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B2B Pharmaceutical Ordering System Using AI

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Abstract

The pharmaceutical B2B ordering system in this project seeks to enhance the supply chain and decision-making by integrating artificial intelligence processes. From the patterns and trends of diseases collected, the system suggests particular drugs and makes forecasts for existing stocks, thus predicting orders and ensuring that they are fulfilled without unnecessary hitches. Demand remains a variable in any business and therefore adaptive learning algorithms equipped with the system facilitate demand forecasting, thereby delivering the appropriate recommendations and ensuring availability of medication at the most appropriate time and location. Due to the advanced features of order management, this system also makes it possible to monitor the phases of order bulk within appropriate time frames and allows users to provide feedback for orders ranging from creation to completion. Besides, a specifically designed insights module also presents important market data and analysis to stakeholders within the organization to support the policy development about the various, and oft changing, needs of the market in healthcare. This type of approach has the additional advantage of improving the supply chain mode and structure with respect to costs while also helping to enhance patient care through improved timelines of delivery of the required medicines. In conclusion, the presented system exploits the existing features of artificial intelligence in the pharmaceutical industry to improve the supply chains, cut costs, and generally improve the health of patients.

Keywords: Pharmaceutical ordering system, Data Collection, Ordering System, Artificial Intelligence, Adaptive Learning

1. Introduction

Pharmacy services are an essential part of healthcare. People have been forced to maintain social distance as a result of the COVID-19 pandemic, hence internet tools are accessible to aid in medication administration. Consider the quarantine guidelines. Several governments have taken steps to prevent the virus. Launch, and online pharmacies are now an exceedingly popular way to purchase proper medication. In Sri Lanka, there are currently very few mobile applications available. Every pharmacy operates autonomously and provides online services. They offer pharmaceutical services to their clients. However, none of them were able to obtain the customer's prescribed drugs in a single location.[1]

Artificial intelligence (AI) is a potent tool that uses human knowledge to accelerate problem resolution. AI algorithms can evaluate vast amounts of biological data, such as proteomics and genomes, to find disease targets and predict how they interact with possible therapies. This enables more concentrated and effective drug discovery, improving the likelihood of successful approval. [2]

In an aging society, it is critical to emphasize the health of the elderly. Medication safety is an important part of the healthcare system. The integration of machine learning and data analysis is crucial for efficient service delivery. This research seeks to create a pharmaceutical management information system for data

analysis and visualization by merging pharmaceutical services and information technology.[3]
Artificial intelligence (AI) is a novel technology used in a wide range of industries, including healthcare. Artificial intelligence has the potential to significantly improve prescription management and patient care in pharmacies. This review focuses on a number of artificial intelligence applications in pharmaceutical practice. The development of AI technologies provides pharmacists with tools and systems to help them make correct, evidence-based healthcare decisions[4]. Pharmacists can utilize artificial intelligence and machine learning to examine patient information such as medical records, lab findings, and medication profiles. This helps discover potential drug-drug interactions, evaluate pharmacological safety and efficacy, and make individualized recommendations.[5]

1.1 Overview

The pharmaceutical supply chain has recently faced a number of challenges, including fluctuating demand, supply disruptions, and the requirement to accurately estimate the delivery of medicines. With rising healthcare demands and shifting disease patterns, pharmaceutical businesses' capacity to adjust quickly and effectively manage their inventory becomes important. Outdated purchasing and inventory systems are often built on static data and require regular human upgrades, reducing their agility and effectiveness. Such limits can lead to recurring stockouts, overstock inventories, and high operational expenses, among other negative repercussions for patient care and supply chain stability.The B2B pharmaceutical ordering system uses artificial intelligence to optimize and speed up the purchasing process for pharmacies and medical practitioners. The system can optimize ordering decisions by analyzing enormous amounts of data, such as inventory levels, order histories, and market trends. This reduces wasteful inventory while ensuring that pharmacies have adequate supply levels.

1.2 Problem Definition

The chain of pharmaceutical providers is challenging in relation to inventory systems and matching the changing requirements, particularly in such regions which are in need of a given medicine due to the prevalence of a disease. The normal systems of ordering do not possess the requisitecapacity and experience needed to project such shifts, leading to under-supply, over-stocking and high operating losses. This document addresses the problem of more effective and faster B2B ordering system featuring artificial intelligence based drug recommendations, inventory control and order placement and fulfillment with regard to actual disease incidence. The purpose of the this system will be making better decisions, cutting down on expenses and improving access to key medicines by means of adaptive learning and demand forecasting.

