Cardiff Internet of Things Group

Internet of Things Garage

Internet of Things Research and Teaching: Vision and Mission

Introducing the Internet of Things Garage

build-driven ***experimental,*** ***applied***

'IoT Garage'
'IoT Laboratory'

History:

Principal Investigator:

PhD Students:

Nada Alhirabi
Designing Privacy by Design IoT Applications
[Since OCT 2018]

Areej Alabbas*
Secure Service Placement for IoT
[Since JAN 2019]

Atheer Jeraisy
Reusable Privacy Components for IoT
[Since APR 2019]

Asma Irfan
Adapting to Discomfort Towards Sustainable Built Environments [Since JAN 2020]

Naeima Hamed
Semantic Data Integration For Forest Observatory
[Since JAN 2020]

Reem Aldhafiri
Cyber-Physical Privacy for Ageing
[Since OCT 2020]

Wael Alsafery
Layered Framework Towards Resilient Smart Buildings
[Since JAN 2021]

Yaser Awwad
Video Analytics for Anomaly Detection
[Since JUL 2021] [MPhil]

Norah Albazzai
Augmenting Anomaly Detection with Tiny Cameras
[Since JUL 2021]

Lamya Alkhariji
Knowledge-Driven Privacy by Design for IoT
[Since DEC 2018]

Bayan Almuhander
Privacy-Aware Smart Home Data Management
[Since OCT 2019]

Dominic Fonseca
Low-Cost Reliable Multi-Sensor People Counting
[Since OCT 2020] [MPhil]

Hakan Kayan
Context-Aware Security for Cyber-Physical Systems
[Since JAN 2020]

Yasar Majib
Context-Aware Security for Smart Homes
[Since OCT 2020]

Mark Butterworth
Low Power IoT Infrastructure for Harsh Environments
[Since OCT 2020]

Omar Mousa
End-User Development for Linked-Data Observatories
[Since JAN 2021]

Abdulaziz Aljohani
Self-Configuring Anomaly Detection IoT Architecture
[Since JUL 2021]

Azhar Alsufyani
Context-Aware Knowledge-driven Cyber-Physical Security
[Since OCT 2021]

Suhas Devmane
Talking Buildings: Smart Building Pattern of life
[Since OCT 2021]

Mohammed Alosaimi
Evaluation Framework for Anomaly Detection
[Since OCT 2021]

Fatmah Alqarni
Learning Privacy and Laws Through AI-Mediated Exploration and Design
[Since APR 2022]

Siyuan Li
Adaptive Mobile Sensing within Buildings
[Since OCT 2022]

Rayan Binlajdam
Forest Health Index
[Since OCT 2022]

Kira Nurse
Tangible Interfaces for Assisting Young People with Neurodiversity
[Since OCT 2024]

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Annual Summary for 2023

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- *Designing Privacy-Aware Internet of Things Applications* *Anomaly Detection on the Edge using Smart Cameras under Low-Light Conditions*
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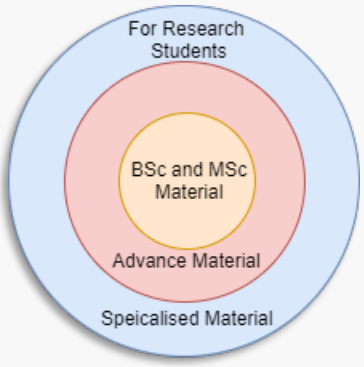
Teaching Vision

CM2306 Communication Networks
CMT223 Internet of Things: Systems Design

Content: *Applications and Use cases Architectures Sensing and Actuation Networking and Communications Data management and analytics Privacy and Security Human Factors and Interactions Design Strategies and Prototyping*

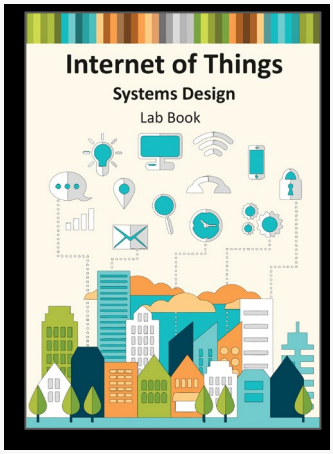
Modularity and Complexity:



Advanced materials

Specialist materials

Labs and Practical:



Research with BSc and MSc students:

Dissemination and Community Engagement

Funding Support

EPSRC Edgy Organism

(Co-Investigator)

EPSRC PETRAS 2 Event Support Grant (PESG)

(Principle-Investigator)

EPSRC PETRAS Demonstrator

(Principle-Investigator)

Google Research Scholar Program

(Principle-Investigator)

CASPER Shield (CyberASAP Program)

(Principle-Investigator)

UK – Egypt Trans-National Education (TNE) Grant: Edge Analytics 2.0

(Co-Investigator)

