ReACTIVE Too: Newsletter 1

Dear Readers,

Welcome to our first ReACTIVE Too newsletter!

ReACTIVE Too: "Reliable Electronics for Tomorrow's Active Systems" is a Marie Skłodowska-Curie Action - Research and Staff Exchange (RISE) project.

This 4-year ReACTIVE Too project is a research network that was launched in February 2020 and has twelve Partners from five European Countries one partner from China; with the University of Wolverhampton as Coordinator. The project stared on 1st February 2020 and due to time lost during the pandemic has been extended until 31st July 2025.

Full details can be found on the project web site: www.reactivetoo.org

and on Horizon 2020: https://cordis.europa.eu/project/id/871163

This first newsletter will outline the vision for the research project and the progress made to date.

Professor David M. Harvey, ReACTIVE Too Dissemination Manager, Emeritus Professor in Electronic Engineering, LJMU, UK.

1 - This project has received funding from the European Union's Horizon 2020 research and innovation programme under the Marie Sklodowska-Curie grant agreement No 871163

In this edition....

Overview of Project: Reliable Electronics for Tomorrow's Active Systems

ReACTIVE Too: Reliable Electronics for Tomorrow's Active Systems is a research-focused project that brings together a unique team of academic and industrial members. The team will tackle challenging aspects of reliability and future developments in electronic systems. Consisting of European organisations from Finland, France, Poland, Bulgaria and the UK and international partners from China, each partner country will normally supply both industrial and academic units.

ReACTIVE Too will do research into design for reliability for electronics-based systems and will include the introduction of an agile hardware development cycle with virtual techniques to uniquely address reliability and physical validation in active safety systems.

Exemplar systems from partner companies in Automotive and Healthcare will be used to validate the ideas. The team will be developed through a series of workshops and secondments. Future plans will be developed during these interactions to target new research and innovation topics and more intense interactions by making future joint funding proposals.

Please read details about our partners at: https://reactivetoo.org/our-partners

2 - Partner location courtesy of https://cordis.europa.eu/project/id/871163

Spotlight on kick-off Meeting

A very successful Kick-off meeting was held at The University of Wolverhampton, Telford Campus on 18-19 February 2020. All ReACTIVE Too team members were represented either in-person or linked in via video conferencing. A very excited group were pleased to meet and further develop ideas and relationships to research during the 4-year project.

During the meeting the status of the Consortium Agreement was reviewed with specific focus on IP. Workplan and secondment activities were consolidated and discussed to best fit in with partners activities. A Dissemination Manager was elected and procedures for dissemination, communication and outreach outlined. The planning for four workshops was started based on a peripatetic nature with one technical workshop in four different partner countries.

Dr Fideline Tchuenbou-Magaia

ReACTIVE Too Project Coordinator

University of Wolverhampton, UK

Vote of thanks to the original Project Coordinator

Professor Ndy Ekere Chaired the meeting as the Original Project Coordinator. Since then Ndy was successful in being promoted to Professor of Manufacturing Engineering and Pro-Vice-Chancellor for the Faculty of Engineering and Technology at LJMU, which was fortunate as LJMU is one of the partners, and he will still contribute to the project. We thank Professor Ekere for his immense stamina and vision in putting the project together and leading the team through inauguration and delivery. We know we can count on his continued support to the team from his new senior position. Dr Fideline Tchuenbou-Magaia of the university of Wolverhampton was elected as the new ReACTIVE Too coordinator from July 2021. We all wish Fideline well in her new role!

3 - ReACTIVE Too team assembled at The University of Wolverhampton Kick-off Meeting 18-19 February 2020.

Two workshops completed in Finland and UK

Two workshops have been completed.

First Workshop: Finland November 2020

Smart furniture and wearables workshop

As all international research projects, **ReactiveToo** project has also faced challenges when it comes to international networking and secondments. However, due to the enthusiasm of the partners, the project activities have started, but a little differently than originally planned. The Finnish project partners Satakunta University of Applied Sciences (SAMK) and Tampere University (TUT) have been developing tools for visualising the potential of technology and mapping the potential application areas for the developed technology. Multidisciplinary networking and ideation have been on the key

focus. As an important part of this task, Reactive Too project organized **Smart furniture and wearables online workshop** together with Baltse@nior 2.0 project.