2. Related Work

In 2024 et.al Ranula Gihara Gamagehave [1] researched PharmaGo, an innovative online pharmacy ordering platform, was created to make medicine ordering easier for pharmacies and medical professionals. PharmaGo provides a smart ordering system that boosts supply chain effectiveness, speeds up inventory management, and guarantees the timely availability of pharmaceuticals by utilizing cutting-edge technology like artificial intelligence and real-time data monitoring. The platform gathers and examines data on area healthcare requirements, demand trends, and disease trends to maximize order fulfillment and offer tailored medication recommendations. Because an adaptive demand forecasting module may anticipate changes and allow for proactive inventory revisions, it lowers the risk of stock shortages or overstocking.
In 2024 et.al Gaurav Agrawal [2] have researched Artificial intelligence (AI) is revolutionizing pharmac-

eutical medicine delivery by improving patient outcomes, productivity, and accuracy. AI-driven technology makes it possible to develop novel delivery systems that are suited to specific requirements, optimize drug formulation, and establish customized prescription schedules. Artificial intelligence (AI) can forecast patient demand, boost supply chain efficiency, and decrease delivery delays with predictive analytics and machine learning, guaranteeing the timely and economical distribution of necessary pharmaceuticals. In addition to tracking patient adherence, AI-powered monitoring devices can anticipate possible side effects, enabling physicians to modify treatment plans beforehand.

In 2023 et.al Songkran Kantawong [3] have explained Novel solutions are required in healthcare services to solve issues of accessibility, efficiency, and safety. Smart e-Public Pharmacy Machine Assistants, powered by cloud-based technologies and AI diagnoses, provide a major advance in the delivery of seamless pharmaceutical services. These innovative technologies enable patients to access crucial medicines and medical advice online, removing the need for in-person visits and reducing exposure risks. By combining AI-powered diagnostics, the devices might deliver personalized prescription recommendations based on symptoms and medical history, ensuring timely and accurate treatment. The ability of cloud-based infrastructure to synchronize data in real time enables medical professionals to remotely monitor and manage patient interactions, prescriptions, and inventories.

In 2022 et.al Eric Kin-Lap Lee [4] have researched The increasing complexity of hospital pharmacy operations needs advanced technology that improve decision-making and patient outcomes. This study describes an intelligent decision-making system for hospital pharmacies that employs advanced artificial intelligence (AI) and machine learning (ML) techniques to enhance medicine administration, inventory control, and prescription accuracy. The system analyzes real-time data from patient records, medicine inventories, and disease patterns to give data-driven insights and personalized treatment recommendations. By assessing historical data and current patient conditions, the AI system may estimate medication requirements, identify potential drug interactions, and streamline the prescription process, ensuring that patients receive the correct medication at the right time.

In 2024 et.al Dr. V. Sesha Bhargavi [5] have explained The increasing complexity of hospital pharmacy operations necessitates innovative technology that improves decision-making and patient outcomes. This paper offers an intelligent decision-making system for hospital pharmacies that employs advanced artificial intelligence (AI) and machine learning (ML) techniques to enhance medicine administration, inventory control, and prescription accuracy. The system provides data-driven insights and personalized treatment recommendations based on real-time data from patient records, prescription inventories, and sickness patterns. By assessing historical data and current patient conditions, the AI system may estimate medication requirements, identify potential drug interactions, and streamline the prescription process, ensuring that patients get the right medication at the right time.

2.1 Challenges

1. Pharmaceutical Supply Chain Challenges

One of the biggest challenges in the pharmaceutical supply chain is demand uncertainty. Forecasting inaccuracies can result in costly and inefficient stockouts or overstocking, as found by Chopra and Meindl (2016). In the pharmaceutical industry, these difficulties are made worse by the intricacy of inventory control, fluctuating demand patterns according to the prevalence of diseases, and regulatory limitations. These issues cannot be adequately addressed by traditional solutions, which mostly rely on static demand models and human processes.

2. Role of Artificial Intelligence and Machine Learning

Machine learning and artificial intelligence have been presented as solutions to these difficulties. Zhao et al. (2020) investigated how AI-powered demand forecasting models may better predict drug requirements by analyzing previous sales data, disease outbreaks, and demographic characteristics. Using these technologies, B2B pharmaceutical systems can automatically react to changes in demand, ensuring that the right number of prescription drugs are ordered and delivered on time. Wu et al. (2019) investigated in greater depth how machine learning models may detect stockouts and increase inventory levels, resulting in decreased operational costs and consistent medicine supply.