Scalable Circular Supply Chains for the Built Environment

(Co-Investigator)

EPSRC PETRAS 2 (National Centre of Excellence for IoT Systems Cybersecurity)

(Co-Investigator)

Checking at the Edge

Partners

Building Research Establishment

Connected Places Catapult

Danu Gurang Field Center

Defence Science and Technology Laboratory

Digital Communities Wales

Exalens

Government Communications Headquarters

Google

His Majesty's Government Communications Centre

Innovate Trust

Metropolitan Police

My Data Fix

Office of Communications

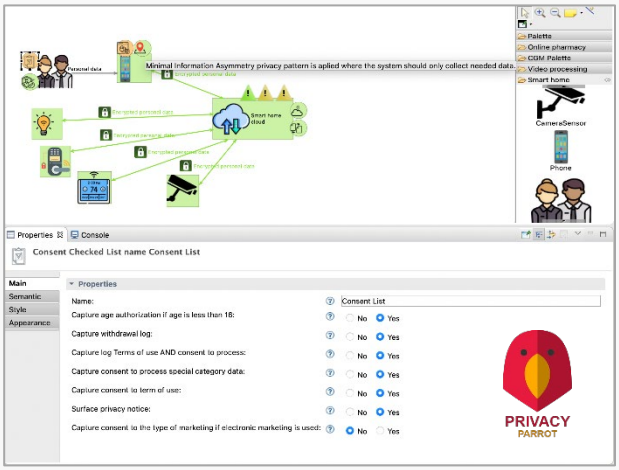
PETRAS National Centre for Cyber Security

Safehouse Technology

Vortex IoT

PRIVACY FLUID

Interactive Design Method for Augmenting Software Design Process Toward Privacy-Aware Internet of Things Application Designs



Partners and Relevant Projects

PETRAS MY DATA FIX

Outcomes

- [Journal] Designing Privacy-Aware IoT Applications for Unregulated Domains
  PDF
- [Journal] PARROT: Interactive Privacy-Aware Internet of Things Application Design Tool
  PDF BIB SOURCE VIDEO
- [Journal] Security and Privacy Requirements for the Internet of Things: A Survey
  PDF BIB
- [Demo] Demo Abstract: PARROT: Privacy by Design Tool for Internet of Things
  PDF BIB SOURCE VIDEO VIDEO
- [Poster] Privacy-Patterns for IoT Application Developers
  PDF BIB SOURCE POSTER

PRIVACY FLUID

Augmenting Software Design Processes by Developing Knowledge-based AI Technique Towards Assisted Privacy-aware Internet of Things Application Designing

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Partners and Relevant Projects

PETRAS

Outcomes

- **[Journal]** Synthesising Privacy by Design Knowledge Toward Explainable Internet of Things Application Designing in Healthcare

  PDF BIB RESOURCES SOURCE

- **[Journal]** Semantics-based Privacy by Design for Internet of Things Applications

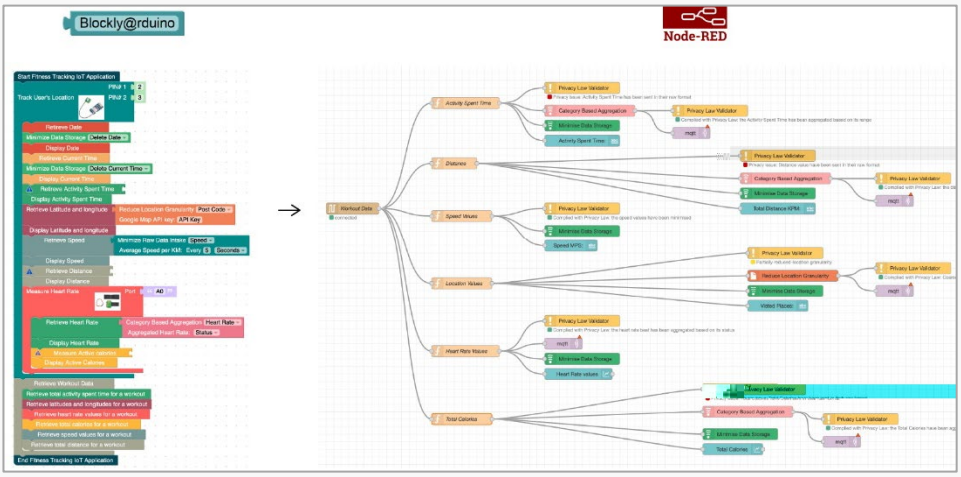
  PDF BIB RESOURCES SOURCE

- **[Poster]** Ontology Enabled Chatbot for Applying Privacy by Design in IoT Systems

  PDF BIB SOURCE POSTER

PRIVACY FLUID

Augmenting Software Engineers' Capabilities Towards Developing Privacy Law-Friendly Internet of Things Applications using End-User Development Paradigm.



