

UFFICIO ACQUISTI

SERVICESTELLE EINKAUF

DETERMINA A CONTRARRE

VERFÜGUNG ZUM VERTRAGSABSCHLUSS

Affidamento della fornitura di OPTICAL TRACKING SYSTEM

Vergabe der Lieferung von OPTICAL TRACKING SYSTEM

IDO 4477 – PIS 152361

CIG 8709307B7D

CUP I52F20000650006

Project-Acronym "MELANIE", Project code FESR1138

EFRE-FESR-Program 2014-2020

Il Direttore,

Der Universitätsdirektor,

Considerato che si rende necessario procedere con l'affidamento in oggetto;

Festgestellt, dass die im Betreff genannte Vergabe notwendig ist;

Preso atto che si intende soddisfare il seguente interesse pubblico:

Festgestellt, dass damit folgendes öffentliches Interesse erfüllt werden soll:

Optical tracking system needed to track rigid objects and up to two articulated full human bodies including required hardware and software for creating technological systems interacting with the human.

Optical tracking system needed to track rigid objects and up to two articulated full human bodies including required hardware and software for creating technological systems interacting with the human.

Visto l'art. 21 ter, comma 2 della legge provinciale 29 gennaio 2002, n. 1, il quale prevede che: "*Per gli affidamenti di forniture, servizi e manutenzioni di importo inferiore alla soglia di rilevanza comunitaria, le amministrazioni aggiudicatrici di cui al comma 1, fatta salva la disciplina di cui all'articolo 38 della legge provinciale 17 dicembre 2015, n. 16, in alternativa all'adesione alle convenzioni-quadro stipulate dall'ACP e sempre nel rispetto dei relativi parametri di prezzo-qualità come limiti massimi, ricorrono in via esclusiva al mercato elettronico provinciale ovvero, nel caso di assenza di bandi di abilitazione, al sistema telematico provinciale*";

Nach Einsichtnahme in Art. 21 ter, Absatz 2 des Landesgesetzes vom 29. Jänner 2002, Nr. 1, welcher folgendes vorsieht: „Für die Vergabe von Liefer-, Dienstleistungs- und Instandhaltungsaufträgen unter dem EU-Schwellenwert greifen die öffentlichen Auftraggeber laut Absatz 1, unbeschadet der Bestimmung laut Artikel 38 des Landesgesetzes vom 17. Dezember 2015, Nr. 16, alternativ zum Beitritt zu den von der AOV abgeschlossenen Rahmenvereinbarungen und unter Einhaltung der entsprechenden Preis- und Qualitätsparameter als Höchstgrenzen, ausschließlich auf den elektronischen Markt des Landes Südtirol zurück oder auf das telematische System des Landes, wenn es keine Ausschreibungen für die Zulassung gibt“;

Rilevato che per l'affidamento in oggetto non è attiva una convenzione/contratto quadro dell'ACP;

Festgestellt, dass für die gegenständliche Vergabe keine Konvention/Rahmenvereinbarung der AOV aktiv ist;

Rilevato che per l'affidamento in oggetto non è attivo un bando sul mercato elettronico dell'ACP;

Festgestellt, dass für die gegenständliche Vergabe keine Ausschreibung auf dem elektronischen Markt der AOV aktiv ist;

Ritenuto di porre a base d'asta l'importo di € 75.390,00 IVA esclusa;

Festgestellt, den Betrag von € 75.390,00 zzgl. MwSt. als Ausschreibungsbetrag festzulegen;

Ritenuto pertanto utile procedere con la seguente procedura, da pubblicare sul portale della Provincia SICP:

Procedura negoziata sotto soglia ai sensi dell'art. 12 comma 1 punto a) del regolamento acquisti in c.d. con l'art. 26 comma 6 L.P. 15/2015;

Constatato che l'aggiudicazione, ai sensi dell'art. 33 LP 16/2015 in c.d. con l'art. 36 comma 9bis del D.Lgs. 50/2016, avverrà con il criterio del prezzo più basso;

