, high-reliability, embedded, full-featured, public-domain, SQL database engine. It is the most used database engine in the world. It is an in-process library and its code is publicly available. It is free for use for any purpose, commercial or private. It is basically an embedded SQL database engine. Ordinary disk files can be easily read and write by SQLite because it does not have any separate server like SQL. The SQLite database file format is cross-platform so that anyone can easily copy a database between 32-bit and 64-bit systems. Due to all these features, it is a popular choice as an Application File Format.



**FIG 5: SQLite Database**

**3. LITERATURE SURVEY**

The Literature survey of supply chain and inventory management is separated into two categories which are the traditional inventory management methods and the intelligent inventory management methods, as follows. The main purpose of inventory management is to store a certain amount of physical resources for a company or enterprise, which can then be transformed into profits via effective product sale or other operations. As explained, the inventory management is a core part of the supply chain management process, which is now becoming a vital focus of many enterprises and companies. Generally, the performance of the inventory management can be affected by a lot of factors. Since it is one key part of the supply chain management, a great deal of researches has been proposed to optimize the efficiency of the inventory management process to finally promote the performance of the supply chain. For example, reference would like to optimize the process of inventory management by using the performance management technology to promote the activities of the whole supply chain management. Specifically, this work classified irregular demands into three kinds which are erratic, slow moving, and lumpy ones. Then, three corresponding periodic review policies were proposed to maintain the lowest holding inventory. The results indicated that this work was very effective especially for dealing with the erratic inventory demands. Despite this, this work did not take the dynamic changing environment into consideration, which may not be applicable.

In order to show a clear direction of the inventory management, discussed the challenges of IM by dividing the corresponding challenges into five categories, that is, the technology, the organization, the finance, the management, and the information involved in the process of inventory management. In particular, such classification was made based on the decision variable, the demand type, the quality deterioration function, and the method of settlement used, such that the classification could not only provide the detailed description about IM but also show a gap to be developed. Similarly, it also explored the potential challenges of IM by dividing the whole process into multiple different aspects which included the safety inventory, the procurement efficiency, the demand prediction, and the training and interaction. Such two kinds of classification both promote the development of inventory management, but the difference is that [20] studied each aspect deeply and provided optimization directions for each of them. Compared with the above research work that intended to review inventory management, many other works were more inclined to study the technical aspects of inventory management. For example, reference [12] focused more on addressing the unnecessary out-of-stock and the oversupply issues that happened during the process of inventory management. In order to address these issues, this work proposed to optimize both the transport and inventory, such that the strategies of the single inventory and bulk order were jointly taken into consideration. In this way, the market supply-demand ratio could be dynamically adapted. But the drawback still existed, that is, it would take a long time distributing the products from the warehouse to the retailer, when there was a shortage of products at the retail level. As for reference [13], it tried to optimize the entire inventory management process via introducing a novel inventory replenishment and distribution model. Specifically, this work first analyzed the characteristics of the existing distributed inventory model, and then, it combined the advantages of cloud computing and the distributed inventory model to finally build the hierarchy-control distributed inventory model. By simulation and calculation, the results indicated that the proposed distributed inventory model was correct and effective. However, it should be noted that both references [12, 13] did not consider the uncertainty of the market, which may cause great loss especially when the oversupply situations happen.

In order to prevent such incidents from happening, so tried to build a safety inventory and start the research from the perspective of reducing the loss caused by the uncertainty of customer demands, it focused on optimizing the deficiency of traditional inventory management methods and forecasting the demands for all kinds of emergency supplies using the Euclidean algorithm. it developed an automated inventory system based on the passive radio frequency ID. Compared with the manual system, the product delivery time was reduced from 15.45 minutes to 2.92 minutes on average. However, the two references were different, which was mainly reflected by the fact that the safety inventory has mainly considered the number of customers, customer satisfaction, delivery reliability, and supply reliability, while the safety inventory in mainly considered the product usage frequency, service quality level, and sales situation. Therefore, the former realized a safety inventory from the view of customers, while the latter realized a safety inventory from the perspective of products. Nevertheless, none of them are totally intelligent, which means that the human intervention will be required more or less, and then, the inventory error would occur with a high probability when the amount of product becomes extremely large.

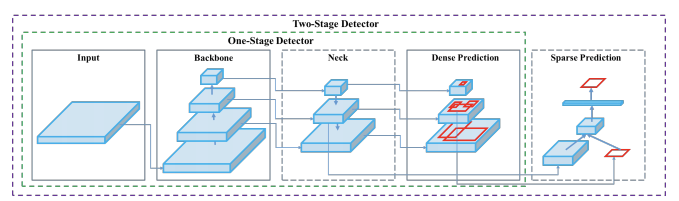
The turning point of the development from traditional inventory to intelligent inventory is about the prediction technology of customer demands. Generally speaking, there are many prediction methods and they can be divided into two categories. The first one mainly relies on static mathematical statistical analysis methods, while the second one mainly relies on the machine learning methods.

The traditional static mathematical analysis-based methods (e.g., statistics and data mining) rely heavily on the quality of history data (e.g., product order). Hence, high-quality data would lead to a more accurate prediction accuracy than low-quality data. Usually, the mathematical analysis is executed and applied on these history data for the purpose of digging out the potential pattern and trends about the market needs. Such needs are proportional to the customer demands, based on which we can optimize the inventory management process. Specifically, this work first searched the corresponding product order information on the web. Then, the data mining technology was applied to dig the potential customer demands in the future and finally to establish one simple but concise inventory policy. The results indicated that by using the history sales data, this work could reduce the total cost of inventory more efficiently. As explained, the quality of the data is of vital importance. However, the collected data from the web usually has very low quality and needs a lot of extra procedures before putting them into use.

Similarly, another work also used the data mining technology to address the inventory management problem. In particular, this work focused more on studying the correlation among the historical data. Based on the intercorrelation discovered, a more complete analysis was carried out to improve the prediction accuracy and this work claimed to reduce both the cost and energy consumption for enterprises. Despite this, mainly relying on static mathematical statistics leads to an awkward situation that the prediction accuracy achieved by these methods is not very high. Another factor greatly influencing the achieved prediction accuracy is the data quality. However, it is generally known that the open-source data quality cannot be guaranteed and their format may not satisfy the corresponding requirements, such that the robustness and scalability of inventory management cannot be guaranteed neither.

Compared to the above work using the statistical methods, the second kind of research work on intelligent inventory has higher intelligence, since they mainly rely on the well-known machine learning models and methods (e.g., deep learning and reinforcement learning methods). The general workflow for most work using the machine learning method is that they first establish and train a learning model. It is noted that the learning model should be trained by a large number of historical datasets to generate a common knowledge system. After that, the customer demand prediction can be carried out based on this trained model. The more mature this model is, the higher the accuracy of the prediction results is. For instance, it adopted the artificial neural network (ANN) to deal with the process of inventory management. The intermediate process of inventory was modeled as the ANN’s hidden layer. After that, the learning model was continuously trained to approximate a solution with the optimal prediction accuracy. Despite the case that this work claimed to have achieve better results, there are also some limitations for this work, for example, it assumed that the demand changes regularly, while such changes were uncertain in the real world. Another limitation was that this work did not take enough consideration on the impact factors of the safety stock, which resulted in the situation that the actual safety stock was inadequate.

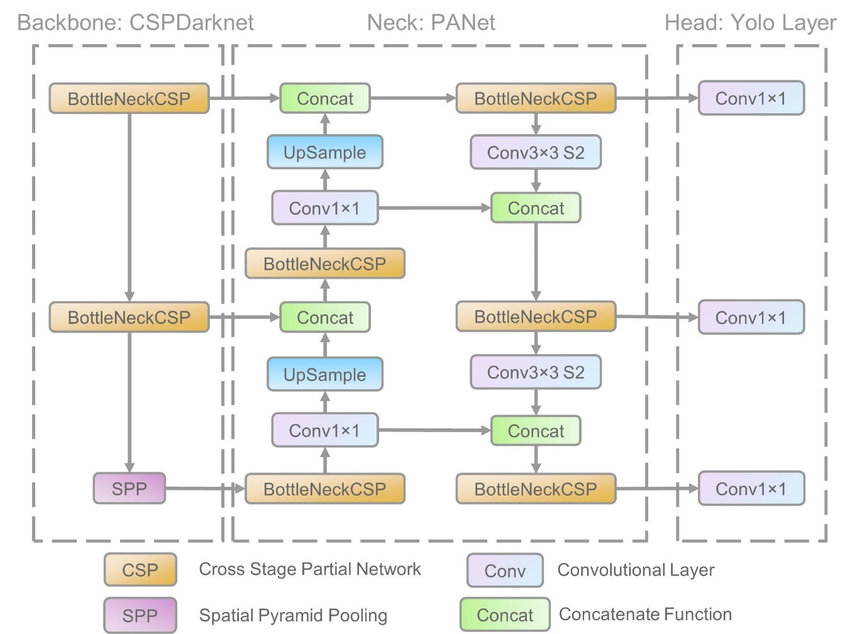
**3.1 ARCHITECTURE:**

**FIG 6: ARCHITECTURE OF INVENTORY MANAGEMENT SYSTEM**

**YOLOv5**

YOLO stands for You Look Only Once and it is one of the finest family of object detection models with state-of-the-art performances. It’s first model was released in 2016 by Joseph Redmon who went on to publish YOLOv2 (2017) and YOLOv3 (2018). In 2020 Joseph Redmon stepped out from the project citing ethical issues in the computer vision field and his work was further improved by Alexey Bochkovskiy who produced YOLOv4 in 2020.YOLOv5 is the next controversial member of the YOLO family released in 2020 by the company Ultranytics just a few days after YOLOv4.YOLOv5 is used for object detection. All the controversy aside, YOLOv5 is a cool model that requires minimal effort to work with it and produces impressive practical results as we saw in the example.



The YOLO family of models consists of three main architectural blocks  
 i) Backbone,   
ii) Neck and  
iii) Head.

1. **YOLOv5 Backbone:** It employs CSPDarknet as the backbone for feature extraction from images consisting of cross-stage partial networks.
2. **YOLOv5 Neck:** It uses PANet to generate a feature pyramids network to perform aggregation on the features and pass it to Head for prediction.
3. **YOLOv5 Head:**  Layers that generate predictions from the anchor boxes for object detection.

Apart from this YOLOv5 uses the below choices for training –

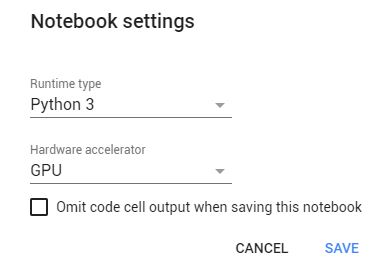
1. **Activation and Optimization:** YOLOv5 uses leaky ReLU and sigmoid activation, and SGD and ADAM as optimizer options.
2. **Loss Function:** It uses Binary cross-entropy with logits loss.

YOLOv5 has multiple varieties of pre-trained models as we can see above. The difference between them is the trade-off between the size of the model and inference time. The lightweight model version YOLOv5s is just 14MB but not very accurate. On the other side of the spectrum, we have YOLOv5x whose size is 168MB but is the most accurate version of its family.

**Setting up YOLOv5:**

**a) Enable GPU in Google Collab**

Visit [Google Colaboratory](https://research.google.com/colaboratory/), a free online Jupyter Notebook with GPU provided by Google research. Next, change the runtime type to GPU but visiting the notebook settings.



