Expression of Interest (EOI) for Participation in the Grand Challenge

CSIR- Central Glass & Ceramic Research Institute

Date: __/__/2026 *EOI Reference Number: CIMESGC02*

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1. Introduction

The CSIR-Central Glass & Ceramic Research Institute (CGCRI) is pleased to invite Expressions of Interest (EOI) from qualified and experienced firms, research institutions, and individual developers to participate in the Grand Challenge initiative. This initiative is focused on developing innovative solutions for the 'Centre of Innovation & Manufacturing Ecosystem for Sensors (CIMES) in Industrial IoT,' aimed at fostering an ecosystem for advancing and producing fiber optic sensor technologies.

2. Objective of the Grand Challenge

The primary objective of this Grand Challenge is to establish a collaborative framework that will be mutually beneficial to both the CIMES project and the participating entities. This initiative seeks to leverage the expertise and talent within the local ecosystem to develop state-of-the-art solutions that address critical industrial challenges. Participants will gain valuable experience and confidence by engaging in real-time projects. Ultimately, this Grand Challenge aims to promote innovation, drive collaboration, and contribute to the development of impactful, cutting-edge technologies.

3. Scope of Work

The Grand Challenge is planned to be floated for the following work packages:

work package I:
This Grand Challenge seeks the design and development of a complete real-time hardware–software system for detecting electrical/railway poles along railway tracks using LiDAR technology. The system must identify poles on both sides of a moving railway vehicle, measure their distance from the track with ±1 cm accuracy, capture GPS coordinates and timestamps, and compensate for motion-induced errors using accelerometers. It will integrate high-speed LiDAR sensors, GPS, accelerometers, and Microcontroller/FPGA-based processing into a unified architecture capable of operating at approximately 300 Hz. The solution must store up to 50 lakh pole records and provide real-time operator feedback. The challenge emphasizes performance, modularity, accuracy and scalability under real operating conditions.

work package II:
This Grand Challenge by CSIR-CGCRI seeks the design and development of a modular, scalable, and secure software ecosystem to extend its existing LabVIEW-based FBG interrogation system. The solution must integrate a modular LabVIEW interface with a cloud-based IoT platform capable of securely handling real-time data, including parameters, remarks, timestamps, and alarm severity levels. It should also include Windows and Android client applications that display real-time data and generate alarm notifications. The system must ensure secure communication, multi-user scalability, and seamless synchronization between all components. Emphasis is placed on modularity, future expandability, performance reliability, and smooth integration without altering the core interrogation software.

Details of the work to be done for each work package are illustrated in **Annexure I** of this document.

Participants in the Grand Challenge will be expected to:

i. Develop a solution that aligns with the specific objectives and requirements of the challenge.
ii. Conduct comprehensive testing and validation of the proposed solution.
iii. Demonstrate the functionality and effectiveness of the developed solution.
iv. Provide detailed documentation outlining the development process, methodologies employed, and scalability potential of the solution.

4. Eligibility Criteria

To qualify for participation, respondents must meet the following criteria:

i. **Technical Expertise:** Proven technical expertise in relevant domain as per the requirement of each work package. The requirements for technical expertise based eligibility for each work package is detailed in the annexure II of this document.
ii. **Teamwork:** The capacity to collaborate effectively with other team members and stakeholders.
iii. **Communication skills:** The ability to clearly communicate technical concepts and project outcomes.
iv. **Project management skills:** The ability to plan, organize, and execute projects within deadlines.

The Grand Challenge aims to identify the most suitable firms/teams/individuals for carrying out development-related work in CIMES. Upon selection through the Grand Challenge, each chosen firm/ team/individual will receive a separate work order for the procurement of development-related services in accordance with CSIR-CGCRI regulations.

