APPLICATION FOR ETHICAL APPROVAL

In order for research to result in benefit and minimise risk of harm, it must be conducted ethically. A researcher may not be covered by the University's insurance if ethical approval has not been obtained prior to commencement.

The University follows the OECD Frascati manual definition of **research activity**: "creative work undertaken on a systematic basis in order to increase the stock of knowledge, including knowledge of man, culture and society, and the use of this stock of knowledge to devise new applications". As such this covers activities undertaken by members of staff, postgraduate research students, and both taught postgraduate and undergraduate students working on dissertations/projects.

The individual undertaking the research activity is known as the "principal researcher".

Ethical approval is not required for routine audits, performance reviews, quality assurance studies, testing within normal educational requirements, and literary or artistic criticism.

Please read the notes for guidance before completing ALL sections of the form.

This form must be completed and approved prior to undertaking any research activity. Please see Checklist for details of process for different categories of application.

Delete the Guidance Notes at the end of the form BEFORE submitting your application

SECTION A: About You (Principal Researcher)

1	Full Name:		Xu Zhang			
2	Tick all boxes which apply:		Member of staff:	☐	Honorary research fellow:	☐
3	Undergraduate Student	☐	Taught Postgraduate Student	☒	Postgraduate Research Student	☐

4	Institute/Academic Discipline/Centre:	University of Wales Trinity Saint David
5	Campus:	Swansea
6	E-mail address:	2200467@student.uwtsd.ac.uk
7	Contact Telephone Number:	+86 13870996130
	For students:	
8	Student Number:	2200467
9	Programme of Study:	Software Engineering and Artificial Intelligence
10	Director of Studies/Supervisor:	Terry Walcott

SECTION B: Approval for Research Activity

1	Has the research activity received approval in principle? (please check the Guidance Notes as to the appropriate approval process for different levels of research by different categories of individual)		**YES**	☒	**NO** ☐
					Date
2	If Yes, please indicate source of approval (and date where known): ***Approval in principle must be obtained from the relevant source prior to seeking ethical approval***	Research Degrees Committee		☒	**31/03/2023**
3		Institute Research Committee		☐	
4		Other (write in)		☐	

SECTION C: Internal and External Ethical Guidance Materials

	Please list the core ethical guidance documents that have been referred to during the completion of this form (including any discipline-specific codes of research ethics, and also any specific ethical guidance relating to the proposed methodology). Please tick to confirm that your research proposal adheres to these codes and guidelines.	
1	**UWTSD Research Ethics & Integrity Code of Practice**	☒
2	**UWTSD Research Data Management Policy**	☒
3		☐

SECTION D: External Collaborative Research Activity

1	Does the research activity involve collaborators outside of the University?		**YES**	☐	**NO**	☒
2	If Yes, please provide the name of the external organisation and name and contact details for the main contact person and confirmation this person has consented to their personal data being shared.as part of this collaboration.					
3	Institution					
4	Contact person name					
5	Contact person e-mail address					
6	Has this individual consented to sharing their details on this form?		**YES**	☐	**NO**	☐
7	Are you in receipt of a KESS scholarship?		**YES**	☐	**NO**	☐
8	Is your research externally funded		**YES**	☐	**NO**	☐
9	Are you specifically employed to undertake this research in either a paid or voluntary capacity?	Voluntary	**YES**	☐	**NO**	☐
10		Employed	**YES**	☐	**NO**	☐
11	Is the research being undertaken within an existing UWTSD Athrofa Professional Learning Partnership (APLP)	If YES then the permission question below does not need to be answered.	**YES**	☐	**NO**	☐
12	Permission to undertake the research has been provided by the partner organisation	(If YES attach copy) If NO the application cannot continue	**YES**	☐	**NO**	☐

Where research activity is carried out in collaboration with an external organisation

13	Does this organisation have its own ethics approval system?	**YES**	☐	**NO**	☐
14	If Yes, please attach a copy of any final approval (or interim approval) from the organisation				

SECTION E: Details of Research Activity

1	Indicative title:	Search on Chiller load prediction based on CEEMDAN-BiLSTM-Attention model for sufficient data and small sample data cases		
2	Proposed start date:	31/03/23	Proposed end date:	25/04/23

