

Design and Implementation of an Embedded VoIP System using Bluetooth Technique

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Abstract

- **With development of the wireless technology, the mobility of VoIP devices have been improved in recent years.**
- **The Bluetooth, a kind of short distance wireless communication technology, plays an important role behind all this.**
- **In this paper, we proposed an embedded VoIP system using Bluetooth wireless technology, which can bring convenient for people who talk to each other by using this VoIP system.**

INTRODUCTION

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- In recent years, the VoIP technology and system are becoming increasingly popular due to the improvement of bandwidth of internet and voice coding technology.
- VoIP represents that voice is delivered over Internet by using Internet protocol.
- It can reduce the cost of telephone communication due to the packet switching on Internet and higher channel utilization rate.

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- According to the definition given by SIG group, Bluetooth technology is a short distance and low cost wireless communication standard.
- By using this standard, some movable communication devices, such as notebook computer, PDA, mobile phone, digital camera, even keyboard and mouse, can be connected together.
- The Bluetooth wireless communication uses an unused 2.4GHz frequency band which can be used throughout the whole world. Thus, it ensures the unimpeded access throughout the world.

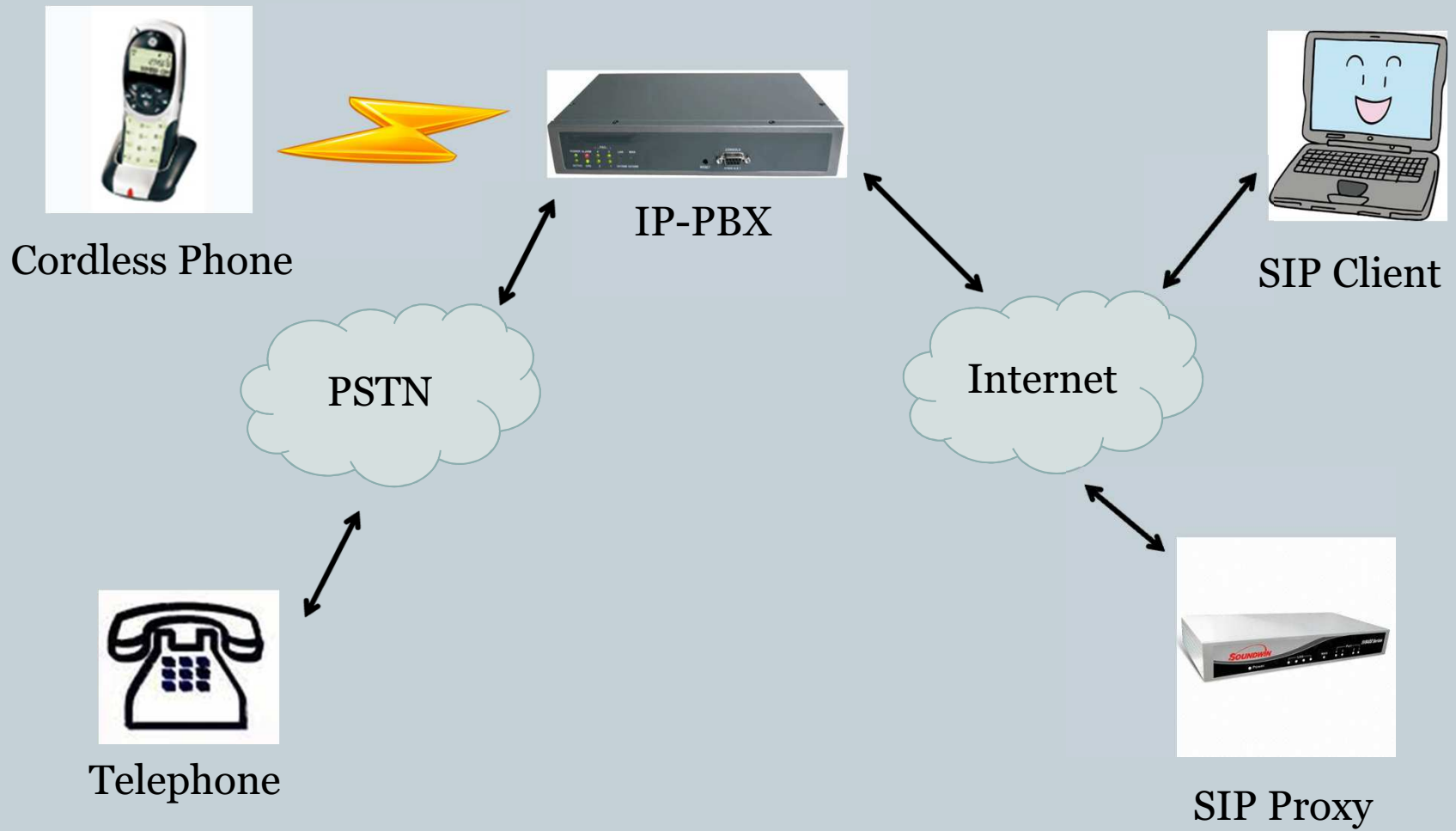
SYSTEM ARCHITECTURE

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- Our purpose in this paper is to setup an embedded VoIP gateway which allows user telephone by using a cordless phone.
- In order to achieve the desired result, the following task must be performed in this system:
- 1)The cordless phone should be connected to an IP-PBX over Bluetooth;
- 2)The cordless phone can communicate with a remote SIP client by using SIP and;
- 3)The user can telephone by using headset user interface which provide some basic functions, such as call, phone book, Off hook, On hook, etc.

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- The system's hardware consist of five parts, as shown in Figure 2. The user can dial number and telephone by clicking the headset keypad. The headset is connected to Bluetooth module via wirless link.
- The control signaling is delivered between Headset and BT module along Bluetooth link. Infineon 5120P platform provides Telephony API (TAPI) for developer to control hardware Codec.
- MC14583 is a 13 bit linear PCM Codec.
- The voice is delivered along voice path which connected to PSTN phone.

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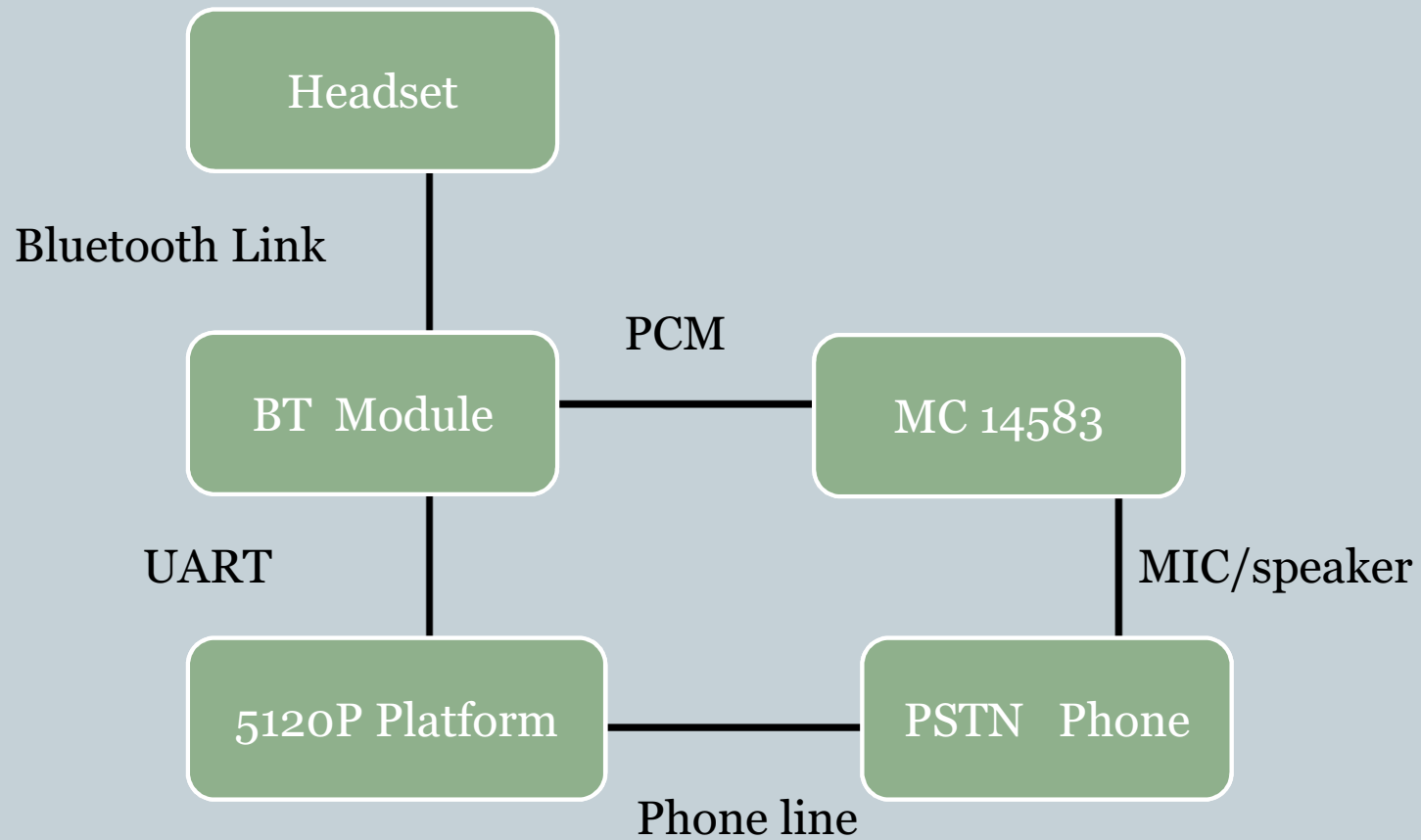


