

**Office of the Provost**  
**National University of Singapore**  
**College of Design and Engineering**  
**REx Fellows' Grant Application Form**

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Note to Applicants:

- All fields must be completed. Incomplete forms may not be accepted.
  - Applicants are to submit the completed grant application form in **PDF format** online via the CDE Enhancement Portal by the deadline stipulated for each grant call.
  - For group projects, only one form is to be submitted per group. The form should be submitted on the CDE Enhancement Portal by the group leader.
  - All text should be single spacing, Arial, 10 pt.
  - For details on eligibility and terms and conditions, kindly refer to the REx Fellows' Grant Guidelines.
  - For general and administrative enquiries, please contact the UREx Administrative team at [ugep@nus.edu.sg](mailto:ugep@nus.edu.sg) or contact your Programme's UREx coordinator. For claim related-queries, kindly contact Undergraduate Research Coordinating Team: John Caines (Manager) [jlc@nus.edu.sg](mailto:jlc@nus.edu.sg) or Siti Nur Fairuz Sheikh Ismail (Instructor) [fairuzsi@nus.edu.sg](mailto:fairuzsi@nus.edu.sg) or Siti Fathima (Executive) [sfathima@nus.edu.sg](mailto:sfathima@nus.edu.sg)
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Research Grant Proposal

- (a) UREx project title: Algorithmic Optimization for Error Reduction in Robotic Packaging Systems
- (b) Type of project: Group
- (c) Abstract of UREx project (no more than 100 words)

This project aims to reduce the error in robotic systems used for packaging items. The primary focus is on addressing both hardware and software issues to enhance the robot's performance in folding packaging successfully. While Hardware troubleshooting will address mechanical components, our core efforts will concentrate on developing the best algorithms to minimize errors. By integrating these solutions, the project seeks to achieve a significant reduction in packaging errors, thereby increasing efficiency and reliability in the production line.

- (d) Background literature and research hypothesis of UREx project

Enhancing software algorithms through advanced machine learning techniques will significantly reduce error rates in robotic packaging systems. This software improvement is expected to have a greater impact on error reduction compared to hardware modifications alone.

(e) Brief description of methods and approaches

System Analysis:

- Identify key components in robot's movements
- Evaluate Robot's performance and identify areas for improvement

Hardware Evaluation:

- Address mechanical issues that could affect reliability of data collected

Data Pre-processing:

- Gather raw data from sensors/logs
- Review data for data cleaning, transformation and reduction
- Analyze data distribution and relationships

Literature Review:

- Study existing research on robot packaging systems and error reduction techniques

Algorithm Development:

- Develop and refine algorithms to improve error detection and real-time correction

Integration & Testing (if possible):

- Integrate algorithm into robot and conduct controlled tests to measure performance
- Evaluate effectiveness of improvements and identify further optimization

Documentation & Reporting:

- Document robotic components and different types of errors
- Document methodologies and findings
- Documentation of various algorithms tested and recommendation of best algorithm

(f) Proposed budget breakdown and justification

Note: Applicant should discuss with UREx supervisor(s) on the overall proposed budget. Up to \$2,500 (for individual projects) or \$5,000 (for group projects) research grant will be provided to support the cost of research work and deliverables for UREx project. Applicants and potential supervisors may refer to REx Fellows' Grant Guidelines for details pertaining to the terms and conditions of the grant.

Item	Proposed budget (SGD)	Justification
Flight ticket x2	1000 x2	Solution developed is successful and to be integrated into robot, would like to be present on-site with professor and colleagues to see and learn. This includes troubleshooting any problems as well.  (tentative and not confirmed)

	Total: 2000	
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(g) References and appendices (if any)

This project will be worked alongside with Harada Labs from Osaka University. This was my research project in Summer and would like to continue the research remotely in Singapore.



Signature of applicant

31/07/2024

Date

## **REx Fellows' Grant Guidelines (CDE)**

### **1. Introduction**

- 1.1 Students who are interested to enrol in UREx should submit an application form to be eligible for a research grant of up to \$2,500 (for individual projects) or \$5,000 (for group projects) which can be used to reimburse costs of the associated UREx project.
- 1.2 The research grant will be provided on a requirement basis for the UREx project. Each grant application form submitted should account for the expenses involved in the utilisation of the grant.

