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Proposal for an ECETDHA Mini-Grant

Development of Touch-Board Projects for Children and Adults on the Autism Spectrum by Students from The School of Engineering + Technology and School of Art and Design in Two Cross-listed Interdisciplinary Service Learning Courses

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August 1, 2018

Abstract: The grant is requested to fund the Touch-Board kits and peripherals to allow students from The School of Engineering + Technology and The School of Art and Design to develop projects that cater to the needs of children and adults on the autism spectrum who are clients at the Full Spectrum Farm, Cullowhee, NC [1]. We also aim to involve the clients at the Farm in basic programming and artistic design to express their own creativity. The developed projects will be kept and used at the Farm, and hence funding is needed to provide project materials. This cross-listed service learning course will not only provide our students real-world projects to implement design principles and practice interdisciplinary collaboration, but also potentially develop a new focus on individualized enrichment for people on the autism spectrum.

Justification:

Touch-Board [2], by Bare Conductive [3], is similar to the Arduino IDE. Unlike typical Arduino boards the Touch-Board includes a micro-SD card to store sound tracks that are updatable using a computer. The wiring is done with black conductive paint, applied easily by a brush on paper with drawings, regular objects, walls, and/or floors (see Figure 1.) Sensor input can trigger certain sound tracks or activate actuators.

Figure 1. Touch-Board paint to create graphic sensors, objects as sensors, and sensing spaces [2]

The Electrical and Computer Engineering Technology students are well versed in microcontroller programming and will lead in the early phases of the projects. However, the art students will also need to learn how to program the boards for separate use later. The autistic clients will be taught simpler procedural and visual programming techniques. This approach is supported well with the Arduino programming environment used with the Touch-Board. Moreover, the wide availability of sample programs and amateur resources will make this effort self-sustaining. The benefit for the ECET students is exposure to more humanitarian aspects of design. The art students will gain new abilities to include controlled systems in their work. The autistic clients will gain access to a new set of tools for exploration and education. Drawing circuits will increase the access to electronics in non-technical settings. At the completion of the project the materials will remain at the Farm for client use and the Art and ECET students can provide mentoring support.

The purpose of this project is two-folded: to create an interdisciplinary environment for the engineering and art students to learn programming skills and design principles through service; and, to serve the people on the autism spectrum with useful designs. During our interactions with the adults and children clients at the Full Spectrum Farm, they enjoy pottery, gardening, mandala drawing, and other painting styles. Their subjects include animals, trains, and light patterns such as by LEDs. We plan to record real-life sounds of animals, trains, etc., their own voices, and educational instructions to facilitate their activities on the Farm.

The measurable objectives to be achieved are that our students will create assistive technology designs with realistic constraints and objectives. They will work on multidisciplinary teams outside Engineering, communicate effectively to non-technical audiences. Personally, we want to assist and learn from the clients at the Farm as they make useful designs for the people on the autism spectrum.

The benefits to the Electrical and Computer Engineering Technology community include marketable skills, impactful technology to serve our community, and impact on an even wider population of the people on the autism spectrum.

Intended Report:

The demonstrations of the final projects that will be left to use at the Full Spectrum Farm will be videotaped and shared with the community.

A final report will be generated to summarize the development of the project, to include both successful and unsuccessful attempts with explanations and solutions. The report will explain the final prototypes with bill of materials, instructional manuals, and user evaluations. The report will give suggestions on how to improve the designs further and how some of the most useful features can be applied in other scenarios.

Meanwhile, the experiential learning experiences of our students through interdisciplinary collaboration and service learning will be presented at the ASEE annual conference, the

Leonardo journal, and other potential venues. If we could gain enough insight on the autistic learning process, we also plan to write on such topics and submit for journal publication.

Time Line:

By this ECETDHA mini-grant proposal, we sincerely ask for your support from **Nov 1, 2018 to Oct 31, 2019 for a year**, which is critical to get us started on the service learning opportunity of our students in Winter 2019 and the collaboration with Full Spectrum Farm for multiple years. The College of Music and Fine Performing Arts at WCU has already provided two instructors with two Touch-Board kits for experimentation, and both The School of Engineering + Technology and The School of Art and Design are committed to this project. Dr. Yan has already received a $1000 grant offered by the Faculty Institute of Community Engagement (FICE) at WCU from Sep 15, 2018 to Mar 30, 2019, which will help to prepare for the Spring 2019 service learning courses. The FICE funding and the ECETDHA mini-grant will support the project materials to be used at the Farm, and funding from other sources is being sought to support undergraduate research assistants, travel to conferences to present papers, and course project materials. In Winter 2019, the focus will be 2D designs. In later semesters, the students will explore 3D designs and additional actuators to deepen all participants' understanding of the technology and learning processes.