3 **Introduction to the Research (maximum 300 words)**

Ensure that you write for a <u>Non-Specialist Audience</u> when outlining your response to the three points below:

- *Purpose of Research Activity*
- *Proposed Research Question*
- *Aims of Research Activity*
- *Objectives of Research Activity*

Demonstrate, briefly, how **<u>Existing Research</u>** has informed the proposed activity and explain

- *What the research activity will add to the body of knowledge*
- *How it addresses an area of importance.*

4 **Purpose of Research Activity**

In recent years, there has an expanding concern about energy consumption, with energy consumption for buildings reaching about 40%. In order to achieve intelligent decision management in terms of energy, the ability to correctly forecast a building's energy load is essential.

(this box should expand as you type)

5 **Research Question**

In HVAC systems, chillers consume more than half of the energy required to maintain indoor thermal comfort, and the majority of instantaneous load-based supervisory optimization solutions have a lag. Therefore, it is necessary to develop HVAC system power distribution strategies based on chiller load forecasts to achieve energy efficiency optimization.

(this box should expand as you type)

6 **Aims of Research Activity**

Find a method to improve the accuracy of chiller load for sufficient data and small sample data cases.

(this box should expand as you type)

7 **Objectives of Research Activity**

HVAC operational dataset in buildings.

(this box should expand as you type)

8 **Proposed methods (maximum 600 words)**

(1) CNN model is combined with the BiLSTM model to build the migration model. It uses superimposition of four convolutional layers and four pooling layers as CNN layers to extract data features, and then fed them into the BiLSTM neural network for chiller load prediction.

	(2) Make the CEEMDAN-BiLSTM-Attention model as the prediction model. Firstly, the collected building chiller operation data are pre-processed by de-weighting and padding to generate original data y(t), and use CEEMDAN to decompose it into multiple IMF components. After being independently normalized for each deconstructed IMF subsequence, each IMF component is then predicted using the BiLSTM and Attention method.
9	(this box should expand as you type)

10	**Location of research activity** Identify all locations where research activity will take place.
11	Wuhan University of Technology (this box should expand as you type)
12	**Research activity outside of the UK** If research activity will take place overseas, you are responsible for ensuring that local ethical considerations are complied with and that the relevant permissions are sought. Specify any local guidelines (e.g. from local professional associations/learned societies/universities) that exist and whether these involve any ethical stipulations beyond those usual in the UK (provide details of any licenses or permissions required). Also specify whether there are any specific ethical issues raised by the local context in which the research activity is taking place, for example, particular cultural and/or legal sensitivities or vulnerabilities of participants.
13	*(this box should expand as you type)*

14	Use of documentation not in the public domain: Are any documents **NOT** publicly available?	**NO**	☒
		YES	☐
15	If Yes, please provide details here of how you will gain access to specific documentation that is not in the public domain and that this is in accordance with prevailing data protection law of the country in question and England and Wales. *(this box should expand as you type)*		

SECTION F: Scope of Research Activity

1	**Will the research activity include:**	**YES**	**NO**
2	Use of a questionnaire or similar research instrument?	☐	☒
3	Use of interviews?	☐	☒
4	Use of diaries?	☐	☒
5	Participant observation with their knowledge?	☒	☐
6	Participant observation without their knowledge?	☐	☒
7	Use of video or audio recording?	☒	☐
8	Access to personal or confidential information without the participants' specific consent?	☐	☒
9	Administration of any questions, test stimuli, presentation that may be experienced as physically, mentally or emotionally harmful / offensive?	☐	☒
10	Performance of any acts which may cause embarrassment or affect self-esteem?	☐	☒
11	Investigation of participants involved in illegal activities?	☐	☒
12	Use of procedures that involve deception?	☐	☒
13	Administration of any substance, agent or placebo?	☐	☒
14	Working with live vertebrate animals?	☐	☒

15	Other primary data collection methods, please explain in this box For example, 'focus groups'. Please indicate the type of data collection method(s) in this box and tick the accompany box.		
16	Details of any other primary data collection method: (this box should expand as you type)	☐	☐

If NO to every question, then the research activity is (ethically) low risk and **may** be exempt from **some** of the following sections (please refer to Guidance Notes).

