Video-based Cameras Systems for supporting Older Adults with Multimorbidity at home: Opportunities and Challenges

VisuAAL Doctoral Seminar: STOCKHOLM

21/04/2023

Mohamed Osman, TCPHI-TCD

This project has received funding from the European Union's Horizon 2020 research and innovation programme under the Marie Skłodowska-Curie grant agreement No 861091".

Universitat d'Alacant
Universidad de Alicante
Project Coordinator

RWTH AACHEN UNIVERSITY

Stockholm University

Trinity College Dublin
Coláiste na Tríonóide, Baile Átha Cliath
The University of Dublin

TU WIEN

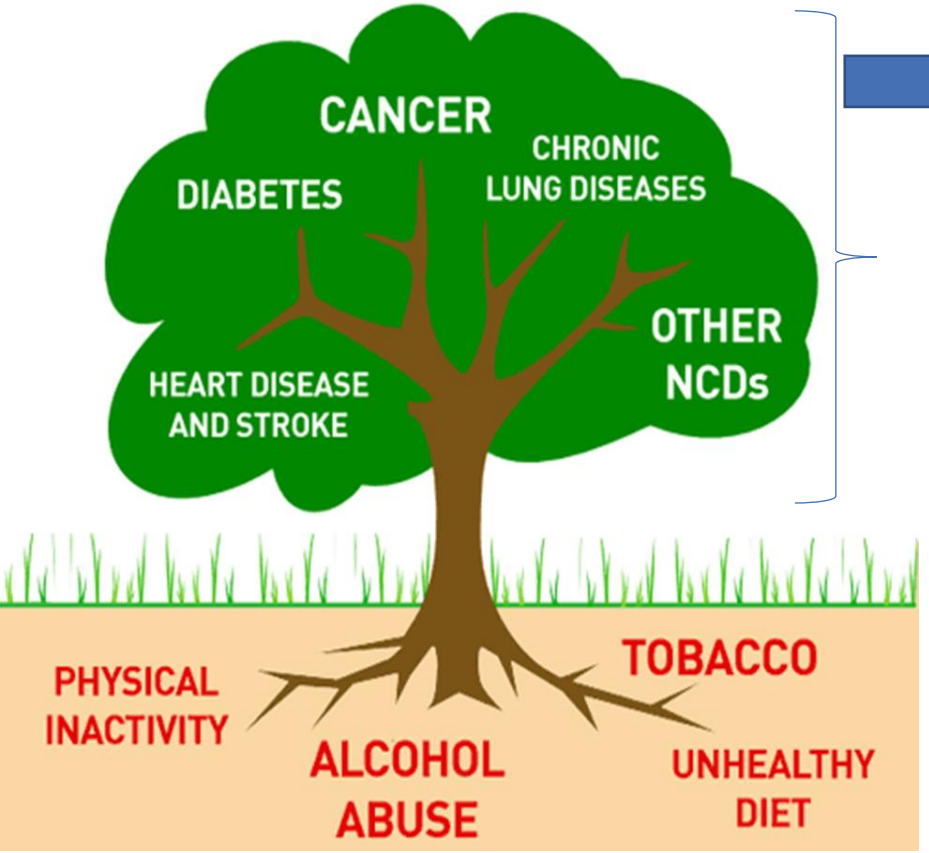
Outline

1. Introduction
2. Scoping Review Results
3. Challenges: Acceptance / Privacy
4. Future Directions
5. Ethical Framework
6. Progress Update
7. Timeline

Project Aims

"To understand and explore the **usage** and **acceptance** of video-based camera systems to effectively support the self-management programmes for older adults living at home with multimorbidity. Emphasis will be placed on discovering the **factors** that may facilitate the camera acceptance among older adults with multimorbidity and their care network"

Introduction



Stress on the Healthcare System

Model of care = Self-management + at Home + Supportive Technology

Care Network (CN)

Healthcare Professionals ⟷ **Informal/Formal Caregivers** → **People with Multimorbidity (PwM)**

