STORE STOCK MANAGEMENT SYSTEM

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Abstract

For small businesses in retail, managing stock effectively is really important. This project introduces a predictive store stock management system designed specifically for retailers. It uses Machine Learning techniques like regression, Decision Tree, Support Vector Regressor, k-Nearest Neighbors, Adaboost, Gradient boost, Xgboost and etc to guess how much stock will be needed in the future and when it will be needed. By looking at past sales, trends in the market, and other factors like seasons or promotions, the system can make pretty accurate predictions. It then gives advice on how much stock to order and when, to avoid running out of items or having too much left over. This system helps small retailers to work smarter, keep customers happy, and make more money in a competitive market.

1. Problem Statement

Small retail businesses need to manage their stock well to satisfy customers and stay competitive. This project introduces a smart system that predicts how much stock will be needed in the future. By looking at past sales and market trends, the system can make accurate guesses. It helps small retailers order the right amount of stock at the right time, so they don't run out or have too much left over. This system aims to make small retailers work smarter, keep customers happy, and earn more money in a tough market.

2. Market Needs

Retailers of all sizes want better ways to manage their stock efficiently and save money. They need smart stock management system that uses Artificial Intelligence and Machine Learning to help them predict what to order, when to order and how much to order so they can aviod running out of stock or having to too much inventory sitting around. the retail world is always changing, with trends and customer preferences shifting all the time. So, there's a big need for solutions that give stores simple advice and insights to keep up with these changes and manage their stock better.

3. Target Specifications and Characterization

3.1 Target Customers:

Our target customers are small retail businesses operating in various industries, including but not limited to:

- **Fashion Retail:** Clothing boutiques, shoe stores, accessory shops.
- **Electronics Retail:** Consumer electronics stores, gadget shops.
- **Grocery and Food Retail:** Local supermarkets, specialty food stores, convenience stores.
- **Home and Lifestyle Retail:** Furniture stores, home decor shops, gift shops.
- **Health and Beauty Retail:** Cosmetics stores, pharmacies, beauty salons.

3.2 Determine Needs and Pain :

Small retail businesses face several common challenges in managing their stock effectively:

- **Inaccurate Demand Forecasting**: Predicting how much of a product customers will buy is tricky for small businesses. Sometimes they order too much, leading to stockouts (running out of stock) or too little, resulting in excess inventory that ties up funds.
- **Manual Inventory Management:** Many small businesses still manage their stock using manual methods like spreadsheets or handwritten records. These methods are prone to mistakes and can be time-consuming.
- **Limited Resources and Expertise:** Small businesses often don't have the money or know-how to invest in advanced inventory management systems. This lack of resources can make it hard for them to keep track of their stock efficiently.
- **Overstocking and Understocking:** Maintaining the right amount of stock is really important for small businesses. If they have too much stuff sitting in their storage, it means they've spent money on things that aren't selling, which could have been used for other important expenses. On the flip side, if they don't have enough of what customers want to buy, they might lose sales or make their customers unhappy because they can't get what they need. It's a bit like walking a tightrope – finding that perfect balance between having just enough stock and not too much or too little can be quite tricky.

3.3 Our system solves these problems by doing the following:

- **Accurate Demand Forecasting:** It uses smart technology (AI and ML) to predict how much stuff stores will need based on past sales and what's happening in the market.
- **Automated Inventory Management:** It takes care of tracking and ordering stock automatically, so stores don't make mistakes and always have the right amount of stuff.
- **Affordability and Scalability:** It's not too expensive and can grow with the store, even if it's small and doesn't have a lot of money.
- **Seasonal Demand Adaptation:** It adjusts to changes in what customers want during different times of the year, so stores don't end up with too much or too little stock.
- **Optimization Algorithms:** It uses fancy math to figure out the best way to manage stock, so stores don't waste money on having too much stuff lying around.