Partners and Relevant Projects

PETRAS

Outcomes

- **[Technical Report]**

  PDF

- **[Journal]** **Privacy Laws and Privacy by Design Schemes for the Internet of Things: A Developer's Perspective**

  PDF BIB RESOURCES SOURCE

- **[Demo]** **Canella: Privacy-Aware End-to-End Integrated IoT Development Ecosystem**

  PDF BIB SOURCE VIDEO

PRIVACY FLUID

Interaction Methods for Privacy Preferences Management in Shared Spaces

Partners and Relevant Projects

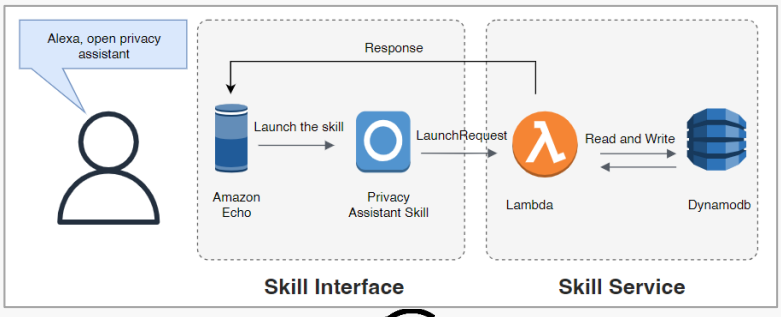
PETRAS

Outcomes

- [Technical Report] PrivacyCube: Tangible Privacy Interface for Improving Privacy Awareness in IoT PDF
- [Journal] Interactive Privacy Management: Toward Enhancing Privacy Awareness and Control in the Internet of Things, PDF BIB SOURCE
- [Demo] PriviFy: Configuring Privacy Preferences of IoT Devices using Tangible Interfaces VIDEO
- [Demo] Demo Abstract: PrivacyCube: A Tangible Device for Improving Privacy Awareness in IoT PDF BIB SOURCE VIDEO VIDEO

PRIVACY FLUID

Privacy Considerations when Designing Smart Home Systems to Facilitate Independent Living for Ageing



Partners and Relevant Projects

Innovate Trust

PETRAS

Outcomes

- [Technical Report] Understanding the Privacy Needs of Older Adults Using IoT Devices
- [Technical Report] Voice-Enabled Privacy Assistant Towards Facilitating Successful Ageing in Smart Homes
- [Conference] Enhancing Privacy Awareness and Digital Skills in Smart Home Device Users with Privacy Assistant: A Conversational Interface for Older Adults,
- [Demo] Voice-Enabled Privacy Assistant Towards Facilitating Successful Ageing in Smart Homes,

PDF BIB SOURCE VIDEO

Facilitating Novice Software Engineers to Learn Privacy by Design and Privacy Laws through AI-Mediated Exploration and Design

Tangible Interfaces for Assisting Young People with Neurodiversity Towards better Understanding Online Harms

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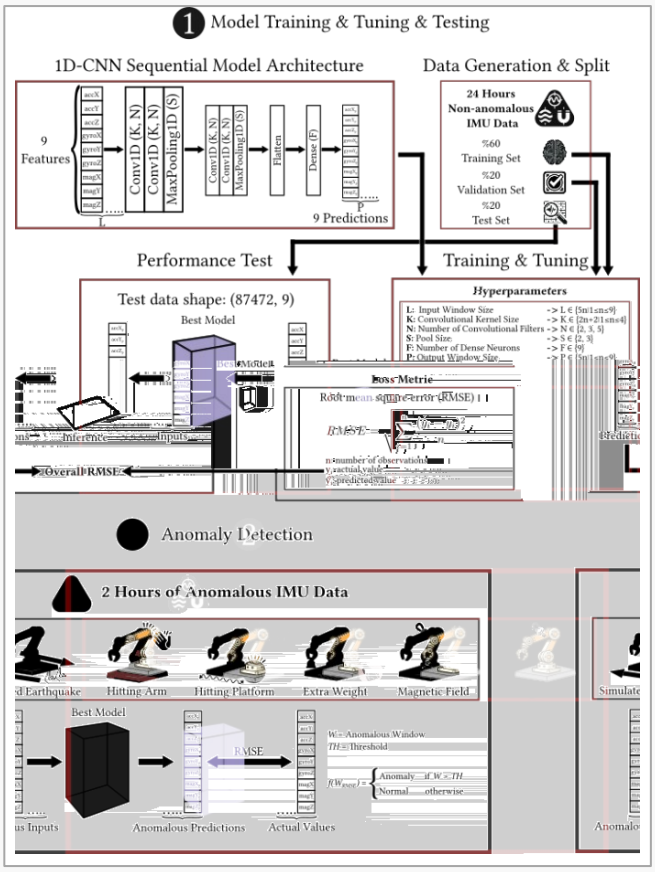
RESILIENTSENSING.AI

