L-Università ta' Malta
Faculty of Engineering

Department of Systems & Control Engineering

2024 - 2025

ANNUAL REPORT

Prepared By :

Department of Systems and Control Engineering

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Annual activity report for the year 2024 - 2025 published by the
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Images on title page show (top left to right order): a robotic manipulator fitted with a visual camera, an autonomous unmanned aerial vehicle, Mr Matthew Mifusd delivering a talk to the general public during the Engineering Final Year Projects Exhibition, and a thermal image of a person taken by one of the FLIR thermal cameras.

Contents

Key Descriptors

Members of Staff

Academics	8
Visiting Academics (a total of T2 appointments)	2
Systems Engineers	2
Assistant Laboratory Manager	1
Administrative Staff	1

Externally Funded Members of Staff

Research Support Officer IV	1
Research Support Officer III	1
Research Support Officer II	2
Research Support Officer I	1

Research Projects

Research Funds Disbursed During 2020/21

International Funds	€ 40,000
National Funds	€ 229,063
Internal Funds	€ 9,600

Student Supervision

Supervision/Co-supervision of B.Eng. Final Year Students	8
Supervision/Co-supervision of M.Sc. by Research Students	7
Supervision/Co-supervision of M.Sc. in Signals, Systems and Control	2
Supervision/Co-supervision of M.Phil./Ph.D. Students	6

Peer-reviewed Publications

Book Chpaters	2
Journal papers	8
Conference papers	14
Non-peer reviewed articles	1

Teaching Activities

Postgraduate study units	16 (>90 ECTS)
Undergraduate study units	22 (111 ECTS)
Pre-tertiary study units	4 (20 ECTS)

Outreach Events

Public engagement events	10
Student outreach events	16

1. Foreword

Nothing useless is, or low;
Each thing in its place is best;
And what seems but idle show
Strengthens and supports the rest.

Henry Wadsworth Longfellow, The Builders

Reflecting on the past year, the Department has maintained its strong commitment to both undergraduate and postgraduate students, to our research profiles and in the administration of the department, faculty and University at large. All this, while delivering, for the first time, the asynchronous online lectures of the MSc in Intelligent Systems, Signals and Control. The achievements recorded in this annual report took place in an environment that has not always been supportive—one where success is often measured by a financial yardstick, and where the academic effort risks being undervalued, even as administrative demands continue to grow.

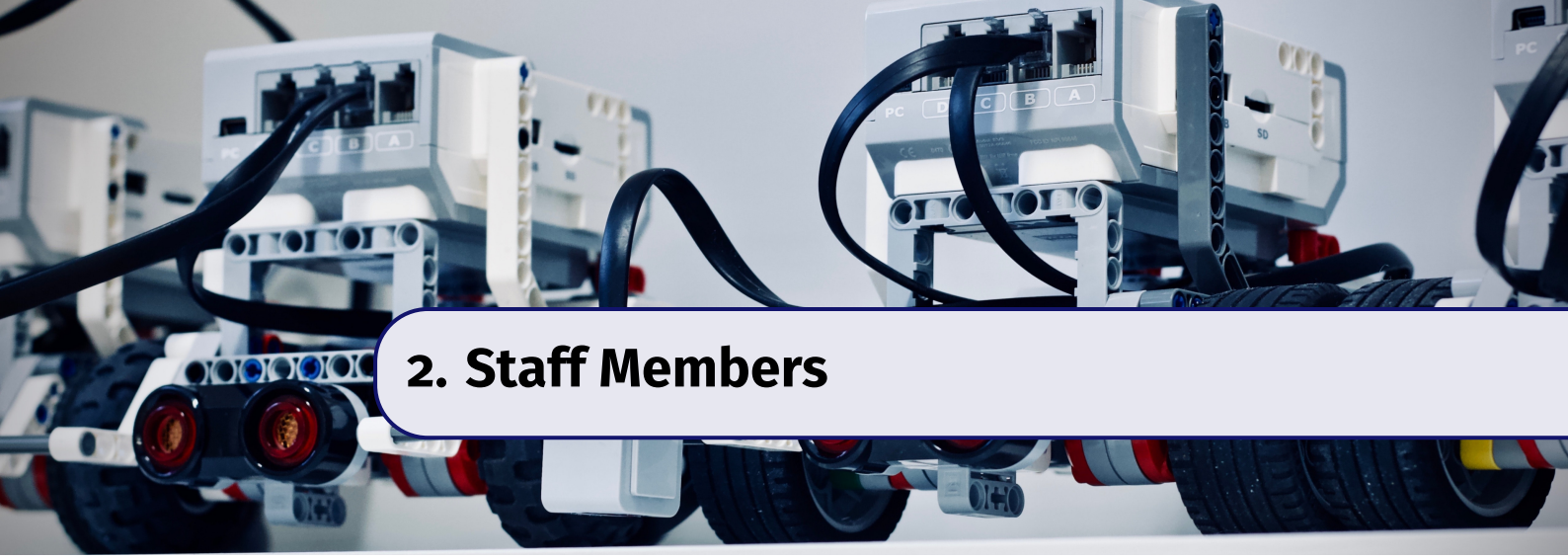
I am deeply grateful that within the Department, care for our students remains at the forefront, and that every effort is made to ensure that they reach their full academic potential. It is encouraging to see that our students recognise and appreciate this commitment. Beyond KPIs, TAEs, or mentions on walls of fame, we are shaping the next generation of engineers through our work ethic, attention to detail, compassion, and enthusiasm—and this is something of which we should be truly proud.

Educating university-level students is more than simply turning up in classrooms to deliver lectures. It involves active participation in local and international fora, staying abreast of the latest research in our respective fields, and bringing that knowledge back into the classroom and into the boards of studies that govern our courses.

Our Department members are not interchangeable. Each brings unique experience, expertise, and perspective to the diverse areas that make up Systems and Control Engineering. For this, I am sincerely grateful for the dedication, creativity, and contributions of every member of the Department.

I am grateful for the effort and commitment of each member of the Department. Thank you! and let's have another successful year ahead.

Prof. Alexandra Bonnici
Head of Department
4th October 2025



2. Staff Members

2.1 Staff Members List

Head of Department

Prof. Alexandra Bonnici, *B.Eng. (Hons.) (Melit.), M.Phil. (Melit.), Ph.D. (Melit.), LLCM(TD), SMIEEE, MIET, MACM*

Full Professors

Prof. Ing. Simon G. Fabri, *B.Elec. Eng. (Hons.) (Melit.), M.Sc. (Sheff.), Ph.D. (Sheff.), SMIEEE*
Prof. Ing. Kenneth P. Camilleri, *B.Elec.Eng.(Hons.) (Melit.), M.Sc. (Sur.), Ph.D. (Sur.), MIET, SMIEEE*

Associate Professors

Prof. Ing. Marvin K. Bugeja, *B.Eng. (Hons.) (Melit.), Ph.D. (Melit.), SMIEEE, MIET*
Prof. Ing. Tracey Camilleri, *B.Eng. (Hons.) (Melit.), Ph.D. (Melit.), SMIEEE*

Senior Lecturers

Dr Kenneth Scerri, *B.Eng. (Hons.) (Melit.), M.S. (Oakland), Ph.D. (Sheff.), MIEEE*
Dr Ing. Stefania De Battista Cristina, *B.Eng.(Hons) (Melit.), M.Sc. (Melit.), Ph.D. (Melit.), MIEEE, MIET*
Dr Ing. Luana Chetcuti Zammit, *B.Eng. (Hons.) (Melit.), M.Sc.(Eng.), Ph.D. (Melit.), MIEEE*

Visiting Academics

Dr Brian Azzopardi, *B.Eng. (Hons.) (Melit.), Ph.D. (Manchester), PGCHE (Oxford Brookes)*
Ing. Andre Sant, *B.Eng.(Hons.) (Melit.), M.Sc.(Eng.), MIEEE*

Research Support Officer IV

Dr Liam Butler *B.Sc.(Hons.)(Open),M.Sc.(Open.),Ph.D.(Newcastle)*

Research Support Officer III

Dr Hani Hazza Ali Ahmed *B.Eng.(Hons.)(Sana'a),M.Tech.(CUSAT),Ph.D.(UniMAP)*

Research Support Officer II

Mr John Soler, *B.Sc.(Hons.)(Melit.), M.Sc.(Open)*
Mr Jeremy James Cachia, *B.Sc.(Hons.)(Melit.), M.Sc.(Imperial)*

Research Support Officer I

Ms Dina Owens, *Engineer (UFA State, Aviation Technical University, Russia)*

Systems Engineers

Dr Ing. Rachael Duca, *B.Eng. (Hons.) (Melit.), M.Sc.(Eng.), Ph.D. (Melit.)*
Ing. Matthew Mifsud, *B.Eng. (Hons.) (Melit.), M.Sc.(Eng.)*

Assistant Laboratory Manager

Mr Noel Agius

Administrators

Ms Sanchia Cilia Lentini

3. Administrative Contributions

3.1 Administrative Contributions of Department Members

Department members contribute to the administration of the Department, Faculty and the University through memberships in various committees. The list below, indicates the administrative contribution of various department members throughout this academic year.

Prof. Ing. Simon G. Fabri

- University Pro-Rector for Research and Knowledge Transfer
- A member of the following University Boards and Committees:
  - Academic Resources Funds Committee
  - Board of the Centre for Biomedical Cybernetics (Chair)
  - Board of the Institute of Physical Education and Sport (Chair)
  - Board of the Institute for Climate Change and Sustainable Development
  - Doctoral Academic Committee
  - SEA-EU Affairs Committee
  - University Research Expo sub-committee (Chair)
  - Board of Studies of the M.Sc. in Intelligent Systems, Signals and Control
  - University Assessment Appellate Board
  - Doctoral School Board
  - PhD and Research Master Degrees Scholarship Board (co-Chair)
  - IT Services Committee (Chair)
  - Malta University Publishing Board
  - Professional Development Committee (Chair)
  - Professional Doctorate Sub-committee
  - Research Engagement Committee (Chair)
  - Research Funds Committee (Chair)
  - Staff Affairs Committee
  - Staff Scholarships and Bursaries Committee
  - Board of Directors of MUIP
- Editor in Chief of the University's THINK magazine
- UM representative on the European University Association (EUA) Research and Innovation Strategy Group (RISG)
- Member of the Executive Board of the Mediterranean Control Association
- Lead manager of the Control Systems Engineering Laboratory within the Department

Prof. Ing. Kenneth P. Camilleri

- Member of the Board of Studies of the M.Sc. in Signals, Systems and Control
- Member of the Board of the University of Malta Magnetic Resonance Imaging (UMRI) Platform
- CBC representative on the Board of the Malta Neuroscience Network (University of Malta)
- Assists the European Union's Research Executive Agency (REA) and the European Climate, Infrastructure and Environment Executive Agency (CINEA) in its evaluations of proposals submitted to various Horizon Europe calls and other calls for proposals
- Assists various international research agencies in evaluating research proposals
- Lead manager of the Biomedical Engineering Laboratory within the Department

Dr Kenneth Scerri

- Chair of the Faculty of Engineering International Affairs Committee
- Coordinator of Data Science Platform (DSP)
- Member of the:
  - Engineering Faculty Board
  - Board of Studies for MSc by Research in Engineering
  - Board of Studies of the M.Sc. in Signals, Systems and Control

Prof. Ing. Marvin K. Bugeja

During this academic year, Prof. Ing. Bugeja was on sabbatical leave, which suspended most of his administrative duties. However, he remained active as an academic advisor for the UM Robotics team and a visiting academic at Brno University of Technology.

