Final Year Project Showcase Batch 2019
Year 2023

Department: Computer & Information Systems Engineering Programme: Computer & Information Systems Engineering	
1	**Project Idea** The project aims to develop an Adaptive Traffic Signals Control system within an Intelligent Transportation System. Traditional traffic signal systems operate on fixed timers, leading to inefficiencies and traffic congestion. This project proposes an innovative approach that automates traffic signals based on real-time traffic conditions, resulting in optimized traffic flow.
2	**Process** The process of our final year project involves the following key steps: **Object Detection Algorithm (YOLOv7):** We employ the YOLOv7 object detection algorithm to accurately identify and track vehicles in real-time, from frames received through cameras, attached at each lane in an intersection. This algorithm plays a crucial role in determining the traffic conditions in each lane. **Road Occupancy Calculation**: Using a formula, based on the detected vehicles we calculate the road occupancy for each lane. This metric provides valuable information about the traffic density and helps in making informed decisions for signal control. **Scheduling Algorithm:** A scheduling algorithm is implemented to analyze the road occupancy data and determine the optimal traffic signal timings for each lane. It considers factors such as traffic density and road capacity to dynamically adjust the signal durations. **Hardware Implementation**: Our project is deployed on the Jetson Nano, a powerful hardware device capable of processing real-time data efficiently. A camera is attached to the Jetson Nano to capture the traffic scenario and provide input to our algorithms. **Intersections Coordination**: To ensure smooth traffic flow, we have also incorporated coordination with nearby traffic intersections. By considering the traffic conditions at neighboring intersections, we can synchronize the signals and avoid congestion.
3	**Outcome** The expected outcome of our project is an adaptive traffic signal control system that leads to the following benefits: **Reduced Traffic Congestion**: By dynamically adjusting signal timings based on real-time traffic conditions, our system aims to reduce traffic congestion at intersections, leading to shorter commute times and reduced fuel consumption. **Improved Traffic Flow:** Optimized signal timings enhance the overall traffic flow, reducing stop-and-go patterns and improving the efficiency of transportation systems.

	Enhanced Commuting Experience: Motorists will experience smoother and more predictable journeys, leading to improved quality of life and reduced stress associated with traffic congestion.
4	**Evidence (Theoretical Basis)** Our FYP is built upon several key theoretical foundations that underpin its functionality and effectiveness in optimizing traffic signal control: Traffic Flow Theory: Our project draws heavily from traffic flow theory, a fundamental concept in transportation engineering. This theory encompasses principles such as traffic density and capacity. By applying these principles, our adaptive traffic signal control system determines optimal signal timings that maximize traffic flow and minimize congestion. Real-Time Data Analysis: The theoretical basis of our FYP includes the use of real-time data analysis. We employ advanced algorithms to process data from vehicle detection and road occupancy calculations. This data is then used to make informed decisions regarding signal control. Real-time data analysis ensures our system can dynamically respond to changing traffic conditions. Intersection Coordination: Effective traffic signal control requires coordination between neighboring intersections. The theoretical basis for this aspect is rooted in traffic engineering principles, emphasizing the importance of synchronizing signals to prevent gridlock and ensure the efficient flow of traffic throughout the road network. Machine Learning and Object Detection: We incorporate machine learning techniques, specifically the YOLOv7 object detection algorithm, into our project's theoretical foundation. This algorithm allows us to accurately identify and track vehicles in real-time. This theoretical basis enables our system to assess traffic conditions in each lane and make timely signal adjustments.
