Artikel 5

by Elang Timoho

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The Development of A Simple Tool to Reduce the Sitting Time using Seeeduino Stalker and LabVIEW

Dian Artanto
[1]Department of Mechatronics, Polytechnic of Sanata Dharma, Yogyakarta, Indonesia
(Tel : +62-81328448740; E-mail: dian.artanto@gmail.com)

Abstract - This paper describes the development of a simple tool to record the sitting time of a user and give a warning if his/her sitting time exceeds the specified time limit. The tool was mounted on a chair to make the user free from the hassle of carrying it. The tool was made using a Seeeduino Stalker, which is a microcontroller board for wireless sensor network with data logger functionality. The tool was equipped with a pressure sensor, FSR, to determine whether the chair is occupied, and a Buzzer to provide a warning sign. LabVIEW software is used here to create a user-friendly display. By using the tool, it is expected that the user can reduce his/her sitting time.
Keyword: ***reduce sitting time, Seeeduino Stalker, FSR, Buzzer, LabVIEW.***

I. Introduction

In the article entitled "Sitting Time and All-Cause Mortality Risk in 222.497 Australian Adults", by Hidde et al, has founded that prolonged sitting is a risk factor for all cause mortality, independent of physical activity.

The same thing is also found in the article entitled "Sitting Time and Mortality from All Causes, Cardiovascular Disease, and Cancer". The author of this article, Peter et al, have provided evidence that daily time spent sitting was associated with an elevated risk of all-cause and cardiovascular disease mortality.

Similarly, a study titled "Role of Low Energy Expenditure and Sitting in Obesity, Metabolic Syndrome, Type 2 Diabetes, and Cardiovascular Disease" by Mark et al, reinforced the fact that prolonged sitting affects the health risks. The longer a person sits, the greater the risk to health.

As well as on a research titled "Deleterious Associations of Sitting Time and Television Viewing Time with Cardio metabolic Risk Biomarkers" by Alicia et al, has shown that sitting time and TV viewing time were deleteriously associated with cardio-metabolic risk biomarkers.

Therefore, the purpose of this paper is to develop a tool that can reduce the amount of the sitting time.

II. System Hardware

The tool developed in this study should have the following features:

- Able to detect the presence of someone who sits.
- Able to give a warning if his/her sitting time exceeds the specified limits.
- Able to record the sitting time data.
- The tool mounted on a wheeled chair. To make the chair can move freely, the equipment must be free from the power cable to the power cord and communication cable to the computer.

To achieve all the above features, the tool is developed with the following design:

- Using a pressure sensor, FSR (Force Sensing Resistor), which is placed on top of the seat cushion to detect whether someone is sitting. When a person sits, the value of pressure on the seat cushion will increase.
- Adding a Buzzer to give warning signals.
- Using a Seeeduino Stalker board to get data logger functionality with real time clock.
- A Seeeduino Stalker comes with Solar LiPolymer Ion Battery Charger, that could recharge itself by solar energy.
- By adding a Xbee, Seeeduino Stalker can communicate wirelessly with a computer.

Here is the implementation of the above design:

Fig. 1. The tool will be mounted on this chair

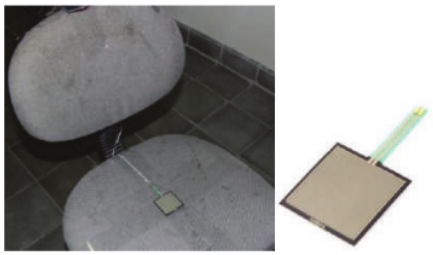

Fig. 2. A FSR sensor is placed on top of the seat cushion

Here is a schematic diagram of circuit that connects a FSR sensor and a Buzzer to ATmega328 microcontroller in a Seeeduino Stalker board:

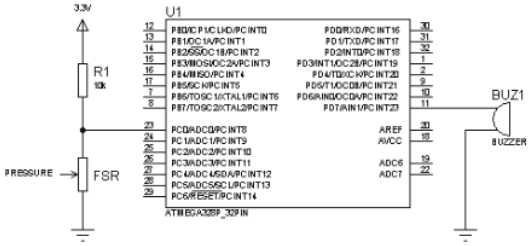

Fig. 3. A circuit shows connection between a FSR sensor, a Buzzer and ATmega328 microcontroller in Seeeduino Stalker board.

Here is a schematic diagram of the Seeeduino Stalker circuit board along with the component inside.

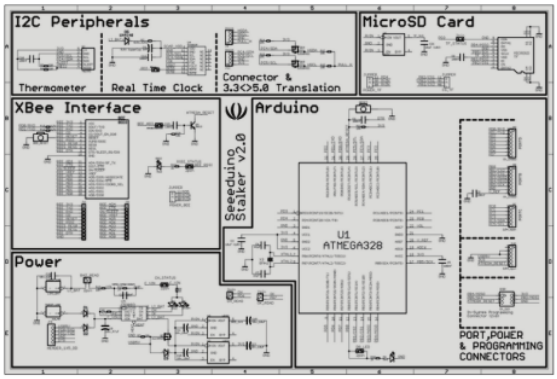

Fig. 4. Schematic diagram of the Seeeduino Stalker circuit board

Here is the entire component of the tool and each connection to the Seeeduino Stalker, including a Solar Cell, a Lippo Battery, a RTC (real time clock), a SDcard, a XBee, a Buzzer and a FSR.