Healthcare Facility

At home

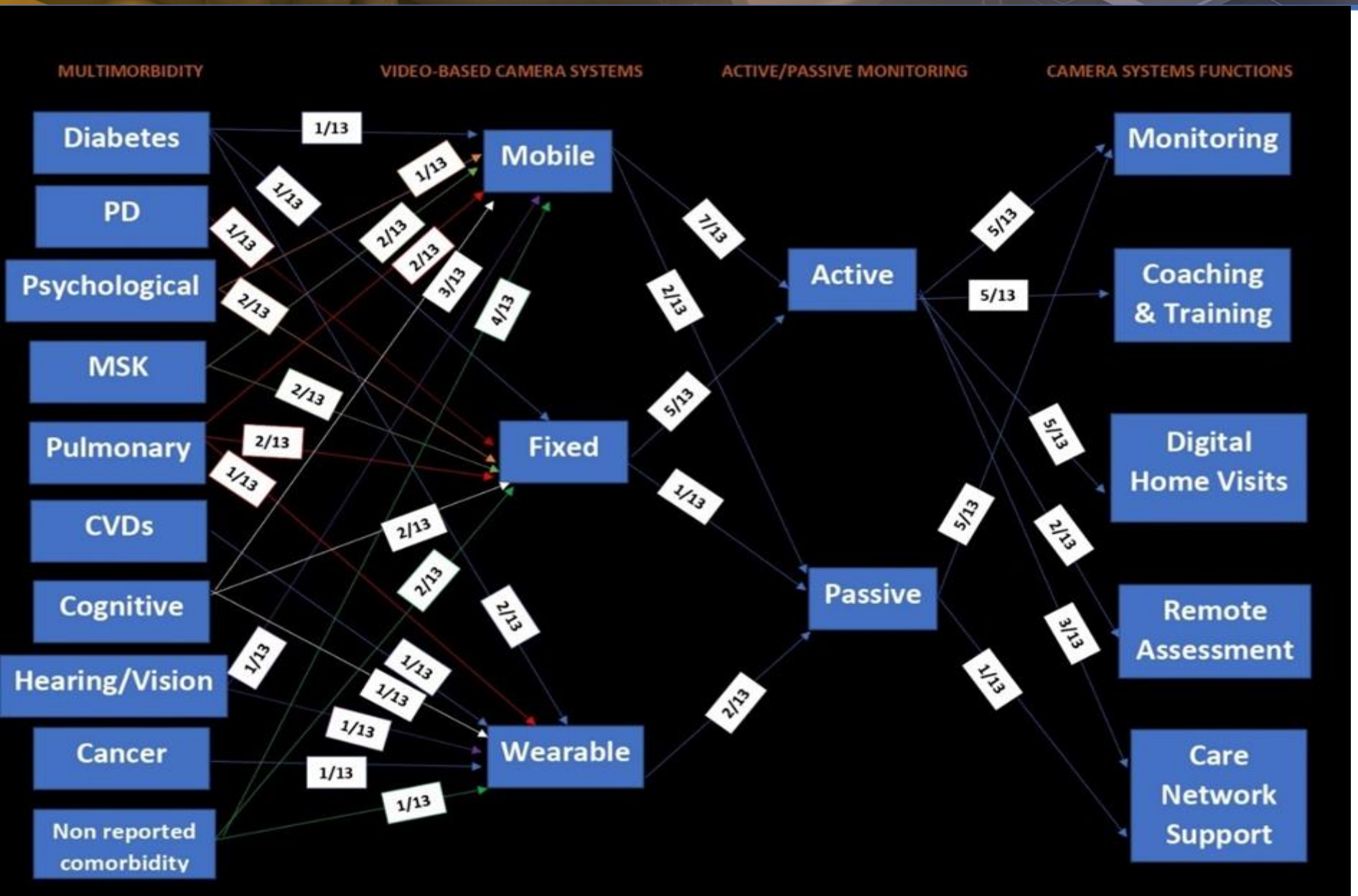
Behavioural Risk Factors

- **Monitored**
- **Assessed**

Video-based Camera Systems

visuAAL

State-of-the-art



Mobile=service robots and all handheld devices (phones or tablet PCs)
Fixed=mounted to wall/ceiling or web cameras attached to desk PCs or laptops
Wearable=worn by the participants
Active= require active participant interaction with the system to perform specific functions either to report symptoms, perform a specific task or training and attend a patient education session
Passive= camera systems that do not require participant interaction (monitoring)

Taxonomy: System Function (Use)

Video-based camera systems functions	n.
Monitoring	**10/13**
Coaching & Training	**5/13**
Digital Home Visits	**5/13**
Care Network Support	**4/13**
Remote Assessment	**2/13**

