AUTOMATIC BUS INFORMATION AND TICKETING USING PIC MICROCONTROLLER

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Abstract: For many years, public transportation system have been an essential part of day – to – day life and so this particular project provides ease to the public by providing service to them in such a way by making use of certain technologies. This system provides passenger control in public transportation vehicles by automated devices and automated ticketing system. Automatic bus stop information provides means to provide information about the bus at the bus stop to the passengers which is departed from a previous bus stop by the Zigbee transceiver. Next the unmanned ticketing is to provide tickets to the passengers by providing RFID tags to each and every one by which they have to place it over the RFID reader so that it would take the balance according to their destination from their account. The person carrying the RFID tag must enter the number of tickets he/she requires. This is done manually by the use of keypad and the details are displayed in the LCD. The IR sensor unit counts the number of persons entering and exiting the bus and it sends the signal to control the operation of stepper motor. When the IR sensor counts a value exceeding the entered value, then the buzzer gives an alert. When the bus arrives, Zigbee unit automatically sends the signal to the transceiver placed at the bus station. At the bus station, the PIC Microcontroller processes this signal and the controller controls the audio playback unit and the voice announcements are given accordingly.

Keywords: PIC Microcontroller, RFID module, Zigbee module, IR unit, Stepper motor unit, Audio Playback unit.

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1 Introduction

Embedded systems are controllers with on chip control. They consist of microcontrollers, input and output devices, memories etc., on chip and they can be used for a specific application. A single chip microcomputer typically includes a microprocessor RAM, ROM, timer, interrupt and peripheral controller. Embedded systems are used for real time applications with high reliability, accuracy and precision. Embedded systems are operated with Real Time Operating systems like WinCE, RT Linux, VxWorks, PSOS, etc. Automatic bus stop information provides means to provide information about the bus at the bus stop to the passengers which is coming from a previous bus stop and also by audio through RFID. Next the unmanned ticketing is to provide tickets to the passengers by providing RFID tags to each and every one by which they have to scratch it over the RFID reader so that it would take the balance according to their destination from their account.

The RFID (Radio frequency Identification) unit consists of the RFID reader and the RFID tag. The tag contains electronically stored information that can be read from up to several meters away. Some tags require a battery and are powered by the electromagnetic fields used to read them. This unit serves as the automatic ticketing system in bus.

The information about the location and place of the bus is provided with the help of Zigbee transceiver placed at the bus and the bus stop. Zigbee is based on the IEEE 802.15.4 standards for WPAN’s. The technology is intended to be simpler and cheaper than Bluetooth. Zigbee has a defined data of 250 Kbits/sec. Zigbee enabled with a RFID can support few range of distance. The Audio playback unit is composed of APR9600 IC that is trained in such a way to give the voice announcements for the passengers waiting at the bus stand.

This module can record and playback upto 16 different voices that can be used for different purposes. Simultaneously the message is displayed in the LCD and the Audio playback is given for the passengers.

II. Hardware Description

A). Automatic Ticketing System

The figure corresponds to the Automatic Ticketing System that will be placed in the bus. This system consists of the RFID reader and the RFID Tag that enables the passengers to obtain the tickets. The stepper motor helps in the functioning of the doors. The IR sensor is used to monitor the number of passengers entering and existing the bus. If the number of passengers do not match with the number of tickets taken then the Buzzer gives the alert. The Zigbee is used to transmit and receive messages.
B). Bus Information System

The figure represents the system of bus information placed at the bus station. The Zigbee plays a major unit in this section as it is capable to transmit and receive. The message transmitted by the bus is received by this Zigbee transceiver which is then processed further by the microcontroller and the appropriate audio playback is given and the message is displayed in the LCD. If any misbehavior happen at the station, the user can send the information to the bus using the keypad placed. The bus will be diverted in alternate route and information is passed through audio playback unit.

