Software Detailed Design Specifications

Autogoni

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Revision History

Revision	Date	Revised By	Notes
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1. Introduction

1.1 Purpose

The purpose of this document is to describe the Software Detailed Design Specifications.

1.2 Scope

All of the design principles involving the software will be outlined and described in this document. For details regarding the hardware and system, please refer to the Hardware and System Detailed Design Specification documents.

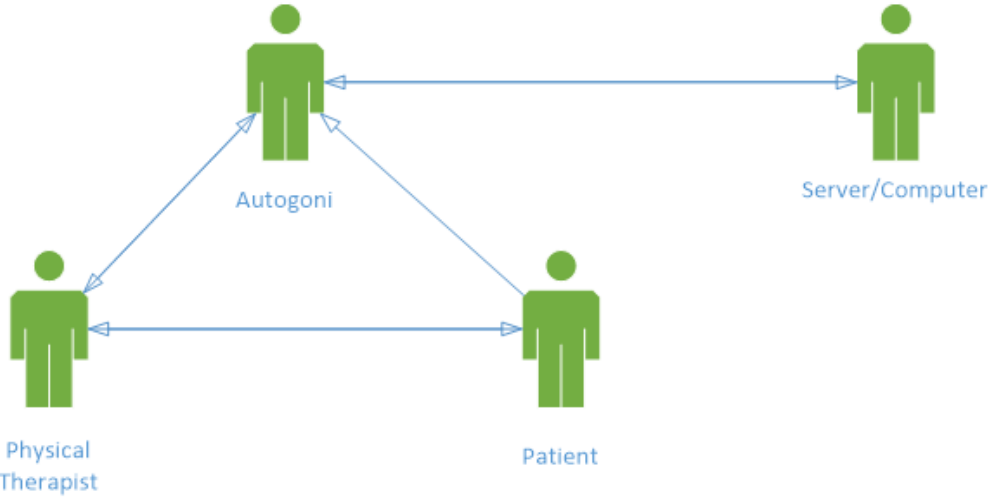

Figure 1: Basic, interaction based use case diagram of the Autogoni device.

1.3 Software Description

The software on the AutoGoni receives the measured joint angles from the hardware. It stores this data and transmits it to the PC when connected via USB. The software also includes the GUI. It displays menu items that the user can cycle through to navigate to their desired option.

1.4 Terms and Definitions

Table 1: Terms and definitions listed for reference.

Term	Definition
Goniometer	Instrument for the precise measurement of angles, especially one used to measure the angles of joints of the body
Joint angle	Angle between two body segments linked by a joint
Physical Therapist (PT)	Health care professionals who help patients reduce pain and improve or restore mobility
System Usability Scale (SUS)	Tool for measuring the usability of a system
User interface	Visual part of system through which a user interacts
GUI	Graphical user interface
PC	Personal computer
USB	Universal serial bus

2. Software Overview

2.1 Overall Description

This section describes the software of the system.

2.1.1 Software Functions

This section describes the functions that the software will accomplish.

2.1.1.1 Interpretation of Angle Measurements

The software must be able to coordinate with the hardware to read and interpret the angle measurements. This is accomplished by interpreting values sent by the rotary encoder hardware, and a 8-bit value is interpreted to represent a 7-bit position value. This allows the system to have a resolution of 128 values when interpreting angle measurements. The received value is converted to degrees by multiplying by (360 / 128).

2.1.1.2 Display of Values and User Interface

The software must be able to coordinate with the hardware to display output to the user. There are four overall variables to be tracking: the current angle measurement, all passive measurements, all active measurements, and the current measurement number.
These values are stored internally and the values are updated at 5Hz, by transmission over serial to the LCD.

2.1.1.3 User Interface of Autogoni

The software must be able to operate a user interface for control of the menu. The user interface implemented displays the current measurement number, the live angle measurement, the passive angle of the current measurement and active angle of the the current measurement.

2.1.1.4 User Interface of Computer Application

The computer application gives the user the ability to view all measurements in a table, make edits to the measurements, and store the measurements to a CSV file. The graphical user interface (GUI) was written in Python. There is a “Transfer Data” button to connect the computer to the Autogoni through a serial communication, a table to display all the measured values from the Autogoni, and entry field for the user to type in the name of the file they want to save to, and a “Save” button.

