

# A Comparison and Evaluation between F-scan and Textile capacitive proximity sensor

Changwon Wang, Jonggab Ho, Jaekyung Kwak, and Se Dong Min

**Abstract**— We designed a textile capacitive proximity sensor of insole type and gait monitoring system. The TCPS contains a 10 sensor and consist of three layers. Low pass filter were used for remove noise using matlab2015a. Finally, we evaluated the system performance between F-scan and textile capacitive proximity sensor.

## I. INTRODUCTION

The gait is the most common activity in daily life and it is a basic parameter to monitor ones health status. Also, gait is the natural and convenient way to move in short distances. Currently, various researches are being conducted in detect of gait parameters using a conductive textile, which contains text count, stride time, and etc. [1-3]. In this paper, we developed a textile capacitive proximity sensor and gait monitoring system. Then, we evaluated the system performance between F-scan and TCPS. We expect that our proposed system will be helpful for gait monitoring and analysis research.

## II. METHODS AND RESULTS

Insole-type TCPS was developed based on capacitive proximity sensing theory. It contains a total 10 sensors and consists of three layer, including two shield layers and one sensor layer as illustrated in Fig. 1. It was designed 270 mm in length.

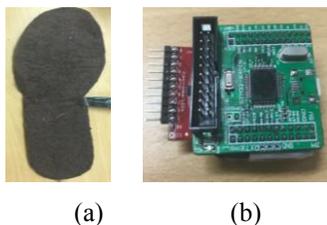


Figure 1. The structure of TCPS and gait data measurement board  
a) TCPS structure, b) data measurement board

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In order to convert analog to digital data, STM32-62pin board was used and transfer to PC using bluetooth communication. Data were collected from 10 healthy people that were between 22 and 30 years old. All subjects were instructed to walk on a treadmill at 1.5 km/h. Data were sampled at 100 Hz during 3 minutes and measured simultaneously using F-scan and TCPS as shown in Fig. 2.

As a result of the FFT, a gait data component was detected at less than 3 Hz. So, signal preprocessing were performed for obtain a lower noise data using low pass filter, which has 3 Hz cut-off frequency.

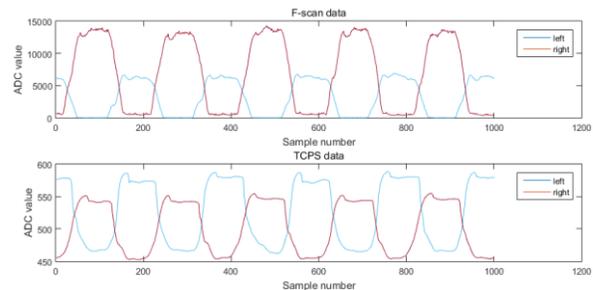


Figure 2. Gait raw data during 10 sec (F-scan and TCPS)

Correlation analysis was performed to evaluate a system performance between F-scan and TCPS. Also, it was performed for the remaining data except for 10 seconds before and after the experiment. As a result, correlation coefficient showed at 0.936 and p-value is 0.000.

TABLE I. RESULT OF CORRELATION ANALYSIS BETWEEN F-SCAN AND TCPS

|      |                         | F-scan         |
|------|-------------------------|----------------|
| TCPS | Correlation coefficient | <b>0.936**</b> |
|      | p-value                 | <b>0.000*</b>  |
|      | N                       | 16000          |

Our research shows that the gait data can be clearly measured by TCPS. In the future, we has plan to compare with various gait measurement system and advancement of TCPS.

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