Figure 2 Hardware system overview

System components

- In order to realize the above-mentioned objective, we divided the whole system into several system Components, as shown in Figure 2. The Blue Z is an implementation of the Bluetooth protocol stack for Linux.
- Microwin provides basic mapping function on the upper layer of the application. As an interface between the Bluetooth module and the IP-PBX, the UART driver is responsible for the processing of information over a serial port.
- SIP is a session initiation protocol which is defined by IETF, and has a text-based format for the transmission agreement.
- When the communication of the multimedia format is completed, convenient communication will be based on the result of the use of RTP which can transmit voice and video.
- The system components are shown in Figure 3.

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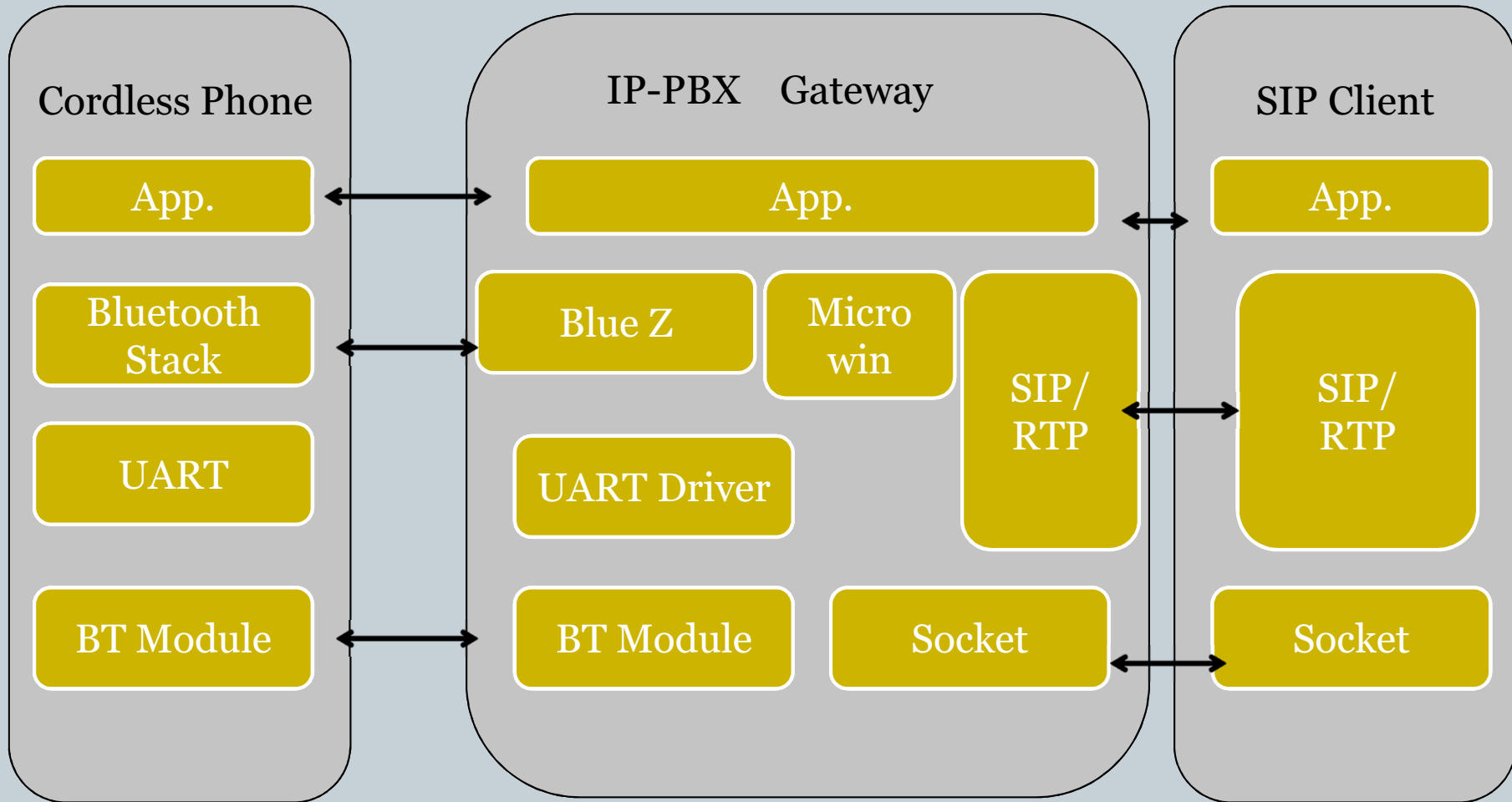


Figure 3 System component

SYSTEM IMPLEMENTATION

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- **In this system, we used Infineon ADM5120 target board to develop program code.**
- **Infineon 5120P platform provides Telephony API(TAPI) for developer to control hardware Codec. TAPI provides eleven services for digit signaling processing, as shown in Figure 5.**

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- **The Vinetic Codec consist of ALM, SIG, PCM and COD module. Each module provides different function according to what kind of data they process.**
- **SIG module**
- **COD module**
- **ALM module**
- **PCM module**

