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**Challenge:**

**Objective:** ICT-2011.2.1 Cognitive Systems and Robotics

**Project website address:** [www.echord.eu](http://www.echord.eu)

## **D3.5.5**

### **5th six-monthly report on experiment progress and on reviews**

Due date of deliverable: [31/10/2017]

Actual submission date: [31/10/2017]

Start date of project: 01/10/2013

Duration: 53 months

Organisation name of lead contractor for this deliverable: SSSA

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## 1. Executive summary

The aim of the document is to present the collection of information about the progress of the selected Experiments from Call2 during the 5<sup>th</sup> six-monthly report. The progresses will be displayed through one table. The table consists of the following information for each experiment, that summarizes the progress of the last 6 months:

- Self-assessment status;
- Deliverable status;
- Milestones status;
- Technological KPIs status;
- Impact KPIs status;
- Dissemination KPIs status.

The status is represented by a traffic light having the color of:

- Green: the progresses are on line with the expectations;
- Yellow: the progresses have some delays and/ or the quality of the work is slightly below the expectations;
- Red: the progresses are really delayed and/or the quality of the work is deeply below the expectations.

For yellow and red traffic lights, justifications will be reported.

## 2. Summary of the progresses

The summary of the progresses of Call 2 reported below comprehends the timeline between April 2017- October 2017.

### Call 2 Experiments

	Self-Assessment	Milestone	Deliverable	Technical KPIs	Impact KPIs	Dissemination KPIs
DUALARMWORKER						
Injerobot						
SAGA						
Flexsight						
Max Es						
AAWSBE1						
Wires						
Keraal						

Saferun						
Radoroso						
Homerehab						
Fastkit						
Cocomaps						
Grape						
Catch						
Hyq-Real						

## DUALARMWORKER

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### Summary:

Some delays were present and D2.2 and D3.1 were not developed in an optimal way but experimenters modified both quickly and provided the expected information.

In general RRTConnect planner was used to develop the core of the motion planning. Test on Octomap done in order to assess the best method for fast change in the environment implemented. New grippers implemented too. Dual arm closed kinematics planner v1.2 tested both at Tecnia and Airbus.

The Dual Arm Closed Kinematics Planner is combined with a Database that stores successfully calculated trajectories. With this strategy, experimenters are able to reuse trajectories instead of having to recalculate them every time.

Periodic assessment green: few questions on the new gripper but in general the progress is good.

Deliverable status: D2.2 and D3.1 were at first poor and I requested them to provide them in a more structured way and they quickly did so.

dKPI: a lot of work has been done to catch up properly on the dissemination KPIs and reports have been provided.

The experimenters always provide useful videos to assess their progresses.

### Justifications for yellow or red lights

- Deliverable: Delays in providing D2.2 and D3.2

## Injerobot

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### Summary:

Injerobot is progressing well. There have been some delays in reaching technical and impact KPI, but the experimenters always justified the delays. The experimenters are

almost always on time with the upload of the required documents and are responsive to the requests made by the moderators. They have been to the Bristol RIF to test their system and reported the visit in Deliverble 9. On the other side, the website is extremely poor, and we have recommended to improve it, with more information and easy to browse to get organized information (such as publication, events, research, visit to RIF, partners....).

#### **Justifications for yellow or red lights**

- Part of the tKPI have been reached with some delay and one has been not reached yet. However, the experimenters always justified the delay and kept the portal updated with the status of the KPIs
- iKPI #1 has been only partly reached. However, the experimenters justified the delay and kept the portal updated with the status of the KPI

### **SAGA**

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#### **Summary:**

Synthetic summary: the Experiment has suffered from a series of setbacks; first, integration of sensors presented problems (electronic interference), then, flight certification could not be obtained. The Experimenters moved on to the B-plan, using lighter drones. Work is proceeding but with some delays. They were granted a four-month extension to allow comfortable completion of their work. Currently, they are finishing the collection of a data set to train the computer vision component. Development of the prototype drone is essentially done. Coordination algorithms have been developed and tested in simulation. CNR will begin work on practical flight coordination on a pair of drone prototypes in December. There were significant delays, but the Experiment is moving in the right direction.