Context-Aware Security for Industrial Cyber-Physical Edge Resources



Partners and Relevant Projects

PETRAS GCHQ EXALENS®

Outcomes

- **[Technical Report]**
  Real-time Anomaly Detection in Industrial Robotic Arms via TinyML PDF
- **[Technical Report]**
  CASPER: Context-Aware IoT Anomaly Detection System for Industrial Robotic Arms
  PDF
- **[Journal]** **AnoML-IoT: An End-To-End Reconfigurable Multi-Protocol Anomaly Detection Pipeline for Internet of Things**
  PDF BIB SOURCE CODE CODE CODE
- **[Journal]** **Cybersecurity of Industrial Cyber-Physical Systems: A Review**
  PDF BIB SOURCE
- **[Demo]** **CASPER: Context-Aware Anomaly Detection System for Industrial Robotic Arms**
  PDF BIB SOURCE VIDEO CODE DATA SET DATA SET

RESILIENTSENSING.AI

Context-Aware Security for Smart Homes using Cyber-Physical Behavioural Data Analysis

Partners and Relevant Projects

PETRAS bre GCHQ

Outcomes

- [Technical Report] Cyber Physical Anomaly Detection for Smart Homes: A Survey PDF
- [Journal] Dataset for Cyber-Physical Anomaly Detection in Smart Homes PDF BIB SOURCE CODE DATA SET DATA SET
- [Journal] Detecting Anomalies within Smart Buildings using Do-It-Yourself Internet of Things PDF BIB DATA SET SOURCE CODE

RESILIENTSENSING.AI

Video Analytics towards Anomaly Detection on Edge for Smart Cities

(a) High-Light, *"Farm"*. (b) Rainy Weather, *"Car Parking"*.

(c) Low-Light and Noise, *"Farm"*. (d) Low-Light and Noise, *"Castle"*.

Partners and Relevant Projects

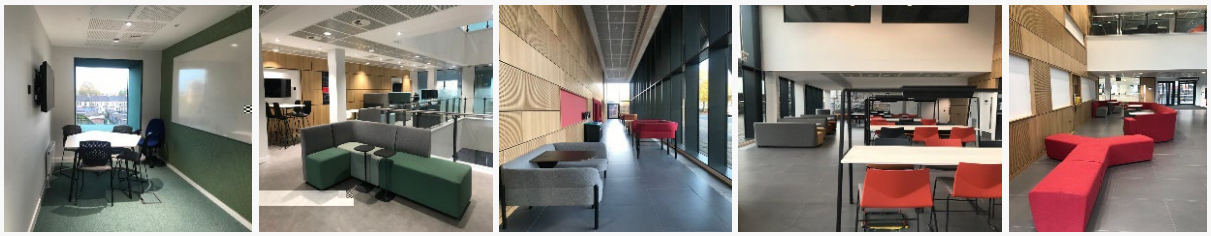
UtterBerry® CISCO BT

Outcomes

- **[Technical Report]** **Anomaly Detection on the Edge Using Smart Cameras Under Low-Light Conditions** PDF

RESILIENTSENSING.AI

Sensing as a Service within Buildings Towards Data-Driven Collaborative Service Design



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Partners and Relevant Projects

CARDIFF UNIVERSITY
PRIFYSGOL CAERDYDD

Outcomes

- [Journal] **Sensing within Smart Buildings: Survey,** PDF BIB SOURCE

RESILIENTSENSING.AI

Self-Configuring Internet of Things Architecture for Context-Aware Anomaly Detection

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Partners and Relevant Projects

Explore the Role of Tiny Cameras Towards Augmenting Anomaly Detection within Built Environments

RESILIENTSENSING.AI

Context-Aware Knowledge-Driven Cyber-Physical Security at the Edge for Smart Homes

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Partners and Relevant Projects

Outcomes

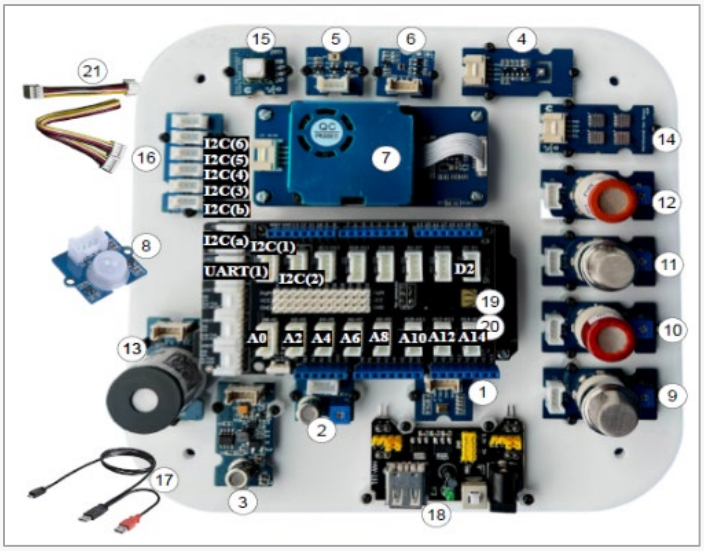
- **[Technical Report]**
  Physical Security at Smart Home: A Review,