As such, there is no intension to impose any additional restrictions or grant further relaxations regarding the eligibility of Indian firms/teams/individuals to receive a work order. Any Indian firm/team/individual that is legally eligible for service procurement by CSIR-CGCRI through a work order may participate in the Grand Challenge. These firms/teams/individuals are required to possess only the necessary documents (such as PAN, GST, citizenship related etc.) that CSIR-CGCRI mandates for service procurement through work orders. If any individual/team/individual does not possess the required documents for receiving a work order from CSIR-CGCRI, they may participate through their institution/organization/firm which possesses the required documents.

However, since the objective of the CIMES project is to establish an indigenous ecosystem for sensor development and manufacturing in India, foreign firms/teams will not be eligible to participate.

5. Submission Requirements

Interested entities are invited to submit their EOIs, which should include the following components:

i. **Cover Letter:** A brief introduction to the organization or individual, including contact details.
ii. **Technical Expertise:** A summary of relevant expertise and experience, particularly in areas related to the Grand Challenge.
iii. **Project Approach:** A preliminary outline of the proposed approach to address the challenge, including the technologies and methodologies to be employed.
iv. **Previous Work:** Examples of past projects that demonstrate capabilities in the relevant areas.
v. **Team Composition:** Details of the proposed team, including qualifications and roles.
vi. **References:** Contact information for at least two professional references.

The following points may be noted:

<u>Regarding legal papers:</u>

For proof of citizenship, GST/PAN, or similar documentation, any document deemed acceptable by CSIR-CGCRI under current regulations is considered valid for submission.

Regarding qualifications, background and technical expertise:

Regarding technical expertise, details of all relevant qualifications of the firm's technical team, including degree and diploma certificates, as well as certifications from both short-term and long-term courses, may be accepted. To assess the firm's domain expertise, past purchase orders and work orders for similar projects is also required. Additionally, the firm/team/individual is permitted to submit supplementary documents such as certificates of appreciation, awards, recognitions, prizes, patents, research papers, copyrights and media reports etc. that highlight its technical expertise in the relevant field.

Regarding NDA declaration:

The firm/team/individual must also submit a declaration or No Objection Certificate (NOC) on its letterhead, stating that if shortlisted for the pre-bid meeting, it agrees to sign a Non-Disclosure Agreement (NDA) before attending the meeting with CSIR-CGCRI.

Regarding financial liability:

CSIR-CGCRI will not bear any expenditure for travel, accommodation of the firm. All such expenses will have to be borne by the firm itself.

Regarding budget/financial grant:

The financial grant or budget for each work order under the Grand Challenge is capped at INR 10 Lakhs. The grant amount will be disbursed from the 'Grand Challenge' fund under the CIMES project. However, a budgetary quotation will be requested from each firm (or team/individual as per case) for the specified 'work package.'

In the selection process for awarding the work order, some preference will be given to firms/teams/individuals that quote a lower amount for the work. The exact weightage and formula for this preference are outlined in detail later in this document. This preference is intended to incentivize firms to submit their most competitive (lowest) price for the work.

Regarding risk of potential damage of CGCRI facilities by the firm:

If a firm/team/individual is selected for the issuance of a work order, it will be required to deposit INR 2 Lakhs as a bank guarantee or in the form of a demand draft as caution money. This amount may be utilized to cover the cost of repairing CSIR-CGCRI equipment or facilities in the event of any damage caused by the firm during the development work. However, for government institutions (including autonomous bodies/PSUs), this requirement may be relaxed or waived off.

Regarding IPR:

If any intellectual property is developed during the process, credit will be shared between CSIR-CGCRI and the firm/team/individual. However, the primary ownership of the IP and responsibility for the expenditure related to filing the IPR will be determined on a case-by-case basis, as per the direction of the PRC and this will be reviewed at the time of filing of the IPR. The applicant of the IPR will retain the exclusive financial rights of the IPR.

