VIT®
BHOPAL
www.vitbhopal.ac.in

Report on

Application of IOT in transportation

Class Assessment

Group no. – 03

Course – Fundamentals of sensors & IOT

Course code – EAC3017

Semester – Winter Semester 2023-24

Faculty - Dr. Soumitra Kesari Nayak

Submitted by – Group 3

1. **21BAC10035 – Rani Kushwaha**
2. **21BAC10036 - Sachin**
3. **21BAC10038 - Manish Meena**
4. **21BAC10039 - Kajal**

Submitted to-

Dr. Soumitra Kesari Nayak

Application of IOT in transportation

1. Introduction:

In recent years, the integration of Internet of Things (IoT) technology has revolutionized the transportation sector. IoT's ability to connect devices and gather real-time data has led to significant advancements in efficiency, safety, and sustainability within transportation systems worldwide.

2. Objective:

The objective of this report is to explore the various applications of IoT in transportation, highlighting its impact on improving infrastructure, optimizing operations, enhancing safety measures, and fostering a more sustainable transportation ecosystem.

3. Applications:

3.1 Smart Traffic Management: IoT sensors and cameras monitor traffic flow, optimize signal timings, and reroute vehicles to reduce congestion and minimize travel time.

3.2 Vehicle Tracking System: IoT-enabled tracking devices provide real-time location data, vehicle diagnostics, and predictive maintenance alerts, optimizing vehicle efficiency and reducing downtime.

3.3 Public Transportation Optimization: IoT sensors on buses and trains gather data on passenger flow, enabling authorities to optimize routes, schedules, and capacity management.

3.4 Smart Parking Systems: IoT sensors detect available parking spaces and transmit this information to drivers' smartphones, reducing traffic congestion and emissions associated with searching for parking.

3.5 Vehicle-to-Infrastructure Communication (V2I): IoT-equipped vehicles communicate with roadside infrastructure to receive real-time traffic updates, safety alerts, and navigation assistance.

3.6 Automated Toll and Ticketing Systems: IoT technology enables automated toll collection and ticketing processes, reducing wait times and enhancing the efficiency of transportation systems.

3.7 Asset Tracking: IoT technology enables the tracking of shipments and goods in transit, enhancing supply chain visibility and security.

3.8 Environmental Monitoring: IoT sensors monitor air quality, noise levels, and other environmental factors, enabling authorities to implement measures to reduce pollution and improve public health.

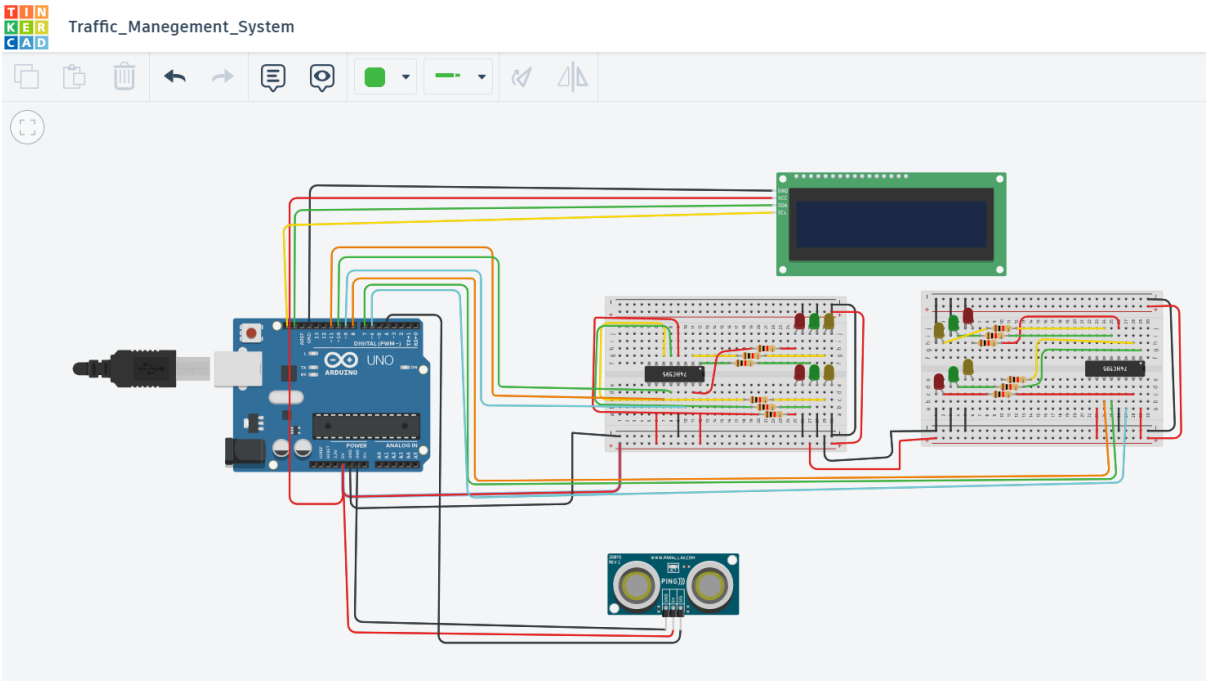
3.9 Connected Autonomous Vehicles (CAVs): IoT connectivity allows autonomous vehicles to communicate with each other and with infrastructure, enhancing safety, coordination, and traffic flow.