Prof. Ing. Tracey Camilleri

- Director of the Centre for Biomedical Cybernetics
- Chair of the Doctoral Committee of the Centre for Biomedical Cybernetics
- Chair of the M.Sc. Board of Studies of the Centre for Biomedical Cybernetics
- A member of the:
  - Faculty of Engineering Doctoral Committee
  - Board of Studies of the M.Sc. in Signals Systems and Control
  - Board of Studies of the M.Sc. in Medical Physics
- Management Committee Member of the EEG101 COST Action

Prof. Alexandra Bonnici

- Department head
- A member of the:
  - Faculty Board of the Faculty of Engineering
  - Faculty's Board of Studies (B.Eng. Electrical and Electronics area of study)
  - Board of Studies of the MSc by Research in Engineering
  - Board of Studies of the MSc in Signals Systems and Control
  - Board of Studies of the Certificate in Engineering Sciences
  - TRAKE steering committee
  - Doctoral Board of Studies for the Centre of Biomedical Cybernetics
  - National STEM Engagement Working Group
  - MATSEC Board
- Chair of the Student-Staff Liaison Committee of the Faculty of Engineering.
- University representative for the SEA-EU Society Hub Working Group.
- Program Coordinator of the Certificate in Engineering Sciences

- Secretary and Treasurer of the ACM SigWeb Executive Committee

Dr Ing. Stefania Cristina

- Chair of the Faculty's PR Committee
- A member of the:
  - University's Visiting Lecturers and External Examiners Committee
  - Board of Studies of the Faculty of Engineering (B.Eng. Electrical and Electronics area of study)
  - Board of Studies of the M.Sc. in Signals Systems and Control
  - Doctoral Committee of the Centre for Biomedical Cybernetics
  - M.Sc. Board of Studies of the Centre for Biomedical Cybernetics
- Education and Training Secretary with the Chamber of Engineers
- Assists in the evaluations of project proposals submitted to various Horizon Europe calls

Dr Ing. Luana Chetcuti Zammit

- Coordinator of the MSc in Intelligent Systems, Signals and Control
- Chair of the Faculty Research Ethics Committee
- A member of the Faculty Sustainable Committee
- Member of the European Control Association

Ms Sanchia Cilia Lentini

- Administrative assistance with the Technology Clubs

4. Academic Activities

Department members are active members of the research community, providing scholarly service to the community in addition to supervising students at various undergraduate and postgraduate levels and seeking funds to support the research community within the Faculty and the University. This section gives an overview of these activities, detailing scholarly activities, supervised projects, publications and other academic activities undertaken by the department members.

4.1 Overview of Scholarly Activities of Academic Staff Members

Prof. Ing. Simon G. Fabri

Prof. Fabri's academic work focuses on Automatic Control Engineering, particularly adaptive and intelligent control; computational intelligence and AI methodologies for control, modelling of dynamic systems and signals; nonlinear and stochastic control; systems theory; robotics and robot control systems; and applications of control systems. Specific scholarly contributions carried out during this academic year are listed below.

Contributions to research projects

- Main investigator on the TRAKE project "CONAI"
- Co-investigator in the TRAKE project "BRAINCON"
- Co-investigator in the Xjenza funded project SCP-2022-007 "SALTT-CITY"

Contributions to peer review

Prof. Fabri is a reviewer on several academic journals and is a review committee member or associate editor for several international conferences. Prof. Fabri is also the Associate Editor of the International Journal of Systems Science published by Taylor and Francis.

Prof. Ing. Kenneth P. Camilleri

Prof. Camilleri's academic work is concerned with signal and image processing, computer vision and machine learning, with a particular focus on the application of these areas to health and medicine. Specific scholarly contributions carried out during this academic year are listed below.

Contributions to research projects

- Principal investigator for the:
  - RIDT Malta Neuroscience Network Brain Fund Award "DeepMotionBMI"
  - TRAKE project "BrainCon"
  - Xjenza Sino-Malta-2023-18 "SIDec"
- Co-investigator for the Xjenza National R&I Fusion funded projects:
  - Smart Cities Thematic Funding Programme project SCP-2022-010 "SmartGaze"

  - GoToMarketAccelerator R&I-2018-012A “EyeCon+”
- Co-investigator for the Xjenza Research Excellence Programme funded projects
  - REP-2023-022 “EyeTrack”
- Co-investigator for the Xjenza Malta Cancer Research Programme funded project CRP-2025-01 “Thermascan”
- Co-investigator for the projects funded by the Ministry for Education, Sport, Youth, Research and Innovation (MEYR):
  - “SmartGaze(MEYR)”
  - “NeuroBCI”
- Co-investigator for the TRAKE projects
  - “CAMVISM”
  - “CONAI”
- Co-investigator for the RIDT Cancer Research Grant 2018 project entitled “Combined Thermal and Visual Imaging for Early Detection of Skin Cancer”
- Co-investigator for the University of Malta Research Excellence Fund 2023 “BrainWeb”

Contributions to local and international networks

Prof. Camilleri is a participant and management committee member of the COST Action CA19121 “GoodBrother”

Contributions to peer review

Prof. Camilleri is a member of the Editorial Board of the Journal of Neuroscience Methods (Elsevier) and a regular reviewer for several journals including the:

- IEEE Transactions in Image Processing,
- IEEE Access, the SPIE Journal of Electronic Imaging
- Elsevier Expert Systems with Applications
- Elsevier Biomedical Signal Processing and Control Journal
- Taylor & Francis Brain Computing Interfacing Journal

He is also a reviewer and/or member of various international programme committees of several international conferences, including the:

- ACM Symposium of Document Engineering,
- Annual International Conference of the IEEE Engineering in Medicine and Biology Society
- International Conference on Pattern Recognition
- International Conference on Informatics in Control, Automation and Robotics

Dr Kenneth Scerri

Dr Scerri’s academic work is concerned with system modelling and data engineering with applications in transportation, air quality and biomedical signal processing. Specific scholarly contributions carried out during this academic year are listed below.

Contributions to research projects

Dr Scerri is a principal investigator on the following research projects:

- Postdoctoral Fellowship Scheme project ”RoadEye” funded by the Ministry of Education, Sports, Youth, Research and Innovation.
- Research, Innovation & Development Trust (RIDT) project ”CAIRED - Cardiovascular Artificial Intelligence: e-Health for Diabetes (CAIRED).

Dr Scerri is a co-investigator on the following research projects:

- H2020 project "Activation of NATURE-based solutions for a JUST low carbon transition" (JustNature).
- Xjenza Space Upstream Thematic Programme 2023 project "Operation - Tom"
- FUSION: R&I Research Excellence Programme project "MARC - Measuring the ARchitecture of Consciousness".
- FUSION: R&I Research Excellence Programme project "LSDI - Liquid State Dual fuel Injection"
- Research, Innovation & Development Trust (RIDT) project "Brian - Brain Research through Imaging Analysis for Neuro-oncology"
- Internal seed fund Be-BoB (Beyond Boundaries of the Brain) project.

Contributions to local and international networks

Dr Scerri is a member of the EU COST action "CA18232 - Mathematical models for interacting dynamics on networks"

Contributions to peer review

Dr Scerri is a reviewer for the International Journal of Systems Science, the IEEE Transactions on Automatic Control and various international scientific conferences.

Prof. Ing. Marvin K. Bugeja

Prof. Bugeja's academic work is concerned with robotics and automatic control systems. Specific research areas of interest in robotics include: autonomous mobile robots, mobile manipulators, multi-robot systems and robot control; while focus areas in general control systems include: nonlinear, adaptive, intelligent, stochastic and neuro control, as well as mechatronic and process control systems, among others. Specific scholarly contributions carried out during this academic year are listed below.

Contributions to research projects

- Principle applicant of the successful Xjenza funded CVP application R&I-2022-009 "REALISM"
- Co-applicant of the successful Xjenza funded CVP application R&I-2022 "RIV"
- Co-investigator in project "CONAI", funded by TRAKE
- Co-investigator in project "BRAINCON", funded by TRAKE
- Co-investigator in the ongoing Xjenza funded TDP projects:
  - R&I-2019-005-T "SIT-DIAB"
  - R&I-2021-005-T "SMARTSPACK"

Contributions to peer review

Prof. Bugeja is an associate editor on the EUCA Conference Editorial Board, and is reviewer and programme committee member for several international conferences and journals.

Contributions to local and international networks

Prof. Bugeja is a member of the Astrionics research group (Astrea), University of Malta, the Particle Detector and Accelerator research group, University of Malta, a research committee member of the Centre Innovation Drones de Normandie (CIDN) and a past member of the General Assembly of the European Control Association (EUCA). In addition, he is a regular invited lecturer at the ISMMB, Department of Mechatronics, Faculty of Mechanical Engineering, Brno University of Technology, Brno, Czech Republic and is a technical advisor and team mentor for the UM Robotics club.

Prof. Ing. Tracey Camilleri

Prof. Camilleri's academic work is concerned with the signal processing of biomedical data and the development of human-machine interface systems, particularly using electroencephalography (EEG)

and electrooculography (EOG). Specific scholarly contributions carried out during this academic year are listed below.

Contributions to research projects

- Principal investigator for the:
  - "SmartGaze" SCP-2022-010, funded through the Xjenza FUSION Smart Cities Thematic Funding Programme
  - "EyeCon+" R&I-2018-012-A, funded through Xjenza FUSION Go-to-Market Accelerator Programme
  - "NeuroBCI", funded through the Ministry of Education, Sport, Youth, Research and Innovation
- Co-investigator on the projects:
  - "BRAINCON", funded by TRAKE
  - "EyeTrack", funded through Xjenza Research Excellence Programme
  - "BrainWeb", funded through University of Malta Research Excellence Programme 2023
  - "SmartGaze", funded through the Ministry of Education, Sport, Youth, Research and Innovation
  - "SIDEC", funded through the SINO-MALTA fund 2023

Contributions to local and international networks

Prof. Camilleri is a management committee member of the EU COST action "EEG101 - Fundamentals of Open & Rigorous EEG Science".

Contributions to peer review

Prof. Camilleri is a reviewer for journal submissions including, the Journal of Selected Topics in Signal Processing, the Journal of Biomedical Engineering and Control and the IEEE Transactions on Biomedical Engineering, among others.

Prof. Alexandra Bonnici

Prof. Bonnici's academic work is concerned with image processing and computer vision, applying these disciplines to document engineering, specifically focusing on sketched documents and musical documents. Specific scholarly contributions carried out during this academic year are listed below.

Contributions to research projects

- Co-investigator on the Xjenza Malta Research Excellence Programme funded project REP-2024-057 "NOMOCRAT"

Contributions to peer review

Prof. Bonnici is a reviewer or programme committee member for journals and conferences including:

- IEEE Transactions on Multimedia
- Computer and Graphics Journal
- ACM International Symposium on Document Engineering
- Eurographics Conference on Visualization.

Prof. Bonnici is also an associate editor on Xjenza the journal of the Malta Chamber of Scientists and an editorial board member for ST-OPEN, the journal of the University of Split. She is also an evaluator for the Xjenza STEM Community Fund.

Contributions to local and international networks

Prof. Bonnici is the chair of the steering committee of the ACM International Symposium on Document Engineering.

Dr Ing. Stefania Cristina

Dr Cristina's academic work is concerned with image processing and computer vision, with particular focus on their application to assisted living technologies and thermal imaging. Specific scholarly contributions carried out during this academic year are listed below.

Contributions to research projects

- Principal investigator for the:
  - RIDT Cancer Research Grant 2018 project entitled "Combined Thermal and Visual Imaging for Early Detection of Skin Cancer"
  - Xjenza Malta Cancer Research Programme funded project CRP-2025-01 "Thermascan"
- Co-investigator on the Xjenza Malta Research Excellence Programme funded project REP-2024-057 "NOMOCRAT"

Contributions to peer review

Dr Cristina is a reviewer for several conferences and journal submissions, including:

- International Workshop on Assistive Computer Vision and Robotics (ACVR)
- ACM Symposium on Eye Tracking Research and Applications (ETRA)
- ACM Symposium on Document Engineering (DocEng)

Contributions to local and international networks

Dr Cristina is a participant and management committee member of the COST Action CA19121 "GoodBrother". She also contributes, as a senior writer, to one of the largest websites covering machine learning topics, `machinelearningmastery.com`.

Dr Ing. Luana Chetcuti Zammit

Dr Chetcuti Zammit's academic work is concerned with machine learning and control with applications in transportation. Specific scholarly contributions carried out during this academic year are listed below.

Contributions to research projects

- Principal Investigator for the research on Traffic Accidents in children
- Principal Investigator for the research on Traffic Accidents in women
- Principal Investigator for Maritime Network research
- Principal Investigator for Blockchain research
- General Chair for ECC 2029 preparations

Contributions to peer review

Dr Chetcuti Zammit is a reviewer for international conferences such as the European Control Conference and the IEEE Intelligent Transportation Systems Conference.

Contributions to local and international networks

Dr Chetcuti Zammit is a member of the General Assembly of the European Control Association (EUCA).