**b) Mounting Our drive**

Run the below code to mount and use your personal google drive. You can use the images/videos present in your own drive

from google.colab import drive

drive.mount('/content/drive')

**c) Cloning the YOLOv5 Repository**

Clone the YOLOv5 repository made and maintained by Ultralytics.

Input:

!git clone https://github.com/ultralytics/yolov5

Output:

Cloning into 'yolov5'...

remote: Enumerating objects: 7103, done.

remote: Counting objects: 100% (209/209), done.

remote: Compressing objects: 100% (129/129), done.

remote: Total 7103 (delta 122), reused 154 (delta 80), pack-reused 6894

Receiving objects: 100% (7103/7103), 9.12 MiB | 19.58 MiB/s, done.

Resolving deltas: 100% (4858/4858), done.

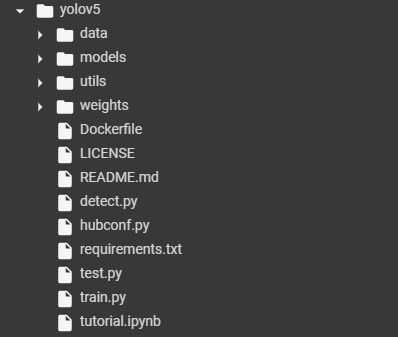
**d) Installing Requirements**

Run the following command to install the required package in order to run the YOLOv5 detector. The second command is to go inside the directory where the files reside.

!pip install -r yolov5/requirements.txt

!cd /content/yolov5

After the successful execution the directory structure looks like this:



**YOLOv5 Object Detection on Videos**

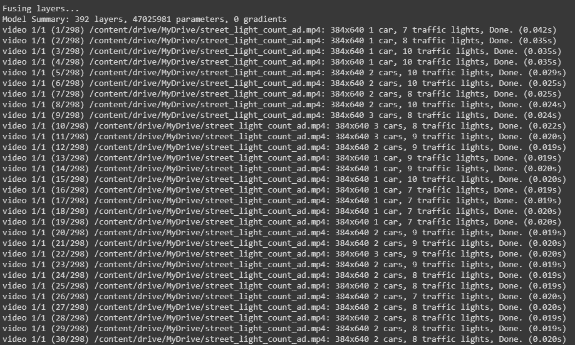
The YOLOv5 command that we have seen in the above examples for images works seamlessly with videos as well. We just have to pass the path of the video saved in our drive, as shown below.

Input:

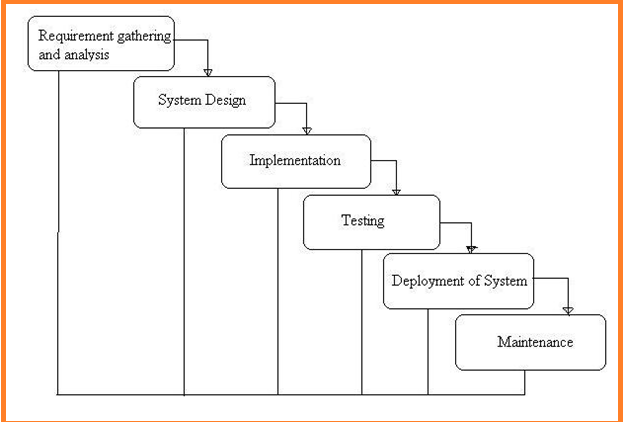
!python /content/yolov5/detect.py --source /content/drive/MyDrive/street\_light\_count\_ad.mp4 --weights yolov5l.pt --conf 0.25

Video is processed frame by frame and predictions for each frame is printed.

Output:



**SYSTEM ANALYSIS:**



**FIG 7: Project SDLC**

**Requisites Accumulating and Analysis**

It’s the first and foremost stage of the any project as our is an academic leave for requisites amassing, we followed of IEEE Journals and Amassed so many IEEE Relegated papers and final culled a Paper designated “Individual web revisitation” by setting and substance importance input and for analysis stage we took referees from the paper and did literature survey of some papers and amassed all the Requisites of the project in this stage.

**System Design**

In System Design has divided into three types like GUI Designing, UML Designing with avails in development of project in facile way with different actor and its utilizer case by utilizer case diagram, flow of the project utilizing sequence, Class diagram gives information about different class in the project with methods that have to be utilized in the project.

**Implementation**

The Implementation is Phase where we endeavor to give the practical output of the work done in designing stage and most of Coding in Business logic lay coms into action in this stage its main and crucial part of the project.

**Testing:**

**Unit Testing**

It is done by the developer itself in every stage of the project and fine-tuning the bug and module predicated additionally done by the developer only here we are going to solve all the runtime errors.

**Manual Testing**

As our Project is academic Leave, we can do any automatic testing so we follow manual testing by endeavor and error methods.

**Deployment of System**

Once the project is total yare, we will come to deployment of client system in genuinely world as its academic leave we did deployment in our college lab only with all need Software’s with having Windows OS.

**Maintenance**

The Maintenance of our Project is one time process only

**TITLE OF THE SURVEY PAPER-1:** A Study of Inventory Management System Case Study.

**DESCRIPTION:** In this paper, Inventory management is to find the quantity of inventories that will fulfil the demand, avoiding overstocks. This paper presents a case study for the steel manufacturing industry (Small Scale Industry) on inventory management. The relationship between the inventory management and company performance was determined based on inventory days and return on asset (ROA) analysis.

**TITLE OF THE SURVEY PAPER-2:** A Deep Learning-Based Inventory Management and Demand Prediction Optimization Method.

**DESCRIPTION:** This paper of Inventory management, as the key part of supply chain management, plays a very important role in reducing the overall cost of supply chain management. Generally, too much or too little inventory can have a bad result. For example, excessive inventory can result in the oversupply situation, since the number of stored products has exceeded the market demands greatly.

**TABLE 1**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **S.NO** | **TITLE** | **AUTHOR** | **PUBLICATION**  **YEAR** | **CONCEPT** |
| 1. | A Study of Inventory Management System Case Study | Tariq Hussain Sheikh | 2016 | to identify and compare the  different discourses that stakeholders involved in Smart City projects build  around the concept. The deﬁnition of the Smart City concept has been the key  element selected to be analyzed, being used to stablish the conceptual basis that  structures the different points of view that stakeholders have about the topic.  In this paper, Inventory management is to find the quantity of inventories that will fulfil the demand, avoiding overstocks. This paper presents a case study for the steel manufacturing industry (Small Scale Industry) on inventory management. The relationship between the inventory management and company performance was determined based on inventory days and return on asset (ROA) analysis. |
| 2. | A Deep Learning-Based Inventory Management and Demand Prediction Optimization Method. | Chuning Deng and Yongji Liu | 2015 | This paper of Inventory management, as the key part of supply chain management, plays a very important role in reducing the overall cost of supply chain management. Generally, too much or too little inventory can have a bad result. For example, excessive inventory can result in the oversupply situation, since the number of stored products has exceeded the market demands greatly. |

**4. SYSTEM DESIGN**

The System Design Document describes the system requirements, operating environment, system and subsystem architecture, files and database design, input formats, output layouts, human-machine interfaces, detailed design, processing logic, and external interfaces.

**4.1 INTRODUCTION TO UML DIAGRAMS**

**Global Use Case Diagrams:**

Identification of actors:

**Actor:** Actor represents the role a user plays with respect to the system. An actor interacts with, but has no control over the use cases.

Graphical representation:



<<Actor name>>

An actor is someone or something that:

Interacts with or uses the system.

• Provides input to and receives information from the system.

• Is external to the system and has no control over the use cases.

**4.1.1 Identification of use cases**

**Use case:** A use case can be described as a specific way of using the system from a user’s (actor’s) perspective**.**

**Graphical Representation:**



**Construction of Usecase diagrams**

Use-case diagrams graphically depict system behavior (use cases). These diagrams present a high-level view of how the system is used as viewed from an outsider’s (actor’s) perspective.

**4.1.2 SEQUENCE DIAGRAMS**

A sequence diagram is a graphical view of a scenario that shows object interaction in a time-based sequence what happens first, what happens next. Sequence diagrams establish the roles of objects and help provide essential information to determine class responsibilities and interfaces.

**Object:**

****An object has state, behavior, and identity. The structure and behavior of similar objects are defined in their common class. Each object in a diagram indicates some instance of a class. **Message:**

A message is the communication carried between two objects that trigger an event. The

synchronization of a message can be modified through the message specification.

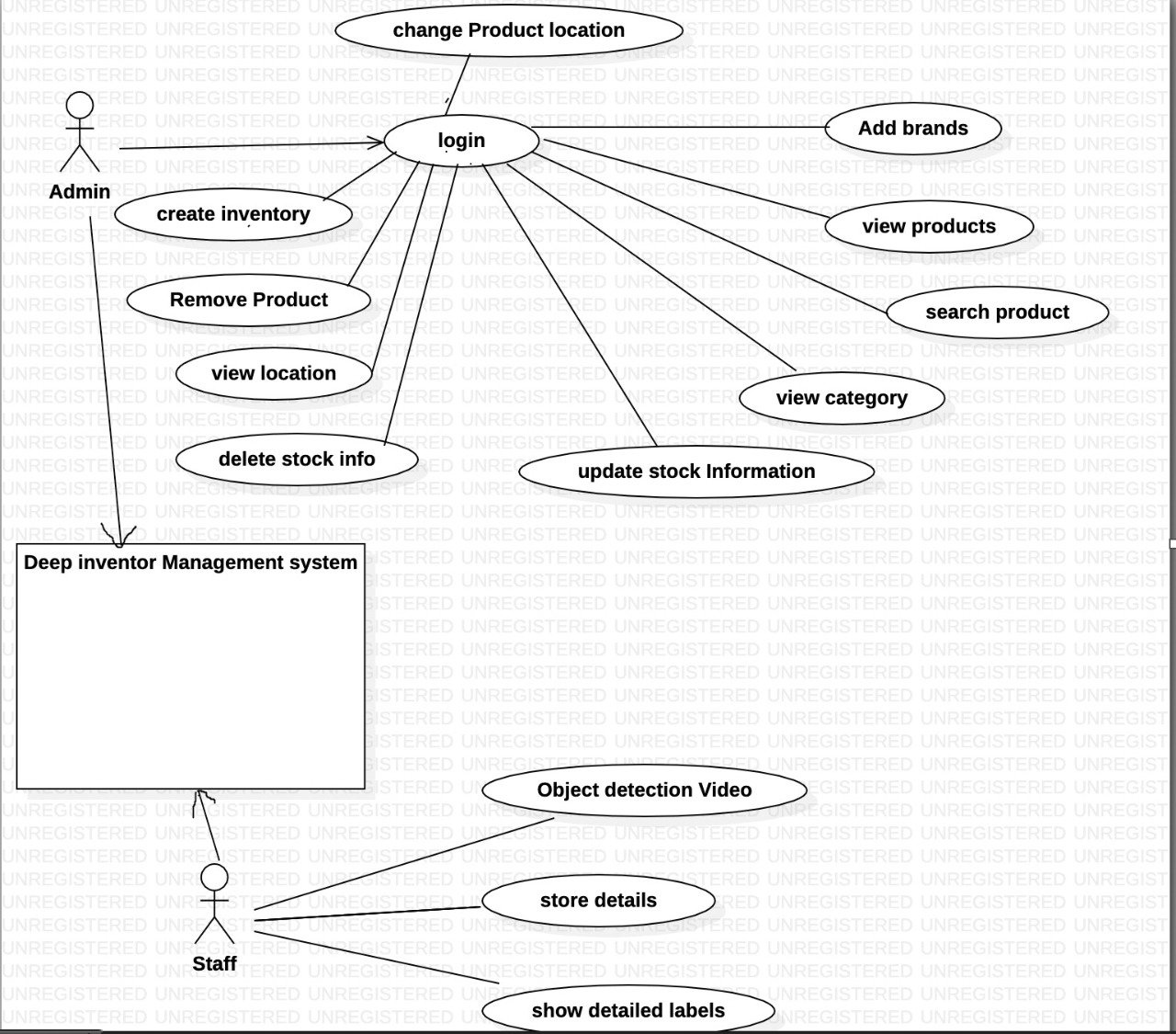
**Link:**

A link should exist between two objects, including class utilities, only if there is a relationship between their corresponding classes.

