Sheffield Hallam University

UREC2 RESEARCH ETHICS PROFORMA FOR STUDENTS UNDERTAKING LOW RISK PROJECTS WITH HUMAN PARTICIPANTS

This form is designed to help students and their supervisors to complete an ethical scrutiny of proposed research. The University Research Ethics Policy (www.shu.ac.uk/research/excellence/ethics-and-integrity/policies) should be consulted before completing this form. The initial questions are there to check that completion of the UREC 2 is appropriate for this study. The final responsibility for ensuring that ethical research practices are followed rests with the supervisor for student research.

Note that students and staff are responsible for making suitable arrangements to ensure compliance with the General Data Protection Act (GDPR). This involves informing participants about the legal basis for the research, including a link to the University research data privacy statement and providing details of who to complain to if participants have issues about how their data was handled or how they were treated (full details in module handbooks). In addition, the act requires data to be kept securely and the identity of participants to be anonymised. They are also responsible for following SHU guidelines about data encryption and research data management. Guidance can be found on the SHU Ethics Website www.shu.ac.uk/research/excellence/ethics-and-integrity

Please note that it is mandatory for all students to only store data on their allotted networked F drive space and not on individual hard drives or memory sticks etc.

The present form also enables the University and College to keep a record confirming that research conducted has been subjected to ethical scrutiny.

The UREC2 form must be completed by the student. Supervisors will review their students' completed UREC forms and, if necessary, inform students of any required changes. For UREC2* (Low Risk Research with Human Participants), the supervisor then signs off the form. Additional guidance can be obtained from your College Research Ethics Chair[1]

* If the supervisor thinks that the project is likely to result in a publication then the UREC2 form ***must*** be reviewed by an **independent reviewer**, drawn from the module teaching team, before data collection begins.

Students should retain a copy for inclusion in their research project, and a copy should be uploaded to the relevant module Blackboard site.

Please note that it may be necessary to conduct a health and safety risk assessment for the proposed research. Further information can be obtained from the University's Health and Safety Website https://sheffieldhallam.sharepoint.com/sites/3069/SitePages/Risk-Assessment.aspx

[1] College of Social Sciences and Arts - Dr. Antonia Ypsilanti (a.ypsilanti@shu.ac.uk)
College of Business, Technology and Engineering - Dr. Tony Lynn (t.lynn@shu.ac.uk)
College of Health, Wellbeing and Life Sciences - Dr. Nikki Jordan-Mahy (n.jordan-mahy@shu.ac.uk)

SECTION A

1. Checklist questions to ensure that this is the correct form:

Health Related Research within the NHS, or His Majesty's Prison and Probation Service (HMPPS), or with participants unable to provide informed consent check list.

Question	Yes/No
Does the research involve? • Patients recruited because of their past or present use of the NHS	NO
• Relatives/carers of patients recruited because of their past or present use of the NHS	NO
• Access to NHS staff, premises, or resources	NO
• Access to data, organs, or other bodily material of past or present NHS patients	NO
• Foetal material and IVF involving NHS patients	NO
• The recently dead in NHS premises	NO
• Prisoners or others within the criminal justice system recruited for health-related research	NO
• Police, court officials, prisoners, or others within the criminal justice system	NO
• Participants who are unable to provide informed consent due to their incapacity even if the project is not health related	NO
• Is this an NHS research project, service evaluation or audit? *For NHS definitions please see the following website* http://www.hra.nhs.uk/documents/2013/09/defining-research.pdf	NO

If you have answered **YES** to any of the above questions, then you **MUST consult with your supervisor** to obtain research ethics from the appropriate institution outside the university. This could be from the NHS or Her Majesty's Prison and Probation Service (HMPPS) under their independent Research Governance schemes. Further information is provided below. https://www.myresearchproject.org.uk/

2. Checks for Research with Human Participants

Question	Yes/No
1. Will any of the participants be vulnerable? *Note: Vulnerable people include children and young people, people with learning disabilities, people who may be limited by age or sickness, pregnancy, people researched because of a condition they have, etc. See full definition on ethics website in the document* ***Code of Practice for Researchers Working with Vulnerable Populations*** *(under the Supplementary University Polices and Good Research Practice Guidance)*	NO
2. Are drugs, placebos, or other substances (e.g., food substances, vitamins) to be administered to the study participants or will the study involve invasive, intrusive, or potentially harmful procedures of any kind?	NO
3. Will tissue samples (including blood) be obtained from participants?	NO

