Intelligent Shopping Cart Facility Using USB Firmware with PIC18f4550

Jethava Hiren[1], Mukesh Saini[2]

[1]PG Student, Department of EC, Patel Institute of Engineering & Science,
RGPV University, Bhopal, India

[2]Assistant Professor, Department of EC, Patel Collage of Science & Technology,
RGPV University, Bhopal, India

Abstract: *USB communication is growing in popularity for remote upgrades, downloading data and other portable serial communication applications. Microchip's USB PIC MCUs bring the benefits of full-speed USB to a broad range of embedded designs that can operate in various environments and locations, enabling easy access to other USB devices such as printers, handheld devices or PCs .Nowadays, in mall for purchasing variety of items it requires trolley. Every time customer has to pull the trolley from rack to rack for collecting items and at the same time customer has to do calculation of those items and need to compare it with his budget in pocket. After this procedure, customer has to wait in queue for billing. So, to avoid headache like pulling trolley, waiting in billing queue, thinking about budget, We are introducing new concept that is "INTELLIGENT SHOPPING CART FACILITY USING USB FIRMWARE WITH PIC18F4550".The autonomous billing system uses Zigbee transceiver to transmit/receive the product information. Hence it eliminates the existing queuing system in the supermarket.*

Keywords: Barcode scanner, PICDEM Full-Speed USB Kit, *Zigbee Technology,* Optical sensor.

1. Introduction

In this smart world, no one can end up the day without using any kind of embedded system products. It makes our human life very smarter and to feel comfortable Lot of electronic products are introduced for visually impaired but all having some sort of drawbacks such as complexity in operation, need of more practice, higher cost, expensive design methodology and installation, non optimized data, more time consuming and tough maintenance. At present in the case of shopping there is no such embedded product. Shopping is one of the interesting things for every human. But this simple task cannot be easily achieved flow less because customer has to wait for billing procedure the goal of every product is nothing but to attain the top position in the market. For that, the product should have some basic qualities such as low cost, portability, easy working and maintenance. So the proposed system is effectively designed by considering these aspects in mind. To provide the low cost and efficient embedded product, PIC microcontroller is preferred.

Scanner technology and PIC microcontrollers are coordinately used to design the system. It can be easily implemented in the supermarkets where all kind of things available under one roof. At transmitting side, the system uses a barcode scanner. It is an optical machine-readable representation of data. The system using two Zigbee transceiver modules, one interfaced with microcontroller and the other one connected with PIC18F4550 Full-Speed USB module. The identification and wireless techniques are implemented to determine and transmit the product information automatically. At the receiver side, the system use USB Communication Device Class (CDC) specification. The Microsoft Windows driver conforms to this specification. Therefore, the embedded device must also be designed to conform with this specification in order to utilize

this existing Windows driver. So, systems easily connect through USB port with PC.
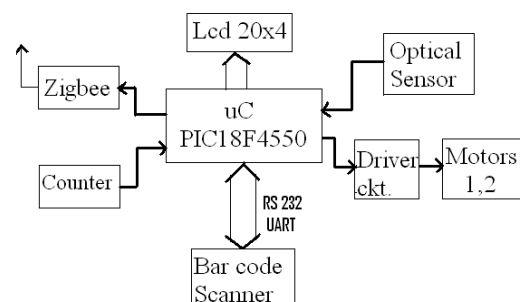
2. Block Diagram

2.1 Transmitter

Figure 1: Block Diagram for TX module

As per denoted in Figure 1, bar code scanner interface with microcontroller through serial communication protocol. This serial communication module is capable of standard RS-232 operation and provides support for the LIN bus protocol. Other enhancements include Automatic Baud Rate Detection and a 16-bit Baud Rate Generator for improved resolution. Scanned items are display on LCD. Customer can maintain their budget because total cost for purchased items also displayed on LCD. When customer press conform switch provided on trolley, purchased order transmit on air through Zigbee.
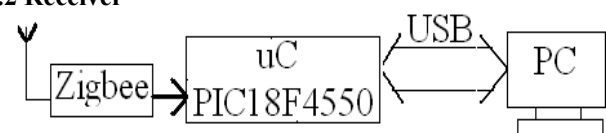
2.2 Receiver

Figure 2: Block Diagram for RX module

As Shown in Figure 2, Purchased items for predefine customers are receive by Zigbee module and display on PC. Here, the system uses Microchip USB firmware. So receiving module directly interface with PC via USB cable.

