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Mobile Phone Application in Biotelemetry

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Abstract. This article discusses the possibilities of using mobile phone biological for telemetry signals. Bluetooth wireless technology will be transferred information measured pulse oximetry and monitor blood pressure. All data are processed and displayed on a mobile phone using an application written in Java. The article provides information on the structure and its application to a mobile phone implementation.

Keywords: Bluetooth, Java, Mobile Phone, Pulse Oximetry, Blood Pressure Measurement

1. Introduction

This work gives basic information about Bluetooth technology in biotelemetry in connection with mobile telephony. The work was focused on very specific and narrow range of uses Bluetooth Java Micro Edition in the series, designed for mobile devices. The Nokia 6260 was chosen, on which the application was developed and tested. There were used medical devices, complemented by Bluetooth Interface - the UA-767PC gauge and pulse oximetry ChipOx.

The most important part of this work is to develop applications for mobile phones that will work wirelessly with a variety of medical devices. Currently the application is designed to be possible easily expandable with additional modules for each unit. The core of the entire application, along with communication interface separated from the interface each devices.

2. Hardware specification

Bluetooth modules which was chosen for realization Bluetooth communication can be used as a component in many types of systems allowing them to communicate wirelessly with other Bluetooth products such as PC-cards, laptops, handheld computers and mobile phones. It allows with an RS232 port or UART interface to communicate wirelessly via Bluetooth with other Bluetooth devices. The module can be configured using the Windows based configuration wizard or using AT commands. It supports Generic access profile, Serial port profile, Dial-up profile and LAN access profile. The module is qualified according to the Bluetooth 1.1 specification. Next function of this module is Wireless multidrop. This feature allows the module to simultaneously communicate with up to three remote Bluetooth devices depending on application and cases. The module automatically forms a wireless multidrop network and distributes all data to all connected devices.

Pletysmograph OEM module ChipOX measures the non-invasive saturation by oxygen (SpO2), plethysmogram, pulse rate, body temperature and temperature of surroundings. ChipOx offers 3 analog voltage inputs with maximal input voltage 2400 mV for the measurement of other parameters, which are each sampled with a maximum of 100 Hz, 12 Bits. The sampling rate and the input voltage ranges are freely configurable over the communication protocol. These inputs were used for body temperature and temperature of surroundings measurement, breathe frequency and car speed were temperature sensor were proposed and realized. The measurement of the rest bioparameters (SpO2, ...) was provided by finger or ear sensor.

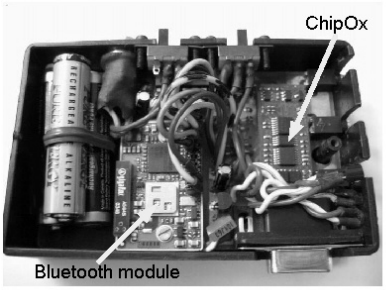

Fig 1. Bluetooth Pulse Oximetry Device

The device UA-767PC is used in the implementation of this work. To determine the values of blood pressure an indirect measurement method, oscillation, this uses only a single oscillation of the cuff. The principle of the oscillating method is the transmission of vibration caused by arterial wall turbulent flow of blood in a blood vessel, using the deformed cuff. The cuff must be placed in your arm, level with the heart. The cuff is pressurized air above the systolic pressure. This is followed by a gradual reduction in pressure in the cuff, increasing the amplitude of oscillation. After the maximum value occurs at further reducing the pressure in the cuff to decrease the amplitude of these oscillations. Upon full release of cuff should be extinguished turbulent flow in a blood vessel (restoration of laminar flow of blood), and thus the disappearance of oscillations. Cuff pressure oscillations in the maximum point correspond to mean arterial pressure. Determination of blood pressure using the oscilometric method with one sleeve is made of a computational algorithm equipment manufacturer. This method is very sensitive to patient movement during the measurement. Changes in stresses muscles cause volume changes in the cuff, thereby distorting the measured values. Monitor UA-767PC is equipped with an internal memory for storing up to 126 measurements, one measurement includes the following four basic data: systolic pressure, diastolic blood pressure, heart rate and time data from the time of the measurements. Other parameters that can be evaluated can be calculated from these values after transfer to your computer. The advantage of this monitor is that not every measurement must always be stored in memory. Whether the measure is imposed or not is left to the user's choice. If the user selected an option to save or not to store the data and the decision is left to the device, the measured values are automatically stored in memory. The above text implies that this device is also equipped with a digital timer.

