Implementation of Fingerprint Assist Wending Machine with Recharge Option

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Abstract - In this paper we propose an implementation technique for coffee vending machine with the goal of getting recharge option for customer using fingerprint-based authentication. We implement the proposed design based on Advance Virtual RISC (AVR) microcontroller. The circuit is tested and compared with the existing embedded technology. Among the various biometric traits (e.g., face, iris, fingerprint, voice), Fingerprint-based authentication has the longest history, and has been successfully adopted in both forensic and civilian applications. Advances in fingerprint capture technology have resulted in new large scale civilian applications. The purpose of this article is to give an overview of fingerprint-based recognition and discuss research opportunities for making these systems perform more effectively.

Keywords - *AVR, Embedded Technology, Real time processor, Fingerprint module. Fingerprint feature extraction, finger print individuality.*

I. INTRODUCTION

The main aim of vending machine is to give the instantaneous refreshment to the customer. So making some changes and provide a flexibility to the seller as well as customer, we take a some step towards our project. This is the conceptual application of vending machine by adding some extra circuitry to the present one.

Present vending machine requires one seller who provides beverage to the customer. Present vending machine is operated by a seller manually and play roll of moderator between machine and customer. So, there is direct contact between vending machine and customer. As we provide recharge system for customer which is most flexible for customer as well as seller. That is help to direct contact between customers. The recharge system is totally operated by seller with administrator password to start the vending machine process.

In recent decades, two forces have driven the increase of the processor performance. Firstly, advances in very large-scale integration (VLSI) technology.

The fingertip pattern of an individual is unique to that person. This is the central premise of fingerprint based authentication systems used for identifying individuals.

In practice, however, various sources of variability can confound this uniqueness information and cause erroneous decisions to be made. A central problem in fingerprint analysis, therefore, is to determine the amount of information in a fingerprint and assess the extent of uniqueness. These problems can be addressed by eliciting statistical models that adequately capture the different sources of variability.

In this work, a methodology for easy design and real implementation of micro-controller is proposed, in order to provide customers with a user-friendly tool. Simple designs using micro-controllers are exposed to the customers at the beginning, rising the complexity gradually toward a final design with microcontroller integrated in an vending machine.

II. ADVANCED VIRTUAL RISC

AVR microcontrollers can be termed as a mini computer with all peripherals on the chip. A typical AVR microcontroller can contain peripherals like RAM, EEPROM, Flash memory, Input-Output (I/O) pins, Analog to Digital converters, PWM channels, Timers etc. It also has a CPU for processing, but not as fast and complex as the one within a computer. These AVR microcontroller (from now on termed as µc's) is an 8-bit microcontroller and based on Reduced Instruction Set Computer (RISC) architecture. 8-bit means that the µc can transmit and receive data in a set of 8 bits. Atmel manufactures 3 variations of 8-bit microcontrollers.

- TinyAVR
- MegaAVR
- XmegaAVR

Fig. 1 : Different types of AVR Microcontrollers.

These variations are there to distinguish based on their physical size, memory size, number of inbuilt peripherals and their applications. MegaAVR is the most popular one with enough memory for our basic projects with suitable peripherals.

The ATmega32 is a low-power CMOS 8-bit microcontroller based on the AVR enhanced RISC architecture. By executing powerful instructions in a single clock cycle, the ATmega32 achieves throughputs approaching 1 MIPS per MHz allowing the system designer to optimize power consumption versus processing speed.

The AVR core combines a rich instruction set with 32 general purpose working registers.

All the 32 registers are directly connected to the Arithmetic Logic Unit (ALU), allowing two independent registers to be accessed in one single instruction executed in one clock cycle. The resulting architecture is more code efficient while achieving throughputs up to ten times faster than conventional CISC microcontrollers.

The ATmega32 provides the following features: 32K bytes of In-System Programmable Flash Program memory with Read-While-Write capabilities, 1024 bytes EEPROM, 2Kbyte SRAM, 32 general purpose I/O lines, 32 general purpose working registers, a JTAG interface for Boundary-scan, On-chip Debugging support and programming, three flexible Timer/Counters with compare modes, Internal and External Interrupts, a serial programmable USART, a byte oriented Two-wire Serial Interface, an 8-channel, 10-bit ADC with optional differential input stage with programmable gain (TQFP package only), a programmable Watchdog Timer with Internal Oscillator, an SPI serial port, and six software selectable power saving modes.