**4.1.3 CLASS DIAGRAM**

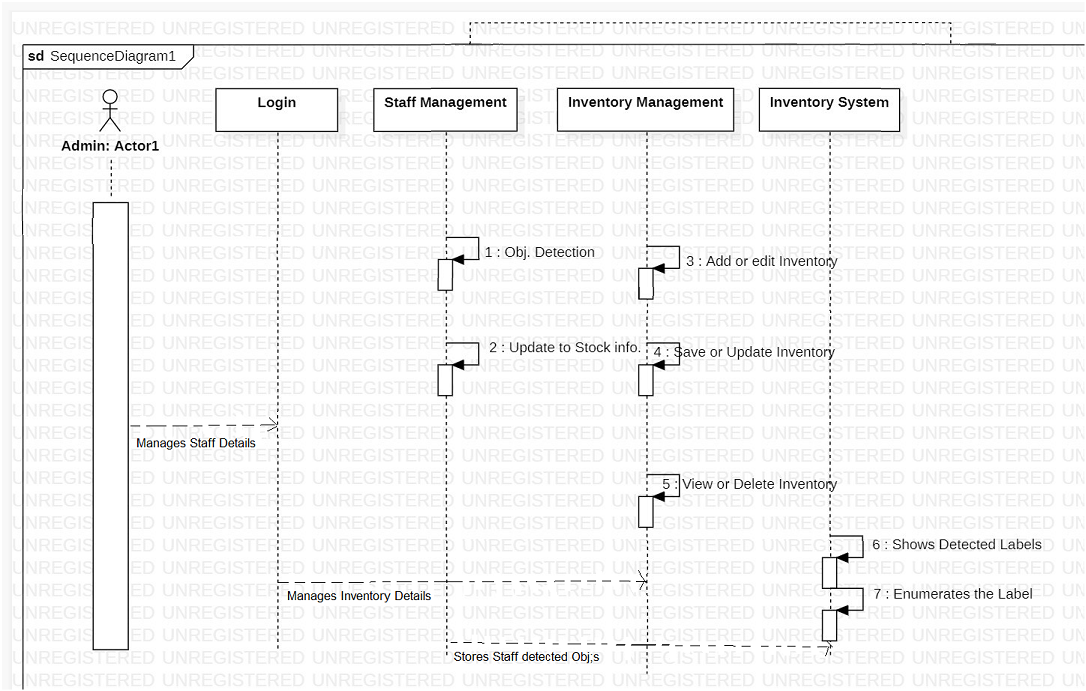
A class is a set of objects that share a common structure and common behavior (the same attributes, operations, relationships and semantics). A class is an abstraction of real-world items.

