

प्रौद्योगिकी हस्तांतरण के लिए पसांद की अभिव्यक्ति

**EXPRESSION OF INTEREST for TRANSFER OF TECHNOLOGY**

## **“RIGE-SENSE System”**

**A Machine Vision Solution for Estimation of the Age of the Raw Rice**



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## 1. Introduction

Centre for Development of Advanced Computing (C-DAC), Kolkata in collaboration with Food Corporation of India (FCI), New Delhi developed a product, namely “RIGE-Sense: A machine vision solution for estimation of the age of the raw rice”.

FCI follows a standard chemical procedure to estimate milling age of raw rice which includes manual shaking and color analysis. The manual method for determining the age of rice, known as the Mixed Indicator Method, presently requires the laboratory condition for studying the age of rice, presents several challenges and limitations, including subjectivity, inconsistencies in the assessment process, lack of authenticity and real-time monitoring, etc. To address these challenges, transitioning to automated or technology-driven methods could offer more accurate, efficient, and scalable solutions for rice age determination. This automated solution applies computer vision, machine learning algorithms, and sensor-based techniques that can provide consistent and objective results while eliminating the limitations associated with manual methods.

C-DAC, Kolkata has designed and developed an automated solution to estimate the age of the raw rice including a software application running on an embedded platform. Whereas, FCI has contributed to the development of the chemical method, domain expertise, providing rice samples, and validation of the solutions developed by C-DAC, Kolkata.

## 2. Expression of Interest (EOI)

Centre for Development of Advanced Computing (C-DAC) invites “**Expression of Interest**” (EOI) from Indian companies for the Transfer of Technology (ToT) from C-DAC to manufacture, market, sell and deploy **RIGE-SENSE System** - a machine vision solution for estimation of the age of the raw rice.

This document gives details about

- The product
- The terms and conditions for companies to propose their Expression of Interest and
- How to enter into Transfer of Technology (ToT) agreement based on the terms given herein.

## 3. Brief about C-DAC

Centre for Development of Advanced Computing (C-DAC) is the premier R&D organization of the Ministry of Electronics & Information Technology (MeitY), Government of India for carrying out R&D in IT, Electronics and associated areas. Different areas of C-DAC, had originated at different times, many of which came out as a result of the identification of opportunities.

C-DAC is working on strengthening national technological capabilities in the context of global developments in the field and responding to change in the market needs in selected foundation areas. In that process, C-DAC represents a unique facet working in close junction with MeitY to realize the nation’s policy and pragmatic interventions and initiatives in Information Technology. As an institution for high-end Research and Development (R&D), C-DAC has been at the forefront of the Information Technology (IT) revolution, constantly building capacities in emerging/enabling technologies and innovating and leveraging its expertise, caliber, skill sets to develop and deploy IT products and solutions for different sectors of the economy, as per the

mandate of its parent, the Ministry of Electronics and Information Technology (MeitY), Government of India and other stakeholders including other funding agencies, collaborators, users and the market-place.

C-DAC, Kolkata is one of the 12 Centres of C-DAC in India and situated at most privileged and strategic location at Kolkata, India for pursuing R&D activities in the area of electronics & IT. C-DAC Kolkata's laboratory infrastructure and manpower have got unique strength of pursuing R&D activities in the fields blended with electronics & sensing system, machine vision and image processing, advanced instrumentation, soft computing and software development.

#### 4. **Brief about FCI**

The Food Corporation of India was setup under the Food Corporation's Act 1964, in order to fulfill following objectives of the Food Policy: Effective price support operations for safeguarding the interests of the farmers, distribution of foodgrains throughout the country for public distribution system and maintaining satisfactory level of operational and buffer stocks of foodgrains to ensure national food security. Since its inception, FCI has played a significant role in India's success in transforming the crisis management-oriented food security into a stable security system. FCI's foremost priority is to ensure food security for the nation by effectively managing the procurement, storage, and distribution of essential commodities, thereby providing a reliable and sufficient food supply to meet the needs of the population.

#### 5. **Brief description about the technology to be transferred**

The **RIGE-SENSE System** is a device that estimates the age of milled raw rice employing machine vision technique and through checking of generated colour as the result of a chemical method applied on the rice sample. The device comprises of TWO modules – Sample preparation module and Colorimetric module.

