

D2.4.3 Glove Prototype, third iteration



ID and title	D2.4.3 Glove Prototype, third iteration. Public version
Description	This document describes the glove prototype, third iteration.
Work package	WP2 Hardware and Firmware Development
Status	External release
Type	Report
Confidentiality	PUBLIC
Version	V2.0
Actual date of delivery	02.10.2015 (internal release) 14.01.2016 (external release)
Contractual date of delivery	30.09.2015 (M17)
Reviewer for external release	RRD/Hocoma

Project name	ironHand
Project number	AAL-2013-6-134
Project start date	1 May 2014
Project duration	3 years



AMBIENT ASSISTED LIVING

JOINT PROGRAMME

AAL-2013-6-134

Document history

Version	Date	Status	Changes	Owner(s)
v0.1	16.09.2015	First draft		Martin Wahlstedt, Bioservo
V1.0	02.10.2015	Internal release	Finalisation	Martin Wahlstedt, Bioservo
V1.1	09-11-2015	Internal review		Bob Radder, Gerdienke Prange, RRD
V1.2	13-11-2015	For SG approval	Updates after review	Martin Wahlstedt, Bioservo
V2.0	14-01-2016	External release	Approved by SG	

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1 Introduction

The third iteration of the glove prototype will be a glove tailored for activities of daily living (ADL) and will be ready for testing the orthotic effect during clinical measurements (such as the Box and Blocks Test, Jebsen Taylor Hand Function Test and grip strength measurements) and functional tasks.

1.1 Findings from feasibility test

Improvements for this version are based on feedback from the feasibility study performed in T4.3. A few of the comments are listed below.

- Difficult to close the zippers of the glove
- Difficult to grasp the cap of the bottle
- The glove felt warm
- Some people didn't know how to place the Velcro

In general, improvements have focused on improving donning/doffing, airiness, general usability and to minimise the impact of the glove for fine motor tasks.

2 System Overview

The ironHand (iH) assistive system can support the hand function in case of reduced grip strength and/or reduced hand function. It strengthens the human hand by using artificial tendons and motors that give additional force to the thumb, middle and ring finger. The index finger is kept unaffected to allow for fine motor manipulation that don't require a force grip. The ironHand Assistive system consists of two main parts:

- **Glove.** The main purpose of the glove is to apply the forces generated by the motors in the control unit and to provide the control unit with sensory input from touch sensors at the fingertips of the covered fingers and along the ventral side of the middle finger. The forces are applied by artificial tendons that are sewn into the glove along the length of the fingers.
- **Control unit.** The control unit contains a battery for power source, one motor for each finger that receives extra force and a microcontroller that controls the ironHand Assistive system functionality.

A cord connects the control unit with the glove and holds the artificial tendons as well as electrical cables for sensors. Close to the glove there is a connection that can be opened, separating the glove from the control unit. This gives the possibility to switch between gloves or replace an old glove. See Figure 1 and Figure 2 .

When an object is touched with the aid of the ironHand Assistive system, the touch sensors send a signal to the control unit which pulls the tendons such that the force in the grip becomes larger. The extra force applied by the glove is in proportion to the force applied by the user. Hence, the user can control (increase and decrease) the extra force applied by the ironHand Assistive system. In addition to this, the relation between the force applied by the user and the force added by the system is adjustable via the user interface. Two factors can be adjusted: maximum force and sensitivity. For more information about this and how to configure the system, see the User Guide (D3.4.6).

The glove is designed to support grips involving the whole hand (triggered by the fingertip sensors), as well as the hook grip (triggered by a sensor on the 2nd phalange of the middle finger). Grips triggered by the fingertip sensors directly follows the user's intention: when the user applies more force him/herself, the glove responds by adding more force, and vice versa. The hook grip works slightly different: when the user triggers the hook grip by e.g. lifting a bag the middle and ring finger are contracted to ensure that a steady grip is applied. This enables the user to e.g. carry a bag for a longer period of time, even if his/her own force is lowered due to lack of endurance. When the grasped object is released, the grip will release within a short period of time.

