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**Assignment Report:** Designing an Intelligent Algorithm to Predict Customer Needs in Delivery Applications

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## **1. Introduction**

Logistics services like food delivery and e-commerce have become fundamental services in contemporary digital economies. The platforms closely depend on artificial intelligence (AI), machine learning (ML), and predictive analytics to enhance customer satisfaction and efficiency of the services. The accurate prediction of the needs of the customers, the time of delivery, and the pattern of demand and optimization of the logistics processes is one of the greatest challenges in the delivery systems.

The recent research suggests that intelligent software is capable of its ability to analyze massive data, such as traffic status, customer actions, order trends, and environmental factors, to give useful predictions that enhance the efficiency of operations. The predictive models also assist the companies to minimize delays, streamline delivery routes, customer satisfaction, and overall quality of services.

This literature review discusses six studies referring to intelligent algorithms and predictive analytics in the context of delivery systems. The review will break down the objectives, methods and findings of each study and then provide the critical analysis of their strengths, and limitations to the same. Lastly, the links among the papers are established to bring out research trends and gaps that are pertinent in developing an intelligent algorithm to predict customer requirements in delivery apps.

## **2. Literature Review of Selected Papers**

### **Paper 1 Efficient Food Delivery Management: Predicting Delivery Times for Improved Customer Experience**

(Kumar & Mishra, 2024)

This paper aims at enhancing the effectiveness of food delivery through forecasting the delivery time with the help of machine learning algorithms. The primary goal of the study is to improve the level of customer satisfaction through decreasing the error of estimating the delivery time. The authors also note that incorrect prediction of delivery may have a negative impact on the trust of the user and the experience of the whole service.

The steps used in the methodology include data preprocessing, feature engineering and exploratory data analysis (EDA) to find the relevant predictors that impact on the delivery time. A number of machine learning models were used, such as Linear Regression, Lasso Regression, Decision Trees, Random Forest, and XGBoost. The grid search CV was used to tune the hyperparameter and enhance the model.

The findings indicated that the ensemble models (Random Forest and XGBoost) had a higher predictive accuracy than the simple regression-based models. The research finds that predictive models should be incorporated into delivery platforms as this will help enhance efficiency and consumer satisfaction.

Nevertheless, the study concentrates on prediction of the delivery time and not on the prediction of the general customer behavior. Also, it is possible that the dataset used does not reflect all the geographic or operational settings.

## **Paper 2 Improving Customer Satisfaction with Predictive Analytics in Logistics and Delivery Systems**

(Yerra, 2024)

This paper discusses the role of using predictive analytics in improving customer satisfaction in logistics and delivery services. The study focuses on how artificial intelligence can be used to predict disruptions in delivery and enhance the efficiency of the supply chain.

The methodology incorporates historical logistics data, GPS tracking information, IoT sensors and ERP systems to create predictive analytics models. These models examine factors like traffic statistics, weather, performance of the vehicle and the demand of the customers.

According to the study, predictive analytics has a great influence on enhancing accuracy of delivery, minimizing operational delays, and allowing customers to update their services in real time. The AI-powered systems also enable the companies to notice anomalies like car breakdowns or disruptions to the supply chain.

The main strong point of this research is the fact that it integrates various sources of information. Nevertheless, the study is conceptual in a few ways and fails to give specific performance comparisons among machine learning models.

## **Paper 3 Designing an AI-Driven Intelligent Vehicle Routing Model for Real-Time Order Picking and Delivery Operations in Food Service Logistics**

(Dutta, Sarddar & Ghosh, 2025)

The paper presents an artificial intelligence-based vehicle routing model that will optimize the order picking and delivery processes. The study will combine real-time information and machine learning to enhance routing in food delivery networks.

The authors use full feature engineering and exploratory data analysis to determine important variables in predicting demand patterns. The models of machine learning were a number of regression based, such as Linear Regression, Ridge Regression, and Support Vector Regression (SVR).

The findings indicate that the combination of predictive demand models and vehicle routing algorithms in the delivery planning and operational efficiency process is enhanced. Nevertheless, the levels of accuracy of the predictive models were rather moderate, which reveals the necessity of some additional optimization.

One of the drawbacks is that the model is primarily concerned with routing optimization and not overall customer behavior prediction.

#### **Paper 4 Optimizing Delivery Time with an Intelligent Forecasting Model: Leveraging AI and Machine Learning for Efficient Logistics**

(Szymański et al., 2024)

This paper explores how data mining, machine learning and visual analytics could help optimize the logistics process and predict delivery time. The researchers emphasize the significance of exploratory data analysis (EDA) in interpreting big data prior to applying the predictive models.

The study highlights that visual analytics and dashboards aid organizations to convert unprocessed data to usable information. Patterns in the delivery operations are detected and logistical outcomes forecasted through machine learning algorithms.

The results indicate that smart forecasting systems can enable companies to track the performance indicators and enhance operational decision-making. Nonetheless, the research is centered primarily on analytics infrastructure and visualization and not on particular algorithm implementations.

