Master’s Pitches

# Collecting Accessible Heat Loss Data

The National Energy Action has estimated that approximately 6.5 million people in the UK were living in fuel poverty January 2024 (Hinson, Bolton, & Kennedy, 2024) following a hike in energy prices. Fuel poverty can cause or exacerbate respiratory, cardiovascular, thermoregulatory and mental health conditions (Lee, Sinha, Boyce, Allen, & Goldblatt, 2023), particularly within the lower socio-economic region. With this in mind, and with a drive to install new, sustainable heating alternatives to the condensing gas boiler (Energy Saving Trust, 2024), it is important to also identify which properties are subjected to the greatest levels of heat loss. Whilst generic data sets exist to predict the approximate rate of heat loss for homes of a certain age, size, number of occupants etc., there is nothing widely accessible and comprehensive that considers all these features. This project aims to build on current, unrefined processes for collecting the heat loss data across the UK and propose a platform whereby that data may be easily accessible to aid tackling the problem of fuel poverty.

## Visions for the Project

* Design a drone fitted with infrared cameras that addresses the problems of unreliable temperature readings (considering important features such as build quality, repairability, user interface etc.)
* Create a business case for the value of this technology (identifying houses with high levels of heat loss data earlier can prompt effective targeting to minimise spending/energy consumption – dynamic pricing model for renovations possibly)
* Incentivise people to collect their own heat loss data?
* Gamification of heat loss data collection from the homeowners

## General Information

* Home temperature losses are highest in [**the UK**](https://www.euronews.com/green/2022/11/22/uk-government-announces-funds-to-insulate-homes-is-it-proof-that-civil-resistance-works), which has the oldest housing stock: 37 per cent of homes in the UK were built before 1946

# Weather Compensation Modelling with Forecasting

New sustainable heating alternatives to the standard gas boiler utilise modelling software to minimise energy consumption. Heating properties at lower flow temperatures allows for heating systems to leverage higher Coefficients of Performance (COP) and reduce cycling effects. It is therefore important to develop accurate weather compensation models that consider details about the property whilst anticipating changes in demand (weather, popular use cases etc.). This project aims to use data from a variety of housing archetypes to accurately predict potential energy savings with practical and idealistic heating systems, leveraging machine learning, forecasting and data analysis.

## Visions for the Project

* Collect data on a variety of houses to compare heat loss values and energy costs
* Develop a machine learning model that considers as many features as possible about a house to predict the heat loss for that property (train against known heat loss data)
* Integrate weather forecasting to see whether predictive changes can trigger significant savings

## Bottlenecks

* Accessibility to data

# Morphogenetic Design and Construction

* Morphogenetics inspired generative AI software for designing biological structures capable of growing into areas with structural weaknesses to offer reinforcement
* Building Information Modelling (BIM) software plugin for designing morphological structures inspired within a known environment (i.e take a prompt for a bridge to be built over a river)
* A morphogenetic approach to building natural environments

## Useful Links

<https://www.youtube.com/watch?v=bEm-fXkLw7g>

<https://www.youtube.com/watch?v=3BFf7mJNSQE>

# Carbon Storage through Limestone Mineralisation AI

Existing approaches to storing sequestered carbon through mineralisation involve large robotic arrays of powdered lime that the carbon is passed over to be effectively absorbed.

# Agricultural Yield Modelling and Optimisation

As a result of climate change, accessibility to water is becoming increasingly scarce

* Crop field optimisation with topological analysis of environment and climate forecasting with the aim to maximise profits – design a dashboard (full stack design), allow farmers to model long term and short gains effectively

## Useful Links

<https://www.sciencedirect.com/science/article/pii/S0301479705002677>

# Alternatives to Concrete Tunnel Boring Rings

# Manufacturing Complex Geometric Bodies Through Subtractive Manufacturing Techniques

<https://www.youtube.com/watch?v=bfJY0syocfU>

* Use Liam’s connections at hypertunnel to learn more about tunnel boring swarm robotics