1. Overview

The Department of Mechanical Engineering at the University of Massachusetts Lowell seeks bids for a Motion Capture System or equivalent and associated equipment and delivery. This is a motion capture system that will be used to develop an indoor test bed for aerial and ground robots. The motion capture system provides the position and orientation of the objects flying in the arena. This information is used from the robots to fly autonomously.

The University of Massachusetts Lowell is located in the historic industrial city of Lowell, 25 miles northwest of Boston, with the campus spanning more than 125 acres along the Merrimack River. More than 12,000 resident and commuter students of all backgrounds pursue bachelors, masters, and doctoral degrees as well as professional certificates in the arts, humanities and sciences; education; engineering; health and environment; and management. Internationally recognized for its excellence in science and engineering, UMass Lowell is a leader in nanotechnology and nanomanufacturing, biomanufacturing, bioinformatics and advanced materials. The University is a nationally ranked research university that receives a significant percent of funding from federal agencies and private industry.

More information on the Lowell campus can be found at www.uml.edu.

2. Specifications

2.1 Overview

The University of Massachusetts Lowell seeks bids for Motion Capture System used for indoor testing of autonomous robots or Equivalent and its associated equipment or equivalent as specified below.

- **Volume**: The motion capture system should be capable of covering a workspace with the following dimensions (20ft L x 20 ft W x 8 ft H). The coverage volume is a factor of many parameters related with the number of the cameras. These specifications will be covered in detail. We are looking for a system that can cover the above dimensions and effectively track approximately 12 robots operating in the workspace simultaneously.

- **Frame Rate**: This is the rate that the cameras acquire each frame. A high frame rate results in a large number of measurements per second. These measurements are used by the feedback algorithms to generate the control signals that operate the vehicles autonomously. The higher the frame rate the better is the fidelity of the control law. A minimum of 300FPS is required from the system to generate reliable control signals.

- **Resolution**: The resolution is related with the number of pixels per frame. A high resolution guarantees that the markers used to identify the objects can be tracked...
accurately. Each object is identified in the workspace by the attachment of three (or more) markers in a unique configuration. Having a high resolution the motion capture software will be able to identify accurately markers of small size. This is particularly important due to the small size of the robots that will function in the workspace of the motion capture system. The diameter of the robots will be approximately 10cm, therefore, in order to fit three market minimum in each robot each of them should have a very small size. The resolution should be sufficient to accurately track the markers. A minimum resolution of 1280 x 1088 is required to accurately identify the robots that will operate in this system.

• **Field of View:** This is possibly one of the most important characteristics of the camera. The field of view determines how wide in the coverage angle of each camera. It is important that the field should be wide enough to cover as much volume as possible. A wide file should also be accompanied my minimum distortion due to the fishbowl effect. Finally, if a camera system has a large field of you then more volume can be covered by a less number of cameras; thus, fewer cameras are needed from the system for a given workspace. A field of view of 70 degrees is preferred. Approximately 45 degrees should be the minimum admissible threshold.

• **Interface:** The interface is related with the type of connection that the cameras have amongst them. These cables transmit the vision signal from the camera to the computer mainframe. The type of the interface will determine the transmission rate, latencies into the system and the admissible distance in between cameras. The worst solution is USB since the total length of the cable can be no more than 12ft. The best solution is Gigabit Ethernet.

• **Software:** The software processes the video signals from the cameras and generates the position and orientation of the objects that move into the workspace. The software should be a turn-key solution with a smooth learning curve minimizing the time that the operator should invest in order to learn how to operate the product. In addition, the software module should generate all the necessary information that is required to operate autonomously the robots.

• **Accessories:** A truss system or tripods are needed to mount the cameras. In addition, low cost markers are also necessary

• **All quantities estimated above are for reference purposes and do not represent a commitment to buy or a guaranteed quantity.**
3. Warranty

- Initial warranty period shall be a minimum for one year from Delivery
- Warranty includes all parts and labor
- Should the manufacture warranty extend beyond one year, the longer date shall prevail.
- Vendor must provide a Copy of the Manufacture Warranty