2.2 System Architecture

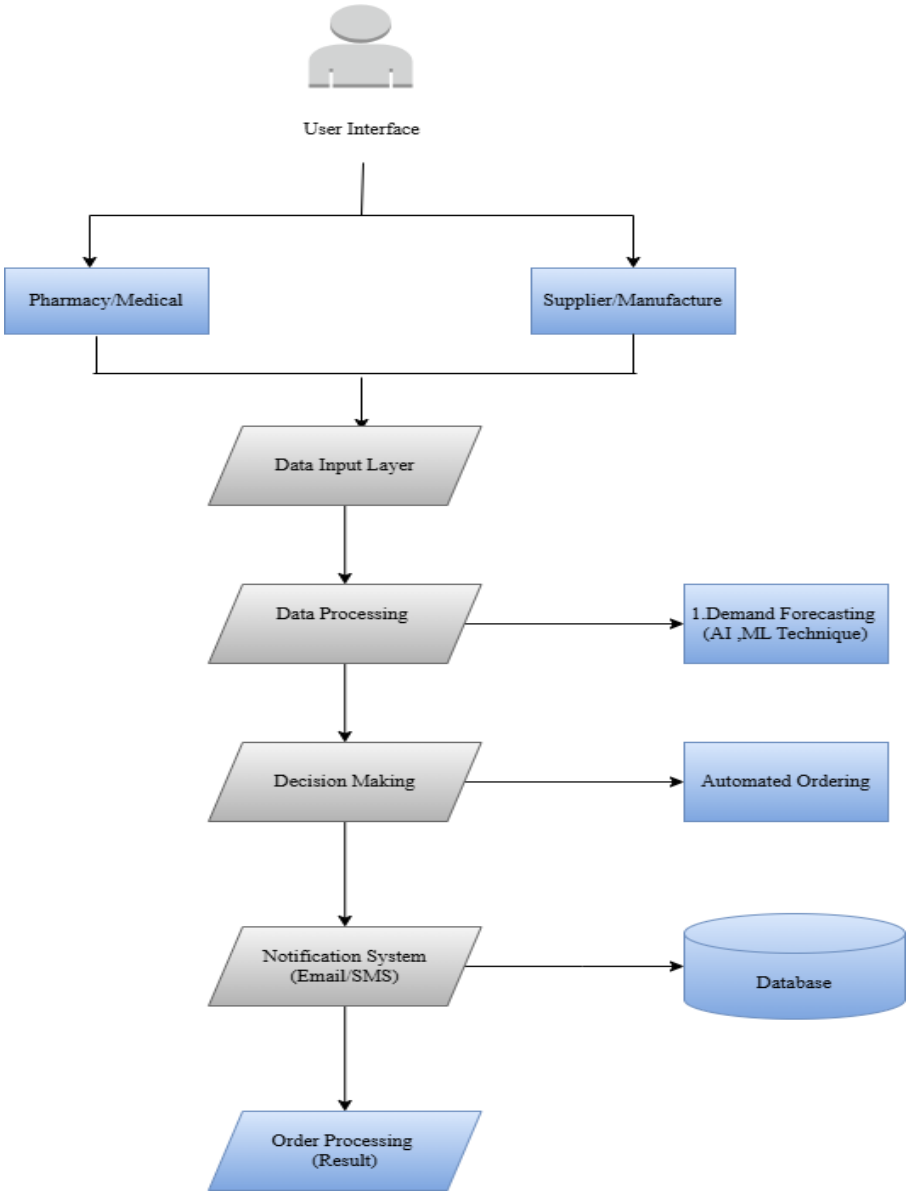

Fig 1: System Architecture

User Interface:

- The initial point at which users (pharmacies/medical institutions) connect with the system. Users specify their order details, such as drug names, amounts, and delivery dates.

Data Input Layer:

- The system collects and saves the order information entered by users. This information is critical for further processing and decision-making.

Data Processing:

- The collected order data is processed to extract relevant information like drug demand patterns and historical sales data.

Demand Forecasting (AI/ML Technique):

- The algorithm uses historical data and current trends to forecast future demand for specific medications. This forecasting assists in optimizing inventory levels and avoiding stockouts or overstocking.

Decision Making:

- The system determines order quantities and supplier selection based on processed data and demand estimates.

Automated Ordering:

- Once the decisions are made, the system automatically generates purchase orders and sends them to the selected suppliers.

Notification System:

- The system sends notifications via email or SMS to relevant stakeholders (users, suppliers) regarding order status updates, shipment confirmations, and delivery notifications.

Order Processing (Result):

- The final step involves tracking the order fulfillment process, from order placement to delivery.
- The system may also generate reports on order performance, delivery times, and supplier performance.

Database:

- The system maintains a database to store all relevant information, including order history, supplier details, product information, and demand forecasts.

3. Merits and Applications

All pharmacies with a valid certification and the distributors with license will be able to access this website.

