HACKATHON

on

Development of GUI based 3D CAD Slicing and Sliced 2D Tool Path Generating Software Code using Medial Axis Transformation with Axis Offset method without Infills for Collaborative Industrial Robots in High Volume Metal Deposition

Central Mechanical Engineering Research Institute
Council of Scientific and Industrial Research
(An Autonomous Institution)
Government of India - Ministry of Science and Technology
M.G. Road, Durgapur 713209, West Bengal, India
E-mail:

Invitation for Hackathon

Central Mechanical Engineering Research Institute (CSIR-CMERI), Durgapur, under the aegis of Council of Scientific and Industrial Research (CSIR), Ministry of Science and Technology, Govt. of India, invites Idea Submission for "Development of GUI based 3D CAD Slicing and sliced 2D tool path generating software code using Medial Axis Transformation with axis offset method without infills for collaborative industrial robots in high volume metal deposition". The document containing details of scope of work, eligibility criteria instructions, code of conduct etc. along with necessary formats for submission is attached. The eligible teams may submit their responses in prescribed format (pdf) to ma.mukherjee@cmeri.res.in by 09-08-2021 till 11:59 PM

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Section 1: Introduction

Project title:	Development of GUI based 3D CAD Slicing and sliced 2D tool path generating software code using Medial Axis Transformation with axis offset method without infills for collaborative industrial robots in high volume metal deposition
Project acronym:	CADSlice
Project No.:	WAAM3DP/Hck/CADSlice/2021/V01
Project Organizer / Lead beneficiary:	CSIR-CMERI Durgapur
Project dates:	Idea submission: 10.07.2021 to 09.08.2021
	Selection: 10.08.2021 to 16.08.2021
	Discussion: 17.08.2021 to 23.08.2021
	Implementation: 05.09.2021 to 11.08.2021
	Presentation/delivery: 12.09.2021 to 13.09.2021
Software tools:	Coding Language for 3D slicing algorithm and GUI development: C, C++, Python, Java, Visual Studio, etc. Additionally, any open-source tools may also be used.
Project Patron:	Prof. (Dr.) Harish Hirani, Director, CSIR-CMERI
Editor- In Chief:	Dr. Avik Chatterjee, Chief Scientist, CSIR-CMERI
Joint Editor (s):	Dr. Anjali Chatterjee, Chief Scientist, CSIR-CMERI Dr. Manidipto Mukherjee, Sr. Scientist, CSIR-CMERI Dr. Manivannan R, Scientist, CSIR-CMERI
Project Reviewers:	Dr. Rajesh P. Barnwal, Pr. Scientist, CSIR-CMERI Dr. Srinivasan Aruchamy, Sr. Scientist, CSIR-CMERI Dr. S.R.K. Vadali, Pr. Scientist, CSIR-CMERI Mr. Anirudh Kumar, Sr. Scientist, CSIR-CMERI
Project convenor:	Dr. Manidipto Mukherjee, Sr. Scientist, CSIR-CMERI

Section 2: Project description

I. Scope of Work

CSIR-CMERI invites participation for developing algorithm and software code for robot driven wire arc additive manufacturing system and invites ideas for the development software solution having following capabilities.

- Capability to parse 3D model/CAD model in *.stl and/or *.step format. (The 3D CAD model, in *.stl and *.step formats, is given in the link https://tinyurl.com/35nbfvzp)
- Development of slicing algorithm from CAD solid model components (in *.stl and/or *.step format) generating sliced 2D tool path using medial axis transformation and axis offset method without infills for high volume metal layer deposition in direct arc energy deposition process by collaborative industrial robots (IRB-1520ID, ABB Robot with IRC-5 Controller)
- Innovative design of GUI with following essential features.
  - Capability in GUI to display model after import in a graphical window.
  - Capability to define slicing height.
  - Capability to orient the imported model in the desired axis for slicing and rescale it if necessary.
  - Capability to extract all the 2D sliced geometry from *.stl and/or *.step format.
  - Capability to generate toolpath with respect to medial axis in the sliced 2D layer
  - Capability to create medial axis offset for solid layer deposition without infills.
  - Capability to group similar sliced geometries.

Selection Criteria of Idea submission

Sl. No.	Criteria	Max. marks (%)
1.	**Innovative ideas in 3D CAD slicing code** • Capability to parse 3D model files – number of extensions supported in *.stl and/or *.step format. • Slicing algorithm and Tool path generation	40
2.	**Schematic representations of GUI** • Designs in UX/UI design software like Figma or Drawings/sketches with supported text to explain GUI will be sufficient. • Rendering and control of input 3D model (in *.stl and/or *.step format) in GUI	20
3.	**Methodology** • Steps of implementation must be provided clearly. • This is important to understand the flow of the idea.	30
4.	**Deliverables** • Flow chart indicating the concept algorithm and implementation strategy.	10
	Total	**100**

Note: Top 10 proposals will be selected for the next phase.

II. Implementation

- If your proposal is selected for the hackathon, you will be invited to nominate 2-3 team members (including yourself) for the implementation phase.
- Implementation phase may be conducted in both online or/and offline mode.
- All the participating teams shall be provided with 7 days idea implementation time to complete the task on a given 3D CAD model.

III. Presentation/delivery

All the teams have to present their work before the committee on the 8th and 9th day of the hackathon. The review session would be followed by the announcement of the winning team and happy hour.

