

Smart Control Components and Bicycle Sharing Systems

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Abstract. A smart control component is a type of embedded systems, such as SoC, system on a chip. It may control various objects and build to internet of things, IoT. Bicycle sharing systems are popular and green transports in China. They can be set up based on IoT and smart control components. In this paper, a smart control component, SoC, and the bicycle sharing system will be discussed. Since the system has made some obvious contribution in energy-conservation and environment-protection, to organize a bicycle sharing system with smart control components is valuable and significant.

Introduction

As a new generation of network application, The IoT, Internet of Things, is a scenario in which everything has a unique identifier and the ability to communicate over the internet or a similar wide-area network [1].

Smart control components are showing as some embedded system, and essential parts of many advanced IT systems, such as IoT. SoC, system on a chip, is a typical smart control component.

A bicycle sharing system is the modern and smart transport system, and an application of IoT. Nowadays, it is quite popular in China. Some its pictures are illustrated in Fig.1.



(1)



(2)



(3)

Fig.1 bicycle sharing systems (1) riders, (2) (3)bicycles

Although public sharing bicycles just issued several years in China, they are the good solution for short distance transportation, such as among subway or bus station, home, supermarket, post office, cinema and so on, and have made enormous contribution in energy-conservation and environment-protection [2].

Smart Control Components

There are many devices for smart control components. As an advanced embedded system, SoC is an useful and helpful element.

An IP core is a basic part of SoC. Since SoC is a kind of hardware, the IP cores or modules are implemented as hardware yet. If an IP module can be driven by some MPU, Microprocessor Unit, instructions, it must be a component for the SoC [3]. When implementation of the IP is based on FPGA, Field Programmable Gate Array, with VHDL, a hardware description language, its functions are designed by programming. In theory, functions of single instruction are not limited with enough FPGA resource [4]. Hence, with the IP modules, operations of the SoC will be simplified [5]. The

organization draft of a customized SoC based on MPU and IPs for bicycle sharing systems, can be indicated as Fig. 2.

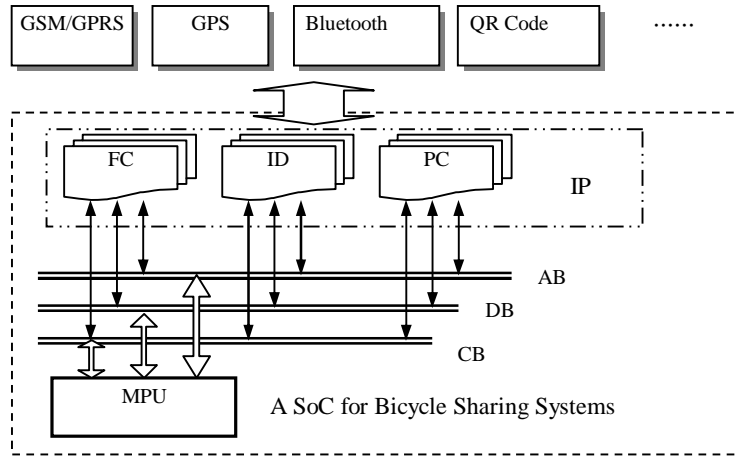


Fig. 2. A customized SoC with MPU and IPs

In Fig. 2, some components are shown as follows.

AB: Address Bus;

DB: Data Bus;

CB: Control Bus;

FC: Functional Components;

ID: Interface Drivers;

PC: Peripheral Controllers.

Here, MPU is a microprocessor unit. MPU is the brain of a SoC. All instructions of the system are managed by the MPU. The MPU normally is designed as a RISC, Reduced Instruction Set Computer, based on PLD, Programmable Logic Device, hardware with HDL, Hardware Description Language, programs.

For various applications, the IP modules in a SoC are different. For the application in Fig.2, there are GSM/GPRS, GPS, Bluetooth, QR code and other peripherals to be concerned. One IP module is suitable for some simple solution. Since the IP modules are different, the solution of SoC is a special application [6]. Hence, The SoC is customized.

