IJCAT - International Journal of Computing and Technology
Volume 1, Issue 1, February 2014
www.IJCAT.org

Wireless Relay Controller Using Android Smartphone

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Abstract - The main objective of the project is to develop a system to control the relay circuit of an embedded system via the android smart phone. The user accesses the security system via tablet or any portable devices. For establishing this, what we need is Bluetooth connectivity with our controllers well as our Tablet/Mobile. We have to make the connection by pairing it. Once it is done the communication can be possible. The Project is developed in Java Programming Language by using the Eclipse Integrated Development Environment (IDE). We use the Android Software Development Kit (SDK) which includes a variety of custom tools that help us develop mobile applications on the Android platform. The core part of the app is the Bluetooth connectivity establishment by this newest IDE. One of the most widely used mobile OS these days is ANDROID. Android does a software bunch comprise not only operating system but also middleware and key applications. Android Inc was founded in Palo Alto of California, U.S by Andy Rubin, Rich miner, Nick sears and Chris White in 2003. Later Android Inc. was acquired by Google in 2005. After original release there have been number of updates in the original version of Android.

***Keywords*- Bluetooth, Relay control, Android, wireless, communication.**

1. Introduction

Remote controlling of a system using smart phone is the technology of today and future of tomorrow for budding engineer. Remote controlling of a system is possible by controlling a relay in a system by relay controller. In the case of smart phone controlled relay control the system works with the help of Bluetooth [6]/Wi-Fi [7]/any wireless technology in smart phone and the wireless receiver in the embedded part. The Embedded part we are developing is using Renesas's 16bit R8C/25 [8] family micro-controller. Renesas is the world's third largest micro controller manufacturer. The R8C Tiny series microcontrollers belong to the popular M16C platform. It has been specifically designed to provide the lowest-cost system solution for general-purpose applications. The system we developed has the specifications to control a relay by the commands or respective signal from the Smartphone via Bluetooth.

Bluetooth the technology of today and its merely replaced by the Wi-Fi technology and wimax but it has lowest power consumption and simple development platform, thus Bluetooth is advised greater than other competitor technology.

The smart controllers over smart phones are developing day by day from the introduction of android smart phone to the world. The main hardware platform for Android is the ARM architecture. Android has a large community of developers writing applications ("apps") that extend the functionality of the devices. There are currently over 200,000 apps available for Android. Android Market is the online app store run by Google, though apps can also be downloaded from third-party sites. Developers write primarily in the Java language, controlling the device via Google-developed Java libraries. And As of May 2011 Google said that 400,000 new Android devices were being activated every day—up from 100,000 per day in May 2010—and more than 100 million devices have been activated. And it's the reason to develop an essential, cost effective and helpful application in the android platform to serve the humanity.

2. Overview

Applications are usually developed in the Java language using the Android Software Development Kit, but other development tools are available, including a Native Development Kit for applications or extensions in C or C++, and Google App Inventor, a visual environment for novice programmers. For establishing this system, what we need is Bluetooth connectivity with our controllers well as our Tablet/Mobile. We have to make the connection by pairing it; once it is done the communication can be possible. Using this app we can control a system from a fair distance (Approx. 10mts) thus by ensuring the security and convince to a greater
By simply pressing a button in the Application.

This device powered by Renesas's 16bit R8C/25 family micro-controller. Renesas is the world's third largest micro controller manufacturer. The R8C Tiny series microcontrollers belong to the popular M16C platform. It has been specifically designed to provide the lowest-cost system solution for general-purpose applications. These MCUs are fabricated using a high-performance silicon gate CMOS process, embedding the R8C/Tiny Series CPU core, and are packaged in a 52-pin molded-

plastic LQFP. The R8C/25 Group has on-chip data flash (1 KB x 2 blocks), 64KB ROM and 3 KB RAM. The 16-bit CPU can be directly clocked at 20 MHz and execute 89 instructions, each configurable with multiple addressing modes.

The Project is developed in Java Programming Language by using the Eclipse Integrated Development Environment (IDE). We use the Android Software Development Kit (SDK) [9] which includes a variety of custom tools that help us develop mobile applications on the Android platform. The core part of the app is the Bluetooth connectivity establishment by this newest IDE. This application will be installed and deployed on Android Froyo+ Devices. The App has an optional feature of access control of the system, on Bluetooth connectivity. Simply this is a step towards a Smart system using the relay controller by smart phones.