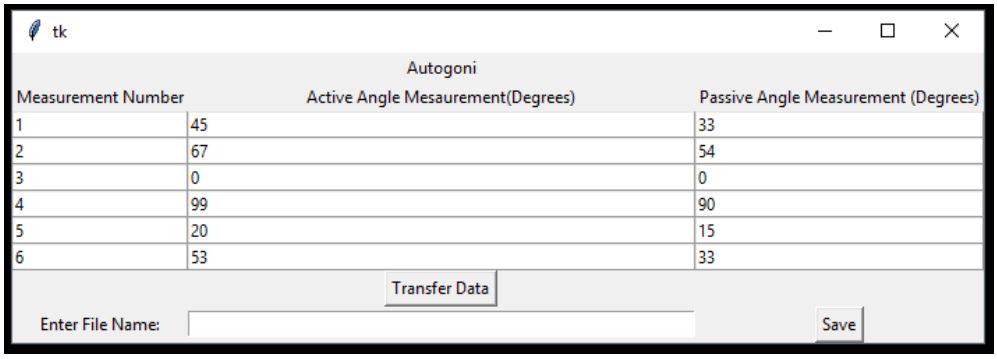

Figure 2: Screenshot of the computer application UI.

2.1.1.5 Data Transfer to Computer

To complete the data transfer from the Autogoni to the computer, the Autogoni must first be connected to the computer with a USB. Once connected, the user must hit the “Transfer Data” button to set up a serial communication port between the computer and the device. Next, the user

must press all three buttons on the Autogoni at the same time to tell it to transfer the data. The data gets transferred through the serial port and processed through the Python code. The code is able to filter out the overhead from the data transfer and isolate the various measurements. These measurements are used to display on the computer UI. If the user chooses to save the values to a file, Python is able to write all of these data values to individual, formatted elements in a CSV file.

2.2 State Diagram

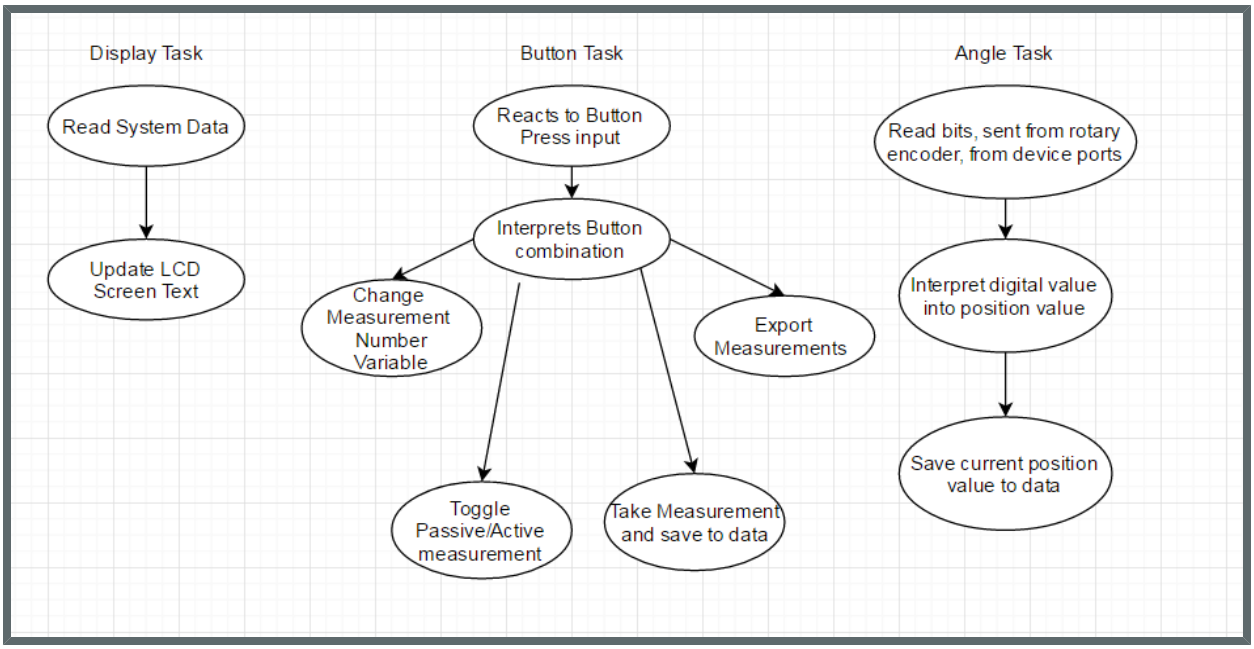

Figure 3: State diagram of software

3. Specific Requirements

3.1 Operating System Requirements

The operating system for the Autogoni will be a real time operating system that is operable on the chosen microcontroller.

3.2 Coding Language Requirements

The coding language used will have important functionality.

3.2.1 Interrupts

The coding language will have the ability to use and implement interrupts.

3.2.2 Multitasking

The coding language will have the ability to run multiple tasks at once.