Bicycle Sharing System and Smart Control

The operation frame of sharing bicycles is shown as Fig. 3. The system operation may be concerned to users with mobile phone, smart bicycles, network and cloud computing centre [7].

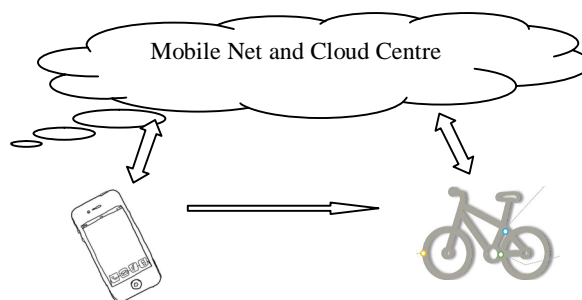


Fig. 3 The operation frame of sharing bicycles

The first step for operation of a bicycle sharing system is to look for an available bicycle through GPS with a mobile phone. Before the step, an APP of the bicycle sharing system have to be download to a mobile phone. Normally, some deposit is required to use a sharing bicycle yet.

Secondly, to scan QR code on the bicycle by the mobile phone is to unlock. In this procedure, some information is transmitted and received between the mobile phone and cloud computing centre with mobile network, such as GSM, GPRS and so on. The information includes state and open code of the bicycle, unlock instruction, user information and time record.

Then the bicycle is unlocked and ridden by user.

Finally, the riding may finish. And, the bicycle has to be locked. At the same time, some information is also transmitted and received between the mobile phone and cloud computing centre. From the information, the centre can charge for the riding and send relevant message to user. Hence, the lock is very important. Without lock after riding, the centre may consider the user not to finish the riding and charge more money.

In fact, the key technology for the operation is about to manage and control electronic lock of a bicycle sharing system [8]. To unlock a sharing bicycle is referred to Fig.4.



Fig. 4 Unlock a sharing bicycle

The smart control for sharing bicycles is concerned to not only customized SoC but also some new technology, such as big data, cloud computing and IoT.

The big data, cloud and IoT are the most advanced research in IT nowadays. They are all adopted in the bicycle sharing system.

For the big data based on Mobike, the biggest company of bicycle sharing systems, smart lock, in order to modify existing bikes and optimize new bikes release, GPS and communication module produced big data. To analyze these data, the estimate market demand can be issued.

About cloud, all the big data will store on cloud. User can scan QR code to un-lock, then make the connection between user and smart lock. Deal with recharge and payment, establish or reuse some other credit system to rule the use habit.

The sharing bicycle is an application of IoT. Smart lock integrated GPS module to realize precise localization. Exclusive SIM card makes the instant messaging, via the cloud to monitor use status. To cooperate Baidu Yun, a cloud service, is to set up “Smart point” to fuse the Power Supply, and to manage and maintain the system.

IoT is an integrated part of future internet and could be defined as a dynamic global network infrastructure with self-configuring capabilities based on standard and interoperable communication protocols where physical and virtual ‘things’ have identities, physical attributes, and virtual personalities and use intelligent interfaces, and are seamlessly integrated into the information network. In the IoT, ‘things’ are expected to become active participants in business, information and social processes where they are enabled to interact and communicate among themselves and with the environment by exchanging data and information ‘sensed’ about the environment, while reacting autonomously to the ‘real/physical world’ events and influencing it by running processes that trigger actions and create services with or without direct human intervention [9].

However, similar to bicycle sharing systems, any development of IoT never lacks smart control components, such as a customized SoC.

Conclusions

Smart control components are composed of embedded hardware and software, and are essential for applications of IT advanced technology, such as internet of things, IoT. A typical smart control component is the system on a chip, SoC.

The bicycle sharing system is a popular utility of IoT. It has made some obvious contribution in green transportation, energy-conservation and environment-protection.

To build a bicycle sharing system, the smart control components are indispensable. Therefore, to discuss how to organize a bicycle sharing system with smart control components is valuable and significant.

Acknowledgements

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