The workshop participants represented different disciplines as the word cloud illustrates. Total number of participants was 50, which exceeded our expectations!

The workshop consisted of two sections dedicated to 1. Smart furniture concepts and 2. Smart clothing concepts. In each session, early-stage prototypes were first presented to participants. After this, ideation phase started with individual ideation, in which Padlet platform was used to gather ideas. The last phase was a joint discussion. In the Smart furniture phase, the presented prototypes included: a magic mirror, a smart gaming chair, fall detective base boards and a smart restaurant table. Smart clothing prototypes included a smart easy-to-put-on jacket, game controller clothes and wearable touchpads.

Many thanks to the workshop organisers and facilitators: Dr Sari Merilampi, SAMK and Dr Johanna Virkki, TUT, and their teams.

4 - Smart furniture and wearables workshop participants top skills in a word cloud.

5 - Smart jacket with embedded alarm function.

Second Workshop: Liverpool 14 October 2022

Design and Reliability of Electronic and Active Systems workshop

A full agenda was followed with short taster talks from all partners present in the morning:

1. Welcome to LJMU, PVC Prof Ndy Ekere
2. Reliability issues in integrated optoelectronics, Prof Richard De La Rue

3. What is an active system and their potential reliability issues, Dr Derek Braden, Royal Academy of Engineering Visiting Professor LJMU and Director Aptive
4. Reliability in textiles, Dr Johanna Virkki TUT
5. Reliability required and tested for Smart furniture, Sari Merilampi SAMK
6. Facilities at Sensor City, George Barclay, Sensor City
7. Green electronics and nanoelectronics for reliability, Prof Y C Chan
8. Smart mirror and reliability consideration, Dr Piotr Czekalski SUT
9. Reliability for energy harvesting, Dr Samuel Margueron UBC
10. How reliable are novel materials, Dr Zlatka Stoeva DZP Technologies
11. Sensors for monitoring battery degradation and performance, Mr Obinna Nwadiuto, Wolves
12. NanoTechLab capability in a nutshell, Dr Prof Evgeni Ivanov NanoTechlab
13. Battery Energy Throughput Prediction model, Mr Folarin Ojetoro, Wolves
14. Non-destructive testing for reliability improvements possible in solder joints, Prof GM Zhang/Prof D M Harvey

We were pleased to have two external "Keynotes" from Prof Richard De La Rue who joined us from Glasgow and Prof Y C Chan who joined in person, as well as an opportunity for two ESRs/PhD Students to present their work to a friendly audience.

A brief project update was given by the Dr Fideline Tchuenbou-Magaia the ReACTIVE Too Project Coordinator, with future secondment plans discussed by the group.

A composite selection of some parts of the workshop are given in Figure 3.

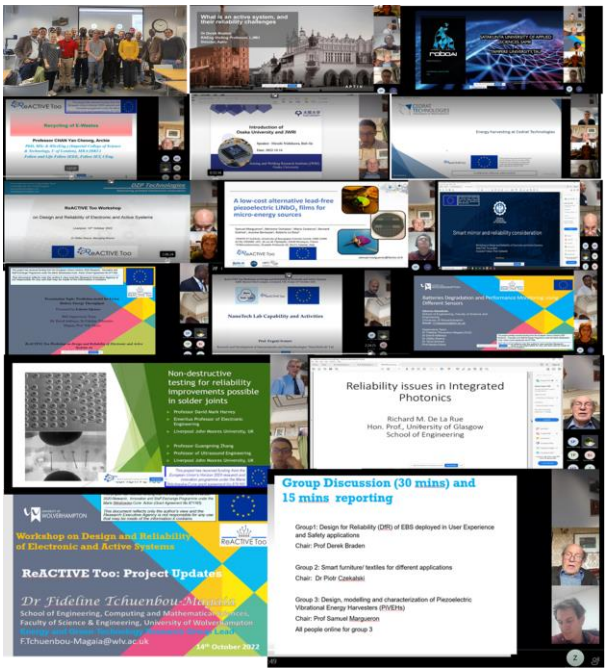
All participants stayed for group discussions in the afternoon and evening. Three subject groups were formed for project discussions and action points developed over the afternoon were reported and discussed by the whole team. Group 1: Design for Reliability (DfR) of EBS deployed in User Experience and Safety applications, Chair: Industrial Prof Derek Braden; Group 2: Smart furniture/ textiles for different applications,Chair: Dr Piotr Czekalski; Group 3 (online): Design, modelling and characterization of Piezoelectric Vibrational Energy Harvesters (PiVEHs), Chair: Prof Samuel Margueron