6. Evaluation Process

The EOIs will be assessed based on the following criteria:

i. **Relevance of Experience:** The relevance of the respondent's prior work to the specific research and development objectives of the Grand Challenge.
ii. **Innovation Potential:** The originality and potential impact of the proposed approach.
iii. **Technical Capability:** The respondent's technical expertise and the availability of resources to successfully execute the project.
iv. **Feasibility and Scalability:** The practicality of the proposed solution and its potential for scalability in industrial applications.
v. **Collaborative Potential:** Willingness and ability to collaborate effectively with other participants and stakeholders.

Note: The details of selection process, is explained in detail in **Annexure II** of this document.

7. Submission Deadline

All EOIs must be submitted by **one month** from **date of publication of this advertisement** to email ids ***nabarun.cgcri@csir.res.in*** and ***fosterfopd@gmail.com***. Submissions received after this deadline will not be considered.

8. Contact Information

For any inquiries or additional information regarding this EOI, please contact:

- **Contact Person Name: Nabarun Polley**
- **Position: Sr. Scientist and Convener**
- **CSIR- Central Glass & Ceramic Research Institute**
- **Address: 196 Raja S.C Mullick Road, Jadavpur, Kolkata-32**
- **Phone Number: 9477482143**
- **Email Address: *nabarun.cgcri@csir.res.in*, *fosterfopd@gmail.com***

9. Important Notes

i. Submission of an EOI does not guarantee selection for participation in the Grand Challenge.
ii. Shortlisted participants will be invited to submit a comprehensive proposal and may be required to attend an interview or presentation.
iii. CSIR-CGCRI reserves the right to make all final decisions regarding the selection of participants for this initiative.

Annexure I

Work Package: I

1.1 Background

CSIR–Central Glass and Ceramic Research Institute (CGCRI) develops various Fiber Bragg Grating (FBG) based sensors for Railway applications. To augment the parameters detected by existing CGCRI sensor systems, a LiDAR-based railway pole detection system is required.

CGCRI has procured high-speed LiDAR sensors, Xilinx ZCU104 FPGA development boards, and Windows-based computers for the development of this system. The objective is to float a Grand Challenge for the design and development of a real-time system capable of detecting electrical/railway poles along railway tracks, determining their distance from the track, recording their GPS coordinates, and storing the data in real time.

The proposed system will be mounted on a railway car and shall integrate LiDAR sensors, GPS, accelerometers, FPGA/microcontroller processing units, data acquisition systems, and operator display units.

1.2 Problem statement

A complete hardware–software system needs to be designed and developed for detecting electrical/railway poles along the railway track and determining distance from the track, GPS coordinates, and recording time-stamped event data with motion compensation.

Functional Requirements

- Two high-speed LiDAR sensors shall be mounted on either side of the railway vehicle to detect poles on both left and right sides of the track.
- The system shall detect poles within a distance threshold of 12 meters from the railway track.
- The LiDAR sampling rate shall be approximately 300 Hz.
- The accuracy of pole distance measurement from the track shall be within ±1 cm.
- Accelerometers shall be used to measure lateral displacement/vibration and compensate motion-induced errors.
- A GPS module shall provide latitude, longitude, and time synchronization data.
- The system shall be capable of storing data of up to 50 lakh (5 million) poles.
- The system shall record pole detection event, distance from track, GPS coordinates, timestamp, and motion parameters.

System Architecture Components

- LiDAR Sensors – Two LiDAR sensors mounted on either side of the railway vehicle to detect presence and distance of poles accurately.
- Level Converter – Converts industrial LiDAR output voltage levels (0–10V DC) to levels compatible with ADC.
- GPS Module – Provides latitude, longitude, and precise timing information.

- Accelerometer – Measures lateral vibration and displacement of the railway car to compensate motion-induced errors.
- Microcontroller / FPGA Unit (Xilinx ZCU104) – Acts as the central processing unit for data acquisition, processing, motion compensation, synchronization, and control.
- Data Acquisition System – Stores processed sensor data including pole detection events, distance from track, GPS coordinates, timestamps, and motion parameters.
- Display Unit – Provides real-time visual feedback to the operator.