### **2. Eligibility Criteria**

Students enrolling for UREx should satisfy the following criteria:

- Must be a registered student of CDE
- Have at least Stage 2 standing
- Have at least two regular semesters of study remaining prior to graduation
- UREx cannot be undertaken concurrently with UROP (EG2605), SEP, NOC, or Industrial Attachment (IA). Students must ensure they have submitted their final report for UREx before they commence UROP, SEP, NOC, or IA
- For students taking both UROP and UREx (Note: cannot be taken concurrently), the scope of the project for UROP should be different from that of UREx.
- FYP can be taken concurrently with UREx, however the FYP project should be significantly different from the UREx project
- UREx can only be taken once; students have a maximum of two regular semesters to complete UREx
- Main supervisor for UREx must be a full-time academic staff from CDE (includes staff with joint appointments with CDE).

### **3. Application Procedure and Approval of Project Grant**

- 3.1 The call for REx grant proposals will be made twice a year. The grant call and closing dates will be communicated to applicants by the UG Research Coordinating team at the Office of the Provost (PVO).
- 3.2 Each grant proposal will be evaluated by the UG Research Coordinating team according to the following criteria:
  - (a) Clear articulation of motivations for seeking to enrol in UREx.
  - (b) Clear articulation of research gaps and proposed methods to address these gaps in the UREx.
  - (c) Justifiable proposed budget breakdown of REx research grant.
- 3.3 Applicants are to fill out all sections of the REx Fellows' Grant Application Form containing applicant's details, description of the project and a tabulated proposed budget breakdown. The completed form should be uploaded online via the Enhancement Portal as a PDF file named as "StudentName\_Department\_CDE\_MonthYear.pdf", where "Department" refers to

the department hosting the UREx project. For group projects, only one form is to be submitted per project.

- 3.4 Applicants will be informed of their application outcome by email. Upon approval of the grant application form, applicants will be named as a “REx Fellow” and will be allocated the UREx course (CDE2605R) on their CANVAS page.

#### **4. Terms and Conditions**

- 4.1 Supervisors have the responsibility to ensure that the project carried out by REx Fellows are in compliance with NUS’s code of ethics, research integrity and responsible research conduct.

- 4.2 Wherever applicable, supervisors should ascertain that necessary approvals are in place before carrying out the research activities.

- 4.3 The REx Fellows’ research grant shall be used solely for the purposes of the associated UREx project. REx Fellows have up until their final semester before graduation to utilise the grant monies.

- 4.4 The following items are allowed to be purchased using the REx Fellows’ research grant:

- (a) Consumables, lab supplies, use of research facilities and equipment directly required for the associated UREx project.
- (b) License fees of software to be used for the associated UREx project.
- (c) Registration fees for conferences, seminars or workshops.
- (d) Costs of preparing project deliverables such as costs of printing posters, travel and transportation costs directly associated to carrying out the associated UREx project.
- (e) Books or journal articles which are directly related to the associated UREx project. Subscription to journals which are NOT available in the university’s libraries is allowed.
- (f) Fees associated with publications of manuscript in journals.

- 4.5 The ownership of items purchased using the REx Fellows’ research grant will be subject to agreements between REx Fellows and their supervisors. Items such as books, journal articles or posters can be kept by REx Fellows with the approval of their supervisors. Items to be used in a lab setting should be kept by the research lab.

- 4.6 The following items are not allowed to be claimed from the REx Fellows’ research grant:

- (a) Entertainment and refreshment.
- (b) Personal expenses not related to associated UREx project.
- (c) Equipment or devices not related to associated UREx project.

#### **5. Deliverables**

The deliverables for UREx include:

- a) Attendance for a minimum of five REx workshops, two of which are core REx workshops - Ethics in Research, and Research Methodologies.
- b) UREx report: 10-20 page technical report on the conducted research.
- c) Executive summary: 1-2 page non-technical report that summarizes the conducted research in clear and concise layperson terms.

For group projects, each team member is required to complete the attendance of workshops and submit an individual UREx report and executive summary.