
Ultra-cyberPhysical system for tRuly wirelesS charging (UPRISING)

A Data Management Plan created using DMPTuuli

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Project abstract:

The wired charging and need of battery replacements are critical barriers for scalable and sustainable mobile connectivity over time. UPRISING is committed to radio frequency (RF)-wireless power transfer (WPT) for breaking this barrier because its potential for realizing long-range multi-user mobile charging. The main reasons of why RF-WPT solutions have not flooded the market are: i) low end-to-end power transfer efficiency (PTE), ii) people's fear of wireless, and iii) lack of technology standardization. There is an urgent need of developing PTE-boosting, cost-efficient, and risk-aware guarantees on the people's exposure to electromagnetic field (EMF) radiation, to make RF-WPT attractive and competitive. UPRISING introduces and optimizes a cyberphysical system addressing these challenges, thus, leading to a functional and competitive indoor RF-WPT system. UPRISING helps mature RF-WPT technology, increasingly bringing the attention of companies, startups, and global market.

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1. General description of data

1.1 What kinds of data is your research based on? What data will be collected, produced or reused? What file formats will the data be in? Additionally, give a rough estimate of the size of the data produced/collected.

UPRISING uses openly available datasets, e.g., datasheets of rectenna circuits, sensors, energy transmitters, metasurfaces from state-of-the-art research/products, and synthetic data (simulated or model-based data), e.g., for energy consumption profiles of the energy harvesting devices, channels' impairments, and service tasks/requirements. The data produced by the project can be classified as i) programming codes and ii) data results from computer simulations and statistical analysis.

Computer-based simulation and analysis will be carried out on Matlab, Mathematica, Python, and potentially other machine-learning programming environments. The codes will be stored in text files (.m, .txt, and/or .csv). Meanwhile, the data results from computer simulations and analysis will be stored in .mat, .m, .csv, and .npy formats.

The size of the data to be produced/collected is in the order of a few hundreds of GBytes altogether.

1.2 How will the consistency and quality of data be controlled?

Risks of losing or accidentally changing the data are minimized by storing it in several repositories and storage units in parallel. The data is periodically updated in these repositories at a different pace, such that they work as a backup in case of corrupted or accidentally changed data.

Processed data files are reviewed by a senior researcher of the project (e.g., post-doctoral researcher and/or PI) before release and backup. Feedback on quality and/or additional requests from the open community will be considered, and data may be updated. Codes will be updated via a version control repository.

2. Ethical and legal compliance

2.1 What legal issues are related to your data management? (For example, GDPR and other legislation affecting data processing.)

In the project, there is no personal data (i.e. data on 'identified or identifiable person') or private data from companies.

Produced data can be made freely open in general. The only exception is related to intellectual property rights (IPRs). In the case of IPRs, only the corresponding public description will be available on the PI website, and other project-related reports. Notice that the public description of an IPR is usually used by the management office (in this case, the UOULU Innovation Center) for finding potential licensors/collaborators using emails and/or web pages.

The management of data is ruled by a legal framework at both the European and national levels.

2.2 How will you manage the rights of the data you use, produce and share?

The research project will not use any data which is covered by the Copyright, Designs and Patents, or any other similar legislation. Every research partner will sign a contract agreeing that data arising from research projects will be made openly available where possible. Data will be open (with the only exception of IPRs, see related matters in the next paragraph) and will be licensed with CC BY 4.0 using Qvain (qvain.fairdata.fi). Information on licenses will be included in the metadata.

The intellectual property of the data relevant to IPRs will remain with the researchers but be handed to UOULU. Note that UOULU has a tech transfer office, the Innovation Center, which supports researchers with the exploitation and protection of research results. This institution ensures the IPR management is properly carried out. It is responsible for effective planning and realization of exploitation measures before, during, and after research work. Inventions, software, and databases are handled systematically by using Greip® IP Management software. With it, invention disclosures are made electronically and the UPRISING participants can be easily and safely informed about inventions

or computer software made in the project.