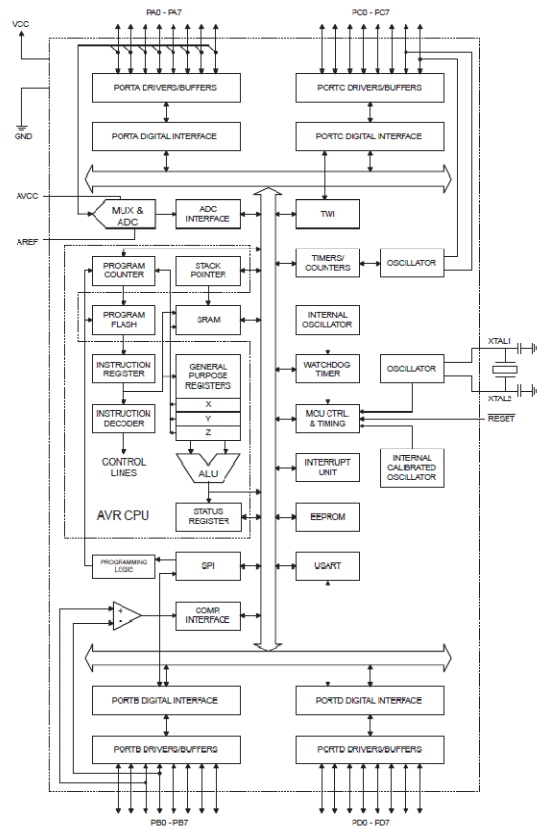

Fig. 2 : Block diagram of ATmega32

The Idle mode stops the CPU while allowing the USART, Two-wire interface, A/D Converter, SRAM, Timer/Counters, SPI port, and interrupt system to continue functioning. The Power-down mode saves the register contents but freezes the Oscillator, disabling all other chip functions until the next External Interrupt or Hardware Reset. In Power-save mode, the Asynchronous Timer continues to run, allowing the user to maintain a timer base while the rest of the device is sleeping.

The ADC Noise Reduction mode stops the CPU and all I/O modules except Asynchronous Timer and ADC, to minimize switching noise during ADC conversions. In Standby mode, the crystal/resonator Oscillator is running while the rest of the device is sleeping. This allows very fast start-up combined with low-power consumption. In Extended Standby mode, both the main Oscillator and the Asynchronous Timer continue to run.

The device is manufactured using Atmel's high density non-volatile memory technology. The On-chip ISP Flash allows the program memory to be reprogrammed in-system through an SPI serial interface, by a conventional non-volatile memory programmer, or by an On-chip Boot program running on the AVR core. The boot program can use any interface to download the application program in the Application Flash memory. Software in the Boot Flash section will continue to run while the Application Flash section is updated, providing true Read-While-Write operation. By combining an 8-bit RISC CPU with In-System Self-Programmable Flash on a monolithic chip, the Atmel ATmega32 is a powerful microcontroller that provides a highly-flexible and cost-effective solution to many embedded control applications.

The ATmega32 AVR is supported with a full suite of program and system development tools including: C compilers, macro assemblers, program debugger/simulators, in-circuit Emulators and evaluation kits.

III. HARDWARE PLATFORM

A. RS232 STANDARD

Information being transferred between data processing equipment and peripherals is in the form of digital data which is transmitted in either a serial or parallel mode. Parallel communications are used mainly for connections between test instruments or computers and printers, while serial is often used between computers and other peripherals. Serial transmission involves the sending of data one bit at a time, over a single communications line. In contrast, parallel communications require at least as many lines as there are bits in a word being transmitted (for an 8-bit word, a minimum of 8 lines are needed).Serial transmission is beneficial for long distance communications, whereas parallel is designed for short distances or when very high transmission rates are required. In addition to communications between computer equipment over telephone lines, RS-232 is now widely used for direct connections between data acquisition devices and computer systems. As in the definition of RS-232, the computer is data transmission equipment (DTE). However, many interface products are not data communications equipment (DCE).Null- modem cables are designed forthis situation; rather than having the pin-to-pin connections of modem cables, null modem cables have different internal wiring to allow DTE devices to communicate with one another.