Acceptance and Demonstration

- Demonstration of real-time pole detection on both sides of the railway track.
- Validation that poles within 12 meters from the track are correctly detected and recorded.
- Demonstration of distance measurement accuracy within ±1 cm.
- Demonstration of motion compensation using accelerometer data.
- Demonstration of GPS synchronization and coordinate recording.
- Demonstration of data storage capability up to 50 lakh pole records.
- Demonstration of stable operation at LiDAR sampling rate of approximately 300 Hz.
- Submission of complete hardware design files, firmware, FPGA codes, source codes, and project files.
- Demonstration of modularity allowing future algorithm upgrades or sensor replacement.
- Knowledge transfer and training to designated CGCRI personnel.

1.3 Technical Eligibility

The participating team/firm should have proven competency in LiDAR-based sensing systems, FPGA-based embedded system design (Xilinx platform preferred), real-time signal processing, GPS-integrated embedded systems, and large-scale data acquisition systems.

The team/firm must demonstrate successful completion of similar real-time embedded sensing or railway-related projects.

1.4 Mode of work

The major part of the work is expected to be carried out at CSIR–CGCRI premises using available hardware including LiDARs, Xilinx ZCU104 boards, and computing systems.

However, some portions of design and development may be carried out outside the institute. No equipment or components belonging to CGCRI shall be taken outside the institute premises without prior approval.

1.5 Evaluation parameter

The parameter for evaluation for the work is as follows

sl no.	Parameter	Description
1.	Features and User Friendliness	Ease of operation, clarity of display interface, ease of calibration, deployment simplicity, and quality of documentation.
2.	Efficiency and scope of further development	Efficient utilization of processing and memory resources and scope for future expansion such as additional sensors or enhanced analytics.
3.	Modularity and Ease of Integration	Ease of integration among LiDAR, GPS, accelerometer, FPGA, and data acquisition systems, and flexibility for future upgrades..
4.	Performance	Reliability, repeatability, real-time detection capability, ±1 cm measurement accuracy, and stable operation at 300 Hz sampling rate.
5.	Flexibility	Upgradability and compatibility with additional embedded sensors, railway systems, and future technological enhancements.

Work Package: II

2.1 Background

CSIR-CGCRI has developed a LabVIEW-based GUI and control software for an existing Fiber Bragg Grating (FBG) Interrogation System. To extend the capabilities of this system, a modular, scalable, and secure software ecosystem is required.

This includes development of a modular LabVIEW interface capable of integrating with the existing system, a cloud-based IoT platform for secure real-time data handling, and client applications for Windows and Android platforms for monitoring and alarm notification purposes.

The developed system should enable seamless communication between the LabVIEW interface, cloud infrastructure, and end-user applications while maintaining modularity and future scalability.

2.2 Problem statement

A modular and extensible software ecosystem needs to be designed and developed to interface with the existing LabVIEW-based FBG interrogation software and provide cloud connectivity and cross-platform client applications.

The system should consist of the following major components.

Modular LabVIEW Interface

- Interface with the existing LabVIEW (Version 16) code.
- Accept up to 10 parameter names (string format).
- Accept corresponding real-time parameter values (floating-point format).
- Accept remarks/comments for each parameter (string format).
- Accept alarm severity levels ranging from 0 to 9, where 0 = No risk and 9 = Highest risk requiring immediate attention.
- Be modular in architecture so that it can be integrated, upgraded, reused, or replaced without modification to the core FBG interrogation software.

Cloud-Based IoT Platform

- Receive real-time or near real-time data from the LabVIEW module.
- Securely store parameter names, values, remarks, timestamps, and alarm levels.
- Support scalable multi-user and multi-device architecture.
- Ensure secure communication through authentication, encryption, and access control mechanisms.
- Support future expansion including additional parameters, devices, and analytics features.

User Applications
Windows-Based Application

- Display parameter names, real-time values, remarks, and alarm severity levels.
- Provide visual and/or audible alarm notifications.