Knowledge-based Cyber

PDF

RESILIENTSENSING.AI

Talking Buildings: Making Buildings Talk using Adaptable Data Analytics



Partners and Relevant Projects

bre

Outcomes

- [Technical Report]
  Towards A Sustainable Built Environment: A Review,
- [Technical Report]
  Detection in Smart Buildings Using IoT Sensors

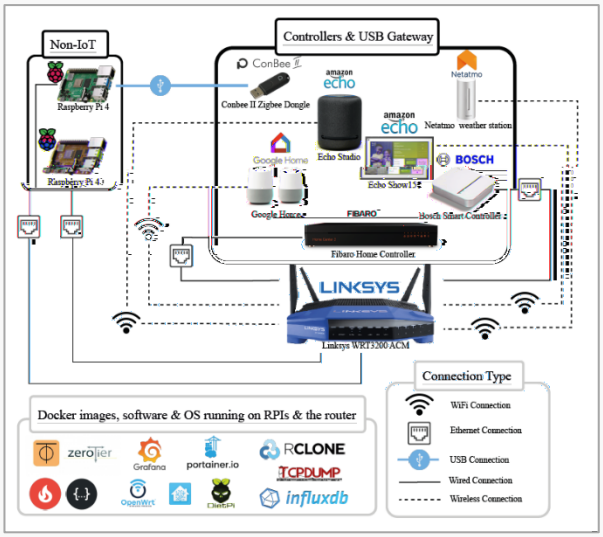
Human–Building Interaction

PDF

Dataset for Anomaly

RESILIENTSENSING.AI

Developing an Evaluation Framework for Anomaly Detection within Built Environments



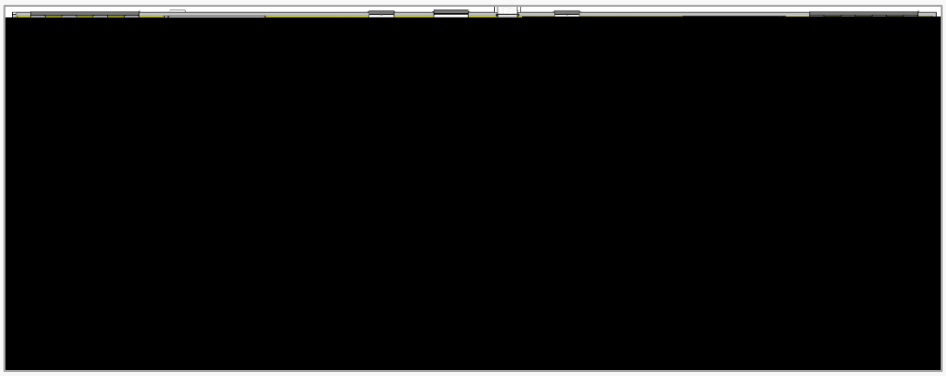
Partners and Relevant Projects

PETRAS bre GCHQ

- [Technical Report] Testbeds and Evaluation Frameworks for Anomaly Detection within Built Environments: A Systematic Review, PDF

RESILIENTSENSING.AI

Low-Cost Adaptive Mobile Sensing within Buildings towards Augmenting Smart Buildings



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Partners and Relevant Projects

RESILIENTSENSING.AI

Resilient Build Environments (CASPER Shield)

Motivation and Business Need:

Technical Challenge:

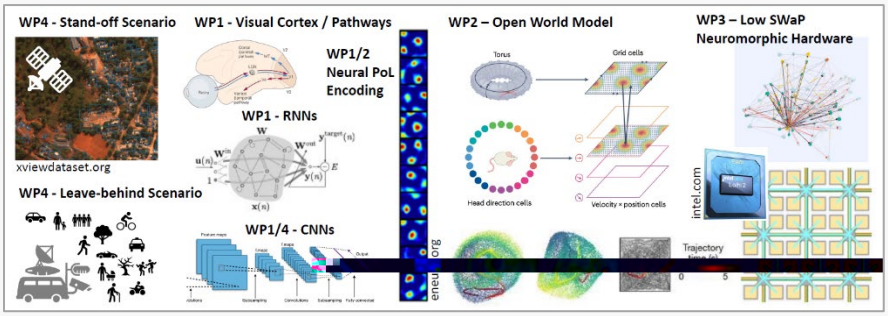
Market Opportunity and Competition:

VIDEO

CYBER + ASAP Academic Startup Accelerator Programme

RESILIENTSENSING.AI

Edgy Organism: Modelling Patterns of Life with 100mW

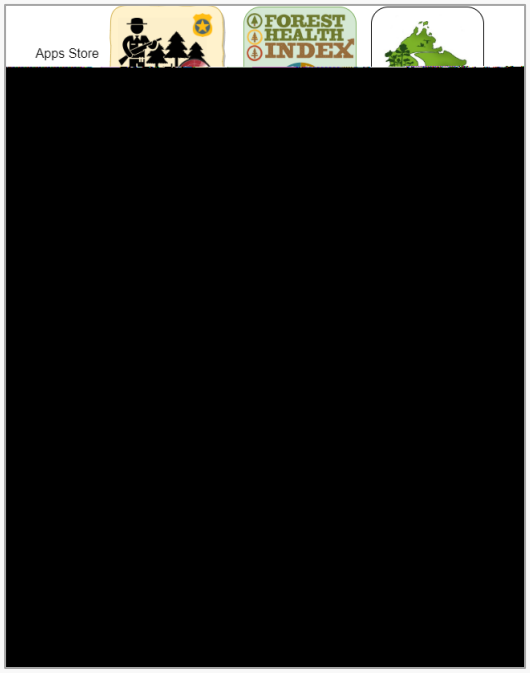


Partners and Relevant Projects

[dstl] HMGCC GCHQ

DATA OBSERVATORIES

Semantic Data Integration Towards Forest Observatory-based App Ecosystem



Partners and Relevant Projects

Outcomes

- [Technical Report]
  A Comparison of Open Data Observatories PDF
- [Technical Report]
  Forest Observatory: A Resource Of Integrated Wildlife Data
  PDF BIB RESOURCES VIDEO
- [Conference]
  FOO: An Upper-Level Ontology for the Forest Observatory,
  PDF BIB SOURCE RESOURCES
- [Journal] Query Interface for Smart City Internet of Things Data Marketplaces: A Case Study
  PDF BIB SOURCE VIDEO

DATA OBSERVATORIES

Dynamically Orchestrate-able Low Power Internet of Things Infrastructure for Sustainable Wildlife Conservation




Partners and Relevant Projects

DANAU GIRANG • FIELD CENTRE •

Making Linked Data Accessible through End-User Development for Bioscience Researchers in the Context of Micro Observatories

Partners and Relevant Projects

Outcomes

- [Technical Report]
  ForestQB: Enhancing Linked Data Exploration through Graphical and Conversational UIs Integration,
- [Technical Report]
  -

DATA OBSERVATORIES

Scalable Circular Supply Chains for the Built Environment

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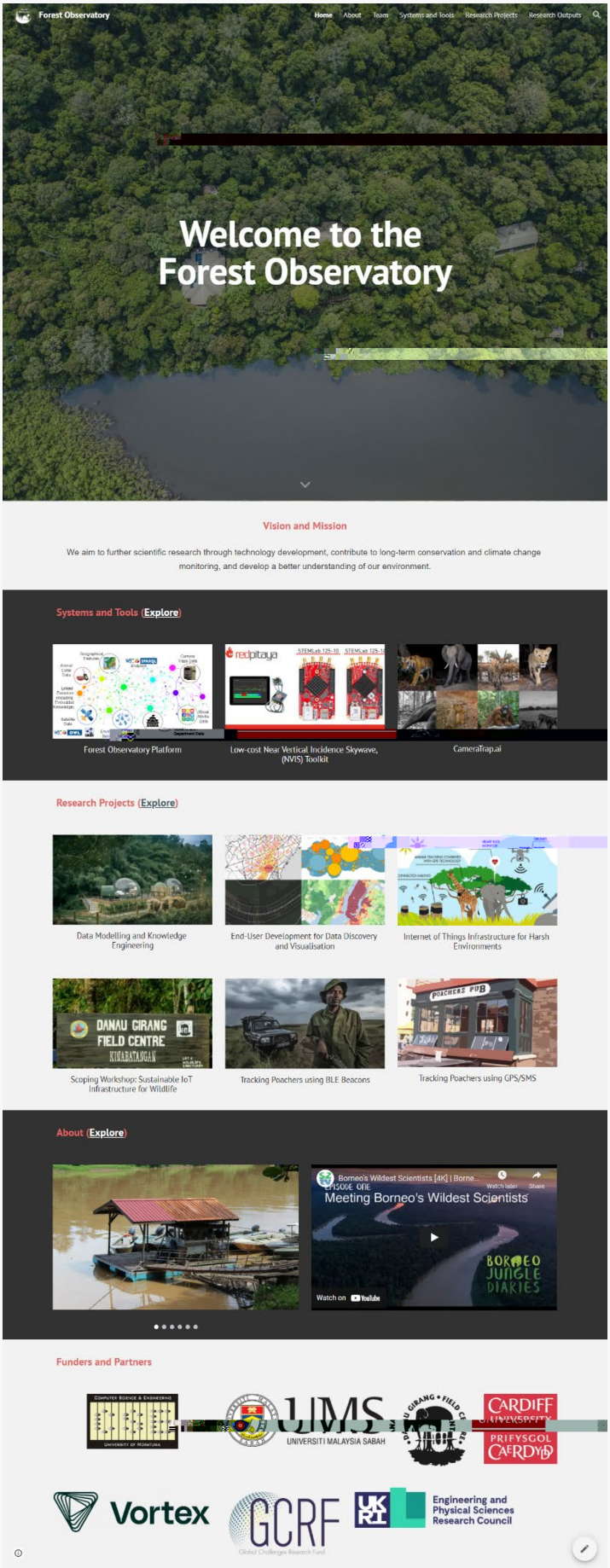
Partners and Relevant Projects