4. RFP Response Required Requirements

- Submit one (1) complete proposal in PDF format via e-mail to purchasing@uml.edu
- Printed Page size should be 8 1/2" x 11". Type size for text should be at least 10-points.
- Unnecessarily elaborate responses beyond that sufficient to present a complete and effective response is not desired. Unless specifically requested in the RFP, elaborate art work, corporate brochures, lengthy narratives, expensive paper, specialized binding, and other extraneous presentation materials are neither necessary nor desired. Submissions will become part of the official records for this RFP and cannot be returned.
- Submission of a bid represents an acceptance of the University Standard Terms and Conditions.
- Please provide a concise proposal in electronic form, no later than 2 p.m. on Tuesday December 3, 2013, to:

  purchasing@uml.edu
  Attn: Eleni Pigakis
  UMass Lowell
  Purchasing Department
  Wannalancit Business Center, Rm 415
  600 Suffolk Street
  Lowell, MA 01854


5. Questions/RFI’s

5.1. All Questions should be submitted electronically via email and directed ONLY to:

  Eleni Pigakis
  purchasing@uml.edu
6. Terms and Conditions

Terms
- All bids are FOB Destination
- University Standard terms are Net 30
- The University reserves the right to award this bid in part or in whole to the vendor(s) who the University deems provides the best value for products or a suite of products capable of meeting the network requirements listed in this RFP
- The University reserves the right to bid any portion of the equipment under this RFP separately should it be in the best interest of the University.

Disclaimer
- UMass Lowell reserves the right to reject any and all bids and to adapt the project’s specifications based on information received in the course of this negotiation. Information in the proposal deemed proprietary by the vendor should be specifically identified, and will be kept in confidence. UMass Lowell will not be responsible for any costs incurred by a vendor in the preparation and/or production of a proposal.
- The University may cancel this proposal at any time under any condition.

Selection and Notice
- Awards shall be let to the proposer who, the University, in its opinion, deems responsive and responsible taking into consideration the reliability of the proposer, the qualities of service and products to be supplied, and their conformity with the requirements and the purposes of which required. While considered, pricing will not be the main factor in selection.
- The University reserves the right to reject any and all proposals, to omit an item or items, or to accept any proposal deemed to be in the best interest of the University.
- The University will notify the selected vendor of its decision and will be prepared to enter into a standard University contract and/or issue a Purchase order immediately upon selection and notification that the offer to engage is accepted by the vendor. The University may request clarification of any proposal by phone, e-mail, in writing or during an in-person presentation.

Entire Agreement
- This proposal represents the entire agreement. Any terms on a contractor’s invoice are not a part of and are not merged into the agreement, unless mutually agreed upon by UMass Lowell and the contractor in writing. Any exceptions to the terms and conditions contained within this proposal must be so noted in writing within the contractor’s response. Any exceptions taken to the terms and conditions within this proposal may result in the classification of contractor’s response as non-responsive and no consideration for award will be given.
• 29C and with Commonwealth Regulation 815 C.M.R. 4.00. Please state your billing schedule tied to deliverables.

7. **Certification of Non-Collusion**

• Pursuant to Massachusetts General Law, Chapter 7, Section 22 (20), I certify under penalties of perjury that this proposal is in all respects bona fide, fair, and made without collusion or fraud with any person. As used in this certification the word “person” means any natural person, joint venture, partnership, corporation or other business or legal entity.

8. **Compliance with Laws and Regulations**

• In accordance with the terms and conditions of this RFP, the Contractor represents that it is qualified to perform the services set forth herein and has obtained all requisite licenses and permits to perform the services. In addition, the Contractor agrees that the services provided hereunder shall conform to the professional standards of care and practice customarily expected of firms engaged in performing comparable work; that the personnel furnishing said services and products shall be qualified and competent to perform adequately the services assigned to them; and that the recommendations, guidance, and performance of such personnel shall reflect such standards of professional knowledge and judgment.

9. **Equal Opportunity/Affirmative Action**

• The University of Massachusetts Lowell is an Equal Opportunity/Affirmative Action, Title IX, H/V, ADA 1990 Employer and Executive Order 11246, Title 41, Part 60 of the CFR Sections 741.4, 250.4, 1.40, and 1.4 are hereby incorporated.

10. **Proposal Conditions**

• Proposal must be signed by an official authorized to bind the vendor to its provisions.

• This RFP document must be returned and signed as required in section 4

• Proposals must remain valid for at least 90 calendar days from the deadline for proposal submission.

