Specifications after 1 month

	Description of requirements after Phase I	Description of implementation plan for Phase I (to be delivered after 1 month – by January 31, 2016)
General requirements		
Overall system	Specification of overall system setup with geometric parameters, weight of the system, description of interaction modalities. One single prototype mainly with mock-up functionalities, see below.	This will be done inside T2, leaded by Metralabs with the help of UMA and the support from the other partners. The following works have been performed during the first month (M1): • A first software architecture has been agreed and the work to be done on each part of it is distributed among the partners. • Hardware requirements and integration between sensors and the robotic platform have been studied and a first model has been proposed. • Interaction modalities agreed: the system will be able to communicate using natural language, it will also use a touch screen, and the patient could be provided with a tablet upon request. The use of the kinect sensor for gestural interaction with the system will be studied during Phase II. Specific tasks to be done during Phase I are: • Complete definition of the physical and software architectures of the framework, including the CGAmed modules for data management within the project (review and edition of audio/video and test files, data transferring to the CDMS or other external systems) and the robot, and all interfaces (patient/relative - robot, clinician - robot, clinician - CGAmed) (M2, All). • Complete definition of the physical and software architecture of the CLARK robot and how all hardware devices (camera, kinect, microphone, etc.) will be integrated into it (M4, Metralabs and UMA). • Building a first prototype of the CLARK robot. It will port all required sensors, as well as batteries, barebones, switch, etc. (M5, Metralabs). • Integration of all software perception modules within the software

		architecture (M4, UMA) • Integration of the Pelea Automated Planning architecture within the software architecture (M4, UC3M). This includes the specification of the information that has to be gathered from the environment, the format it will be provided on and the way the high-level reasoning module will command the other modules to obtain it, including for example activating or deactivating a given module, moving the robot to a certain position, etc. • Mock-up of all GUIs linked to the framework interfaces (patient/relative - robot, clinician - robot, clinician - CGAmed) (M5, Metralabs). A first prototype of the system able to perform the requested tests (Barthel, MMSE and Time up and Go) will be provided at M5 to be tested at SAS by the beginning of June as part of T3.
Weight	The specified system must be portable by a normal human, the first prototype can be bigger/heavier, but needs to give an impression of the final one at the end of stage III.	The prototype from Metralabs will be an autonomous mobile service robot. Its weight will be close to 50 Kgr and could be moved by a normal person. Once installed, the robot will use its autonomous capabilities to navigate within its operational environment, hence no lifting or manipulation will be necessary beyond installing the system. Intelligent autonomous movement will not be available for this phase but will be added later. A document covering the complete robot specification will be provided at M6 (Metralabs).
Power supply	The specified system must be able to be operated both in battery mode for at least 8 hours, as well as in plugged-in mode, the first prototype can be powered by cable. For the final systems, inability to operate in battery mode may be an critical problem because the device will be used in patient's rooms or small places where plugging may be very complicated	The prototype from Metralabs is currently able to work in battery mode for more than 8 hours. It can also work in plugged-in mode and recharge itself autonomously between sessions. This requirement will be detailed at the CLARK robot specifications.
Language interface	Technical concept and prototype of a robust natural language interface which allows for multi-language support. Prototypes in stage I and II can use any European language (preferably English, Spanish, or Catalan), but the capability for multi-	This will be performed inside T2 (M5, UMA). The multi-language support will be afforded by acquiring the language preference of the users from the patient profile stored within the system. The Language identifier will determine the text on the interfaces and the language employed at the