RS-232 cables are commonly available with either 4, 9 or 25-pin wiring. The 25-pin cable connects every pin; the 9-pin cables do not include many of the uncommonly used connections; 4-pin cables provide the bare minimum connections, and have jumpers to provide "handshaking" for those devices that require it.

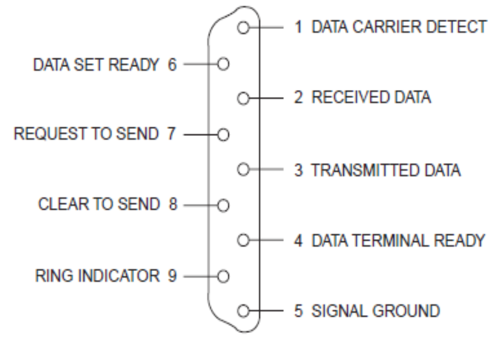

Fig. 3 : RS232 port

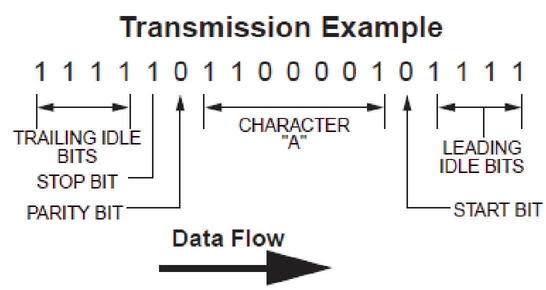

Fig. 4 : Data flow in RS232

B. LCD Display

The liquid crystal display controller and driver LSI displays alphanumeric. It can be configured to drive a dot-matrix liquid crystal display under the control of a 4- or 8-bit microcontrollers. Since all the functions such as display RAM, character generator, and liquid crystal driver, required for driving a dot-matrix liquid crystal display are internally provided on one chip, a minimal system can be interfaced with this controller/driver.The liquid crystal display driver circuit consists of 16 common signal drivers and 40 segment signal drivers. When the character font and number of lines are selected by a program, the required common signal drivers automatically output drive waveforms, while the other common signal drivers continue to output non-selection waveforms. Sending serial data always starts at the display data character pattern corresponding to the last address of the display data RAM (DDRAM). Since serial data is latched when the display data character pattern corresponding to the starting address enters the internal shift register, the drives from the head display. The low power supply (2.7V to 5.5V) of the LCD is suitable for any portable battery-driven product requiring low power dissipation.

C. Fingerprint Module

Among all the biometric traits used for authentication, fingerprint-based recognition has the longest history (almost 100 years) and has been successfully adopted not only in forensic applications, but in an increasing number of civilian applications. The reason behind this success is because fingerprints generally meet the requirements of a biometric trait discussed in the previous paragraph. Due to the wide appeal of fingerprints, fingerprint-based authentication systems continue to dominate the biometrics market by accounting for almost 52% of current authentication systems based on biometric traits. The rapid evolution of mobile commerce and banking (m-commerce and m-banking) services in recent years has placed new emphasis on user ID technology and created widespread deployment of biometrics in this field. New and miniaturized fingerprint sensors capable of being embedded in a mobile phone have been developed to meet the demands of m-commerce and m-banking applications.

In contrast to traditional two dimensional array sensors, these new one-dimensional line scan sensors require the finger to be swiped in order to acquire a fingerprint impression for recognition.

D. I^2C Connection

In consumer electronics, telecommunications and Industrial electronics, there are often many similarities between seemingly unrelated designs. For example, nearly every system includes.

(a) Some intelligent control, usually a single-chip microcontroller.

(b) General-purpose circuits like LCD drivers, remote I/O ports, RAM, EEPROM, or data converters.

(c) Application-oriented circuits such as digital tuning and signal processing circuits for radio and video systems, or DTMF generators for telephones with tone dialling.

I^2C-bus compatible ICs allow a system design to rapidly progress directly from a functional block diagram to a prototype. Moreover, since they ‘clip’ directly onto the I^2C-bus without any additional external interfacing, they allow a prototype system to be modified or upgraded simply by ‘clipping’ or ‘unclipping’ ICs to or from the bus.