5	**Impact on Sustainability of Urban Regions or SDG-11 "Sustainable Cities and Communities"** Our FYP, the Adaptive Traffic Signals Control in Intelligent Transportation System, aligns with Sustainable Development Goal **11 (SDG-11)** - "Sustainable Cities and Communities" and has a significant impact on the sustainability of urban regions by: Reducing Traffic Congestion: Our system minimizes traffic congestion, leading to shorter commutes, lower fuel consumption, and reduced greenhouse gas emissions, making urban transportation more sustainable. Improving Traffic Flow: Dynamic signal adjustments reduce stop-and-go traffic patterns, decreasing fuel waste and emissions, contributing to sustainable urban transportation. Enhancing Quality of Life: The project provides stress-free commutes, improving the well-being of urban residents and promoting sustainable urban living. Environmental Sustainability: Lower carbon emissions and improved air quality result from reduced congestion, supporting urban environmental sustainability. Supporting Sustainable Planning: Traffic data generated by our system informs urban planners and policymakers, aiding informed decisions for sustainable urban development and infrastructure enhancements.

6	**Competitive Advantage or Unique Selling Proposition** (Cost Reduction, Process improvement,
a	**Attainment of any SDG** (e.g. How it is achieved and why it is necessary for the region) Our project aligns with several SDGs, which include: **SDG#03: Good Health and Well-Being** By reducing traffic congestion and improving traffic flow, we contribute to the well-being of commuters who experience less stress and air pollution during their journeys. **SDG#09: Industry, Innovation, and Infrastructure** Our project embodies innovation in traffic management by introducing advanced technologies and infrastructure improvements, which are essential for modernizing transportation systems and making them more efficient and sustainable. **SDG#11: Sustainable Cities and Communities** Our adaptive traffic signal control system promotes sustainable urban development by optimizing traffic management. This leads to reduced traffic-related emissions, less fuel consumption, and improved quality of life for city residents. **SDG#17: Partnerships for the Goals** The successful implementation of our project relies on collaborative partnerships between municipalities, transportation authorities, technology providers, and other stakeholders. This cooperative approach is necessary to address traffic challenges effectively and create more sustainable urban environments.
b	**Environmental Aspect** (e.g. carbon reduction, energy-efficient, etc.) Our project contributes to environmental sustainability by: Carbon Reduction: Optimizing traffic flow and reducing congestion through our adaptive traffic signal control system helps decrease the number of vehicles idling at intersections. This results in reduced carbon emissions and a more eco-friendly transportation system.
c	**Cost Reduction of Existing Product** Our project offers potential cost savings by: Reducing Fuel Consumption: Commuters experience shorter commutes due to reduced congestion, resulting in lower fuel consumption and cost savings. Infrastructure Maintenance: Municipalities can extend the lifespan of roads and traffic signal equipment, leading to long-term cost reductions in maintenance and repairs.
d	**Process Improvement which Leads to Superior Product or Cost Reduction, Efficiency Improvement of the Whole Process** (e.g. What is the issue is current process and what improvement you suggests) Our project addresses process improvement by: Current Process Issue: Traditional traffic signal systems relying on fixed timers often lead to traffic congestion, longer commute times, and increased fuel consumption, negatively impacting the environment and commuters. Proposed Improvement: We propose a dynamic traffic signal control system that adapts signal timings in real-time based on traffic conditions, significantly reducing congestion,

	shortening commute times, and lowering fuel consumption, resulting in a more efficient and environmentally friendly transportation process.	
e	**Expanding of Market share** (e.g. how it expand and what is the problem with the current market Our project has the potential to expand market share by: Current Market Problem: The current market for traffic signal control systems mainly relies on static, fixed-timer systems that struggle to address real-world traffic complexities. These systems can lead to increased congestion, longer commute times, and frustrated commuters. Market Expansion Approach: Our adaptive traffic signal control system offers a technologically advanced solution that overcomes the limitations of traditional systems. By significantly reducing congestion and improving traffic flow, it appeals to municipalities and transportation authority's seeking innovative ways to enhance their transportation infrastructure and alleviate urban traffic problems.	