#### **Justifications for yellow or red lights**

- dKPI: No Written report of Networking associations (ZLTO). Deadline 1/3/2017 and No Info. Organisation of events (IEEE TC AgRA Webinar). Deadline: 1/1/2017. Also Written Report with Confagricoltura (same deadline)

### **Flexsight**

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#### **Summary:**

From a technical point of view, some issues are occurring in the project, causing a deviation from DoW: managing deformable objects is not completely solved and onboard computation is delayed due to lack of support on chosen device.

However, interesting results obtainable at the end of the project are still clear and evident.

#### **Justifications for yellow or red lights:**

As already commented in previous reports, work carried out by experimenters is valuable but they do not provide the same value to documents on the portal. Summing up the missing documents:

### *Dissemination milestones*

- 3) Press release 2 - 10.03.2017 not provided
- 16) Attendance to scientific conferences - 30.06.2017 not provided
- 17) Attendance to scientific conferences - 30.09.2017 not provided
- 23) Social media Facebook e Twitter - 10.01.2017 not provided

### *Technical KPI milestones*

- 1) Object recognition - 01.07.2017 not provided
- 2) Localization accuracy - 01.07.2017 not provided
- 3) Operation Life of FSS - 01.09.2017 not provided

### *Impact KPI milestones*

- 5) Newsletter - 01.07.2017 not provided
- 6) Website - 01.07.2017 not provide

## **Max Es**

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### **Summary:**

The goal of the project is to develop a navigation, docking and safety system for autonomous guided vehicles working in an aluminum smelter. Due to the high requirements on the precision of docking, difficult environmental conditions and necessity to work both in- and out-door most of the solutions need to be tailor-made for the application at hand.

The project is generally going well. The experimenters unilaterally decided to change the robot used in the experiment from a laboratory prototype to a larger, serially-produced variant, which will be available later this year. Although this change may have a positive impact on the project by bringing the final solution closer to marker and delivering results better fitting the needs of the end user it has also introduced significant delays in the project. Therefore, the deliverables, technical KPIs and milestones related to the experimental verification of the solution are delayed. The Experimenters have applied for a 6 months' extension of the project to cope with the delays and present the final results within the timeframe of the project.

Despite the lack of formal reporting, initial results related to the navigation and docking components have been presented and seem to be promising in terms of achieved accuracy. The safety module for the developed AGV has also been designed. The protocol for measuring the mapping and positioning accuracy is being developed right now.

The relatively low scores of the project are caused by the delays related to changing the robot used and some issues with reporting. However, the project will probably finish successfully.

### **Justifications for yellow or red lights**

All the technical KPIs are delayed due to switching to a different mobile platform, however the related work has been mostly done and awaits experimental verification. Similarly, the deliverables related to navigation (D3.1 and D3.2), safety (D4.1 and D4.2) and docking (D6.1 and D6.2). The intermediate results have been presented during the monitoring calls though and are convincing enough. The self-assessment reports on the website for the analyzed period are missing.

## AAWSBE1

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### Summary:

Major delays. The next traffic lights will be absolutely red, and an inspection to the experimenters site will be suggested to verify the compliance of the work program to the research and development actions performed

### Justifications for yellow or red lights

- **Self-Assessment** Major delays. The next traffic lights will be absolutely red, and an inspection to the experimenters site will be suggested to verify the compliance of the work program to the research and development actions performed"
- **Deliverables** Old deliverables from previous periods are still pending, poorly written or insufficiently detailed to assess the work done
- **tKPI** Old tKPIs due in the previous periods are still pending, poorly written or insufficiently detailed to assess the work done
- **iKPI** No believable business plan or business model has been provided so far
- **dKPI** Very few details on the dissemination actions has been provided on the E Chord portal. Links, references or other verifiable statements are missing

### Future needed actions asked by the moderator:

**Impact KPI:** Business cases must be improved

**tKPI:** tKPI It is impossible to verify the work progress from the technical point of view

**Milestones:** Video, pictures or other milestone must be uploaded on the Echord portal

**Deliverables:** Too much delays on deliverables and too few details explained

**Dissemination:** Links or other verifiable means should be provided on the Echord portal

## Wires

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### Summary:

The goal of the project is to develop an automated system for wiring of switchgears. The work involves design of a new gripper with a tactile sensors and a vision system for precise localization of the components and wires.

So far the work has been progressing well, some additional tasks e.g. development of an external vision system for precise localization of the wire in the gripper has been performed. This system is used to augment the efficiency of the tactile system integrated with the gripper that was developed in the project. In order to successfully manipulate the wires during insertion in the sockets an extensive research on modelling the deformation

of the wires has been performed.