3.4 Understand Technological Proficiency

Even if stores aren't super tech-savvy, our system is made to be simple and easy for everyone to understand. Here's how:

- **Simple Interface:** We made the system easy to use, so stores can manage their stuff without needing a lot of training.
- **Helpful Training:** We'll teach stores how to use all the fancy features, like AI and ML, so they can get the most out of the system.
- **Made Just for You:** We'll make sure the system fits exactly what each store needs, so it's not overwhelming and matches how they like to work.

By addressing the needs and pain points of small retail businesses and providing adequate support and training, we aim to empower them to leverage advanced technologies like AI and ML to enhance their stock management processes and drive business success.

3.5 Optimization of our model

- **Inventory Turnover Analysis:** This is like checking how fast stuff is selling. If things are sitting on shelves for too long without being sold, it costs businesses money. So, they use this analysis to figure out which items aren't selling well and then decide what to do with them, like putting them on sale.
- **Just-in-Time Inventory:** This is a way of managing stock so businesses only have what they need when they need it. It helps them avoid having too much stuff taking up space and costing money. So, they order new stock just in time to meet customer demand.
- **Continuous Monitoring:** Businesses keep an eye on their stock all the time. If they notice that they're running low on something or they have too much of something else, they can take action right away. This helps them keep their stock levels just right without running out or having too much.

3.6 How can we assess their comfort level with such technologies:

Understanding the technological proficiency of small retail businesses is crucial for ensuring the successful adoption and utilization of AI and ML-based solutions. Here's how we can assess their comfort level with such technologies:

1. Conduct surveys or interviews with potential customers to gauge their familiarity with AI and ML technologies.

2. Offer pilot programs or demos of the AI and ML-based stock management system to small businesses.

3. Provide training workshops or webinars on AI and ML concepts tailored to the needs of small retail businesses.

4. Design the AI and ML-based stock management system with a user-friendly interface that minimizes complexity and technical jargon.

4. External Search

- https://retalon.com/blog/inventory-management-problems
- https://www.kaggle.com/code/arshiyakishore/forecasting

5. Applicable Constraints

- **Budget Constraints:**

We have limited money for building the stock management system. So, we'll focus on making the most important parts first and try to save money by using free software and cloud services instead of buying expensive hardware.

- **Hardware Requirements:**

Building smart systems needs powerful computers, which can be costly. To solve this, we'll use cloud services that offer powerful computers when we need them. This way, we don't have to buy lots of expensive hardware upfront.

- **Expertise in AI/ML:**

Making this system needs people who know a lot about technology and data. We'll put together a team of different experts who can help each other. We might also get help from outside experts to make sure we're doing everything right.

- **Data Availability and Quality:**

We need good information to teach the system how to predict stock. We'll work with stores and data companies to get this information. We'll also make sure the data we use is accurate and reliable by checking it carefully.

- **Regulatory and Compliance Requirements:**

We have to follow rules about keeping people's information safe and private. So, we'll use strong security measures to protect any personal data we use. We'll also keep an eye on the rules and make sure we're always following them.

6. Business Model (Monetization Idea)

1. **Subscription Model:**

Think of it like subscribing to a magazine or a streaming service. Retailers pay a regular fee (monthly or yearly) to use our system. The fee might change depending on how big the retailer is or what extra features they want.

2. **Customized Solutions:**

Some retailers might need special help with their inventory. We offer personalized solutions and advice for them, but they pay a bit more because it's tailored to their needs.

3. **Data Insights and Analytics:**

We analyze the data from our system and offer smart tips to retailers on how to manage their stock better. They pay for this extra advice, based on how much insight they want.

4. **Freemium Model:**

We offer a basic version of our system for free. It's like giving out samples at a store. If retailers want more features, they can choose to pay for them.

5. **Training and Support Services:**

Just like how you might get help learning to use a new phone, we offer training and support for retailers to get the most out of our system. They pay a fee for this service.