4.2 Student Projects and Supervision

4.2.1 B.Eng. (Hons) Students

Project Title: AI-Driven Inverted Pendulum: An Investigation into Machine Learning Applications within Robotics
Student: Nicholas Bajada
Supervisor: Prof. Ing. Simon Fabri

Project Title: Prediction of Traffic Accident Severity
Student: Diana Cassara'
Supervisor: Dr Ing. Luana Chetcuti Zammit
Co-Supervisor: Dr Theresa Bajada

Project Title: Towards a secure urban traffic network
Student: Luca Galea
Supervisor: Dr Ing. Luana Chetcuti Zammit

Project Title: Identifying Optimal Investment Strategies with Deep Learning
Student: Mia Gauci'
Supervisor: Dr Kenneth Scerri
Co-Supervisor: Dr Liam Butler

Project Title: Augmented Storytelling: Bringing Drawings to AR
Student: Vanya Gelfo
Supervisor: Prof. Alexandra Bonnici

Project Title: Stable self-leveling control of a Stewart Platform
Student: Kyle Muscat
Supervisor: Prof. Ing. Simon Fabri

Project Title: Developing a multi-user SSVEP-based BCI
Student: Kaya Saliba
Supervisor: Prof. Ing. Tracey Camilleri

Project Title: Stock Price Predictions Using Ensemble Learning Methods
Student: Luca Trapani
Supervisor: Dr Kenneth Scerri

4.2.2 M.Sc. by Research Students

Project Title: A Novel Approach to Early Skin Cancer Detection Using Dynamic Thermography and Deep Learning
Student: Mr Nipun Sandamal Ranasekara Pathiranage
Supervisor: Dr Ing. Stefania Cristina
Co-Supervisor: Prof. Ing. Kenneth P. Camilleri

Project Title: Multi-Camera Tracking of Road Vehicles
Student: Mr Pierre Zahra
Supervisor: Prof. Adrian Muscat
Co-Supervisor: Dr Kenneth Scerri

PROJECT TITLE: Anomaly Detection in Visual Road Traffic Data
STUDENT: Ms Nicole Bonnici
SUPERVISOR: Prof. Adrian Muscat [1]
CO-SUPERVISOR: Dr Kenneth Scerri

PROJECT TITLE: Investigation of Boosting and Knock on Dual Fuel, LPG-Diesel Engines
STUDENT: Mr Aidan James Azzopardi
SUPERVISOR: Prof. Mario A. Farrugia
CO-SUPERVISOR: Dr Kenneth Scerri

PROJECT TITLE: Anomaly Detection in Photovoltaic Installations
STUDENT: Mr Brian Bartolo
SUPERVISOR: Dr Kenneth Scerri CO-SUPERVISOR: Dr Brian Azzopardi

PROJECT TITLE: Control of Traffic Junction through Markov Decision Processes
STUDENT: Mr Leonard Farrugia
SUPERVISOR: Dr David Suda
CO-SUPERVISOR: Dr Kenneth Scerri

PROJECT TITLE: Dual and Hydrogen Fuelling of Engines
STUDENT: Mr Andrew Fenech
SUPERVISOR: Dr Mario Farrugia
CO-SUPERVISOR: Dr Kenneth Scerri

4.2.3 M.Phil. / Ph.D. Students

PROJECT TITLE: Analysis on the use of EOG data during long-term use
STUDENT: Ing. Matthew Mifsud
SUPERVISOR: Prof. Ing. Tracey Camilleri
CO-SUPERVISOR: Prof. Ing. Kenneth Camilleri

PROJECT TITLE: Analysis of Temperature Transient Patterns using Dynamic Infrared Thermography
STUDENT: Mr Jean Gauci [2]
SUPERVISOR: Prof. Owen Falzon [2]
CO-SUPERVISOR: Prof. Ing. Kenneth Camilleri

PROJECT TITLE: Towards More Compact Chip to Chip Communication Methods
STUDENT: Mr Andre Micallef [3]
SUPERVISOR: Dr. Ing. Marc Anthony Azzopardi [3]
CO-SUPERVISOR: Prof. Ing. Simon G. Fabri

PROJECT TITLE: Application of Computer Vision for Collaborative Robotics
STUDENT: Mr Steve Zerafa
SUPERVISOR: Dr Kenneth Scerri
CO-SUPERVISOR: Dr Brian Azzopardi

[1] Department of Computer and Communications Engineering
[2] Centre for Biomedical Cybernetics
[3] Department of Electronic Systems Engineering

PROJECT TITLE: Development of an Analytical Framework for Robot-inclusive Homes, and of an Autonomous Assistive Robot
STUDENT: Mr Prabhu Rayudu Naraharisetti [4]
SUPERVISOR: Prof. Michael Saliba [4]
CO-SUPERVISOR: Prof. Ing. Simon G. Fabri

PROJECT TITLE: Dual Fuel Engine Dynamic Behaviour Improvement Through Control Techniques
STUDENT: Mr Anthony Theodore Saliba
SUPERVISOR: Prof. Mario Farrugia [4]
CO-SUPERVISOR: Dr Kenneth Scerri

4.2.4 International Undergraduate Students

PROJECT TITLE: Eye-Gaze Calibration Autocorrection Using Interface Design Elements
STUDENT: Mr Lucien Gygli
SUPERVISOR: Prof. Kevin Kim, Prof. Anton Fedosov
CO-SUPERVISOR: Dr Ing. Stefania Cristina
UNIVERSITY: University of Applied Sciences and Arts Northwestern Switzerland (FHNW), School of Engineering, Windisch, Switzerland

4.3 Teaching Activities

The Department is responsible for teaching several study-units at both undergraduate and postgraduate levels, offering its teaching services with the following degree courses:

- B.Eng.(Hons) in Electrical and Electronic Engineering (Faculty of Engineering)
- B.Eng.(Hons) in Mechanical Engineering (Faculty of Engineering)
- Certificate in Engineering Sciences (Faculty of Engineering)
- B.Sc.(Hons) in Technical Design and Technology (Faculty of Education)
- B.Sc.(Hons) in Communications and Computer Engineering (Faculty of ICT)
- B.Sc.(Hons) in Physics, Medical Physics and Radiation Protection (Faculty of Health Sciences)
- M.Sc. in Language and Computation (Institute of Linguistics)
- M.Sc. in Medical Physics (Faculty of Health Sciences)
- M.Sc. in Environmental Management and Sustainability (Institute of Earth Systems)
- M.Sc. in Artificial Intelligence (Faculty of ICT)
- M.Sc. in Applied Oceanography (Faculty of Science)

In addition, the Department also coordinates and delivers a taught M.Sc. in Signals, Systems and Control, offering this course on both a full-time and part-time basis. The study units offered by the Department at undergraduate and postgraduate levels are listed in Tables 4.1 and 4.2 respectively.

Besides these teaching duties, the department also offers additional training to its final year students to assist them in the presentation of the dissertation work. This training consists of a tutorial on the use of LaTeX to write their dissertations and two seminars during which students deliver a 10-minute presentation on their work.

[4] Department of Mechanical Engineering

Table 4.1: Undergraduate study units offered by the Department in 2020/2021

Code	Name	ECTS
SCE Undergraduate Study Units		
SCE1201	Dynamic Systems and Signals 1	5
SCE2111	Automatic Control Systems 1	5
SCE2112	Control Systems 1	5
SCE2201	Numerical Methods for Engineers	5
SCE2213	Automatic Control Systems 2	5
SCE3101	Dynamic Systems and Signals 2	5
SCE3205	Dynamic Systems and Signals 3	5
SCE3204	Image Analysis and Computer Vision	5
SCE3112	Control Systems Technology and Automation	5
SCE3113	Automatic Control Systems 3	5
SCE3114	Introduction to Control Engineering	5
SCE3115	Introduction to Robotics	5
SCE3216	Automatic Control Systems 4	5
SCE4101	Computational Intelligence 1	5
SCE4102	Systems Theory	5
SCE4103	An Introduction to Biomedical Signal Analysis	5
SCE4104	Practical Applications in Computer Vision	5
Other Undergraduate Study Units supported by SCE		
ENR3008	Team Project (unit co-ordination and project supervision)	5
ENR4200	Engineering Project (project supervision & assessment)	20
Pre-tertiary Study Units Supported by SCE		
ENR0012	Trigonometry and Vectors (part of)	6
ENR0013	Matrices, Numerical Methods and Probability (part of)	6
ENR0010	Experimental Setup and Procedures	3
ENR0011	Engineering Technology (coordination & part of)	5
Study units offered to other undergraduate degrees		
SCE2112	Control Systems 1 (ICT)	5
SCE3114	Introduction to Control Engineering (Mechanical Engineering)	5
SCE3206	Control Systems Fundamentals (Technical Design and Technology)	5
SCE3021	Biomedical Signal & Image Processing for Medical Physics (Health Sciences)	6

Table 4.2: Postgraduate study units offered by the Department in 2020/2021

Code	Name	ECTS
SCE Postgraduate Study Units		
SCE5101	Linear Dynamic Systems and Signals	6
SCE5102	Estimation and System Identification	5
SCE5103	Continuous-time Control Systems	5
SCE5104	Discrete-time Control Systems	5
SCE5105	Advanced Signal Processing	5
SCE5106	Research Methods for Systems and Control Engineering	4
SCE5201	Machine Learning and Pattern Recognition	10
SCE5202	Nonlinear Systems and Control	5
SCE5203	System Optimisation and Control	5
SCE5204	Adaptive and Intelligent Control	5
SCE5205	Computer Vision	5
SCE5301	Research Project in Systems and Control Engineering	30
Other Postgraduate Study Units supported by SCE		
ENR5006	Research Methods for Engineers (part of)	5
ENR5026	Science Communication in Engineering (part of)	5
GSC5504	Instrumentation and Ocean Data Systems (part of)	10
ARI5321	Automation and Applied Robotics (part of)	5

4.4 Other Academic Activities

In addition to teaching study units to service degree programs, department members engage in other academic activities examples of which described hereunder.

4.4.1 Certificate in Engineering Sciences

Prof. Alexandra Bonnici coordinated the Certificate in Engineering Sciences, an alternative entry route into Engineering degree courses for students needing to upgrade their Maths/Physics A'levels, who are changing their study direction, or returning back to academia from industry. In the past year, 33 students completed the programme and progressed to undergraduate studies.

4.4.2 NSTF and CERN event: 70 Years of Innovation and Impact

On the 1st of November, 2024, Prof. Alexandra Bonnici, was invited to participate in the joint NSTF and CERN event: 70 Years of Innovation and Impact: Celebrating Our Legacy, which was held at MCAST in Paola. During the event, Prof. Bonnici participated in two panel discussions: Shaping the Future: Education & Science - Preparing the Next Generation of Scientists, and Hands-on Learning: The Power of Practical Experiences.

4.4.3 Carousel Week

Between the 3rd and 7th March 2025, first-year students from the Electrical and Electronic Engineering course took part in Carousel Week, an international exchange funded by the Erasmus BIP programme in collaboration with the Université de Lorraine, Nancy, and the Università di Catania. The Faculty of Engineering hosted 10 students from Nancy and 5 from Catania, while 10 Maltese students joined activities in Nancy. The programme gave students the opportunity to engage in hands-on workshops, cross-cultural teamwork, and gain exposure to different industries. The event was coordinated by Prof. Alexandra Bonnici.

(a)

(b)

Figure 4.1: (a) Prof. Alexandra Bonnici participating in a panel discussion during the NSTF/CERN event, 70 Years of Innovation and Impact: Celebrating Our Legacy. (b) Carousel week students at a visit to Farsons Ltd.

4.4.4 Visit by Prof. Ales Bezrouk and Mgr. Petr Voda, Charles University, Czech Republic

Between the 7th and 10th April 2025, the Department hosted Prof. Ales Bezrouk and Mgr. Petr Voda from Charles University. Prof. Bezrouk and Prof. Voda delivered talks on biopolymer and their degradation processes; eye-tracking control of an adjustable electric bed; and the design and implementation of a true pattern-reversal LED stimulator for visual evoked potential studies. They also toured the laboratories of the department, the Department of Metallurgy and Materials Engineering, and the Centre for Biomedical Cybernetics.

4.4.5 Seminar on Sustainable Engineering 2025

On Wednesday 9th April 2025, The Faculty of Engineering Sustainability Committee held the Seminar on Sustainable Engineering 2025 at the Engineering Research and Innovation Labs. The event brought together researchers, academics, and students to explore how engineering is responding to today's most pressing sustainability challenges. Dr Ing. Luana Chetcuti Zammit chaired this seminar. Mr Nipun Sandamal delivered a presentation about his work, "Dynamic Thermography and Explainable AI for Early Skin Cancer Diagnosis."

4.4.6 University of Malta Research Expo 2025 - UMRE 2025

On Wednesday 28th May 2025, department members participated in the third University of Malta Research Expo (UMRE2025) organised under the pro-rectorate's office of Prof. Ing. Simon Fabri. During this expo, department members presented two talks:

1. *Changing the way we track eyes - fusing the electrooculogram and a webcam for robust eye-gaze tracking* presented by Ing. Matthew Mifsud - a PhD student supervised by Prof. Ing. Tracey Camilleri and Prof. Ing. Kenneth P. Camilleri.
2. *Advancing the Design of Smart and Autonomous Engineering Systems Through Artificial Intelligence* presented by Dr Hani Ahmed, a postdoctoral researcher on the CONAI project led by Prof. Ing. Simon Fabri.