- **Monitoring**: for participants' sedentary behaviour: (diet and physical activity)
- **Coaching & training**: home-based exercises programs or executing a therapeutic rehabilitation program
- **Digital home visits** (DHV): the digital form of the healthcare facilities visits to communicate with the healthcare professionals (i.e. medication management / case consultation / patient education sessions)
- **Care network support**: the regular case reporting and recording to inform the person's CN.
- **Remote assessment**: remote patient assessment (i.e. diabetic foot care)

Taxonomy: System Characteristics

Healthcare facilities:
Fall prediction/detection
Remote vital signs monitoring

Video-based camera systems characteristics	n.
Mobile + Active	**7/13**
Fixed + Active	**5/13**
Mobile + Passive	**2/13**
Wearable + Passive	**2/13**
Fixed + Passive	**1/13**

There is
NOT
any preference of one on another

Selection:
Function + **Setting**

(Fixed+Passive) may replicate

Lead to feeling of **vulnerability**:

Mysterious "someone" or "force"

"**Watching**" and "**Observing**" me

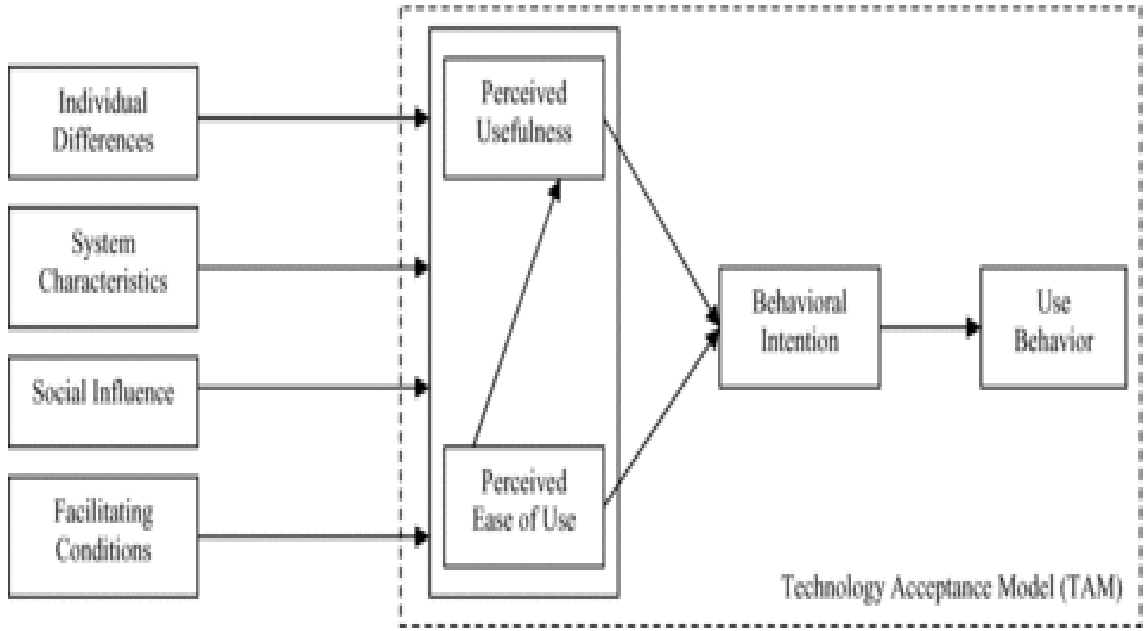
Person has "**no power**"

