FITT-table: Automatic Standing Table for an Active Work Style

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Introduction

The work environment is changing due to a growing number of flex working spaces. This results in individuals having to work behind different desks during the week. To improve the physical activity level of employees, sit-standing desks are provided to give individuals the possibility to have a more active work style. The use of sit-standing desks has been proven to enhance a more active and therefore healthy work routine [3,9]. The availability and overall use of the desks are however not yet fully implemented in the work routine [1]. The height-adjustable desks give employees the option to switch from sit to stand position, but the height is set on an ad-hoc basis by the individual employees themselves. The height might therefore not be the correct height to work in an ergonomically good position, leading to discomfort [10]. Guidelines should therefore be created to make sure employees can use these desks on a structural basis in an ergonomically responsible way [10].

For this purpose, the first version of the FITT-table was developed. This table is an automatic standing table that positions the table in an individual, ergonomically approved, sitting, or standing height including the personal preference of the user. By doing this, we want to create a personalized desk which motivates

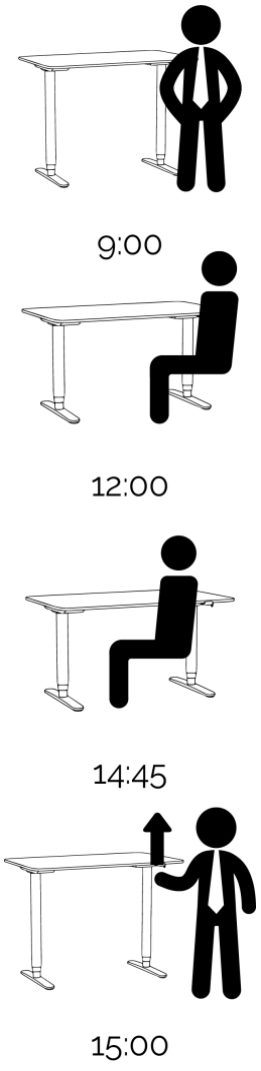

Figure 1. FITT-table scenario

employees to use- and change- positions in an ergonomically responsible manner while also promoting a more active work style.

Related work

When looking to active desks, cycle and treadmill desks are implemented in the office environment to enhance the physical activity patterns of individuals. These options give employees the option to be physically active while conducting their work. These interventions improve the activity pattern of individuals but do lower the overall work performance [11].

When looking at dynamic furniture for active workstyles, PositionPeak is developed [7]. This design gives induvial the option to change positions during meetings. The focus of the design is however on meetings rooms and not the personal workspace of individuals

When looking at automatic sit-standing tables the work of Barbieri et al., [2] shows a design that nudges individuals to switch to a standing position. In their design, they developed a semi-automatic table which schedules 10 minutes of standing after 50 min of sitting. A user can agree, refuse, or postpone (by 2 minutes). The results of implementing this table show a reduction of sitting time contributing positively to their health and well-being, without interrupting their regular work [2].

Based on the work findings of Barbieri et al., [2] we want to further extend this by additionally taking the daily activity pattern of individuals into account. The FITT-table will, next to being an automatic sit-standing table, collect the number of steps of users. The steps will be used to identify active and non-active periods and adapt its sitting and standing position based on this.

FITT-table

The FITT-table (Figure 2) is based on the existing IKEA automatic stand-sit BEKANT desk [8]. The controller of the table was adapted to override the UP and DOWN controls of the controller, based on the example of Rantanen [5]. The Ikea controller is connected to an Arduino mega. The Arduino Mega is connected to an MFRC522 RFID sensor and an ultrasonic HC-SR04 distance sensor. The RFID reader is used to read the RFID cards which are used as individual identification tags to put the table in its personalized standing or sitting position. The ultrasonic transducer is used to measure the height of the table. A Particle Photon is connected to the Arduino Mega via the TX/RX connection. The Particle Photon is used to obtain the step count of the user. The Fitbit step count data is collected via the Fitbit API, which sends the steps of the user to the Particle cloud in a set time interval. The Photon is subscribed to the step data event and calculates if the user has more or fewer steps than a set threshold. The connection of the Fitbit data and the FITT-table is based on earlier developed work of Brombacher et al., [4].

Figure 2. Development of the FITT table

Scenario

A person arrives at the office at 9:00 and walks to one of the flex desks. She scans her employee card at the table and the table adjusts its height to a standing position, which she pre-determined as her preferable working position. The personalized height of the desk is determined together with an ergonomist to have a good working posture.

After working in a standing position for a certain time interval, she can scan her employee card again and the table moves to its sitting position. She works in this position for another time interval and during this interval her Fitbit measures that she had not been moving too little. After several inactive periods, the table will autonomously move up, reminding the user to be active and change position during the workday (Figure 1).

Future development

The current version of the FITT table functions as a proof of concept and to explore the possibilities of automatic sit-stand tables to make people more active during their work routine. The current version of the table is however not ready to be set out in a field study. The table needs to be connected with the company database to use the employee cards (of another medium that can identify users) that are used within the company. A data logging system needs to be implemented to learn about the behavior and preferences of users. More research needs to be conducted on the position changes of the table to find the appropriate moments to go from sitting to standing, which fit in the existing work routine of individuals [6].

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