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1. Introduction - Fitness Mat Dev Kit

The Fitness Mat Development Kit is designed for those who want to make smart products for fitness and wellness applications. This Development Kit will allow you to evaluate the Fitness Mat and fix your specific requirements for your final system, including integration requirements.

Sensing Tex is aware of each specific customer need for the Fitness Mat, considering the size, aspect, sensor area variations and wired or wireless solution for the data analysis, etc.

The Fitness Mat business model is based on the development of a final product with Sensing Tex through collaboration and partnership, licensing technology and creating an exploitation agreement.
About Fitness Mat Development Kit

The greatest way to do exercise and improve performance
Fitness Mat Dev Kit is a unique set of technology components for a product development in the fitness market. It offers a way to track posture and make sure you are doing your exercise right. Moreover, the Fitness Mat helps minimize the potential for personal harm and gets the best exercise results. Get real-time feedback in your fitness practice.

Virtual personal trainer
The best way to work out is doing it right, getting the best out of your trainning. With Fitness Mat Dev Kit you can build your customized personal trainer. The App is just an example of how it can recognize some fitness or yoga exercises. Get the most out of it by adapting it to your own exercises.

Easy installation
There is no installation work required; simply place the Fitness Mat on the floor, connect it to your Tablet, Phone or PC and begin your favorite exercise.

High integration
The sensors are integrated between two layers of high quality materials. The user will not notice any difference between a mat designed by Sensing Tex and a regular mat.
Precision
Since the system compares the pressures in several points throughout an extensive sensing matrix, this could further the development to lead an advanced algorithm, considering a person’s weight to distinguish between normal and risky body positions.

Easy to use
The Fitness Mat can be rolled up and be completely portable. The appearance is similar to a yoga fitness mat due to the high quality materials used in creating this fitness product.

With the kit you will get an idea of the possibilities of our system and its integrability. You can also build your own mat with your own materials or even integrate the sensor system in your already manufacturated mat. Do not hesitate to contact our engineering team.

2. Technical Features

The Fitness Mat Dev kit includes the following:

<table>
<thead>
<tr>
<th>Component</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ELECTRONIC MODULE</td>
<td>114_PST_SDK_05</td>
</tr>
<tr>
<td>TRANSPORTATION BAG</td>
<td>Transportation Bag</td>
</tr>
</tbody>
</table>

Figure 3: Fitness Mat Dev Kit Components

As it is described in the SDK documentation, basic software is delivered together with the SDK for your Windows-based PC and Android. The SDK is connected to your PC through a Bluetooth communication, for instance using a dongle Bluetooth, or USB standard cable.
3. Sensor and Mat Features

Sensor Features

Our standard product has been designed to offer you enough amount of sensors for a demo based on a mat size. The standard product is based on the features described below.

<table>
<thead>
<tr>
<th>Elements</th>
<th>Units</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Effective sensor size</td>
<td>mm</td>
<td>470 x 470</td>
</tr>
<tr>
<td>Sensor distribution (rows x columns)</td>
<td>#</td>
<td>16 x 16</td>
</tr>
<tr>
<td>Individual sensor size diameter</td>
<td>mm</td>
<td>20</td>
</tr>
<tr>
<td>Resolution (distance between sensor centers)</td>
<td>mm</td>
<td>30</td>
</tr>
<tr>
<td>Connector</td>
<td>mm</td>
<td>32 ways x 2,54 pitch</td>
</tr>
<tr>
<td>Total sensor matrix</td>
<td>#</td>
<td>256</td>
</tr>
</tbody>
</table>

![Figure 4: Sensor Layout](image)
Mat Features:

<table>
<thead>
<tr>
<th>Features</th>
<th>Units</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mat size</td>
<td>mm</td>
<td>570 x 510</td>
</tr>
<tr>
<td>Sensor distribution (rows x columns)</td>
<td>#</td>
<td>16 x 16</td>
</tr>
<tr>
<td>Layers (laminated materials)</td>
<td></td>
<td>Non-Skid Layer</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Stepping Layer</td>
</tr>
</tbody>
</table>