"**Control**" over me

visuAAL

Technology Acceptance Model

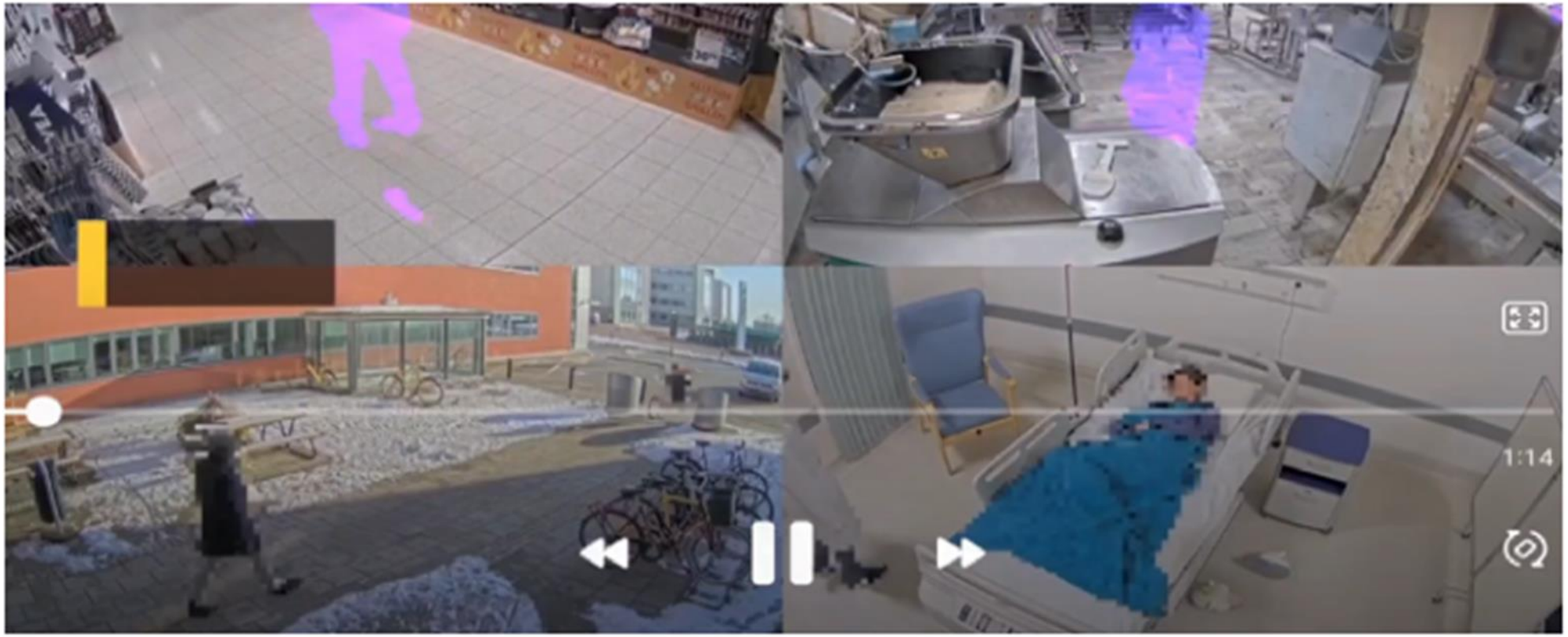
- **Individual differences:** users' demographics, previous experiences and views, and self-efficacy.
- **System characteristics**: system operability, interaction, and functions
- **Social influences** "subjective norm" : which refers to person's beliefs about whether people of importance will approve/disapprove a specific technology
- **Facilitating conditions**: Privacy solutions



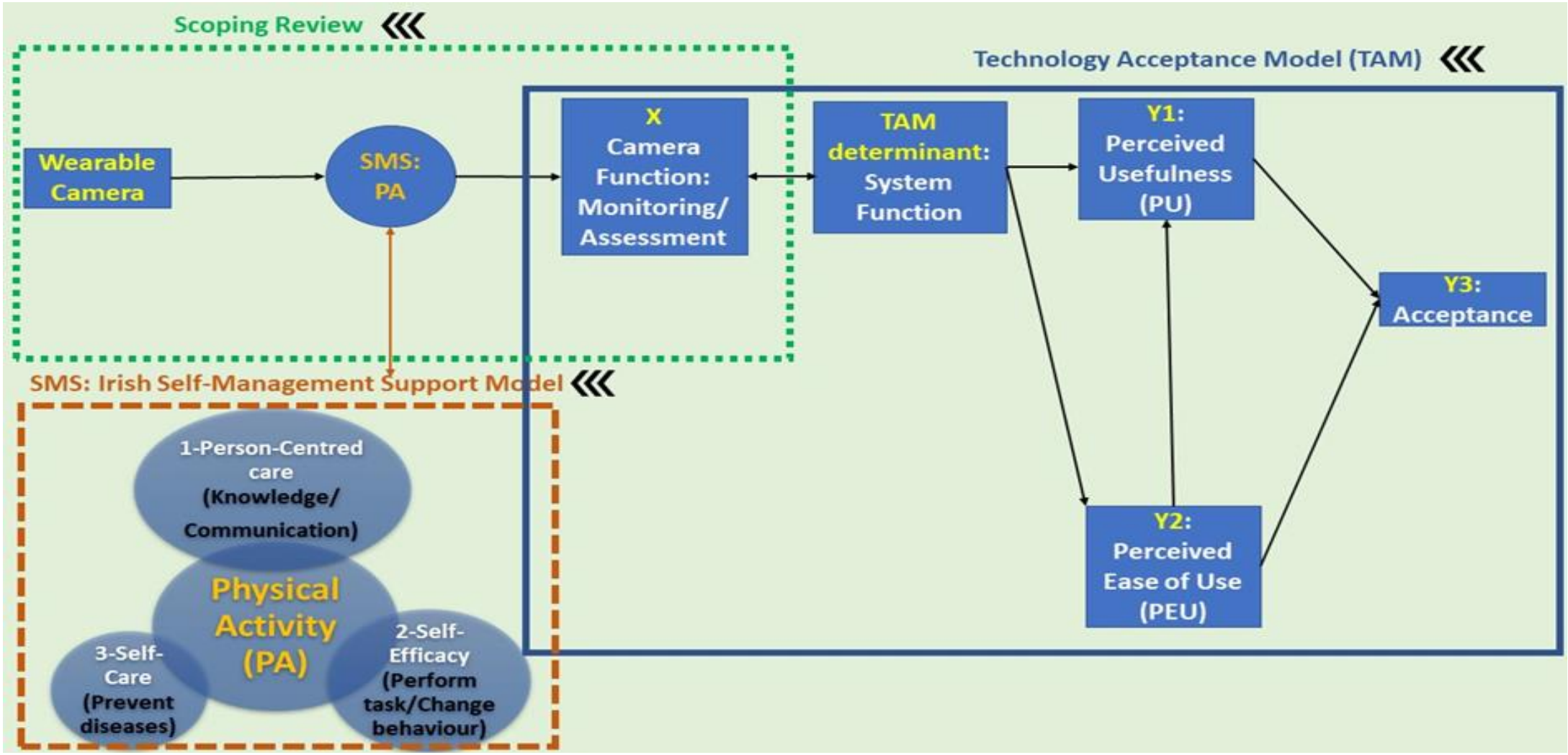
Privacy dimensions

- Identity: Face / Voice / Tattoos / Background
- Bystanders: Formal/Informal caregivers
- Data: what will you collect? Who will see/use it? Where will be stored? How long will be stored? Will it be shared?

Privacy Solutions: Privacy Filters



Future directions: Conceptual framework



Why Physical Activity for Self-management Support (SMS) Programmes?

- Physical activity (PA) is all the movements and actions during the day that make the person active to fulfill all their daily activities (i.e. self-care, transportation, chronic conditions management, sports and exercises)
- PA has always been recommended and prescribed as the key element for any NCDs prevention and management programmes for all age groups, and does not require a previous GP approval to start PA for stable chronic conditions (WHO Physical Activity Factsheet, 2021)
- The Irish chronic conditions SMS steering group asked to explore more supportive tools to cover the common needs of the PwM to decrease their sedentary behaviours by supporting their PA SMS programme

1- Objective Assessment of Physical Activity

- Wearable monitors:
- (1) motion sensors (i.e., accelerometer or pedometer)
- (2) Camera direct PA observation

2- Monitoring, Tracking, and Changing Sedentary Behaviour (Physical Inactivity)

- Wearable cameras have been an effective and feasible supportive intervention for changing physical inactivity
- Physical inactivity behavioural change strategies can be achieved by behavioural change techniques that depend on **setting a PA goal** and **self-monitoring** this goal to accomplish
- These behavioural change strategies will increase the users' **awareness** and **motivation** to tackle physical inactivity
- Assist health practitioners to design a sustainable person-centred PA self-management programmes thanks to the rich contextual video data which helps to understand the surrounding environment

Future directions: Project Objectives

Objective 1 — To identify the roles *(functions) and effective use* of the various video-based camera systems to support home-based SMS programmes for PwM; *challenges and concerns* from the users' perspectives; and *factors* affecting the technology acceptance

Scoping Review

Guided by the TAM formulated scoping review results

Objective 2 — To explore the effect of the wearable camera functions (Physical Activity PA monitoring/assessment) on the participants' perceived usefulness (PU) to accept this technology as a multimorbidity SMS supportive tool

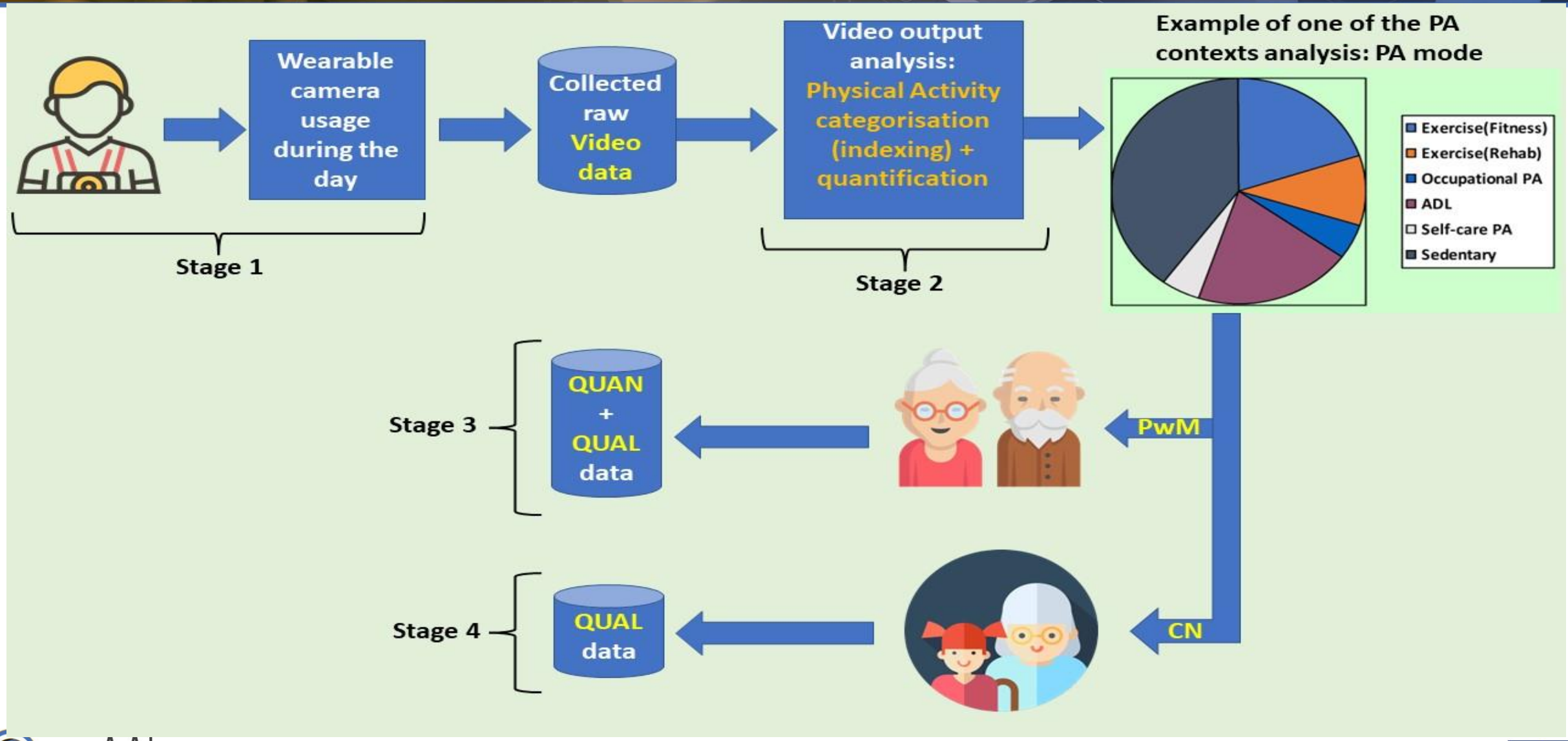
Objective 3 — To explore how the participants' perceived ease of use (PEU) of the wearable camera and its associated functions will influence their intention to use and adopt this multimorbidity SMS supportive technology

Objective 4 — To discover the utility and usefulness of the collected PA contextual video data and its influence on the participants' PU to design tailored SMS interventions

