

Rajarajeswari College Of Engineering

Department Of Information Science and Engineering

TECHNICAL SEMINAR ON



**REVOLUTIONIZING PUBLIC TRANSIT: AN AI POWERED
SOLUTION FOR CROWD MANAGEMENT ON BMTC BUSES**

THEME : SMART VEHICLE

UNDER THE GUIDANCE OF
Prof Rathidevi.T
Assisstant Professor,Dep of ISE

Presented By
Thanush.P
1RR20IS043
Dep of ISE, RRCE

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ABSTRACT

The Bangalore Metropolitan Transport Corporation (BMTC) faces challenges in managing crowds and ensuring efficient public transit services. To address this, we propose an AI-powered solution for crowd management on BMTC buses. Our system leverages real-time data and AI algorithms to predict crowd density on buses and optimize routes accordingly. This solution aims to improve passenger experience, reduce overcrowding, and enhance overall efficiency of the BMTC bus system.



INTRODUCTION

Public transit systems are the lifelines of urban centers, connecting people to their destinations efficiently. However, overcrowding on buses, especially during peak hours, has been a persistent challenge for many cities, including Bangalore. To address this issue, we propose an innovative solution leveraging Artificial Intelligence (AI) to revolutionize crowd management on BMTC buses.

Our AI-powered system utilizes real-time data and predictive analytics to optimize bus routes, schedules, and capacity management. By accurately predicting demand and adjusting services accordingly, we aim to enhance the commuter experience, reduce congestion, and improve overall efficiency of the BMTC bus network through AI human count sensors.

Problem Statement

Overcrowding on Bmte buses in Bangalore negatively impacts safety, comfort and Efficiency

1. Lack of real-time crowd density monitoring.
2. Absence of efficient data transmission to the BMTC office.
3. Insufficient measures for ensuring passenger safety and comfort.
4. Need for improving the welfare of BMTC employees.



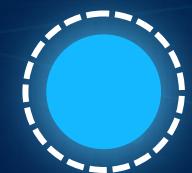
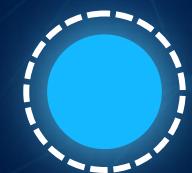
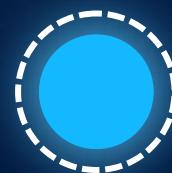
DEATHS IN ACCIDENTS INVOLVING BMTC BUSES TOUCHES **156** AND KSRTC 53 BETWEEN 2019 TO 2023, ACCORDING TO BENGALURU TRAFFIC POLICE DATA. THE NUMBER OF INJURED IS **413** IN ACCIDENTS CAUSED BY BMTC BUSES



**BMTC CREW FAIL TO FOLLOW PASSENGER SAFETY NORMS;
BUSES KEEP DOORS OPEN. THE BMTC SHOULD ADD MORE
BUSES TO RESOLVE CROWDING ISSUES WHILE THE SAFETY OF
PASSENGERS MUST BE PRIORITISED.”**

OBJECTIVES

An AI-powered sensor-based prototype solution has been developed to manage crowds on BMTC buses."



CROWD DENSITY MONITORING

- Utilizes AI and sensor technology.
- Helps optimize bus routes and schedules.
- Enhances commuter safety and comfort.
- Improves efficiency of BMTC bus network.

DATA TRANSMISSION TO BMTC OFFICE

- Current data transmission methods to BMTC office are inefficient.
- Lack of real-time data hinders effective crowd management.
- Improved data transmission needed for better bus scheduling and route optimization.
- Enhanced data flow can lead to more accurate passenger information and service updates.

BENEFITS FOR PASSENGERS AND BMTC

- Improved comfort and safety due to better crowd management.
- Reduced wait times and more reliable schedules.
- Increased efficiency and capacity utilization of buses.
- Real-time data for route optimization and service planning.

