Electronic Bus Scheduler Using Bluetooth Technology

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Abstract- *Electronic Bus Scheduler using Bluetooth technology in present era is a useful electronic device for school colleges, where there are not fixed daily route for the buses. In this proposed module we have used Bluetooth module at receiver end, for receiving the information via Bluetooth. It saves our time that we use in enquiring about the route of buses , it also saves paper, manpower etc.. In this paper we have proposed a system in which person (particular)can update the real time information about the route of buses wirelessly using Bluetooth our proposed module consist of two section TX and RX . At the Rx section we have use Bluetooth module for receiving the information, Arduino uno,MAX7219, common cathode display driver and seven segment display (common cathode) for displaying numeric digits, At the we used a android phone ,for giving the information to scheduler .*

Keywords- BLUETOOTH, MODULE, ARDUINO, SEVEN SEGMENT DISPLAY, EDA, CAD, MAXIM, GSM, ISM, FHMA

I. INTRODUCTION

1. BLUETOOTH TECHNOLOGY

Bluetooth is a wireless technology standard for exchanging data over short distances (using short wavelength UHF radio waves). In the ISM band from 2.4 to 2.485 GHz) from fixed and mobile devices, and building personal area networks (PANs), it was originally conceived as a wireless alternative to RS232 data cables. It can connect several devices, overcoming problems of synchronization. Bluetooth operates at frequencies between 2402 and 2480 MHz, or 2400 and 2483.5 MHz including guard bands 2 MHz wide at the bottom end and 3.5 MHz wide at the top. This is in the globally unlicensed (but not unregulated) Industrial, Scientific and Medical (ISM) 2.4 GHz short range radio accommodates 40 channels frequency band. Bluetooth uses a radio technology called frequency hopping spread spectrum. Bluetooth divides transmitted data into packets, and transmits each packet on one of 79 designated Bluetooth channels. Each channel has a bandwidth of 1MHz. It usually performs 800 hops per second, with Adaptive Frequency Hopping(AFH) enabled. Bluetooth low energy uses 2 MHz spacing[1].

2. PROTEUS/ISIS

The Proteus Design Suits is an Electronic Design Automation (EDA) tool including schematic capture, simulation and PCB layout modules. It is developed in Yorkshire, England by Labcenter Electronics Ltd with offices in North America and several overseas sales channels. The software runs on the Windows operating system and is available in English, French, Spanish and Chinese languages[2].

3. BLUETOOTH MODULE

[1] HC-06

HC-06 module is a Bluetooth module which uses SPP(serial port protocol) . This module also supports transparent wireless serial communication. This module has enhanced data rate of 3Mbps and also frequency band of 2.4GHz. It has its nominal range of 10m. It has also channel bandwidth of 1 MHz and also 16-bit CRC data protection.

[2] HC-05

HC-05 module is a Bluetooth module which uses SPP (serial port protocol). This module also supports transparent wireless serial communication. This module has enhanced data rate of 3Mbps and also frequency band of 2.45GHz. It has its nominal range of 10m. It has also channel bandwidth of 1 MHz and also 16-bit CRC data protection. This Bluetooth module HC-05 has six output pins namely STATE, TXD, RXD, GND, VCC and EN (enable).[3] The HC-05 Bluetooth Module has 6pins. They are as follows:

[3] ENABLE

When enable is pulled LOW, the module is disabled which means the module will not turn on and it fails to communicate. When enable is left open or connected to 3.3V, the module is enabled i.e., the module remains on and communication also takes place. [9]

[4] STATE:

It acts as a status indicator. When the module is not connected to or paired with any other Bluetooth device, signal goes Low. At this low state, the led flashes continuously which denotes that the module is not paired with other device. When this module is connected to/paired with any other Bluetooth device, the signal goes high. At this high state, the led blinks with a constant delay say for example 2s delay which indicates that the module is paired.[9]

Table 1. Main parameters of hc05/hc06 [4]

HC O5	HC 06
Master and slave mode can be switched	Master and slave mode can't be switched
Master role: have no function to remember the last paired salve device. It can be made paired to any slave device. In other words, just set AT+CMODE=1 when out of factory. If you want HC-05 to remember the last paired slave device address like HC-06, you can set AT+CMODE=0 after paired with the other device. Please refer the command set of HC-05 for the details.	Master role: have paired memory to remember last slave device and only make pair with that device unless KEY (PIN26) is triggered by high level. The default connected PIN26 is low level.
Pairing: The master device can not only make pair with the specified Bluetooth address, like cell-phone, computer adapter, slave device, but also can search and make pair with the slave device automatically. Typical method: On some specific conditions, master device and slave device can make pair with each other automatically.	Pairing: Master device search and make pair with the slave device automatically. Typical method: On some specific conditions, master and slave device can make pair with each other automatically
Multi-device communication: There is only point to point communication for modules, but the adapter can communicate with multi-modules.	Multi-device communication: There is only point to point communication for modules, but the adapter can communicate with multi-modules.
Default communication baud rate: 9600, 4800-1.3M are settable.	Default communication baud rate: 9600, 1200-1.3M are settable.
Consumption: During the pairing, the current is fluctuant in the range of 30-40mA. The mean current is about 25mA. After paring, no matter processing communication or not, the current is 8mA. There is no sleep mode. This parameter is same for all the Bluetooth modules.	Consumption: During the pairing, the current is fluctuant in the range of 30-40 m. The mean current is about 25mA. After paring, no matter processing communication or not, the current is 8mA. There is no sleep mode. This parameter is same for all the Bluetooth modules.