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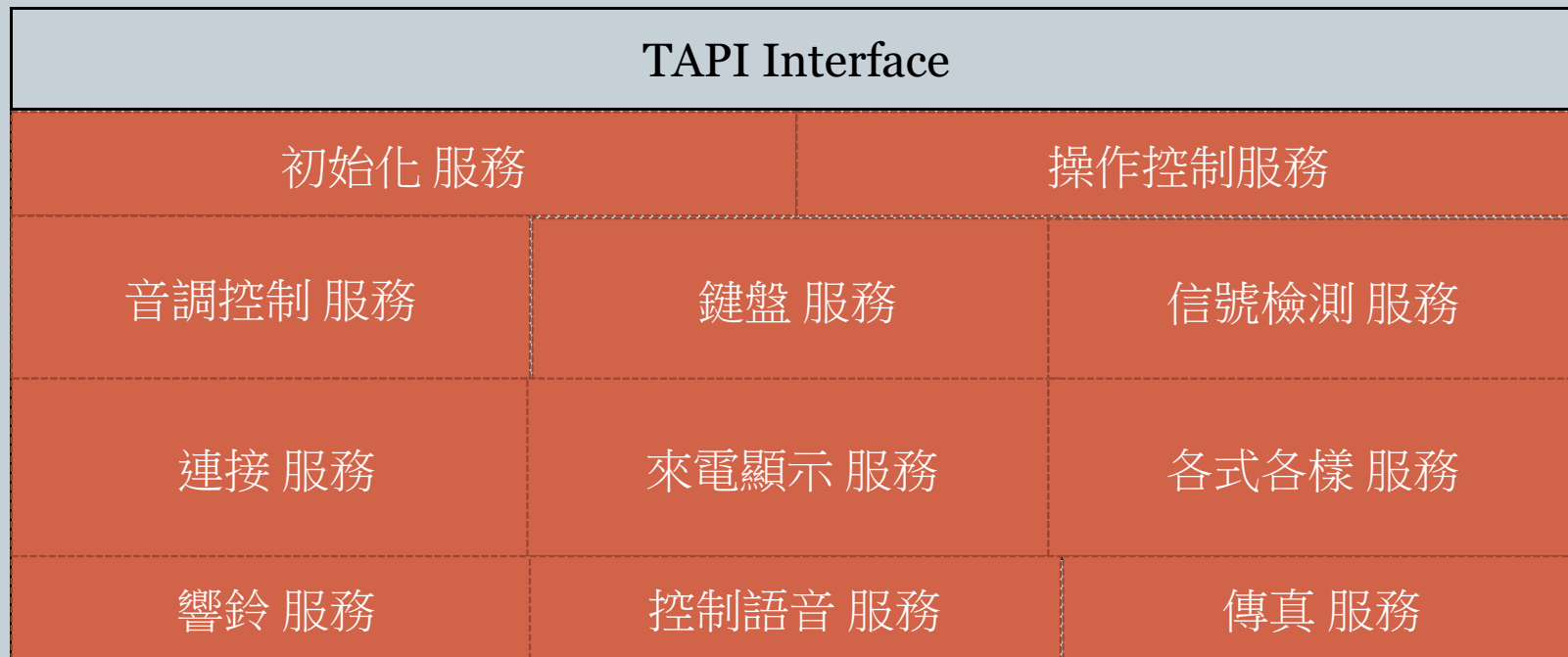


Figure 5 TAPI service

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- **SIP call procedure is shown in Figure 6.**
- **At first, the initial status is idle.**
- **When received the INVITE message, it will enter the ringing status. After sending INVITE message, it will enter the waiting status. If the user wants to hang up, it only sends BYE message and then enters idle status.**

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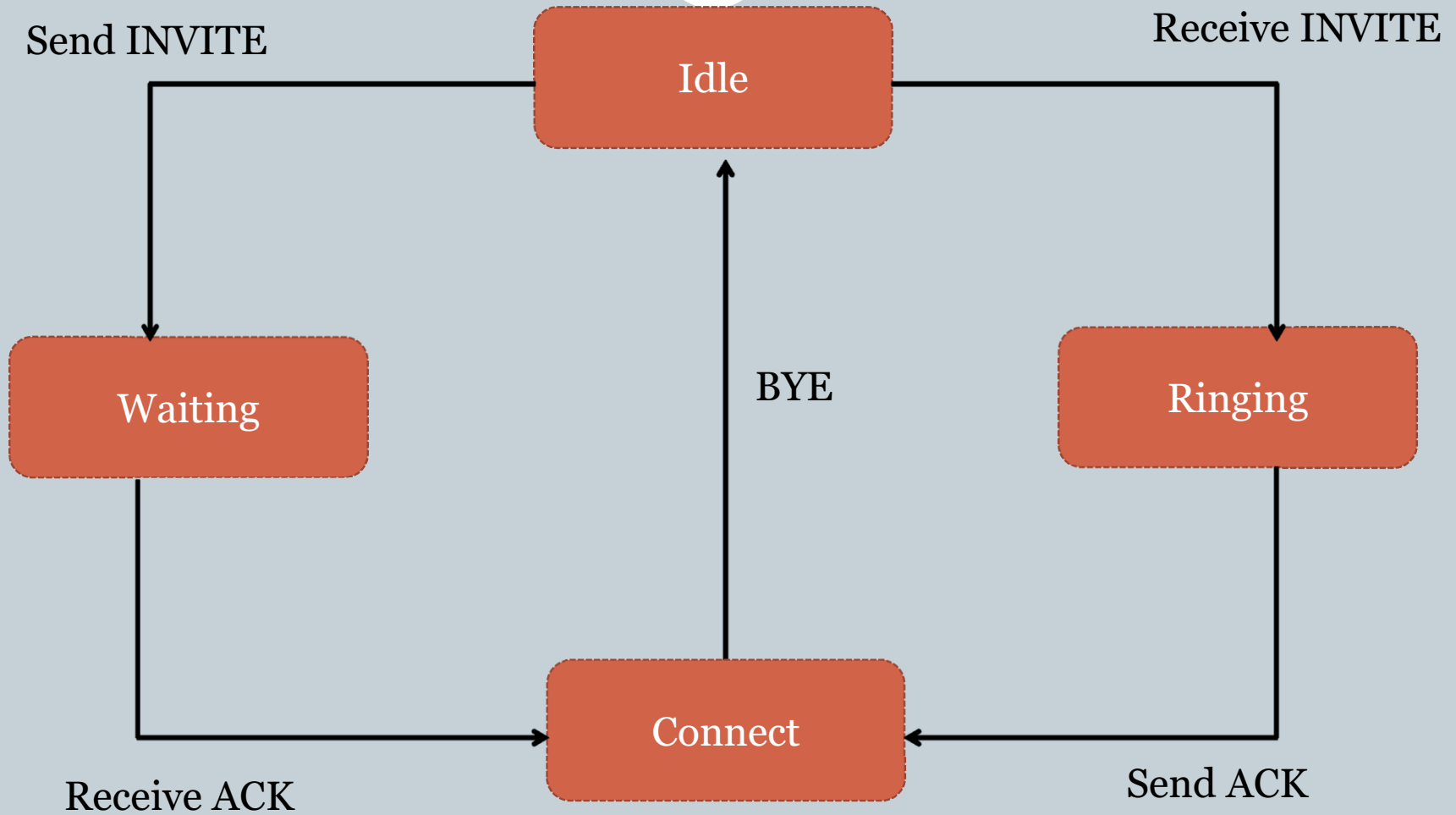


Figure 6 SIP call procedure

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In face, there are four flows in this system. Every flow has respective data type. For example, the SIP/RTP packets are delivered along SIP.RTP path.

The voice is delivered along voice path which connected to PSTN, the headset is connected to Bluetooth module via wireless link.

The SIP/RTP flow chart is shown in Figure 7.

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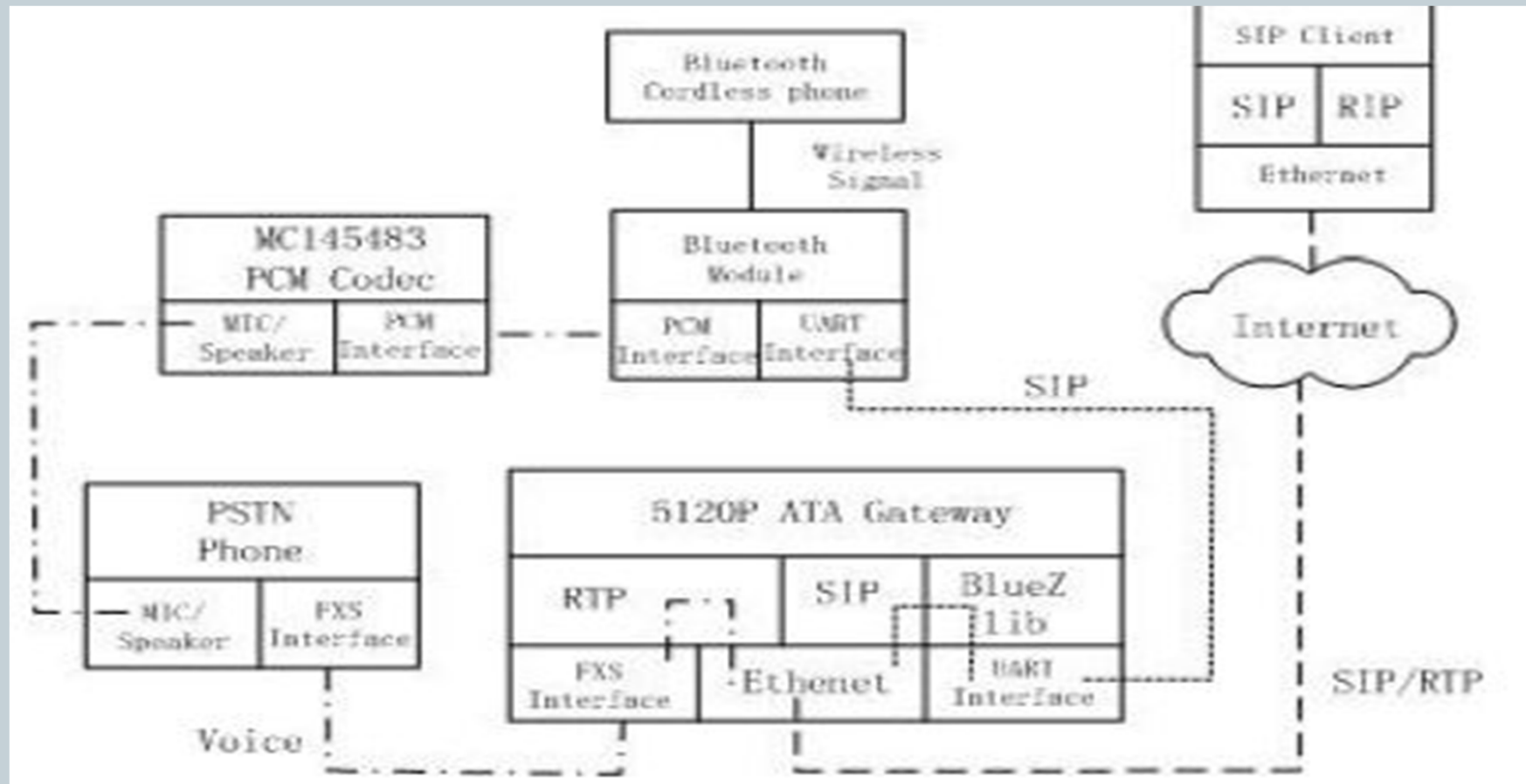


Figure 7 The SIP/RTP flow chart

SYSTEM TEST

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- **As one of testing project, BlueZ Library Testing is important and contains rctest, sdptest, scotest, L2test and hcimu program corresponding to respective components.**
- **BlueZ Testing Component is shown in Figure 8.**

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- In the Figure 8, the L2test program performs many testing functions (such as listen, receive, send and connect) for L2CAP (Logical Link Control and Adaptation Protocol) component.
- The RFCOMM protocol uses the L2CAP layer to provide emulation for a serial port.
- The rctest program performs testing for it. Sdptest implements testing for SDP (The service discovery protocol) which provides management for service control procedure, such as service

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- search request and service search response. The scotest program is responsible for the testing for the synchronous connection oriented(SCO)link which used primarily to transport voice data.