4.4.7 Engineering Exhibition

Between the 20th and 22nd June 2025, our final-year students presented their projects at the Engineering Exhibition organised by the Faculty of Engineering. This year's exhibition also gave the general public a unique opportunity to tour our state-of-the-art laboratories and take part in hands-on workshops and interactive project demonstrations. The department offered three workshops:

(a) (b)

Figure 4.2: (a) Visit by Prof. Rasit Koker. (b) Dr Luana Chetcuti Zammit introducing the Seminar on Sustainable Engineering

- *Mobile Phones: How do the work*, delivered by Prof. Alexandra Bonnici.
- *AI Unleashed*, delivered by Prof. Alexandra Bonnici.
- *Decoding Biosignals: Why Your Body Talks and Tech Listens* delivered by Prof. Ing. Tracey Camilleri, Dr Ing. Nathaniel Barbara and Ing. Matthew Mifsud.

4.4.8 Visit by Prof. Rasit Koker, Sakarya University of Applied Sciences

Between the 23rd and 25th of June, the Department had the pleasure of hosting Prof. Rasit Koker from the Sakarya University of Applied Sciences. During his visit, Prof. Koker delivered two insightful talks:one on the use of machine learning techniques in robotics, featuring a case study; and another on recent developments in unmanned aerial vehicles powered by artificial intelligence. Prof. Koker also attended the Faculty's MSc seminar, where he engaged with postgraduate students on their ongoing research.

4.4.9 Participation in the EUCA General Assembly meeting

Between the 24th and 27th June 2025, Dr Ing. Luana Chetcuti Zammit participated in the EUCA General Assembly meeting held in Thessaloniki in Greece, and engaged in interesting discussions with international academics and researchers. She presented a proposal to host ECC 2029 in Malta. Based on the reviewers recommendations, her proposal was chosen to host ECC2029.

4.4.10 Engineering Students Summer Training Course

Between the 30th June and 5th August 2025, Mr. Noel Agius delivered a six-week summer training course for all first-year Electrical & Electronic and Mechanical Engineering students. The training began with demonstrations of direct-on-line (DOL) and forward/reverse motor starters using single- and three-phase induction motors. Students were introduced to electrical measuring instruments, motor protection devices, wiring practices, and motor configurations (star/delta, nameplate interpretation, bootlace terminals).

Students then completed four practical tasks:

1. Wiring a DOL starter for a 24V DC motor.
2. Wiring a forward/reverse starter for a 24V DC motor.
3. Wiring a DOL starter interfaced with a PLC programmed in ladder logic.
4. Building a PWM-based motor control circuit on a breadboard, interfaced with a DS1104 controller and MATLAB/Simulink, enabling real-time speed and direction control via ControlDesk.

All tasks required wire lacing, inspections, continuity tests, and voltage measurements to ensure safe and correct operation.

4.4.11 Innovating Insurance: Malta's Digital Shift & Emerging Risks.

On the 2nd July, Dr Ing. Luana Chetcuti Zammit participated in the event Innovating Insurance: Malta's Digital Shift & Emerging Risks. The event offered valuable insights into how digital transformation and emerging risks are reshaping the insurance industry.

4.4.12 Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC)

Between the 14th and 17th of July 2025, members of the SCE Department, together with members of the Centre for Biomedical Cybernetics, participated in the IEEE EMBC 2025 held at the Bella Center in Copenhagen, Denmark. A total of eight papers were presented, both as oral and poster contributions, showcasing research conducted within the SCE Department as well as in collaboration with the Centre for Biomedical Cybernetics. The attending SCE Department members were:

- Prof. Ing. Kenneth P. Camilleri
- Prof. Ing. Tracey Camilleri
- Dr Ing. Stefania Cristina
- Ing. Matthew Mifsud
- Mr Nipun Sandamal
- Mr Jeremy James Cachia

4.4.13 The ACM Symposium on Document Engineering

Between the 2nd and 5th September 2025, Prof. Alexandra Bonnici attended the 25th ACM Symposium on Document Engineering (DocEng). During the conference, Prof. Bonnici took part in a Birds-of-a-Feather discussion on the security and legal aspects of Artificial Intelligence; chaired the SIGWEB town hall meeting — where issues related to ACM Open and article processing charges (APCs) were discussed; and led the DocEng steering committee meeting. Prof. Bonnici also held discussions with the organising committee for DocEng 2026.

4.4.14 Road Safety on Five Continents 2025

Between the 3rd and 5th September, Dr Ing. Luana Chetcuti Zammit participated in Road Safety on Five Continents CONFERENCE and presented the research work on traffic accidents in children.

4.4.15 EEG101 COST Management Committee Meeting

On the 24th of September 2025, Prof. Ing. Tracey Camilleri and Dr Natasha Padfield attended the first Management Committee Meeting for the COST Action CA24148 - EEG101: Fundamentals of Open & Rigorous EEG Science. The aim of this action is to develop concrete strategies for addressing salient issues impeding EEG-related research. At this meeting, which took place at the COST offices in Brussels, they represented the community of EEG researchers based in Malta. The meeting was a valuable networking opportunity, and also led to fruitful discussions about how to kickstart work in the Action.

4.5 Publications

Book Chapters

1. S. Colantonio, S. Aleksic, J. Calleja Agius, K. P. Camilleri, A. Čartolovni, P. Climent-Pérez, S. Cristina, V. Despotovic, H. K. Ekenel, M. E. Erakin, F. Florez-Revuelta,"A Historical View of Active Assisted Living", In "Privacy-Aware Monitoring for Assisted Living: Ethical, Legal, and Technological Aspects of Audio-and Video-Based AAL Solutions", pages 3-44, Cham: Springer Nature Switzerland, 2025.
2. S. Cristina, P. Počta, A. Zgank, K. P. Camilleri, S. Colantonio, L. Lambrinos,"Remote monitoring of vital signs", In "Privacy-Aware Monitoring for Assisted Living: Ethical, Legal, and Technological Aspects of Audio-and Video-Based AAL Solutions", pages 217-237, Cham: Springer Nature Switzerland, 2025.

Journal Publications

1. L. T. Triccas, S. Van Hoornweder, T. Camilleri, L. Boccuni, A. Peeters, V. Van Pesch, R. Meesen, D. Mantini, K. Camilleri, G. Verheyden, "EEG Responses to Upper Limb Pinprick Stimulation in Acute and Early Subacute Motor and Sensorimotor Stroke: A Proof of Concept", Translational Stroke Research, January 2025.
2. Y. Chen, Y. Peng, J. Tang, T. A. Camilleri, K. P. Camilleri, W. Kong, A. Cichocki, "EEG-based affective brain-computer interfaces: recent advancements and future challenges", Journal of Neural Engineering, June 2025.
3. Z. Zhao, Y. Li, K. P. Camilleri, W. Kong, "Multi-view graph fusion of self-weighted EEG feature representations for speech imagery decoding", Journal of Neuroscience Methods, vol. 418, June 2025.
4. Y. Li, Z. Zhao, J. Liu, Y. Peng, K. Camilleri, W. Kong, A. Cichocki, "EEG-based speech imagery decoding by dynamic hypergraph learning within projected and selected feature subspaces", Journal of Neural Engineering, vol. 22, nr 4, July 2025.
5. M. Joby, S.G. Fabri, I. Tzortzis, S. Santra, "Reducing Conservatism in Observer-Based Control for Time-Delay Systems with Random Input Nonlinearity", International Journal of Robust and Nonlinear Control, July 2025
6. T. Camilleri, P. Farrugia, M. Bugeja, and P. Refalo, "Meeting Multi-User Needs in Early Design Stages: A Data-Driven Conceptual Framework for Smart and Sustainable Packaging", Applied Sciences MDPI 15, no. 16: 9024, August 2025.
7. J. Gauci, O. Falzon, K. P. Camilleri, "Registration of long-term recordings of thermographic video applied to foot temperature monitoring" Quantitative InfraRed Thermography Journal, pages 1-21, September 2025.
8. B. Bartolo, B. Azzopardi, K. Scerri, "Development and implementation of a public data repository for photovoltaic systems: Case study Malta's living laboratories", Solar Energy Advances, 2025.

Conferences Publications (Peer Reviewed)

1. B. Bartolo, B. Azzopardi, K. Scerri, "Data-Driven Validation of Photovoltaic Performance in the Climatic Context of Malta", IEEE PES Innovative Smart Grid Technologies Europe (ISGT Europe), October 2024.
2. C. Caruana, S. Bhattacharya, R. Raute, A. Micallef, K. Scerri, "Optimal MBU positioning under fault scenario for distribution networks with high PV penetration", IET Conference Proceedings (CP904), November 2024.
3. L. A. Mifsud, T. Scicluna, K. Scerri, M. Farrugia, "Experimental Investigation of Downhill Regenerative Braking of Electric Vehicles from CAN Bus Data", 21st International Conference on Mechatronics (ME 2024), December 2024.
4. L. A. Mifsud, K. Scerri, M. Farrugia, "Regression Analysis of Factors Affecting Round-Trip Regenerative Braking Efficiency using Real-World Data", 21st International Conference on Mechatronics (ME 2024), December 2024.

5. H. H. Ahmed, S. G. Fabri, M. K. Bugeja, K. P. Camilleri, “Reinforcement Learning Control Strategies: Q-learning, SARSA, and Double Q-learning Performance for the Cart-Pole Problem”, International Conference on Control, Automation and Diagnosis (ICCAD), July 2025.
6. N. Padfield, S. Turk, K. Mujahid, T. A. Camilleri, Y. Peng and K. P. Camilleri, “A spatio-spectral analysis of decoding imagined speech from the idle state”, IEEE Engineering in Medicine and Biology Society (EMBC), July 2025.
7. N. Sandamal, S. Cristina, K. P. Camilleri, “Decoding diagnosis: AI explainability for enhanced skin cancer detection”, IEEE Engineering in Medicine and Biology Society (EMBC), July 2025.
8. M. Mifsud, T. A. Camilleri and K. P. Camilleri, “Real-time EOG signal baseline drift estimation using passive VOG data”, IEEE Engineering in Medicine and Biology Society (EMBC), July 2025.
9. J. J. Cachia, N. Barbara, T. A. Camilleri and K. P. Camilleri, “An analysis of electrooculography slow-oscillation during light adaptation under varying lighting intensities”, IEEE Engineering in Medicine and Biology Society (EMBC), July 2025.
10. N. Barbara, T. A. Camilleri and K. P. Camilleri, “EOG-based ocular angle estimation without assuming equal vertical ocular angles”, IEEE Engineering in Medicine and Biology Society (EMBC), July 2025.
11. M. Borg, S. Mizzi, R. Farrugia, T. Mifsud, A. Mizzi, J. Bajada and O. Falzon, “An investigation of foot temperature deviations in individuals with diabetes: insights from wearable in-shoe technology”, IEEE Engineering in Medicine and Biology Society (EMBC), July 2025.
12. S. Turk, N. Padfield, K. Mujahid, T. A. Camilleri and K. P. Camilleri, “Word-specific properties affect classification performance in Brain-Computer Interfaces for decoding imagined speech from EEG”, IEEE Engineering in Medicine and Biology Society (EMBC), July 2025.
13. C. Gilford, T. A. Camilleri and K. P. Camilleri, “User discomfort in SSVEP-based BCIs - can modulation depth offer a solution?”, Brain-Computer Interfaces, vol. 11, issue 4, September 2024.
14. T. Bajada, L. Chetcuti Zammit, “A data driven approach to understand patterns of children as victims of road injury crashes, case study: Malta”, Proceedings of Road Safety in Five Continents, September 2025.

Non-peer reviewed articles

1. N. S. Pathiranage, S. Cristina, K. P. Camilleri, “Robust Iris Centre Localisation for Assistive Eye-Gaze Tracking”, arXiv preprint arXiv:2411.04912, November 2024.

