

Faculty Exchange Report (Summary)

February 2017

The present document intends to report, in a summarized form, the activities carried out during the Faculty Exchange period of my sabbatical leave from August to December 2016 in CMU Silicon Valley (CMU-SV), at NASA Ames Research Park, in Mountain View, CA, hosted by Prof. Bob Iannucci.

Summary of Activities

This 4 months Faculty Exchange has been preceded by 2 years of contacts, 2 visits to Silicon Valley in 2014 and 2015 and joint preparation in the framework of the CMU Portugal program ERI «VR2Market» and the dual-degree ECE PhD student João Falcão recruitment and co-supervision.

The activities carried out in the reported period were, as planned, two-folded involving the integration the VitalResponder®(VR) platform we have been developing under the VR2Market ERI with the Cross-Mobile Emergency Communications platform, namely with a related concept on passive (or implicit) communication between man and Unmanned Autonomous Vehicles (UAV) initially identified by the student Will Hendry in his project “UAS: Man’s best Friend” developed on spring 2016. This integration is the first task of the dual-degree work plan of our student.

As with the VR platform we are dealing with human advanced sensing where our psychophysiological analytics can sense emotional states such as stress or fatigue, we identified the opportunity to explore putting the “human psychophysiology in the loop” and explore new concepts in man-UAS interaction, following the “UAS: Men’s Best Friend” concept previously referred. With this integration we intended to explore implicit interaction between a subject and his autonomous drone, much like as if the drone was the man’s animal pet.

An integrated system was developed and the results of this integration were tested with volunteers at a specific event of field experimentation promoted by the Naval Postgraduate School (NPS) at military camp in California. On the first two days, we have tested and adapted the system in trials with the involved researchers as VR subjects. On the second phase, we performed an Ethics CMU Institution Review Board (IRB) approved volunteer based field study involving 8 participants to demonstrate the proof of concept of the aimed system. A total of 24.7 Gb of data were collected for more than 236 minutes (~4h). At the time of this report we are analyzing the recorded data to complete the present study and close a related paper.

Nevertheless, the results so far already clearly show that we have achieved the full integration of the two systems using it in the field with multiple users, proving the feasibility of performing the needed data fusion with some simple

analytics (such as ECG R-R peaks distance) to implement the Man-UAS Symbiosis System (MUSS) concept we are pursuing.

Furthermore, we also report some other collaborations with other CMU-SV faculty members that complemented nicely my «Silicon Valley experience».

Collaboration with other CMU-SV colleagues

While at Carnegie Mellon University - Silicon Valley, we collaborated in two other colleagues apart from my host, namely in their MSc course activities and guided some undergrad students' projects.

Cécile Péraire, Prof. Dr.

Following my first visit in 2014, we have started to collaborate with Cécile on a project called «Incident Aide» where we initiated the integration of vital signs into the project mobile app. During the 2016 Faculty Exchange we have further developed this project with her master students and also attended some classes to interact with the students.

Please find attached a letter related to this collaboration.

Stuart Evans, Ph.D.

Following our previous contacts on our technology details and IP we were developing around the VitalResponder platform I have collaborated with Stuart in his master course of «Commercializing Intellectual Property» at the CMU Engineering and Business School. These students came both from Pittsburgh and Silicon Valley to work on our (and other two) case studies and take it to a pitch to the Sand Hill Angels venture capital company. This collaboration with Stuart extended further to the Emirates Airlines CMU Innovation Lab and to several presentations of our platform for several guests as reported in the attached letter.

Conclusion

The reported Faculty Exchange had several important results that largely potentiate the close R&D collaborations with faculty at CMU-SV.

On one hand, the joint R&D in “Man-Drone Symbiosis” is novel and poses very challenging research questions that will probably go beyond the dual-degree PhD and the CMU-P ERI we are currently executing and will call for both PIs to start looking for further funding so that it may expand into a major topic within both west coast to west coast (USA to EU) labs.

On another hand, several other collaborations emerged and/or strengthened to other areas that are also highly interesting and have potential to generate further R&D and even entrepreneurship results in the coming future.

Acknowledgments

All the reported activities could not have happened with the help and support of several distinguished people and institutions that we want to thank:

- To the CMU-Portugal program and to FCT that has been supporting many of our ideas and R&D work and once more supported this Faculty Exchange.
- To INESC TEC and FEUP for the continuous support to all our R&D and pedagogic activities since we came to U.Porto.
- To Bob Iannucci that enthusiastically opened his group and lab for some more or less crazy ideas of joining physiology and UAVs and to our long discussions, brainstorming and dozens of ideas for new projects to do together.
- To our joint dual-degree student João Falcão that is the main merger in this joint line of research and is also funded by the CMU-Portugal.
- To Ervin Teng and Cef Ramirez for their continuous support in providing their expertise as a real team in the development of the Man-UAV Symbiosis System and to Will Hendry for his initial concept of the “UAV-Man’s best friend”.
- To Gerald Scott (Scotty) for his unconditional support to our experiment at JIFX and to Raymond Buettner, director of NPS, who provided the needed contacts in the military structure so that our IRB clearance has been approved.
- To Diana Leathers, Stacy Marshall, Sari Smith and Steven Rosenberg for their logistics support at CMU-SV and to Jelena Kovačević for her formal invitation to the Faculty Exchange from the CMU ECE department.
- To the remaining colleagues with which I interacted at CMU-SV, namely Stuart Evans and Cécile Pérraire, and to Sean Lanthier for his support and first responder requirements and observations to our work.
- Finally, to all volunteers of our field study, for their will to help us in this scientific endeavor.