	language support has to be demonstrated	verbal channel. For the TTS part, we are currently using Festival, for Spanish and English languages. For the ASR part, we are currently able to compile a grammar for dealing with Spanish or English languages within the Microsoft Speech Platform SDK. Robustness on the interface will be achieved by taking into consideration the specific Context where the speech is captured. For instance, within the Barthel test, the robot will ask the patient (or relative) to answer the questions with one of three options: 'zero', 'five' or 'ten' points. Of course, other words will appear on the responses, but the correct spelling/understanding of these specific words should be specifically trained. In the different questions within the MMSE test other words must be intensively analysed and tested. The Context identifier is known by the automated planner in charge of supervising the course of action, and it will be the responsible of providing this information (as a parameter that modulates the behaviour) to the rest of software components on the architecture.
Touch-screen interaction	Mock-up of touch-screen based interaction for all sorts of dialogues, for tests, configuration, and evaluation/data management. Other, yet easy to use and robust interaction modalities besides spoken language are also possible for the tests. They need to be able to be used if the natural language interface is not suitable, e.g. when a patient is not or only hardly able to speak. Also here, the multi-language issues apply in the same form as described above	The touch-screen integration will be performed inside T2. Specific tasks to be performed are: • Capture of the GUI4PRI (GUI for patient-robot interaction) requirements for each of the users and use cases (M2, SAS) • Definition of the requirements and features of the integrated HRI system using both natural language (see above) and touch-screen (M3, UMA) for each use case. • Study of accessibility and legal issues regarding the user interfaces (M2, UC3M). Currently started; a document will be distributed by mid-February. • Creation of the GUI4PRI mock-up according to the previous requirements (M5, UMA). In addition to an embedded touch screen, the robot will port a tablet and, upon request, the relative or patient could take it and use to interact with the robot. This tablet will mirror the GUI4PRI at the touch-screen but will allow the user to work with this interface in a more easy way. The integration of verbal (speech) and non-verbal (touch-screen) channels for HRI is currently solved by the use of a common inner model (UMA)

Motion tracking	Concept and exact specification of motion tracking system with planned analyses in context of the Get up and Go test and the Tinetti Balance and Gait tests	The motion tracking system will be endowed within one of the software modules on the architecture inside T2. Tasks to accomplish include: • Capture of a collection of real Get up and Go tests using the kinect v2. The mock-up capture system is currently working at the Hospital Universitario Virgen del Rocio at Seville (M2, SAS). • Develop a draft of the GUI4CCI (GUI for clinician - CGAmed interaction) that will be able to graphically provide the clinicians all details about the collected data (video and evolution of the patient's joints with time) (M4, UMA). See below ('Patient-specific view' item). • Manually scoring the collection of recorded tests (M3, SAS). • Selection of the main characteristics (time and/or joints' behaviour) that will compose the feature vector defining the execution of the test (Experts on CGA from the SAS and on human motion capture from UMA, M4). • Evaluation of the correlation among features and scores. Specification of a machine learning framework for automating the scoring process (M6, UC3M).
Mobility		
Platform's ability in terms of person following, face tracking, and similar advanced features	Implementation of patient motion tracking functions on sensors used for activity analysis.	As described above, the motion tracking system will be developed and integrated in the system inside T2. Sensors required for this feature (kinect v2) will be incorporated to the first implemented prototype (M5). Tasks to be done inside Phase I regarding this item are: • Analysis of the advanced features required to successfully interact with the patient and to perform the different CGA tests (M2, SAS and UMA). • Usage of the results of previous analysis in the hardware design of the platform (M4, Metralabs and UMA). • Capture of a collection of real required tests (Barthel, MMSE and Time up and Go) using the kinect v2. The mock-up capture system is currently working at the Hospital Universitario Virgen del Rocio at Seville (M2, SAS). • Implementation of advanced perceptual features involved in the

		tests to be demonstrated in Phase I (M5, UMA). • In future phases the robot will also be able to move, keeping interacting people in the perceptual field of its sensors. The prototype in Phase I will be endowed with the ability to execute these behaviours (M5, Metralabs).
Actual testing		
Dialogue (questionnaire)-based tests	Mock-up of the dialogue-based Barthel test	This will be performed inside T1 (UC3M and SAS), although some tasks are common with "Touch-screen interaction" item (see above). Tasks are: • Create a use case description for the Barthel and MMSE tests (M1, SAS). A first version has been currently created. • Create a PDDL description for the above tests (M3, UC3M). A preliminary version of the automated planning domain for the Barthel test has been created. It will be enriched by studying the remaining tests. By the beginning of June it will be able to manage the flow of the required tests in a fully autonomous way.
Tests based on motion analysis	Mock-up of the Get Up and Go test.	Tasks to be performed are similar to the previous item ones, but some extra ones appear: • Creating a use case description for the Get up and Go test (M1, SAS). • Creating a PDDL description for the above test (M3, UC3M). • Defining the algorithms that will be used to analyze the test results (see "Motion tracking", UMA and UC3M)
Audio/Video recording	Proof of concept of the ability to record patients while they are performing the selected tests. Video recording is especially important for gait or balance tests, and audio and video for mental tests. The system should provide suitable point and field of view for the tests.	This will be performed inside T2 with some support from T1. Tasks are: • Definition of the most appropriate points to record each test (or even for specific parts of each test) (M3, SAS). In next phases the robot will be commanded to autonomously reach those points. • Definition of the video/audio formats and the storage/transmission requirements (M2, UMA). • Definition and implementation of the recording management procedure (M3, UC3M). Recording will be managed by the automated planning system which will also tag the audio/video files using timestamps and semantic information.
Evaluation and data		

management		
Patient-specific view	Mock-up of the dashboard for one patient's data including his development in test results, and access to raw data, such as answers given in a specific test or videos and other visualisation of the motion analysis.	This will be performed mainly inside T2. Tasks to be performed are: • Capture of the GUI4CCI requirements for physicians (M2, SAS). • Study of accessibility and legal issues regarding data access (M2, UC3M). • Creation of the GUI4CCI mock-up according to the previous requirements (M5, UMA). This work will include the partial GUI4CCI developed at 'Motion tracking' item (see above)
Analysis of results	Concept to interpret and codify patients/relatives answers of selected tests and to calculate test scores based on codified information. The Health Professional has to be able to modify or correct tests scores	Work on this item will be mainly performed in T7 (phase III), but some preliminary work will be conducted during phase I, namely: • Study of interpretation/codification strategies for questionnaire-based tests, focusing on activities performed by the patient (e.g. drawing). Suitable machine learning techniques will be selected (M5, UC3M and UMA) • Study of interpretation/codification strategies for movement-based tests. Suitable machine learning techniques will be selected (M6, UMA and UC3M) Tests scores automatically assigned by CLARK (Barthel, MMSE or Get up and Go) can be corrected by the Health Professional using the GUI4CCI developed within the 'Patient-specific view' item. It will constitute the clinician - CGAmed interface described at the 'Overall system' item.
Integration into clinical data management	Possibility to interface with clinical data sys- tems in the overall concept	As part of T1 SAS will define the technological requirements to interface with the Hospital clinical data system (CDMS), based on standard specifications, both to recover and to store data. Within the whole framework, this interface will connect the CDMS with the CGAmed server. The data on the CGAmed will be structured according to the interoperability profiles recommended for public procurement by the European Commission. In addition, HL7 standards will be applied to integrate specific information about the test and audio or video data. The integration will follow then a direct pathway for some parts of the stored patient data but we should need to define new mechanisms for the use of video and audio combined with the medical test scores. Within this stage, a document will summarize how this interface could be solved, addressing

		also data protection and confidentiality issues (M6). A first draft of the CGAmed server (models of the patients or sessions) will be defined by SAS and UC3M, and implemented with the help of software engineers from the UMA team.
Data protection	Description of data protection concept and fulfilment of standards	Also as part of T1 SAS will describe the data protection requirements and include them in the former document (M6, see previous point)
Configuration		
Patient- specific configuration	Mock-up of system dialogues for selection of tests and definition of test sequences in form of flow charts, handling of patient data	Within the overall system, we will define a specific interface between clinician and robot. The idea of this interface, controlled through a specific GUI4CRI (GUI for clinician-robot interaction), is not the patient-specific view (covered by the GUICCI, see above) but the configuration of the daily agenda of the robot (and of the clinician). The implemented GUI4CRI (M5, UC3M) will allow the clinician to consult the patient data from the CGAmed, but mainly to set the tests to perform for each specific patient, and the planned time/date or the room where these tests will be performed. The design and usability of the GUI will be supervised and tested by the personnel from the SAS team.
Integration of new/additional tests	Mock-up of a functionality to develop a new questionnaire-type tests.	This will be done as part of T1, with the following tasks: • Definition of the generic types of questions that could be part of a clinical questionnaire-based test. (M3, SAS) • Mock-up of the interface for creating the new tests and their integration into the GUI4CRI (M6, UC3M)
Integration of new tests based on motion/video analysis	Description of concept. This type of new assessments need the help of system experts, but the specified system should have the possibility to add such things.	This will also be done as part of T1. Tasks: • Definition of generic types of motion/video analysis tests that could possibly be needed. (M5, SAS) • Evaluation of the ability of the architecture to automatically record and analyze these new tests (M6, UMA and UC3M). The proposed architecture is modular so new modules to capture/record the new tests can be added easily.

Calibration	Mention, if there is a need to calibrate the motion detection component	In order to be fully functional, the CLARK robot will only need a minor specific calibration step on this stage (speakers and shotgun microphone tuning) (UMA). Human motion detection will be afforded using the kinect v2 sensor and will not require any specific calibration. In further phases of the project, when the navigation skill is finally evaluated for its implementation, we should need to define the map of the space (Metralabs).