Key targets for the group include completing the design, manufacture and reliability testing of a variety of "Smart" devices that fit in both the Healthcare and Automotive sectors, including, Smart Table, Smart Chair and Smart Mirror.

Many thanks to the workshop organisers and facilitators, Profs D.M. Harvey and GM. Zhang LJMU, Dr Fideline Tchuenbou-Magaia, and associates.

Additional Workshop: Liverpool 20 October 2022

Due to four secondees from SAMK being in Liverpool at the same time an additional workshop was organised to investigate LJMU's Living Lab in the Faculty of Health. This crosses over from engineering to health, a topic SAMK are helping to lead in ReACTIVE Too. A very useful research day was spent with 12 participants, focused on needs and associated health sectors. Many thanks to the workshop facilitator Dr Grahame Smith, Reader in Mental Health, and innovation lead in the Faculty of Health at LJMU, and his team.



6 - Thumbnail image of the Liverpool workshop

7 - Seminar group picture plus remote group LJMU Liverpool

8 - SUT presentation LJMU Liverpool 14 October 2022

9 - LJMU presentation LJMU Liverpool 14 October 2022

10 - Afternoon workshop group activities LJMU

11 - Additional workshop at LJMU in their living lab within the Faculty of Health.

Highlight on SUT secondments

In each newsletter we will be a focusing on a researcher, research team or work package to highlight all the different research projects that are currently going on ReACTIVE Too.

In this first newsletter we will look at SUT as they were first off the blocks as Dr Krzysztof Tokarz was seconded from SUT, in Poland to Sensor City in Liverpool, UK in January/February 2022. In fact Krzysztof was the lone ReACTIVE Too pioneer as a colleague from SUT Dr Piotr Czekalski due to travel with him was restricted by Covid, but Piotr has since also spent a secondment at Sensor City in Liverpool.

Working in tandem with Sensor City and LJMU Dr Tokarz and the ReACTIVE Too team manufactured and started to test some novel electronics circuit boards. This type of circuit design can be used in future research by the team for example in automotive or healthcare settings. Figures show Dr Tokarz placing solder balls on a custom PCB deigned at LJMU, reflowing the solder in a small solder oven, then performing thermal cycling tests in a thermal chamber. Novelties in this work include the design of the solder balls, which include nanoparticles to improve reliability, designed through joint working with materials scientists in Malaysia, Japan and Hong Kong, and the accelerated thermal cycling profiles developed through joint working with Aptiv in UK and Poland.

In parallel the team at SUT, in this case mainly Dr Tokarz and Dr Piotr Czekalski have designed and built a “Smart” mirror. Two protypes have been build, one for testing at SUT in the university's research lab and another for “Living Lab “ testing in Dr Tokarz’s bathroom. Further details will be posted in this exciting development in future.

The mid-term ReACTIVE Too meeting will be held at SUT in April 2023 alongside one of the ReACTIVE Too workshops also hosted by SUT in partnership with NanoTechLab, Bulgaria and DZP, UK.

12 - SUT, Sensor City and LJMU team inside Sensor City Atrium

13 - SUT Pioneer placing solder balls on PCB

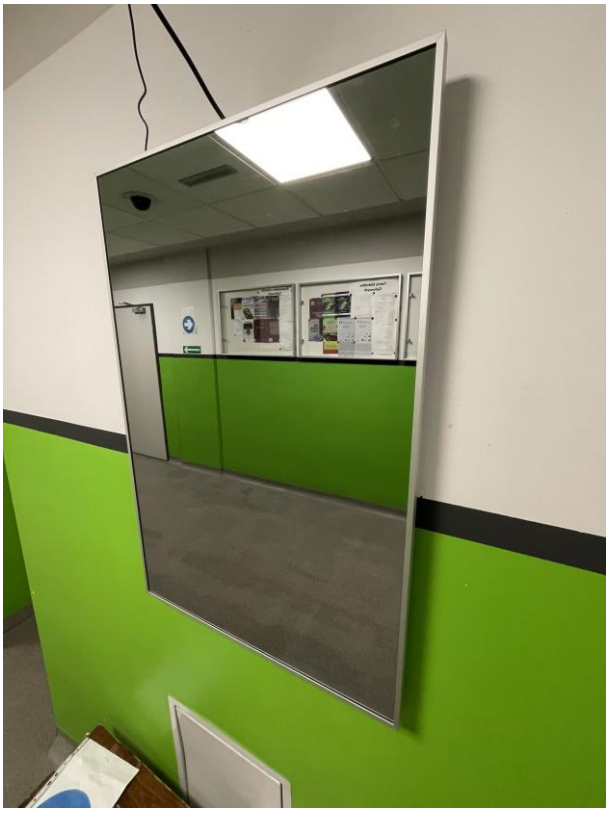
14 - Reflow soldering

15 - Industrial Scale Thermal Cycling/ Reliability Testing

16 - SUT, Sensor City and LJMU team outside Sensor City Building

Smart Mirror Prototypes


09:13



International publications

Publication successes

Even though the project is at an early stage a significant publication have been made in a high ranking international journal:

Kangkana Baishya, David M. Harvey, Teresa Partida Manzanera, Guangming Zhang & Derek R. Braden,. 2022. Failure patterns of solder joints identified through lifetime vibration tests, Nondestructive Testing and Evaluation, doi: 10.1080/10589759.2022.2084616.

Bohdan Shubyn, Daniel Kostrzewa, Piotr Grzesik, Paweł Benecki, Taras Maksymyuk, Vaidy Sunderam, Jia-Hao Syu, Jerry Chun-Wei Lin, Dariusz Mrozek,. 2023. Federated Learning for improved prediction of failures in Autonomous Guided Vehicles, Journal of Computational Science, Volume 68 101956, ISSN 1877-7503. doi: 10.1016/j.jocs.2023.101956.

Wang, H, Zhang, G, Ma, H, Zhang, X, Manzanera, TP, Braden, D, Harvey, D and Salleh, MAAM., 2023 Reliability and Failure Modelling of Microelectronic Packages Based on Ultrasonic Nondestructive Evaluation Data. Independent Nondestructive Testing and Evaluation (NDT and E) International. ISSN 0963-8695 (Accepted).

Publications leading into the project:

Mohamad Zaimi N.S., Mohd Salleh M.A.A., Abdullah M.M.A.B., Ahmad R., Mostapha M., Yoriya S., Chaiprapa J., Zhang G., & Harvey D.M., 2020. Effect of Kaolin Geopolymer Ceramic Addition on The Properties of Sn-3.0Ag-0.5Cu Solder Joint. Materials Today Communications, 25, 101469, pp.1-15. doi: 10.1016/j.mtcomm.2020.101469

Alireza Eslami Majd & Nduka Nnamdi Ekere,.2020. Crack initiation in PV module interconnection, Solar Energy, 206, pp. 499-507. doi: 10.1016/j.solener.2020.06.036

Baishya K., Harvey D.M., Zhang G., Braden D.R., 2020. Investigation Into How the Floor Plan Layout of a Manufactured PCB Influences Flip-Chip Susceptibility to Vibration. IEEE Transactions on Components, Packaging and Manufacturing Technology (CPMT), 10, pp. 741-748. doi: 10.1109/TCPMT.2020.2987334

Upcoming Events

Wednesday 26 April 2023 Workshop: Design for Reliability of Active Systems workshop at SUT Gliwice Poland (hybrid meeting), led by SUT and co-led by DZP,UK and NanoTechLab, Bulgaria. Attendance by all partners, public, industry and guests. SUCCESSFULLY COMPLETED!

Thursday 27 April 2023 The mid-term ReACTIVE Too review meeting will be held at SUT Poland. Attendance by all partners in-person or by remote access, and by EU Project Officer.