If YES to any question, then no research activity should be undertaken until full ethical approval has been obtained.

SECTION G: Intended Participants

1	**Who are the intended participants:**	**YES**	**NO**
2	Students or staff at the University?	☒	☐
3	Adults (over the age of 18 and competent to give consent)?	☒	☐
4	Vulnerable adults?	☐	☒
5	Children and Young People under the age of 18? (Consent from Parent, Carer or Guardian will be required)	☐	☒
6	Prisoners?	☐	☒
7	Young offenders?	☐	☒
8	Those who could be considered to have a particularly dependent relationship with the investigator or a gatekeeper?	☐	☒
9	People engaged in illegal activities?	☐	☒
10	Others (please identify specifically any group who may be unable to give consent) please indicate here and tick the appropriate box.		
11	Other – please indicate here: (this box should expand as you type)	☐	☒

12	**Participant numbers and source** Provide an estimate of the expected number of participants. How will you identify participants and how will they be recruited?	
13	How many participants are expected?	Three *(this box should expand as you type)*
14	Who will the participants be?	Classmates in UWTSD *(this box should expand as you type)*
15	How will you identify the participants?	By whether they are willing to research this field *(this box should expand as you type)*

16	**Information for participants:**	YES	NO	N/A
17	Will you describe the main research procedures to participants in advance, so that they are informed about what to expect?	☒	☐	☐
18	Will you tell participants that their participation is voluntary?	☒	☐	☐
19	Will you obtain written consent for participation?	☒	☐	☐
20	Will you explain to participants that refusal to participate in the research will not affect their treatment or education (if relevant)?	☒	☐	☐
21	If the research is observational, will you ask participants for their consent to being observed?	☒	☐	☐
22	Will you tell participants that they may withdraw from the research at any time and for any reason?	☒	☐	☐
23	With questionnaires, will you give participants the option of omitting questions they do not want to answer?	☒	☐	☐
24	Will you tell participants that their data will be treated with full confidentiality and that, if published, it will not be identifiable as theirs?	☒	☐	☐
25	Will you debrief participants at the end of their participation, in a way appropriate to the type of research undertaken?	☒	☐	☐
26	If NO to any of above questions, please give an explanation			
27	*(this box should expand as you type)*			

28	**Information for participants:**	YES	NO	N/A
29	Will participants be paid?	☐	☒	☐
30	Is specialist electrical or other equipment to be used with participants?	☐	☒	☐
31	Are there any financial or other interests to the investigator or University arising from this study?	☐	☒	☐
32	Will the research activity involve deliberately misleading participants in any way, or the partial or full concealment of the specific study aims?	☐	☒	☐
33	If YES to any question, please provide full details			
34	*(this box should expand as you type)*			

SECTION H: Anticipated Risks

1	**Outline any anticipated risks that may adversely affect any of the participants, the researchers and/or the University, and the steps that will be taken to address them.** If you have completed a full risk assessment (for example as required by a laboratory, or external research collaborator) you may append that to this form.		
2	**Full risk assessment completed and appended?**	**Yes**	☐
		No	☒
3	**Risks to participants** For example: emotional distress, financial disclosure, physical harm, transfer of personal data, sensitive organisational information		
4	Risk to Participant: *(this box should expand as you type)*	*How will you mitigate the Risk to Participant* *(this box should expand as you type)*	

5	If research activity may include sensitive, embarrassing or upsetting topics (e.g. sexual activity, drug use) or issues likely to disclose information requiring further action (e.g. criminal activity), give details of the procedures to deal with these issues, including any support/advice (e.g. helpline numbers) to be offered to participants. Note that where applicable, consent procedures should make it clear that if something potentially or actually illegal is discovered in the course of a project, it may need to be disclosed to the proper authorities	
	(this box should expand as you type)	
6	**Risks to investigator** For example: personal safety, physical harm, emotional distress, risk of accusation of harm/impropriety, conflict of interest	
	Risk to Investigator: *(this box should expand as you type)*	*How will you mitigate the Risk to Investigator:* *(this box should expand as you type)*
7	**University/institutional risks** For example: adverse publicity, financial loss, data protection	
	Risk to University: *(this box should expand as you type)*	*How will you mitigate the Risk to University:* *(this box should expand as you type)*