Question	Yes/No
4. Is pain or more than mild discomfort likely to result from the study?	NO
5. Will the study involve prolonged or repetitive testing?	NO
6. Is there any reasonable and foreseeable risk of physical or emotional harm to any of the participants? *Note: Harm may be caused by distressing or intrusive interview questions, uncomfortable procedures involving the participant, invasion of privacy, topics relating to highly personal information, topics relating to illegal activity, or topics that are anxiety provoking, etc.*	
7. Will anyone be taking part without giving their informed consent?	NO
8. Is the research covert? *Note: 'Covert research' refers to research that is conducted without the knowledge of participants.*	NO
9. Will the research output allow identification of any individual who has not given their express consent to be identified?	NO

If you have answered **YES** to any of these questions you are **REQUIRED** to complete and submit a UREC3 or UREC4 form. Your supervisor will advise. If you have answered **NO** to all these questions, then proceed with this form (UREC2).

3. General Project Details

Details	
Name of student	Mandar Dnyaneshwar Satpute
SHU email address	MandarDyaneshwar.D.Satpute@student.shu.ac.uk
Department/College	School of Computing and Digital Technologies
Name of supervisor	Domdouzis Konstantinos
Supervisor's email address	K.Domdouzis@shu.ac.uk
Title of proposed research	AI-Powered Urban Traffic Optimization in the UK using Reinforcement Learning and Edge Computing.
Proposed start date	07-11-2025
Proposed end date	07-01-2026
Background to the study and the rationale (reasons) for undertaking the research (500 words)	Urban traffic congestion represents a persistent and significant socio-environmental challenge across the United Kingdom, contributing heavily to air pollution, elevated commuter stress, and substantial economic losses due to delays **(Department for Transport, 2023; INRIX, 2023)**. Conventional traffic management systems—which often rely on static, time-of-day programming—are fundamentally incapable of adapting to the unpredictable, minute-by-minute fluctuations of modern urban traffic flow **(Chen & Wu, 2025)**. This failure necessitates a fundamental shift toward

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	intelligent, self-optimizing solutions. Existing academic research has widely established the potential of Deep Reinforcement Learning (DRL) as the most suitable methodology for dynamic signal control, as DRL agents learn optimal timing policies through trial-and-error in a simulated environment **(Yang et al., 2025)**. Furthermore, to address the complexity of city-wide networks, cutting-edge studies confirm the necessity of incorporating Graph Neural Networks (GNNs) to model the intricate spatial relationships between intersections **(Yang et al., 2025)**. Finally, to ensure real-world viability, the entire decision-making process must function in a low-latency environment, aligning with the principles of Edge Computing, as centralized cloud processing introduces significant delays **(Chen & Wu, 2025; Yang et al., 2025)**. The rationale for this project is to bridge the implementation gap by creating a unified, functional system that integrates all these necessary components. This dissertation is a Proof-of-Concept focusing on the successful technical implementation and evaluation of this integrated architecture. The core of the research involves: • **Algorithmic Innovation (ADDRL + GNN):** The project's primary contribution is the development of an Adaptive Decentralized Deep Reinforcement Learning (ADDRL) framework. This system is enhanced by integrating a Graph Neural Network (GNN) to model the road network and enable individual traffic signal agents to make coordinated decisions. This focus ensures the system optimizes traffic flow across an entire network, not just at isolated intersections. • **Simulating Edge Responsiveness:** The system will be built within the SUMO (Simulation of Urban Mobility) environment. The entire data processing pipeline is designed to be streamlined and efficient, utilizing a Python-based data streaming approach to accurately mimic the low-latency data input required by Edge Computing principles. This validates the framework's potential for real-time deployment. • **Feasibility and Evaluation:** This methodology is designed to be resource-efficient and feasible within the academic timeframe. The goal is to provide robust, quantitative evidence by comparing the performance of this integrated AI

