# MEDICAL DEVICE FOR VISUALLY IMPAIRED USERS AND USERS NOT VISUALLY IMPAIRED

## CROSS-REFERENCE TO RELATED APPLICATION

**[0001]** This application claims the benefit of European Patent Application No. 07022538.8 filed Nov. 21, 2007, the entire disclosure of which is hereby incorporated by reference.

## FIELD OF THE INVENTION

**[0002]** The present invention refers to a medical device, in particular for self testing and monitoring the concentration of analytes in a body fluid, or a blood parameter, or for the controlled administration of therapeutic agents, comprising a connectable, preferably pluggable Braille or Braille-like module for visually impaired users, so that both visually impaired users and users not visually impaired can read the data generated by the medical device and/or control the medical device.

## BACKGROUND

**[0003]** In many fields of healthcare, repeated measurement and monitoring of certain analytes present in body fluids, such as blood or urine, is of particular importance. One special case concerns for example patients affected by diabetes who need to measure very frequently the concentration of glucose in order to respond promptly with the correct medication. If certain limits are indeed exceeded, the affected patient might even incur in coma and death. The high concentration of glucose in the blood is also responsible for well known side effects gradually deteriorating the state of health. Therefore long term monitoring is required in order to keep the glycemic level under control. Blood glucose data are thus useful both to the physician who has the task to determine the most appropriate long-term therapy and to the patient who daily needs to adapt the administration of medications according to the measured glucose levels. These depend in fact not only on the diet, but also on the daily physical activity and many other factors, which influence the metabolism.

**[0004]** A number of small, reliable and low-cost medical devices, which can be handheld, are today available to the patient for self monitoring. Devices for controlled administration of therapeutic agents, such as insulin pumps, are also commercially available.

**[0005]** The number of examples of medical devices to which this invention refers to is however not limited to diabetes care. Worth mentioning are for example also those devices for monitoring blood pressure or other blood parameters like the coagulation factors.

**[0006]** A complication associated with the use of such medical devices arises when the patient or user is also visually impaired. This health condition might exist for example since birth or following a trauma, but progressive visual impairment eventually culminating in blindness is also one of the long-term side effects, cited above, caused by the high concentration of glucose in blood. In other words, it is relatively frequent for diabetic patients to be also visually impaired. Thus it is particularly by these that a valid solution to this technical problem is highly desired.

**[0007]** There are known examples of medical devices on the market such as glucose meters or insulin pumps which partly solve this problem by providing a talking function, i. e. providing an audible output. This function can be either directly integrated into the medical device with considerable development costs for each different medical device or indirectly provided through a second device, e. g. in wireless communication with the medical device like the Accu-Chek® Voicemate device by Roche Diagnostics, described in EP1728470. The main advantage in the latter case is that a single talking device can be used for several medical devices, thus partly reducing the development costs, although these remain high.

**[0008]** A disadvantage of any acoustic approach remains however the fact that discretion and privacy are compromised any time the user is not alone, either at home or in a public place. This function may be therefore not desired by the user in every situation.

**[0009]** Another approach would be that based on tact. For example, the Braille code, devised in 1821 by Louis Braille, is widely used by blind people to read and write. Each Braille character is made up of six dots, which can be raised e.g. by relief printing or Braille embosser typically on paper, and as such sensed by the fingertip upon contact. These six dots are arranged in a rectangle or cell containing two columns of three dots each. A dot may be raised at any of the six positions to form sixty-four ($2^6$) possible combinations.

**[0010]** Now, while static Braille or contour text can be relatively easily achieved on paper or plastic sheets, far more complicated is to integrate an electromechanical Braille display on a medical device. Such displays, so called refreshable Braille displays or Braille terminals, provided especially as interface for computers, exist but are extremely expensive, compared to the medical device itself. Hence, this approach becomes technically and commercially unsuitable.

**[0011]** The theoretical possible use of Braille displays for medical devices such as glucose meters was mentioned already in documents like WO 2005/065539, WO 2005/086744 and WO 2006/026741. These failed however to specify what sort of Braille display could have been used and how it would have been used.

## SUMMARY

**[0012]** In general, the development of a dedicated medical device, which is suitable just for visually impaired users remains economically inconvenient.

**[0013]** It is therefore an object of the present invention to reduce the development costs of a medical device for visually impaired users. This is achieved by the present invention by means of a tactile display module for visually impaired users connectable, preferably pluggable into a medical device, wherein the medical device is the same developed for users not visually impaired. At the same time the development costs of said module are also low thanks to a new emerging technology making use of thin and flexible plastic sheets, organic transistors and plastic actuators, particularly suitable for Braille and Braille-like displays. This technology is described in more detail in Kato, Y. et al, *IEEE Transactions on Electron Devices,* 2007, 54, 202-208.

**[0014]** A further advantage of the present invention is to provide a medical device, which is not merely intended for visually impaired users, but for both visually impaired users and users not visually impaired, allowing information exchange between them. For example, it could happen that a visually impaired user needs to show the result to another