The experimenters have also proposed a new method of generating semi-automatically data for deep-learning based training of electronic components recognition system.

There have been slight changes in the schedule of the project – in order to prepare two submissions to ICRA task 3 has been temporarily delayed while the effort focused on tasks 4 and 5. Overall it is a good project that can be expected to deliver meaningful results. Therefore, the new gripper has not been prepared yet, and the experiments are performed using sensorized version of two commercial grippers.

### **Justifications for yellow or red lights**

Due to a slight change in the schedule described below deliverable D4 (End effector prototype) and the corresponding milestone 3 (End effector validation) are delayed. However, the overall status and quality of deliverables and milestones is good. The two last self-assessments are missing.

## **Keraal**

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### **Summary:**

The overall project is on track. Problem in deliverables and Dissemination milestones observed. I push experimenters to provide more technical details. The experimenters not responded yet to provide relevant information. Progress is on track according to self-assessment by Experimenters. The technical moderator is in contact with them, overall, they are doing well.

### **Justifications for yellow or red lights**

- Deliverables: Domestiarion of Robot Coach due on September 17 not yet delivered and Ethical approval achieved but no document uploaded
- tKPI: Automatic detection of all exercises due on 1/6/2017 are not yet completed
- iKPI: interest from the therapists questionnaire due on 1/9/2017 is not yet delivered

## **Saferun**

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### **Summary:**

Most of the technical work in the Experiment is finished, they have successfully integrated their software into the industrial partner's platform (E80) and successfully implemented and demonstrated in an end-user factory (PREGEL). All is left is data collection for post-processing. Impact of the Experiment is a bit of a question mark. The industrial partner E80 is getting a benefit from it, in the form of an improved product (although the improvement is hard to quantify). Specific impact for the end-user and academic partner are unclear.

## **Radoroso**

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### **Summary:**

The Experimenters are under-delivering, relying on previous work in another project.

After the Moderating Team pointed out the problem, they said they were intent on correcting course. Judging from material delivered, that has been only very partially the case. A few, low-effort, additional aspects have been included, but the overall package still falls short of the target. Final TRL is expected to be very low, and industrial accordingly weak. A firm tone is probably necessary to try to get as much as possible from them. In addition, we should start to carefully assess efforts expanded, to have concrete elements supporting the diagnostic of under-delivery.

### **Justifications for yellow or red lights**

- Self-Assessment
- Deliverables: small delay (less than 1 month) but poor quality for large deviation
- iKPI: #1 not OK
- dKPI: only website but without ECHORD++ logo

### **Homerehab**

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#### **Summary:**

The goal of the project is to develop an affordable and mobile system for rehabilitation of upper limbs. In the last period the Experimenters have finalized development of the prototype system which will be used in the validation trials in the hospital. The robotic system offers all the expected functionalities: movement in 6 degrees of movement, force support, gravity compensation etc. The device allows the user to control 3D games in order to motivate him/her to properly execute the exercises. A patient's state monitoring system was also developed, though it is a bit simplistic with respect to the initial claims. The tele-rehabilitation platform offering remote access to patient's rehabilitation progress and state data needs some final polishing as well. The experimenters are going to start testing trials in a local hospital in the second half of November.

Overall, the project is going well and most of the deficiencies reported earlier were resolved. There is a slight delay caused by necessity to get ethics approval, so an extension of the project may be needed.

### **Fastkit**

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#### **Summary:**

Technical progress has been good, but likely final prototype TRL is fairly modest (5 to 6). The system developed has and will help the team in securing follow-up funding, several industrials have expressed interest, one of them having signified their willingness to invest in the technology. Most functionalities have been integrated (locomotion, localisation, grasping), but a number of aspects remain to be implemented (constrained manipulator configuration instead of the current suspended) or improved (localisation, control of cable tension).

### **Justifications for yellow or red lights**

- iKPI: missing information
- dKPI: press release text is not provided

## Cocomaps

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### **Summary:**

The initial goal of the project was to develop a collaborative, cognitive architecture allowing robots to have meaningful conversations with humans, to extract task-relevant information from them and then to act depending on the results of the conversation. Several components ranging from the scene-understanding to human-tracking to voice recognition were to be developed, while the cognitive architecture and conversation module were to be developed by extending the pre-existing software.