3.1 Smart Traffic Management

3.1.1 Overview

The Smart Traffic Management system integrates IoT technology to enhance traffic flow and pedestrian safety. Utilizing an Arduino microcontroller, ultrasonic sensors, LEDs, and an LCD display, this system regulates traffic signals and provides real-time information to pedestrians.

3.1.2 Circuit Diagram



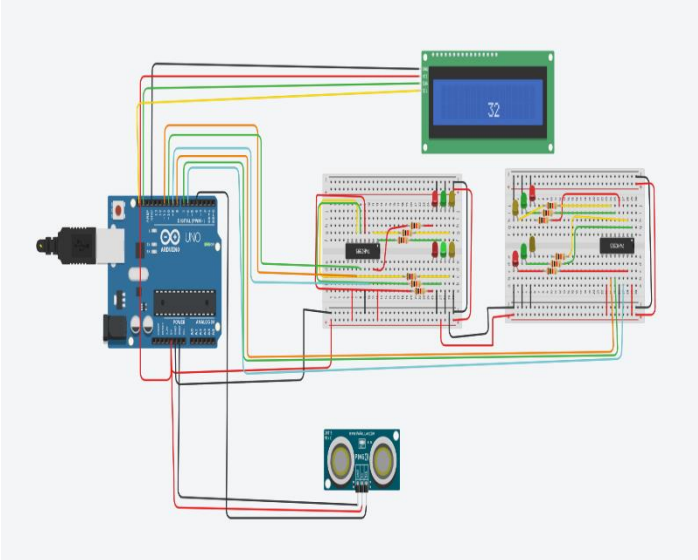
The system incorporates ultrasonic sensors for vehicle detection and four sets of LEDs for traffic signal indications. An Arduino microcontroller processes sensor data and controls LED output based on traffic conditions.

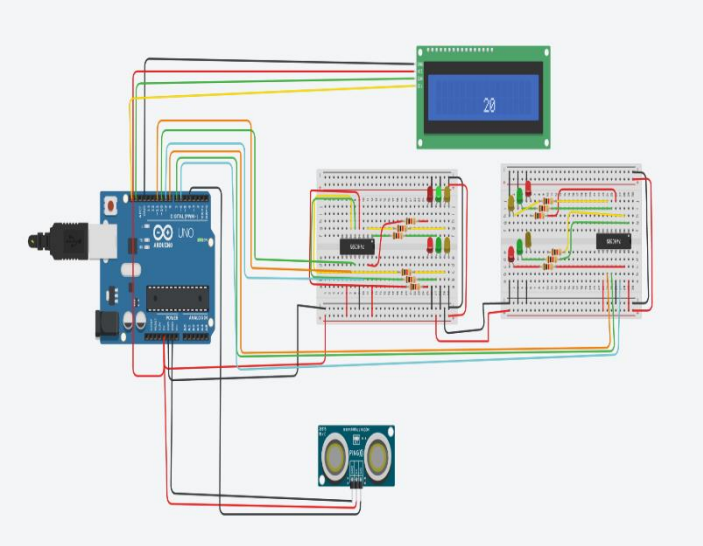
3.1.3 Working

1. Ultrasonic Sensor Operation: Ultrasonic sensors detect the presence of vehicles at each intersection.

2. LED Signal Control: The Arduino microcontroller processes sensor data and controls the LED signals accordingly:
    - Green LED: Signals for a specific direction are activated when the road is clear.
    - Red LED: Signals are displayed when the road is occupied or during pedestrian crossing phases.
3. LCD Display: An LCD display provides pedestrians with real-time information about the time remaining to safely cross the road.