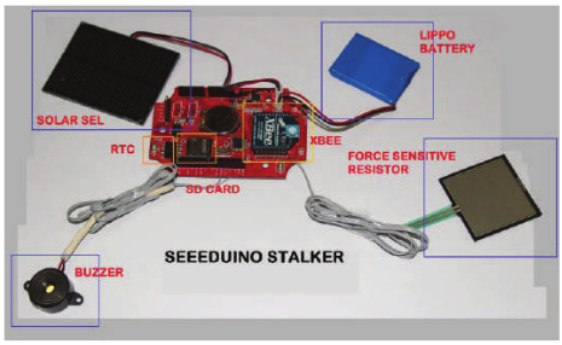

Fig. 5. Seeeduino Stalker connected with all components.

Here the circuit was placed in the back seat, unless the FSR sensor was placed on the seat cushion.

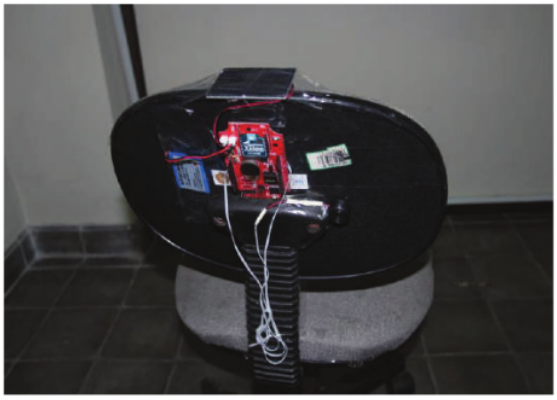

Fig. 6. The circuit was placed in the back seat.

III. System Software

The system software for the tool using Arduino and LabVIEW software: Arduino software for programming of ATmega328 microcontroller, and LabVIEW software for displaying the graphs of data on the computer.

Because the tool uses battery power, it is necessary to make savings in power consumption on Seeeduino Stalker board. This saving power consumption is done by making a Seeeduino Stalker sleep when not doing anything.

Further, the Seeeduino Stalker was programmed only to wake up briefly once every 6 minutes. When awake, the FSR sensor Stalker should read, save data into the SD card, send the data to the computer via the XBee and then sleep again.

In this application, the RTC on Seeeduino Stalker is necessary to provide the proper timing in real time.

For the application of warning, it is done by adding code that asks whether the sitting time have exceeded the time limit. If yes, then the Buzzer will sound. Buzzer will not stop sounding if the sensor still detects the person sitting. Buzzer will be silent if the sensor no longer detects the person sitting for 2 minutes. In this application, the time limit is set for 30 minutes, as recommended (see article “Sitting less for adults”). This time limit can be changed if desired.

For programming with LabVIEW software, the software used to be able to display the data of FSR pressure sensor in the bar charts forms, and process it so that it can be seen how much the sitting time per day and per month, along with notes about when the longest sitting time happen and when the shortest sitting time happen in one day. With the user friendly display, the user is expected to be more motivated and used to reduce her/his sitting time.

IV. Results And Discussion

Here is the file result of data storage on the SD card, which opened with Notepad.

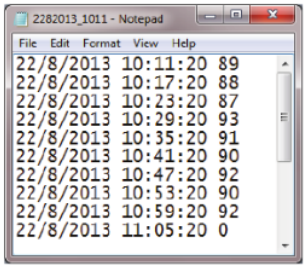

Fig. 7. Data of FSR sensor along with the time record.

Here is the graphic display of the sitting time data using LabVIEW software:

Fig. 8. Display data with graphic using LabVIEW software

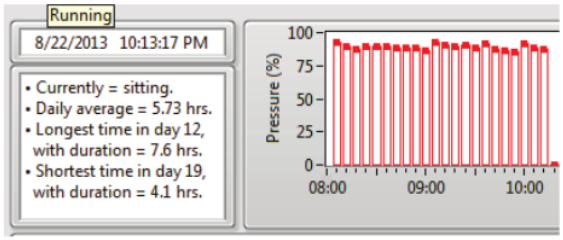

Fig. 9. Zooming image on the note of the display

IV. Conclusion

In this paper, a simple tool to reduce the sitting time has been described. From the results of the monitoring data on LabVIEW, after the tool is applied for a few days, the tool has been successful in reducing sitting time of user effectively. For further research, this tool will be equipped with a measurement of weight and blood sugar.

References

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[7] Datasheet of FSR (Force Sensing Resistor)

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