

Backyard Brains

www.backyardbrains.com

Songbird Identification System

Description of Project

More than half of U.S. bird species are threatened by climate change. There is a need for large scale data collection on songbirds both in the U.S. and in remote regions of the world. Documenting the activity of songbirds remains a challenge, given the high cost of accurately collecting and storing song data. There are options for affordable, high-quality, and inexpensive microphone systems on the market. However, there is a need for a system that will autonomously detect, store and report bird song from its environment.

The goal of this MDP project This MDP project will develop system, with the goal of creating one that is also suitably robust for outdoor deployment, low-cost and battery-operated.

Include a Deliverable (Phase I) and Details Here: BASELINE GOAL

A device that correctly identifies each of 8 common local birds and records appropriate environmental information along with the song (time start, time end, location and nd environmental conditions). This version will concentrate on common Michigan songbirds (Rose-breasted Grosbeak, House Wren, Rock Wren, Bewick's Wren, American Robin, Wood thrush, Baltimore Oriole, and the Ruby-throated Hummingbird).

Include a Deliverable (Intermediate – Phase II) and Details Here: SUCCESS

A working device that is shown to be feasible in the appropriate outdoor conditions and can run autonomously for at least 14 days.

Include Stretch Goals and Details here: HIGH SUCCESS

A device that automatically reports results for a period of months without intervention.

Location

Ann Arbor, MI. You are welcome to use the Backyard Brains office and laboratories as well.

Project Sponsor Mentor

Greg Gage, CEO, Backyard Brains

Gregory J Gage is a DIY neuroscientist. He has a Ph.D. in biomedical engineering from the University of Michigan where he worked in a neuroscience lab studying the microcircuits of the brain that are involved with choice behaviors. His work is published in top neuroscience journals, and was the recipient of the prestigious Anuradha Rao Memorial Award from Cell Press for this work as a graduate student.

While in grad school, Greg co-founded a company called Backyard Brains with his then grad-school labmate, Tim Marzullo. While working on his Ph.D., Greg would often go out to local public schools to talk about the importance of studying neuroscience (1 in 5 people will be diagnosed with neurological disorder with no known cures). He developed our lesson plans using models and analogies about how the brain works, but what he really wanted to teach the students was "electrophysiology". This truly is how the brain works. The brain is an electrical organ, and the cells (neurons) communicate with "spikes": a brief pulse of electricity. In my research at the University, he would record these spikes to learn what the neurons were telling us about how the brain worked. Traditionally, to do experiments with electrophysiology, one needs to be in a Ph.D. program and use expensive equipment (our electrophysiology rig cost \$40,000). To make this accessible for their outreach goals, Tim and Greg set out on a self-imposed engineering challenge: To reduce this equipment down to the basic components, and record a spike for <\$100. Less than a year later, we got our first prototype to work and were able to bring spikes into the classrooms! After getting requests from colleagues and teachers, they launched Backyard Brains. The goal of his company is to make cheap versions of what we used at university to let everyone have access to neuroscience tools. Partnering with teachers and artists, we have created lessons and guides for over a dozen experiments. Each one demonstrating one basic principle about how the brain works. These are things you've probably never learned or may have forgotten. From "spikes" to "cyborgs" to "neuroprosthetics", there is something of interest for everyone. Understanding the brain remains a great challenge, both to professional neuroscientists and the general public alike. I want to increase the public's understanding of neuroscience, create a community of amateur neuroscientists, and usher in the next generation of neuroscientists.

Project Faculty Mentor

Please advise if there are any specific members of the faculty whom you would like us to approach for your project. All projects receive a faculty mentor for each student team.

Key Skills & Project Roles

MDP Sponsored Projects are both a professional and academic learning experience for students. By participating in this program, students are actively preparing for graduate school and a professional career. As part of the experience, MDP expects professional behavior. To best prepare you for future professional opportunities, your experiences on this MDP team will be very broad. In addition to key technical skills that you will bring to the team, you will engage deeply in the self-directed learning of new and important concepts, demonstrate flexibility, collaboration, and cooperation, and develop strong professional communication skills. This also means that you will need to be able to work outside of your traditional area of study in the true multidisciplinary nature of our projects. You won't always be able to anticipate how your skills and expertise will be used, so the MDP Sponsored Project will challenge you to grow and develop as a professional.

Project Roles	Key Skills and/or Knowledge	Likely Majors
Signal Processing (2 Students)	Signal processing (bird song identification), sensor selection and integration	Electrical Engineering Computer Engineering MICDE,
Programming - Front End (2-3 Students)	General Programming, Data Processing, Sensor integration,	Computer Science MIDAS
Back End - Database (1 -2 Students)	Database design, efficient storage of large amounts of captured audio data,	Data Science, Computer Science Computer Engineering MIDAS
Avian Biology (1 student)	Basic avian biology and communication	Biology, EEB, Biomedical Engineering (with strong biology background) or strong interest in birds

Desired Additional Knowledge, Skills and Experience:

Good hands on development and building skills, interest in birds and the outdoors, experience in sound recording and audio file manipulation,

Company Overview

General Company overview here Backyard Brains was founded as an S-Corporation in March 2009 by Greg Gage and Tim Marzullo. We currently have 11 full-time employees: the two founders, an engineering manager, software developers, engineers, accountant, marketing, production manager and production staff. We also have several part-time employees: teachers, artists, and production help. Our corporate objective is "Neuroscience for Everyone" and we strive to democratize access to neurotechnology. Our core belief is that by increasing access to principles of neuroscience at an early age, we will both inspire the next generation of engineers and physicians and improve the public's understanding of general brain function. The founders have complementary backgrounds in biology and electrical engineering, and they have Ph.D's in neuroscience and biomedical engineering from the well-known Neural Engineering Lab at the University of Michigan. Our core competencies are public engagement, hardware invention, and software development. Similar to modern software companies, we engage in the practice of iterative development and rapid deployment, which allows us to create close relationships with customers as well as continually improve our products.

Both founders are effective public speakers and have over a decade of experience leading outreach for students. Greg was recognized by TED (Technology, Entertainment and Design), a private non-profit foundation formed to disseminate "ideas worth spreading," as a senior TED fellow. The TED fellowship program brings together "young world-changers and trailblazers who have shown unusual accomplishment and exceptional courage" in their field. He was invited to speak at the main TED conferences in 2012, 2013, and 2015, and his TED talks about Backyard Brains have to date reached over 5M viewers so far. Both Tim and Greg were recognized by the Society of Neuroscience with a "Next Generation Award" for their educational outreach efforts.

Legal Requirements

Citizenship and Right to Work Options

- This project is open to all students regardless of citizenship status

Intellectual Property Agreements / Non-Disclosure Agreements

- Students will sign the Duty to Disclose (We are open Source no NDA required)

Internship Information

- Summer Internships Interviews guaranteed