

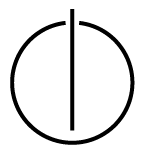
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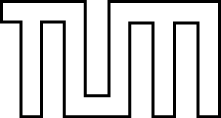
Der Technischen Universität München

Bachelorarbeit in Wirtschaftsinformatik

**Implementation of a Bluetooth touchpad based on Android OS**

Nikolay Kostadinov





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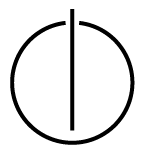
Bachelorarbeit in Wirtschaftsinformatik

**Implementierung eines Bluetooth Touchpads**

**auf Basis von Android OS**

**Implementation of a Bluetooth touchpad based on Android OS**

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Ich versichere, dass ich diese Bachelorarbeit selbstständig verfasst und nur die angegebenen Quellen und Hilfsmittel verwendet habe.

München, den 15. Oktober 2011 Nikolay Kostadinov

I assure the single handed composition of this bachelor thesis only supported by declared resources.

München, den 15. Oktober 2011 Nikolay Kostadinov

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Abstract (English)

Smart phones are gaining popularity both in the corporate and the entertainment sectors. They are gradually becoming a universal device, able to complete a variety of different tasks and fit into various use case scenarios. This work concentrates on realizing a single scenario and presents a completely new way of using a mobile phone for remote control of notebooks, computers and other Bluetooth-enabled devices.

The aim of this work was to develop a touchpad by using the Android OS as a platform. The touchpad application running on Android phone is able to connect to other systems over the Bluetooth radio technology. By using a set of standard supported drivers, the application provides an input service for the user that is not less powerful than the capabilities of ordinary input devices such as mouse and keyboard. The project not only fulfils this goal, but also introduces an extensible framework, which is extremely easy to implement by developers willing to unleash the power of the Bluetooth communication in combination with the widely supported drivers for input devices.   
 The open source Android operating system has established its place as the most popular operating system, designed to power smart phones and other mobile devices. Devices running this freely distributed OS are less expensive, than other devices with similar hardware specifics. For its openness, user-friendly concepts and developer-friendly software development tools, it became the platform of choice for this project.

Abstract (Deutsch)

Smartphones werden immer populärer sowohl in der Unternehmens- als auch in der Unterhaltungsbranche. Sie werden allmählich zu einem universellen Gerät, das in der Lage ist, zahlreiche Aufgaben zu erfühlen. Deswegen findet es auch in vielen Anwendungfälle einen Platz. Diese Arbeit konzentriert sich auf die Realisierung von so einen Anwendungfall und präsentiert eine völlig neue Art und Weise, wie die Fernsteuerung von Notebooks, Rechnern und anderen Bluetooth-fähigen Geräten, mit Hilfe eines Mobiltelefons betrieben werden könnte.

Das ursprüngliche Ziel dieser Arbeit war es, ein Touchpad auf Basis von Android OS zu entwickeln. Die Touchpad-Anwendung, die aufs Android-Handy läuft kann sich mit anderen Systeme mit Hilfe der Bluetooth-Technologie verbinden. Durch die Verwendung von einer Reihe von Standard-unterstützten Treiber bietet die Anwendung den Nutzer zahlreiche Eingabemöglichkeiten, die nicht weniger mächtig sind als diese, die von üblichen Geräten wie Maus und Tastatur angeboten sind. Allerdings, erfühlt das Projekt nicht nur dieses Ziel. Es wird ein Framework vorgestellt, welche von den Entwicklern sehr einfach zu implementieren ist. Damit können sie Applikationen entwickeln, die sowohl die Vorteile der Bluetooth-Kommunikation, als auch der breit unterstützten Treiber für Eingabegeräte ausnutzen.

Die Open-Source-Betriebssystem Android hat sich in der letzten Jahren als die meistgenutzte Betriebsystem etabliert, die speziell für mobile Geräte entwickelt ist. Geräte, auf die dieses freies OS läuft, sind meistens billiger als andere Geräte mit vergleichbaren Hardware-Spezifikationen. Android ist offen und bietet benutzerfreundliche Konzepte, sowie entwicklerfreundliche  Software-Entwicklungstools. Deswegen ist Android die natürliche Wahl für diesen Projekt.

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2. Introduction

As Android becomes more and more popular, third-party developers are producing an increasing number of Android applications. The applications are small and useful programs utilizing different combinations of hardware features. Although, most of the mobile devices running Android are supporting Bluetooth communications, very little is done for realizing the vision that a mobile phone could be used as an universal remote control, that could connect to virtually any notebook, computer or other type of device supporting the Bluetooth technology and a standard set of drivers for input services, such as the HID drivers.

The main problem is the missing support for these drivers. The developer would have to dive deep into the lower levels of the operating system’s architecture and write programs interacting directly with the Bluetooth stack as part of the operating system’s core. The input service that would be provided by the application must be described according to the HID protocol. Information on how to do this is also spare. Then the resulting service description has to be inserted in the registry of an existing SDP module, which is responsible for making it publicly available, so the computer could find it and read it. Since the computer and respectively the user are aware of the service, a communication channel over Bluetooth must be established, so the service would be utilized.  Although, Bluetooth communication is generally supported by APIs that are part of the Android framework, developers are not provided with access to the lower level communication protocols, such as L2CAP. However, if communication on the higher levels is possible, there must be a way of accessing the protocols beneath.

The Bluetooth touchpad project is presenting a solution for each of these problems. A service description for a Bluetooth mouse and keyboard is defined and passed to the SDP server of the Android operating system. On the other hand, the resulting application is able of establishing communication by using the required protocols, although this feature is not officially supported. The solutions are packed in an extensible framework, which could be easily implemented by developers and used in other projects. The Bluetooth touchpad app, implemented on top of the framework is abstracting from the mouse and keyboard input specifics and thus provides a number of totally different input capabilities by using the phone’s motion sensors, the phone’s display and even the voice recognition API.

In this work, first the Bluetooth technology and also some specifics of common Bluetooth input devices are presented. The SDP is also explained, since it is playing an important role in the Bluetooth stack. Afterwards, the Android platform and the development phone used in the project are briefly introduced. After building up this foundation of knowledge, the implementation of the framework is reviewed in detail. In the last chapter results of quality tests are provided and the application’s performance is measured.