Blog posts and tutorials

1. From Concept to Champion: Reflections on 10 Months of Robotics Success, by Aislinn Seguna, 9 December 2024.

Magazines and newspapers

1. SmartGaze: Providing an Alternative Way of Smart Device Control through Eye Gaze, Newspoint, 17 December 2024.
2. Lighting the way: how EyeTrack’s electrooculography is set to transform gaze-tracking systems, THINK Magazine, issue 46, pages 52-55, March 2025.
3. SmartGaze: A vision for autonomy in smart device control, Times of Malta, 13 July 2025.
4. Research into Decoding Speech from Brain Signals Presented at EMBC 2025, Newspoint, 22 July 2025.
5. NeuroBCI: Empowering ALS patients through brain-computer interfaces, Newspoint, 1 September 2025.
6. Controlling devices with just a thought, by Natasha Padfield, The Sunday Times of Malta, 21 September 2025

5. Professional Development

The Department members make efforts to keep abreast with new administrative, pedagogical and technological practices by following lectures, talks or courses as organised by the University of Malta and other relevant entities. The Department also maintains its commitment to offer its members the opportunity to share knowledge and experiences through the Learning Thursdays. These sessions provide a platform for academic and technical staff members, research support staff and post-graduate students of the Department, the Centre for Biomedical Cybernetics, as well as close research collaborators from other departments or institutes to discuss academic matters of common interest as well as providing final year and postgraduate students the opportunity to communicate their research work. The following summarises all the professional development activities carried out by department members during this year.

5.1 Courses and Training Followed by Staff Members

- Prof. Ing. Tracey Camilleri participated in the orientation session for the new Academic Mentoring Programme organised by the University of Malta in November 2024, and was assigned a mentee.
- Prof. Ing. Tracey Camilleri attended the 'Preparing for Tenure' workshop in February 2025 organised by the Office for Professional Academic Development and the Office for Human Resources Management & Development at the University of Malta.
- Prof. Ing. Tracey Camilleri attended the 'Academic Research and Writing Using Generative AI' workshop in June 2025 organised by the Office for Human Resources Management & Development at the University of Malta.
- Dr Ing. Stefania Cristina participated in the 'Think sensory! Practical tips for personal wellness, teaching & learning' workshop on the 2nd July 2025, organised by the Office for Human Resources Management & Development and the Office for Professional Academic Development.
- Prof. Alexandra Bonnci attended an HOD meeting on the 18th September 2025 organised by Prof. Valeri Solars. This meeting focused on sharing experiences by Department Heads, and presentations from the director of Human Resources, and the International Office.

5.1.1 Erasmus+ Staff Mobility

- Between the 30th April and 6th May 2025, Prof. Ing. Marvin Bugeja visited the Department of Mechatronics at Brno University of Technology (BUT), hosted by the head of department Prof. Robert Grepl. During his visit, Prof. Ing. Bugeja delivered several lectures and practical sessions on "Nonlinear Control Systems", and "Technical Report Writing and Presentations", to groups of undergraduate and postgraduate students. Moreover, he discussed a number of possibilities for future internships, joint research projects and extended lecturing visits between the two depart-

(a) (b)

Figure 5.1: (a) Prof. Ing. Marvin Bugeja presenting at the Mechatronics Laboratory at Brno University of Technology, Czechia. (b) Prof. Alexandra Bonnici presenting at the Hacettepe University, Ankara, Turkey

ments.

- Between 8th and 12th May 2025, Ms Sanchia Cilia Lentini visited the University of Applied Sciences Upper Austria for a training mobility. Here, Sanchia shadowed administrative staff members at the University to learn and share good administrative practices.
- Between the 9th and 13th June 2025, Prof. Alexandra Bonnici visited the Hacettepe University in Ankara, Turkey, where she delivered a lecture on image binarisation — starting from classical thresholding and moving toward deep learning approaches that frame it as a classification problem. She also had the opportunity to meet with several academics from the Department of Electrical and Electronics Engineering to explore possible areas of collaboration between the two departments.
- Between the 17 to 23 September 2025, Mr Noel Agius, the Universita' degli Studi della Basilicata, Potenza, Italy, for a training mobility. Here, he shadowed technical staff members at the University to learn and share good practices in laboratory management.

6. Research Activities and Collaborations

The Department has an active research track-record with its members actively involved in seeking research funds to support postgraduate and post-doctoral students. This section describes the work carried out through these projects.

6.1 Transdisciplinary Research and Knowledge Exchange Projects

The University of Malta secured ERDF funding through the Transdisciplinary Research and Knowledge Exchange (TRAKE) project ERDF.01.124, funding research projects, through competitive calls.

CONAI - Artificial Intelligence for Control of Complex Systems

Main investigators: Simon G. Fabri, Kenneth P. Camilleri, and Marvin Bugeja
Research Support Officer: Dr Hani Ahmed Hazza
Funding Amount: **€120,000**
Project Leader: Prof. Ing. Simon G. Fabri

This project is on the design of intelligent control methodologies for complex systems that are able to operate under conditions of complexity and uncertainty, using the latest developments in Artificial Intelligence such as deep and reinforcement learning. Intelligent control offers potential for automation of equipment in, for example, control of pollution or wastewater treatment, the development of smart and reliable systems for control of active prosthetic devices, automation and control of industrial manufacturing facilities and robotic assembly infrastructures, and the development of autopilot systems and driverless/autonomous navigation. This widespread use of applications is testimony to the fact that control systems are ubiquitous in many technological areas, and that modern systems exhibit complex challenges that demand smarter controllers than traditional techniques that make use of Artificial Intelligence.

6.2 National Funding

SmartGaze - Control of devices using EOG-based eye-gaze tracking for a smart home environment

Main investigators: Prof. Ing. Tracey Camilleri, Prof. Ing. Kenneth Camilleri, Dr Ing. Nathaniel Barbara
Research Support Officers: Salah Ad-Din Ahmed Youbi, Matthew Mifsud, Ella Miceli Farrugia
Funding Body: Xjenza FUSION Smart Cities Programme
Funding Amount: **€149,982**
Awardee: Prof. Ing. Tracey Camilleri

Being immersed in a technological environment has made it important to be able to communicate and control technological devices in a seamless, effortless manner. The standard interfaces include remote

controls, applications on smartphones or tablets, or touch screens made available on the device itself. This communication modality, however, is not always suitable for individuals with limited fine motor skills who find it difficult to press small buttons on a remote control or icons on a touch screen.

SmartGaze aims to address this issue by exploiting the natural gaze interaction of human beings with devices in their environment to allow individuals with mobility impairments to control devices, such as an air conditioner or television set, using eye gaze tracking. Specifically, electrooculography (EOG) is used as the eye gaze tracking modality, together with head orientation and localisation of the individual within a smart home, to determine the device that the subject wants to control. Once locked with a device, the individual selects device specific control functions through simple eye gestures. The proposed system makes use of a wearable, wireless EOG glasses and does not require a computer screen for device function selection, making the system more practical to use.

SmartGaze thus provides a novel communication interface for individuals who lack the necessary fine motor skills to control standard interfaces, bringing forth more independence and a better quality of life as it reduces the continuous dependence on carers or family members.

This project was successfully completed in December 2024.

EyeCon+ - Validation of Electrooculography-based Eye Tracking

Main investigators: Prof. Ing. Tracey Camilleri, Prof. Ing. Kenneth Camilleri, Dr Ing. Nathaniel Barbara
Research Support Officers: Matthew Mifsud, John Soler, Jeremy James Cachia
Funding Body: Xjenza FUSION Go-to-Market Programme
Funding Amount: **€99,970**
Project Leader: Tracey Camilleri

The success of a previous project, called EyeCon, funded by the Xjenza Technology Development Programme, was in controlling computer applications through electrooculography (EOG) for augmentative and alternative communication. Building upon this achievement, EyeCon+ aimed to validate the previously developed EOG-based eye gaze tracking engine in the context of a virtual typing application. The key achievements include: i) testing of the system with both healthy participants and patients with mobility impairments, ii) the development of an enhanced virtual keyboard application with integrated word prediction and text-to-speech functionality, and iii) an upgraded version of a wearable EOG wearable device designed to improve comfort and usability. This project was successfully completed in August 2025.

NeuroBCI - Development of a Brain Computer Interface System

Main investigators: Prof. Ing. Tracey Camilleri, Prof. Ing. Kenneth Camilleri, Prof. Chris Porter
Research Support Officers: Rosanne Buttigieg
Funding Body: Ministry for Education, Sport, Youth, Research & Innovation
Funding Amount: **€255,119**
Project Leader: Prof. Ing. Tracey Camilleri

NeuroBCI is aimed to develop a brain computer interface system that will allow individuals to interact with technology using their brain signals alone. By wearing an electroencephalography (EEG) headset, patients will be able to send commands without physical movement, opening up opportunities to compose messages, browse the internet, or control smart devices at home. More than a technological breakthrough, NeuroBCI represents a path to independence, dignity, and a voice when speech is no longer possible. This project has commenced at the beginning of September 2025 and is being done in collaboration with Dar Bjorn.

Combined Thermal and Visual Imaging for Early Detection of Skin Cancer

Main Investigators: Dr Ing. Stefania Cristina, Prof. Ing. Kenneth Camilleri
Research Support Officers: Nipun Sandamal
Funding Body: RIDT ALIVE Cancer Research Grant 2018
Funding Amount: **€60,000**
Project Leader: Dr Ing. Stefania Cristina

Early detection of malignant skin lesions is crucial for increasing the effectiveness of skin cancer treatment. Current methods for the differentiation between benign and malignant skin lesions are invasive, because they involve the removal of the skin lesion onto which a hispathology is then performed. This project, alternatively, aims for a non-invasive differentiation between benign and malignant skin lesions by exploiting a combination of dynamic thermography with visual dermoscopy using deep learning techniques. The aim is to study the thermal and visual characteristics of the human skin, in order to automatically distinguish between healthy and pathological skin regions. The use of deep learning techniques has already shown promise in improving detection rates when applied to dermoscopic images, and hence such techniques will be investigated for the purpose of this study.

ThermaScan: Investigating Dynamic Thermography for Skin Lesion Analysis

Main Investigators: Dr Ing. Stefania Cristina, Prof. Ing. Kenneth Camilleri, Prof. Alexandra Bonnici
Funding Body: R&I Thematic Programmes: Cancer Research Programme 2025, Xjenza Malta
Funding Amount: **€299,992**
Project Leader: Dr Ing. Stefania Cristina

Skin cancer is one of the most common cancers worldwide, and early detection is crucial in improving treatment outcomes. While traditional diagnostic methods rely heavily on visual inspection by dermatologists and biopsy, the ThermaScan project explores the use of thermography combined with advanced data analysis techniques for the early and non-invasive detection of malignant skin lesions. This project aims to continue building on the knowledge attained from our earlier work for skin cancer detection using thermography, where we have seen that malignant tissue can exhibit distinct thermal signatures compared to healthy skin.

RoadEye

Main investigators: Dr Kenneth Scerri, Dr Odette Lewis
Research Support Officers: Liam Butler, Walaa Schoeib
Funding Body: Postdoctoral Fellowship Schemee, Ministry of Education, Sports, Youth, Research and Innovation
Funding Amount: **€269,120**
Awardee: Dr Kenneth Scerri

This project aims to develop a unified predictive knowledge platform for transport service providers through collaboration between Greenroads Ltd. (GR), the University of Malta, and Infrastructure Malta (IM). Building on GR's existing real-time traffic monitoring solution, the project will integrate multi-source data to enhance traffic and infrastructure insights. New key performance indicators (KPIs) will assess network conditions and predict potential disruptions, while AI-driven models will suggest re-routing strategies in near real time. The platform will be validated through a local case study and will support data-driven transport management, improved mobility, and sustainable infrastructure planning.

CAIRED - Cardiovascular Artificial Intelligence: e-Health for Diabetes

Main investigators: Dr Kenneth Scerri
Research Support Officers: Dora Lee Borg
Funding Body: RTDI - Cancer Research
Funding Amount: **€30,000**
Awardee: Dr Kenneth Scerri

The Cardiovascular Artificial Intelligence: e-Health for Diabetes (CAIRED) project aims to develop artificial intelligence (AI) models using electrocardiogram (ECG) data to predict cardiovascular disease (CVD) risk in individuals with diabetes. Leveraging single-lead ECGs, such as those obtainable from smartwatches, CAIRED applies convolutional neural networks and explainable AI to identify ECG patterns linked to elevated CVD risk. Using open-source datasets like UK Biobank and Physionet, the project seeks to deliver accurate, interpretable, and accessible digital health tools for early detection, prevention, and personalised care. The outcome will support clinical decision-making and empower individuals through AI-driven e-Health solutions.

6.3 Internal Research Grants

The following projects were awarded through the University of Malta Internal Research Grant funding scheme. During this academic year, all projects awarded under this scheme were allocated a grant of €1,200. A total of seven grants were awarded under this scheme.