IV. PIC Microcontroller

The PIC Microcontroller used for this project is PIC 16F877A. It consists of 35 single-word instructions. It consists of in built 10-bit Analog-to-Digital converter channels, up to 8-channel Analog-to-Digital Converter (A/D). It has 3 timers namely, Timer 0, Timer 1, Timer 2. This kind of PIC family follows low power CMOS technology and the main advantage is that it consumes low power and hence this overcomes the use of Microcontrollers.

V. Usage Of Pic Microcontroller Ports

The PIC Microcontroller used for this project is PIC 16F877A. It consists of 35 single-word instructions. It consists of in built 10-bit Analog-to-Digital converter channels, up to 8-channel Analog-to-Digital Converter (A/D). It has 3 timers namely, Timer 0, Timer 1, Timer 2. There are 5 ports consisting of 33 input/output lines.

Ports Used At The Bus Station

- Port B → Connected to the keypad (4 lines), LCD control lines (RS, R/W, EN).
- Port D → Connected to LCD data lines (8 lines).
- Port C → Connected to TX & RX pins (6 & 7) - the Zigbee module, Audio Playback Unit (3).
- Port B → Connected to the data lines of LCD module (8 lines).
- Port E → Connected to the control lines of LCD module (3 lines).
- Port D → Higher order pins (4, 5, 6, 7) are connected to Stepper motor, pin 0 to Buzzer and pin 1 to the IR sensor unit.
- Port C → Lower order pins (0, 1, 2, 3) are connected to the keypad, TX & RX pins (6 & 7) are connected to the RFID and the Zigbee module.
- Port A → Pin 0 is connected to the confirmation key.
V. Modules

A) RFID Module

RDM 125KHz card mini-module is designed for reading code from 125KHz card compatible read-only tags and read/write card. It can be applied in office/home security, personal identification, access control, anti-forgery, interactive toy and production control systems etc.

B) ZIGBEE Module

This paper aims at presenting the concept of Zigbee, the name of a specification for a suite of high level communication protocols using small, low-power digital radios based on the IEEE 802.15.4-2006 standard for wireless personal area networks (WPANs), such as wireless headphones connecting with cell phones via short-range radio. The technology is intended to be simpler and less expensive than other WPANs, such as Bluetooth. Zigbee is targeted at radio-frequency (RF) applications that require a low data rate, long battery life, and secure networking. Zigbee is a low-cost, low-power, wireless mesh networking standard. The low cost allows the technology to be widely deployed in wireless control and monitoring applications, the low power-usage allows longer life with smaller batteries, and the mesh networking provides high reliability and larger range. Zigbee operates in a range of 2.4 GHz frequency. It is widely used in embedded applications due to low data rate and low power consumption.

C) Relay Circuit

A Relay is nothing but electromagnetic switching device which consists of three pins. They are Common, Normally close (NC) and normally open (NO). The RFID unit is connected to the NC and the Zigbee unit is connected to the NO pin respectively and the common is given to the PIC Microcontroller. This is done in such a way to make communications possible with both the units whenever necessary. Whenever the bus stops at a stage then, a signal is transmitted to the bus station with the help of Zigbee Transceivers. So in this stage the relay is turned on by the microcontroller and hence it goes on to the NO(Normally Open) condition and it connects the Zigbee transceivers of both the sides to establish a communication link.

D) Audio Playback Module

Functional Description of Recording in Audio Playback Unit On power-up, the device is ready to record or play back, starting at the first address in the memory array. Before you can begin recording, the /CE input must be set to low to enable recording. On a falling edge of the /M1_Message pin the device will beep once and initiate recording. A subsequent rising edge on the /M1_Message pin will stop recording and insert a single beep. If the /M1_Message pin is held low beyond the end of the available memory, recording stops automatically, and two beeps are inserted; regardless of the state of the /M1_Message pin. The device returns to the standby mode when the /M1_Message pin is returned high. Functional Description of Playback in Audio Playback Unit On power-up, or after a low to high transition on /RE the device is ready to record or play back starting at the first address in the memory array. Before you can begin playback of messages, the /CE input must be set to low to enable the device and /RE must be set to high to enable playback. The first high to low going pulse of the /M1_Message pin initiates playback from the beginning of the current message. When the /M1_Message pin pulses from high to low a second time, playback of the current message stops immediately. When the /M1_Message pin pulses from high to low a third time, playback of the next message starts again from the beginning. If you hold the /M1_Message pin low continuously, the current message and subsequent messages play until the one of the following conditions is met: the end of the memory array is reached, the last message is reached, the /M1_message pin is released. If the last recorded message has already played, any further transitions on the /M1_Message pin will initiate a double beep for warning and the /M7_END pin will go low. To exit this state you must pulse the /CE pin low once during standby to reset the pointer to the beginning of the first message.