3. Program Structure

The core application consists of classes that provide for control, settings and communication with a Bluetooth interface. Each device has a separate class that uses the core of the program to communicate with others and care only for evaluation of the data, and graphical user interface to control the medical device.

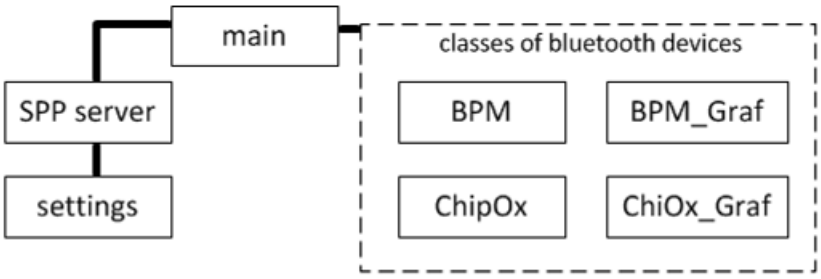

Fig. 2: Structure of an application

Main application is the base class. He is responsible for creating the associated object classes. The report also contains a graphical environment for application instructions.

SPP_Sever is a class that provides the actual communication over the BT interface. Handles the connection to the surrounding devices. It sends and reads data. Index data for the mission, as well as

processing incoming data, providing classes nearby devices. SPP_Server is only a facilitator of communication. Settings are a class through which the user can change settings. BPM is a class with a graphical interface to control the gauge. Managed database of measured data for each patient and store them in memory. BPM_Graf plots of the data stored curve measurement history. ChipOx class is working with ChipOx, a device measuring pulse, blood oxygen saturation and pletysmo curve. ChipOx_Graf is a visualization of the interface for working with ChipOx. Now we introduce the most important elements of each class - the methods, objects and variables.

3.1. Main

Main is, as its name suggests, the main class of the application. KVM it automatically starts up and calls meotdu startapp. Main creates the following key features:

- instance - is the object of his own class. On this subject refer to all other classes that need to collaborate with high street.
- Settings - Settings object class. With this object is called a window, where the user changes settings. It is a choice of accessories, the patient's name, etc.
- mainDisplay - object class Form. This form consists of a graphical user interface main window. It also includes a control menu and the event listener connected to him in response to commands (Commands).
- BPM - BPM object class. BPM (Blood Pressure Monitor) is an object that takes care of controlling the gauge
- chipox - ChipOx class object is an object that works with your device ChipOx which is attached pletysmo probe.
- Main class contains several important methods for controlling the application:
- setDisplay (displayable display) - with this public method to switch the current window. It is used when the window is active with service gauge (object bpm) and the user command in the menu needs to return to the main screen.
- Alert (string text, displayable dalsi_obrazovka, Image image) - is a method that produces informational message. It has two constructors. If you do not its icon, the icon displays the standard. The Nokia 6260 is an exclamation point. The standard picture is dependent on the interpretation of Java in the device.
- startBPM () - This method creates an object bpm and elect him as an active screen applications.
- startChipOx () - This method creates an object chipox and elect him as an active screen applications.
- commandAction (Command c, d displayable) - as in all other classes CommandListener interface using this method the task of responding to user instructions. Specifically it on the menu item the user clicked.