Automatic Control of Mechatronic Systems

Main investigators: Prof. Ing. Simon Fabri
Grant: SCERP01-25

Modern engineering systems often involve mechatronic setups comprising the use of mechanical devices and components; electronic sensors, actuators and circuitry; as well as computational hardware and software algorithms. Examples include, among others, robotic systems, autonomous vehicles, vehicle automation subsystems (such as ABS or cruise control), and quadcopter control. Machine learning algorithms are often utilised to handle the complexity of such systems, because they often present complex and nonlinear dynamics that would benefit from self-autonomous control for appropriate operation, with as little human intervention as possible. This project aims to address such issues by making use of modern control theory coupled with adaptive and nonlinear control techniques and machine learning/artificial intelligence to design, implement and test smart controllers for such systems. Theoretical and practical aspects will be considered, together with simulation studies and implementation/evaluation on laboratory-scale pilot equipment that may include a Stewart platform type of robotic system and a reaction-wheel inverted pendulum apparatus.

Image Binarisation for Document Analysis

Main investigators: Prof. Alexandra Bonnici
Grant: SCERP02-25

Image binarisation plays a pivotal role in document analysis, especially when dealing with complex backgrounds that can hinder text extraction and recognition. This study focuses on binarisation techniques tailored for documents with colourful and textured backgrounds, commonly encountered in posters, flyers, and artistic layouts. The investigation explores adaptive thresholding methods, colour deconvolution, and machine learning approaches to effectively separate text from intricate backgrounds. Performance is evaluated based on metrics such as text integrity, noise reduction, and computational

efficiency. The outcomes aim to inform the development of robust binarisation solutions, enhancing the accuracy of text recognition and automated document processing in visually complex contexts.

Dynamic Systems Modelling for Interdisciplinary Innovation

Main investigators: Dr Kenneth Scerri
Grant:SCERP03-25

This project aims to advance the application of systems theory and modelling across multidisciplinary domains, including transportation, biomedical, and financial systems. By leveraging mathematical modelling, control theory, and data-driven approaches, the project seeks to capture the complex dynamics of real-world systems and enhance predictive capabilities. The ultimate goal is to develop integrated analytical frameworks that support smarter decision-making, optimise system performance, and improve resilience. Through cross-domain collaboration, this initiative bridges theoretical research with practical solutions for sustainable mobility, healthcare innovation, and financial stability.

Brain signals, natural and artificial intelligence, and consciousness

Main Investigators: Prof. Ing. Kenneth P. Camilleri
Grant: SCERP05-25

Brain signals, natural and artificial intelligence, and consciousness: This research revolves around signal and image analysis, machine learning, brain-computer interfacing and the nature of consciousness. Specifically, this project will review the growing literature on the hypothesised nature of consciousness and investigate theoretical, computational and experimental methods that may throw light on this nature. Insights from the nature of consciousness may be applied to ongoing work on brain signals analysis and the nature of intelligence.

Developing a practical human machine interface system

Main investigators: Prof. Ing. Tracey Camilleri
Grant: SCERP13-25

Developing a Practical Human Machine Interface System This work aimed to advance the development of practical Human-Machine Interface (HMI) systems, focusing specifically on electrooculography (EOG) and electroencephalography (EEG) applications. The work related to EOG-based HMI applications primarily addresses the challenge of baseline drift in EOG signals, which negatively impacts gaze point estimation accuracy. Accurate gaze estimation is essential for controlling computer applications, particularly in Augmentative and Alternative Communication (AAC) systems. Current efforts are exploring the integration of passive eye-gaze tracking solutions to enhance EOG-based gaze angle estimation. Furthermore, this funding also aimed to support the development of EEG-based Brain-Computer Interfaces (BCIs), leveraging phenomena such as steady-state visual evoked potentials (SSVEPs) and speech imagery. Ongoing research is investigating a set of imagined words that can be reliably distinguished using EEG signals, enabling the advancement of BCI systems.

Intelligent Transportation Systems

Main investigators: Dr Ing. Luana Chetcuti Zammit
Grant: SCERP14-25

This project aims to enhance Intelligent Transportation Systems (ITS) by addressing fundamental challenges of security and trust. While emerging technologies such as cloud computing enable large-scale data storage and analysis, centralized platforms remain vulnerable to malicious attacks, performance

bottlenecks, and operational inefficiencies. In addition, the absence of mutual trust between ITS entities further complicates system integration and reliability. Current ITS solutions fall short in tackling these critical issues, and this project seeks to bridge that gap by developing approaches that strengthen security and build trust across transportation networks.

Less Constrained Eye-Gaze Tracking for More Natural User Interaction

MAIN INVESTIGATORS: Dr Ing. Stefania Cristina
GRANT: SCERP15-25

This project aims to support ongoing research work in developing deep learning-based methods for eye-gaze tracking, which permit the user to interact in a more natural manner under less constrained conditions. While our long-standing work on eye-gaze tracking has focussed mainly on human-computer interaction at a distance of 60-70cm from the camera (mounted on a monitor screen), more recent research explores less constrained scenarios, where the eye-gaze can be tracked at a lengthier distance from the camera and in unfavourable conditions, such as illumination variations and iris occlusions.

6.4 Non-funded PhD Projects

Analysis on the use of EOG data during long-term use

STUDENT: Matthew Mifsud
SUPERVISORS: Prof. Ing. Tracey Camilleri, Prof. Ing. Kenneth P. Camilleri

In this technological era, the internet has become an accessible medium through which individuals connect from any point in the world through a simple click. In order to carry out different tasks on the internet, users are constantly required to operate different control input devices which range from keyboards to touchscreen devices. Operating these systems requires little to no effort from the user's end, however, such systems are not a viable option for individuals with severe mobility impairments, such as individuals suffering from Amyotrophic Lateral Sclerosis (ALS) or who are completely locked in. In such situations, users typically resort to eye gaze tracking as a suitable alternative, which enables users to communicate efficiently and lead a more independent way of life. Recent developments in electrooculography (EOG)-based eye gaze-tracking research has shown that such systems can achieve improved eye gaze-tracking accuracies, however, the tracking quality in EOG-based systems deteriorates over time. This is a primary stumbling block towards making EOG-based eye gaze tracking a viable option for users who make use of Augmentative and Alternative Communication (AAC) applications on a daily basis. To this end, this doctoral research programme is investigating the long-term usability issues of EOG-based eye gaze tracking, in an effort to preserve the gaze tracking quality and make it a possible alternative to current videooculography (VOG)-based eye gaze tracking solutions.

6.5 Projects with Department Members as Collaborators

JUSTNature - Activation of NATURE-based solutions for a JUST low carbon transition

LOCAL INVESTIGATORS: Dr Edward Duca [1], Dr Kenneth Scerri and Prof. Ing. Daniel Micallef [2]
FUNDING BODY: EU H2020 LC-CLA-11-2020

Cities are major energy consumers and significantly contribute to greenhouse gas (GHG) emissions. They have a high density of socio-economic activities and a built environment design that enhance these issues. In this regard, especially developed cities can be exemplars in leading the way towards a low-carbon society, and turning it into an opportunity as recently iterated by the European Green Deal. Such advances can address several other challenges arising from urbanisation and structural socio-economic changes. Cities represent a complex setting, where low income populations are more exposed to environmental ills, environmental and climate impacts are not distributed evenly, environmental qualities are becoming increasingly exclusive to high-income households, and wealthier neighbourhoods are more biologically diverse than others. In this regard, the overall objective of JUSTNature is the activation of nature-based solutions (NbS) by ensuring a just transition to low-carbon cities, based on the principle of the right to ecological space. This in particular refers to the right to clean air and indoor/outdoor thermal comfort for human health and well-being, as well as thriving biodiversity and ecosystems. It also refers to the duty of not constraining the ecological space of others, in particular in relation to the mitigation of climate change and measures required for reducing GHG emissions. JUSTNature will contribute to this vision of shaping low-carbon cities by developing a set of typical Low carbon | High air quality NbS in seven European city practice labs. By activating their just implementation, it will drive the co-design, co-creation and co-decision of supporting interventions with regard to four innovation dimensions: 1) enabling effective governance, 2) enabling NbS system maintenance and operation, 3) enabling innovative business models and market design, and 4) enabling efficient technologies and applications.

Sit_Diab - Smart Insole Technology for the Salvage of the Diabetic Foot

MAIN INVESTIGATORS: Prof. Alfred Gatt [3], Prof. Cynthia Formosa [3] and Prof. Ing. Marvin Bugeja
FUNDING BODY: Xjenza FUSION R&I Technology Development Programme

This project aims to develop and validate a device in an attempt to reduce the incidence of diabetic foot complications. The technology being developed assesses the patient's risk of getting a diabetic ulcer by monitoring foot plantar pressure and temperature during walking. The technology uses Artificial Intelligence to process the pressure and temperature signals to determine areas which have a high risk of ulceration during daily activities. The proposed solution is envisaged to eventually replace traditional offloading techniques, which have been shown to be ineffective in reducing amputation rates in practice.

SALTT-CITY - A User-Experiences Based Approach for Designing Connected Speech and Language Therapeutic Toys in a Smart City

MAIN INVESTIGATORS: Prof. Ing. Philip Farrugia[4] and Prof. Ing. Simon G. Fabri
FUNDING BODY: Xjenza Smart Cities Thematic Programme

The SALTT-CITY project is a multidisciplinary collaboration led by Prof. Philip Farrugia from the Department of Industrial and Manufacturing Engineering and includes members from the Department of Speech and Language Pathology and the Department of Microelectronics and Nanoelectronics. It aims

[1] Centre for Entrepreneurship and Business Incubation
[2] Faculty for the Built Environment
[3] Department of Podiatry
[4] Department of Industrial and Manufacturing Engineering

to develop a platform which supports connected Speech and Language Therapeutic Toys (SALTTs) in a smart city environment, enabling the elicitation of user-experiences and integrating them in computer-based design support tools. This project builds upon the SPEECHIE project which took place over a period of three years during which an innovative product service system (PSS) was developed. The product in this PSS enhances the engagement of children with 'Developmental Language Disorder' during speech and language intervention, whereas the service aspect assists speech and language pathologists in monitoring children's progress during therapy in clinical and home settings.

SMARTSPACK - A User-Centred Smart PlatforM for Designing and MAnufactuRing Self-SaniTising and Sustainable PACKaging

INVESTIGATORS: Prof. Ing. Philip Farrugia[??], Prof. Ing. Marvin Bugeja, Dr Margaret Camilleri Fenech[5]
FUNDING BODY: Xjenza FUSION R&I Technology Development Programme

SMARTSPACK aims to develop a novel sanitising solution, integrated in the packaging, such that the user is invariably bound to sanitise their hands before consuming the edible product inside the packaging. A user-centred design (UCD) approach will be employed in the design, to ensure that the consumer is satisfied with the smart packaging. Thus, contributing to the overall good user-experience of the end-user. Furthermore, design for sustainability principles will also be employed. Environmental and ethical concerns are also becoming increasingly important in consumers' product choices. Moreover, end-users would be able to input their demographics and feedback of experiences with the packaging through the SMARTSPACK platform. Their experiences will be measured using metrics such as (i) Type of package, (ii) Ease of opening, (iii) Ease of application, (iv) Satisfaction with sanitiser amount, and (v) Satisfaction with sanitiser properties such as viscosity. The outcomes from the SMARTSPACK platform will be used by the intelligent cloud to infer the right amount of sanitising solution to the respective packaging being fabricated. This will be achieved with the application of big data analytics on smart packaging production.

Operation Tom - Enhancing Astronaut Neuro-Imaging Capabilities: Toolbox Optimization and Modification

INVESTIGATORS: Dr Claude Bajada [6] and Dr Kenneth Scerri
FUNDING BODY: Xjenza Space Upstream Thematic Programme 2023

While changes to brain structure resulting from spaceflight have been extensively studied, limited research has focused on brain function. To fill this void, the project aims to enhance the capabilities of the Vogt-Bailey (VB) toolbox, a software developed by the BOB Lab at the University of Malta in conjunction with external collaborators. This toolbox is specifically designed to identify patterns of homogeneity in brain activity at the scale of a few millimetres. In its current form, however, the VB toolbox's assessment of local brain function may not consistently reflect the underlying biological mechanisms due to limitations that inadvertently amplify homogeneity at a small scale. These limitations do not arise from poor construction of the toolbox, but as a natural consequence of the preprocessing of fMRI data. The scientific approach involves accurately quantifying the impact of the resulting artefacts, and subsequently developing mitigation measures by exploring adjustments to standard preprocessing methods and/or employing data reconstruction techniques. The toolbox will also be adapted to spaceflight-specific factors such as the upward shifting of the brain and the enlargement of the ventricles, as these could potentially interfere with the data analysis.