Considerato che sono stati condotti accertamenti volti ad appurare l'esistenza di rischi da interferenze nell'esecuzione dell'affidamento con il seguente risultato:

in conformità a quanto previsto dall'art. 26, comma 3-bis, del d.lgs. 81/2008 non è necessario redigere il documento unico di valutazione dei rischi da interferenze (DUVRI), poiché non sussistono costi per la sicurezza per i seguenti motivi: mera fornitura di materiale;

Preso atto, che per i seguenti motivi e ai sensi dell'art. 28, comma 2 L.P. 16/2015 non viene fatta una suddivisione in lotti: si tratta di una fornitura unica che deve essere eseguita da un unico operatore economico;

Preso atto che per il seguente motivo viene invitato ai sensi dell'art. 12 comma 3 del regolamento acquisti della Libera Università di Bolzano e art. 26 comma 4 ultimo periodo della L.P. 16/2015 soltanto un unico operatore economico a presentare un'offerta: vedi la dichiarazione di unicità elencando le proprietà uniche del prodotto allegata;

Constatato che le clausole negoziali essenziali sono contenute nella lettera di invito rispettivamente nell'incarico;

Considerato che l'affidamento in oggetto è finanziato con i seguenti mezzi (budget):

PIS	Importo iva inclusa/Betrag inkl. MwSt.
152361	92.000,00

Visto il regolamento acquisti della Libera Università di Bolzano, la L.P. 16/2015 nonché il D.Lgs. 50/2016;

Preso atto che in merito all'affidamento in oggetto non sono presenti situazioni di conflitto di interessi di cui all'art. 42 D.Lgs. 50/2016;

Festgestellt, dass somit folgendes Verfahren, welches auf dem Landesportal ISOV veröffentlicht wird, zweckmäßig erscheint:

Verhandlungsverfahren unter EU-Schwelle gemäß Art. 12 Abs. 1 Punkt a) der Einkaufsregelung iVm Art. 26 Abs. 6 LG Nr. 16/2015;

Festgestellt, dass der Zuschlag gemäß Art. 33 des LG 16/2015 iVm Art. 36 Abs 9bis des GvD 50/2016 nach dem Kriterium des günstigsten Preises erteilt wird;

Festgestellt, dass das Vorliegen von Risiken durch Interferenzen bei der Vertragsausführung mit folgendem Ergebnis überprüft wurde:

gemäß Art. 26 Abs. 3-bis GvD Nr. 81/2008 besteht keine Verpflichtung das Einheitsdokument für die Bewertung der Risiken durch Interferenzen (DUVRI) zu erstellen, da aus folgendem Grund keine Sicherheitskosten bestehen: reine Materiallieferung;

Festgestellt, dass aus folgenden Gründen und gemäß Art. 28, Abs. 2 des LG 16/2015 keine Unterteilung in Lose vorgenommen wird: Es handelt sich um eine einheitliche Lieferung die durch einen Wirtschaftsteilnehmer erfolgen muss;

Festgestellt, dass aus folgendem Grund gemäß Art. 12 Abs. 3 der Einkaufsregelung der Freien Universität Bozen und Art. 26 Abs. 4 letzter Teil des L.G. 16/2015 nur ein Wirtschaftsteilnehmer eingeladen wird ein Angebot zu unterbreiten: siehe beiliegende Erklärung der Einzigartigkeit mit Auflistung der einzigartigen Eigenschaften;

Festgestellt, dass die wesentlichen Vertragsklauseln im Einladungsschreiben bzw. in der Beauftragung enthalten sind;

Festgestellt, dass die gegenständliche Vergabe mit folgenden Haushaltsmitteln (Budget) finanziert wird:

Nach Einsichtnahme in die Einkaufsregelung der Freien Universität Bozen, in das LG 16/2015 sowie in das GvD 50/2016;

Festgestellt, dass für die gegenständliche Vergabe kein Interessenskonflikt gemäß Art. 42 des GvD 50/2016 besteht;

DETERMINA

di indire, per i motivi di cui sopra, una procedura negoziata sotto soglia avente ad oggetto la prestazione in oggetto e alle condizioni sopra indicate.

Non viene redatta la relazione unica sulle procedure di aggiudicazione degli appalti in quanto tutte le informazioni pertinenti sono contenute nella presente determina a contrarre.