7. Concept Generation

We're creating a smart system to help stores manage their stuff better. It utilizes advanced data analytics, machine learning algorithms, and real-time monitoring capabilities to forecast future demand, recommend stock replenishment strategies, and minimize stockouts and overstocking issues. This helps stores run smoothly, save money, and make customers happier, no matter how big or small they are

8. Concept Development (Summary of Product/Service will be developed)

Our stock management system is super advanced and helps stores handle their goods in a smart way. It uses fancy tech like data analysis and machine learning to predict what stuff stores will need, keep costs down, and make customers happy.

- **Main Features :-**

Guessing Demand: Our system can figure out how much of each item a store will sell in the future, based on past sales and other info like trends.

Suggesting Reorders: It tells stores when and how much to order, so they don't run out of things or end up with too much.

Keeping Inventory in Check: It helps stores figure out which items aren't selling well, so they can get rid of them and make more room for popular stuff.

Real-Time Warnings: Our system keeps an eye on stock levels and warns stores if they're running low or have too much of something.

- **Benefits :-**

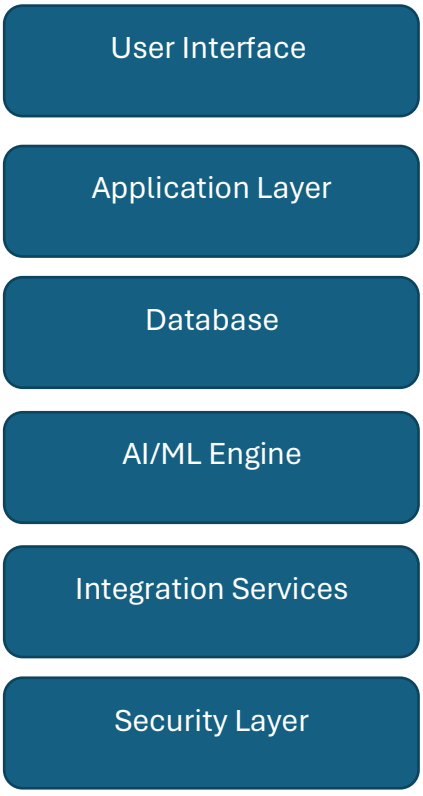
1. **Less Work, More Efficienc**y: It saves stores time and energy by doing a lot of the inventory work automatically, which means fewer mistakes and faster operations.
2. **Save Money:** By helping stores manage their stock better, it cuts down on costs like storing and selling items at a discount.
3. **Happy Customers:** Stores can keep their shelves stocked with what customers want, so they're more likely to come back.
4. **Stay Ahead**: Our system gives stores an edge by helping them make smart decisions based on data and keeping up with what's happening in the market.

- **Target Market :-**

1. Small and medium-sized stores who want to compete with bigger ones.
2. Physical shops looking to keep their shelves full and customers happy.
3. Online stores who want to handle orders better and save on shipping costs.
4. Stores that sell trendy or seasonal items, like clothes or gadgets.

9. Final Product Prototype

Our final product prototype is a state-of-the-art stock management system designed specifically for small retail businesses. It uses smart technology like AI and ML to do a lot of tasks automatically, making it easier for stores to manage their stock and run more smoothly. It's easy to use, can be adjusted to fit different store needs, and gives real-time updates to help stores make smart decisions. It can predict demand, reorder items automatically, organize stock better, and give reports on how things are going. By giving stores helpful tools and saving them time, our system wants to change how stores manage their stock and help them succeed.



- **User Interface (UI):** The part of the system that users interact with, like a website or app.
- **Application Layer:** This is where the smart stuff happens, like predicting sales and managing orders.
- **Database:** Stores all the important data, like what's in stock and what's been sold.
- **AI/ML Engine:** Uses ML Algorithm to analyze data and make predictions about future sales.
- **Integration Services:** Helps the system work with other software that stores might use.
- **Security Layer:** Keeps everything safe and only lets authorized users access the system.