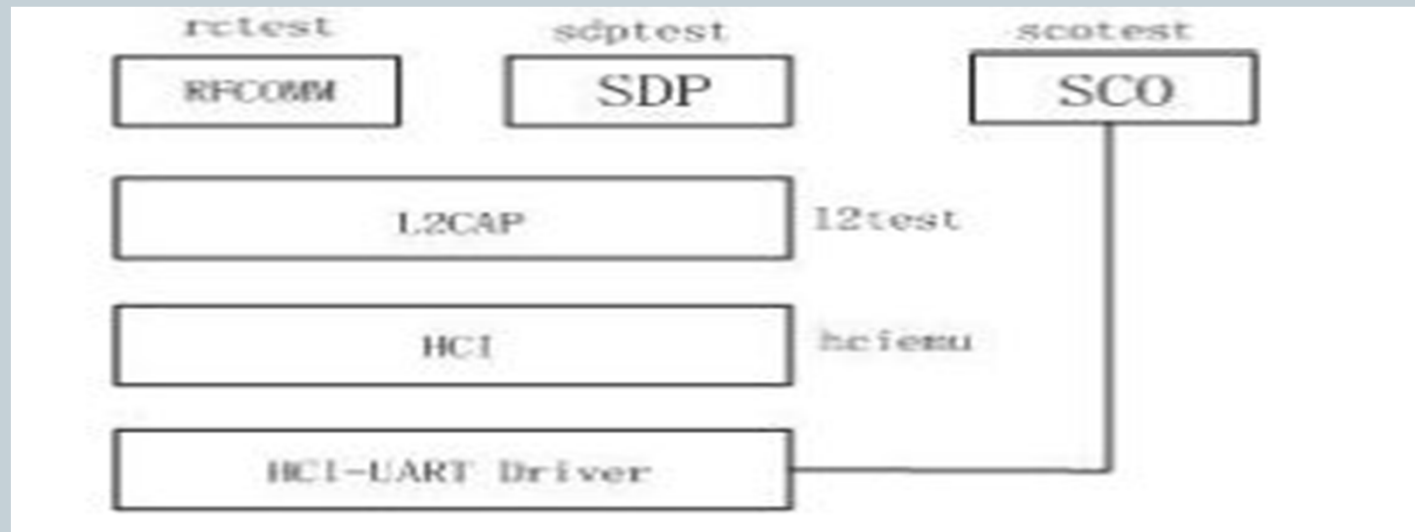


Figure 8 BlueZ testing component

THE USER INTERFACE

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- Finally, the user interface we designed is shown in Figure 9. This interface contains a phone book, which records contact person who are you friends or family and a logbook, which records former call. The headset has basic user interface and function for telephone.

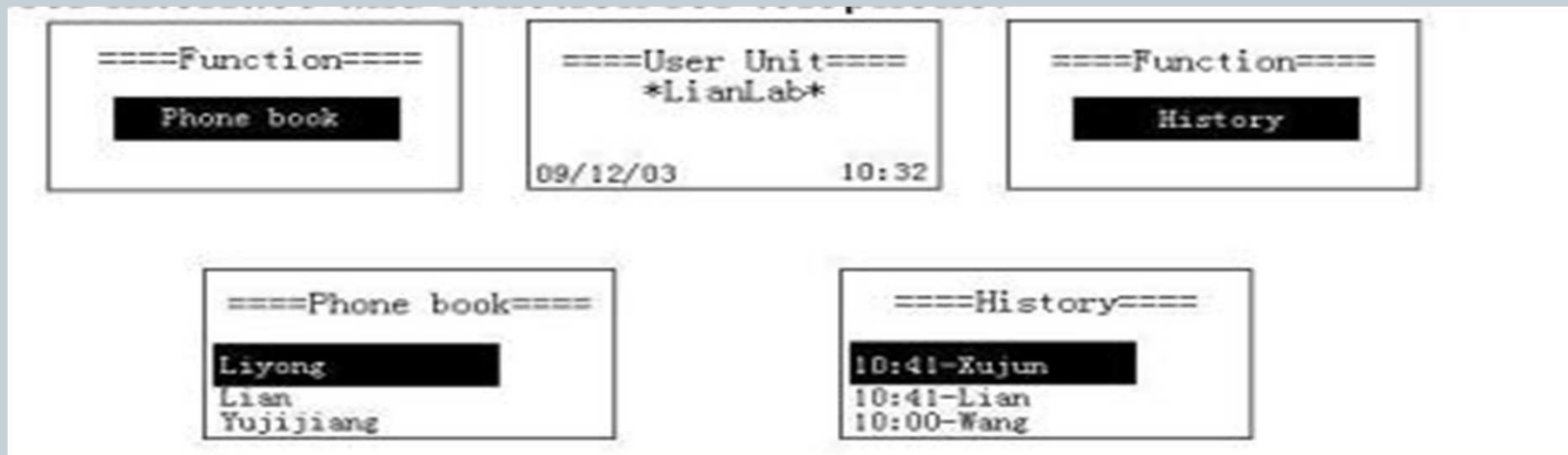


Figure 9 User interface

CONCLUSION AND FUTURE WORKS

- In this paper, we setup a VoIP system. Using Bluetooth technology.
- People can communicate with each other by using this embedded VoIP system.
- However, it has only basic function for telephone, and more advanced function need to be added.
- For example, it lacks the function of talking for more people, and holding on when people is busying or leaving a message for somebody.
- In the future work, we will gradually resolve these problems.

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