VERFÜGT

aus obgenannten Gründen ein Verhandlungsverfahren unter EU-Schwelle für die gegenständliche Leistung und mit den oben genannten Konditionen einzuleiten.

Es wird kein Vergabevermerk zum Vergabeverfahren erstellt, da sämtliche relevanten Informationen in der gegenständlichen Verfügung zum Vertragsabschluss enthalten sind.

Bolzano/Bozen, li/am 13.04.2021

Il Direttore/Der Universitätsdirektor

Dott. Günther Mathà

Il RUP/Der EVV

Dott. Michael Peer

Justification for exclusive purchase

For the Human-centered Technologies Lab (with focus on human-robot interaction and collaboration, haptics, and teleoperation) an **optical tracking system with passive markers** should be purchased. We look for the possibility of simultaneous 6DOF tracking of rigid objects, but also the tracking of articulated human bodies (full body), whereby the system should provide the possibility to track two human skeletons simultaneously. The final tracking area will be 10m x 10m, even though the current temporary space has only a size of 7m x 7m (move of lab planned in the next few years). The cameras are supposed to be fixed to an existing truss. Since technical devices need to react in real-time to the movements of the human bodies or objects, tracking data (single marker data, 6 DOF tracking data when tracking rigid objects, but also the position and orientation of individual body segments when tracking articulated human bodies) needs to be available in real-time with low latency. Marker sets and kinematic/dynamic models underlying the computation should be customizable to fit the various needs. A decent number of cameras is required (minimum 12) as the interaction with technical devices may otherwise lead to occlusion problems.

More specifically, minimum expected technical characteristics of the optical tracking system and software have been defined, see tables further below. Four main players on the market were identified and used for comparison: Vicon, Qualisys, Optitrack and Motion Analysis. For each manufacturer one system out of their portfolios has been chosen that was closest to the minimum requirements. For Vicon the system Vero 2.2 has been chosen, for Qualisys the system Miquis M3, for Optitrack the system Prime17W, and for Motion Analysis the system Kestrel 2200. Other players on the market like AR Tracking (tracks only rigid objects, human model requires a fixed marker cluster), Technoprops (optical motion recognition of face only), WorldViz (only rigid object tracking of wand and head), Simi Reality motion Systems (no online streaming), Northern Digital (optical and electromagnetic tracking specialized for medical application), PhaseSpace (active markers), Codamotion Solutions (active markers), Phoenix Technologies (active LED markers) were excluded due to the reasons reported in parentheses. Results of the final comparison are shown in the following tables.

1.1. Minimum Requirements

1.1.1. Hardware

Tracking cameras:

Requirement	Vicon (Vero 2.2)	Qualisys (Miquis M3)	Optitrack (Prime 17W)	Motion Analysis (Kestrel 2200)
Min. number of cameras: 14	√	√	√	√
Pixels: min 2 MP	√	√	X	√
Resolution: min 1600 x 1000	√	√	√	√
Frame rate: min 300 fps	√	√	√	√
Camera latency: max 4 ms	√	√	√	Could only receive answers to

				system latency (3-5ms for rigid-body, 10ms for articulated bodies)
Possibility to put wide and narrow lenses	√	√	X	√
Range: min 12 m	√	√	√	√
Option for visualizing data in the following modalities: ○ Marker ○ Video (for system setup purposes)	√	√	√	√

Video cameras:

Requirement	Vicon (Vero 2.2)	Qualisys (Miquis M3)	Optitrack (Prime 17W)	Motion Analysis (Kestrel 2200)
Color	√	√	X	√
Pixels: min 2 MP	√	√	X	√
Resolution: min Full HD @ 60 fps	√	√	X	√
Option for wide and narrow lenses	√	√	X	√
Synchronized with tracking cameras	√	√	√	√

Interaction:

Requirement	Vicon (Vero 2.2)	Qualisys (Miquis M3)	Optitrack (Prime 17W)	Motion Analysis (Kestrel 2200)
Interface for capturing analog signals	√	√	√	√
Possibility to trigger the start/stop of the capturing process remotely	√	√	√	√

Markers and suits:

Requirement	Vicon (Vero 2.2)	Qualisys (Miquis M3)	Optitrack (Prime 17W)	Motion Analysis (Kestrel 2200)
2 tracking suits for full-body tracking, if available separate parts for upper and lower body	√	√	√	√
Marker clusters for full-body tracking	√	√	X	X

Mounting:

Requirement	Vicon (Vero 2.2)	Qualisys (Miquis M3)	Optitrack (Prime 17W)	Motion Analysis (Kestrel 2200)
Mounting clamps with ball heads for cameras to be fixed to a tubular truss	√	√	√	√
Additional tripod for color camera	√	√	√	√

Station for data recording and analysis:

Requirement	Vicon (Vero 2.2)	Qualisys (Miquis M3)	Optitrack (Prime 17W)	
Recording and postprocessing PC of last generation and graphics card with adequate memory, at least 24 inches montiro and 2 SSDs, one for operating system and software installations with minimum 256GB and one for data with minimum 1TB	√	√	√	√

1.1.2. Software**General:**

Requirement	Vicon (Vero 2.2)	Qualisys (Miquis M3)	Optitrack (Prime 17W)	Motion Analysis (Kestrel 2200)
Control of system via a single standard PC	√	√	√	√
Tracking possibility for: <ul style="list-style-type: none"> • 3D tracking of markers • 6D tracking of rigid objects • Simultaneous tracking of at least 2 articulated full human bodies • Simultaneous tracking of at least 2 articulated human bodies and rigid objects 	√	√	√	√
Possibility for:	√	√	√	√

<ul style="list-style-type: none"> Masking of certain areas in camera views Calibration of video with tracking cameras Visualization and labelling of markers in real-time Gap filling Possibility for obtaining raw data (without applied filters) Possibility of the activation of filters for tracking data Possibility of the activation of filters for analog data from third party devices 				
Mobile app (compatible with Android and iOS) to start/stop data recording and to help with setting up tracking system	√	√	X	X
Possibility to change to a visualization mode (beside of marker and video mode) that allows checking whether markers are bright enough to facilitate the setting of aperture and focus of cameras	√	√	X	X
Compatibility with the most important applications for creating virtual environments like: a) Unity b) Unreal Engine offering the possibility to stream movement data in real-time to the virtual environment	√	√	√	Only Unity

Video:

Requirement	Vicon (Vero 2.2)	Qualisys (Miquis M3)	Optitrack (Prime 17W)	Motion Analysis (Kestrel 2200)
overlay of kinematic data on video	√	√	√	√
possibility for exporting: <ul style="list-style-type: none"> Video Video with overlaid kinematics 	√	√	√	√

Articulated tracking:

Requirement	Vicon (Vero 2.2)	Qualisys (Miquis M3)	Optitrack (Prime 17W)	Motion Analysis (Kestrel 2200)
Possibility to define own marker sets	√	√	√	√
Possibility to define own biomechanical models	√	(only when using third-party software like Visual3D)	(only when using third-party software like Visual3D)	√

Integration:

Requirement	Vicon (Vero 2.2)	Qualisys (Miquis M3)	Optitrack (Prime 17W)	Motion Analysis (Kestrel 2200)
Possibility to synchronize external devices to the tracking system frame rate	√	√	√	√
Possibility to send trigger signal to external device or to receive trigger signal from external device to e.g. start/stop capturing	√	√	√	√
Third-party integration for analog devices (e.g. force plates, EMG systems)	√	√	√	√
Network streaming: <ul style="list-style-type: none"> • via TCP-IP or UDP • to applications in <ul style="list-style-type: none"> ○ C++ ○ Python ○ Matlab ○ ROS (Robot Operating System) • streaming of: <ul style="list-style-type: none"> ○ 3DOF unlabelled and labelled marker positions ○ 6DOF data of rigid bodies ○ position and orientation of body segments of articulated bodies ○ analog/digital data of third-party devices like force plates, EMG devices 	√	√	√	Partly (No Python)

Possibility for real-time streaming of positions and orientations of body segments as well as dependent variables like joint angles based on (predefined, <u>but also self-defined</u>) biomechanical models (not models used for animation purposes)	√	X (only possible for predefined sport marker set and animation marker set, but not for own defined models as this definition would need to be done in third-party software like Visual3D, which does not stream this data)	X (no, since computations of this kind are done in third-party software like Visual3D, which does not stream this data)	√
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Third-party integration

