

**2016 STUDENT EXPERIENCE IN ENGINEERING AND DESIGN FUND**

**Proposal Title: Aria: A Learning Smart Home System**

**Submitted By:**

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Group/Team name: Machine Learning for a Smart Home

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# Project Background

Aria is a smart home automation system that learns from its environment to automate common actions. The Aria system uses a central hub to interconnect various smart devices through multiple different communication mediums. The Aria hub uses machine learning to predict and perform desired changes in the home's environment. The project team consists of four software engineering students.

Any home maintenance task which can be automated can save the owner time and money. Automated environmental control is not a novel concept; devices such as light timers and programmable thermostats have existed for many years. Most of these common devices, however, must be configured manually. The proposed system is able to configure itself based on normal actions taken by the user. By having the system learn the habits of the user dynamically, the configuration is essentially eliminated, leading to an ease of installation that does not currently exist.

Currently, the Aria project is being developed and can communicate with one smart device. The system does not currently have a machine learning component but it does have the ability to control smart devices from a single hub. In order to expand the capabilities of the system, more devices will need to be added and tracked so that it can observe behaviours and react when necessary.

# Proposal Objective

To date, the devices that have been incorporated within this system have all been custom-built smart devices. While this does allow us to test that system can learn from smart devices and perform actions, it does not allow us to integrate with the consumer-friendly devices that are available on the market. Additionally, the project is limited in the complexity of devices that can be used with the system. We currently have no way of verifying that the system we have built will integrate with devices from vendors such as Nest, Samsung SmartThings, Belkin, etc. If we were to receive this funding then we would be able to purchase these third party smart devices and use them to improve the quality of the project by demonstrating how the system performs in a realistic home automation scenario.

# Proposal Benefits

## Benefits for Individual Participants

All of the funding for this project will be used to purchase smart devices and expand the capabilities of this project. Having these devices will allow the system to integrate more closely with industry standards and help produce an overall, more robust system. The devices would aid in our individual understanding of devices in the field and their application in a machine learning smart home setting.

## Benefits for Carleton’s Faculty of Engineering and Design

The faculty will have these smart devices for the continuation of this project or for any internet of things projects. All of the devices that are purchased will be available to the faculty after the project is complete. The finished project can be used as a starting point for any internet of things project because of the interaction between so many different types of devices.

## Benefits for General Public

This funding will be used to purchase a set of smart devices for this project. These devices will enable us to expand the integration of the system and make it more accessible for the general public. The learning functionality of the system will simplify automation tasks around the home but could also be used for automating nursing homes, schools or other commercial locations.

# Proposal Implementation Plan

In order to get a prototype and proof of concept of the system, we need to get devices communicating with a server and make them controllable through a web user interface. Once this milestone is achieved then the machine learning aspect of the system will be explored and added to the system. Once the system begins to make is own decisions we will expand the system by adding more devices. The project will then become more focused on iteratively refining the system and adding more device communication capabilities.

The biggest risks associated with this project will be getting different types of devices from various vendors to communicate together. Each device will have its own communication protocol and will require many technical details to incorporate it into the machine learning.

# Project Continuity

As the internet of things continues to expand and smart device are becoming more advanced, this project will remain relevant in the following years. As long as interest in the field of home automation remains prevalent, this project will remain extremely relevant and can be directly continued by future students. Because of the broad nature of the internet of things, our project also has relevance outside of home automation specifically. The integration of multiple third party devices functioning in one network can be used as an example for any future internet of things projects..

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| **Part A. PROPOSAL COST ESTIMATE** | |
| **Equipment** *- List the equipment that would be purchased for the project, if applicable.* |  |
| WeMo Coffee Maker | $190 |
| 2 x Aeotec Z-Wave RGB Light | $160 |
| Raspberry Pi 3 | $60 |
| 2 x Arduino Uno | $70 |
| 2 x Arduino WiFi Shield | $80 |
| Z-Wave USB Adapter | $85 |
| Honeywell Smart Thermostat | $170 |
| Smart Passive Infrared Motion Sensor | $60 |
| Temperature + Humidity Sensors | $40 |
| Double Break-Beam Motion Sensor | $48 |
| **Building Materials and Manufacturing Services** |  |
| *- List the materials and manufacturing services you are proposing to purchase for the project, if applicable.* |  |
| Soldering Iron | $20 |
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| **Contest, Competition or Race Costs** |  |
| *- List all expenses to participate in a conference, competition or race, if applicable.* |  |
| **Administration Costs** *- List all administrative expenses, if applicable.* |  |
| **PROJECT FULL COST ESTIMATE** | ***$***983 |

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| **Part B. PROPOSAL FUNDING ESTIMATE** | |
| **C. OTHER FUNDING CONTRIBUTIONS** *- List all other sources of funding for your proposal, if applicable.* | |
| *(Additional Funding Examples - Fundraising, Sponsorship, Participation fees, Carleton University sources)* |  |
| No Additional Funding |  |
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| **D. REQUEST -**  **Student Experience in Engineering and Design Fund** | |
| **Identify Building Materials and Manufacturing Service****costs to be covered by SEED Fund** |  |
| All information covered in section Part A | $983 |
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| **Identify Competition/Conference Costs to be covered by SEED Fund** |  |
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| **TOTAL FUNDING REQUEST** | $983 |