WorkFlow :-

- **Login/Register:** Users sign in or create an account.
- **Dashboard:** Users see important info and shortcuts to key features.
- **Inventory Management:** Users can add or update products and manage stock.
- **Demand Forecasting:** Predicts what items will sell well in the future.
- **Order Management:** Helps users create and track orders automatically.
- **Reporting:** Gives detailed reports on how the store is doing.
- **Settings:** Users can customize the system to fit their needs.
- **Help & Support:** Offers guides and resources for assistance.

Benefits :-

- **Improved Efficiency:** Saves time and reduces mistakes by automating tasks.
- **Optimized Stock Levels:** Keeps just the right amount of stock to meet demand.
- **Data-Driven Insights:** Helps stores make smart decisions based on real-time data.
- **Cost Reduction:** Saves money by avoiding overstocking and wasted storage.
- **Enhanced Customer Satisfaction:** Makes sure customers can always find what they need, keeping them happy and coming back.

10. Product Details :-

- **How Does It Work?**

Step 1: Data Collection

The system gathers information from different places like sales records, inventory lists, and market trends.

Step 2: Data Processing

It cleans up the collected data to fix any mistakes or missing information.

Step 3: Feature Engineering

The system picks out important details from the data that help predict future stock needs.

Step 4: Model Training

Using fancy math (machine learning), the system learns from past data to predict future stock demand.

Step 5: Prediction

Based on what it's learned, the system guesses how much stock will be needed in the future.

Step 6: Recommendations

It suggests the best times and amounts to order more stock to keep everything balanced.

Step 7: Monitoring and Feedback

The system keeps an eye on how things are going and gets better at predicting over time by learning from its mistakes.

- **Data Source**

Sales Records: Transactional data capturing historical sales.

Inventory Records: Information on current stock levels.

Market Trends Data: External data sources providing insights into market trends and consumer behavior.

Seasonal Data: Historical info about how sales change during different times of the year.

Promotional Activity Data: Details about sales and marketing events, like discounts or special offers.

- **Algorithms, Frameworks, Software:-**

Algorithms: Time-series forecasting algorithms (e.g., ARIMA, SARIMA, Prophet), machine learning algorithms for regression and classification (e.g., Random Forest, Gradient Boosting Machines, xgboost).

Frameworks/Software: Python programming language, libraries such as pandas, scikit-learn, and TensorFlow or PyTorch for machine learning tasks, database systems like MySQL or PostgreSQL for data storage.

- **Team Needed to Develop**

Data Scientists: They analyze data, build models, and check if they work well.

Software Engineers: They create the main system, connect it to databases, and make it look nice.

Domain Experts: These are people who know a lot about retail and how stores manage their stuff.

Project Manager: This person makes sure everyone is doing their job and that the project is going as planned.

- **COST**

Development Costs: This includes paying salaries to the team, covering office costs, and buying equipment needed to create the system.