2.1 System illustration

Below are a number of pictures showing the system on a user and close-ups of the ingoing parts.

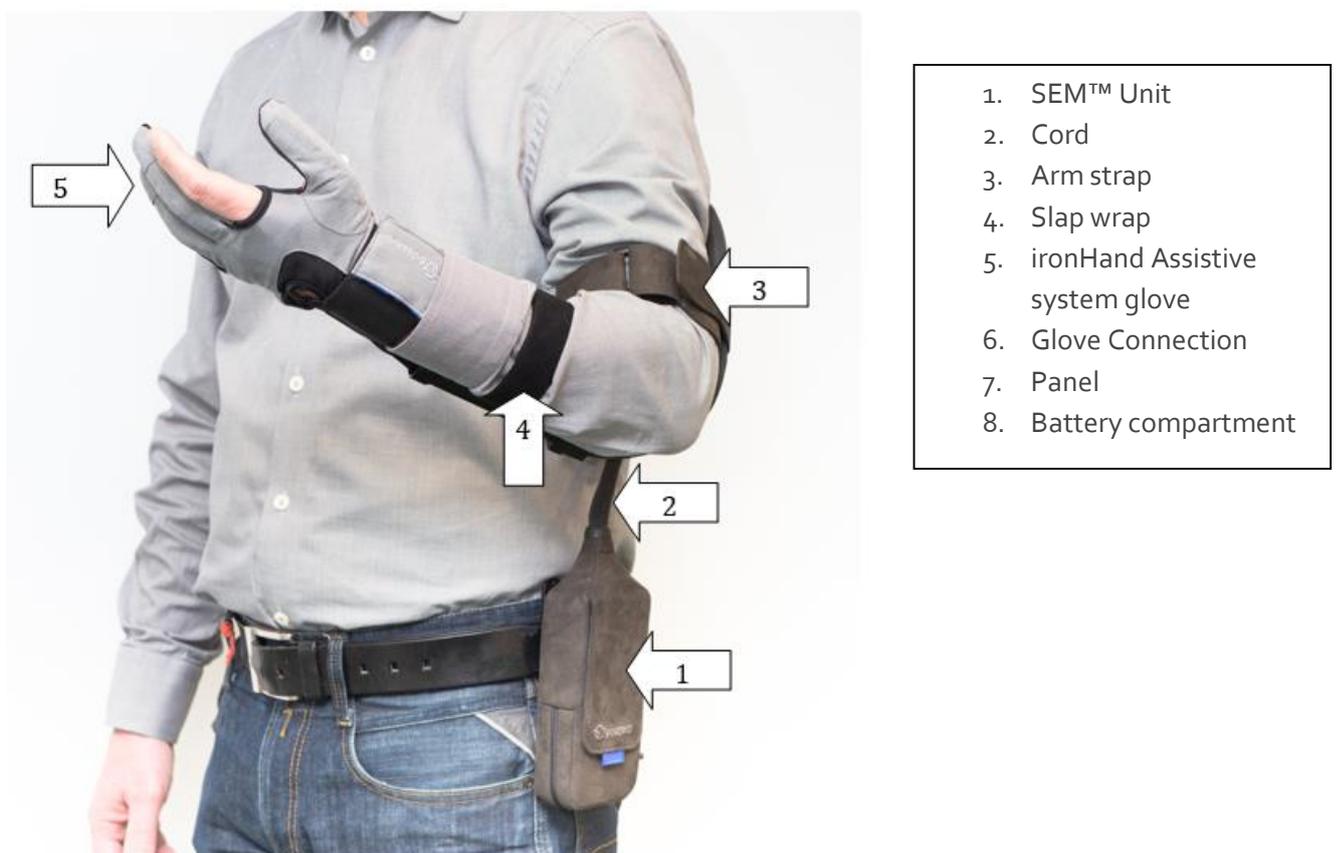


FIGURE 1. THE SYSTEM ON A USER



FIGURE 2. CONTROL UNIT AND GLOVE CLOSE-UP