Fiscal Year:	FY 2013	**Task Last Updated:**	FY 08/19/2015
PI Name:	Christoudias, Mario Ph.D.		
Project Title:	Automatic Video-based Motion Analysis		
Division Name:	Human Research		
Program/Discipline:			
Program/Discipline--Element/Subdiscipline:			
Joint Agency Name:		**TechPort:**	No
Human Research Program Elements:	(1) **SHFH**:Space Human Factors & Habitability (archival in 2017)		
Human Research Program Risks:	(1) **HSIA**:Risk of Adverse Outcomes Due to Inadequate Human Systems Integration Architecture		
Space Biology Element:	None		
Space Biology Cross-Element Discipline:	None		
Space Biology Special Category:	None		
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PI Organization Type:	INDUSTRY	**Phone:**	(617) 864-0636 x3133
Organization Name:	Vecna Technologies, Inc.		
PI Address 1:	6404 Ivy Lane, Suite 500		
PI Address 2:			
PI Web Page:			
City:	Greenbelt	**State:**	MD
Zip Code:	20770-1423	**Congressional District:**	5
Comments:	Vecna Technologies, Inc. corporate address is Greenbelt, MD. PI is located at Vecna location in Cambridge, MA.		
Project Type:	Ground	**Solicitation / Funding Source:**	SBIR Phase II
Start Date:	01/01/2013	**End Date:**	08/31/2015
No. of Post Docs:		**No. of PhD Degrees:**	
No. of PhD Candidates:		**No. of Master' Degrees:**	
No. of Master's Candidates:		**No. of Bachelor's Degrees:**	
No. of Bachelor's Candidates:		**Monitoring Center:**	NASA JSC
Contact Monitor:	Whitmore, Mihriban	**Contact Phone:**	281-244-1004
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Flight Program:			
Flight Assignment:			
Key Personnel Changes/Previous PI:	NOTE: PI change from Neal Checka to C. Mario Christoudias, Ph.D. in 2015. Additional personnel are Prasad, Harsha MS; Kethamakka, Sai MS; and Thangali, Ashwin PhD.		
COI Name (Institution):			
Grant/Contract No.:	NNX13CA06C		
Performance Goal No.:			
Performance Goal Text:			
	Understanding task performance and crew behavioral health is crucial to mission success and to the optimal design, development, and operation of next-generation spacecraft. Onboard resources, like a conventional 2D video camera, can capture crew motion and interaction; however, there is a critical need for a software tool that achieves unobtrusive, non-invasive, automatic analysis of crew activity from this footage. The proposed automatic video-based motion analysis software (AVIMA) supports this R&D effort by automatically processing and analyzing complex human motions in conventional 2D video without the use of specialized markers. Unlike many video analytics solutions, AVIMA goes beyond simple blob-based video analysis by tracking the geometric configuration of human body parts like the trunk, head, and limbs. This tracking enables human motion understanding algorithms to model and recognize complex human actions and interactions.		

Task Description:	The resulting system will represent a substantial breakthrough providing benefits to an array of applications in video surveillance, human-computer interaction, human factors engineering, and robotics. Aims for Phase II: Phase II work will leverage the Phase I preliminary designs and prototype results to design and implement a complete human motion analysis and visualization tool. 1. Enhance the human motion analysis module to automatically estimate 3D human body pose from 2D video footage and to enable quick and robust tracking across a variety of operating scenarios. 2. Investigate and implement a video analytics module that employs state-of-the-art machine learning algorithms to interpret the subjects' movements with respect to their operational environment, objects in the environment, and other crewmates. 3. Design and implement a user friendly graphical user interface that allows the user to define events/actions to recognize, visualize, and quantify results more quickly. 4. Evaluate the usability, accuracy and robustness of the individual algorithms as well as the end-to-end software system both qualitatively and quantitatively. Test the prototype with potential end-users at NASA. Aims for Phase II E: Phase II E continues the work from Phase II, focusing on pursuing 2-D video analysis focusing on microgravity video (i.e., floating postures for person detection and tracking) POTENTIAL NASA COMMERCIAL APPLICATIONS: Vecna expects the full-scope software system to have immediate and tangible benefit for NASA's Exploration Systems Mission Directorate (ESMD). ESMD focuses on the human element of exploration by conducting research to ensure astronaut explorers are safe, healthy and can perform their work during long-duration space exploration. Task performance and crew behavioral health are key concerns in the design, development, and operation of next generation space vehicles. Operations in confined, isolated, and resource-constrained environments can lead to suboptimal human performance. As such, there is a critical need for Vecna's proposed software tool that automatically processes and analyzes crew motion and interaction from video footage captured by a single conventional 2D video camera. Such a diagnostic tool will enable unobtrusive and non-invasive measurement of task performance and crew behavioral health.
Rationale for HRP Directed Research:	
Research Impact/Earth Benefits:	The proposed technology is applicable to a wide range of Department of Defense (DoD) and intelligence community areas including force protection, counter-terrorism, human activity monitoring, and surveillance and tracking. We see significant potential for application of this tool to support a range of tactical and strategic systems, including shipboard Navy CIC centers, Army field C3I centers, or USAF theater airborne command posts. A number of programs sponsored by the DoD (FCS, HumanID, CTS, Mind's Eye, Rail Security Pilot) employ video-based monitoring systems and would benefit from the proposed system. Also, Vecna will investigate commercialization opportunities in other sectors, including mobile robotics, interactive displays, and visual surveillance. Initial analysis of these market segments reveal both unaddressed needs as well as vast potential for rapid adoption and growth. As robotic systems become more commonplace in today's society, robust, intelligent interaction between humans and robots is essential. To interact with humans in a lifelike manner requires the robot to infer physical intentions based on visual cues. The proposed technology could potentially revolutionize human-robot interaction. In the surveillance market, automated screening provides an immediate and extant application opportunity for AVIMA. Digital signage and displays provide another venue for applying the AVIMA technology within healthcare.
Task Progress:	New project for FY2013. Reporting not required for this SBIR Phase 2 project. NOTE also PI change in 2015 from Neal Checka to C. Mario Christoudias, Ph.D.
Bibliography Type:	Description: (Last Updated:)