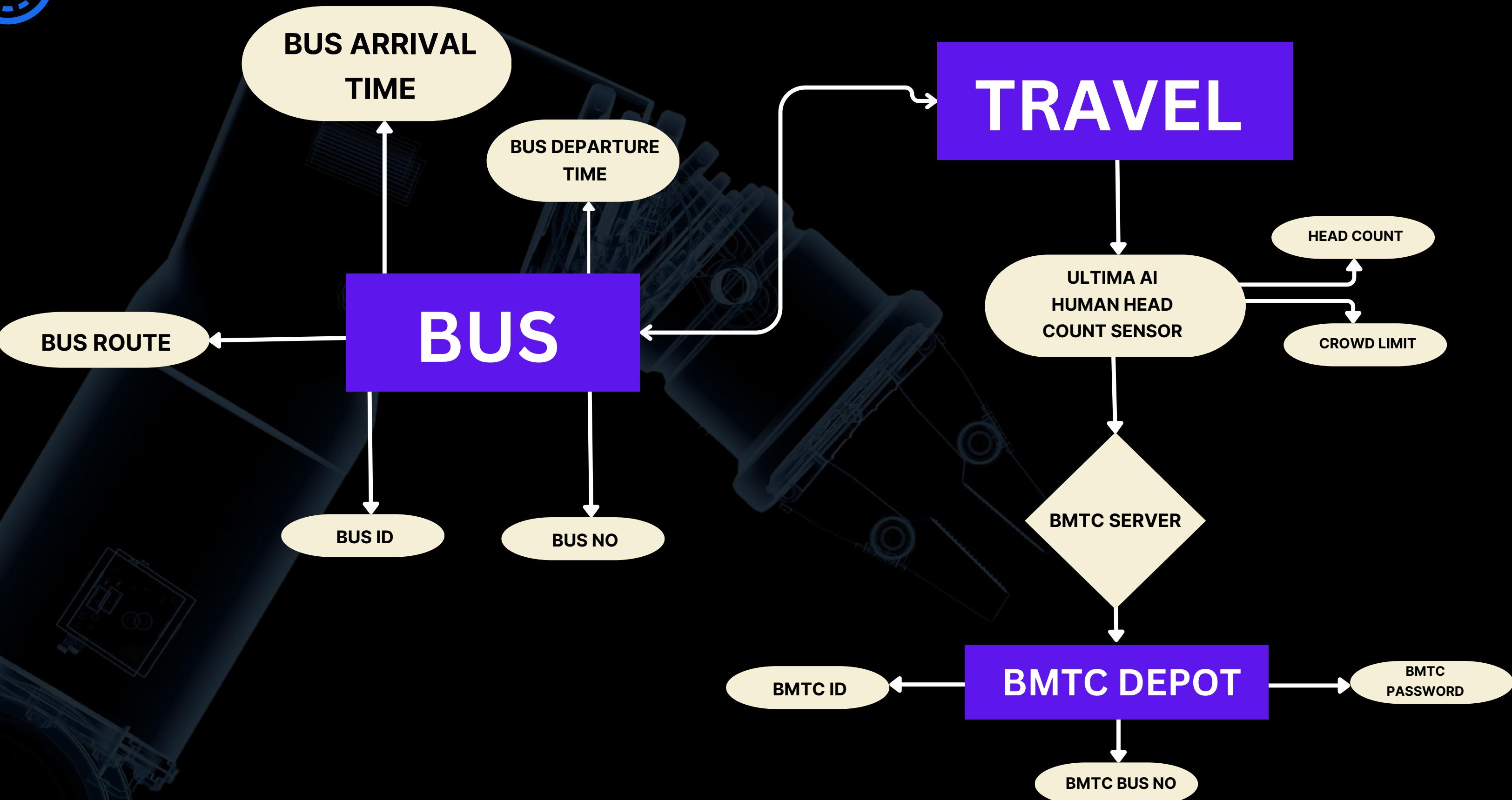
Employee Welfare

- Offering opportunities for skill development and career advancement.
- Enhances the quality of service for commuters.
- Contributes to the overall efficiency of BMTC operations.

SAFETY AND SECURITY

- CCTV surveillance on buses.
- Emergency response systems.
- Ticket checking to deter miscreants.
- Encouraging reporting of suspicious activities.