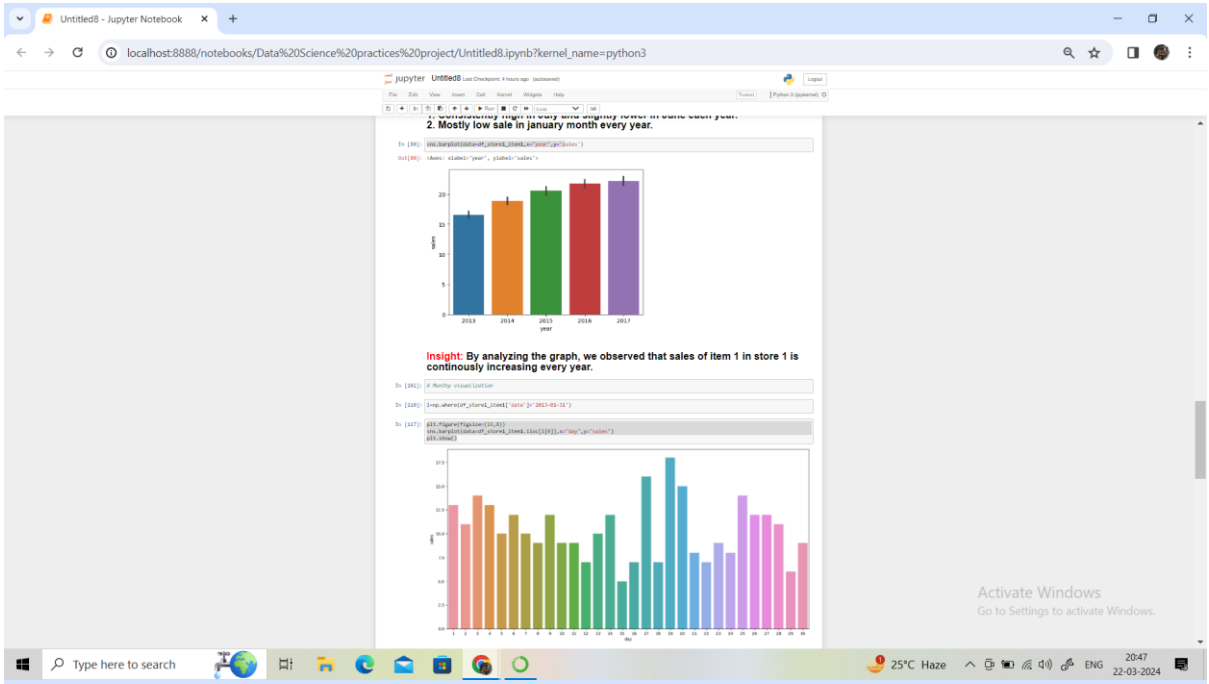
Infrastructure Costs: Money spent on things like computers, software licenses, and cloud services where the system will be stored.

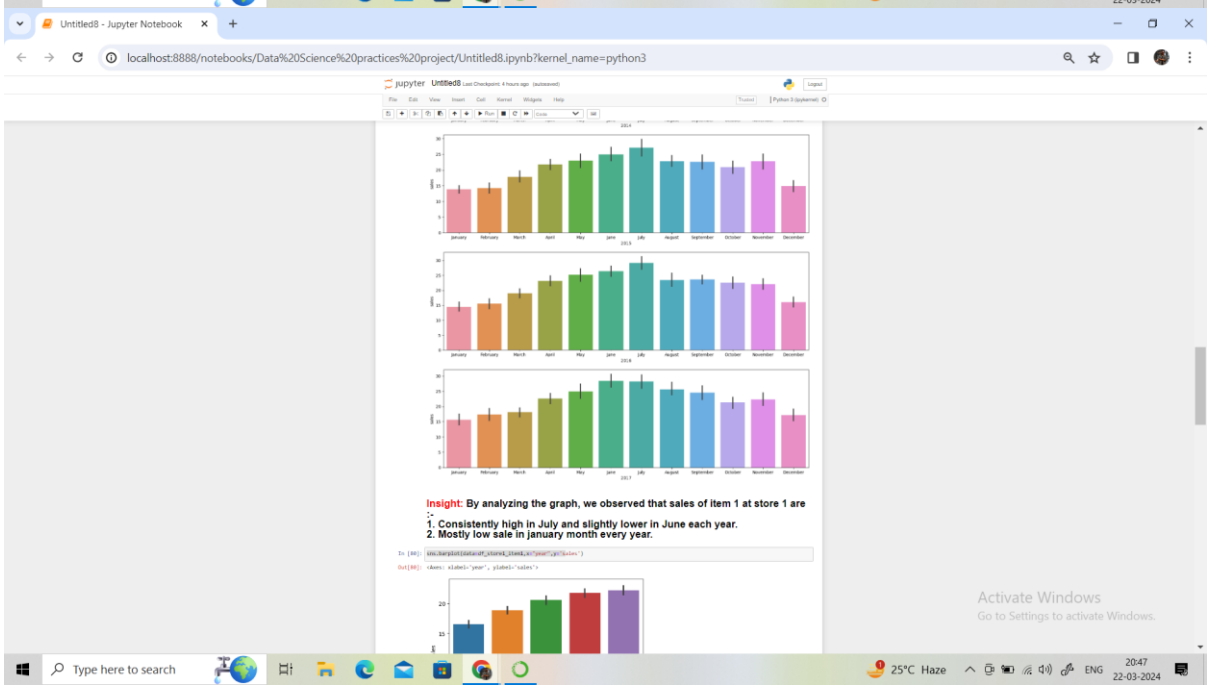
Maintenance Costs: Money needed to keep the system running smoothly after it's been made, like fixing bugs, updating software, and helping users with any problems they have.