f	**Capture New Market** (e.g. Niche market or unaddressed segment) NA	
g	**Any Other Aspect (Please tag it like above options)** Data-Driven Insights: Our system generates a wealth of real-time traffic data, which can be used for various purposes beyond traffic signal control. This data can be analyzed to gain insights into traffic patterns, identify accident-prone areas, and inform future urban planning and infrastructure development decisions. This aspect adds further value to our project beyond its primary function of traffic signal control. Adaptability to Undisciplined Data: Unlike many existing traffic control systems that rely on disciplined data, our project's adaptability to undisciplined data enhances its real-world applicability and robustness. This feature allows it to perform effectively in dynamic and unpredictable traffic scenarios, making it a versatile solution for diverse urban environment	
7	**Target Market** Our target market includes: • Municipalities: City governments and transportation authority's seeking innovative solutions to improve traffic management and reduce congestion in urban areas. • Urban Planners: Professionals involved in urban planning and development looking for ways to optimize transportation systems. • Commuters: Individual motorists who will benefit from reduced commute times and improved traffic flow. Environmental Advocates: Organizations and individuals focused on reducing carbon emissions and promoting sustainable transportation solutions.	
8	**Team Members** (Names along with email address	Hamza Munir(hamzamunir2001@gmail.com) Anas(annassamad20@gmail.com) Shah Hussain(shahhussain12179@gmail.com) Areeba Fayyaz(areeba.fayyaz88@gmail.com)
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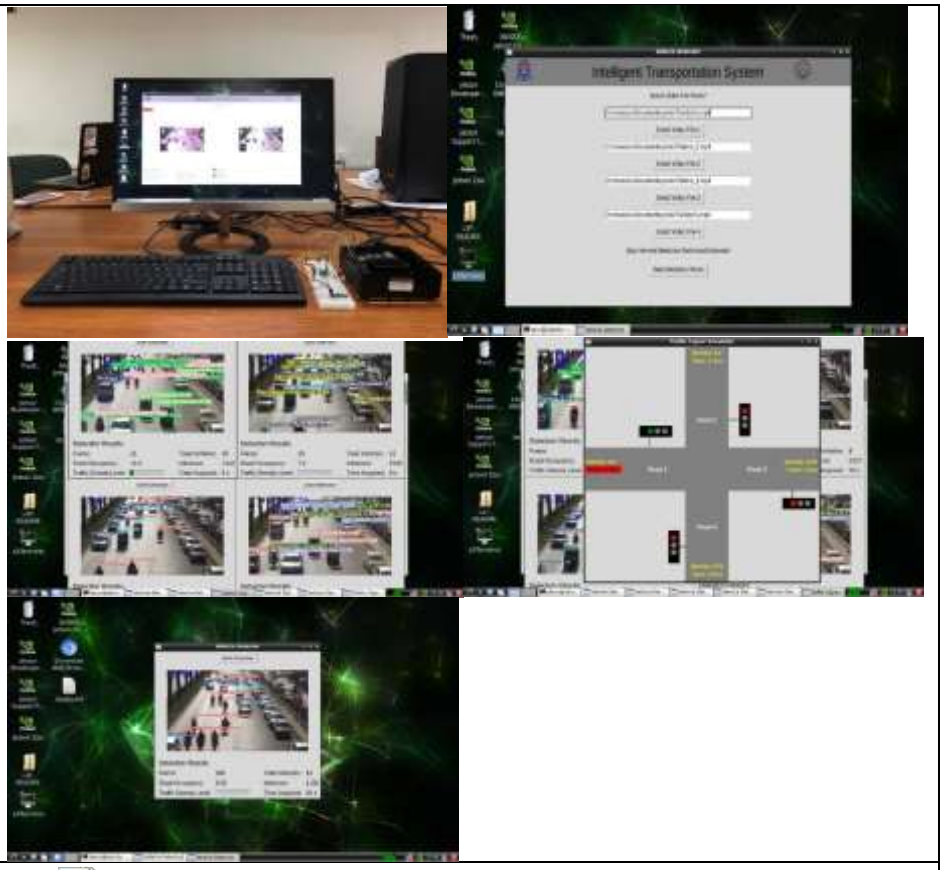
10	**Pictures (If any)**	
11	**Video (If any)**	Video.mp4