Plan Overview

A Data Management Plan created using DMPonline

Title: wireless power transfer

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Template: University of Glasgow PGR Template

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Project abstract:

In recent years, there has been an increasing use of low-power devices, such as sensors and implantable devices, for various applications such as hydrology, biology, environmental monitoring, construction, and mechanics. These devices are often deployed in harsh environments, including those that are underwater, underground, or within infrastructures, and are sometimes enclosed in metal cavities such as steel bridges, pipes, and shipping containers. However, providing power to these sensors is a significant challenge due to several factors, including the high cost of access, physical infeasibility, and limitations in size and lifetime.

One possible solution to this challenge is wireless power transfer (WPT), which can replace the need for batteries and power cables. Various methods of WPT, such as energy transfer, inductive coupling, and capacitive coupling, have been reported in the literature. However, these methods are ineffective for powering sensors within enclosed metal cavities due to the skin effect of metal, which prevents RF energy transmission, and inductive and capacitive coupling from penetrating the metal enclosure.

To address this issue, a new hybrid wireless power transfer (HWPT) system is proposed in this work. The HWPT system combines RF energy transfer with ultrasonic energy transfer (UET) to establish an energy transfer path in both the air and metal. The RF link provides reliable and flexible energy transfer, while the UET link overcomes the limitations of energy transfer in metals.

To achieve this, the coupling circuit design for the RF and UET links is crucial. Since the energy density and operating frequency of the RF and UET links are vastly different, a new coupling circuit needs to be designed to enable the two types of waves to couple effectively. The coupling circuit must also meet the wide-band and wide-voltage RF energy input and be able to match different frequency ultrasonic transducers. Additionally, the circuit must be ultra-low power consumption to ensure maximum energy conversion efficiency. Since this solution coupled electromagnetic energy and ultrasonic energy, knowledge of both fields of electromagnetics and acoustics is required. This paper innovatively integrates the energy transmission schemes of the two fields analyzes the structure and link loss of the proposed HWPT system presents the coupling circuit design and simulation results, and discusses the power budget for the system based on the simulation and measurement results.

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wireless power transfer

Overview

Researcher Name

Yufei Ma

Supervisor name

Chong Li

Project title

Hybrid Wireless Power Transfer System for Sensors Application in Harsh Environment

Funder & award number

no

Project Summary

A new hybrid wireless power transfer (HWPT) system is proposed in this work. The HWPT system combines RF energy transfer with ultrasonic energy transfer (UET) to establish an energy transfer path in both the air and metal. The RF link provides reliable and flexible energy transfer, while the UET link overcomes the limitations of energy transfer in metals.

Data

What types of data will be collected or created?

• Experimental measurements
• Photographs, micrographs
• Design data for sensors and test setup
• Custom written code

What formats will you use?

• data in spreadsheets will be in .csv format
• image data will be captured in the manufacturer’s format but will be stored as .tif, .png, .jpg, at el. files
• Design data will be in .igs and .gds format and also stored as .pdf
• code will be written in Python, Matlab, et al.

How much data will you collect?

About 2GB

Documentation

How will the data be documented and described?

with any necessary details on the origin or manipulation of the data in order to prevent any misuse, misinterpretation or confusion.

Are there any standards for this in your field of research?

no

Ethics and Intellectual Property

Who owns the data in your project?

Me

Detail any ethical, legal or commercial considerations relating to your research data

no

How will these concerns be dealt with?

no

Storage and Organisation

How will the data be named, organised and structured?

By data

How will the data be stored for the duration of the project?

OwnCloud

How will the data be backed up during the project?

to use automatic backup services provided by IT Services

Does access to the data need to be controlled for the duration of the project?

no

Who has the right to access the data during the project?

Yufei Ma
Chong Li

Deposit and long-term preservation

Which data should be retained long-term?

research data has long-term value

How long will data be retained for?

minimum of 10 years

Where will the data be archived at the end of the project?

• Enlighten: Research Data, the University of Glasgow's institutional data repository

What formats will the data be archived in?

same as the working formats identified in Section 2

Data sharing

Is any of the data suitable for sharing?

Research Data

How will the data be shared?

Data will be shared via the repository deposit

Who should be able to access and use the shared data?

Suitable for open public access

Implementation

Who is responsible for implementing this plan?

Yufei

How will this plan be kept up-to-date?

flow the research plan

What actions are necessary to implement this plan?

Contact local IT support to ensure storage provision is adequate

What training or further information are needed to implement this plan?

attend one of the workshops on managing research data

Planned Research Outputs

Publication - "Combined RF-Ultrasonic Wireless Powering System for Sensor Applications in Harsh Environment"

Planned research output details

Title	DOI	Type	Release date	Access level	Repository(ies)	File size	License	Metadata standard(s)	May contain sensitive data?	May contain PII?
Combined RF-Ultrasonic Wireless Powering System fo ...	10.1109/RWS56914.2024.10438557 ...	Publication	2024-01-21	Open	None specified		Creative Commons Attribution 4.0 International	None specified	No	No