Given the long-term plan and our commitment to this project, the time line of the short-term ECETDHA mini-grant is as follows.

Nov 1, 2018 - Dec 31, 2018: File for IRB approval and order project materials, based on our ongoing interactions with the clients at the Full Spectrum Farm and our experimentation of the Touch-Board kits. The milestone is to obtain IRB approval and receive all orders before Jan 2019.

Jan 1, 2019 – Feb 28, 2019: Conduct Phase I in the service learning courses, to teach our students the basics of programming and designs and allow them to familiarize themselves with the clients at the Farm to get some initial ideas on how the projects will be. The milestone is for the students to pass midterms and to submit initial deigns. Depending on the number of the students, our students may pair up and each group will work with a client at the Farm. Every design will have a specific client to serve in mind.

Mar 1, 2019 – May 10, 2019: Conduct Phase II in the service learning courses, to teach our students to guide and/or assist the clients at the Farm to design and test the projects. The learning processes and design steps will be documented. The milestone is to finish the designs to the clients' satisfaction and to compile documentation including video-footage.

May 11, 2019 – Oct 31, 2019: Reflect upon and disseminate our findings in reports, videos and publications. The milestone is to upload videos online and submit scholarly papers.

References:
[1] Full Spectrum Farm at Cullowhee, NC, http://fullspectrumfarms.org/index.html
[2] Touch Board Starter Kit Introduction, https://www.bareconductive.com/shop/touch-board-starter-kit/
[3] About the company "Bare Conductive", https://www.bareconductive.com/about/

Budget:

Right now, at Full Spectrum Farm, there are 9 adults and 7 children as regular clients year-round. Their pottery and painting rooms can use some instructional stations made by the Touch-Board kits, and the clients there have already proposed a suite of projects they'd like to do with the Touch-Board. We plan to have 10 Touch-Board projects at the Farm.

The Touch-Board Workshop Pack (https://www.bareconductive.com/shop/touch-board-workshop-pack/), priced at $560 plus tax, includes 5 Touch Boards, 5 Electric Paint 50ml Jars, 5 Electric Paint 10ml Tubes, 5 MicroSD cards, 5 MicroSD card readers, 5 Micro USB cables, 5 Universal USB plugs, and 50 Alligator clips. The paint is consumable, and there is a 1-liter paint jar (https://www.bareconductive.com/shop/electric-paint-1l/), priced at $280 plus tax. Peripherals are needed such as brushes, paint plates, speakers, LED light strips, and cardstock paper at various sizes. Bare Conductive also offers ready-to-use printed sensor in a set of 3 (https://www.bareconductive.com/shop/printed-sensor-set-of-3/), priced at $12.50 plus tax, and electric paint lamp kit (https://www.bareconductive.com/shop/electric-paint-lamp-kit/), priced at $45 plus tax, which are both useful accessories.

The budget for project material is listed below. ECETDHA funding of $1000 is requested, with a matching fund of $1000 from FICE at WCU. The total expense is $2005, and the funding from ECETDHA and FICE matching is $2000. The balance of $5 and other unexpected expenses will be covered by Dr. Yan's faculty spending account and The School of Engineering + Technology.

	Unit Price	Quantity	Subtotal	Funding
Touch-Board workshop pack	$560	2	$1,120	
1-liter paint jar	$280	1	$280	
Speakers	$20	10	$200	
Brushes	$10	10	$100	
Paint plates	$6	10	$60	
LED light strips	$50	1	$50	
Cardstock paper	$50	1	$50	
Printed sensor set	$12.50	4	$50	
Electric lamp kit	$45	1	$45	
Shipping			$50	
ECETDHA Funding				$1,000
Matching (FICE fund)				$1,000
Dr. Yan's FSA				$5
			$2,005	**$2,005**