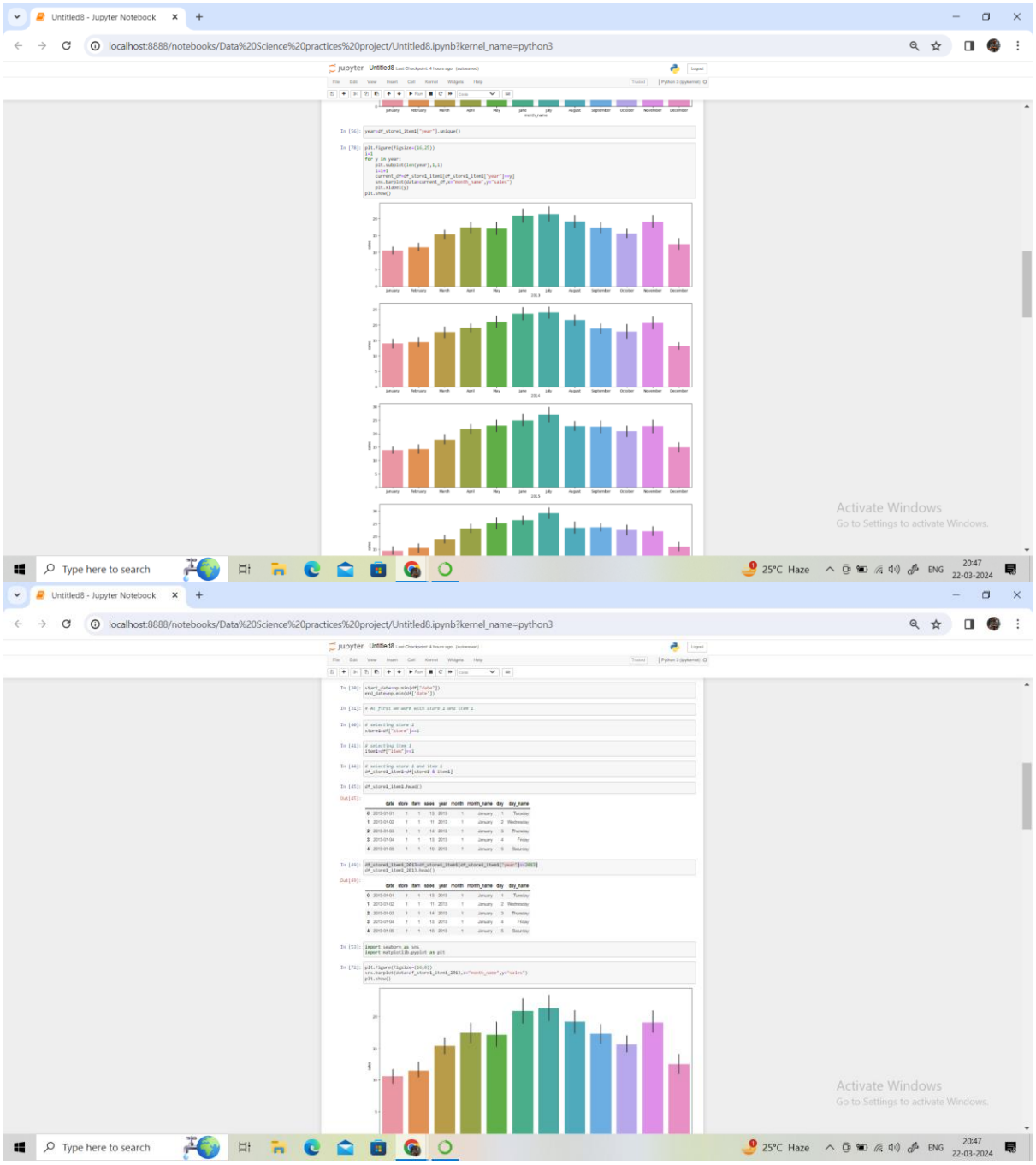
Training Costs: Money spent on teaching people how to use the system properly and how to fix any issues that might come up.