• Late proposals will not be considered. Proposals must be in the Purchasing Department before the date and time specified. Postmarks are not considered in
determining late proposals. However, should a late proposal be the only response and if the proposal is also postmarked prior to the date and time of proposal opening, Purchasing may choose to make award to the proposer if it is determined that acceptance of the late proposal is in the best interest of the University of Massachusetts Lowell. When no proposals are received, in urgent circumstances the Purchasing Department may make an award based upon informed competition and without advertising.

- Any proposals may be withdrawn or modified prior to the date and time stated in the proposal for the opening of proposals. Such withdrawal or modification may be either in writing and signed by an authorized representative of the proposer, or made in person at the Purchasing Department provided in the latter case that the proposer or his authorized representative shows adequate identification. FAX withdrawals, but not modifications, will also be accepted, provided written confirmation by the proposer is mailed and postmarked on or before the date and time set for proposal opening.

11. **Proposer Representations**

- Each proposer by making its proposal represents that:
  
  - The proposal document and requirements have been read and understood by the proposer.
  
  - The proposal is based upon the items described in the RFP documents and requirements without exceptions.
  
  - The proposal has been arrived at independently and is submitted without collusion.
  
  - The contents of the proposal have not been disclosed by the proposer nor to the best of its knowledge and belief, by any of its employees or agents, to any person not an employee or agent of the proposer, or its surety on any bond furnished herewith, and will not be disclosed to any such person prior to the opening of proposals.
  
  - No attempt has been made or will be made to induce any other person or firm not to submit a proposal.
12. **Required Proposal Signature Forms**

The following forms must be reviewed and submitted with your proposal

- Attachment A: Price Sheet
- Attachment b: Proposal Offer Signature (Signature Required).
- Attachment C: Certification of State Tax Compliance (Signature Required).
- Attachment D: Anti-Collusion Form (Signature Required).
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Proposers are required to sign this form and submit it with their bid proposal.

To the University of Massachusetts Lowell, the undersigned proposes to provide equipment and services for the University of Massachusetts Lowell in accordance with the terms specified below and the terms of this request: CL14-EP-0030

The undersigned also hereby declares that it is the only person or persons interested in this proposal, that the proposal is made without any connection with other persons making any bid for the same work; that no person or persons directly or indirectly interested in this proposal, or in any contract which may be made under it, is expecting profits to arise therefrom; and without directly or indirectly influencing or attempting to influence any other person bidding for the same work; and that this proposal is made with distinct reference and relation to the specifications prepared for this case and herein mentioned. The undersigned declares that, in regard to the conditions affecting the work to be done, this proposal is based solely on their own investigations and research and not in reliance upon any representations of any employee, officer, or agent of the Commonwealth of Massachusetts.

The undersigned also hereby declares that the pricing provided their response in Attachment A is accurate and binding. (See Attachment A)

Name of Signatory (Person signing below): ________________________________

Contact Name: ________________________________

Contact Telephone Number: ________________________________

Contact Business Address: ________________________________

Contact City and State: ________________________________

Contact Email Address: ________________________________

Authorized Signature: ________________________________

Printed Name and Title: ________________________________

Date of Offer: ________________________________

Duration of Offer (minimum 90 Days) ________________________________
Pursuant to Massachusetts General Laws, Chapter 62C Section 49A, Clause (B), added by Section 36 of Chapter 233 of 1983:

(Name of Person Representing Company/Firm): _______________________________________

for (Name of Company/Firm): ____________________________________________________

whose principal place of business is located at:

Company Address: ________________________________________________________________

Do hereby certify under the pains and penalties of perjury that the above mentioned named contractor has complied with all laws of the Commonwealth of Massachusetts relating to taxes.

Authorized Signature: ____________________________________________________________

Printed Name: ___________________________________________________________________

Title: __________________________________________________________________________

Date: __________________________________________________________________________
Attachment D

Certification of Non-Collusion

CL14-EP-0030

Bidders are required to sign below and submit this form with their bid.

A person submitting a bid or a proposal for the procurement or disposal of supplies or services to any governmental body shall certify in writing, on the bid or proposal, as follows:

The undersigned certifies under penalties of perjury that this bid or proposal has been made and submitted in good faith and without collusion or fraud with any other person. As used in this certification, the word "person" shall mean any natural person, business, partnership, corporation, union, committee, Club, or other organization, entity, or group of individuals.

(Signature of individual submitting bid or proposal) and Date

(Name of business)

Signature Date: ______________________________