#### **Paper 5 Precision Delivery: Machine Learning Algorithms for Real-Time Food Delivery Estimates**

(Geetha Sri et al., 2025)

This study suggests the prediction model of the delivery time in real-time using the sophisticated methods of ensemble learning. The paper combines Google Maps API measurements of traffic and machine learning algorithms to enhance prediction accuracy.

The authors apply the Random Forest, XGBoost, LightGBM, and a Stacking Regressor model. The stacking method is a combination of several models to obtain a good prediction performance.

The outcomes of the evaluation show that the predictions are very accurate with the  $R^2$  at 0.8389. SHAP analysis is also used in the model to explain the importance of features and enhance the transparency of the model.

The primary weakness of the research is that it mainly works on the estimation of delivery time as opposed to customer needs or preferences.

## **Paper 6 AI-Driven Optimization Models for E-Commerce Supply Chain Operations**

(Kaul & Khurana, 2022)

The present paper discusses how artificial intelligence can be used to streamline the supply chain in e-commerce, such as demand forecasting, inventory control, and minimization of delivery time.

The study tells about some of the more developed AI methods like Recurrent Neural Networks (RNNs), Long Short-Term Memory (LSTM) networks, and Transformer models. These are demand forecasting and supply chain optimization models.

The research finds that AI-based systems can help logistics be more efficient and cost-effective in terms of operations. Inventory levels and the delivery routes can also be optimized using reinforcement learning techniques.

Though the article has significant information on AI-based logistics optimization, it is more theoretical and does not include the detailed empirical analysis.

### **3. Critical Analysis of the Selected Papers**

The articles reviewed altogether prove the significance of artificial intelligence and machine learning in providing better delivery systems. The majority of works focus on predictive analytics as a means of determining the time of delivery and ensuring the effective work of logistics processes. Random Forest, XGBoost, regression models, and neural networks are just some of the machine learning tools that are common in the literature.

One of the strong points of the papers reviewed is that they employ data-driven solutions, feature engineering, exploratory data analysis, as well as real-time data integration. These methods allow to make better predictions and work more effectively.

Yet, there are a number of limitations that are noted. To begin with, a significant number of investigations are devoted to prediction of the delivery time and not to the overall customer behavior prediction. Second, not all studies have large-scale real world datasets, and such a limitation may affect the external validity of the findings. Lastly, the problem of integrating predictive models and real-time delivery platforms is not comprehensively discussed in some studies.

### **4. Relationships among the Studies.**

There are a number of similar themes that can be identified in the literature reviewed.

#### **1. Application of Machine Learning Algorithms.**

Machine learning algorithms like random forest, XGBoost as well as regression models are most commonly used in most studies to predict the delivery outcomes.

**2. Relevance of Data Preprocessing and Feature Engineering.**

Preprocessing of the data and feature engineering have been found to be important processes in enhancing the accuracy of the prediction.

**3. Assimilation of Real-Time Data Sources.**

The availability of real time data like traffic data, weather and GPS tracking has a great impact on predictive performance.

**4. Concentrate on Operational Effectiveness and Customer Contentment.**

Every research points out that predictive analytics can lead to the increased performance of delivery and the better customer experience.

Regardless of these similarities, a research gap remains to be closed by coming up with intelligent algorithms that can be used to forecast customer needs, demand patterns, and delivery logistics in a coherent framework.

**5. Summary Table of Reviewed Papers**

| Author           | Year | Methodology                                        | Key Findings                                              | Limitations                               |
|------------------|------|----------------------------------------------------|-----------------------------------------------------------|-------------------------------------------|
| Kumar & Mishra   | 2024 | ML models (Random Forest, XGBoost, Decision Trees) | Improved delivery time prediction                         | Focus limited to delivery time            |
| Yerra            | 2024 | Predictive analytics using logistics data          | Improved customer satisfaction and operational efficiency | Limited technical model comparison        |
| Dutta et al.     | 2025 | AI-based vehicle routing with regression models    | Enhanced routing optimization                             | Moderate prediction accuracy              |
| Szymański et al. | 2024 | Data mining and visual analytics                   | Improved logistics decision-making                        | Focus on analytics rather than algorithms |

|                   |      |                                                      |                                    |                                    |
|-------------------|------|------------------------------------------------------|------------------------------------|------------------------------------|
| Geetha Sri et al. | 2025 | Ensemble learning (XGBoost, Random Forest, LightGBM) | High accuracy delivery prediction  | Limited focus on customer behavior |
| Kaul & Khurana    | 2022 | Neural networks and reinforcement learning           | Improved supply chain optimization | Mostly conceptual discussion       |

## 6. Synthesis of the Literature

The literature reviewed indicates that machine learning technology and predictive analytics are critical in the current delivery systems. The current literatures emphasize mainly on the enhancement of delivery time prediction, route optimization, and logistics efficiency. Nevertheless, there are comparatively fewer research works that cover the greater issue of anticipating customer needs and conduct in the context of delivery apps.

To fill this research gap, future systems are recommended to combine the customer behavior analysis, demand forecasting and delivery optimization in a single smart algorithm. These systems might integrate machine learning models with real-time sources of data in order to offer customized recommendations, improved delivery paths, and precise service forecasts.

The creation of such an integrated approach will improve the performance of the delivery platforms in a major way and it will also increase customer satisfaction.

## References

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