2.3 Methodology

Optical Sensor:-In this paper we have adopted the Obstacle Detection methodology. It is used to keep predefine path for trolley. If obstacle is far away from sensor, it does not give reflected back signal and if obstacle is in range of sensor then it will get the reflected signal then obstacle is detected.
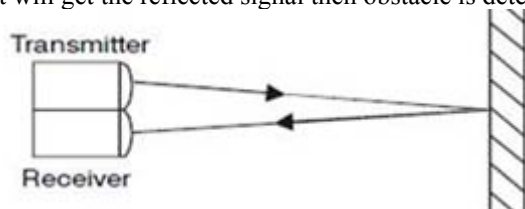

Figure 3: Optical Sensor

Barcode Scanner:-A barcode is an optical machine-readable representation of data, which shows certain data on certain products like unique ID. Purpose of using barcode is to automatically identify the product from its unique barcode label printed on it. This barcode reader is combination of hand held unit (LED array source & CCD capture) and decoder circuit which takes raw data of barcode and outputs serial data at 9600 bps with RS232 level output suitable for interfacing with microcontrollers or PC serial port.

Figure 4: Bar code Scanner

3. Hardware Design

3.1 Development Board

The PICDEM™ PIC18 Explorer Demonstration Board is the latest demonstration board for evaluating Microchip Technology's PIC18FXXXX and PIC18FXXJXX families of devices. The board contains 18f series IC. The board can be used as a stand-alone device or with an in-circuit debugger, such as the MPLAB® ICD 2, and host PC. Free software development tools are available for application development and debugging.
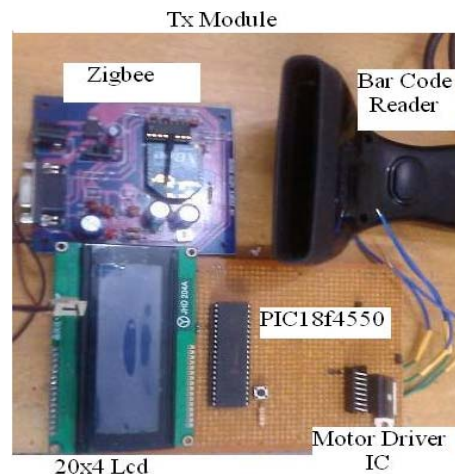

Figure 5: Transmitter Module

Figure 6: Receiver Module

PIC18F4550 is a High-Performance, Enhanced Flash, USB Microcontrollers with nano Watt Technology. This family of devices offers the advantages of all PIC18 microcontrollers – namely, high computational performance at an economical price – with the addition of high endurance, Enhanced Flash program memory. In addition to these features, the PIC18F2455/2550/4455/4550 family introduces design enhancements that make these microcontrollers a logical choice for many high-performances, power sensitive applications.

3.2 Zigbee

The Zigbee-PRO RF Modules was engineered to meet IEEE 802.15.4 standards and support the unique needs of low-cost, low-power wireless sensor networks. The modules require minimal power and provide reliable delivery of data between devices. The modules operate within the ISM 2.4 GHz frequency band and are pin-for-pin compatible with each-other.
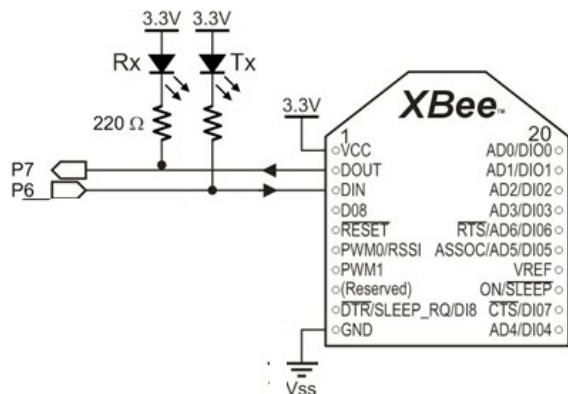
Figure 7: Zigbee module

Key Features

- Indoor/Urban: up to 300' (90 m), 200' (60 m) for International-variant.
- Transmit Power: 63mW (18dBm), 10mW (10dBm) for International-variant.
- TX Peak Current: 250mA (150mA for international variant).
- RX Current: 55 mA (3.3 V).

4. Software Design

4.1 MPLAB IDE

MPLAB IDE is a Windows OS based Integrated Development Environment for the PICmicro MCU families and the dsPIC Digital Signal Controllers. The MPLAB IDE provides the ability to:

1. Create and edit source code using the built-in editor.
2. Assemble, compile and link source code.
3. Debug the executable logic by watching program flow with the built-in simulator or in real time with in-circuit emulators or in-circuit debuggers.
4. Make timing measurements with the simulator or emulator.
5. View variables in Watch windows.
6. Program firmware into devices with device programmers

4.2 C18 C COMPILER

MPLAB C18 C Compiler is a cross-compiler that runs on a PC and produces code that can be executed by the Microchip PIC18XXXX family of microcontrollers. Like an assembler, the MPLAB C18 compiler translates human-understandable statements into ones and zeros for the microcontroller to execute. Unlike an assembler, the compiler does not do a one-to-one translation of machine mnemonics into machine code.

MPLAB C18 takes standard C statements, such as "if(x==y)" and "temp=0x27", and converts them into PIC18XXXX machine code. The compiler incorporates a good deal of intelligence in this process. It can optimize code using routines that were employed on one C function to be used by other C functions. The compiler can rearrange code, eliminate code that will never be executed, share common code fragments among multiple functions, and can identify

data and registers that are used inefficiently, optimizing their access.