3. Documentation and metadata

3. How will you document your data in order to make the data findable, accessible, interoperable and reusable for you and others? What kind of metadata standards, README files or other documentation will you use to help others to understand and use your data?

Data will be openly available and cited in publications and data repositories, and will be accompanied by supplementary information. After the publication, the data will be available for download from online sharing repositories for the broad research community.

Codes, results, and other data will be accompanied by a description of the parameters and experimental conditions. Such documentation ensures proper data use by careful explanation of all the important parameters, conditions, and variables. Researchers in the project will take care of providing the required meta-data.

In case of codes and data results, a corresponding well-structured and understandable README file will be provided. This, accompanied by specific descriptions within the codes, and explanations in reports and publications, will make the data reusable. Keywords and proper titles will be used to ensure data is findable. We aim to ensure the interoperability aspect of FAIR data. That is data that is readable both by humans and machines.

4. Storage and backup during the research project

4.1 Where will your data be stored, and how will the data be backed up?

The code files and data results from computer simulations and analysis will be uploaded to the ITEE's computer servers and the GitHub (<https://github.com/>) repository. Codes will be updated via a version control repository. Back-ups will be made periodically, and the periodicity depends on the specific renewal rate of the data type. The experts (which include the project post-doctoral researcher and PI, and ICT services staff) are committed to careful monitoring of data quality and system integrity, upgrade and validation measures, and disaster preparedness as required by good practice.

4.2 Who will be responsible for controlling access to your data, and how will secured access be controlled?

During data analysis and ideation, the data is exchanged internally using the UOULU intranet, via a Sharepoint specifically created for this end. Users' access rights are managed by the IT staff of the university. Later on, the data can be made accessible in the GitHub repository (together with the corresponding metadata, also available via Qvain). The PI is responsible for uploading and making the data accessible. In the case of IPRs, the PI and UPRISING researchers first, and then the UOULU's innovation center, are responsible for securely handling the corresponding data/info.

5. Opening, publishing and archiving the data after the research project

5.1 What part of the data can be made openly available or published? Where and when will the data, or its metadata, be made available?

All data which is not defined as confidential (as in the case of IPRs) will be openly available after proper processing (including meta-data) in the corresponding repositories (mainly Github) and Qvain.

In the case of IPRs, only their corresponding public descriptions (and accompanying metadata) will be available on the PI's and project's web pages. This can be executed immediately after submission.

5.2 Where will data with long-term value be archived, and for how long?

Very long-term preservation services will not be probably needed as UPRISING promotes science renewal. Nevertheless, data will be archived in the Github repository, (ITEE)'s computer servers, and cloud servers, while following their policies. Moreover, UPRISING will ensure that the research data are migrated to new formats, platforms, and storage media as required by good practice. DOI's [=persistent identifier] will be generated, enabling access to the data sets via persistent links.

6. Data management responsibilities and resources

6.1 Who (for example role, position, and institution) will be responsible for data management?

The PI is directly in charge of data management.

Research data management, IT, and legal support services of UOULU will be used to secure lawful and secure data management processes in line with the requirements of Aka and UOULU. The data management tasks during the whole project include, for example, managing separate datasets, data quality control, metadata production, data storage and backup, disposing of data, sharing data, and archiving data. The project management is responsible for all of these.

6.2 What resources will be required for your data management procedures to ensure that the data can be opened and preserved according to FAIR principles (Findable, Accessible, Interoperable, Re-usable)?

UPRISING will follow the FAIR principles. The data should be findable for re-use. For this, proper keywords, classifications, and DOI will be used when data is uploaded. Accessibility means that a standardized communication protocol is used to retrieve the data or metadata. For interoperability, the data is made available through a formal, accessible, shared, and globally applicable language. For re-usability, the data and the metadata should be described with accurate and relevant attributes.

The time and effort to prepare the data for preservation and sharing have been estimated and are included in the UPRISING planned resources. 1 PM per year has been allocated to this, together with a few other responsibilities. The project will use UOULU's and Github's data storage, sharing, and preservation services, which are free of cost.