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	system against standard fixed-timing management techniques. The project successfully fulfils the requirements of a Masters-level analytical dissertation by delivering a validated prototype and measurable results to contribute valuable insight for urban planners. • In this dissertation, the practical experiments will focus on a Sheffield city-centre road network, which is used as a prototype case study for UK urban traffic optimisation. **References:** Chen, H., & Wu, Y. (2025). Intelligent traffic signal optimization algorithm based on multi-source data fusion. *International Journal of Distributed Sensor Networks, 21*(2). https://doi.org/10.1177/18724981251369386 Department for Transport. (2023). *Transport and environment statistics: 2023*. HMSO. https://www.gov.uk/government/statistics/transport-and-environment-statistics-2023 INRIX. (2023). *2022 Global Traffic Scorecard*. https://inrix.com/scorecard/ Yang, F., Liu, X. C., Lu, L., Wang, B., & Liu, C. (2025). A self-supervised multi-agent large language model framework for customized traffic mobility analysis using machine learning models. *Transportation Research Record, 2679*(7), 1–16. https://doi.org/10.1177/03611981251322468
Aims & research question(s)	**Aim:** To implement and quantitatively evaluate an ADDRL–GNN framework on a simulated Sheffield city centre road network, using UK traffic data filtered for the Sheffield area, to demonstrate superior, coordinated traffic flow optimisation compared to fixed-timing systems. **Research Question:** How can an AI powered traffic signal system, applied to a simulated Sheffield city centre network using filtered UK traffic data and edge-style control, dynamically optimise urban traffic signals to reduce congestion and improve traffic efficiency?

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Methods to be used for: 1. Recruitment of participants 2. Data collection 3. Data analysis	**Recruitment of participants:** A small sample of 5-10 participants (e.g., fellow students on the MSc course) will be recruited via convenience sampling (a direct email or in-person request). **Data collection:** 1. Computational Data: Data is simulated in real-time within the SUMO environment, informed by publicly available DfT historical traffic flow data. **UK Department for Transport (DfT) Data** **Purpose:** To provide realistic traffic flow numbers to build the simulation's demand. • **Dataset 1 (Primary):** Average annual daily flow (578,217 records) ➢ **Link:** https://storage.googleapis.com/dft-statistics/road-traffic/downloads/data-gov-uk/dft_traffic_counts_aadf.zip • **Dataset 2 (Supporting):** Raw counts (5,113,740 records) ➢ **Link:** https://storage.googleapis.com/dft-statistics/road-traffic/downloads/data-gov-uk/dft_traffic_counts_raw_counts.zip • **Dataset 3 (Supporting):** Average annual daily flow by direction (1,062,881 records) ➢ **Link:** https://storage.googleapis.com/dft-statistics/road-traffic/downloads/data-gov-uk/dft_traffic_counts_aadf_by_direction.zip • **License: Open Government Licence (OGL) v3.0** ➢ **Link:** https://www.nationalarchives.gov.uk/doc/open-government-licence/version/3/ ➢ **Permission:** The license grants the freedom to:

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	"copy, publish, distribute... and adapt the Information... for both commercial and non-commercial purposes." This explicitly permits its use for this academic dissertation. **2. OpenStreetMap (OSM) Data** ➢ **Purpose:** To provide the physical road network map for the SUMO environment. ➢ **Source Link:** https://www.openstreetmap.org ➢ **License: Open Data Commons Open Database License (ODbL)** ➢ **Link:** https://opendatacommons.org/licenses/odbl/1-0/ ➢ **Permission:** The license grants the freedom "To Share... To Create... To Adapt" the data. This explicitly permits the creation of a "derivative work" (the .net.xml file) for this project, provided attribution ("© OpenStreetMap contributors") is given in the final report. **3. Eclipse SUMO Software** ➢ **Purpose:** The core simulation engine. ➢ **Source Link:** https://eclipse.dev/sumo/ ➢ **License: Eclipse Public License 2.0 (EPL-2.0)** ➢ **Link:** https://www.eclipse.org/legal/epl-2.0/ ➢ **Permission:** This is a standard open-source license. Section 2(a) grants a "world-wide, non-exclusive, royalty-free" license to "reproduce, prepare derivative works of, publicly display, publicly perform, [and] distribute" the software, which fully permits its use for academic research. 2. Participant Data: Participants will be shown the final visualisation dashboard (a static report or HTML file generated by Python/Matplotlib) and asked to complete a short, anonymous usability questionnaire. Data collection will take approximately 10 minutes per participant. **Data analysis:**