**Figure 5:** Mat Layout
4. Electronic Features

<table>
<thead>
<tr>
<th>Elements</th>
<th>Units</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size</td>
<td>mm</td>
<td>90x46x17</td>
</tr>
<tr>
<td>Digital resolution</td>
<td>bits</td>
<td>12</td>
</tr>
<tr>
<td>Inputs</td>
<td># x #</td>
<td>Multifunctional inputs for Sensing Tex Samples up to 16x16</td>
</tr>
<tr>
<td>Communication</td>
<td></td>
<td>USB &amp; BT</td>
</tr>
<tr>
<td>Frequency</td>
<td>frames/s</td>
<td>15</td>
</tr>
<tr>
<td>Battery</td>
<td>mAh</td>
<td>500</td>
</tr>
<tr>
<td>Cable USB</td>
<td>Type</td>
<td>Micro</td>
</tr>
</tbody>
</table>

**Figure 6**: 114 PST SDK 05
4.1 Powering The SDK Through The USB Connector

The SDK includes a USB B connector to allow wired communication with your PC. In this case, the USB cable will power also the SDK. For a quick test of the system, this is the recommended method.

4.2 Connecting The Fitness Mat To The SDK

The Fitness Mat is already connected to the SDK through two 16-pin connectors.

1. Place pins on the outside connector.

2. Switch on position and red light start blinking.

3. Ensure connection is complete. Also connect USB B to charge the battery or to connect to PC.
5. Software Features - APPs

The SK HW is provided together with Windows and Android Apps.

5.1 Windows App

![Figure 8: Hands and feet recognition with Fitness Mat software.](image)

The Windows App allows you to discover the capabilities of the Fitness Mat system. You can see the pressure mapping, recognize human patterns in real time and do some predefined exercises.

You can connect the App and the Fitness Mat System by using an USB cable or via Bluetooth. Please start by connecting the Fitness Mat to a PC through any of these options. Your computer will recognize it as a COM port and you will be ready to start using the App.
Pattern Recognition

The Fitness Mat has a 16x16 sensor matrix, which allows you to recognize human patterns.

Since the Development Kit Mat is big enough to make exercise on it and you have 256 sensors, the system will not recognize smooth patterns. In Sensing Tex we offer Mats, sensors and systems with more resolution. We can also make a personal design to match your needs.

As an example, in the next figures you can see a foot and a hand captured with the same windows App but using a 114 PST 03 Sensor (256 sensors in a smaller area)

![Figure 8: Hands and feet recognition with PST 03](image)

Exercises

With Fitness Mat Windows App you can make some exercises. They are divided in two groups (these tools have been created just as a basic demo to show what is possible):

**Floor Exercises counter**

1. Jumping jacks
2. Squat jumps

**Postures or Center of Gravity**

1. Warrior position.

By clicking on each exercise button the exercise starts (Figures below)
Jumping Jacks

A Jumping Jack is a physical jumping exercise performed by jumping to a position with the legs spread wide and the hands touching overhead, sometimes in a clap, and then returning to a position with the feet together and the arms at the sides.

Figure 9: Jumping Jack Exercise (button pressed).

Squat Jumps

During the Squats Jumps stand with your feet shoulder-width apart then do a regular squat and then jump up explosively.

Figure 10: Squat Jumps Exercise (button pressed).
Warrior Position

The Warrior Position exercise has the purpose of controlling your gravity center. The purpose of the exercise is to remain as much time as possible in the position shown in the selected button (Figure below), ensuring that your gravity center matches the screen center highlighted in the App.

Figure 11: Warrior Position Exercise.
Some examples of pattern recognition:

Crunches

The Fitness Mat system can also recognize crunches. The next two images are an example of its capabilities. In the first one you can see a person laying on the mat. You can recognize the feet, hip, shoulders and head. In the second one you can see more pressure on the hip, no shoulders or head touching the mat and less pressure on the feet.

