Based on PIC 16F628A single chip electronic lock design

Today, we are living in the in the of embedded systems surrounded by devices that based on the embedded systems like cars, washing , medical equipment’s etc.An embedded system is a computer system designed for specific control functions often with realtime computing constraints.It is embedded as part of a complete device which often including hardware and mechanical parts. By contrast, a general-purpose computer, such as a personal computer(PC), is designed to be flexible to meet a wide range of end-user needs. Embedded systems control many devices in common use today. One of prominent example of an embedded system is a microcontroller , which is a small and tiny computer designated to perform some specific tasks. A microcontroller program(firmware) is the one, which decides what functionality the microcontroller provides to a user. A program that has the ability to run on a microcontroller without the need of an operating system is called as a firmware. That means, a firmware has the privilege to access the hardware directly.This paper tries to explain an electronic lock firmware in detail. The basic idea of microcontroller is to collect all the input and output peripherals in one simple circuit, which represent the microcontroller instead of the large and sophisticated computer with microprocessor and large numbers of peripherals.

The firmware directly deals with peripherals and Input/Output ports to give complete

functionality of microcontroller.

Microprocessor differs from a microcontroller in many aspects. First and the most important aspect is its architecture. In order for a microprocessor to function properly, other components such as memory, peripherals and input output ports must be connected to it. In short, we can say that a microprocessor is the heart of the computer and it works a group with other peripherals/parts of the computer system.On the other hand, a microcontroller is designed to be comprised as a single unit which can perform independently. No other external component is needed for its application because all necessary peripherals and ports are already built into it. Ultimately, it saves the time and space needed to construct devices.

With the development of electronic technology, all kinds of electronic products emerge as the times require, electronic lock is one of them. According to the information, electronic lock research from the nineteen thirties began, in some special places early application. The lock is on the after the keyboard to input a password to complete the unlocking process. Study of the lock 's original intention, is to improve the safety of the lock. Due to the electronic lock key size ( code quantity greatly, with machine )Mechanical lock, and can avoid the key being imitated and stay safe hidden trouble. Electronic lock just remember one password, without carrying metal key, remove people carrying metal.The key of troubles, and by more and more people enjoy. Electronic lock variety, such as fingerprint lock, digital lock, magnetic lock, IC card lock, and other biological. But more practical or key type electronic lock. 2.Nineteen eighties, with the electronic lock special integrated circuits, electronic lock has the advantages of small size, high reliability, high cost, is suitable for use in high security.Occasions, and have power to provide energy, use is limited in a certain range, so it is difficult to popularize, no study has been significant progress.At present, in the western developed countries, electronic lock technology is relatively advanced, full range, electronic lock has been widely used in the intelligent entrance guard system, through a variety of more safety. A more reliable technology to achieve the management of door. In the our country electronic lock overall level still is in on international 70 time around, electronic lock the cost is very high, the market still with buttons.Lock, key type and the card key type electronic lock has been the

introduction of the international advanced level, now there are several factory production supply market. But the domestic self-developed electronic lock, the city field structure has not been formed, is applied. The domestic many enterprises also introduced the world's advanced technology, development foreground is very considerable.

The system is implemented using assembly language. The purpose of using this language is to get a better picture and understanding of the PIC architecture.Another positive aspect of using assembly language is that it gives very wide and flexible way to interact with microcontrollers even though its implementation is harder than BASIC or C languages, which are used as a language for programming microcontrollers. There are mainly two parts of the system implementations:

A. Keypad Implementation

The system dedicates PORTB for keypad implementation in which 4 pins are reserved for columns and the remaining 4 pins for rows. Hence, the system uses these 8 pins for construction of 16 keys matrix, which makes an efficient use of the limited ports provided in PIC16F628A.

There is an important precaution which must be taken while implementing the keypad because, the keypad processing rely on a mechanical process (pressing and releasing keys). This phenomenon generates a spark, which influences the electrical properties of pin while pressing and releasing the

key, which causes the pin status to be unstable and can’t be recognized properly whether it is 0 or 1. So, to overcome this, a delay must be provided to give enough time for the pin status to be stable and can be read correctly, this time could be 20ms or more.

1. Key Scanning

The keypad design is influenced by electrical phenomena, which states that, if we short circuit two pins, one with zero and the other with high voltage,then both the pin voltage would drop to zero.

This fact could be used for designing the keypad. As mentioned above, PORTB is reserved for the keypad and the most significant 4 bits are used for column indexing, which are set as input port (for input port, we must set TRISB register to high ) to check whether they have dropped to 0 voltage when they are attached with the selected row after pressing the key.