The project is significantly affected by delays and divergence from the original objectives. The first is, according to the Experimenters, caused by postponed initial payment, which had catastrophic impact on the original schedule (necessity to find a new employee, unavailability of the robot originally selected for the project etc.). The second is caused by having to use different robots than the originally selected, which in turn resulted in different sensors available.

The experimenters applied for an extension of the project and a revision of the KPI document to cope with those hindrances. According to the proposal, the deadlines for all the deliverables and KPIs would be postponed by three months to compensate for the initial delay. The Experimenters would also like to switch the scope of the image processing tasks from navigation and object recognition to emotions recognition and human detection, which seem to be more relevant to the development of a dialogue based system.

In the current state of the development it is unclear if the Experimenters will be able to deliver the solution presented in the proposal. A lot of the components is still under development; the scope of the demonstration has changed as well. An interim review of the experiment will be organized before making the decision on the potential extension of the project.

### **Justifications for yellow or red lights**

No self-assessments available on the platform in the reported period.

Deliverables T8.D1 (Draft Collaborative Cognitive Map) overdue 6 months, T9.D1 (Demo 1: Collaborative Visual Detection) overdue 5 months, T8.D2 (Final Collaborative Cognitive Map) overdue 2 months and T10.D1 (Demo 2: Collaborative Visual Search) overdue 1 month.

Milestones 4 (Demonstration 1), 5 (Collaborative Cognitive Map Complete) and 6 (Demonstration 2) not completed on time.

None of the tKPIs achieved, the iKPI 2 (Psychone framework) due on the 1st September not available either, reports from networking with customers (dKPI 5,6,7), press releases (dKPI 2 and 3) not available.

## Grape

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### **Summary:**

About the Period Reports the experimenters obtained, right now, two green lights and a red light. The Report for the 4th Period has been uploaded and assessed with a green light.

Although the experiment started with some difficulties and delays, according to moderators' opinion now the progress is positive and they hope that no more red lights will be set in the research area. However, experimenters should take care of the actions needed in the portal such as marking as "OK" the activities done.

Website has to be modified including ECHORD funding reference.

### **Justifications for yellow or red lights**

- Milestone: Huge delay - Milestone3
- tKPI: Huge delay - All tKPI

## Catch

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### **Summary**

The monitoring periodic report #3 was delivered to moderators on May 18th, 2017 (two months and a half late). In the moderators' opinion about this 3° periodic report (Jan-Feb 2017), the paragraph 2 (T1) describes the same work done in D1 (Dec 2016). Furthermore, the T1 had to end on Feb. 2017, but it continued until Apr. 2017, this decision was taken by CATCH experimenters. About the paragraph 5 (T4), the work done respect to the 2° periodic report is not clear. So, considering all that, the traffic light should be yellow.

Regarding monitoring periodic report #4, connecting this new contribution with the previous information provided by Experimenters, in general, in the moderators' opinion, having into account the previous information and this new information that is submitted, the project seems to be running correctly during this fourth considered monitoring period report.

Regarding monitoring periodic report #5, connecting this new contribution with the previous information provided by Experimenters, in general, the project seems to have a correct evolution during this considered fifth period. Raffaele suggested to highlight how CATCH Experimenters faced and overcame the critical issues such as vision, arms coordination and gripping. However, it is detected an important delay in the submission of the documentation. In addition, there are some questions that should be clarified for a correct implementation of the platform concerning the behavior of the aforementioned platform face with surface irregularities and the correct detection of the fruit position.

Raffaele sent an e-mail with a request of information regarding the delay but no answer was given.

### **Justifications for yellow or red lights**

- Self-Assessment: Some delays are detected in some assessments.
- Milestones: Delays in providing the deliverables to know the achieved

milestones.

- Deliverables: Delays in providing the deliverables and some deliverable is not uploaded on CATCH Portal yet (in particular, Deliverable #D3 ("Robot and Control System")).
- Technical KPIs: Delays in providing the KPIs.

## Hyq-Real

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### **Summary**

They are late on integration, due in part to delays in obtaining some of the components, in particular the MOOG ISA, which is a complicated piece of hardware with a sophisticated conception process (3D printed metal). Most components are on the way, and they are beginning the main integration task. They asked for an extension to have the time to finish integration and testing comfortably, the Technical Moderator is in favor of this request. They have secured funding for a follow-up.

### **Justifications for yellow or red lights**

- Deliverables: Additional comments on D2.2 were requested by the technical moderator during a specific call.