**Project Proposal**

**Project Team ID: 6**

**Project Title: Real Autobots and Decepticons: Programming a Self-Reconfiguring Robot**

**Team Members**

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| --- | --- | --- |
| **Member** | **Name** | **Email / Phone** |
| Team leader | Carter Chase | chascw01@students.ipfw.edu |
| Member 1 | Ben Smith | smitbd05@students.ipfw.edu |
| Member 2 | Jeffery Ross | rossjj02@students.ipfw.edu |
| Member 3 | Trevor Seitz | seitts01@students.ipfw.edu |
| Member 4 |  |  |

**Project Advisor**

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| --- | --- |
| Name / Title | Dr. John Licato |
| Office | ET 125N |
| Phone | 260-481-6343 |
| Email | licatoj@ipfw.edu |

**Project Sponsor (Optional)**

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| --- | --- |
| Contact person | Dr. John Licato |
| Contact info | [licatoj@ipfw.edu](mailto:licatoj@ipfw.edu) |
| Company name | Analogical Constructivism and Reasoning Lab (ACoRL) |
| Address |  |

**Project Description**

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| **Type** |  |  |  |
| **Abstract** | A senior project group in Electrical + Computer Engineering (ECE) has been creating a robot array consisting of several modular units that can reconfigure themselves into a wide variety of possible arrangements [1]. Ideally, the robots would be able to form (for example): a bridge, stairs, a wall, etc [2]. These robots will communicate with each other using a well-known protocol such as WIFI or Bluetooth.  The artificial intelligence still needs to be programmed. Choosing a possible shape to transform into is relatively easy, but actually designing a step-by-step plan so that the robot modules can move into place without any human assistance, is a more difficult AI problem. Every robot will communicate with a central server that handles the transformation algorithms. This server will receive all sensor data, compute actions, and send instructions to the modular bots. The CS senior design team will be responsible for creating both the high level algorithms and the API for robot-server communication.  Unfortunately, the CS senior design team will not have access to the final robots until midway through the project. To aid in development in the meantime, the CS senior design team will have access to the 3D simulator Webots. The CS senior design team will first develop transformations for the simulation platform and then, once the robots are complete, they will implement the algorithms on the actual modular bots. The CS senior design team will need to design the central server’s API to be versatile enough to communicate with both the virtual robots and the real robots.  In addition to working with Dr. Licato, the CS senior design team will work with the ECE senior design groups in a first-ever collaboration between departments here at IPFW. Progress made in this project will be used as a launching point for at least one external funding proposal to be written by Dr. Licato, in collaboration with other ETCS Faculty (Drs. PomalzaARaez (ECE), Liu (ECE), and Bi (ME)). The robotics projects and code completed by the CS and ECE senior project teams will be used in future robotics courses here at IPFW. | | |
| **Requirements** | * Virtual model of the robot in Webots   + Identical virtual hardware of the real robot   + Report valid sensor data   + Listen for commands from an external API * Python control application for controlling both virtual and physical robots   + Create the Bluetooth API for the physical robots   + Create the HTTP API for the virtual robots   + Receive and interpret data from robot sensors * Python algorithms for arranging robots in 2-3 formations   + Communicate with the robots through the control application   + Receive sensor data from the control application | | |
| **Optional features** | * Add more advanced commands to the robot’s internals library * Additional, more complicated, formation algorithms will be designed as time permits | | |
| **Required resources** | * Several Bluno Nano Arduino Microcontrollers matching the specifications used in the modular robots. * Several Bluetooth Low Energy receivers * Access to the Webots simulator | | |
| **Required backgrounds** | * Python, C (or willingness to learn) * Understanding of AI planning algorithms | | |
| **References** | [1] <http://modlabupenn.org/smores/>  [2] <https://www.youtube.com/watch?v=dRA4sD_3xu0> | | |

As a member of Project Team, I agree to attend project meetings regularly, participate in developing project actively, and make a full effort to complete this project as proposed.

Team Leader Date

Team Member 1 Date

Team Member 2 Date

Team Member 3 Date

Team Member 4 Date

As the Project Advisor, I agree to meet regularly with the student project team, manage their activities, and participate in the evaluation of project deliverables.

Project Advisor Date

As the Project Sponsor, I agree to communicate with the student project team as needed to provide information related to project scope, requirements, assumptions, constraints or other items that may impact project success, and to participate in the evaluation of project deliverables.

Project Sponsor Date