11. Code Implementation :-

- **Screenshots**






Untitled8 - Jupyter Notebook
localhost:8888/notebooks/Data%20Science%20practices%20project/Untitled8.ipynb?kernel_name=python3
jupyter Untitled8
In [56]: year=df_stored_item1["year"].unique()
In [70]: plt.figure(figsize=(16,25))
i=1
for y in year:
plt.subplot(len(year),1,i)
i+=1
current_df=df_stored_item1[df_stored_item1["year"]==y]
sns.barplot(data=current_df,x="month_name",y="sales")
plt.xlabel(y)
plt.show()
January February March April May June July August September October November December
month_name
sales
2013
2014
2015
Activate Windows
Go to Settings to activate Windows.
Type here to search
25°C Haze
ENG
20:47
22-03-2024

Untitled8 - Jupyter Notebook
localhost:8888/notebooks/Data%20Science%20practices%20project/Untitled8.ipynb?kernel_name=python3
jupyter Untitled8
In [30]: start_date=np.min(df["date"])
end_date=np.min(df['date'])
In [31]: # At first we work with store 1 and item 1
In [40]: # selecting store 1
store1=df['store']==1
In [41]: # selecting item 1
item1=df["item"]==1
In [44]: # selecting store 1 and item 1
df_stored_item1=df[store1 & item1]
In [45]: df_stored_item1.head()
Out[45]:
date store item sales year month month_name day day_name
0 2013-01-01 1 1 13 2013 1 January 1 Tuesday
1 2013-01-02 1 1 11 2013 1 January 2 Wednesday
2 2013-01-03 1 1 14 2013 1 January 3 Thursday
3 2013-01-04 1 1 13 2013 1 January 4 Friday
4 2013-01-05 1 1 10 2013 1 January 5 Saturday
In [49]: df_stored_item1_2013=df_stored_item1[df_stored_item1["year"]==2013]
df_stored_item1_2013.head()
Out[49]:
date store item sales year month month_name day day_name
0 2013-01-01 1 1 13 2013 1 January 1 Tuesday
1 2013-01-02 1 1 11 2013 1 January 2 Wednesday
2 2013-01-03 1 1 14 2013 1 January 3 Thursday
3 2013-01-04 1 1 13 2013 1 January 4 Friday
4 2013-01-05 1 1 10 2013 1 January 5 Saturday
In [53]: import seaborn as sns
import matplotlib.pyplot as plt
In [72]: plt.figure(figsize=(16,8))
sns.barplot(data=df_stored_item1_2013,x="month_name",y="sales")
plt.show()
sales
Activate Windows
Go to Settings to activate Windows.
Type here to search
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22-03-2024

- Github link

12. Conclusion

our stock management system is made specifically for small retail stores. It uses smart technology like AI and ML to solve the main problems these stores face with managing their stock. By predicting demand accurately, automating inventory tasks, and using smart math to optimize stock levels, our system makes things easier and cheaper for stores while keeping customers happy.

It's easy to use, can be adjusted to fit each store's needs, and gives real-time updates to help stores make smart decisions. Plus, we offer training and support to make sure every store can use it well, no matter how much they know about technology.

Overall, our system is set to change how small retail stores work, making them more efficient, profitable, and successful in the long run.