**Sample Preparation Module:** The sample preparation module of the "RIGE-SENSE" system streamlines the process of preparing rice samples for analysis. Initially, a predetermined weight of rice is manually placed into a transparent test tube, which is then positioned within the system. Meanwhile, a chemical solution, vital for the analysis, is prepared manually and stored in a container placed on the holder attached to the system. A computer-controlled liquid dispensing arrangement precisely dispenses a predefined volume of the chemical solution into the test tube, ensuring accuracy and consistency. Subsequently, the shaker unit is engaged to thoroughly mix the rice sample with the solution for a predetermined period, facilitating homogenization. This integrated approach automates the sample preparation process, minimizing manual intervention and enhancing efficiency in the analysis of rice samples within the "RIGE-SENSE" system.

**Colorimetric Module:** The colorimetric module integrated into the "RIGE-SENSE" system is designed to accurately assess the age group of rice samples. Consisting of a digital camera, illumination setup, single-board computer, display unit, and power supply, this module operates seamlessly following the sample preparation stage. Once the solution containing the rice sample is thoroughly mixed, the digital camera captures an image of the test tube. Advanced AI/ML algorithms are employed to analyze the color properties of the mixed solution, discerning subtle variations indicative of rice age. System calibration is meticulously conducted using data from known rice samples of varying ages, ensuring precise analysis. The software generates an output predicting the age group of the rice sample, providing valuable insights for quality assessment and inventory management. This automated colorimetric module enhances efficiency and accuracy in determining rice age within the "RIGE-SENSE" system, offering a sophisticated solution for agricultural and food industries.

## 5.1. Product Specification and features

### 5.1.1. Major Features:

- ✓ Single board computer-based embedded system
- ✓ Touch-operated display
- ✓ Controlled dispensing module with peristaltic pump
- ✓ Controlled vibration for proper mixing
- ✓ Illumination system using LEDs with electronic lumen control
- ✓ Image capturing using digital RGB Camera
- ✓ Digital image processing and analysis techniques
- ✓ User-friendly graphical interface for analysis and report generation.
- ✓ Analysis report is stored in database for future reference and retrieval
- ✓ Input Electrical Supply: 220 Volt AC, 50 Hz
- ✓ Cloud integrated solution



Fig. RIGE-SENSE System.

## 5.2. Use Cases and target application domains

Indeed, the described instrument represents an automated system tailored for precise chemical mixing and colorimetric analysis, with the capability to discern biochemical changes. Its versatility extends beyond its application in the Food Corporation of India (FCI) to various laboratory research domains requiring similar functionalities. By accurately dispensing predefined volumes of chemicals and ensuring thorough mixing with samples, this system enables the observation of color changes indicative of biochemical reactions. In fields such as biochemistry, microbiology, and food science, where biochemical reactions and color changes signify important phenomena, this automated system provides a reliable platform for experimentation and analysis. Its adaptability and reliability make it a valuable asset in advancing scientific research and innovation across diverse disciplines, contributing to enhanced understanding and problem-solving in complex scientific challenges.

### 5.2.1. Prospective End Users

- Food Corporation of India
- Research Laboratories
- State Govt and Central Govt warehouses
- Educational institutes

## 6. Invitation for Expression of Interest

- a) C-DAC invites “Expression of Interest” (EOI) from Indian Companies in the format given in Annexure-1 (Part A & Part B). Companies can become transfer of technology (ToT) partner of C-DAC based on the information furnished in Annexure – I subject to the assessment by the C-DAC.
- b) This invitation of EOI will be open till **23<sup>rd</sup> June 2024**. Techno-commercial and financial bids received after this closing date will not be considered.
- c) The EOI offers received from the vendors shall be evaluated by C-DAC as per C-DAC ToT rule.
- d) The transfer of technology to selected party / parties will be done in a non-exclusive manner.
- e) C-DAC reserves the right in selecting a single party or multiple parties and the C-DAC decision in this selection process is final.
- f) The selected party / parties need to sign an agreement with C-DAC to be eligible for obtaining this technology.
- g) Participation in this EOI does not guarantee any association with C-DAC, unless the agreement is signed.
- h) The submission of the EOI shall include all such documents that are specified herein to prove the authenticity of their offer and any claim made therein. All cost and expenses associated with submission of EOI shall be borne by the bidder while submitting the EOI and C-DAC shall have no liability, in any manner in this regard, or if it decides to terminate the process of short listing for any reason whatsoever.
- i) C-DAC reserves the right of rejecting any offer without assigning reasons.
- j) There is neither a business guarantee nor any commitment for funding support from C-DAC to the selected ToT partner.

## 7. Who can Apply

Any Indian Company or Start Ups willing to acquire ToT licenses, manufacture, market, sell and deploy “RIGE-SENSE System” can apply.

## 8. How to Apply

Interested companies may send expression of interest by filling the template as per Annexure – I (Part-A and Part-B), Annexure-II and Annexure-III along with supporting documents to

### **Group Head, AEE Group**

Centre for Development of Advanced Computing

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Email: [alokesh.ghosh@cdac.in](mailto:alokesh.ghosh@cdac.in)

Also, mark a copy to the following email ids: [amitava.akuli@cdac.in](mailto:amitava.akuli@cdac.in); [gopinath.bej@cdac.in](mailto:gopinath.bej@cdac.in);

Website: [www.cdac.in](http://www.cdac.in)

## 9. ToT Agreement

- a) The ToT partner is selected based on the expression of interest submitted by interested companies.
- b) If selected, the company shall pay onetime ToT license subscription fee and sign the ToT agreement to become ToT partner of C-DAC. Onetime ToT license subscription fee finalised by C-DAC shall be informed to all the bidders who have participated in the EOI.
- c) C-DAC shall sign the technology transfer agreement with the company on receiving the onetime ToT fee.
- d) The license will be granted on Non-Exclusive basis.
- e) The “RIGE-SENSE System” technology shall be transferred only after completing the full ToT payment.
- f) The software product activation license key shall be procured by the company from C-DAC for each unit manufactured and sold to the client on payment of the royalty charges plus applicable taxes in advance. C-DAC, will provide one-unit user license free of cost along with ToT.
- g) No ToT partner will be allowed to quote for “RIGE-SENSE System” or participate in the bid for product selling unless he/she enters into an agreement and pays the full ToT fees. The ToT fees are non-refundable. If any party offers/quotes the rates without an agreement with C-DAC, C-DAC will not be responsible for any such event.

## 10. Validity & Renewal of TOT agreement

- a) Payment of ToT license fee grants the partner for manufacturing, marketing and selling “RIGE-SENSE System” for a period of **5 years** from the date of signing of the agreement
- b) For continued support beyond **5 years** the partner shall be required to renew the ToT agreement by paying the renewal charges on a mutually agreed terms before the expiry of valid ToT license, which will be valid for a further extended period of **five years**.
- c) If the renewal is initiated after the stipulated period, a fresh ToT agreement needs to be signed by the company based on the EOI conditions prevailing at that time.
- d) After five years (from the date of signing the ToT agreement) a new ToT agreement is to be signed by the company based on the terms and conditions prevailing at that time.
- e) Any customization requirements of the ToT partner shall be entertained by C-DAC only if a valid ToT subscription exists. Such customizations shall be undertaken by C-DAC at cost basis on mutually agreed terms and conditions.

## 11. C-DAC Deliverables

On payment of onetime license fee and signing of ToT agreement, the following items shall be provided by C-DAC to the TOT partner for production and product marketing support. The deliverables will be

- a) ToT Partnership certificate
- b) Technical Documentation of the product (e.g. technical specifications, Mechanical drawings, Schematic and PCB design with Gerber files, Manufacturing know-how, etc.)
- c) User Manual
- d) Bill of Materials and probable sourcing information
- e) Software executable files (Source code will not be transferred)
- f) Test Plan and Procedure
- g) Handholding support following ToT (One year after ToT)
- h) Training to the technology recipients (up to three days training program at C-DAC)
- i) Optional - One unit of the “RIGE-SENSE System” may be available as a demonstration module at the cost of Rs. 2,00,000.00/- (Two lacks only) (taxes extra, as applicable)

## 12. Contact Details

For any queries please contact:

### **Dr. Amitava Akuli**

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**Annexure – I (Part-A)**

**Company Profile of the bidder**

A.	Company Profile
1.	Name of the Organization: Website:
2.	Name of the Contact Person: Address: Mobile: Landline: Fax: E-Mail:
3.	Year of Incorporation:
4.	Type of Organization a. Public Sector/ Limited/Private Limited/ Partnership/Proprietary/ Society/ Any other b. Whether 'Foreign Equity Participation (Please give name of foreign equity participant and percentage thereof) c. Names of Directors of the Board/ Proprietors d. Name and address of NRI(s), if any
5.	Category of the firm: Large/Medium/Small scale unit / Others
6.	Address of the Registered Office: (Include Certificate of Registration)
7.	Number of Offices with addresses (Excluding Registered Office): India, ..... Abroad:.....
8.	Certificate of registration as a manufacturing unit
9.	Permanent Account Number
10.	GST Reg. No.
11.	ISO or any equivalent Certification

## Annexure – I (Part-B)

### Technical Collaborations of the bidder

1.	The organization must be a reputed firm/company/SME/startup/R&D company incorporated in India.
2.	The turnover is to be supported by financial statements of accounts/ Annual reports duly certified by a Chartered accountant/ Balancesheets of last 3 years/ Income tax returns for the last 3 years period.
3.	Company profile, giving details of current activities and management/ personnel structure including evidence of incorporation. The company should be registered and ISO orequivalent certified.
4.	Details of absorption of technology for a product/knowhow that has been taken up on produc tion scale in the past may also be given
5.	The manpower strength (Technical:Mechanical, Electrical, Electronics, Software & NonTechnical etc.) at various levels to be furnished Technical: a. B.E./ B.Tech / M.Tech / PhD b. DIPLOMA c. SKILLED TECHNICIANS d. UNSKILLED
6.	The list of machine tools /equipment/software/facilities available related with work to be furnished.
7.	The in-house technological expertise available to be furnished
8.	The list of equipment available for inspection and quality control to be furnished.
9.	The industry should have adequate space for undertaking this work. Available space - Covere & Open and location details to be furnished.
10.	List of products/technologies worked with as regular activity in last three years. Give the list of products/technologies with general specifications and the customers.
11.	List of PSUs/Govt..customers – with contact details (Address,Telephone no., Contact Person)
12.	The details of sales, marketing and maintenance network to be furnished
13.	The list of technical collaborators for various ongoing products may be furnished
14.	The bidder shall provide details of the sub-vendors in case they propose to employ for Partwork.
C.	<b>Expression of Interest: Spell out the extent of interest and envisaged market potential</b>

I hereby declare that the above information is true to the best of my knowledge.

Signature with Name & Seal:

Place:

Date:

## Annexure - II : Financial Bid Format

(To be submitted in sealed envelope)

### Price bid One Time TOT License subscription cost and Royalty

Sl. No.	Product	Company details (Name, address, Contact person, mobile No, email address)	ToT Partnership licence cost for 5 years in Rs. (excluding taxes) (Upfront fees)	Royalty per unit selling or software licence per Unit (for 5 years) in Rs. (excluding taxes)
1	RIGE-SENSE System			

#### Additional cost:

I am interested to buy one “RIGE-SENSE “system for demonstration purpose? (YES/ NO)

If YES, Additional cost of Rs. 2,00,000 (excluding GST as applicable) to be paid at the time of ToT.

I hereby agree with the terms and condition of ToT by C-DAC and submitting the financial offer.

Signature with Name & Seal:

Place:

Date:

## Annexure – III: Product Brochure



### RIGE-Sense: Rice Age Sensing using Colorimetric Technique

#### Different types color developed with respect to Age

- Rice of different ages developed different color with certain chemical processes.
- Changes in color can be detected using machine vision technique.



Age of Rice Sample	Colour
0 Month	GREEN
1 Month	AVOCADO GREEN
2 Month	AVOCADO GREEN
3 Month	YELLOW
4 Month	YELLOW ORANGE
> 4 Month	ORANGE

#### Technical Features:

- Technology: Digital image processing
- Type of Rice: Raw Rice
- Illumination system: LEDs with electronic lumen control
- Processing board: Single board computer
- Camera: High-definition Digital RGB Camera
- Input Electrical Supply: 220 Volt AC with  $\pm 10\%$  variation, 50 Hz
- Pump: High precision pump
- Motor: DC motor
- Controlled dispensing
- Controlled vibration in shaking module

#### Colorimetric Solution Module:

- Web Camera
- Illumination system with electronic control circuit
- Single Board Computer
- Power supply unit

#### Liquid Dispenser Module:

- Dispensing Pump
- Power supply unit

#### Shaker Module:

- DC Motor
- Power supply unit



#### Benefits:

- Fast & reliable
- Helps in the process chain of procuring Rice by FCI, reducing recycling of old rice.

#### Target Users:

- Food Corporation of India
- Research institutes

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