E) Stepper Motor Unit

The simplest way of interfacing a unipolar stepper to PIC Microcontroller is to use a breakout for ULN2003A transistor array chip. The ULN2003A contains seven Darlington transistor drivers and is like having seven TIP120 transistors all in one package. The ULN2003A can pass up to 500 mA per channel and has an internal voltage drop of about 1V when on. It also contains internal clamp diodes to dissipate voltage spikes when driving inductive loads. To control the stepper, apply voltage to each of the coils in a specific sequence.

F) IR Sensor Unit

The IC555, which is designed for a duty cycle of 0.8msSec, with a frequency of 120Hz and 300 mA peak current, is used to drive the infra-red LED.D1. The diodes D1 and D2 are on the same line, just a few centimeters apart. Thus diode D2 receives the infra-red output from the diode D1. The diode signal, which is given to the inverting terminal of the op-amp IC LM 358 gets amplified and its peak is detected by diode D4 and capacitor C4. The forward voltage produced by diode D4 is compensated by diode D3 with R5 and R6. According to the distance between the infra-red transmitter and receiver, a proportional DC voltage is fed to the inverting input of IC2. According to the output of the comparator the LED is turned ON and OFF and this is detected by the PIC Microcontroller.

VIII. Experimental Results

• The program is written in such a way that the maximum capacity of the bus is limited to 10.
• The bus departs only this maximum limit is reached.
• The passenger has to place the RFID tag over the reader in order to select the stage and number of tickets.
• The keypad connected (Port C) with the PIC Microcontroller enables the passenger to deal with the selection and ticketing process.
• The details about this process are displayed in 2x16 LCD. (Port B -> Data lines, Port E-> Control lines)
• After the confirmation, the stepper motor is driven by the controller and the door is open. (Connected to Port D)
• The IR unit counts the number of passengers getting inside the bus, once the value is reached; it sends the signal to the controller and indicates it to close the door.
• And finally at every stage the stepper motor and the IR unit does the same process.
• Whenever the bus arrives at a stage (say Stage A), the PIC Microcontroller at the bus powers up the relay and thus sends the data through the Zigbee Transceiver indicating the arrival of the bus.
• This transmitted signal is received at the bus station with the help of another Zigbee Transceiver placed at this end.
• The TX and RX pins of the PIC Microcontroller receives the signal and processes it.
• The Audio Playback unit is recorded with the capability to announce the status and the position of the bus according to the signal received by the PIC Microcontroller.
• The LCD display, displays the current position of the bus in accordance with the received signal.

Figure 4: Hardware board placed in the bus

Figure 5: Hardware board placed at the bus station

IX. Conclusion

Thus, we have constructed the automated ticketing process in the bus. Using RFID reader, the amount required to travel some distance will be processed and displays the reduced amount in the RFID tag. By this scheme we are able to provide support to the passengers and allocate limited seats in the transportation vehicle. The Bus Information system is executed with the help of Zigbee Transceiver and the bus status is displayed in the LCD placed at the station. Also voice announcement have been achieved through speakers and the passengers can send bus station information to the bus.

IX. Future Work

Now the automatic ticketing and bus information system have been implemented. Nowadays many misbehavior happen against woman’s travelling in public transportation. So the future work is to avoid women under attack problems using some security measures included in the public transits.

References