Selection Criteria of winner

Sl. No.	Criteria	Max. marks (%)
1.	**3D CAD slicing code and Tool path generation** • Capability to parse 3D model files – number of extensions supported. • Slicing algorithm and Tool path generation • Execution code in Windows platform,	60
2.	**Design of GUI** • Capability in GUI to display model after import in a graphical window. • Capability to define slicing height. • Capability to orient the imported model in the desired axis for slicing and rescale it if necessary. • Capability to extract all the 2D sliced geometry from *.stl and/or *.step format. • Capability to generate toolpath with respect to medial axis in the sliced 2D layer • Capability to create medial axis offset for solid layer deposition without infills. • Capability to group similar sliced geometries.	30
3.	**Deliverables** • Code – Algorithm/ Flowchart/ Source code • GUI – design files.	10
	Total	**100**

Note: decision of the committee will be final and no review/question shall be entertained.

IV. The prize / motivational factor

- The winning team will be rewarded with prize money and may also get a golden opportunity to work along with the core project team for two-three months.

Section 3: Code of Conduct

CSIR-CMERI is an organization about working, as a group, to empower ourselves and others to improve our local community through technology. The institute is committed to providing a safe and welcoming space, without regard to age, gender, race, ethnicity, nationality, sexual orientation, gender identity, gender expression, mental or physical disability, physical appearance, religion, level of knowledge, level of experience, parental status, marital status, socioeconomic status or background, political affiliation, or any other attribute. The institute share the responsibility of enforcing these policies as necessary to maintain an open and welcoming environment.

As the organizers of the event, we believe that the below principles are essential to maintaining this environment. In addition, we believe that they are good principles for life in general.

Applicability

This code of conduct serves as the benchmark to ensure that everybody and anybody who wishes to participate in this Hackathon is able to do so, and applies to all the events, from idea submission to happy hours. Further, it applies to online activities related to the event, including postings on Google Groups, Google meet, Google drive, Dropbox etc. DO NOT submit your ideas to any open-source platforms like GitHub, slack etc. without the consent of CSIR-CMERI in order to avoid any future issue of copyright infringement.

Principles

Do Not Harass

Harassment is any unwelcome or hostile behavior towards another person for any reason. This includes, but is not limited to, offensive verbal comments related to personal characteristics or choices, sexual images or comments, deliberate intimidation, bullying, stalking, following, harassing photography or recording, sustained disruption of discussion or events, non-consensual publication of private comments, inappropriate physical contact, or unwelcome sexual attention. Conduct need not be intentional to be classified as harassment.

CSIR-CMERI strictly discourages the above and will not tolerate such behavior in any circumstance.

Respect the Opinions and Abilities of Others

This themed hackathon is designed as a place for people all of different skill levels and approaches to meet and work together toward common goals. As a result, we do not expect that everybody will share the same opinion. However, we do expect that disagreement is done respectfully.

Additionally, we expect that members will educate others respectfully. To this end, do not assume anybody else's level of expertise or knowledge. Do not belittle a lack of information, or insist on unnecessary precision. We are all learning, so afford others—as well as yourself—room to grow.

Keep Your Team Open

Except for instances where it would significantly impede productivity, there is always room on a project for one more person. Unless doing so would be counter-productive to the goals of the project, anybody who is interested in a project may be allowed to join it**.**

Build With, Not For

Work to ensure that the community is well-represented in all stages of development. Seek out those who are under-represented, and remove barriers to access. Listen as much—or more—than you speak, and give full consideration to all ideas, even if they seem improbable at first.

Empower, Experiment, and Find a Way for Everybody to Contribute

When more people share their knowledge and skills, they give a project a greater chance to succeed. When somebody shows up with an unusual skill, look for ways to fit them into the team rather than reasons why it wouldn't work. Experiment with new approaches, and don't be afraid to try something that might not work.

Section 4: Format of idea submission

Proposal Template
When completed, the proposal should not exceed more than **5 pages** (Part I-III combined including graphs, figures and tables). Part IV may be attached separately.

I: Proposal basics
- **Proposal Title:**
- **Proposer Name:**
- **Team Name:**
- **Proposer Institution:**
- **Proposal Abstract:**

II: Proposal details
Describe the solution methodology you will address in the hackathon.

(*Note: You do not need to know the technical details of exact implementation process at this stage- working that out may be part of the hackathon process - just present your idea/ argument regarding the probable steps to realize the idea into real implementation during the implementation stage if given the resources and expertise. However, if you do know the technical details but haven't been able to implement them, tell us and explain what are the challenges you are thinking that may inhibit such development.*)
Tools:
List any software tools (e.g., C, C++, Python, Java, Visual Studio, OpenGL, R etc.) that you think you might need to accomplish your proposal. Multiple tools can be utilized either separately or in combination to realize the solution.
Data sets:
List any data sets you know that could be helpful for this challenge. Be sure to indicate in what file formats those data exist and if there are any access or distribution restrictions involved in their use.

III: Contact information
Please give contact information in the following format for the person who will represent your team.
- **Name:**
- **Position at your institution/affiliation:**
- **Field of study/Degree:**
- **Email:**
- **Phone:**
- **Website (optional):**

(*Note: If your proposal is selected for the hackathon, you will be invited to nominate 2-3 team members (including yourself) for the next phase.*)

IV. Declaration form

Declaration
We hereby confirm that all the information provided herewith is correct and accurate to the best of our knowledge. We also confirm that our submitted idea is original and there is no conflict of interest that may impact on the delivery of the work to CSIR-CMERI during implementation phase. We also confirm that there is no financial interest to report. We also confirm that we are not a staff/near relative to staff/JRF/SRF/Project associates and other temporary staff/student of CSIR-CMERI. Summarily, we have no direct/ indirect links with the CSIR-CMERI in the past or present.   Signature of the contact person: Name: Attested by-   Signature*: (Director/Principal/Head of the department/Mentor/Professor/Manager/Team leader) (*In the event that signature is not feasible owing to the epidemic, an email approval should be attached.)   Name and Designation: Date: