INDIAN INSTITUTE OF SCIENCE
BANGALORE

Notice Inviting Tender (NIT)
under Two-Cover Bid System

for

Supply and Installation of Motion Capture System for Tracking Aerial and Ground Robots, Robert Bosch Centre for Cyber Physical Systems (RBCCPS), Indian Institute of Science, Bangalore

Tender No.: IISC/Purchase/RBCCPS/2021/01
Date: January 8, 2021

Chair
RBCCPS IOE Purchase Committee
Division of RBCCPS
Indian Institute of Science,
Sir C. V. Raman Road,
Bangalore 560012 (INDIA)

Website: www.iisc.ac.in

GSTIN: 29AAATI1501J2ZV

Email ID for this tender
Office.cps@iisc.ac.in

INTRODUCTION

The Centre for Networked Intelligence (referred henceforth as the Purchaser in this document), under the division of EECS and RBCCPS, Indian Institute of Science (IISc), is planning to set up a Test-bed consisting of high-speed motion capture cameras, wired network switches, active and passive trackers and computing servers. The Test-bed is meant for research purposes — to conduct research in development of state-of-the-art controllers and motion algorithms and to develop experiments to demonstrate the applications of autonomous aerial and ground robot technologies.

The Test-bed is required to support the evolving robotic paradigms and should be compatible with software's such as ROS (Robot Operating System) and MATLAB. In accordance with the specialised nature of planned experiments, the Purchaser has identified the OEM equipment (with model numbers) that needs to be procured for the tracking system. Bids are invited from bidders in two-cover format for the Test-bed equipment, along with the management software, as per the bill of quantity in Annexure-I. The proposed topology of the Test-bed is illustrated in Annexure-II.

1. SCOPE OF WORK

The solution proposed by the bidder is expected to be a total turn-key solution meeting all the stipulated requirements including supply, installation (including intra-Testbed network cabling), commissioning, configuration of the management software, and configuring connectivity to the rest of the IISc campus via the gateway router. The bid is also expected to include three years of OEM support.

The proposed Test-bed should be operable in both indoor and outdoor conditions, for which the bidder should also look into support elements like tripods, cabling etc. which could be handled and moved to various locations based on the experiment requirement. The initial setup will be housed in Artificial Intelligence and Robotics Laboratory of the Aerospace Engineering department and the requirements of power and cooling will be the responsibility of the Purchaser. The bidders have to ensure that the resources (personnel) allocated for each one of the above tasks are competent and capable to meet all the technical requirements in order to ensure that the broad objective of delivery of services as per expectations is fully met.

2. BIDDER'S ELIGIBILITY CRITERIA

1) **Bidder should be an Indian OEM or its authorised vendor.** The bidder should submit documentary proof that he is authorised by the OEM to supply the equipment.

2) The bidder should have a track record of having previously supplied similar equipment to Central/State Government or other reputed firms. Purchase order copies of previous installations are required along with customer contact details.

3) In the technical bid, the bidder should clearly demarcate the responsibilities between the OEM and the bidder. Complete details of the same have to be submitted in the technical bid. However, for complete supply, installation, and post-installation service, the bidder shall be responsible.

4) The bidder has to provide an undertaking on the official letter-head of the company that it has not been blacklisted by any department or undertaking of the Central or State Government department/Public Sector Undertakings (PSU)/Public Sector Enterprises (PSE)/ Banks in India.

5) The bidder (along with the OEM) should be in a position to demonstrate their competence and capability (with sales office and service centre based in Bangalore), as a team, to deliver all the services expected during the contract period.

3. SUBMISSION OF BID

1) The offer should be in two-bid system in two-cover format – i.e., "Technical bid" and "Commercial bid".

2) Technical bid must contain the technical details only. This part must not include price offered by the bidder. The Price must be mentioned in the commercial bid part only.

3) Late or delayed tenders shall be summarily rejected. Bids sent through email/fax or submitted in hard copy format will not be accepted and such bids will be treated as non-responsive bids.

4) Bidder(s) must submit PAN given by Income Tax authorities, TIN and copy of PAN / TIN with the bid.

5) Bid document(s) and all enclosures must contain the name and address of the bidder, as well as the signature and seal of the authorised representative of the bidder.

6) The Bank/RTGS detail on the letter-head of the bidder(s) must be submitted along with the tenders (technical bid). A copy of the cancelled cheque should also be attached.

7) The bidders are required to register themselves with the IISc through hellovendor.iisc.ac.in for getting a payment in due course of time.

3.1 TECHNICAL BID

The technical bid should contain the following.

1) Overall compliance statement indicating adherence to each and every clause in the terms and conditions, as per annexure-III.

2) Detailed technical description of the products and datasheets for the specific configuration options quoted.

3) A letter from the OEM authorizing the bidder to bid for this tender.

4) Terms for licensing (perpetual or linked with support contract) and service/support for each hardware/software component. Terms for software usage and update should be unambiguously stated.

5) A clear installation-deployment-testing plan for the Test-bed, with requirements from Purchaser clearly identified phase-wise.

6) A copy of the masked commercial bid of the bill-of-materials.

7) It is mandatory that the BoQ adequately covers all hardware/software necessary for satisfactory operation of the Test-bed. The bid has to quote for the entire solution as per BoQ, partial offers will not be accepted.

   The bidder is required to indicate, by filling-in Annexure-IV, whether each line item in the BoQ is quoted.

3.2 COMMERCIAL BID

1) The commercial bid should contain details of the prices for each one of the subsystems (including of the software licenses) of the total offer giving clearly the rate and the quantity.
2) Price must be offered only in the prescribed priced bid format for all the line items.
3) Price should include all discounts applicable to research institution given that the test-bed will be used for research purposes.

4. INSTALLATION, TRAINING AND DOCUMENTATION, SUPPORT CONTRACT

4.1 INSTALLATION

The total solution supply, installation, and commissioning, as per the PO (purchase order), should be completed within 8 weeks after receiving firm PO from IISc.

4.2 TRAINING AND DOCUMENTATION

1) Appropriate number of training sessions for IISc technical staff for effective operation and management of the Test-bed, including the configuration/usage of the management software supplied.
2) Documentation (manuals, operating instructions, etc.) for all hardware, software, and services offered (in printed/digital format) shall be provided to the Purchaser.
3) A technical report on the Test-bed specific hardware and (management) software configuration will be a prerequisite condition for granting acceptance from the Purchaser.

4.3 WARRANTY AND OEM SUPPORT CONTRACT

1) The bidder/OEM shall be fully responsible for the warranty period.
2) Preventive maintenance and repairs of the components supplied by the bidder are the responsibilities of the bidder.
3) OEM support contract should be for a period of three years from the date of acceptance of the equipment for both hardware and software.
4) While the support contract is valid, the bidder/OEM shall attend to all the hardware and/or software problems on site and shall replace the defective parts at no extra cost to the purchaser within 5 working days after reporting the issue.

5) All critical security updates must be promptly applied by the bidder/OEM personnel. The purchaser should be intimated about all non-critical security updates within a week of their release by the OEM. All feature update releases for software must be made available to the Purchaser during the validity period of support contract.

6) All software tools should also be provided in CD/USB format and the purchaser shall be permitted to make at least 2 copies of the software tools /updates for emergency recovery.

7) Performance security guarantee through any nationalized bank in India for 10% of the total purchase order amount shall be given by the selected bidder to the Purchaser. Format of the performance security guarantee will be given by the purchaser at the time of issuing the purchase order.

8) OEM/bidder shall clearly specify the conditions over which the service obligations will be void. Detailed document regarding warranty conditions and applicability should be submitted along with bid with a declaration of accepting the warranty conditions of the purchaser stated at above clause 4.3.

5. ADDITIONAL GUIDELINES

1) Regarding any clarification on technical aspects or any other issue, a pre-bid meeting will be held on a date and time as mentioned in this tender document at Indian Institute of Science, Bangalore (Robert Bosch Centre for Cyber-Physical Systems). Queries, if any, may only be submitted to the email ID office.cps@iisc.ac.in before the pre bid meeting. No queries will be entertained after the pre-bid meeting.

   The changes in the tender, if any, made after pre-bid meeting, would be published on the IISc website www.iisc.ac.in Any kind of corrigendum/ addendum will become an integral part of this tender document.

2) **As this item is required for research purposes only, hence GST** rate will be 5%; any other statutory levies should be shown separately and not included in the total amount, to enable IISc to avail exemption. IISc is eligible for 5% GST under concessional certificate for which GST exemption certificate will be provided against proforma invoice.

3) Delayed and/or incomplete tenders are liable to be rejected.

4) The technical bid should not contain any price information. Non-conformance will result in disqualification.

5) All pages of the technical bid should be duly signed by the bidder.

6) The bidders are requested to go through the terms and conditions detailed in this document, before filling out the tender. Agreeing to the terms and conditions of the tender document (by signing all pages of the copy of the tender document) is a mandatory requirement.

7) Award criteria: the two-cover system will be followed;

a. Commercial bids of technically qualified bids alone will be taken up for further processing. Decision of IISc will be final and binding.

b. Subject to Clause 5(11), IISc will award the contract to the bidder whose technical bid has been determined by the Purchase Committee to meet technical evaluation criteria and who has offered the lowest evaluated bid price.

8) IISc reserves the right to accept or reject any bid, and to cancel the tender process and reject all bids, at any time prior to the award of contract, without thereby incurring any liability to the affected bidder(s) or any obligation to inform the affected bidder(s) of the grounds for the IISc's action.

9) The Director, IISc, Bangalore-12 reserves the right to modify the technical specifications or the required quantity at any time.

10) IISc will place the purchase order only on the successful bidder. Courts of Bangalore/New Delhi shall have exclusive jurisdiction over matters covered in this tender.

11) The bid must be addressed to "The Chair, RBCCPS IOE Purchase Committee"

12) Contact: any queries or requests for clarification must be directed (through email only) to office.cps@iisc.ac.in

6. COMMERCIAL TERMS AND CONDITIONS

1) The commercial bid should contain, among other things, payment terms, warranty, installation, and commissioning charges. These charges will be paid only after successful supply, installation and acceptance.

2) Withholding tax, if applicable, will be deducted from the PO amount.

3) Price should be quoted per unit and the total amount for the required quantity should also be quoted.

4) Offer should be valid for 180 days from the date of submission.

7. PAYMENT TERMS

100% payment will be released after complete supply, installation, and commissioning of the items followed by submission of invoice and warranty certificate and any other documents as per PO.

8. IMPORTANT DATES

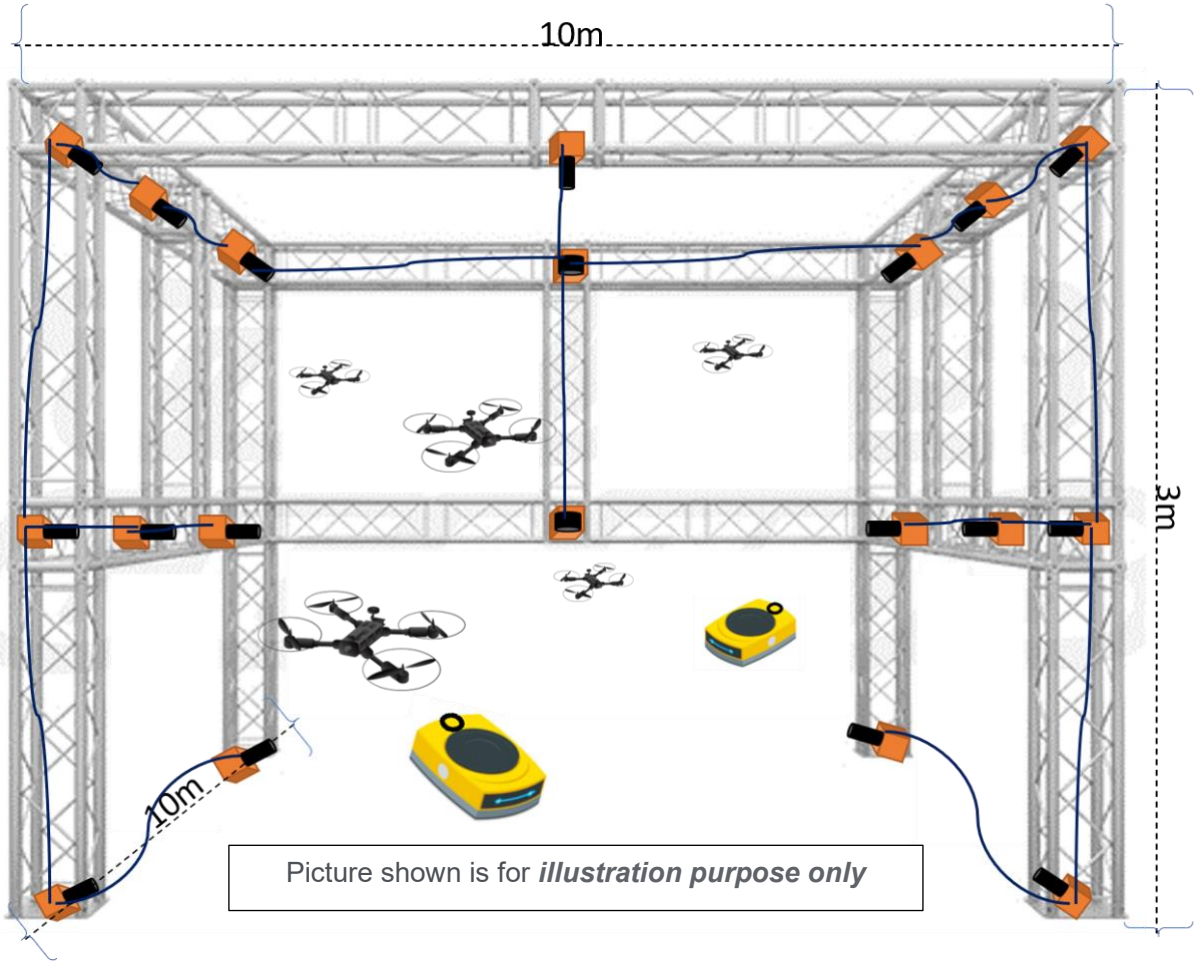
Release of tender document	8th Jan 2021
Submission of queries (for pre-bid clarification) by email to office.cps@iisc.ac.in	13th Jan 2021
Pre-bid Clarification meeting at RBCCPS, IISc	14th Jan 2021
Deadline for submission of bids	29th Jan 2021
Opening of technical bids	30th Jan 2021
Technical presentations	30th Jan 2021
Opening of price bids	30th Jan 2021

ANNEXURE-I

The bidders are required to submit their bids as per the following Bill of Quantity:

Sl. No.	Item Description	Part Number	Quantity
1	**Complete Kit Required for Indoor and Outdoor Testing:**		
1.1	Real-time 3D Positioning and Tracking Device – indoor and outdoor		1
1.2	Calibration device		1
1.3	PoE+ Switch (Indoor)		1
1.4	PoE+ Switch (Outdoor)`		1
1.5	Ethernet Cables (Cat 6)		Required Amount
1.6	Tracking Markers		100 markers each (16mm,12.5 mm)
1.7	Mounts for indoor and truss setup for outdoor		Required amount
1.8	Software		Required software that support bots Linux and Windows. With unlimited departmental license
1.9	Hardware accessories		Required amount

ANNEXURE-II: TEST-BED SET-UP



Specific Requirements:

1. **MODE OF OPERATION:**
    a. Indoor and Outdoor Operation.
2. **VOLUME TO BE TRACKED**:
    a. 10 × 10 × 3 meter (minimum)
3. **OBJECTS TO BE TRACKED:**
    a. 20 robots (minimum), 100 markers each (16mm,12.5 mm). The weights of trackers for these robots should be less than 30 gm.
4. **PRECISION**
    a. 90% and above in tracking volume.
    b. Total system latency should be less than 10 millisecond.

c. The speed of the robot is up to 8m/s. It is a combination of aerial and ground robots.
d. It should have 3D resolution of tracking at 10 m distance should be less than 0.05mm.

5. **FRAME RATE:**
    a. Minimum 300FPS and must track UAVs that fly at 8m/s.
6. **PORTABILITY**:
    a. The system should be easily portable for indoor and outdoor experiments (mounting on truss).
    b. Mounting devices and carry cases has to be provided for trackers and its accessories.
    c. We need necessary cables and clamps such that portability is taken care.
7. **WEATHER PROOFING AND IP67**:
    a. Tracker and cables should handle all weather operations (satisfy IP67 requirements).
    b. Tracker should have necessary filters such that we can operate in day light.
    c. All infrared trackers should have high grade corrosion resistant die-cast aluminum housing.
8. **MINIMALISTIC OPERATIONS**:
    a. The system should have provision to expand the capture volume with minimum restructure of current setup. Minimum time to calibrate for starting the setup. In order to minimize the system setup and maintenance, tracker system should use single ethernet cable setup (preferably daisy chain wiring schema) which directly connects to PC/Laptop.

b. The software should have dedicated real-time data software filtering functionality easily activated by a single click. Automatic labelling of trackers must be included.

9. **SENSOR AND RESOLUTION**:
    a. CMOS type with resolution of at least 10 megapixels.

10. **TRACKERS**:
    a. All trackers should feature a real-time on-board marker data processing that calculates the center point of markers and outputs coordinates in real time. The system allows carrying out outdoor measurements under the direct sunlight. The tracker should be completely noiseless to avoid any disturbance to the measurement subjects.
    b. All infrared trackers should be equipped with remotely controlled motorized optics for convenience of adjustments during outdoor use. All infrared tracker strobes should contain high-powered surface mounted LED's.
    c. All infrared trackers should operate in the 100% invisible infrared wave length range. All infrared trackers should operate with the electronic frame shutter. Each infrared tracker should be equipped with a display showing tracker number, number of visible markers in real time.

11. **HARDWARE**
    a. **CAMERA SYSTEM CONNECTIVITY & CAMERA CABLING**:
        i. Camera system communications with PC should be done through a set of intermediate ethernet switches or, otherwise, directly from one of the cameras to PC.
        ii. Camera cables should be equipped with dust-proof high-quality industrial ODU push-pull connectors suitable for heavy-duty outdoor use.

iii. The camera system should be mobile and easy to relocate, with cables not exceeding 20 meters in length.

iv. The system should include 2 full sets of cables (1 set for permanent use in the main laboratory (Indoor), 2nd set for use outside of the laboratory (Outdoor))

b. **SYNCHRONIZATION**:

i. The system should be able to integrate with external equipment, such as forceplates. The whole set of 3D data shall be populated on a suitable portable computing system (Outdoor Setup laptop PC).

ii. The system should include 2 sets of synchronization cables, external trigger switches and BNC cables, 1 set for each respective lab (Indoor and Outdoor).

iii. The system should include a device to validate the platform data alignment with its location in the 3D motion capture volume.

c. **CAMERA MOUNTING**:

i. Camera system must be mounted on a suitable truss setup for outdoor. For indoor, it must have the respective fasteners.

ii. For additional applications, we need the necessary cables, clamps and mounts from the vendor such that portability is taken care, (which takes care of the mounting on metal truss).

d. **ACCESSORIES:**

i. The system should include a sufficient number of carry cases for all infrared cameras, cabling and marker accessories.

ii. The system should include one calibration kit, including a carbon fiber wand, suited with an aluminum carry case.

iii. The L-frame should be equipped with water level, level adjustment screws and extendable forceplate alignment plates.

12. **SOFTWARE**

a. **OPERATING SYSTEM COMPATIBILITY**

i. Ubuntu (18+) and Windows 10

b. **SPECIFIC SOFTWARE COMPATIBILITY**

i. ROS (Robot Operating System)

ii. MATLAB and Simulink

c. **3D DATA ACQUISITION SOFTWARE:**

i. Data acquisition software should come with an unlimited number of departmental licenses that can be installed on multiple workstations enabling multiple PC operators to carry out simultaneous data processing or with at least 30 licenses/dongles.

ii. Data acquisition software should provide means for quick and intuitive hardware setup, calibration, even with some occlusion partially obstructing the camera view.

iii. Data acquisition software should feature individual camera settings control and calibration of entire system.

iv. Data acquisition software should allow 2D, 3D, 6DOF data real-time streaming, capture and storage.

v. Data acquisition software should provide user-friendly and flexible means for both manual and automatic labeling of markers. The automatic labeling should be applicable both in real-time and in post-processing modes.

vi. Markers' automatic labeling template should be flexible and generic enough to identify any maneuver of the robot. Markers' automatic labeling template should be able to merge data from multiple subjects to ensure scalability and enable its use for different subjects wearing identical marker setups.

vii. Data acquisition software should allow one-click switching between 2D marker mode and a video mode for each infrared camera in the system. Data acquisition software should allow simultaneous 3D or 6DOF data visualization both in real-time and post-processing mode.

viii. Data acquisition software should allow real-time streaming, capture and export of the 3D/VIDEO overlay footage in all the readily available formats. Data acquisition software should be capable of re-processing, gap-filling and filtering of the collected data.

ix. Data acquisition software should display synchronized data from all integrated devices in real time.

ANNEXURE-III: TECHNICAL BID COMPLIANCE CHECKLIST

Sr. No.	Criterion	Yes/No
1	Letter from OEM that the bidder is authorised to supply the equipment	
2	Whether the bidder has supplied similar equipment to Govt institutes or reputed firms and whether documentary proof attached	
3	Declaration that the bidder is not blacklisted by any Govt entities in India	
4	Detailed technical specifications and datasheets for all line items	
5	Terms for hardware/software licensing, updates and support clearly stated	
6	A clear installation-deployment-testing plan	
7	BoQ compliance sheet filled in and a copy of masked commercial bid attached	

ANNEXURE-IV: BOQ COMPLIANCE SHEET

Sl. No.	Item Description	Part Number	Quantity	Quoted Yes/No
1	**Complete Kit Required for Indoor and Outdoor Testing:**			
1.1	Real-time 3D Positioning and Tracking Device – indoor and outdoor		1	
1.2	Calibration device		1	
1.3	PoE+ Switch (Indoor)		1	
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1.9	Hardware accessories		Required amount	