These are captures of the two body positions when executing a crunch.

Respiratory Rate

Due to the sensitivity of our sensors, it is possible to detect respiratory rate. Simply lay on the mat and watch how your chest pattern changes while you breathe.

Your Own Application

The Development Kit shows you just a tiny amount of examples of what you can do with our sensing system: counting exercises, recognizing patterns, measuring the quality of the exercises, detecting breath rate, recognizing floor exercises, etc.
5.2 Android App

You can download the PST DEV KIT APP from the Google Play Store. This way, after selecting the sensor output, you can see the pressure maps on your Smartphone or Tablet.

![Android App on Google Play](image)

This App has equivalent functionalities to the Windows App described above with less function on pressure map image treatment.
6. Main Applications

The Fitness Mat has a large range of applications. It is going to be the next step on fitness technology. Users will finally be able to practice exercises on an intelligent platform and get the best results. The Fitness Mat specifically works in a few distinct models: In-Home Private, and In-Class Assist. As a complement in all kind of sports, it improves performance and help to do the exercise correctly, preventing injuries and everything that involves fitness.

*Fitness Mat will take your practice to the next level!*
7. FAQs

Which kind of applications can be developed with Fitness Mat?

You can add all the exercises you want. Our clients have developed mats for yoga, floor exercises, pattern recognition and a lot of different sports.

Can I recognize movements of the user or only position?

You can recognize not only the body parts that are touching the mat but also the pressure of each one. For example, the Fitness Mat can count pushups (hands and feet in the same position but with different forces during the exercise).

Can I improve the user experience?

Since our system can be connected to any available device via BT or USB, you can add the mat data and use it with any other information. You can use it with videos or images of the exercises. You can also show the user how to do the exercise and be able to know and notify the user what he/she is doing it. You can overlap with real-time images from a camera.

Is the Fitness Mat only for professional athletes?

The Fitness Mat is created for everyone who enjoys the practice of physical exercise.

What is the resolution of the Fitness Mat?

The sensor resolution sets the way you get the information and the smoothness with which the patterns will be recognized. The Fitness Mat has 256 sensor points in a 47x47cm area, which is enough for most of yoga or fitness uses. If you need more resolution or you want to get a better user experience, we can design higher resolution mats (with ~2000 points), so unique prints and smoother patterns can be recognized.

Can I have a different size mat?

Yes, the Fitness Mat Development Kit is only a designed sample, we can build mats based on the size you request.

Can I integrate the sensor feature into my mat?

Yes, the Fitness Mat Dev Kit integrates the sensor feature in some high quality fitness materials. The sensor system is slim enough to get inside most of fitness materials.

Can the Fitness Mat be connected to my iPhone?

The Fitness Mat is designed so that it can be connected to any device. It can be connected to an Android, Windows8, Windows10, iOS (iPhone/IPad/MAC). A wide range of Apps can be developed for this mat, which allows you to socially connect with other users, comparing your training.

Can the Fitness Mat be integrated with some other devices?

Yes, the Fitness Mat can integrate non-intrusive biosensors. For example, heart rate, respiration rate, and proximity sensors, among others. We can integrate lighting and some other actuators by request.
8. Maintenance and Operating Instructions

- Fitness Mat has to be rolled up with care.
- Perform a correct battery charge in each use to achieve better long life battery.
- The Fitness Mat can be cleaned with some soap and water with a tissue.

9. Legal Note

Sensing Tex commercialized products require a careful handling according to the provided instructions. Therefore, any manipulation, modification or transformation applied to Sensing Tex commercialized materials which do not match the standard existing protocols also given to the clients, or which are not strictly authorized by Sensing Tex, will cause an invalid existing product operation warranty, and Sensing Tex will not be responsible for any damage to the product or malfunction.

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