Constraint-Aware Vision–Language–Action Architectures for Structured Built-Environment Reasoning
EPSRC funded PhD studentship with full fee waiver and £21,805 pa stipend (2026/27 rate)

Project Code: DLA_DTP_2026_22

Main Supervisor: Dr Shamaila Iram

Co-Supervisor: Professor Phil Brown

Project Introduction

Large Vision–Language Models have demonstrated strong multimodal reasoning capabilities; however, they are not designed for structured, constraint-bound decision environments such as housing-energy systems. Current dashboards provide descriptive analytics but cannot perform integrated reasoning across visual interface representations, structured housing datasets, and stakeholder queries. This project will develop a constraint-aware hybrid Vision–Language–Action architecture capable of joint multimodal reasoning and action recommendation within structured built-environment contexts. Using an operational 10,000-property dataset, the research advances methodological innovation in multimodal fusion, structured reasoning, and action-grounded AI.

Project Details

Despite advances in Vision–Language Models, existing architectures are not suited to structured, decision-critical environments where tabular data, domain constraints, and action feasibility must be jointly reasoned. Built-environment systems such as housing-energy platforms require integration of structured EPC data, retrofit histories, energy consumption records, and visual interface representations alongside natural language stakeholder queries. No current multimodal framework enables constraint-aware, action-grounded reasoning in this context.

This PhD will develop a novel hybrid Vision–Language–Action architecture explicitly designed for structured built-environment reasoning. The research builds upon an operational visualisation platform containing EPC attributes, fabric data, and energy metrics across approximately 10,000 properties provided by Together Housing Group. The platform will serve as a testbed rather than the research output.

The methodological innovation centres on **three** contributions:

1. **Constraint-Aware Multimodal Fusion**

   Development of a structured reasoning module that integrates tabular housing-energy data with visual-language embeddings through a constraint-aware fusion mechanism.

2. **Action-Grounded Decision Architecture**

   Design of an inference layer capable of generating feasible retrofit or intervention recommendations under energy, fabric, and cost constraints.

3. **Health-Informed Explainable Reasoning**

   Integration of evidence-informed environmental health risk proxies (e.g., damp risk, thermal inefficiency, fuel poverty indicators) to provide explainable reasoning linking actions to potential health mitigation without using patient-level data.

The research will progress in staged development:

- **Year 1** will focus on domain-adaptive VLM integration and structured data fusion;
- **Year 2** will develop action-grounded constraint modelling;
- **Year 3** will integrate health-aware reasoning, robustness evaluation, and generalisation analysis.

Project-specific entry requirements

- Hold (or expect to obtain) a First Class or strong Upper Second-Class degree in Computer Science, Artificial Intelligence, Data Science, Engineering, or a related discipline
- Demonstrate strong programming skills (Python; PyTorch/TensorFlow preferred)
- Have knowledge of deep learning, multimodal modelling, and machine learning theory
- Show interest in AI for structured decision systems and built environments
- Demonstrate ability to work with heterogeneous and multimodal datasets

Further Information

This call is open to **UK Applicants only**.

Applicants should be of outstanding quality and exceptionally motivated.

The studentships are funded for 3 years (subject to satisfactory annual performance and progression review) and will provide for tuition fees and a tax-free stipend paid monthly.

Please note that there are more projects than funded studentships available and therefore this is a competitive application process which will include an interview. Shortlisted candidates will be contacted for an interview in person or via Teams. After interview the most outstanding applicants will be offered a studentship.

Queries about the application process are welcome and should be emailed to pgrscholarships@hud.ac.uk.

Informal enquiries about this project should be directed to Dr Shamaila Iram.

Type of Award: Doctor of Philosophy (PhD).

Eligibility: UK applicants only. First Class or Upper Second-Class Honours degree or equivalent in a

relevant subject area, please refer to the entry requirements on the specific projects being advertised.

Location: Huddersfield.

Funding: 3 years full time research covering tuition fees and a tax-free bursary (stipend) starting at £21,805 for 2026/27 and increasing in line with the EPSRC guidelines for the subsequent years. Funded via the Engineering and Physical Sciences Research Council Doctoral Training Programme.

Duration: 3 years full-time plus 12 months writing up (please note no funding available for writing up period).

Closing date: 28th April 2026

Start date: 1st October 2026

Application details

- Go to the EPSRC webpage and download the Expression of Interest Form 2026.
- Provide copies of transcripts & certificates of all relevant academic and professional qualifications.
- Provide references from two individuals – please contact your referees and ask them to send them directly to pgrscholarships@hud.ac.uk from their email address.
- Proof of eligibility – e.g. scan of passport photo page.
- Completed forms, including all relevant documents should be submitted via-email to pgrscholarships@hud.ac.uk.

Please note: if you do not attach all the relevant documentation prior to the closing date your application will not be considered.

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