4.3 MCHPFSUSB Firmware

The Microchip USB Firmware Framework is a library that can be used to create new USB applications. The USB Framework is based on the latest versions (as this is written) of Microchip development tools. Microchip's current PIC18 USB microcontroller families share the same basic set of USB registers and names. As a result, the MCHPFSUSB Framework can be ported to work with the different PIC18 USB microcontroller families with little to no modification.

4.4 RS 232 Emulation over USB

This figure shows the migration path from RS-232 to USB. The UART physical layer is replaced with the USB hardware layer. Since CDC is a standard USB class, Microsoft has implemented a driver which supports the RS-232 interface emulation. On the PC side, the CDC driver provides the linking layer between the USB hardware and the UART driver. This allows the end application to remain unchanged because from its perspective, it still sees the RS232interface.As for the embedded application side; the PIC18F4550 has a full-speed USB peripheral. In addition, Microchip also provides the CDC RS-232Emulation Reference Project which provides necessary application programming interfaces.
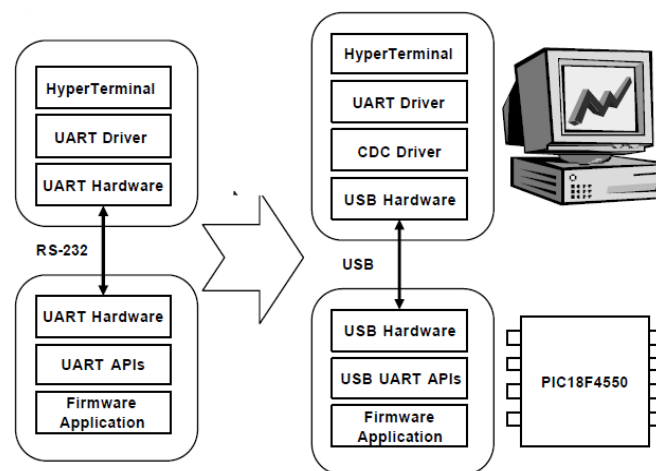

Figure 8: RS-232 to USB Emulation

5. Conclusion and Future Scope

All computers have several USB ports, so USB is much more convenient for users. No work or modification is required on the PC side to implement the RS-232 emulation over USB. This is so because Windows 2000 and XP already come with a driver which provides the RS-232 emulation capability as defined in the Communication Device Class Specification. Therefore the only things left to do are for the embedded device to have the hardware and firmware supports that Conform to the CDC specification.

In Automatic trolley, there is no need to pull heavy trolley, no need to wait in billing queue and no need of thinking about budget. The microcontroller based trolley automatically follows the customer. Also it maintains safe

distance between customer and itself. It gives number of products in trolley and total cost of the products on the spot. It gives facilities like trolley stopping, turning right or left. So, we could successfully implement the concept of Automatic trolley.

The Microchip TCP/IP Stack is a suite of programs that provides services to standard TCP/IP-based applications (HTTP Server, Mail Client, etc.), or can be used in a custom TCP/IP-based application. So using this application we can also maintain online database for selling products.

References

[1] M. Mathankumar, "A Low Cost Smart Shopping Facilitator for Visually Impaired," International Conference on Advances in Computing, Communications and Informatics (ICACCI), pp. 1088-1092, 2013. (conference style)
[2] Bastin Tony Roy Savarimuthu, Morgan Bruce, Maryam Purvis, "A Software Framework for Application Development using Zigbee Protocol," The Information Science Discussion Paper Series, April 2009. (Paper style)
[3] Kenny Ju Min Yeoh, Hwee Ling Wong, "Web-based Remote Navigational Robot for Multiclass Human-Robot Interaction," IEEE Conference on Sustainable Utilization and Development in Engineering and Technology, pp. 170-175, 2012. (conference style)
[4] John Mortan, "THE PIC MICROCONTROLLER," Your Personal Introductory Course, Third edition, an imprint of Elsevier, Burlington, 2005. (book chapter style)
[5] Presi.T.P, "Design And Development Of PIC Microcontroller Based Vehicle Monitoring System Using Controller Area Network (CAN) Protocol," Department of Applied electronics and instrumentation, MES college of engineering, Malappuram, India, 2005. (technical report style)
[6] Microchip, "PIC18F2455/2550/4455/4550 USB Microcontrollers with nanoWatt Technology," Datasheet,2008.[Online]. http://ww1.microchip.com/downloads/en/DeviceDoc/39632e.pdf [Access: 2008]. (General Internet site)

Author Profile

Jethava Hiren G received the B.E. degrees in Electronics & Communication from Hemchandracharya North Gujarat University Patan in 2007, respectively. He is currently pursuing Master of Technology in Digital Communication in Patel Institute of Engineering & Science under RGPV University. His areas of interest in research are Embedded System.