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	1. Quantitative Analysis: python (or R / RStudio) will be used to statistically compare performance metrics (e.g., average travel time) between the AI-controlled simulation and the standard fixed-timing simulation. 2. Qualitative Analysis: Feedback from the anonymous questionnaires will be summarized to evaluate the dashboard's clarity and perceived usefulness.
Outline the nature of the data held, details of anonymisation, storage and disposal procedures as required.	**Nature of Data:** The project holds two distinct types of data: 1. **Participant Data:** Anonymous opinions and ratings collected from the usability questionnaire. 2. **Computational Data:** Non-sensitive, numerical traffic flow statistics (DfT data) and simulation configuration files (SUMO data). 3. For this project, the UK-wide DfT traffic data will be filtered so that only records related to the Sheffield area are used in the simulations. **Anonymisation:** All participant data will be collected **fully anonymously**. The questionnaire will not ask for any Personal Identifiable Information (PII) such as name or student ID. Anonymisation of the computational data is N/A as it consists of aggregated, non-identifiable public statistics. **Data Licensing (Addressing Copyright):** This project acknowledges that the DfT datasets are **Crown Copyright** (and not "public domain"). The data is used under the explicit permission granted by the **Open Government Licence (OGL) v3.0**, which allows for the re-use of this information in academic research. Open Government Licence **Storage:** All data will be stored exclusively on the student's allotted **networked F drive space**, as per mandatory SHU policy. **Disposal:** Data will be retained for the period mandated by the university/module policy and then deleted from the F drive.

4. Research in External Organisations

Question	Yes/No
1. Will the research involve working with/within an external organisation (e.g., school, business, charity, museum, government department, international agency, etc.)?	**NO**
2. If you answered YES to question 1, do you have granted access to conduct the research from the external organisation? *If YES, students please show evidence to your supervisor. You should retain this evidence safely.*	NO
3. If you do not have permission for access is this because: A. you have not yet asked B. you have asked and not yet received an answer C. you have asked and been refused access *Note: You will only be able to start the research when you have been granted access.*	

5. Research with Products and Artefacts

Question	Yes/No
1. Will the research involve working with copyrighted documents, films, broadcasts, photographs, artworks, designs, products, programs, databases, networks, processes, existing datasets, or secure data?	**YES** (Involves DfT data ,OSM DATA and the SUMO software).

Question	Yes/No
2. If you answered YES to question 1, are the materials you intend to use in the public domain? *Notes: 'In the public domain' does not mean the same thing as 'publicly accessible'.* • *Information which is 'in the public domain' is no longer protected by copyright (i.e., copyright has either expired or been waived) and can be used without permission.* • *Information which is 'publicly accessible' (e.g., TV broadcasts, websites, artworks, newspapers) is available for anyone to consult/view. It is still protected by copyright even if there is no copyright notice. In UK law, copyright protection is automatic and does not require a copyright statement, although it is always good practice to provide one. It is necessary to check the terms and conditions of use to find out exactly how the material may be reused etc.* *If you answered YES to question 1, be aware that you may need to consider other ethics codes. For example, when conducting Internet research, consult the code of the Association of Internet Researchers; for educational research, consult the Code of Ethics of the British Educational Research Association.*	NO
3. If you answered NO to question 2, do you have explicit permission to use these materials as data? *If YES, please show evidence to your supervisor.*	YES
4. If you answered NO to question 3, is it because: A. you have not yet asked permission B. you have asked and not yet received and answer C. you have asked and been refused access. *Note: You will only be able to start the research when you have been granted permission to use the specified material.*	**N/A**

SECTION B

HEALTH AND SAFETY RISK ASSESSMENT FOR THE RESEARCHER

1. **Does this research project require a health and safety risk assessment for the procedures to be used?** (Discuss this with your supervisor)

   ☐ Yes
   ☒ No

   If **YES** the completed Health and Safety Risk Assessment form should be attached. A standard risk assessment form can be generated through the Awaken system (https://shu.awaken-be.com). Alternatively if you require more specific risk assessment, e.g. a COSHH, attach that instead.