[5] Institute for Climate Change and Sustainable Development

BRIAN - A User-Centred Smart PlatforM for Designing and MAnufactuRing Self-SaniTising and Sustainable PACKaging

INVESTIGATORS: Dr Claude Bajada [6] and Dr Kenneth Scerri
FUNDING BODY: RIDT cancer research grant 20233

The BRIAN project aims to develop predictive models for tumour failure locations. Our goal extends beyond understanding current tumour behaviour. We aim to improve the effectiveness of treatment by helping clinicians anticipate future tumour spread. This means refining surgical planning to ensure that resection margins not only cover the existing tumour but also areas likely to be involved in future propagation. By doing so, we aim to reduce instances of tumour treatment failure, which are often due to undetected tumour spread during initial treatment. By enhancing the precision of tumour resections and the effectiveness of glioblastoma treatment strategies, our project holds promise to improve life expectancy for glioblastoma patients and reduce the morbidity associated with tumour recurrence. This represents a major advancement in the field of neuro-oncology and a significant stride towards our ultimate goal: a world where high grade gliomas are no longer a death sentence, but a condition that can be effectively managed and treated.

LSDi - Liquid State Dual fuel Injection LSDi

INVESTIGATORS: Prof. Ing. Mario Farrugia[7] and Dr Kenneth Scerri
FUNDING BODY: Xjenza - Research Excellence Programme

This project aims to develop a novel combustion control strategy to mitigate knocking in dual-fuel engines operating on Liquefied Natural Gas (LNG) and diesel. Dual-fuel technology offers significant emission reductions and operational flexibility, particularly in marine and heavy-duty transport applications where full electrification is impractical. Building on insights from the Xjenza-funded BIMA project, this research proposes injecting a small quantity of pressurised LNG into the intake airstream to reduce charge-air temperature through evaporative cooling. This innovative approach seeks to stabilise combustion during transients, minimise knock, and enhance engine efficiency and reliability under varying load conditions.

SIDec - Enhancing Speech Imagery Decoding for EEG-based Brain-Computer Interface Systems

INVESTIGATORS: Prof. Ing. Kenneth Camilleri and Prof. Ing. Tracey Camilleri FUNDING BODY: Xjenza Sino-Malta Fund 2021

Speech imagery (SI) is a brain-computer interface (BCI) paradigm which can enable subjects to intuitively control external devices such as graphical user interfaces or robots in a hands-free manner, by using just their thoughts. However, the widespread use of the SI paradigm has been impeded by the relatively low decoding accuracies obtained when using electroencephalogram (EEG) data, which is a leading non-invasive method of reading brain signals. These low accuracies lead to poor and unrobust BCI performance. This project aims to investigate novel and innovative signal processing, machine learning, and deep learning techniques to improve the accuracy of SI decoding. It also proposes an investigation into fundamental aspects of SI, including the impact of background noise (such as music) on data quality and how the detection rate of words varies for a vast lexicon. Finally, the findings of this project will be further explored and validated through the implementation of online SI BCIs that the user can interact with. From a technical perspective, this project aims to investigate the scalp regions and frequency bands that are the most important for SI decoding. It also aims to investigate the efficacy of various classifiers for SI decoding, as well as novel knowledge-based, collaborative learning

[6] Department of Physiology & Biochemistry
[7] Department of Mechanical Engineering

techniques to improve SI decoding.

EyeTrack - Robust EOG-based Eye-Gaze Tracking under Varying Illumination Conditions

INVESTIGATORS: Dr Ing. Nathaniel Barbara [8], Prof. Ing. Tracey Camilleri, Prof. Ing. Kenneth Camilleri
FUNDING BODY: Xjenza, Research Excellence Programme 2023

Technological advancements have enabled various ways for people to interact with devices, such as touchscreens, voice commands, and hand gestures, but these can be difficult for those with impaired fine motor skills, like stroke or ALS patients. Since their oculomotor function is typically intact, eye movement-based human-computer interfaces (HCI) offer a viable alternative. The EyeTrack project explores electrooculography (EOG) to develop these systems by capturing bio-signals from the eyes using electrodes placed around the face. The research aims to improve gaze estimation by examining different electrode configurations and combinations, optimizing both hardware design and signal processing. Additionally, it addresses inconsistencies regarding how illumination affects EOG signals. While some studies suggest minimal impact, the Arden Ratio clinical test indicates that EOG amplitudes can vary significantly between dark and light conditions, affecting gaze accuracy. The project seeks to develop methods to counteract these variations, thereby enhancing the robustness and readiness of EOG-based technology for users needing alternative communication channels.

BrainWeb - Developing a low-cost brain-native web browser

INVESTIGATORS: Prof. Chris Porter [9], Prof. Ing. Tracey Camilleri, Prof. Ing. Kenneth Camilleri
FUNDING BODY: University of Malta Research Excellence Programme 2023

This project overarching objective is to provide people living with severely restrictive motor limitations access to the internet, and in turn all that it affords. This includes connecting and communicating with other people, learning, working, entertainment, and other activities at the core of what it means to being human. The state of the art presents little to no real opportunities for persons living in a locked-in state to act in an unbounded manner on the web, and this project aims to produce novel assistive technology, with low adoption barriers, for use outside specialised lab environments. The research questions being addressed are the following:

- How can the presentation of stimuli be optimised to afford better performance, throughput, and ergonomics?
- What architectural considerations are required to ensure the browser works efficiently at scale?
- Which EEG headsets can be used reliably for this purpose while ensuring cost-effectiveness, ease of setup and maintenance as well as comfort in long term use?
- Based on the outcomes of the above questions, what considerations are necessary to ensure the browser is ready for use by the public? This involves considerations such as usability, ease of access, security, privacy as well as performance.

SmartGaze - Empowering Independence through Eye-Gaze Control

INVESTIGATORS: Dr Ing. Nathaniel Barbara [10], Prof. Ing. Tracey Camilleri, Prof. Ing. Kenneth Camilleri, Ing. Matthew Mifsud
FUNDING BODY: Ministry for Education, Youth, Sport, Research and Innovation

The proposed project builds upon the success of the first version of this project funded through the Xjenza Smart Cities Programme, through which significant progress was made in developing a state-

[8] Centre for Biomedical Cybernetics
[9] Department of Information Systems
[10] Centre for Biomedical Cybernetics

of-the-art system that enables users to control devices, such as air conditioners, TVs, and motorised blinds, using their head-gaze and eye movements alone. Notably, this system does not rely on any computer interfaces that typically require users to select icons to initiate specific commands. Instead, devices are controlled by having users rotate their heads towards the desired device, allowing it to be identified by the system through location and head orientation tracking. Once a device is selected, the user performs subtle up, down, left, or right eye movements, or blinks, that are detected by signal processing algorithms and used to execute device-specific commands. These movements are captured using electrooculography (EOG) signals, which are low-magnitude biopotentials generated by the eyes that are recorded via the JINS MEME EOG glasses which incorporates electrodes inconspicuously within the bridge and nose pads.

The SmartGaze project aims to further enhance this technology by improving the system's accuracy and reliability. This project seeks to leverage advancements in artificial intelligence, signal processing and machine learning to refine the algorithms used for the detection of the user's eye movements, ensuring greater reliability and a more seamless experience.

NOMOCRAT - New Open Maltese OCR Annotated Texts

INVESTIGATORS: Dr Marc Tanti [11], Prof. Alexandra Bonnici, Dr Ing. Stefania Cristina
FUNDING BODY: Xjenza FUSION R&I - Research Excellence Programme (REP) 2024

The project's objectives are to provide accessibility to Maltese text, specifically to text that is either 'digital born' or available only in print. Such accessibility would include the understanding of text in the documents, with applications for digital libraries and text-to-speech tools for people with vision or reading disabilities. Making Maltese-text documents accessible would also allow for the expansion of the current corpus of Maltese text, the Korpus Malti, which currently only relies on easily accessible digital text like the Maltese Wikipedia, news websites and government provided documents. The project focuses on developing algorithms for image segmentation of scanned pages and optical character recognition (OCR) of Maltese text.

[11] Institute of Linguistics & Language Technology

7. Public Outreach

The Department members continued their efforts to disseminate the research work carried out within the department to the general public as well as to share the love for all engineering with school children. This can be observed by the public engagement activities carried out by department members during the academic year and which are listed below.

7.1 STEM outreach

7.1.1 Engineering Technology Clubs

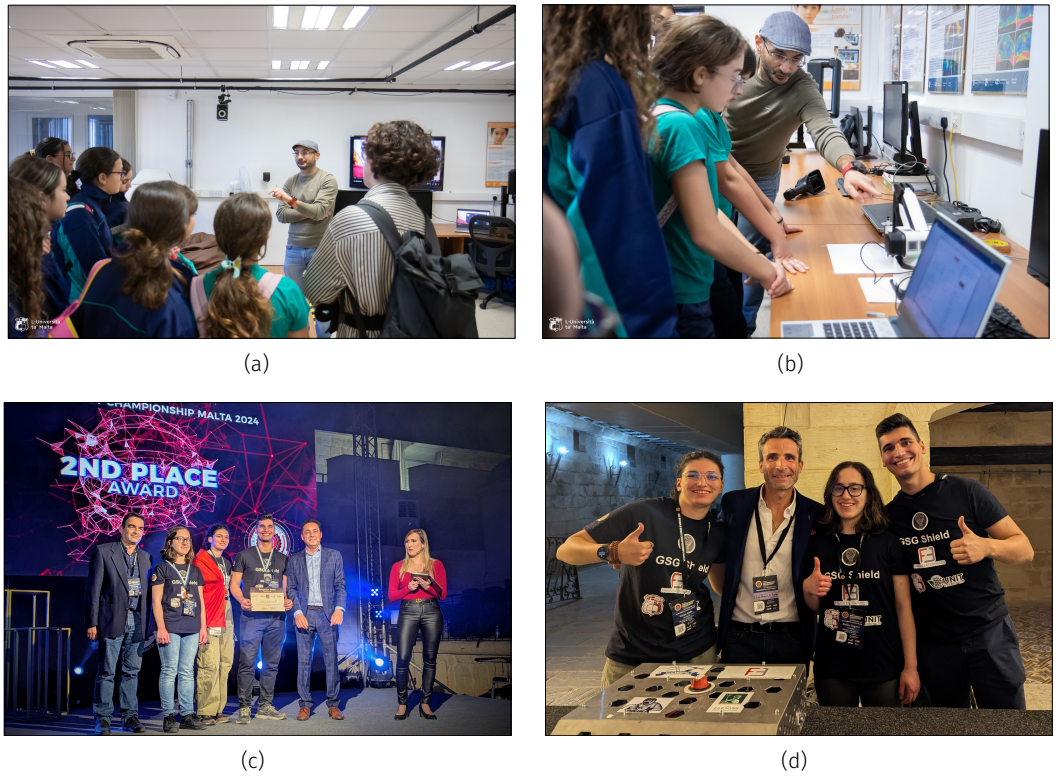
The Department continued to support the Engineering Technology Clubs and, together with other Faculty departments, delivered practical workshops for Year 11 schoolchildren to help them in making their subject "options" choices. Over the academic year, these workshops reached 640 students from various middle schools across the islands. Academic and technical staff members delivered sessions on robotics and biomedical engineering, while Ms. Sanchia Cilia Lentini assisted with the organisational logistics of the Tech Clubs.

7.1.2 Delivery of Talks to students about Engineering Courses and Participation in Career Fairs

- On the 13th November 2024, Prof. Alexandra Bonnici participated in the St Monica career fest delivering a talk to Year 11 girls attending the St Monica schools in Gzira and Birkirkara.
- On the 13th January 2025, Dr Ing. Stefania Cristina co-delivered a talk about the different engineering paths to sixth form students at Junior College.
- On the 11th March 2025, Dr Ing. Stefania Cristina participated in a panel discussion at Junior College for sixth form students, about the role of professional women in society.
- On the 14th March 2025, Dr Ing. Stefania Cristina participated during a career fair organised by St Martin's College in Swatar for sixth form students.
- On the 6th April 2025, Dr Ing. Stefania Cristina participated during Festa Stem, a career fair organised by St Monica School in Gzira for primary and secondary school students and their parents.

7.1.3 IEEE R8 Robot Championships

On the 26th November 2024, Prof. Ing. Marvin Bugeja mentored a successful team of roboticists during the IEEE R8 Robot Championships. This team came together as part of the Robotics Club that Prof. Ing. Marvin Bugeja established. Their efforts were fruitful and they finished second overall in the championship. During this event, Prof. Ing. Tracey Camilleri assisted the judging panel and contributed to the smooth organization of the event. The student team from the Faculty of Engineering (FOE), named GSGShield2024, consisted of Carsten Karl Grech, Vanya Gelfo, and Aislinn Seguna.