Requirement	Vicon (Vero 2.2)	Qualisys (Miquis M3)	Optitrack (Prime 17W)	Motion Analysis (Kestrel 2200)
EMG: Delsys	√ (analog and digital)	√ (analog and digital)		√
EMG: Cometa	√ (analog and digital)	√ (analog and digital)		
EMG: Noraxon	√ (analog and digital)	√ (analog and digital)		
Force plates: AMTI	√ (analog and digital)	√ (analog)	√	√
Force plates: Kistler	√ (analog and digital)	√ (analog and digital)		√
Tobii Pro Eye Tracking Glasses	√	√		√

1.1.3. General system requirements

Requirement	Vicon (Vero 2.2)	Qualisys (Miquis M3)	Optitrack (Prime 17W)	Motion Analysis (Kestrel 2200)
Possibility for extending the system with further cameras of same or different type of same producer	√	√	√	√
Possibility to divide the system into two smaller systems (if additional hardware is needed to do so, please include it in your quote)	√	√	√	√

1.2. Further Interesting System Capabilities

Third-party integration

Feature (integration with)	Vicon (Vero 2.2)	Qualisys (Miquis M3)	Optitrack (Prime 17W)	Motion Analysis (Kestrel 2200)
EMG: Myon	√ (analog)	√ (analog and digital)		
Force plates: Bertec	√ (analog and digital work in progress by Bertec)	√ (analog and digital)	√	
Motekforce Link	√	√		
Dikablis Eye Tracker	√	√		

Synchronization with IMUs:

Feature	Vicon (Vero 2.2)	Qualisys (Miquis M3)	Optitrack (Prime 17W)	Motion Analysis (Kestrel 2200)
Possibility to record frame-synchronized IMU data together with optical data	√	X	X	X

One important difference of the systems in terms of technical capabilities and our requirements can be seen when looking at the 2 marked lines in yellow. These lines refer to the capability of defining own biomechanical models and to stream data like the positions and orientations of body segments as well as dependent variables like joint angles of these models to third-party software. While Vicon and Motion Analysis offer all these capabilities using their own software, Qualisys and Optitrack require the purchase of a third-party software like Visual3D for defining own biomechanical models. This software, however, is currently not capable of streaming data like positions and orientations of body segments as well as dependent variables like joint angles to third-party software as requested in the minimum requirements. These features are crucial as we need the possibility to modify the model depending on current needs (e.g. when capturing elderly people) as well as the option to stream data from this model to allow for the interaction with robots. Thus, the Qualisys as well as the Optitrack system are excluded from further analysis.

Main differences with respect to minimum requirements of the remaining Vicon and Motion Analysis systems can be found in the red marked lines. Motion Analysis unlike Vicon does not sell marker clusters, has no mobile App, has no possibility to change to a visualization mode (beside of marker and video mode) that allows checking whether markers are bright enough to facilitate the setting of aperture and focus of cameras, is only compatible with Unity and not Unreal, offers no Python interface and does not allow for third-party integration of EMG systems like Cometa and Noraxon.

Looking at further criteria, Vicon offers in general much more possibilities for third-party integration and allows frame-synchronized IMU data to be recorded together with optical data, while this feature is not available for Motion Analysis.

Summarizing the technical comparison of the systems, we can conclude that only the Vicon system fulfills all minimal technical requirements and offers on top additional interesting features and thus, this system should be purchased.

Angelika Peer

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Yarnton
Oxford
OX5 1QU

1st March 2021

To whom it may concern

Thank you for your interest in Vicon Motion Systems products and services.

This is to confirm that

GPEM Srl
Via Remartello 49/F
Loreto Aprutino (PE) 65014
VAT#: IT03216821201

is the sole authorised Vicon distributor for the sale and support of our products in Italy.

Should further clarification be required please do not hesitate to contact the undersigned.

Yours Faithfully



Andrew Ray
Sales Support Marketing Director
Vicon Motion Systems Ltd