A Machine Learning – Based Study on Customer Satisfaction with Public and Private Transport in Guruvayoor Municipality

Ms. Varsha Das,

MBA student, Faculty of Management Studies, CMS Business School, Bengaluru
Email: varsha_das23@cms.ac.in

Dr. Syed Shahid Raza,

Assistant Professor, Faculty of Management Studies, CMS Business School, Bengaluru
Email: dr.syed_shahidraza@cms.ac.in

ABSTRACT

Transportation systems play a crucial role in urban development, impacting accessibility, convenience, and economic efficiency. This study applies machine learning techniques to analyze customer satisfaction with public and private transportation in Guruvayoor Municipality. Using a structured survey and data collected from 260 respondents, key satisfaction factors such as service quality, affordability, availability, and digital integration were evaluated.

Machine learning models, including regression and classification algorithms, were applied to predict satisfaction levels and identify key factors influencing passenger experience. The study found that public transport is more affordable but struggles with inconsistent schedules, overcrowding, and lack of digital services. Private transportation, on the other hand, offers greater flexibility but at a higher cost.

The research highlights the benefits of predictive analytics in optimizing transport services, enhancing user satisfaction, and improving operational efficiency. The study also discusses the potential for integrating AI-driven solutions such as real-time tracking, demand forecasting, and personalized commuting experiences.

INTRODUCTION

About the Topic:

Guruvayoor Municipality, a major pilgrimage center in Kerala, requires a robust transportation system to cater to local commuters and tourists. Public transportation, managed by Kerala State Road Transport Corporation (KSRTC), ensures affordability, while private operators provide greater convenience. With the rise of digital advancements, the adoption of machine learning in transport analysis enables accurate predictions and better policy recommendations.

Problem statement

Despite the availability of both public and private transport services, passengers face issues such as inefficiency, affordability concerns, and inconsistent schedules. This study seeks to answer:

1. How do machine learning models help analyze and predict customer satisfaction?
2. What are the major factors influencing commuter preferences?
3. How can public and private transport services be improved using predictive analytics?

Review of literature

- **Dr. Indu Vijayan (2018)** – *Fare Policies: KSRTC vs Karnataka RTC*

Findings: Inefficiencies in fare revisions affected affordability and service reliability.

- **Vini M.S & Sreekrishnan P (2017)** – *Financial Performance of KSRTC*

Findings: Rising costs and inefficient scheduling led to financial struggles and lower passenger satisfaction.

- **Dr. K. Saravana (2016)** – *Passenger Satisfaction in KSRTC*

Findings: Fare, punctuality, service availability, comfort, concessional rates, and staff behavior influenced satisfaction.

- **Centre for Public Policy Research (2016)** – *Public & Private Transport Challenges*

Findings: Regulatory restrictions on private buses caused inefficiencies and impacted commuter satisfaction.

- **Singh, R. & Sharma, A. (2015)** – *Passenger Satisfaction in Indian Transport*

Findings: Punctuality, frequency, cleanliness, and staff behavior were key factors, with punctuality being the top priority.

- **Nair, S. & Menon, R. (2017)** – *Public vs Private Transport in Kerala*

Findings: Private buses were more flexible; public buses ensured safety and concessional fares.

- **Gupta, P. et al. (2015)** – *Technology in Public Transport*

Findings: GPS, mobile ticketing, and smart cards improved efficiency and convenience.

Research Gaps

While prior studies have focused on public transport efficiency and commuter preferences, little research exists on smaller pilgrimage towns like Guruvayoor. This study bridges the gap by conducting a comparative analysis of public and private transport services in the town.

RESEARCH METHODOLOGY

Scope of the Study: The study investigates customer satisfaction with public and private transportation services in Guruvayoor Municipality.

Objectives:

1. To assess overall customer satisfaction with public and private transportation.

2. To analyze the impact of modern technologies on transportation experiences.

3. To identify key service quality attributes affecting commuter satisfaction.

Hypotheses:

- H1: There is a significant difference in customer satisfaction between public and private transportation.

- H2: Adoption of modern technologies positively impacts customer satisfaction.

- H3: Service quality attributes (reliability, affordability, accessibility, safety) significantly influence customer satisfaction.

Research Design: A descriptive research approach was used. Primary data was collected through structured surveys from 260 respondents using purposive sampling. Secondary data was obtained from journals and government reports.

Data Analysis Tools:

- **Descriptive Analysis:** Mean values, percentages, and graphical representations.

- **Comparative Analysis:** Public vs. private transport service quality attributes.

- **Hypothesis Testing:** Annova, Random Forest Classifier, and Multiple Linear Regression

DATA ANALYSIS AND INTERPRETATION

Key Findings

- **Demographics**: 55% of respondents were male, 45% female, with the majority aged 20-30 years.

- **Commuting Patterns**: 24% always used buses for daily travel.

- **Customer Satisfaction Factors**:

  - 45% found public transport comfortable, but overcrowding was a significant issue.

  - 31% supported digital display systems for bus schedules.

  - 52% stated that online payment methods were available.

- **Service Attributes**:

  - Reliability (47%) and affordability (45%) were the highest-rated factors.

  - 21% rated bus conductors' behavior as good, while 24% suggested poor.

- **Machine Learning Model Results**:

  - Random Forest Classifier accuracy achieved 75% the model predicts customer satisfaction based on technology adoption showed higher technology adoption leads to higher satisfaction among respondents. (H2)

  - Annova in H1 indicates the p-value (0.000001) < 0.05, we reject the null hypothesis. This means there is a statistically significant difference in customer satisfaction between public and private transport in Guruvayoor Municipality.

  - Multiple Linear Regression (H3) says there is a statistically significant difference in customer satisfaction between public and private transport in Guruvayoor Municipality.

FINDINGS AND RECOMMENDATIONS

Theoretical Implications:

- The study confirms that **reliability, responsiveness, and affordability** are key service quality attributes affecting customer satisfaction, aligning with the **SERVQUAL model.**

- **Technology Adoption Model (Davis, 1989)** supports findings that passengers prefer digital solutions like online payments and real-time tracking.

Managerial Implications:

1. **Improving Service Reliability and Scheduling:**

   - Introduce **GPS-based tracking systems** for real-time updates.

   - Increase bus frequency during peak hours.

2. **Enhancing Passenger Comfort and Safety:**

   - Improve **seating conditions, ventilation, and cleanliness.**

- Install **adequate lighting and security features** at bus stops.

3. **Technology Integration:**

- Implement **QR code payments, mobile wallets, and smart travel cards.**

4. **Customer Service Training:**

- Conduct **staff training programs** to improve professionalism and passenger interactions.

Limitations of the Study

- Small sample size limited to 260 respondents, affecting generalizability.

- Geographic scope focused only on Guruvayoor Municipality.

- Potential response bias from socially desirable answers.

CONCLUSION

This study highlights the need for improvements in public transportation service quality. While public transport remains affordable, challenges such as overcrowding, unreliable schedules, and limited digital infrastructure reduce commuter satisfaction. Private transportation offers greater flexibility but at a higher cost. Public and private transportation services in Guruvayoor Municipality play a crucial role in daily commuting, affecting both residents and visitors.

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