(a) (b)

(c) (d)

Figure 7.1: (a) Dr Kenneth Scerri delivering an engaging talk to the attendees of the Unconventional Science Careers (b) Dr Kenneth Scerri demonstrating a robotic arm designed and programmed to print, (c & d) Prof. Ing. Marvin Bugeja & the FOE Robotics Team GSGShield2024 at the IEEE R8 Robot Championships 2024.

7.1.4 Unconventional Science Careers, #STEAM@UM

On the 28th and 29th of November 2024, the Department of Systems and Control Engineering participated in the Unconventional Science Career Days organised by the University and during which over 1,000 students and educators attended. The department delivered demonstrations showcasing our work in robotics and biomedical signal processing.

7.1.5 Guidance Teacher CPD

On the 26th of March 2025, Prof. Alexandra Bonnici co-organised a training session for guidance teachers, delivering a talk about the engineering courses delivered at the university of Malta. This was followed by a tour of the Faculty labs assisted by Dr Stefania Cristina and other faculty members.

7.1.6 AI Unleashed Workshop

On the 31st May 2025, Prof. Alexandra Bonnici and Dr Ing. Stefania Cristina delivered a workshop on AI as part of an open day organised by Life Long Learning at Msida. This workshop exposed the attendees to recommendations about the effective use of AI for work and creativity.

7.1.7 Kids on Campus: STEAM sessions

On the 30th and 31st of July 2025, Ing. Matthew Mifsud delivered the Kids on Campus STEAM sessions during which students of all ages toured our laboratories. Students got hands-on experience exploring how engineers use cutting-edge technology to listen to the human body — and even discovered how brainwaves and eye tracking can be used to control devices.

7.1.8 Julian's Pathfinder Tech Startup Challenge - Occupy Mars

On the 9th September 2025, Dr Ing. Stefania Cristina delivered a presentation on technology, robots and AI, followed by a focussed discussion with a subgroup of the participating students, as part of the Julian's Pathfinder Tech Startup Challenge where a group of 24 students were selected across public and private secondary schools to participate in this initiative. On the 12th September 2025, Dr Ing. Stefania Cristina participated as part of a judging panel during the same initiative, by providing feedback on each of the students' presentations.

7.2 Funded Projects Engagement Events

- Combined Thermal and Visual Imaging for Early Detection of Skin Cancer: On the 22nd May 2025, Dr Ing. Stefania Cristina and Mr Nipun Sandamal delivered a presentation on skin cancer awareness in conjunction with the RIDT, at Xara Lodge in Rabat, as part of a fundraising initiative by LIDL where a percentage of their sales on sunblock cream will be donated to the RIDT towards skin cancer research.
- On 21st August 2025, Prof. Tracey Camilleri gave a presentation at a press conference organised by the Parliamentary Secretariat for Youth, Research & Innovation as part of the launch of a new project she is coordinating, entitled NeuroBCI - Empowering ALS patients through brain-computer interfaces.

7.3 Participation in National Events

Department members also participated in national events and science-related festivals that took place during the academic year, as described below.

7.3.1 Engineer Your Career

On the 6th November 2024, Dr Ing. Stefania Cristina participated during the Chamber of Engineer's, Engineer Your Career event, by showcasing one of the Department's robotic arms as a demo during the opening talk, and by meeting with the attending students and parents on the Faculty's stand.

7.3.2 Science in the City 2025

On the 26th of September 2025, the Department participated in the annual Science in the City festival. Prof. Alexandra Bonnici and Ms Vanya Gelfo delivered demos showcasing the use of augmented and virtual reality. Prof. Ing. Tracey Camilleri, Dr Ing. Stefania Cristina, Dr Nathaniel Barbara, Ing. Matthew Mifsud, Mr Vincenzo Andrea Longhi and Mr Kamran Mujahid showcased the use of the thermal camera technology and EMG signal applications. Dr Kenneth Scerri, Dr Liam Butler and Ms Walaa Shuaib showcased the use of AI traffic video analytics to improve transport networks and urban infrastructure in smart cities.

7.3.3 Additional Talks and Laboratory Visits

Department members were involved in lab visits and career talks on request from schools, and other departments as follows:

- On the 4th of December 2024, Dr Ing. Stefania Cristina and Ing. Matthew Mifsud hosted a group of 18 sixth formers from Sir M. A. Refalo Sixth Form, Gozo at the Biomedical Engineering Laboratory.

- On the 5th of February 2025, Prof. Alexandra Bonnici hosted a visit from the Chamber of Commerce and Malta Enterprise at the Signal, Image and Motion Analysis Laboratory in the ERIL building.

Figure 7.2: Prof. Ing. Marvin Bugeja and the GSGShield2024 team members (Carsten Karl Grech, Vanya Gelfo, and Aislinn Seguna) on the set of *Ġimgħa b'Ġimgħa* (Net TV).

- On the 18th of February 2025, Dr Ing. Stefania Cristina, Ing. Matthew Mifsud and Ms Dina Owen hosted a group of students from a local English language school at the Signal, Image and Motion Analysis Laboratory in the ERIL building.

- On the 7th of April 2025, Prof. Alexandra Bonnici, Prof. Ing. Tracey Camilleri and Ing. Matthew Mifsud hosted a group of occupational therapy students and demonstrated the different equipment and research carried out in our labs.

- On the 5th of June 2025, Dr Ing. Stefania Cristina and Ing. Matthew Mifsud hosted a group of sixth form students from De La Salle College Sixth Form at the at the Signal, Image and Motion Analysis Laboratory and the Control Systems and Robotics Laboratory in the ERIL building.

- On the 17th of June 2025, Dr Ing. Stefania Cristina and Ing. Matthew Mifsud hosted a group of 15 students from Verdala International School. Students got a glimpse of the research projects taking place at the Faculty. These students visited the Department's new Signal, Image and Motion Analysis Laboratory and the Control Systems and Robotics Laboratory in the new ERIL premises.

7.4 Media Exposure

- On the 2nd October 2024, Dr Ing. Stefania Cristina appeared on *Bill-Fatti* (One TV), together with members of the Chamber of Engineers and MCAST, to discuss how specialisation at the Faculty of Engineering can be attained.

- On the 22nd October 2024 Prof. Alexandra Bonnici appeared on *Ġimgħa b'Ġimgħa* (Net TV) as part of the She Can campaign.

- On the 20th December 2024, Prof. Ing. Marvin Bugeja together with the three student members of the FOE Robotics Team GSGShield2024, appeared on *Bill-Fatti* (One TV) for an interview about their participation and success in the IEEE R8 Robot Championships 2024, and to promote the faculty's work in the field of robtics.

- On the 9th April 2025, Prof. Ing. Marvin Bugeja together with the three student members of the FOE Robotics Team GSGShield2024, appeared on *Gimgha b'Gimgha* (NET TV) for an interview about their participation and success in the IEEE R8 Robot Championships 2024, and to promote

the faculty's work in the field of robtics.

- On the 4th June 2025, Dr Ing. Stefania Cristina was featured on *Ġimgħa b'Ġimgħa* (Net TV) along with Dr Jean-Paul Mollicone, to disseminate the engineering profession and the Engineering exhibition.

8. Prizes, Awards and Appointments

8.1 Elections and Appointments

- In January 2025, Dr Ing. Stefania Cristina was appointed Education and Training Secretary of the Chamber of Engineers.
- In June 2025, Prof. Alexandra Bonnici reappointed as secretary and treasurer of the ACM SIGWEB.

8.2 Staff Promotions

- In January 2025, Dr. Ing. Luana Chetcuti Zammit was promoted to Senior Lecturer.
- In May 2025, Prof. Alexandra Bonnici was promoted to Associate Professor.

8.3 Ph.D Awards

- On the 17th March 2025, Dr Ing. Rachael Duca was awarded the degree of Ph.D. in Engineering.

8.4 MSc Awards

- On the 17th March 2025, Mr Shawn Darmanin and Mr Luke Scicluna were awarded the degree of M.Sc. in Engineering.

8.5 Best Final Year Project Award

- Mr Carsten Grech, a final year student supervised by Prof. Ing. Marvin Bugeja, was awarded the Best Final Year Project - Electrical Stream, during the 23rd edition of the Malta Engineering Excellence Awards (MEEA) held on the 29th of November 2024.
- Mr Luca Mifsud, a final year student supervised by Dr Kenneth Scerri, was awarded the Best Final Year Project - Electrical Stream, during the 23rd edition of the Malta Engineering Excellence Awards (MEEA) held on the 29th of November 2024.

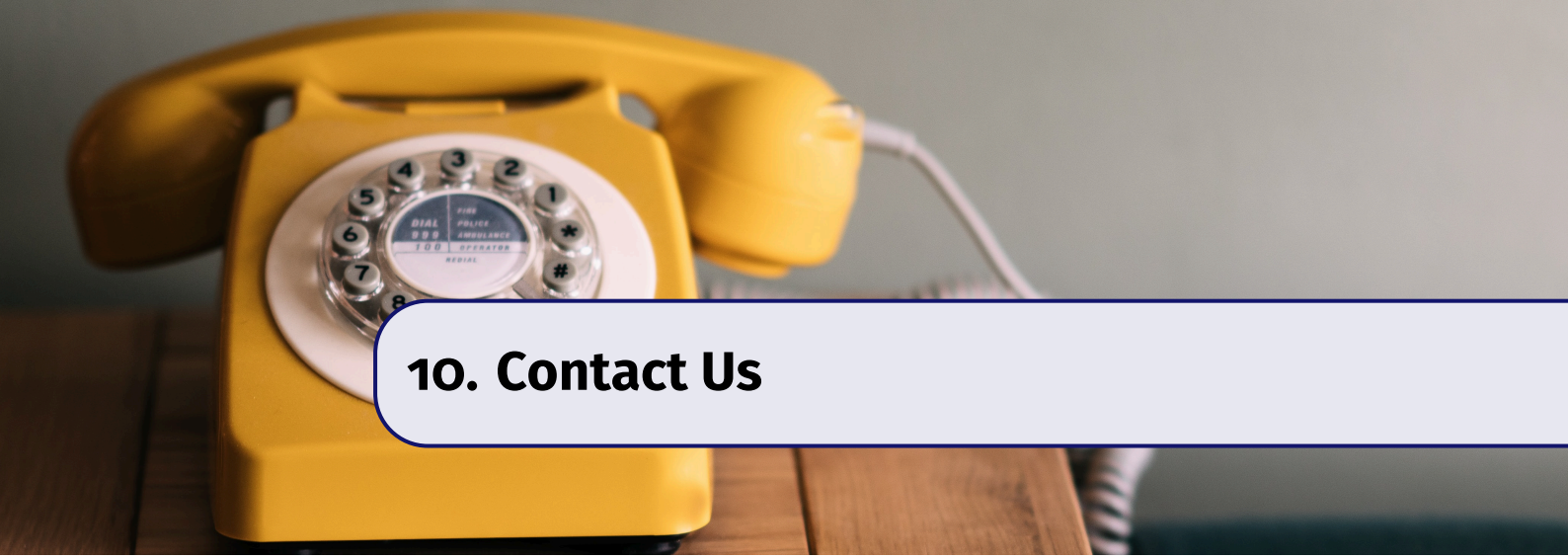
9. Social Activities

Alone we can do so little; together we can do so much.

Helen Keller

The Department of Systems and Control Engineering values the importance of teamwork and recognizes that our contributions to society can be enhanced when we work well together. To encourage stronger relationships, the department organizes activities that take place outside the typical office or lab environment. On the 4th of February, department members joined colleagues from the Faculty of Engineering and the Centre of Biomedical Cybernetics for a walk from the University to Gzira Marina, supporting the Smiling with Jerome Foundation to raise funds for the Foundation. Through this walk, we raised €250 towards the Chemo Bags of Hope that are distributed by the foundation. In addition, as part of the activities of the Student-Staff Liaison Committee, Prof. Alexandra Bonnici co-organized the "Beers with Peers" on the 30th April 2025 and "Engineering the Perfect Slice" on the 5th April 2025, bringing students and staff together in an informal setting, creating bridges between faculty members.

Figure 9.1: Smiling with Jerome fund raising walk



10. Contact Us

For further information, we invite you to visit:

- our **Facebook** page: `www.facebook.com/um.scedepartment/`
- our **University webpage**: `www.um.edu.mt/eng/sce`
- our **Blog page**: `www.systemsandcontrol.com/`

Furthermore, you may wish to contact us through one of the following means:

- on our **e-mail** address: `sce.eng@um.edu.mt`
- on **Messenger**: `m.me/um.scedepartment`
- Secretarial Office - Ms. Sanchia Cilia Lentini: 2340 3385.