

BioMaker Challenge 2017

Remote Environment Controller for Experiments in Extreme Environments

Observing biological systems, animals, traffic or the evolution of cities in their natural environment requires us researchers to travel to remote places. Field trips to these distant locations are often limited in time, expensive, or even dangerous. Here, we propose to build an autonomous environment observer that once installed monitors key parameters.

Our aim is to establish a sensor platform that is autonomous (i.e. solar powered) and able to transmit data and receive instructions remotely. Rather than targeting a single application, we will build a generic sensor platform that can be used for a wide range of applications. In an initial stage we will test our system in the Darwin College student vegetable garden where the sensor platform will be tested in monitoring simple parameters such as precipitation, sunlight shading, soil moisture levels, temperature, humidity etc. Sensor outputs will be used to inform tasks such as watering scheduling. The main outcome of this project will be a field tested generic sensor platform that can be easily adapted for a wide range of tasks.

The multidisciplinary nature of our team, which includes biochemists, electrical and civil engineers but also PhDs working on infrastructure projects in developing countries or rare animal diseases of the Tasmanian devil will ensure a wide applicability and transferability of our sensor platform to research projects.

Team:

Philipp Braeuninger-Weimer

Electrical Engineering | Postdoc | pab96@cam.ac.uk (main contact)
Philipp is the electronics and sensor expert in our team. He has worked on complex sensor projects such as designing allergen sensors for Unilever Ice cream plant and sun tracking mechanisms to boost solar cell harvesting capabilities. Both of these skills are very applicable in this project.

Maximilian Stammnitz

Department of Veterinary Medicine | PhD | mrs72@cam.ac.uk
Max's PhD involves genome sequencing of the Tasmanian devils in Tasmania, one of the most remote locations on this planet. His fieldwork experience will make him an ideal application specialist for our team advising on how to make the sensor toolkit applicable to his research.

Bryn Pickering

Civil Engineering | PhD | bp325@cam.ac.uk
Bryn is completing a PhD in the design of energy supply systems for districts of Bangalore, India, accounting for uncertain environmental and behavioural factors. His previous work includes dissemination of building-level environmental monitoring data for automated control systems. Bryn is currently Environmental and Ethical Officer in Darwin College and will allow us access to the vegetable garden and greenhouse, which will act as

level environmental monitoring data for automated control systems. Bryn is currently Environmental and Ethical Officer in Darwin College and will allow us access to the vegetable garden and greenhouse, which will act as a test environment for our sensor platform.

Chrisitan Schwall

Biochemistry|PhD| cs687@cam.ac.uk

Christian is an expert on measurement automation of biological systems. Complementary to the research field of the above mentioned Christian will advise on the key performance parameters desirable for monitoring biological systems in remote environments.

Estimated initial cost for required Components

330£ for a detailed breakdown see attached excel file

250£ for designing an enclosure box

Delete

<http://www.synbio.cam.ac.uk/biomakerchallenge>
<https://www.irjet.net/archives/V4/i4/IRJET-V4I4516.pdf>

Title of Project

Primary contact for the team

Include name, department, organisation and email address

Team

Please include the names and email addresses of all team members, include their department/organisation and briefly (1-2 sentences) what they will contribute to the project.

Summary

Summarise in one paragraph (~150 words) what you aim to do in the project.

Not all experiments can be performed in a controlled environment, but may require to observe, measure and influence the experimental condition of a remote subject. These may involve

Proposal

Include i) the problem you are addressing, ii) the biological systems you are using, iii) the design goals for the hardware, iv) how you plan to implement the project, v) the proposed outcomes and benefits.

Estimate the components and budget that you need to complete the project

You will be able to order further materials - see ordering instructions on www.synbio.cam.ac.uk/biomakerchallenge. Please include catalogue numbers for RS Components, Farnell, CPC OneCall or other Cambridge University suppliers.

The full application should be no more than 2 pages, excluding any figures, photos and diagrams which should be inserted at the end of the document and referenced in the text.

Please submit an application containing the following sections by email to biomaker@hermes.cam.ac.uk in an editable format such as .odt or .docx (**not PDF**) and attach any images separately to the email.

Things to measure,

Soil temp, outside temp, shading, hours of sunlight, sunlight intensity, local precipitation, soil humidity air humidity, video recording, gps tracking. Data suite. Soil, water, light, animal enemies, Barometric Pressure Sensor, microphone