- Feature a user-friendly graphical interface suitable for both technical and non-technical users.

Android-Based Application

- Provide real-time or near real-time synchronized updates from the cloud platform.
- Support push notifications for alarm alerts.
- Display parameters, remarks, and alarm status clearly.
- Be optimized for reliability, usability, and low power consumption.

The following demonstrations have to be done on the development platform.

Acceptance and Demonstration

- Demonstration of a fully functional modular LabVIEW interface integrated with the existing FBG interrogation software.
- Demonstration of secure real-time data transmission between LabVIEW module and cloud platform, cloud platform and Windows application, and cloud platform and Android application.
- Demonstration of alarm generation and notification mechanisms on both Windows and Android platforms.
- Submission of all source codes, project files, API documentation, system architecture documents, testing reports, and deployment guidelines.
- Demonstration of modularity such that future expansion or module replacement can be carried out without modifying the core interrogation software.
- Knowledge transfer and basic training to designated personnel.

2.3 Technical Eligibility

The participating firm/team should have proven experience in LabVIEW software development, cloud-based IoT platform development, Windows desktop application development, Android mobile application development, and secure software architecture design.

The firm/team must demonstrate successful completion of similar projects involving modular systems, cloud connectivity, and cross-platform application development.

2.4 Mode of work

The work may be carried out partly at the developer's premises and partly at CSIR-CGCRI, as required for integration and testing with the existing FBG interrogation system.

All integration activities involving the existing LabVIEW software must be conducted in coordination with authorized personnel. Any proprietary software belonging to the sponsor shall remain within the institute premises unless otherwise permitted.

2.5 Evaluation parameter

The parameter for evaluation for the work is as follows

sl no.	Parameter	Description
1.	Features and User Friendliness	This means how easily and intuitively the LabVIEW module, cloud platform, and user applications can be configured, integrated, operated, and maintained. It includes clarity of GUI design, ease of deployment, quality of documentation, and simplicity of debugging and usage.
2.	Efficiency and scope of further development	This means how efficiently the system utilizes computing and cloud resources and how much scope is kept open for future expansion such as addition of new parameters, devices, analytics features, or user functionalities without major redesign.
3.	Modularity and Ease of Integration	This means how easily different components of the system such as the LabVIEW interface, cloud platform, and client applications can interact in a modular manner. It includes the ability to modify, upgrade, or replace individual modules without affecting the core FBG interrogation software.
4.	Performance	This refers to reliability, real-time responsiveness, stability of communication, robustness of alarm notification mechanisms, smoothness of operation, and overall system dependability.
5.	Flexibility	This means the upgradability and compatibility of the platform with additional hardware, software tools, cloud services, and future technological enhancements.

Annexure II

Selection Process is explained as follows

STEP 1

In response to the 'Call for Expression of Interest (EOI)' advertisement for the Grand Challenge that will be published in the CIMES Portal as well as CGCRI website, interested firms may submit their biodata/credentials, including details of past work experience, team members' qualifications, technical expertise, legal status, and contact information. Submissions should be sent to the Grand Challenge coordinator at ***nabarun.cgcri@csir.res.in*** and ***fosterfopd@gmail.com***, clearly specifying the work packages they are interested in.

In this stage the firms (or teams/individuals as per case) must also submit a declaration on their official letterhead stating that, if shortlisted for the pre-bid meeting, they agree to sign a Non-Disclosure Agreement (NDA) with CSIR-CGCRI. Additionally, they must provide a separate declaration confirming their willingness to deposit INR 2 Lakhs as a bank guarantee or demand draft as caution money if awarded the work order.

STEP 2

Following the submission of biodata/credentials, an initial screening process will be conducted, and shortlisted firms (or teams/individuals as per case) may be requested to sign the NDA. In this stage CGCRI may ask the firms (or teams/individuals as per case) for some clarifications regarding the submitted documents if required.