8	**Disclosure and Barring Service**			
9	If the research activity involves children or vulnerable adults, a Disclosure and Barring Service (DBS) certificate must be obtained before any contact with such participants.	**YES**	**NO**	**N/A**
10	Does your research require you to hold a current DBS Certificate?	☐	☐	☐

SECTION I: Feedback, Consent and Confidentiality

1	**Feedback** What de-briefing and feedback will be provided to participants, how will this be done and when?
	I will provide participants with real-time information on the current progress of the study, some of the issues that have arisen in the study. Through group discussions or online meetings *(this box should expand as you type)*
2	**Informed consent** Describe the arrangements to inform potential participants, before providing consent, of what is involved in participating. Describe the arrangements for participants to provide full consent before data collection begins. If gaining consent in this way is inappropriate, explain how consent will be obtained and recorded in accordance with prevailing data protection legislation.
	(this box should expand as you type)
3	**Confidentiality / Anonymity** Set out how anonymity of participants and confidentiality will be ensured in any outputs. If anonymity is not being offered, explain why this is the case.
	Do a good confidentiality agreement, do not disclose information with others, do not publish the information of participants in any channel. *(this box should expand as you type)*

SECTION J: Data Protection and Storage

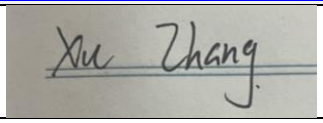
In completing this section refer to the University's Research Data Management Policy and the extensive resources on the University's Research Data Management web pages (http://uwtsd.ac.uk/library/research-data-management/).

1	Does the research activity involve personal data (as defined by the General Data Protection Regulation 2016 "GDPR" and the Data Protection Act 2018 "DPA")?	**YES**	**NO**
	"Personal data" *means any information relating to an identified or identifiable natural person ('data subject'). An identifiable natural person is one who can be identified, directly or indirectly, in particular by reference to an identifier such as a name, an identification number, location data, an online identifier or to one or more factors specific to the physical, physiological, genetic, mental, economic, cultural or social identity of that natural person.*	☐	NO
2	If YES, provide a description of the data and explain why this data needs to be collected:		
	(this box should expand as you type)		
3	Does it involve special category data (as defined by the GDPR)?	**YES**	**NO**
	"Special category data" *means sensitive personal data consisting of information as to the data subjects' –* *(a) racial or ethnic origin,* *(b) political opinions,* *(c) religious beliefs or other beliefs of a similar nature,* *(d) membership of a trade union (within the meaning of the Trade Union and Labour Relations (Consolidation) Act 1992),* *(e) physical or mental health or condition,* *(f) sexual life,* *(g) genetics,* *(h) biometric data (as used for ID purposes),*	☐	NO
4	If YES, provide a description of the special category data and explain why this data needs to be collected:		
	(this box should expand as you type)		

5	Will the research activity involve storing personal data and/or special category data on one of the following:	**YES**	**NO**
6	Manual files (i.e. in paper form)?	☐	☒
7	University computers?	☐	☒
8	Private company computers?	☐	☒
9	Home or other personal computers?	☒	☐
10	Laptop computers/ CDs/ Portable disk-drives/ memory sticks?	☒	☐
11	"Cloud" storage or websites?	☐	☒
12	Other – specify:	☐	☒
13	For all stored data, explain the measures in place to ensure the security of the data collected, data confidentiality, including details of password protection, encryption, anonymisation and pseudonymisation:		

