

Academic Year 2017/18 MURI Research Projects

Below are the **MURI** projects to which IUPUI undergraduate students can apply. Before you contact one or more project mentors to express your interest in a research position make sure that you meet all the eligibility criteria, which include a cumulative GPA of 3.0 or higher and being a fulltime student pursuing your first undergraduate degree at IUPUI.

When emailing the project mentors use the following subject line “2017/18 Academic Year MURI project application”. In the text box list your GPA, your major and your year of study (first year, sophomore etc.) You may consider attaching your resume to the message.

Note: You can apply for a position on more than one project. However, you will be eligible to work on only one project. Once you have been accepted to a project please inform the mentors of other projects that you have applied to.

If you are accepted to a MURI team please know that you are required to work on the project a minimum of 25h/month from October through the end of April.

Deadline for application is September 15, 2017. However, project mentors may decide to close applications for their respective project prior to that deadline once they have assembled their project team.

Project Title	Project Narrative
Investigating climate and society linkages in the mid-continental United States using high resolution lake sediment archives	<p>The project combines geological and anthropological methods to investigate the relationship between climate change, human settlement histories, subsistence patterns, and land-use in the mid-continental United States during the last 2,000 years.</p> <p><u>For students majoring in:</u> Any discipline <u>Required skill set:</u> None.</p> <p>Contact: Dr. Broxton Bird (bwbird@iupui.edu); Dr. Jeremy Wilson (wilsojer@iupui.edu)</p>
High Specific Energy LiNiPO₄/Graphene as Cathode Material for Lithium Ion Batteries	<p>Lithium-ion batteries (LIBs) dominate today's power sources for portable electronics. Current electrode materials are not likely to meet the growing demand for rapidly miniaturizing electronics and large-scale mobile devices. The project focuses on the synthesis of a high performance LiNiPO₄/graphene composite to use as an electrode in LIBs.</p> <p><u>For students majoring in:</u> Mechanical Engineering, Energy Engineering, Chemistry, Material Science and Physics <u>Required skill set:</u> Mechanical design, basic chemistry, physics, material science</p> <p>Contact: Dr. Jian Xie (jianxie@iupui.edu); Dr. Lei Li (lilei@iupui.edu)</p>
Additive Manufacturing of Ceramic Casting Components	<p>The project objective is to generate an in-house designed, affordable 3D ceramic printer for producing large ceramic components.</p> <p><u>For students majoring in:</u> Mechanical Engineering, Electrical Engineering, Energy Engineering, Ceramics, Physics, Chemistry <u>Required skill set:</u> Materials science, Chemistry</p> <p>Contact: Dr. Jing Zhang (jz29@iupui.edu); Prof. Lesley Baker (lesbaker@iupui.edu)</p>
Assessment of Mixed-Reality Virtual Environment for STEM Learning	<p>In order to create an experience that more closely resembles the operation of an actual machine it is critical to move to a mixed-reality platform. In this project a safe, economical, and effective environment for STEM education and training will be developed, which will provide high fidelity simulation, models, labs, equipment, machinery, and engineering systems.</p> <p><u>For students majoring in:</u> Mechanical Engineering, Education, Computer Science,</p>

	<p>Computer Information Technology, Computer Graphics Technology, Computer Engineering</p> <p><u>Required skill set:</u> <i>Mechanical Engineering student:</i> Design, problem solving, statistical analysis, and CAD.</p> <p><i>Computer Science student:</i> Computer programming (Unity, Java, C, and C++), Software development, Computer Graphics, Virtual reality, Computer interface, and Human-machine interface, iOS development environment experience.</p> <p><i>CIT student:</i> Computer programming (C, C++), Computer graphics, Virtual reality, and computer interface.</p> <p><i>Education student:</i> Learning theory, STEM education, assessment, and statistical analysis.</p> <p><i>Computer Graphics Technology:</i> Visualization, and human-computer interface</p> <p>Contact: Dr. Hazim El-Mounayri (helmouna@iupui.edu), Dr. Christian Rogers (rogerscb@iupui.edu)</p>
<p>Computational Modeling and Functional Validation for Cell Spheroids Used in Scaffold-Free 3D Bio-printing</p>	<p>Cell spheroids are microscopic aggregates of cells used as ‘building blocks’ for the creation of higher-order 3D structures, an extremely powerful approach to tissue engineering. The goal is to determine the optical spheroid properties for bioprinting through mathematical and computer-assisted modeling.</p> <p><u>For students majoring in:</u> Computer Sciences, Physics, Engineering, Biology, Pre-Nursing or Pre-Medicine</p> <p><u>Required skill set:</u> No specific skills beyond the background provided by the students’ majors.</p> <p>Contact: Dr. Nicanor I. Moldovar (nimoldov@iupui.edu); Dr. Horia Petrache (hpetrach@iupui.edu)</p>
<p>Mapping the Oratory of Frederick Douglas</p>	<p>The goal of the project is to identify geographical patterns, both chronologically and thematically, in the speeches of F. Douglas, a runaway slave from Maryland who became one of the most influential African Americans of the 19th century.</p> <p><u>For students majoring in:</u> Geography, History, Computer Study, Education, Africana Studies</p> <p><u>Required skill set:</u> locating documents online and in historical sources; analytical skills to determine rhetorical themes to be used in metadata creation for interactive analysis; use of geographic information software (i.e. GeoJSON, etc.); communication skills; knowledge of web design desirable</p> <p>Contact: Dr. John R. Kaufman- McKivigan (jmckivig@iupui.edu); Dr. Jeffery Duvall</p>