**4.2 USE CASE DIAGRAM**



**Figure 8: USECASE DIAGRAM OF COOL DRINK INVENTORY MANAGEMENT SYSTEM**

**4.3 SEQUENCE DIAGRAM**

**FIG 9: SEQUENCE DIAGRAM OF COOL DRINK INVENTORY MANAGEMENT SYSTEM**

**5. IMPLEMENTATION**

**5.1 Code**

**import queue**

**import sqlite3**

**import PIL.Image**

**import av**

**import cv2**

**import numpy as np**

**import pandas as pd**

**import streamlit as st**

**from streamlit\_webrtc import (**

**ClientSettings,**

**VideoProcessorBase,**

**WebRtcMode,**

**webrtc\_streamer,**

**)**

**from src.api import load, get\_model**

**conn = sqlite3.connect('database\_colddrinks.db')**

**c = conn.cursor()**

**Flag = 0**

**def create\_table():**

**c.execute('CREATE TABLE IF NOT EXISTS objectcount(item TEXT,itemcount INT,postdate DATE)')**

**create\_table()**

**def add\_data(item, itemcount, postdate):**

**c.execute('INSERT INTO objectcount(item,itemcount,postdate) VALUES (?,?,?)',**

**(item, itemcount, postdate))**

**conn.commit()**

**def view\_all():**

**c.execute('SELECT \* FROM objectcount')**

**data = c.fetchall()**

**return data**

**def csvformat(data):**

**df = pd.DataFrame(data)**

**df.index.name = 'Ser No'**

**df.to\_csv('cold\_drinks.csv')**

**#st.write('Data is written successfully to csv File.')**

**def excelformat(data):**

**df = pd.DataFrame(data)**

**#df.to\_excel('wine.xlsx')**

**# create excel writer object**

**df.index.name = 'Ser No'**

**writer = pd.ExcelWriter('cold\_drinks.xlsx')**

**# write dataframe to excel**

**df.to\_excel(writer)**

**# save the excel**

**writer.save()**

**class VideoProcessor(VideoProcessorBase):**

**"""**

**class for taking frame / sec and predict on it**

**"""**

**def \_\_init\_\_(self):**

**self.confidence\_threshold = CONF\_THR**

**self.result\_queue = queue.Queue()**

**self.type = None**

**def recv(self, frame):**

**"""**

**:param frame: image array (height, width, channel)**

**:return: image (height, width, channel) with bounding box**

**"""**

**image\_ = frame.to\_ndarray(format="bgr24")**

**# if self.type == "yes":**

**img, counting\_ = load(model, image\_, self.confidence\_threshold, IMAGE\_SIZE)**

**C\_ = {k: v for k, v in counting\_.items() if v > 0}**

**self.result\_queue.put([C\_])**

**# elif self.type == "no":**

**# self.result\_queue.put([None])**

**return av.VideoFrame.from\_ndarray(img, format="bgr24")**

**@st.cache**

**def \_\_model():**

**"""**

**load model in cache mode**

**Returns: torch.Module**

**"""**

**# return get\_model('best3.pt')**

**return get\_model('exp2/weights/best.pt')**

**head\_message\_temp = """**

**<div style="padding:10px;border-radius:5px;margin:10px;">**

**<h3 style="text-align:center;">{}</h3>**

**<h3>Count: {}</h6>**

**<h3>Date : {}<h3>**

**</div>**

**"""**

**if \_\_name\_\_ == '\_\_main\_\_':**

**st.title("Cold Drinks Inventory Management System")**

**style = """<style>**

**footer {visibility: hidden;}**

**</style>**

**"""**

**WEBRTC\_CLIENT\_SETTINGS = ClientSettings(**

**rtc\_configuration={"iceServers": [{"urls": ["stun:stun.l.google.com:19302"]}]},**

**media\_stream\_constraints={**

**"video": True,**

**"audio": False,**

**},**

**)  # permission for camera**

**st.markdown(style, unsafe\_allow\_html=True)**

**# mode\_ = st.sidebar.radio(**

**#     "Mode", ('Staff', 'Admin'))**

**mode\_ = st.selectbox('Mode', ('None','Staff', 'Admin'))**

**if mode\_ == 'Admin':**

**st.title('Admin')**

**option = st.selectbox(**

**'', ('View Inventory',**

**'Update Product',**

**'Delete Product',**

**'Create User',**

**'Generate Report',**

**'Delete User'))**

**st.title(option)**

**if option == 'View Inventory':**

**ALL\_DATA = view\_all()**

**# for i in ALL\_DATA[::-1]:**

**#     st.markdown(head\_message\_temp.format(i[0], i[1], i[2]), unsafe\_allow\_html=True)**

**one = [i[0] for i in ALL\_DATA[::-1]]**

**two = [i[1] for i in ALL\_DATA[::-1]]**

**three = [i[2] for i in ALL\_DATA[::-1]]**

**DATA = {**

**'time': three,**

**'name': one,**

**'count': two**

**}**

**data\_ = pd.DataFrame.from\_dict(DATA)**

**st.table(data\_)**

**stat = data\_.groupby('name')['count'].sum()**

**st.table(pd.DataFrame(stat))**

**elif option == "Create User":**

**blog\_author = st.text\_input("Enter User Name", max\_chars=50)**

**password = st.text\_input("Enter Password", max\_chars=50, type='password')**

**if st.button('Create') and blog\_author and password:**

**st.success('User Created')**

**elif option == "Generate Report":**

**if st.button('Generate'):**

**st.write('Report')**

**elif option == 'Delete User':**

**name\_23 = st.text\_input("User Name", max\_chars=50)**

**if st.button('Delete') and name\_23:**

**st.success('user deleted')**

**elif option == "Update Product":**

**name = st.text\_input("Product name", max\_chars=50)**

**if st.button('Update') and name:**

**st.success('Product Updated')**

**elif option == 'Delete Product':**

**name\_ = st.text\_input("Product name", max\_chars=50)**

**if st.button('Update') and name\_:**

**st.success('Product Deleted')**

**elif mode\_ == 'Staff':**

**date = st.sidebar.date\_input("Date")**

**st.title('Staff')**

**IMAGE\_SIZE = 640  # default image size**

**model = \_\_model()  # model instance**

**# change here for confidence of object predict in image**

**# by default its 70**

**CONF\_THR = 0.65  # Confidence threshold**

**confidence\_threshold = st.sidebar.slider(**

**"Confidence threshold", 0.0, 1.0, CONF\_THR, 0.05**

**)  # Slide bar**

**# mode = st.sidebar.radio(**

**#     "View Mode", ('🎥 video', '🖼️ image', '📊 data'))**

**mode = st.sidebar.radio(**

**"View Mode", ('🎥 video', '📊 data', '🖼️ image'))**

**if mode == '🎥 video':**

**button\_placeholder = st.empty()**

**st.title("🎥 Object detection video")**

**webrtc\_ctx = webrtc\_streamer(**

**key="object-detection",**

**mode=WebRtcMode.SENDRECV,**

**client\_settings=WEBRTC\_CLIENT\_SETTINGS,**

**video\_processor\_factory=VideoProcessor,**

**async\_processing=True,**

**)**

**# if st.button('Capture'):**

**#     Flag += 1**

**if webrtc\_ctx.video\_processor:**

**# checks if camera is running**

**webrtc\_ctx.video\_processor.confidence\_threshold = confidence\_threshold**

**if st.checkbox("Store", value=False):**

**Flag = 1**

**# if st.checkbox("Stop it", value=False):**

**#     Flag = 0**

**if st.checkbox("Show the detected labels", value=True):**

**if webrtc\_ctx.state.playing:**

**labels\_placeholder = st.empty()**

**# button\_placeholder = st.empty()**

**empty = st.empty()**

**while True:**

**if webrtc\_ctx.video\_processor:**

**# webrtc\_ctx.video\_processor.type = st.radio(**

**#     "Capture", ("No", "Yes")**

**#     )**

**try:**

**result = webrtc\_ctx.video\_processor.result\_queue.get(**

**timeout=1.0**

**)**

**except queue.Empty:**

**result = None**

**if result:**

**data\_ = pd.DataFrame(result[0], index=['items'])**

**labels\_placeholder.table(data\_)**

**if Flag:**

**for name, d in result[0].items():**

**add\_data(name, d, date)**

**Flag = 0**

**# Flag -= 1**

**else:**

**labels\_placeholder.table(result)**

**else:**

**break**

**# if st.button('Store'):**

**#     Flag += 1**

**elif mode == '🖼️ image':**

**st.title("🖼️ Object detection image")**

**img\_file\_buffer = st.file\_uploader("Upload an image", type=["png", "jpg", "jpeg"])**

**if img\_file\_buffer is not None:**

**image = np.array(PIL.Image.open(img\_file\_buffer))  # Open buffer**

**image = cv2.resize(image, (IMAGE\_SIZE, IMAGE\_SIZE))  # resize image**

**image\_box, counting = load(model, image, confidence\_threshold,**

**IMAGE\_SIZE)  # function to predict on image**

**st.image(**

**image\_box, caption=f"Processed image", use\_column\_width=True,**

**)**

**C = {k: v for k, v in counting.items() if v > 0}**

**data = pd.DataFrame(C, index=['items'])**

**st.sidebar.table(data)**

**for name, d in C.items():**

**add\_data(name, d, date)**

**elif mode == '📊 data':**

**st.title("📊 data")**

**ALL\_DATA = view\_all()**

**# for i in ALL\_DATA[::-1]:**

**#     st.markdown(head\_message\_temp.format(i[0], i[1], i[2]), unsafe\_allow\_html=True)**

**one = [i[0] for i in ALL\_DATA[::-1]]**

**two = [i[1] for i in ALL\_DATA[::-1]]**

**three = [i[2] for i in ALL\_DATA[::-1]]**

**DATA = {**

**'time': three,**

**'name': one,**

**'count': two**

**}**

**data\_ = pd.DataFrame.from\_dict(DATA)**

**st.table(data\_)**

**stat = data\_.groupby('name')['count'].sum()**

**st.table(pd.DataFrame(stat))**

**Downloadmode = st.sidebar.radio(**

**"Download Mode", ('None','Excel', 'CSV'))**

**if Downloadmode=='CSV':**

**csvformat(data\_)**

**st.write('Data is written successfully to csv File.')**

**elif Downloadmode=='Excel':**

**excelformat(data\_)**

**st.write('Data is written successfully to Excel File.')**

**6. TESTING**

**6.1 Introduction to Testing**

Testing is the process of evaluating a system or its component(s) with the intent to find whether it satisfies the specified requirements or not.

 Testing is executing a system in order to identify any gaps, errors, or missing requirements in contrary to the actual requirements.

**Quality Assurance**

QA includes activities that ensure the implementation of processes, procedures and standards in context to verification of developed software and intended requirements.

**Types of Testing**

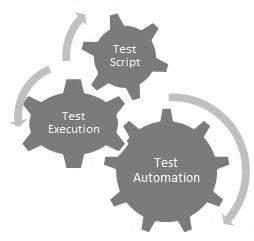
This section describes the different types of testing that may be used to test software during SDLC.

* **Manual Testing**

Manual testing includes testing a software manually, i.e., without using any automated tool or any script. In this type, the tester takes over the role of an end-user and tests the software to identify any unexpected behaviour or bug.

* **Automation Testing**

Automation testing, which is also known as Test Automation, is when the tester writes scripts and uses another software to test the product. This process involves automation of a manual process. Automation Testing is used to re-run the test scenarios that were performed manually, quickly, and repeatedly.



**FIG 10: AUTOMATION TESTING**

**Software Testing Tools**

 The following tools can be used for automation testing:

* HP Quick Test Professional
* Selenium
* IBM Rational Functional Tester
* SilkTest
* TestComplete
* Testing Anywhere
* WinRunner
* LoadRunner
* Visual Studio Test Professional
* WATIR

Levels of testing include different methodologies that can be used while conducting software testing. The main levels of software testing are:

* Functional Testing
* Non-functional Testing

**Functional Testing**

This is a type of black-box testing that is based on the specifications of the software that is to be tested. The application is tested by providing input and then the results are examined that need to conform to the functionality it was intended for. Functional testing of a software is conducted on a complete, integrated system to evaluate the system's compliance with its specified requirements.

There are five steps that are involved while testing an application for functionality.

**Unit Testing**

This type of testing is performed by developers before the setup is handed over to the testing team to formally execute the test cases. Unit testing is performed by the respective developers on the individual units of source code assigned areas.

**Integration Testing**

Integration testing is defined as the testing of combined parts of an application to determine if they function correctly

**System Testing**

System testing tests the system as a whole. Once all the components are integrated, the application as a whole is tested rigorously to see that it meets the specified Quality Standards.

**Regression Testing**

Regression testing is performed to verify that a fixed bug hasn't resulted in another functionality or business rule violation.

**Non-Functional Testing**

This section is based upon testing an application from its non-functional attributes. Non-functional testing involves testing a software from the requirements which are non-functional in nature but important such as performance, security, user interface, etc.

Some of the important and commonly used non-functional testing types are discussed below.

**Performance Testing**

It is mostly used to identify any bottlenecks or performance issues rather than finding bugs in a software.

**Load Testing**

It is a process of testing the behavior of a software by applying maximum load in terms of software accessing and manipulating large input data. It can be done at both normal and peak load conditions.

**Stress Testing**

Stress testing includes testing the behaviour of a software under abnormal conditions. For example, it may include taking away some resources or applying a load beyond the actual load limit.

**Usability Testing**

Usability testing is a black-box technique and is used to identify any error(s) and improvements in the software by observing the users through their usage and operation.In addition to the different definitions of usability, there are some standards and quality models and methods that define usability in the form of attributes and sub-attributes such as ISO-9126, ISO-9241-11, ISO-13407, and IEEE std.610.12, etc.

**Security Testing**

 Security testing involves testing a software in order to identify any flaws and gaps from security and vulnerability point of view.

**Portability Testing**

Portability testing includes testing a software with the aim to ensure its reusability and that it can be moved from another software as well.

Computer hardware, operating systems, and browsers are the major focus of portability testing.

**6.2 Test Cases:**

**TABLE 2**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **S. No** | **Test Case Name** | **Test Case Procedure** | **Expected Result** | **Obtained Result** | **Pass/ Fail** |
| 1 | Item name | Cool Drinks | Should Detect | Detected | **Pass** |
| 2 | Camera module | Turn on Camera, Click the Photo | Photo Should be Captured from Video mode | Photo Captured Lively | **Pass** |
| 3 | Adding Item | Item Name | Item should be Added | Added Successfully | **Pass** |
| 4 | Staff mode | Select the mode | Should land on Staff Mode page | Landed to Staff mode page Successfully | **Pass** |
| 5 | Image Upload | Image File | Uploading | Uploaded | **Pass** |
| 6 | View Inventory | Count of Cool Drinks | Say 10 | Views 10 items | **Pass** |
| 7 | Generate Output Data | Click on store while capturing the image | Should store the data into the database. | Stored in CSV file and Excel file. | **Pass** |