	All the data will only be saved on my laptop *(this box should expand as you type)*		
14	**All Data Storage**		
15	Will the research activity involve any of the following activities:	**YES**	**NO**
16	Electronic transfer of data in any form?	☐	☒
17	Sharing of data with others at the University?	☐	☒
18	Sharing of data with other organisations?	☐	☒
19	Export of data outside the European Union or importing of data from outside the UK?	☐	☒
20	Use of personal addresses, postcodes, faxes, emails or telephone numbers?	☐	☒
21	Publication of data that might allow identification of individuals?	☐	☒
22	Use of data management system?	☐	☒
23	Data archiving?	☐	☒
24	If YES to any question, please provide full details, explaining how this will be conducted in accordance with the GDPR and DPA (and/or any international equivalent):		
	(this box should expand as you type)		
25	List all who will have access to the data generated by the research activity:		
	I will upload my data to a reliable website where anyone can download and use it. *(this box should expand as you type)*		
26	List who will have control of, and act as custodian(s) for, data generated by the research activity:		
	Only me *(this box should expand as you type)*		
27	Give details of data storage arrangements, including security measures in place to protect the data, where data will be stored, how long for, and in what form. Will data be archived – if so how and if not why not.		
	The data will be stored on a secure website for one year, and security can be improved by setting a password, etc. *(this box should expand as you type)*		
28	Please indicate if your data will be stored in the UWTSD Research Data Repository (see https://researchdata.uwtsd.ac.uk/). If so please explain. (*Most relevant to academic staff)*		
	(this box should expand as you type)		
29	Confirm that you have read the UWTSD guidance on data management (see https://www.uwtsd.ac.uk/library/research-data-management/)	**YES** **NO**	☒ ☐
30	Confirm that you are aware that you need to keep all data until after your research has completed or the end of your funding	**YES** **NO**	☒ ☐

SECTION K: Declaration

31	The information which I have provided is correct and complete to the best of my knowledge. I have attempted to identify any risks and issues related to the research activity and acknowledge my obligations and the rights of the participants**.** In submitting this application I hereby confirm that I undertake to ensure that the above named research activity will meet the University's Research Ethics and Integrity Code of Practice which is published on the website: https://www.uwtsd.ac.uk/research/research-ethics/		
	Signature of applicant:		**Date:25/04/2023**

For STUDENT Submissions:

32	Director of Studies/Supervisor:		**Date:**
33	Signature:		

For STAFF Submissions:

34	Academic Director/ Assistant Dean:		**Date:**
35	Signature:		

Checklist: Please complete the checklist below to ensure that you have completed the form according to the guidelines and attached any required documentation:

☒	I have read the guidance notes supplied before completing the form.
☒	I have completed **ALL RELEVANT** sections of the form in full.
☒	I confirm that the research activity has received approval in principle
☒	I have attached a copy of final/interim approval from external organisation (**where appropriate**)
☒	I have attached a full risk assessment (and have NOT completed Section H of this form) (where appropriate) *ONLY TICK IF YOU HAVE* ***ATTACHED A FULL RISK ASSESSMENT***
☒	I understand that it is my responsibility to ensure that the above named research activity will meet the University's Research Ethics and Integrity Code of Practice.
☒	I understand that before commencing data collection all documents aimed at respondents (including information sheets, consent forms, questionnaires, interview schedules etc.) must be confirmed by the DoS/Supervisor, module tutor or Academic Director.
☒	I have deleted the guidance notes before submitting the PG2 for consideration

RESEARCH STUDENTS AND STAFF ONLY
All communications relating to this application during its processing must be in writing and emailed to pgresearch@uwtsd.ac.uk , with the title 'Ethical Approval' followed by your name.
You will be informed of the outcome of your claim by email; therefore it is important that you check your University and personal email accounts regularly**.**

STUDENTS ON UNDERGRADUATE OR TAUGHT MASTERS PROGRAMMES should submit this form (and receive the outcome) via systems explained to you by the supervisor/module leader.

This form is available electronically from the Academic Office web pages:
https://www.uwtsd.ac.uk/academic-office/appendices-and-forms/

Application Process

All staff research projects and all research students must submit the Ethical Approval Form to the **University Research Ethics Committee** via the Academic Office (pgresearch@uwtsd.ac.uk). Staff research directly in relation to personal study for taught undergraduate or Masters programmes should be submitted via the Institute procedures explained below.

Taught masters and taught undergraduate research Ethical Approval Forms are considered **within Institutes.** Institutes will provide details of the specific processes for this. Where the Ethical issues within any single ethical application are of particular concern the Institute will refer these to the University Research Ethics Committee. Any student activity that involves the collection of primary data needs to undergo Ethical approval, this includes assignment work as well as dissertations.

ure that you comply with and tick all that are relevant to your research.