

# A common Interface to Transfer Data Between Telemedicine Devices and Smartphones for Monitoring of Chronic Diseases

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## Abstract

*An important part of chronic patients care is continuous monitoring of relevant parameters according to a particular disease. The subject of the work is an implementation of a common interface to exchange data between various medical devices and smartphones for monitoring of chronic diseases. It also provides means of secure sending data to a dedicated web server. The proposed application is written in Java programming language and it is designed for Android operating system. It also makes use of Bluetooth technique as an interface to communicate with the medical equipment. The proposed Android application will allow chronic patients to track their vital parameters more comfortably and, moreover, the necessary amount of patient's medical device software can be reduced to this one common piece.*

**Keywords:** java android programming, smartphone, java programming, mobile care, chronic disease, bluetooth

## 1. Introduction

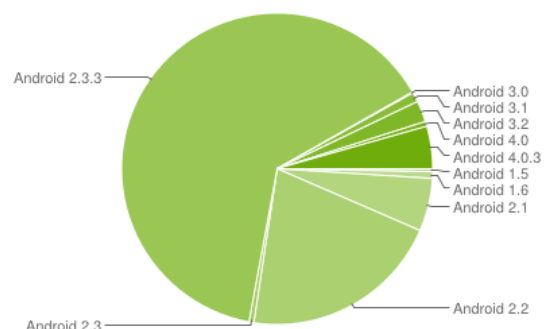
There are a large number of medical equipment manufacturers and even more different models of devices. Failure to comply with the standards [5] of transmitted data structure and the relatively late introduction of these standards has caused a significant problem. Namely, there are a lot of devices on the market that do not follow any common data structure standard. On contrary, vendors define their own ways of organizing data within the transmitted data frames.

This, then, causes the fact that using medical equipment is usually connected with installing a separate piece of software for each particular device [5], [7]. Additionally, it is common that a monitoring of one chronic disease requires keeping track of parameters which can be measured by several different medical devices. Given the increased number of devices and the required effort one puts into the software, there appears to be a need for a common data exchange interface for those devices.

Moreover, having the application installed on a portable device such as a mobile phone or tablet makes the mobile care process more automatic, comfortable and accurate. Therefore, it can provide a considerable support for medical doctors providing them with a thorough, clean view on patients' health.

## 2. General Approach

In this section the proposed application is presented. The application is designed for mobile devices which run Adroid operating system of version 2.1 and above [3].

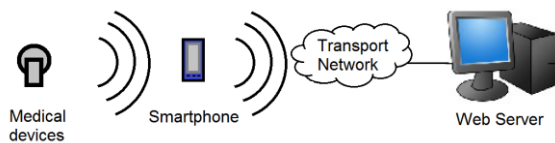


**Figure 1. Approximate percentage of active devices running a given version of the Android platform [3].**

This, then, according to the pie chart in the Figure 1, means that the application can be run on more than 99 per cent of currently active Android devices.

The main reason of choosing this particular version of the platform, apart from its wide availability, is this platform has the Android Bluetooth stack implemented. Bluetooth is a secure [1], [2], [4] data transmission technique often implemented in various medical equipment.

In the Figure 2 a general view of the application is shown. The application creates a Bluetooth connection with a number of medical devices and reads its transmitted data. Then, the data is interpreted in order to extract the values of measurement. Next, depending on whether the Internet connection is available or not, the data is stored in the cellphone memory or sent via the public network to the predefined web server.



**Figure 2. Area of application of the proposed project.**

The principle of operation of the application involves sending data across the public network segment. Consequently, this is connected with several security issues. Due to the sensitivity and personal nature of medical data, the information sent by the proposed application needs to be sent at the highest level of security as possible. Therefore, connection to the web server is based on HTTPS protocol with the dedicated certificates.

### 3. Preliminary Results

As for the preliminary results of this project, a fully working, compatible and stable application has been developed. It works successfully on mobile devices with Android Platform and allows the user to retrieve information from selected medical measurement devices. The application uses

Bluetooth wireless technology. In addition, the application allows the user to send data to web server via a secure HTTPS connection. Consequently, it provides the server with medical information for further storage and analysis by medical professionals.

### 4. Conclusion and Future Work

The future work will be strictly connected to adding new medical devices to the system and integrating their capabilities with the application.

As far as the interaction with the external equipment is concerned, the flexibility of the application seems to be the most vital issue in its future development [6]. The update capability has a direct influence on whether the application will be characterized by a long-term usefulness and users' satisfaction or not.

Apart from that, there are few software bugs which were spotted during the application development phase. These, then, are bound to be fixed in order to improve the application and also make it more stable.

### 5. Acknowledgements

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### 6. References

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