3.1.4 Result





#Case Study 1

Case Study: Automated Toll Tax and Ticketing Using IoT

1. Overview

Traditional toll tax and ticketing systems often suffer from inefficiencies, long queues, and manual errors. To address these challenges, the implementation of IoT in toll tax and ticketing systems offers a revolutionary solution. By integrating IoT technology, toll collection and ticketing processes are automated, enhancing efficiency, accuracy, and convenience for both authorities and commuters.

2. Technology

The automated toll tax and ticketing system leverages various IoT components:

- RFID (Radio Frequency Identification): Each vehicle is equipped with an RFID tag containing unique identification information.
- IoT Sensors: Sensors placed at toll booths detect vehicles as they approach, triggering the toll collection process.
- Communication Protocols: IoT devices communicate with centralized servers via wireless networks, enabling real-time data exchange.
- Cloud Computing: Data collected from IoT devices is stored and processed in the cloud, allowing for centralized management and analysis.

3. Working: How IoT Implemented

1. Vehicle Identification: As a vehicle approaches the toll booth, IoT sensors detect its presence and read the RFID tag.
2. Automatic Toll Calculation: The system retrieves vehicle information from the RFID tag and calculates the appropriate toll amount based on factors such as vehicle type, distance traveled, and toll rates.
3. Payment Processing: Upon toll calculation, the system automatically deducts the toll amount from the commuter's linked payment method, such as an electronic wallet or a registered account.
4. Ticketing Process: For ticketing systems, IoT sensors generate electronic tickets upon vehicle entry, recording the entry time and other relevant details.
5. Real-Time Monitoring: Centralized servers monitor toll booths in real-time, allowing authorities to track traffic flow, revenue collection, and system performance.

4. How It Makes Life Easier

- Reduced Congestion: Automated toll collection minimizes wait times at toll booths, reducing traffic congestion and commuter frustration.
- Enhanced Accuracy: IoT-enabled systems ensure accurate toll calculation and ticketing, eliminating manual errors and discrepancies.
- Convenience: Commuters no longer need to stop or interact with toll booth operators, streamlining the toll payment process and enhancing overall convenience.
- Improved Revenue Collection: By automating toll collection and ticketing, authorities can improve revenue collection efficiency and reduce instances of toll evasion.

- Data Insights: IoT-enabled systems provide valuable insights into traffic patterns, commuter behavior, and revenue trends, enabling authorities to make informed decisions and optimize transportation infrastructure.

GitHub Project Utilized: MyCarToll

This case study is based on the GitHub project titled "MyCarToll," which serves as the foundation for the automated toll management system discussed herein. The project integrates various IoT components and technologies to automate toll tax collection and ticketing processes, aiming to enhance efficiency and convenience for both commuters and toll authorities. Through the analysis and implementation of the MyCarToll project, the following overview, technology, working principles, and benefits of IoT-based automated toll management have been elucidated.

#Case Study 2

Case Study: Vehicle Tracking System Using IoT

1. Overview

The Vehicle Tracking System (VTS) leverages IoT technology to provide real-time location tracking and monitoring of vehicles. By integrating GPS sensors, IoT devices, and cloud computing, the VTS enables efficient fleet management, route optimization, and asset tracking for various industries.

2. Technology

GPS Sensors: Installed in vehicles, GPS sensors accurately determine vehicle locations and movements.

IoT Devices: IoT-enabled trackers transmit GPS data to centralized servers via wireless networks.

Cloud Computing: Data collected from IoT devices is processed and stored in the cloud, allowing for remote access and analysis.

Mobile Applications: Mobile apps provide users with real-time vehicle tracking information and analytics.

3. Working: How IoT Implemented

GPS Data Collection: GPS sensors installed in vehicles continuously collect location data.