3. Literature Survey

3.1 An Empirical Study of RF link for Wireless Automotive Passive Entry System [1]

The wireless systems in automotive applications increase for security and comfort considerations. As the structure of the car involves many metallic frames, the channel of the RF signal is tricky to model. As a consequence, the developers need efficient and accurate means of characterization to develop these systems. This study proposes a full characterization of a RF link between a transmitter (badge) and a receiver (integrated in the structure of the car). As the design of a car is relevant with a multi-scale analysis, the needs can vary from a car to another one: we propose a strategy based on the development of generic wireless modules to cut the development costs. Therefore, the medium of propagation influence is intensively characterized to develop matched strategies for secured data propagation. First, an empirical analysis describes on the radio channel characterization for the car access systems. Then, the received field is measured in 2D around the vehicle for different various parameters (vehicle frame, antennas relative heights, badge and receiver's position and relative distance). The free Radio frequency of 434 MHz is chosen for this study.

The proposed study is useful for the understanding of RF channel for wireless vehicle access systems: a full high resolution probing is proposed for different configurations of the transmitter-badge (polarization) and for different conditions (ground, user). The probing method for the PASE system (Passive Active System Entry) models the external RF coverage versus the angular position of the transmitter badge around the vehicle for different distances between the badge and the vehicle's receiver. From this study, we have shown the contribution of each parametric element on the received power (i.e. the propagation channel): ground reflection and conditions, badge orientation-polarization, metallic frame of the car, human body effects. The impact of each parameter can be analyzed by using a statistic function (Cumulative Distribution Function) or with a mapping of the received power versus the transmitter's position around the vehicle (global coverage area). The new characterization procedure versus 3D-axis from the last part of the paper thus allows fixing the suitable strategies of design. This is convenient to overcome the distribution of the black spots for vertical and horizontal polarizations: diversity system is suitable to get homogenous external coverage (reduction of black spots). This technique is also used to find the optimal receiver's position inside the vehicle. Particular care is supplied on the different system parameters as well as on exchange strategies and RF/LF communication protocols, which has not been reported in this paper.

3.2 Hybrid wired/wireless network for real-time Communications [2]

Recent years have witnessed the ever increasing adoption of digital communication networks in manufacturing environments. Field networks (also known as field buses) are certainly the most popular solution in those scenarios. For a long time they have been used at the lowest levels of factory automation systems (shop floor), which are often characterized by severe timing requirements. On the other hand, Ethernet networks, which were traditionally employed as factory backbones in order to handle information flows between different plant areas, are now deemed suitable also for control applications down to the field level. This is mostly due to enhancements of the network performance, which led to the development of industrial Ethernet protocols purposely designed to provide real-time communications. In many cases, variants of such protocols have been defined that are able to support isochronous communications as well. However, the scenario mentioned above is quickly evolving, and other types of communication technologies, namely wireless networks, are currently widely available at reasonable prices. Wireless communications technologies are becoming more and more pervasive every day, and they are changing deeply several aspects of human life by enabling new perspectives and opportunities that could hardly even be thought of only a few years ago. This is likely going to become true for industrial and factory environments, too, where highly automated production systems can get significant benefits from the introduction of the most advanced wireless communication techniques. Indeed, several studies have recently proved the suitability of some of the most popular wireless solutions for employment in industrial scenarios as well, including real-time communications. Adopting wireless communications in industrial environments is particularly attractive as it allows, in principle at least, the avoidance of cabling, which in many applications turns out to be

cumbersome and/or expensive. However, while several standard solutions and components are commonly available for wired industrial communications, wireless systems are far from being considered well settled for such kinds of applications. In fact, it is worth pointing out that the straightforward introduction of highly innovative solutions in industrial and manufacturing systems has never been either simple or fast. This is due to several reasons, such as reliability, efficiency, safety, cost, and security, just to mention a few. As a consequence, the growth of wireless technologies in industrial applications is expected to be noticeably slower than in other areas, even though they are envisaged to play a crucial role in many next-generation industrial and production systems.