FLOWCHART





ULTIMA AI HUMAN COUNT SENSORS

Ultima AI revolutionizes people counting with AI on CHIP technology, accurately detecting age and gender without recording images, ensuring 100% privacy and market-leading accuracy.



FEATURES

- Get Real-Time Accurate Data
- RELY ON CHIP TECHNOLOGY (-5 to 45 degree)
- 3g/4g/5g Built in Wireless Global Connectivity
- Thinnest Sensor (Shape of a Coin - 21.8mm)
- Born Invisible with Active Stereo Night Vision Sensor
- Auto Calibration, Outstanding Wide Field of view
- GDPR Compliance (No faces or Personal data is recorded)
- Gives 99.9% People counting Accuracy

WORKING METHODOLOGY

- **Requirement Analysis:** Conduct a thorough analysis of the current challenges faced by BMTC buses in managing crowds, including overcrowding, inefficient resource utilization, and safety concerns.
- **Technology Selection:** Identify and select appropriate AI technologies, such as sensors, data analytics software, and communication devices, that can be integrated into BMTC buses to manage crowds effectively.
- **Hardware Procurement:** Procure essential hardware components, including AI sensors, processing units, and data transmission devices, ensuring availability and compatibility with the selected technologies.
- **Software Development:** Develop AI algorithms, data processing software, and user interfaces that are tailored to BMTC's specific needs, ensuring they are timely and aligned with quality standards.
- **Data Connectivity:** Establish reliable data connectivity, such as internet or cellular networks, to enable real-time data transmission between buses and the BMTC office for monitoring and control.
- **Data Security:** Implement robust data security measures to protect sensitive passenger information and ensure compliance with privacy regulations.

- **Integration with BMTC:** Seamlessly integrate the AI-powered crowd management system with existing BMTC systems, databases, and infrastructure to ensure compatibility and smooth operation.
- **User Training:** Provide comprehensive training to BMTC staff on how to effectively use and interpret data from the system to improve decision-making and passenger safety.
- **Regulatory Compliance:** Obtain the necessary approvals and ensure compliance with transportation and privacy regulations to legally implement the AI-powered solution.
- **Testing and Deployment:** Conduct thorough testing of the system to ensure functionality, reliability, and effectiveness. Once validated, deploy the system across BMTC buses.
- **Monitoring and Maintenance:** Continuously monitor the system's performance and conduct regular maintenance to address any issues and ensure optimal functioning.
- **Evaluation and Improvement:** Regularly evaluate the system's performance and gather feedback from users to identify areas for improvement and further enhancement.

AI-Powered Crowd Management on BMTC Buses uses the following Algorithm

1. Machine Learning Algorithms:

Clustering Algorithms: K-means, DBSCAN, etc., to group passengers based on their travel patterns and predict crowdedness.

- **Classification Algorithms:** Random Forest, SVM, etc., to classify bus routes or times that are likely to be crowded.

2. Reinforcement Learning:

- Algorithms like Q-learning or Deep Q Networks can be used to optimize bus routes or schedules to reduce crowding.

3. Deep Learning:

- **Neural Networks:** For image processing to estimate crowd sizes at bus stops or inside buses.

- **Long Short-Term Memory (LSTM):** For time-series forecasting of crowd sizes based on historical data.

4. Optimization Algorithms:

- **Genetic Algorithms:** To optimize bus routes or schedules based on factors like passenger demand and traffic conditions.

5. Simulation Algorithms:

- **Agent-based Models:** To simulate passenger behavior and interactions to predict and reduce crowding.



Use Cases for AI-Powered Crowd Management on BMTC Buses:

- **Real-Time Crowdedness Monitoring:** BMTC staff use real-time data to dispatch additional buses and manage overcrowding.
- **Crowd Density Alerts:** Generate alerts for excessive bus crowding, prompting immediate action by BMTC staff or bus drivers to ensure passenger safety and comfort.
- **Data Transmission to BMTC Office:** Securely transmit real-time crowd density data to the BMTC office, enabling central monitoring, decision-making, and historical analysis to optimize routes and resource allocation.
- **Historical Crowd Density Analysis:** Store historical crowd density data in a database to help BMTC management identify trends, peak hours, and areas with consistent overcrowding for data-driven decisions.