**7. Screenshots**

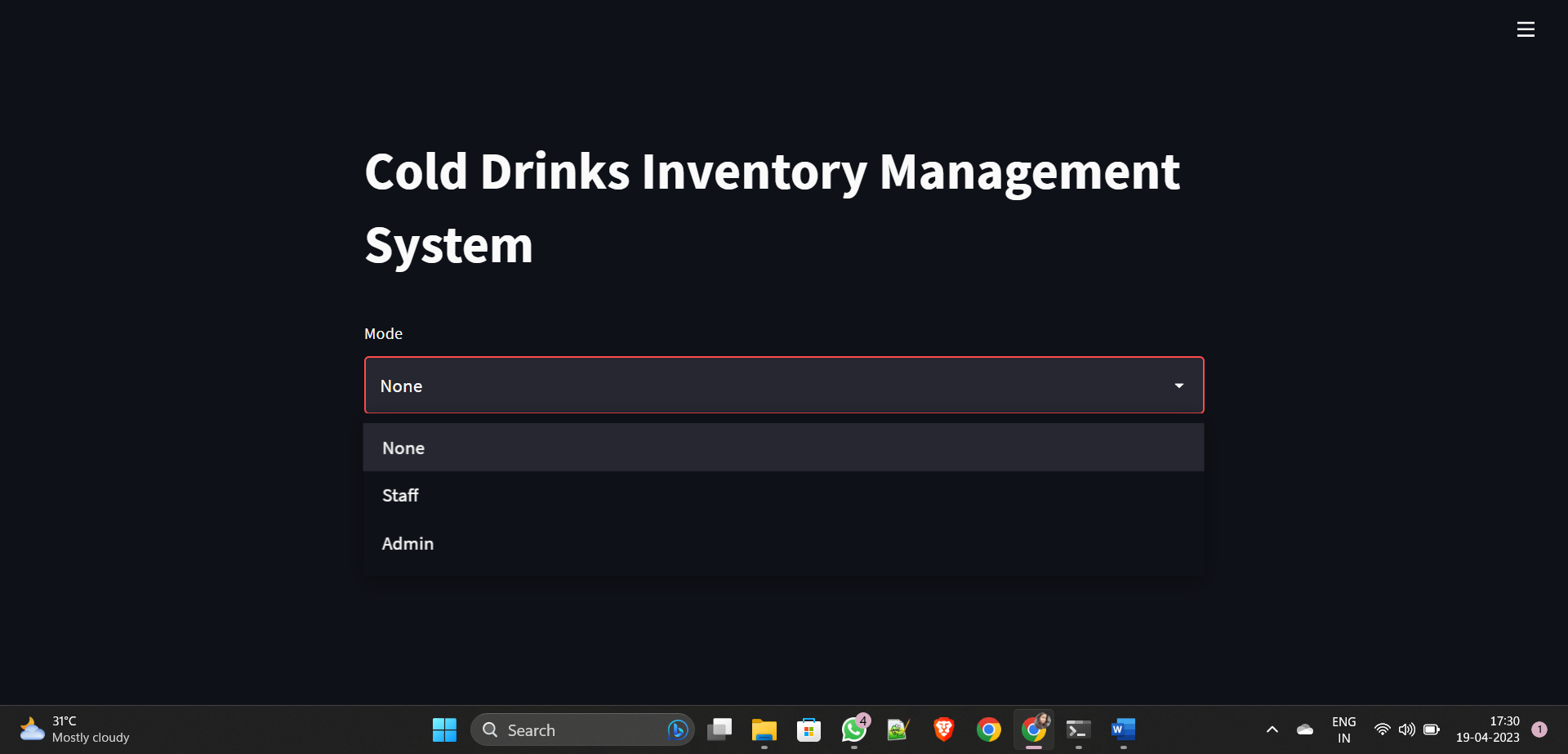


Figure 11: modes of inventory management system

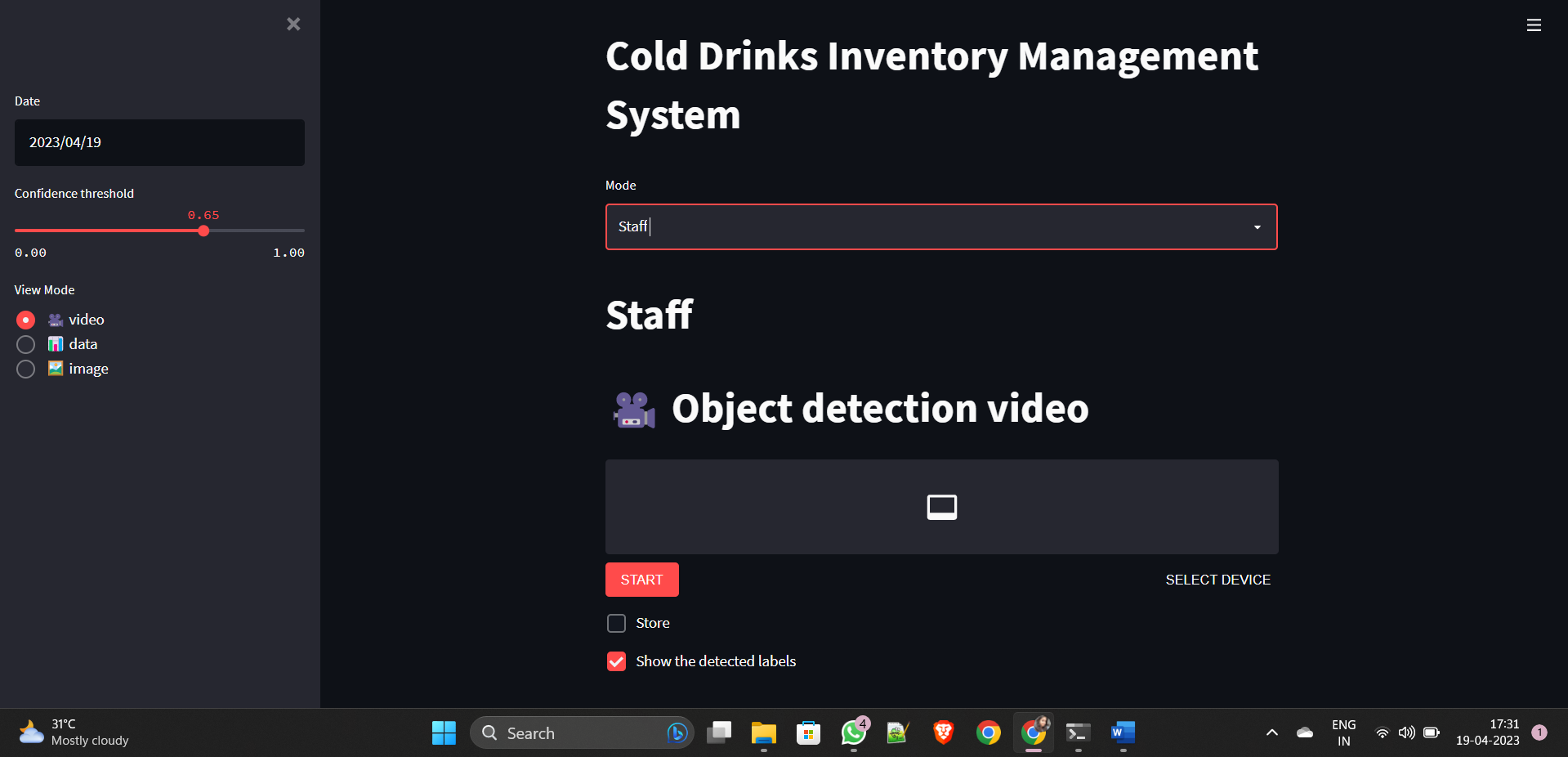


Figure 12: Staff mode for cold drinks management system

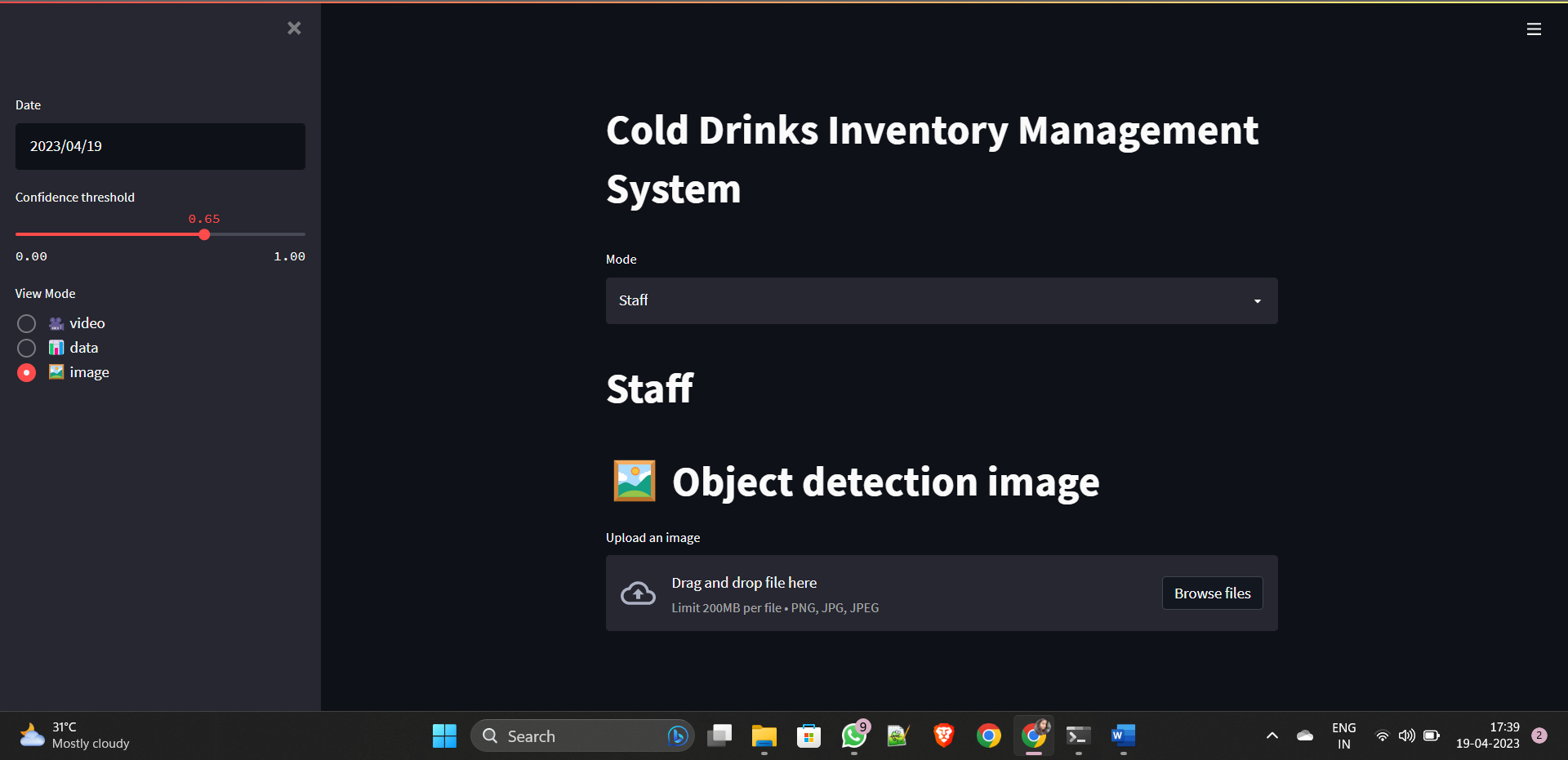


Figure 13 : objection detection

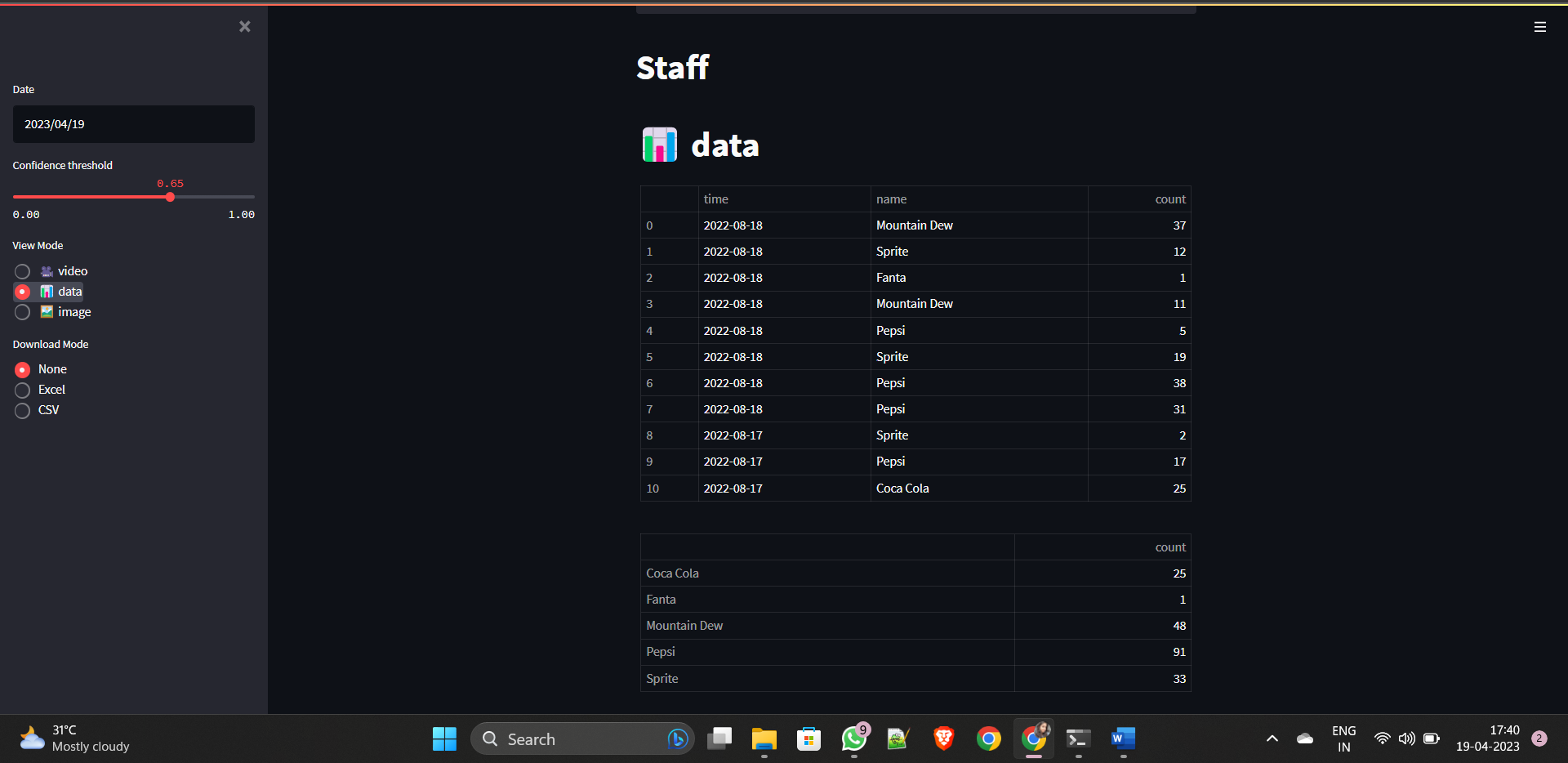


Figure 14 : Data captured for the inventory

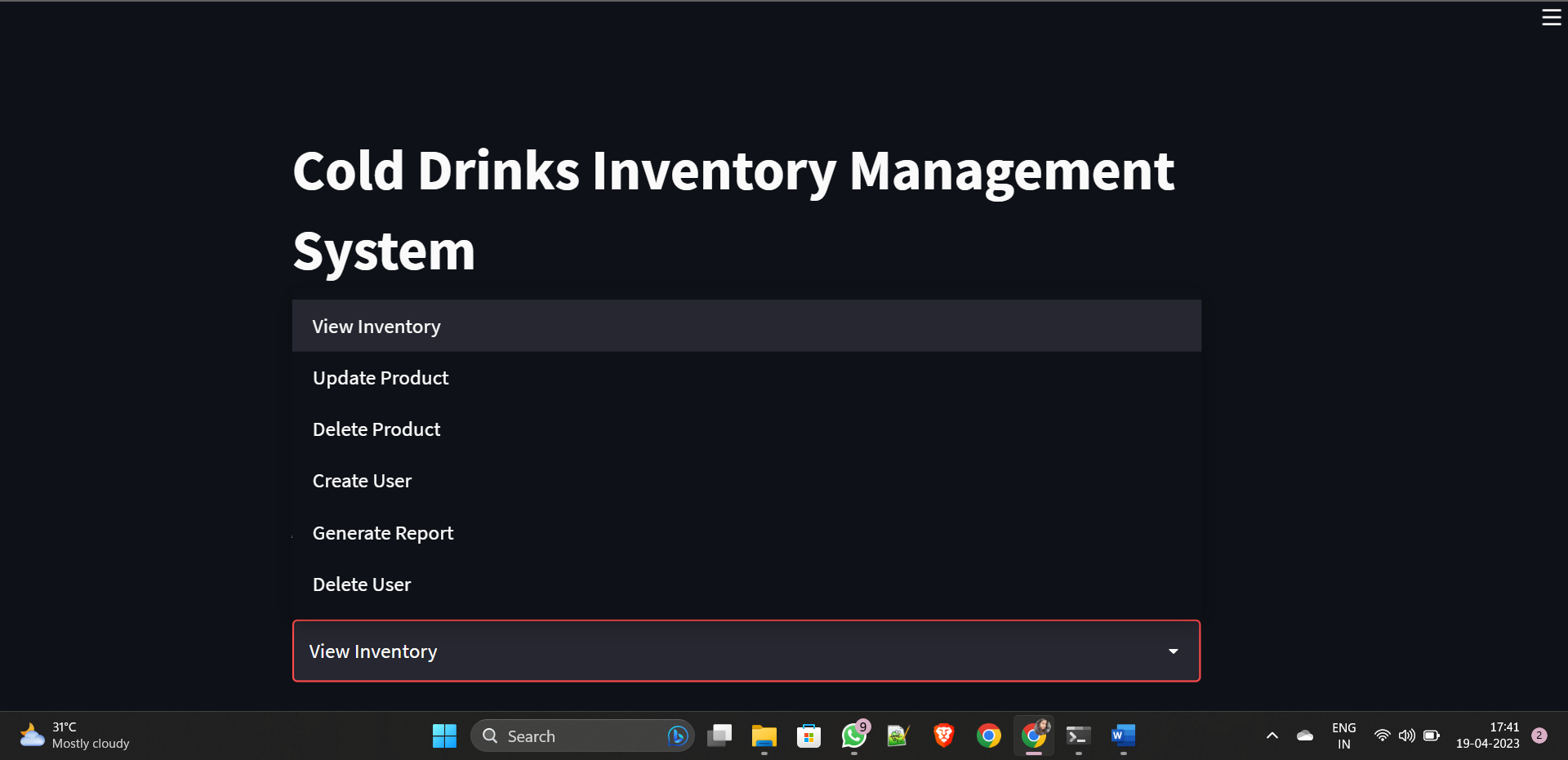


Figure 15: Actions that can be performed on the inventory

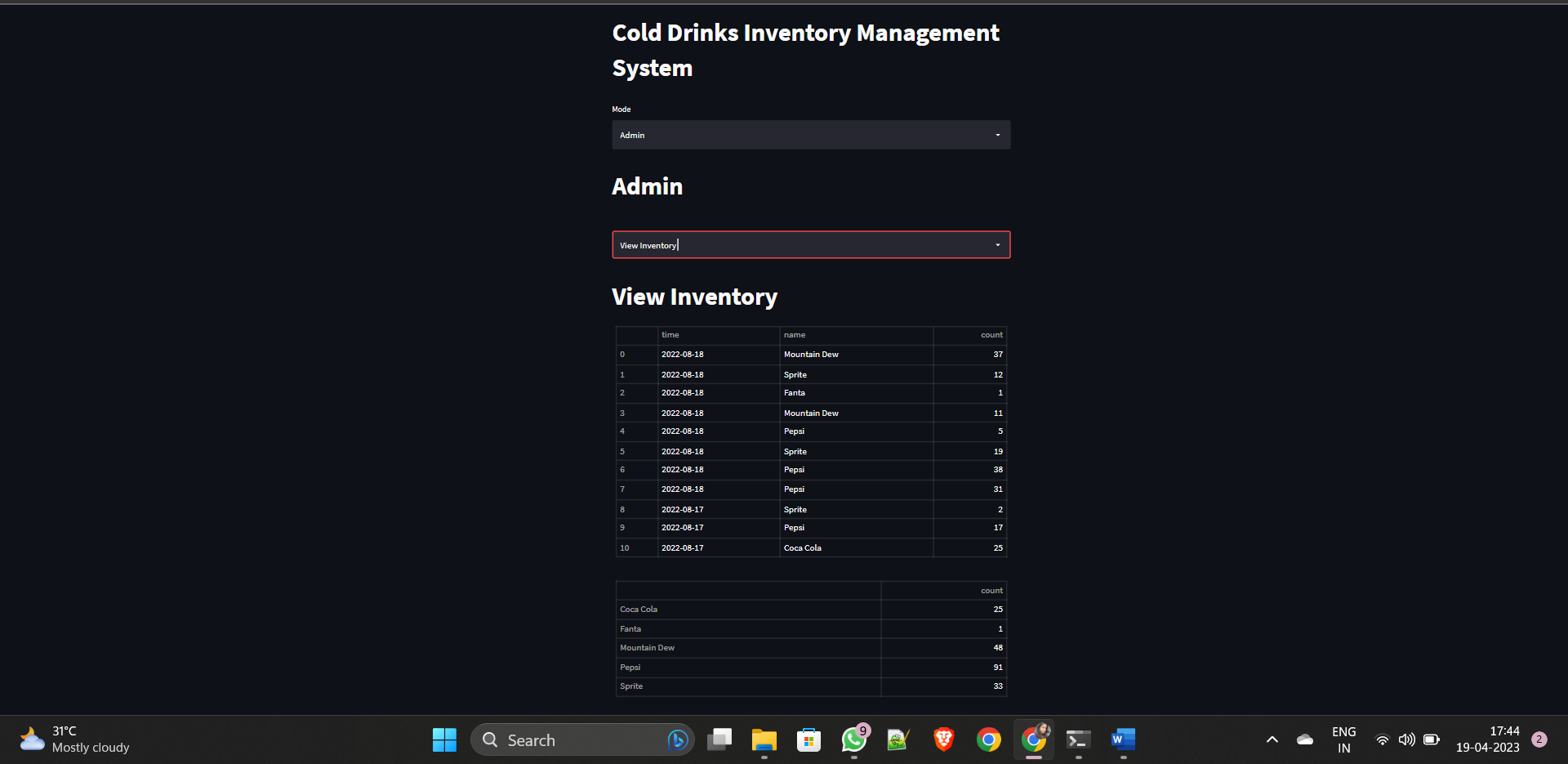


Figure 16 : View Inventory

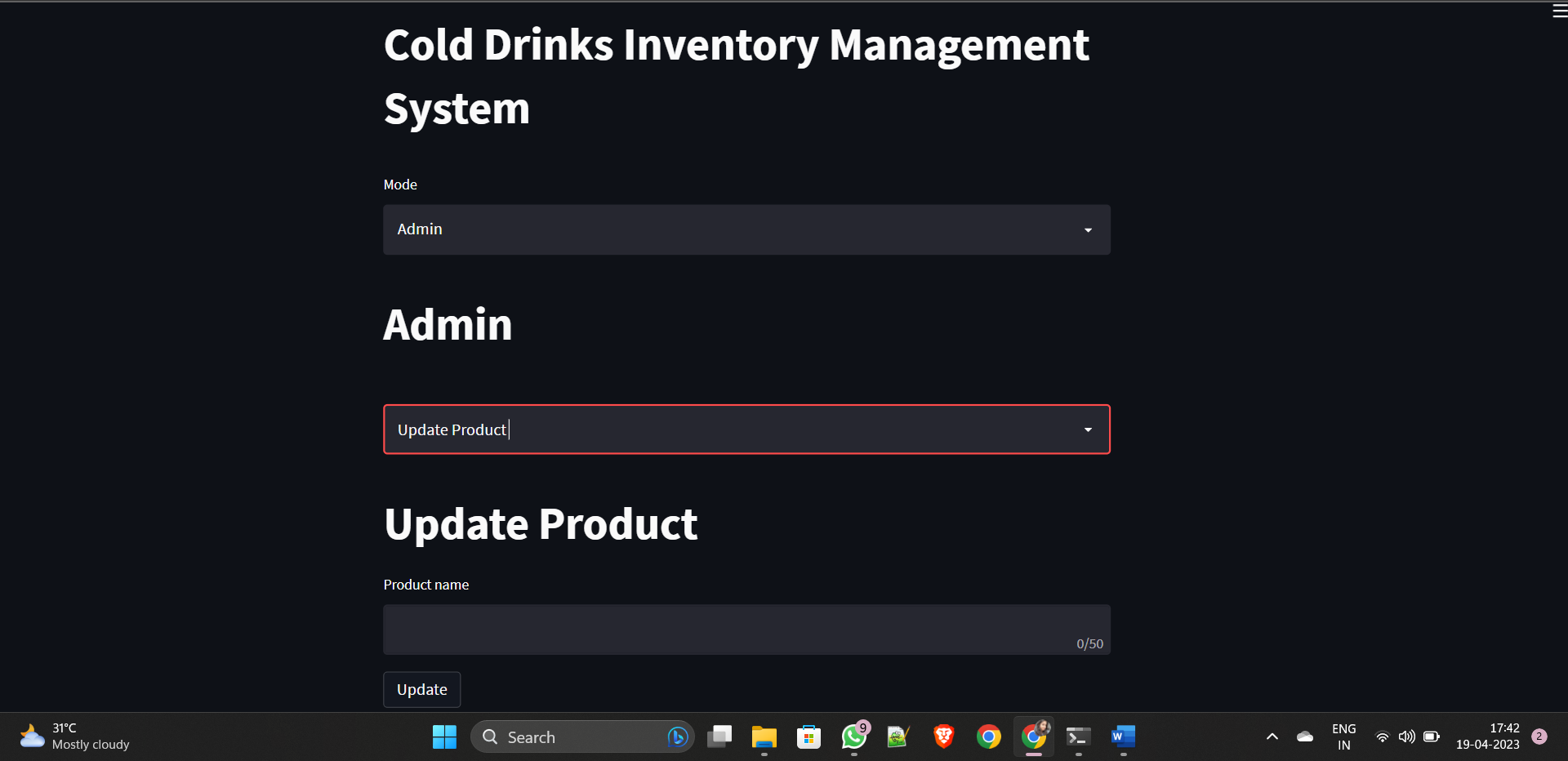


Figure 17: Update Product

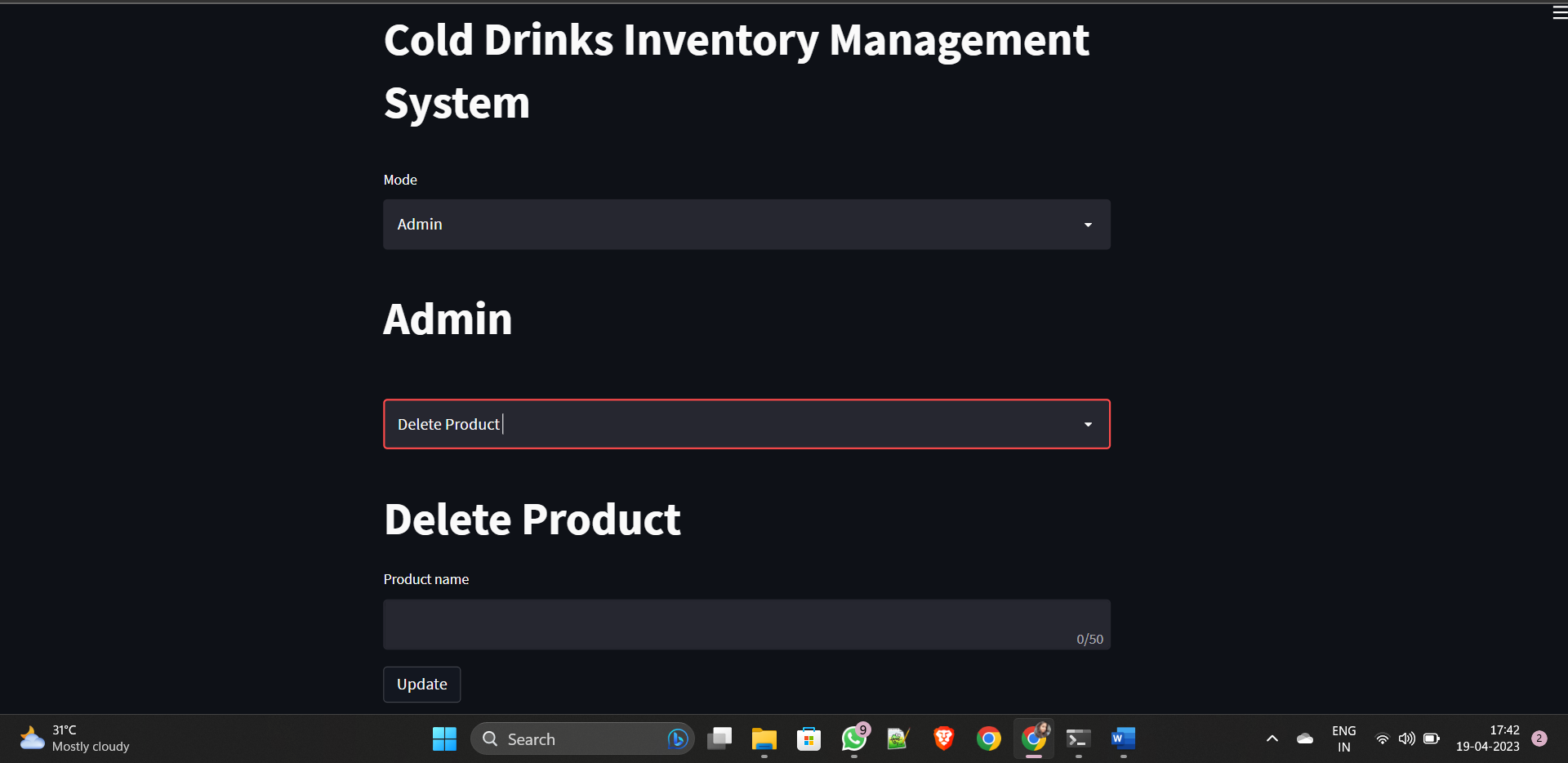


Figure 18 : Delete product

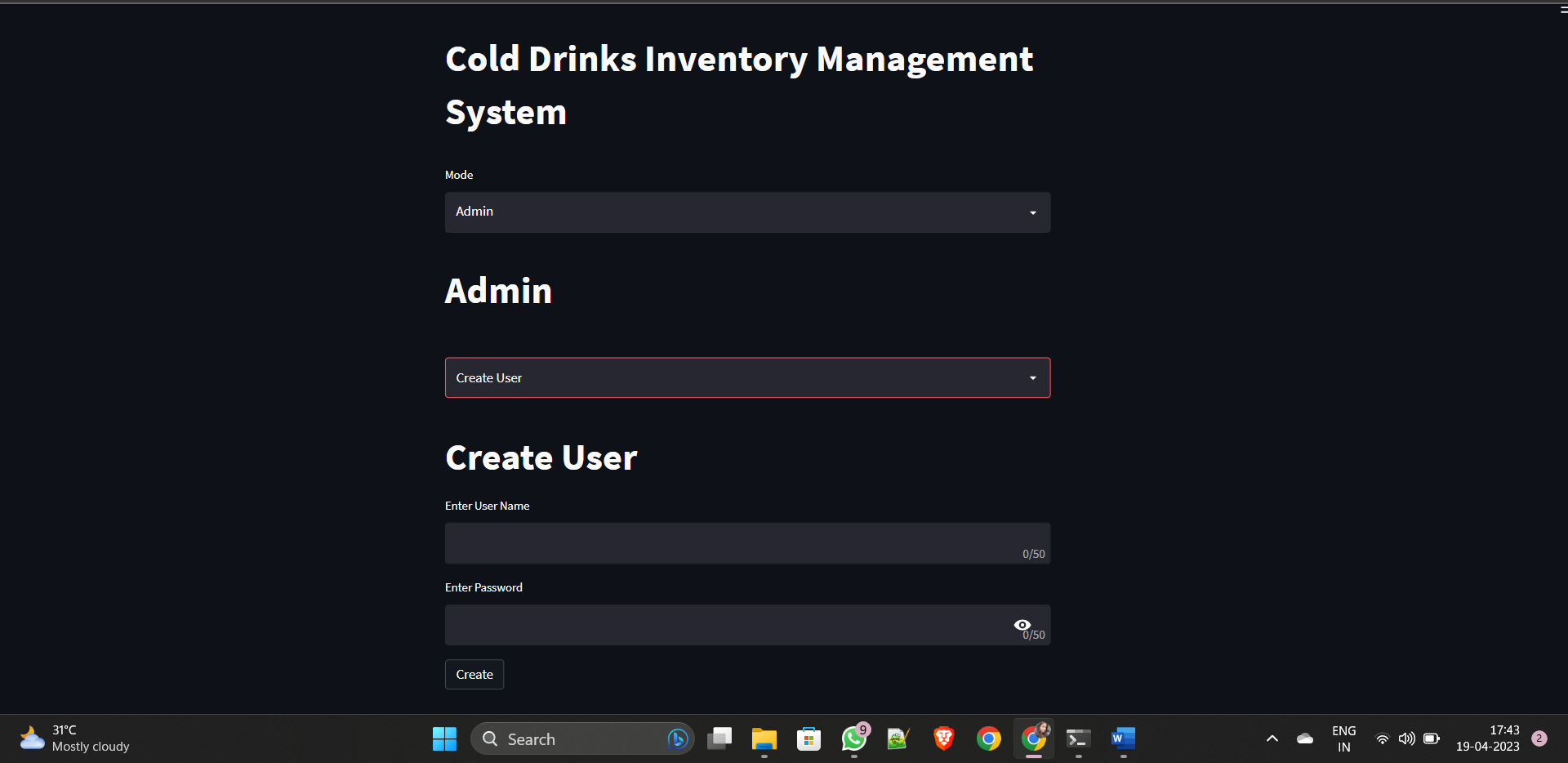


Figure 19: Create User

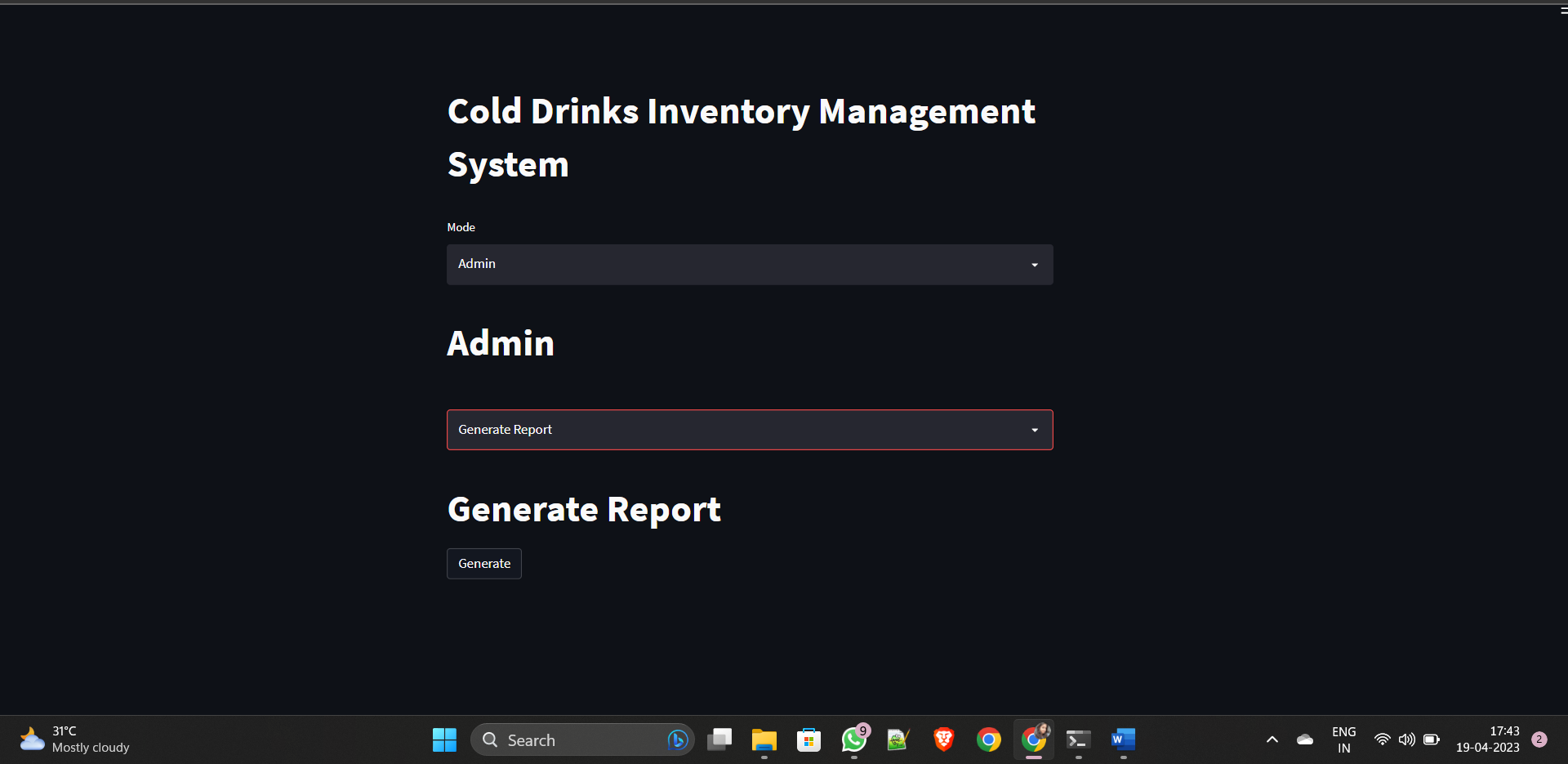


Figure 20: Generate report for the Inventory

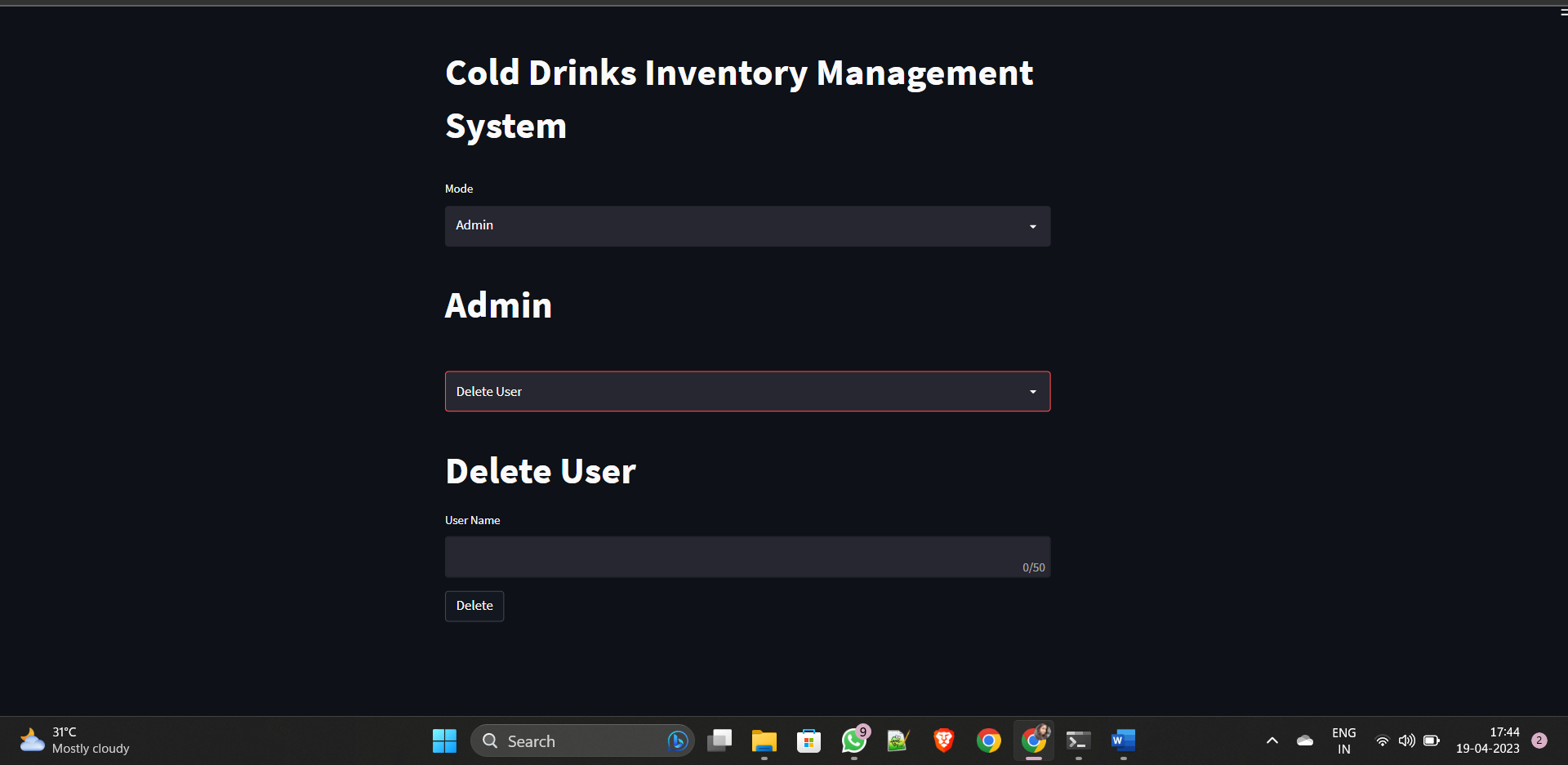


Figure 21: Delete User from the inventory



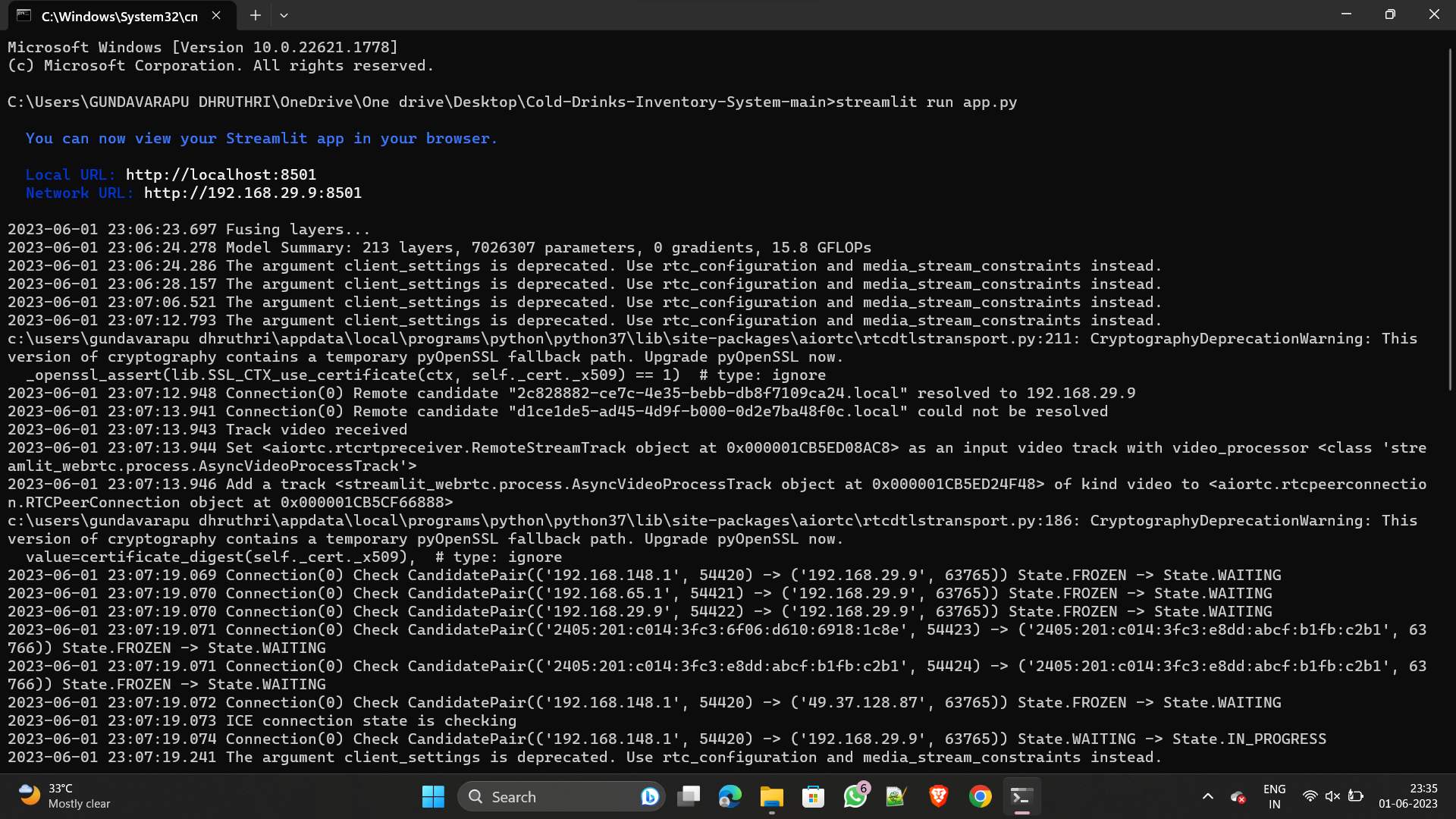
****

Figure 22: Running on Command Prompt

**9. FUTURE ENHANCEMENTS**

An inventory management system plays a vital role in maintaining an optimal stock level, striking a balance between excess inventory and stockouts. Its primary objective is to ensure a seamless supply of materials and stock, guaranteeing uninterrupted production to meet customer demand promptly. By efficiently managing inventory, the system ensures that materials are readily available in sufficient quantities whenever and wherever needed. It eliminates duplication in stock orders, preventing unnecessary excesses or shortages. Moreover, the system helps minimize losses caused by factors such