4. System Design

A. Bluetooth on Android Mobile Devices

Bluetooth [5] is a wireless communications system intended to replace cables on devices such as phones and other mobile devices. It originally was developed in 1994 to replace serial connections via RS-232 cables. It gets its name from a Scandinavian king that united the Danes, because it is meant to unify communication protocols over short range into a single protocol. Bluetooth technology features low power consumption, low cost, and security. It operates in the ISM (Industrial Scientific Medical) Band of 2.4-2.83 GHz. Bluetooth has three different classes based on power consumption and effective range. The Bluetooth protocol allows for seven devices to be linked to a master device in a piconet based on a master/slave relationship.

While a piconet acts as an infrastructure mode network, multiple piconets can create an ad hoc network because the master of one piconet can be a slave in another. To avoid interference and collisions, Bluetooth uses an adaptive pseudo-random frequency hopping technology that is synchronized to the master's clock. Bluetooth offers four security modes based on use of a mutual pin entered into both devices. Authentication and encryption/decryption keys are made after devices are paired with the appropriate pin. Bluetooth development capability was officially added to the Android operating system with the release of the Android 2.1 API. Before this release, there was an API add-on for developers who wished to use Bluetooth in their applications, but has fallen out of use in favor of the official Bluetooth API software. To use Bluetooth in an application, a developer must declare the Bluetooth and Bluetooth ADMIN permissions in the application. Users will be notified of these permissions before download and must allow these permissions to continue downloading the application.

B. Wireless relay controller system

Fig. 1 illustrated the diagram of a wireless relay controller system using android mobile devices. This project called for an Android smart phone or tablet with Bluetooth capabilities and a microcontroller [9] interface to relay controlling. The testing device used was the HTC Wildfire running the Android 2.3 update, a personally owned device that was on hand. The wireless relay system was made of several major components. A Renesas R8C25 microcontroller was chosen for this project for the ease of programming and ability to quickly prototype. The Renesas R8C25 chip. BlueSMiRF gold Bluetooth transceiver [6] was chosen for communication because it came pre-packaged on a break-out board.

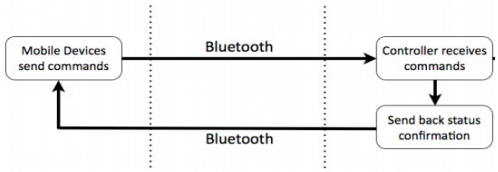

Figure 1 A Diagram Of Wireless Relay Controller Using Bluetooth On Android Mobile Devices

C. Android SDK and Renesas R8C25Firmware

Android uses a Java based language. To develop an Android app, a tool named Eclipse is required as well as Android's SDK, which is an add-on for the Eclipse program. When creating a new application for the Android, the platform version must be selected, e.g. 1.5, 1.6, 2.1, or 2.2. However, the version can differ on the Android device depending on which Android device is being used. The three main components required in the creation of the Android app are: the java file, which is a file that contains all code required for completion of desired tasks and functions; an xml file, which contains the layout for how the application will look to a user; and a resource folder, which contains all images, sounds, and graphics files needed for the application. For a Renesas R8C25, the IDE is provided as the open-source by the company .The tool can run on multiple platforms, e.g. Windows, OS X, and UNIX. The language is a Wiring-based language which is similar to C/C++ style. Two programs were created for this project that had to be able to communicate with one another via Bluetooth channel. One was on the Android mobile device, and the other was on A Renesas R8C25 board, inside the wireless relay controller.fig 2.

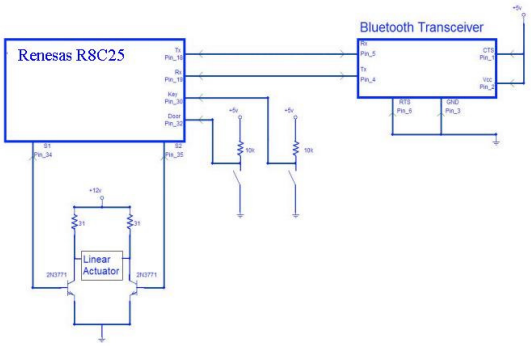

Figure 2 The Wiring Circuit Of Wireless Relay Controller.

5. Conclusion

The "relay controller using smart phone" is computerized, which is computerized, which is used to reduce manual work, save electricity and saves time. More efficient a storage technique insists to reduce the redundancies and helps to review later.

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