	(jduvall@iupui.edu)
Integration of mHBS powered by DHIS2 and NeoWarm	<p>A key barrier to sustained reduction of mortality and morbidity in low/middle-income countries is a lack of access to crucial data to inform decision-making related to stillbirth, neonatal death, and quality-of-care. The focus of the project is to develop a set of integrated digital health and biomedical engineering tools by which health care providers, stakeholders, and partners in low- and middle-income countries can better assess the landscape of neonatal hypothermia and access feasible solutions for the prevention of hypothermia.</p> <p><u>For students majoring in:</u> Informatics, Biomedical Engineering</p> <p><u>Required skill set:</u></p> <p><i>Informatics students:</i> HTML, Java, and Android development (required), and UX testing experience preferred; ability to follow user stories and track user acceptance testing; ability to understand HTML reports and forms; previous experience with DHIS2 is highly preferred; willingness to document all efforts on Github in a highly collaborative manner.</p> <p><i>Biomedical engineering students:</i> Expertise and/or interest in biomedical device design and development and the interface of biomedical technology and informatics is desired; ability to perform engineering verification and validation tasks within a highly collaborative, multi-disciplinary team environment is required.</p> <p>Contact: Dr. Sherri Bucher (shbucher@iu.edu); Dr. Saptarshi Purkayastha (saptpurk@iupui.edu); Dr. William Combs (wicombs@iupui.edu)</p>
A Residential Energy Management Unit	<p>An energy storage system uses well-established car battery technology and provides an affordable approach to be used in residential areas. The focus of this project is to develop an energy storage system that automatically provides instantaneous power on-demand with the objective of reducing electric bills and relieving the need for smart grids to control the load.</p> <p><u>For students majoring in:</u> Electrical Engineering, Electrical Engineering Technology, Business, Marketing, Economics</p> <p><u>Required skill set:</u> Power Electronics, Microcontroller Programming, Energy Management, Matlab/Simulink, Entrepreneurship, Business plan development</p> <p>Contact: Dr. Afshin Izadian (aizadian@iupui.edu); Dr. Robert Weissbach (rweissba@iupui.edu)</p>
Suitability of recycled plastic for	The overall objective of this project is to find the optimal recycled material blends and

<p>extrusion-based additive manufacturing</p>	<p>processing parameters that maximize the quality of additively manufactured parts and, ultimately, assess the suitability of recycled plastic for extrusion-based additive manufacturing.</p> <p><u>For students majoring in:</u> Chemistry, Physics, Mechanical Engineering, Mechanical Engineering Technology, Motorsports Engineering</p> <p><u>Required skill set:</u> Basic knowledge or basic laboratory expertise (or interest) in material chemical characterization, material mechanical testing, plastic extrusion, additive manufacturing, design of experiments, and/or optimization.</p> <p>Contact: Dr. Andres Tovar (tovara@iupui.edu)</p>
<p>Integration of Plasmonic Metasurface on IR Focal Plane Array</p>	<p>Nanoimprint lithography is one of the most cost-effective high volume nanomanufacturing technologies. The goal of this project is to develop a lightweight compact infrared (IR) imager with multispectral or polarimetric capabilities using surface plasmon structures.</p> <p><u>For students majoring in:</u> Mechanical Engineering, Electrical Engineering, Physics</p> <p><u>Required skill set:</u> Microfabrication using UV lithography, Nanoimprint lithography, PDMS soft lithography, FTIR, Optics lab</p> <p>Contact: Dr. Jong Ryu (eryu@iupui.edu), Dr. Ruihua Cheng (rucheng@iupui.edu)</p>
<p>Direct 3D printing metal powders</p>	<p>Bronze is a popular metal for many important uses. The objective of this project is to quantify the tensile strength and hardness properties of Bronze Metal Clay and compare it to wrought and casted metal.</p> <p><u>For students majoring in:</u> Mechanical Engineering, Electrical Engineering, Biomedical Engineering, Chemistry</p> <p><u>Required skill set:</u> Arduino experience, CAD, STL file creation, material science, 3D printing experience desirable</p> <p>Contact: Dr. Michael Golub (migolub@iupui.edu),</p>