as deterioration, pilferage, wastage, and damages, thereby safeguarding the organization's resources. Through effective monitoring and control, an inventory management system contributes to the overall efficiency, profitability, and customer satisfaction of the business. To achieve these objectives, an inventory management system typically encompasses various functionalities, including:

1. Inventory tracking and monitoring: Accurately recording and updating inventory levels, locations, and movements in real-time.
2. Demand forecasting: Utilizing historical data and predictive analytics to forecast future demand patterns and adjust stock levels accordingly.
3. Reorder management: Automating the reordering process, generating purchase orders, and optimizing order quantities and timings.
4. Vendor management: Managing relationships with suppliers and optimizing procurement processes to ensure timely and reliable stock replenishment.
5. Stock classification and categorization: Classifying inventory items based on their value, demand, and criticality to prioritize management efforts and allocate resources effectively.
6. Data analysis and reporting: Analyzing inventory data to identify trends, optimize inventory levels, and generate meaningful reports for decision-making.

**10. CONCLUSION**

The deep inventory management system for cool drinks, powered by the YOLOv5 model and a web app interface, proves to be a valuable tool for staff members and customers alike. The system efficiently counts and tracks the inventory stock by leveraging the capabilities of deep learning, particularly object detection and recognition. By scanning the cool drink products using a smartphone, the system accurately identifies and counts the items, eliminating the need for manual counting and reducing the risk of human error. For customers, the deep inventory management system enhances their experience by ensuring product availability. By accurately monitoring stock levels, staff members can promptly restock cool drinks, minimizing instances where customers encounter out-of-stock items. This leads to increased customer satisfaction, as they can reliably find their desired cool drinks without inconvenience.

The system's benefits extend to both staff members and customers. Staff members benefit from the system's automation, as it simplifies the inventory management process and saves time. The real-time inventory tracking and stock count features enable staff members to make informed decisions about restocking, minimizing the chances of stockouts or overstocking.

Furthermore, an important observation in the deep inventory management system is that when scanning pictures of cool drinks on the rack, the detection may sometimes fail to identify images in the second row accurately. To overcome this limitation, a practical solution is to arrange the stock of cool drinks diagonally. This arrangement ensures that the web app can effectively count all the images of different types of cool drinks and accurately update the inventory database. By segregating each type of cool drink and providing the count of each detected item, the system provides a comprehensive and reliable inventory management solution. This diagonal arrangement optimizes the scanning process, enhances the accuracy of detection, and ensures that no items are missed during the inventory count.