- [Conference] Tracking Material Reuse Across Construction Supply Chains, PDF BIB SOURCE

DATA OBSERVATORIES

Forest Observatory



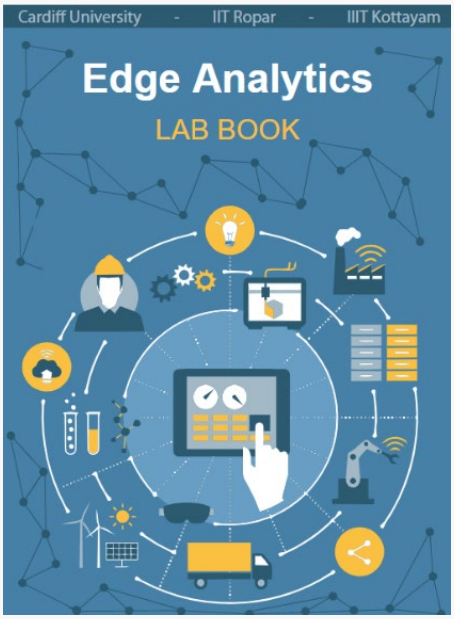
Internet of Things Network for Forest Observatory

Danau Girang Field Centre (DGFC) and surrounded area. Researchers conduct research usually 2-4 miles from the river bank and 20 miles each side along the river (5.430443299150367, 118.0396091749387)

(From Left to Right) both the rechargeable battery pack and the sensor attached to a tree, rechargeable battery pack, sensor installed on top of the DGFC main building roof

LEARNING TECHNOLOGIES

UK – Egypt Trans-National Education (TNE) (Edge Analytics 2.0)



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Partners and Relevant Projects

Durham University | GU | جامعة الجلالة GALALA UNIVERSITY | BRITISH COUNCIL

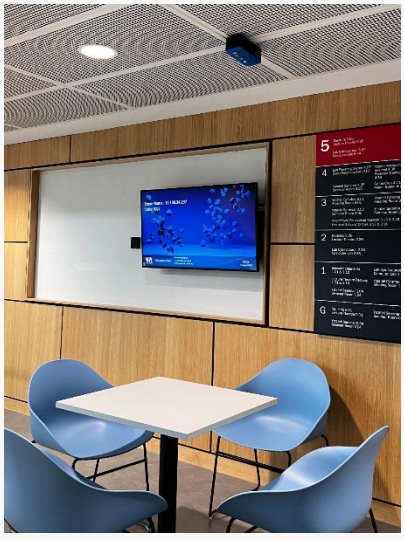
The Knowledge Hub Universities | partnered with Coventry University