On the other hand, the least significant 4 bits of PORTB are set to output, and are used for row indexing. Since they are the output ports, they can be set to high (1) or low (0) by the firmware. By setting each row to zero for every key scan, the system can check each column, to see if any one of them is set to 0. If so, this means that one key of that row has been pressed. This process is repeated for all rows to check all the keys. The functions responsible for scanning key are row\_scan and col\_scan. 1.1 Row scan This function sets every row to zero at a time and calls col\_scan function to check if any column pins drop to zero voltage. This function then increments the key variable for each row assignments, to index the row.

1.2 Col\_scan

This function scans every column pin to check if any one of them is set to zero.

B. LCD Implementation

The other main part of the system implementation is LCD implementation. The LCD

configures to operate in 4 bits interface mode, because of PIC16F628A ports limitations.Sending the command 0x20 then 0x28 will configure the LCD to work in 4 bits interface mode , which means that the maximum characters can be displayed are 40 characters for a 20x2 LCD used by the system.

Electronic lock technology development so far, has been widely used in higher property security areas as information technology and computer technology and the constant development, electronic lock technology will have greater development. Both at home and abroad, the application of electronic combination lock are common, has the very good development prospect. Electronic combination lock commonly used in daily life and work, it is mainly used for guard against theft.

For example,our most common automatic deposit machine, the above is the keyboard type combination lock, if security is not good, bank will not use nature, visible keyboard type combination lock can be trusted. Now, with the progress of science and technology with the development of the electronic combination lock also reached a relatively high level, both on the function, safety performance, and stability is one of the more comprehensive. Now also appeared on the market for fingerprint recognition, is also useful to the human eye and human voice recognition and other high-tech electronic combination lock products. And in order to better achieve confidentiality, people begin to try to use a combination of ways, the password ways are used together, if use fingerprint plus key presses, and voice recognition, etc., so that you can have more privacy. It can be used for bank vault, because for such a performance requirements to the critical point of safety, the use of this combination lock that has a variety of key combination is appropriate, of course we can be bold to try. Even if the combination lock to use some inconvenient, it meet the requirements of the specific bank vault, that is to have extremely high confidentiality, it is special combination lock set for special occasions. So, use your imagination, we can develop more and better electronic combination lock, to meet the needs of public and specific people, to the point of the design of the electronic combination lock reached perfection.So, is extremely broad prospects for the development of the electronic combination lock, and trend of development is the trend of The Times.

外文资料译文

基于PIC 16F628A单片机电子锁的设计

当今,我们生活在嵌入式系统设备的周围,这些基于嵌入式系统的设备如汽车、洗衣机、医疗设备等。

嵌入式系统是一个为完成特定的控制功能,通常用于实时约束计算而设计的计算机系统。嵌入式是作为一个完整的设备的一部分,通常包括硬件和机械零件。相比之下,一台通用计算机,例如个人电脑(PC),它设计灵活来满足各种用户的需求。当今嵌入式系统控制着很多常用设备。

嵌入式系统的一个突出的例子是微控制器,它是被一个小型和微型计算机指定执行一些特定的任务。单片机程序(固件)就是其中之一,它决定单片机给用户提供了什么功能。一个程序,在不需要一个操作系统的情况下,而有能力在单片机上运行被称为固件。这意味着,一个固件有直接访问硬件的特权。在本文中试图详细解释一个电子锁的固件。单片机的基本思想是在一个简单的电路中去收集所有的输入和输出外围设备,它代表的是微控制器,而不是大型和复杂的计算机微处理器和大量的外围设备。 固件直接处理外围设备和输入/输出端口给单片机的完整功能。 在许多方面微处理器与微控制器是有区别的。第一个及最重要的方面是它们的架构。为了让一个微处理器功能能够正常运行,其他的组件,如内存、外设和输入输出端口必须连接到它。简而言之,我们可以说,一个微处理器是计算机的核心,它与计算机系统的其他外围设备/部件一起工作。另一方面,一个微控制器被设计成为一个可以独立执行的单元。不需要其他外部组件的应用程序,因为所有必要的外围设备和部件已经内置。最终,它节省了所需的时间和空间构造设备。

随着电子技术的发展,各类电子产品也在相应产生,电子锁就是其中之一。跟据有关资料的介绍,从20世纪30年代就开始研究电子锁了,很早就已经应用于一些特殊场所。这种锁是通过键盘输入一组密码来完成开锁的过程。研究这种锁的原始目的,就是为增强锁的安全性能。因为电子锁的密钥量密码量非常大,能够与机械锁配合使用,而且可以防止因钥匙被仿制而留下安全隐患。电子锁只需记住一组密码,不用携带金属钥匙,人们携带金属钥匙的烦恼被去除,被越来越多的人所欣赏。电子锁有很多种类,如指纹锁,数码锁,磁卡锁,IC卡锁,生物锁等。但是比较实用的还是按键式电子锁。在20世纪80年代以后,随着电子锁专用集成电路的出现,电子锁的体积变小,可靠性增强,成本较高,适合在安全性要求较高的场合使用,而且需要有电源提供能量,还局限在一定范围内使用,很难得到普及,所以对它的研究的进展一直不明显。目前在西方发达国家,电子锁技术相对来说较先进种类齐全,电子锁已在智能门禁系统中被广泛应用,通过多种更加安全更加可靠的技术来实现大门的管理。在我国电子锁整体水平还处于国际上的70年代左右,而且电子锁还有很高的成本,市场上仍以按键电子锁为主,国际的先进水平已经引进到按键式和卡片钥匙式电子锁,现在在国内有几个生产厂来供应市场需求。但是在国内自行研制开发的电子锁应用还不够广泛,市场结构还没有形成。国内很多企业也引进了世界上的先进技术,发展前景非常可观。