Overall, the deep inventory management system for cool drinks offers numerous advantages. It improves operational efficiency for staff members, prevents stockouts, reduces errors in inventory management, and enhances the customer experience. By leveraging deep learning technology and the YOLOv5 model, the system provides a reliable and efficient solution for managing inventory stock in the context of cool drinks.

**11 REFERENCES**

* [*https://www.camcode.com/asset-tags/what-is-an-inventory-management-system/*](https://www.camcode.com/asset-tags/what-is-an-inventory-management-system/)
* [*https://www.hindawi.com/journals/wcmc/2021/9969357/*](https://www.hindawi.com/journals/wcmc/2021/9969357/)
* [*https://medium.com/@RemiStudios/artificial-intelligence-for-inventory-management-c8a9c0c2a694*](https://medium.com/@RemiStudios/artificial-intelligence-for-inventory-management-c8a9c0c2a694)
* [*https://addepto.com/blog/inventory-management-using-machine-learning/*](https://addepto.com/blog/inventory-management-using-machine-learning/)
* [*https://www.ijert.org/research/inventory-management-using-machine-learning-IJERTV9IS060661.pdf*](https://www.ijert.org/research/inventory-management-using-machine-learning-IJERTV9IS060661.pdf)
* [*https://ieeexplore.ieee.org/document/9835853*](https://ieeexplore.ieee.org/document/9835853)
* [*https://www.researchgate.net/publication/342529859\_Inventory\_management\_using\_Machine\_Learning*](https://www.researchgate.net/publication/342529859_Inventory_management_using_Machine_Learning)

****