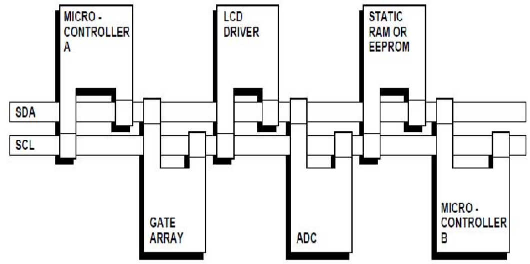

Fig.5: I^2C-bus configuration using two microcontrollers.

A complete system usually consists of at least one microcontroller and other peripheral devices such as memories and I/O expanders. The cost of connecting the various devices within the System must be minimized. A system that performs a control function doesn’t require high-speed data transfer. Overall efficiency depends on the devices chosen and the nature of the interconnecting bus structure. To produce a system to satisfy these criteria, a serial bus structure is needed. Although serial buses don’t have the throughput capability of parallel buses, they do require less wiring and fewer IC connecting pins. However, a bus is not merely an interconnecting wire, it embodies all the formats and procedures for communication within the system. Devices communicating with each other on a serial bus must have some form of protocol which avoids all possibilities of confusion, data loss and blockage of information. Fast devices must be able to communicate with slow devices. The system must not be dependent on the devices connected to it, otherwise modifications or improvements would be impossible. A procedure has also to be devised to decide which device will be in control of the bus and when. And, if different devices with different clock speeds are connected to the bus, the bus clock source must be defined.All these criteria are involved in the specification of the I2C-bus.

The I^2C-bus supports any IC fabrication process (NMOS,CMOS, bipolar). Two wires, serial data (SDA) and serial clock (SCL), carry information between the devices connected to the bus. Each device is recognized by a unique address (whether it’s a microcontroller, LCD driver, memory or keyboard interface) and can operate as either a transmitter or receiver, depending on the function of the device. Obviously an LCD driver is only a receiver, whereas a memory can both receive and transmit data. In addition to transmitters and receivers, devices can also be considered as masters or slaves when performing data transfers. A master is the device which initiates a data transfer on the bus and generates the clock signals to permit that transfer. At that time, any device addressed is considered a slave.

IV. WORKING OF PROJECT

The overall working of project is shown in following flow chart.

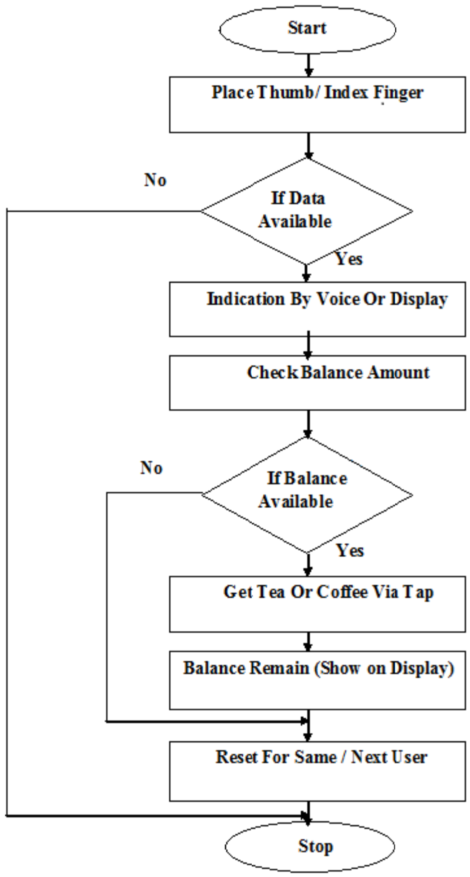

Fig. 6 : Working of proposed vending machine

Now, there are two types of customer for our newly modified vending machine.

A. Known Person:-

This is that type of customer whose data is stored in vending machine with the identification of his finger print .It will work like our bank account. The amount of recharge will recommended to the fingerprint of that person. If that person place a thumb or ID finger on finger print scanner of vending machine, the scanner scan his finger and check the amount of balance remain in his account and also the cost of beverages. Then it will take a decision to supply beverages or not.

B. Unknown Person:-

This is that type of person whose data is not stored in vending machine, so we also provide facility for that person. This unknown person directly goes to the seller and seller will give him beverage from his own account which is already present in vending machine for simplicity of seller. The cost of beverage is deducted from the seller account. So, in this way as we will overcome such a problems.

V. ACKNOWLEDGMENT

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