2. **Will the data be collected fully online (no face-to-face contact with participants)?**

☒ Yes (See the safety guidance for online research[2] and **go to question 7b**)
☐ No (Go to question 3)

3. Will the proposed data collection take place on campus?

☐ Yes (Please answer questions 5 to 8)
☒ No (Please complete all questions and consult with your supervisor))

4. Where will the data collection take place?
(Tick as many as apply if data collection will take place in multiple venues)

	Location	**Please specify**
☐	Researcher's Residence	
☐	Participant's Residence	
☐	Education Establishment	
☒	Other e.g., business/voluntary organisation, public venue	**fully Online via the Internet**
☐	Outside UK	

5. How will you travel to and from the data collection venue?

☐ On foot ☐ By car ☐ Public Transport
☒ Other (Please specify) **N/A**

Please outline how you will ensure your personal safety when travelling to and from the data collection venue.

N/A no travel required

6. How will you ensure your own personal safety whilst at the research venue?

N/A

7. Are there any potential risks to your health and wellbeing associated with either (a) the venue where the research will take place and/or (b) the research topic itself?

☒ None that I am aware of
☐ Yes (Please outline below including steps taken to minimise risk)

[2] Safety guidance for online research includes information on how to set up online surveys and/or conduct online interviews/focus groups. These guidelines can be found in BB. Please check with your supervisor/module leader.

N/A

8. If you are carrying out research off-campus, you must ensure that each time you go out to collect data you ensure that someone you trust knows where you are going (without breaching the confidentiality of your participants), how you are getting there (preferably including your travel route), when you expect to get back, and what to do should you not return at the specified time.

Please outline here the procedure you propose using to do this.

N/A

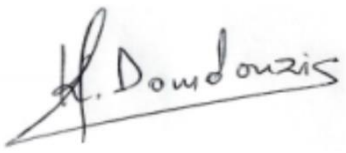
Insurance Check

The University's standard insurance cover will not automatically cover research involving any of the following:

i) Participants under 5 years old
ii) Pregnant women
iii) 5000 or more participants
iv) Research being conducted in an overseas country
v) Research involving aircraft and offshore oil rigs
vi) Nuclear research
vii) Any trials/medical research into Covid 19

If your proposals do involve any of the above, please contact the Insurance Manager directly (fin-insurancequeries-mb@exchange.shu.ac.uk) to discuss this element of your project.

Adherence to SHU Policy and Procedures

<table>
<tr><td colspan="2">Ethics sign-off</td></tr>
<tr><td colspan="2">Personal statement</td></tr>
<tr><td colspan="2">I can confirm that:
I have read the Sheffield Hallam University Research Ethics Policy and Procedures
I agree to abide by its principles.</td></tr>
<tr><td colspan="2">Student</td></tr>
<tr><td>Name: MANDAR DNYANESHWAR SATPUTE</td><td>Date:07/11/2025</td></tr>
<tr><td colspan="2">Signature: MANDAR DNYANESHWAR SATPUTE</td></tr>
<tr><td colspan="2">Supervisor ethical sign-off</td></tr>
<tr><td colspan="2">I can confirm that completion of this form has not identified the need for ethical approval by the TPREC/CREC or an NHS, Social Care, or other external REC. The research will not commence until any approvals required under Sections 4 & 5 have been received and any necessary health and safety measures are in place.</td></tr>
<tr><td>Name: Konstantinos Domdouzis</td><td>Date: 11/12/2025</td></tr>
<tr><td colspan="2">Signature:
  </td></tr>
<tr><td colspan="2">Independent Reviewer ethical sign off</td></tr>
<tr><td>Name:</td><td>Date:</td></tr>
<tr><td colspan="2">Signature:</td></tr>
</table>

Please ensure that you have attached all relevant documents. Your supervisor must approve them before you start data collection:

Documents	Yes	No	N/A
Research proposal if prepared previously	☐	☒	☐
Any recruitment materials (e.g., posters, letters, emails, etc.)	☐	☒	☐
Participant information sheet[3]	☒	☐	☐
Participant consent form[4]	☒	☐	☐
Details of measures to be used (e.g., questionnaires, etc.)	☐	☒	☐
Outline interview schedule / focus group schedule	☐	☒	☐
Debriefing materials	☐	☒	☐
Health and Safety Risk Assessment Form	☐	☒	☐

[3] It is mandatory to attach the Participant Information Sheet (PIS)
[4] It is mandatory to attach a Participant Consent Form, unless it is embedded in an online survey, in which case your supervisor must approve it before you start data collection