3.1 Advantages:

- Increase pharmaceutical orders.
- Patients with chronic conditions can order refills.
- Medicines are more accessible for those who are confined to their homes or live far from a drugstore.

3.2 Disadvantage:

- Integrating AI-powered ordering systems with existing inventory, ERP, and supply chain management systems can be challenging.
- To function flawlessly across platforms, these interfaces usually necessitate specialized knowledge, time, and technical adjustments.

3.3 Applications:

With AI advancements, a B2B pharmaceutical ordering system provides up a wealth of innovative applications in the pharmaceutical supply chain. Here are a few significant applications:

Demand Forecasting: AI can anticipate future demand for a range of drugs by analyzing past sales data, seasonality, and health trends. This helps manufacturers and distributors avoid overproduction and stockouts.

Inventory Optimization: The system may adjust inventory levels dynamically by analyzing data from

several sources, such as current order flow, consumption trends, and expiration dates. This reduces waste, especially for drugs with short shelf lives.

Automated Drug Recommendations: To ensure that pharmacies and hospitals have enough pharmaceuticals on hand to meet projected demand, AI can recommend stock levels and medication types based on disease prevalence and regional patterns.

Fraud Detection: By examining purchasing trends and detecting suspicious conduct, such as abnormally large orders or mismatched drug quantities, AI can help to mitigate the risks connected to counterfeit pharmaceuticals and unethical behavior.

Personalized Pricing: AI can assist in developing competitive pricing strategies that provide targeted discounts and incentives based on factors such as demand, market trends, and consumer order history.

Supply Chain Efficiency: AI's ability to manage supplier relationships, enhance delivery routes, and reduce transit times may allow for faster and more cost-effective client deliveries.

Data-Driven Insights: Pharmaceutical companies can use real-time analytics and reporting to help with strategic planning by learning about sales trends, demand by region, and top-performing goods.

Automated Order Processing: AI saves time and lowers human error by streamlining the whole order lifecycle, from receiving and validating orders to starting shipments and handling returns.

Customer Support: Chatbots or virtual assistants driven by AI may help customers around-the-clock, answer questions about the status of their orders, and suggest products based on their past purchases.

Regulatory Compliance: AI can automatically notify stakeholders of changes in legal or licensing requirements, monitor regulatory developments, and verify compliance, particularly with regard to prohibited chemicals.

By guaranteeing that the appropriate drugs arrive at the right locations at the right times, these AI-driven apps improve the agility, accuracy, and efficiency of a business-to-business pharmaceutical ordering system, eventually improving patient care.

4. Conclusion

This strategy allows people to have their drugs and healthcare supplies delivered to their houses. This enables both small and large-scale pharmacies to expand their consumer base and enhance profitability. In an emergency, this technology could help save lives in medical facilities and clinics. It addresses pharmacists' concerns in a quickly evolving industry by improving accuracy, efficiency, and inventory management. AI integration enhances patient care by strengthening supplier connections and shortening the procurement process. Despite the limitations and hurdles that must be addressed, there is still plenty of room for creativity and expansion. As the healthcare industry advances, pharmacies will need to rely on AI-powered solutions to remain competitive and meet the needs of patients and clients.

5. Future Scope:

With the development of AI, B2B medicine ordering system provides numerous new applications in the pharmaceutical industry. Here are some of the key applications:

- **Demand Forecasting:** AI can predict future demand for various medicines by analyzing sales data, luck, and health. This helps manufacturers and suppliers avoid overproduction and stock-outs.
- **Inventory Optimization:** The system can optimize inventory by analyzing data from various sources such as current orders, consumption, and expiration dates. This reduces wastage, especially for medicines with short shelf lives.

- **Automated drug approval:** To ensure pharmacies and hospitals have enough medicines to meet demand, AI can recommend drug levels and types based on disease and regional patterns.
- **Fraud detection:** By reviewing purchase transactions and identifying suspicious behaviors such as large orders or inconsistent prescriptions, intelligence can help reduce the risks associated with counterfeit drugs and illegal practices.
- **Personalized pricing:** AI can help create competitive pricing strategies by offering discount plans and incentives based on demand, market trends, and customer history.
- **Supply Chain Efficiency:** The ability to manage customer relationships, improve supply chains, and reduce lead times can be faster and greatly beneficial for customer delivery.
- **Data-driven insights:** Pharmaceutical companies can use real-time analytics and reporting to help with strategic planning by best understanding sales, demand by region, and product availability. Save time and reduce human error by streamlining the entire order lifecycle, from receiving and approving orders to initiating shipments and returns. Provide assistance, answer questions about legal orders, and recommend products based on previous purchases.

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