Use Cases for AI-Powered Crowd Management on BMTC Buses:

- **Passenger Information Provision:** Provide real-time crowd information to passengers at bus stops for informed decisions.
- **Route Optimization:** Utilize historical data to optimize bus routes, adjusting schedules and resources efficiently.
- **Emergency Response:** Detect unusual crowd behavior or emergencies, triggering immediate alerts and providing data for rapid response.
- **Remote Monitoring and Maintenance:** Implement remote sensor health and performance monitoring to reduce downtime and maintenance costs.

TECHNOLOGY STACK

HARDWARE REQUIREMENTS

- **AI Sensors (Artificial Intelligence Human Count Sensors):** These sensors use AI to accurately count the number of passengers boarding and alighting from buses.
- **Built-in 3G/4G/5G SIM Card Global Connectivity:** Ensures constant connectivity for real-time data transmission and monitoring.
- **Processing Unit:** Handles the computation and analysis of the crowd data collected by the sensors.
- **Data Transmission Hardware, Network Adapter:** Facilitates the transmission of crowd data to the central monitoring system.
- **LCD Displays:** Used for displaying real-time crowd information to passengers at bus stops.



SOFTWARE REQUIREMENTS



- **AI Algorithms:** Used for processing the data collected by sensors and making real-time decisions.
- **Data Processing Software and Transmission Software:** Responsible for processing and transmitting the crowd data efficiently.
- **Database Management System:** Manages the storage and retrieval of crowd data for analysis and decision-making.
- **User Interface (UI):** Provides an interface for users to interact with the system, such as bus operators or administrators.
- **Integration with BMTC Systems:** Ensures seamless integration with existing BMTC systems for data exchange and coordination.
- **Security and Authentication:** Implements security measures to protect the system from unauthorized access and ensure data integrity.
- **Remote Monitoring and Control:** Allows operators to monitor and control the system from a remote location, enabling them to make real-time decisions and adjustments.
- **Alerting and Notification System:** Provides alerts and notifications to relevant stakeholders, such as bus operators, passengers, and authorities, about important information or events related to crowd management.
- **Maintenance and Diagnostics Tools:** Includes tools for monitoring the health and performance of the system, diagnosing issues, and conducting maintenance tasks to ensure optimal functionality.



DEPENDENCIES AND POTENTIAL SHOWSTOPPERS FOR AI-POWERED CROWD MANAGEMENT ON BMTC BUSES

DEPENDENCIES

- **Hardware Procurement:** Availability and procurement of essential hardware components (AI sensors, processing units, data transmission devices) are crucial for system functionality.
- **Software Development:** Timely and quality-aligned development of AI algorithms, data processing software, user interfaces, and software components is necessary.
- **Data Connectivity:** Reliable data connectivity, including internet or cellular networks, is vital for real-time data transmission between buses and the BMTC office.
- **Data Security:** Ensuring data security and privacy compliance is critical to protect sensitive passenger information and maintain trust.
- **Integration with BMTC:** Seamless integration with existing BMTC systems, databases, and infrastructure is necessary for compatibility.
- **User Training:** Adequate training of BMTC staff to effectively use and interpret system data and alerts is essential.
- **Approvals:** Obtaining required approvals and adhering to transportation and privacy regulations is a crucial dependency.