该系统是使用汇编语言来实现。使用这种语言的目的是为了得到一个更好的描述以及理解单片机的体系结构。使用汇编语言的另一个积极的方面是,它给了非常广泛和灵活的方式去与微控制器进行交互,即使它的实现比BASIC 语言或C语言用作微控制器编程语言时更难。该系统的实现主要有两部分:

A键盘实现

该系统致力于测试实现4插脚为列,其余4插脚为行保留的键盘。因此,该系统使用这些8插脚来建立一个16键矩阵,它作为一个有效的使用有限的部件在PIC16F628A中被提供。

当键盘正在执行时要有一个重要的必须采取的预防措施,因为,键盘在处理时依赖于一个机械过程(按下和释放键) 。这种现象产生了瞬态放电,影响识别的电气性能,当按下和释放按键时,导致识别状态不稳定,不能正确识别是否为0或1。所以,为了克服这个问题,必须提供足够的时间延迟识别状态以达到稳定,可以正确读取,一次延时可能是20毫秒或更多时间。

1、键盘的扫描

键盘的设计是受电现象影响的,也就是说,如果我们短路两个插脚,一个零另一个高电压,那么识别电压将下降到零。从这个事实上就可以用于键盘的设计。 如前所述,PORTB被预留给键盘和最重要的4位用于列索引,它们设置为输入端口(输入端口,我们必须设置TRISB寄存器),检查他们是否有电压降至0,当他们附有被选中的行后按下按键。

另一方面,最重要的4位PORTB将输出,用于行索引。因为他们是输出端口,可以设置为高(1)或低(0)的固件。通过设置每个按键扫描每一行到零,系统可以检查每一列,以查看是否有其中任何一个设置为0。如果是这样的话,这就意味着,那一行的按键已经被按下。他的这个过程是对所有行重复检查所有按键。负责扫描的功能键是行扫描和列扫描。

1.1行扫描

这种功能将每一行设置为零,调用列扫描功能来检查任何一个列插脚电压是否降为零。这种功能为每一行的分配增加按键的易变性,去索引行。

1.2列扫描

这种功能扫描每一列插脚来检查他们中的任何一个是否设置为零。

B.液晶显示器实现

该系统实现的另一个主要部分是液晶的安装启用。由于PIC16F628A端口限制,LCD配置操作在4位接口模式。发送命令0x20到0x28将配置液晶在4位接口工作模式,这意味着20x2液晶使用的系统可以显示的最大字符为40个字符。

电子锁发展至今,已经广泛应用于财产安全防范要求较高的领域,随着信息技术和计算机技术的不断发展,电子锁技术必将有更大的发展。不管是在国内还是国外,电子密码锁的应用都很普遍,具有很好的发展前景。电子密码锁一般应用在日常的生活和工作当中,主要用于防盗。比如我们最常见的自动存取款机,上面就是键盘式的密码锁,如果安全性不好的话,银行自然不会使用,可见键盘式密码锁是可以信赖的。现在随着科技的进步电子密码锁的研制也随着达到了一个比较高层次的水准,不管是在功能上、安全性能上、还是稳定性上都已经是比较全面的了。市场上现在也出现了用于指纹识别的,也有用人眼和人的声音识别的等一些高科技的电子密码锁产品。还有为了能更好的达到保密性,人们开始尝试用组合的方式,将几种密码方式一起使用,如用指纹识别加上按键输入再加上声音识别等,这样就可以有更高的保密性。这可以用于银行金库,因为对于这么对安全性能要求到苛刻地步的场合,使用这种具有多种密钥组合而成的密码锁是很合适的,我们当然可以大胆的去尝试。即使这种密码锁使用起来有些不方便,但是它满足了银行金库的特定的需求,那就是要有极高的保密性,这是对专门的场合设置的专用的密码锁。所以,发挥自己的想象力,我们可以开发出更多更好的电子密码锁,来满足大众的和特定人群的需求,使电子密码锁的设计达到炉火纯青的地步。所以,电子密码锁的发展前景是极其广阔的,发展趋势更是大势所趋。