STEP 3

Once the NDA is signed, shortlisted firms (or teams/individuals as per case) may be invited to a pre-bid meeting, where the details of the problem statement for the work package will be explained in depth.

STEP 4

After the pre-bid meeting, firms (or teams/individuals as per case) will be given approximately 3 weeks to prepare a PowerPoint presentation showcasing their domain expertise, past work experience, approach, concept design, and proposed model for the work. This presentation will be evaluated by an External Review Panel, which will assess the firms (or teams/individuals as per case) based on ten criteria and assign a score out of 80 points. Based on the marks of the ERP, one or more firms may be qualified for each work package.

The first five of the ten criteria are as follows:

1. Relevance of Experience: The relevance of the respondent's prior work to the specific research and development objectives of the Grand Challenge.
2. Innovation Potential: The originality and potential impact of the proposed approach.
3. Technical Capability: The respondent's technical expertise and the availability of resources to successfully execute the project.

4. Feasibility and Scalability: The practicality of the proposed solution and its potential for scalability in industrial applications.
5. Collaborative Potential: Willingness and ability to collaborate effectively with other participants and stakeholders.

The next five of the ten criteria are as package dependent.

For work package 1 these are as follows:

sl no.	Parameter	Description
1.	Features and User Friendliness	Ease of operation, clarity of display interface, ease of calibration, deployment simplicity, and quality of documentation.
2.	Efficiency and scope of further development	Efficient utilization of processing and memory resources and scope for future expansion such as additional sensors or enhanced analytics.
3.	Modularity and Ease of Integration	Ease of integration among LiDAR, GPS, accelerometer, FPGA, and data acquisition systems, and flexibility for future upgrades..
4.	Performance	Reliability, repeatability, real-time detection capability, ±1 cm measurement accuracy, and stable operation at 300 Hz sampling rate.
5.	Flexibility	Upgradability and compatibility with additional embedded sensors, railway systems, and future technological enhancements.

For work package 2 these are as follows:

sl no.	Parameter	Description
1.	Features and User Friendliness	This means how easily and intuitively the LabVIEW module, cloud platform, and user applications can be configured, integrated, operated, and maintained. It includes clarity of GUI design, ease of deployment, quality of documentation, and simplicity of debugging and usage.
2.	Efficiency and scope of further development	This means how efficiently the system utilizes computing and cloud resources and how much scope is kept open for future expansion such as addition of new parameters, devices, analytics features, or user functionalities without major redesign.
3.	Modularity and Ease of Integration	This means how easily different components of the system such as the LabVIEW interface, cloud platform, and client applications can interact in a modular manner. It includes the ability to modify, upgrade, or replace individual modules without affecting the core FBG interrogation software.
4.	Performance	This refers to reliability, real-time responsiveness, stability of communication, robustness of alarm

		notification mechanisms, smoothness of operation, and overall system dependability.
5.	Flexibility	This means the upgradability and compatibility of the platform with additional hardware, software tools, cloud services, and future technological enhancements.

STEP 5

Each qualified firm (or team/individual as per case) (based on marks given by ERP) will be asked to submit their quotation in a sealed envelope. Depending on the quotation amount the firms (or teams/individuals as per case) may be awarded marks out of 20. The formula to calculate this formula is as following.

20x[1-Q/1000000], where Q is the all-inclusive quoted price in INR.

Based on the total marks (i.e. out of 80 judged by ERP and out of 20 as computed from the quoted price), the firms/teams/individuals will be ranked in order. The highest scoring firm/team/individual will be invited to receive the work order. If the highest scoring firm/team/individual refuses to receive work order at this stage, the next ranking one will be called and so on.

STEP 6

The fund will be disbursed after successful implementation of the design and completion of the project by the firm (or teams/individuals as per case).

Regarding TA-DA

In case the parties are invited to give presentation/discussion, they will have to bear the expenditure themselves. CGCRI will not provide any financial assistance towards this.