SHOWSTOPPERS

- **Cost Overruns:** Project budget exceeding due to unforeseen expenses or resource limitations, potentially making it unsustainable.
- **Technical Challenges:** Complex technical issues (e.g., sensor malfunctions or data transmission failures) disrupting system functionality.
- **Data Accuracy:** Inaccurate crowd density measurements or false alerts erode trust in the system's effectiveness.
- **Privacy Concerns:** Privacy-related issues, data breaches, or public surveillance concerns leading to opposition or legal challenges.
- **Resistance to Change:** BMTC staff or passengers' resistance to adopting the new system hinders successful implementation.
- **Scalability Issues:** The inability of the system to handle increased demand or expand to more buses and routes becomes a bottleneck.
- **Lack of User Adoption:** Insufficient acceptance and perceived usefulness among BMTC staff and passengers, limiting benefits.
- **External Factors:** Adverse weather conditions, accidents, or vandalism damaging sensors or disrupting data transmission impacting system performance.

STRATEGIC BUSINESS ADVANTAGES OF AI-POWERED CROWD MANAGEMENT FOR GOVERNMENT IN BMTC BUSES

- **Enhanced Services:** Improving passenger experience to increase ridership and improve public perception.
- **Efficient Resource Use:** Optimizing routes and schedules to reduce operational costs.
- **Data-Driven Decisions:** Making informed policy and resource allocation decisions with comprehensive data.
- **Enhanced Safety:** Detecting overcrowding and ensuring quick response to emergencies to enhance passenger safety.
- **Environmental Benefits:** Reducing fuel usage and emissions through optimized routes.
- **Positive Image:** Demonstrating commitment to efficient, safe, and passenger-friendly transit.
- **Revenue Growth:** Increased ridership can boost government revenue.
- **Regulatory Compliance:** Meeting transportation safety and efficiency regulations.
- **Infrastructure Planning:** Effectively planning future transportation infrastructure.
- **Traffic Reduction:** Encouraging public transportation use to reduce traffic congestion and related costs.



FUTURE SCOPE

- **Predictive Maintenance:** Implement AI to predict the maintenance needs of buses, reducing downtime and improving service reliability.
- **Personalized Services:** Use AI to offer personalized services to passengers based on their preferences and travel history.
- **Dynamic Route Optimization:** AI can dynamically optimize bus routes based on real-time traffic and passenger demand, improving efficiency.
- **Integration with Smart City Initiatives:** Integrate AI-powered buses with other smart city initiatives for seamless urban transportation.
- **Enhanced Security:** Utilize AI for improved security measures such as facial recognition for boarding and monitoring.
- **Sustainable Practices:** Implement AI to monitor and reduce the environmental impact of buses, promoting sustainability.
- **Mobile App Integration:** Develop a mobile app that integrates with AI-powered buses for easy ticketing, route planning, and real-time updates.
- **Data Monetization:** Explore opportunities to monetize data collected by AI, such as providing insights to city planners or advertisers.
- **Accessibility Improvements:** Use AI to enhance accessibility features for passengers with disabilities, ensuring inclusivity.
- **Partnerships with Tech Companies:** Collaborate with technology companies to continually innovate and improve AI-powered solutions for public transit.

CONCLUSION

THE IMPLEMENTATION OF AI-POWERED CROWD MANAGEMENT ON BMTC BUSES PRESENTS A TRANSFORMATIVE SOLUTION FOR PUBLIC TRANSIT. BY LEVERAGING ADVANCED TECHNOLOGIES, SUCH AS AI SENSORS AND DATA ANALYTICS, WE CAN ENHANCE PASSENGER EXPERIENCES, OPTIMIZE RESOURCE UTILIZATION, AND IMPROVE OVERALL SAFETY. THIS SOLUTION NOT ONLY BENEFITS PASSENGERS BUT ALSO CONTRIBUTES TO ENVIRONMENTAL SUSTAINABILITY THROUGH REDUCED EMISSIONS AND TRAFFIC CONGESTION. ADDITIONALLY, IT ALIGNS WITH REGULATORY STANDARDS AND FACILITATES FUTURE INFRASTRUCTURE PLANNING. ULTIMATELY, EMBRACING AI IN PUBLIC TRANSIT WILL NOT ONLY REVOLUTIONIZE THE BMTC BUS SYSTEM BUT ALSO SET A PRECEDENT FOR SMART AND EFFICIENT TRANSPORTATION SYSTEMS WORLDWIDE.

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THANK YOU!

Do you have questions?