Objective 5 — To identify the participants' privacy considerations of the wearable camera and its influence on the participants' intention to use and adopt this multimorbidity SMS supportive technology

Exploratory Mixed Methods Case Study

Future directions: Procedure and Data Collection



Ethical Framework for Wearable Cameras in Health Behavioural Research (Paul Kelly, 2013)

Informed written consent of participant	• Inform about the **amount** of collected data • The **nature and type** of data that will be collected. i.e.(what you do, and for how long) • Confidentiality will **not protect illegal activities** and should be passed to law enforcement • No individual will be identifiable in any research dissemination without their consent • Participants will have the **opportunity to view** (and delete if necessary) their recordings • Participants can **remove the camera or pause/stop** recording • A team of trained researchers will have access to the recordings
Privacy and confidentiality	• Data can only be retrieved by the research team • Data should be stored according to national data protection regulations • Devices should be configured to allow participants to pause recording for short periods. • Participants should be allowed **to remove the device** at any time

Non-maleficence	• Participants should be prepared for questions by the public with **a short sentence** that explains the device
Autonomy of third parties	• Participants should seek **verbal permission from informal/formal caregivers** and cohabitants before study commencement • Participants should inform friends of device when encountered and offer to remove device if they are uncomfortable • Participants should be told to inform third parties that they also can request video deletion by asking the participant to inform the research team, or contacting them directly

Progress Review

Theme	Items	Status	
		Done	Ongoing
Identify the Relevant Project Literature	Care provided to patients with single chronic conditions vs multimorbidity	✓	
	Self-management support (SMS) programmes in general and the Irish SMS model of care for patient with multimorbidity	✓	
	AAL technologies and camera-based intervention roles in supporting chronic conditions	✓	
	Theories underpinning technology acceptance	✓	
Scoping Review	Map the functions (roles) and system characteristics of video-based camera systems	✓	
	Explore the different multimorbidity in these studies	✓	
	Challenges and concerns from the users' perspectives, and factors affecting the technology acceptance	✓	
Research Collaboration	Second reviewer for ESR8's scoping review. My role included literature screening (abstract and full text), eligible literature selection and data extraction	✓	
Research Training Schools	September 2021- VisuAAL training school, the University of Alicante, Spain: computer vision/ AAL video-based monitoring technologies/ gender, ethical and legal considerations	✓	
	March 2022- VisuAAL training school, the Technical University of Vienna, Austria: visual computing/ artificial intelligence and computer vision/ image analysis/ privacy preservation algorithms	✓	
	May 2022- VisuAAL training school, the University of Aachen, Germany: science communication/ interdisciplinary research collaboration	✓	
	June 2022- VisuAAL training school, TCD: digital health and integrated care/ the application of behaviour change to visual systems/ living labs visits to Maynooth University and Dundalk Institute of Technology	✓	
	June 2022- TCD Postgraduate Student Learning and Development summer school: academic writing skills	✓	