RESEARCH INFRASTRUCTURE

Smart Home Lab

RESEARCH INFRASTRUCTURE

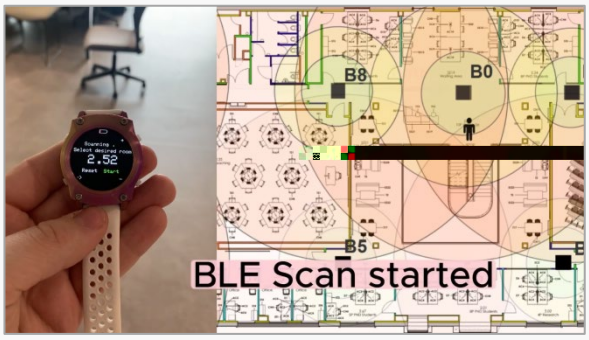
Abacws Smart Building Testbed



Incubator Projects

Indoor Navigation System using Smart watch and BLEs

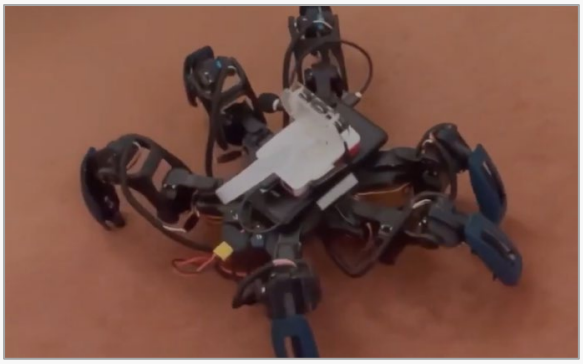
BSc



VIDEO

Robot Assistant to Prevent and Manage Falls

BSc

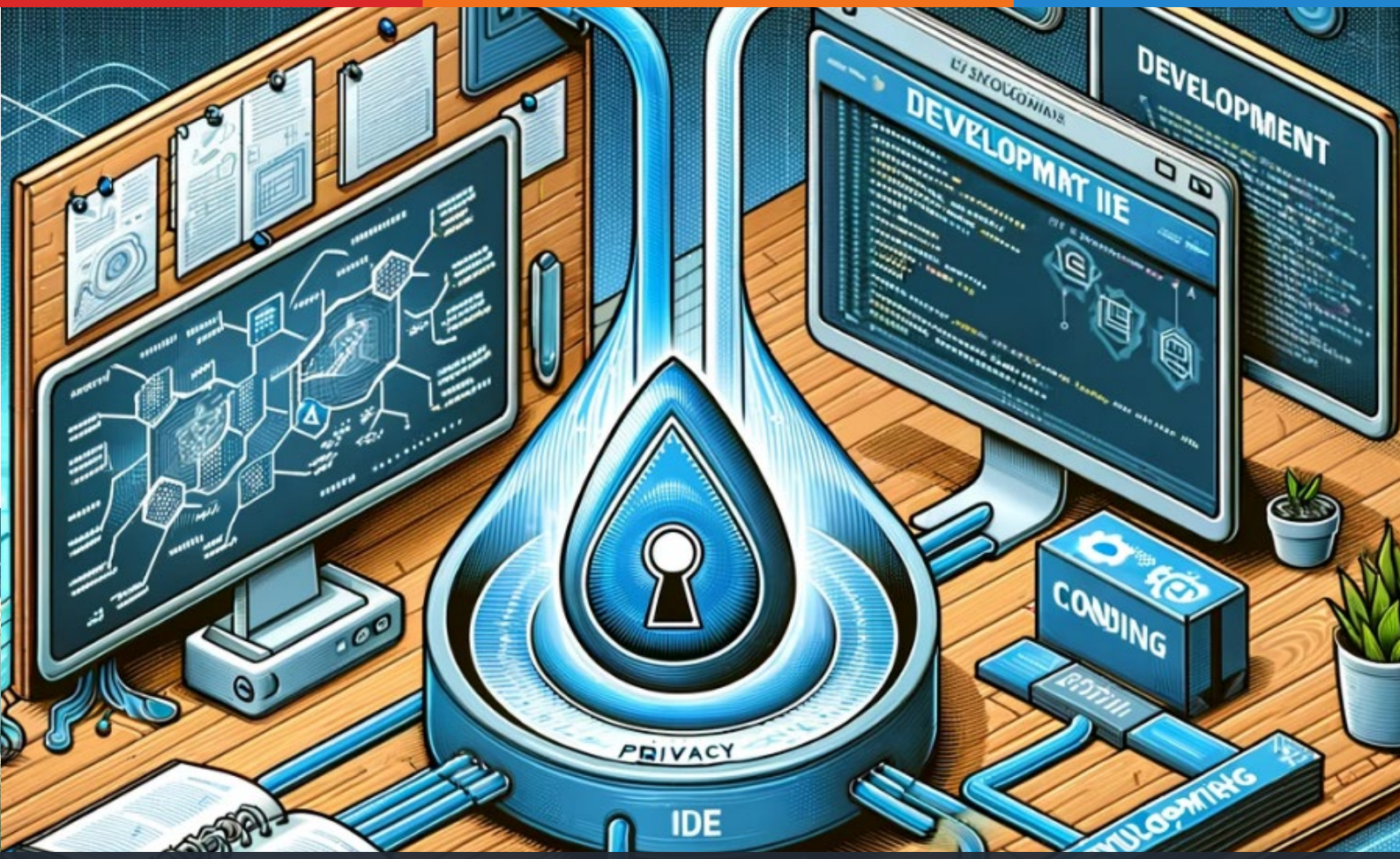


VIDEO

PETRAS in Lego Demonstrator

Funded

VIDEO



gitlab.com/IOTGarage

bit.ly/2JMoSd4

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