Data Transmission: IoT devices transmit GPS data to centralized servers over wireless networks.

Cloud Processing: Data is processed and stored in the cloud, allowing for real-time tracking and analysis.

Mobile Access: Users access vehicle tracking information through dedicated mobile applications, providing real-time updates on vehicle locations and status.

Alerts and Notifications: The system generates alerts and notifications for events such as route deviations, unauthorized vehicle use, or maintenance reminders.

How It Makes Life Easier

Enhanced Fleet Management: VTS enables fleet managers to monitor vehicle locations, optimize routes, and improve operational efficiency.

Asset Security: Real-time tracking reduces the risk of vehicle theft and unauthorized use, enhancing asset security.

Improved Customer Service: VTS enables businesses to provide accurate delivery estimates and proactive communication to customers.

Cost Savings: By optimizing routes and reducing idle time, VTS helps reduce fuel costs and improve overall vehicle efficiency.

Data-driven Insights: VTS provides valuable data insights into vehicle usage patterns, driver behavior, and maintenance needs, enabling informed decision-making and continuous improvement.

GitHub Project Utilized: GPS Tracker

This case study is based on the GitHub project titled "GPS Tracker," which serves as the foundation for the implementation of a GPS-based vehicle tracking system. The project integrates IoT technology to enable real-time location tracking and monitoring of vehicles. By utilizing GPS sensors, IoT devices, and cloud computing, the GPS Tracker project facilitates efficient fleet management, route optimization, and asset tracking for various industries. Through the analysis and implementation of the GPS Tracker project, the following overview, technology, working principles, and benefits of IoT-based vehicle tracking have been elucidated.

#Case Study 3

Case Study: Smart Parking System Using IoT

1. Overview

The Smart Parking System (SPS) utilizes IoT technology to optimize parking space utilization and enhance user experience. By integrating sensors, IoT devices, and mobile applications, SPS provides real-time parking availability information, reducing congestion and improving urban mobility.

2. Technology

Parking Sensors: IoT-enabled sensors detect vehicle presence and occupancy in parking spaces.

IoT Devices: Sensors transmit parking data to centralized servers via wireless networks.

Mobile Applications: Mobile apps provide users with real-time parking availability information and navigation assistance.

Cloud Computing: Data collected from sensors is processed and stored in the cloud, enabling remote access and analysis.

3. Working: How IoT Implemented

Parking Space Monitoring: Sensors detect vehicle presence and occupancy in parking spaces.

Data Transmission: IoT devices transmit parking data to centralized servers, where it is processed and analyzed.

Real-time Updates: Mobile applications display real-time parking availability information to users, enabling them to find and reserve parking spaces.

Navigation Assistance: Users receive navigation assistance to the nearest available parking space, optimizing the parking search process.

Payment Integration: SPS may integrate payment systems to enable cashless parking transactions and streamline the payment process.

How It Makes Life Easier

Reduced Traffic Congestion: SPS provides real-time parking availability information, reducing circling time and congestion.

Improved User Experience: Users can easily find and reserve parking spaces, enhancing convenience and reducing stress.

Optimized Parking Space Utilization: SPS optimizes parking space usage, maximizing revenue for parking operators and reducing the need for additional parking infrastructure.

Environmental Benefits: Reduced circling time and congestion contribute to lower emissions and improved air quality.

Data Insights: SPS provides valuable data insights into parking utilization patterns, enabling urban planners to make informed decisions about parking management and infrastructure development.

4. Result:

The integration of IoT in transportation has led to tangible results such as reduced traffic congestion, improved fleet efficiency, enhanced safety measures, optimized public transportation systems, and minimized environmental impact. These advancements have contributed to a more connected, efficient, and sustainable transportation ecosystem**.**

5. Summary:

In essence, the application of IoT in transportation has sparked a revolution in how we perceive and interact with our mobility systems. By harnessing real-time data and connectivity, IoT solutions have optimized traffic management, enhanced vehicle tracking, and streamlined various aspects of transportation infrastructure, including public transit and toll systems. These advancements collectively contribute to safer, more efficient, and sustainable transportation networks. Ultimately, IoT's integration into transportation exemplifies a pivotal step towards a future where connectivity and data-driven insights drive continuous improvement and innovation in our global mobility systems.