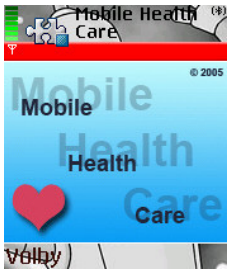

Fig. 3: Main screen

3.2. SPP_Server

This class provides application connection with nearby devices via the BT interface. Its task is only to convey the data to the communication interface devices. The actual preparation and data processing are in charge of the class of devices.

Mobile phone is a device for communicating data server. Ambient devices are therefore clients to which the mobile phone tries to connect. It is therefore necessary to set the device as follows. Sending data is

solved by using public methods and is triggered only in case of need. On the contrary, to receive data in a self-running thread and it is always active when the application expects data.

Setting up your content is very large portion of the program therefore has its own class. Its graphical means inherits from the class Form. It is further augmented by the two interfaces CommandListener (already mentioned commands the listener to create the menu) and RecordFilter by which the filter lists.

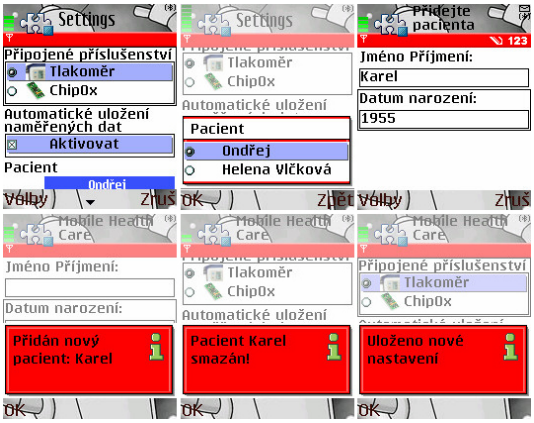

Fig. 4: Settings screens

BPM is a class that provides an interface for working with pressure UA-767PC. BPM class inherits its properties for Form class. It is therefore the type of displayable class. It implements the Runnable interface and CommandListener, which is an interface allowing to create a separate thread.

BPM includes a dynamically changing menu, which responds to a specific application state. The item "Measure the pressure 'are on the menu pops up when the gauge is actually attached to the application.

A class at runtime creates another two auxiliary fibers. The first thread is used to query the server using the prepared data SPP_Server.isReady (). If data is ready, it reads. The second type of fiber Timer uses a nested class 'Connection'. Its function is to set the interval to send messages to artificial gauge. He is automatically disconnected when idle. BPM_Graf class is based on the Canvas class. This class is viewable used for graphics applications such as games. He can draw basic geometric objects, has also implemented a listener input from the keyboard.

Fig. 5: Blood Pressure Monitor User Interface

3.3. ChipOx

The class of applications with which users can connect to devices of the same name, so ChipOx. After connecting the device switches to the next screen object class ChipOx_Graf.

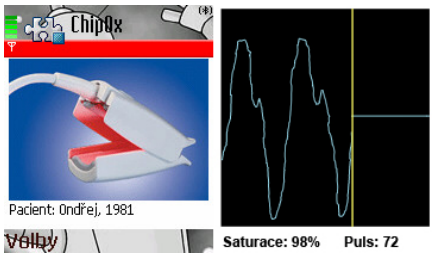

Fig. 6: Pulse Oximetry User Interface

This class is part of the visualization interface ChipOx. The heir FullCanvas class, which is a specific class of Nokia's included in the package NokiaAPI. By implementing this interface class ChipOx disappears its portability to different types of mobile phones. It will only run on Nokia devices, or to others who have in their library NokiaAPI Java specification. Class FullCanvas was necessary to use virtual machine because, unlike classical Canvas can be used by the display and not just the small part that would be to plot the curve pletysmo inadequate.

4. Conclusion

The proposed application can be seen as a building block for larger, commercially viable project. Among other possible extensions uvedu applications such as: increasing the number of supported medical devices with data storage, into a database, complete the application can send the measurement results via SMS and GPRS, a desktop application for medical records data to individual patients, a communication protocol between the mobile phone and PC patient doctor, printer output etc.

5. Acknowledgements

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