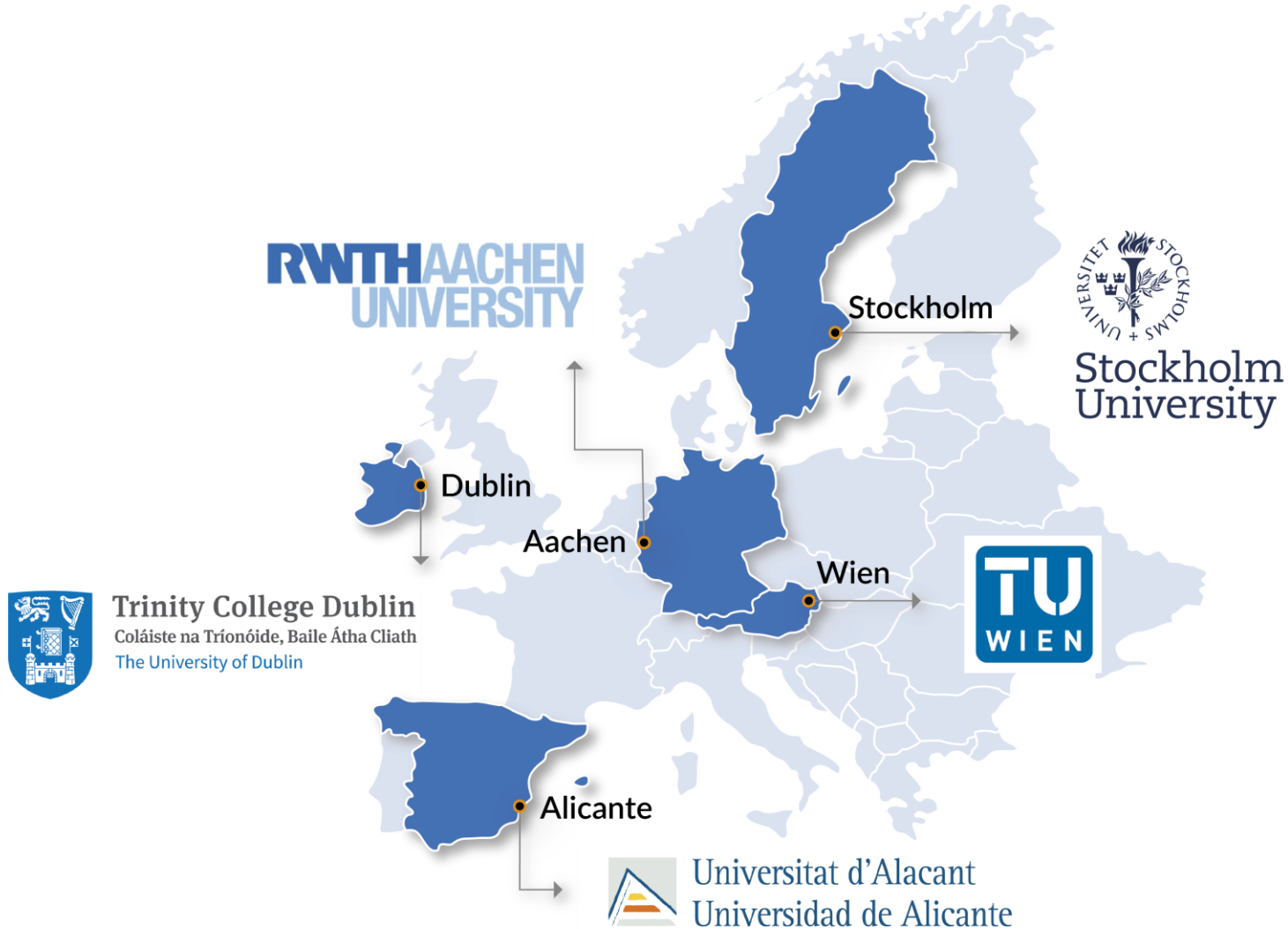
Progress Review

Presentations	March 2022- The chair for the breakout session of "Innovation and Digital Health" during THEconf2022 conference	✓	
	April 2022- TCD Peer Support Session Presentation	✓	
	May 2022- The first VisuAAL doctoral seminar- Aachen, Germany	✓	
TCD Modules	Research Integrity and Impact in an Open Scholarship Era: mandatory 5 ECTs module	✓	
	Data Protection Training: mandatory training provided by the data protection office	✓	
	Academic English EAP module: 10 ECTs	✓	
	Theory and Practice of Research Methods for Healthcare: mandatory 10 ECTs module		⌛
	Teaching and Supporting Learning as a Graduate Teaching Assistant: 5 ECTs		⌛
	Postgraduate Statistics Certificate: one-year postgraduate certificate		⌛
Preparation for the Ethics Application and DPIA	Research Integrity and Impact in an Open Scholarship Era module	✓	
	Data Protection Training	✓	
	Ethics application system (REAMs) online training	✓	
	Established contact with the Data Protection Officer (DPO)	✓	
	Submission of the ethics application on the 5th May 2023		⌛
Forthcoming Research Activity	Research proposal: exploratory mixed methods case study	✓	
	Approaching the recruitment channels		⌛

Timeline

Research Activities	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Finalising Research Proposal												
Ethics Submission												
TCD Confirmation Interview												
Scoping Review/Protocol Publication												
Data Collection/Cleaning/Analysis/Conclusion												
PhD/Training Activities												
Secondment: Dundalk Institute of Technology												
PhD Chapters:Intro, Lit. Review and Methods												
Secondment: AIAS, Bologna												
PhD Chapters: Results, Analysis, Discu., Concl.												
PhD Defending												

Thank You….



visuAAL