4. ARDUINO UNO

This is microcontroller board based 28 pin Atmega328p-pu AVR series IC. It has 14 digital input/output pins out of which 6 pins can be used as a PWM output. This has also 6 analog input pin. Operating frequency of this is 16MHz. it has flash memory 32kb. EPROM 2kb& RAM 2KB. It has also one UART.4.8-bit PWM output and 2, 16-bit PWM output[5].. The pin configuration with figure of Arduino uno is described below

Table 2. Pin details of Arduino

PIN NO.	PIN NAME	MAPPED PIN NAME
1	RESET	RESET
2	RXD	RX/DIGITAL I/O 0
3	TXD	TX/DIGITAL I/O 1
4	INT0	DIGITAL I/O 2
5	INT1	DIGITAL I/O 3
6	T0	DIGITAL I/O 4
7	VDD	SUPPLY VOLTAGE
8	GND	GROUND
9	XTAL1	CRYSTAL PIN1
10	XTAL2	CRYSTAL PIN 2
11	T1	DIGITAL I/O 5
12	AINO	DIGITAL I/O 6
13	AIN1	DIGITAL I/O 7
14	ICP1	DIGITAL I/O 8
15	OC1A	DIGITAL I/O 9
16	OC1B	DIGITAL I/O 10
17	MISI	DIGITAL I/O 11
18	MISO	DIGITAL I/O 12
19	SCK	DIGITAL I/O 13
20	AVCC	SUPPLY VOLTAGE
21	AREF	VREF
22	GND	GROUND
23	ADC0	ANALOG INPUT 0
24	ADC1	ANALOG INPUT 1

25	ADC2	ANALOG INPUT 2
26	ADC3	ANALOG INPUT 3
27	ADC4	ANALOG INPUT 4
28	ADC5	ANALOG INPUT 5

[1] ATMEGA328P-PU

The Atmega328 is a single-chip microcontroller created by Atmel in the megaAVR family. The Atmel 8bit AVR RISC based microcontroller combines 32 kB ISPN flash memory with read while write capabilities, 1 kB EEPROM, 2 kB SRAM, 23 general purpose I/O lines, 32 general purpose working registers, three flexible timer/counters with compare modes, internal and external interrupts, serial programmable USART, a byte oriented 2wire serial interface, SPI serial port, 6channel 10bit A/D converter (8channels) in TQFP and QFN/MLF packages), programmable watchdog timer with internal oscillator, and five software selectable power saving modes[6]. The device operates between 1.85.5 volts. The device achieves throughput approaching 1 MIPS per MHz. It operates at maximum frequency of 20MHz and its operating temperature is -45°C to +85°C. The power consumption of Atmega328p-pu is approximately 0.6mA/MHz.

Table 3. Key parameters of atmega328p-pu

Pin no.	Pin	Function
1	PC6	Reset
2	PD0	Digital Pin(Rx)
3	PD1	Digital Pin(Tx)
4	PD2	Digital Pin
5	PD3	Digital Pin(PWM)
6	PD4	Digital Pin
7	Vcc	Positive Voltage(Power)
8	GND	Ground
9	XTAL1	Crystal Oscillator
10	XTAL2	Cryatal Oscillator
11	PD5	Digital Pin(PWM)
12	PD6	Digital Pin(PWM)
13	PD7	Digital Pin
14	PB0	Digital Pin
15	PB1	Digital Pin(PWM)
16	PB2	Digital Pin(PWM)
17	PB3	Digital Pin(PWM)
18	PB4	Digital Pin
19	PB5	Digital Pin
20	Avcc	Positive Voltage for ADC (Power)
21	Aref	Reference Voltage
22	GND	Ground
23	PC0	Analog Input
24	PC1	Analog Input
25	PC2	Analog Input
26	PC3	Analog Input
27	PC4	Analog Input
28	PC5	Analog Input

5. MAX7219/7221

The MAX7221 is compact, serial input/output common-cathode display driver that interface microprocessors (µPs) to 7-segment numeric LED displays of up to 8 digits, bar-graph displays, or 64 individual LEDs. Included on-chip are a BCD code-B decoder, multiplex scan circuitry, segment and digit drivers, and an 8x8 static RAM that stores each digit. Only one external resistor is required to set the segment current for all LEDs. The MAX7221 is compatible with SPI, QSPI, and MICROWIRE, and has slew rate limited segment drivers to reduce EMI [7]. A convenient 4-wire serial interface connects to all common µPs. Individual digits may be addressed and updated without rewriting the entire display. The MAX7221 also allow the user to select code-B decoding or no-decode for each digit. The devices include a 150µA low-power shutdown mode, analog and digital brightness control, a scan limit register that allows the user to display from 1 to 8 digits, and a test mode that forces all LEDs on.

Table 4. Pin description of MAX7219/7221

PIN	NAME	FUNCTION
1	DIN	Serial data input. Data is loaded into internal 16 bit shift register on clocks rising edge.
2,3,5,6, 7,8,10,11	DIG0-DIG7	Eight-digit drive lines that sink current from the display common cathode. MAX7221's digit drivers are high impedence when turned off.
4,9	GND	Ground(both ground pins must be connected)
12	CS	Chip-select Input. Serial data is loaded into the shift register while CS is low. The last 16 pins of serial data are latched on CS's rising edge
13	CLK	Serial- clock Input. 10MHz maximum rate. On CLK's rising edge, data is shifted into the internal shift register. On CLK's falling edge, data is clocked out of DOUT. On MAX7221, the CLK input is active while CS is low.
14,15,16,17, 20,21,22,23	SEGA-SEGG,	Seven segment drives and decimal point drives source current to

	DP	display. MAX7221 segment drivers are high-impedance when turned off.
18	ISET	Connect to Vdd through a resistor(Rset) to set to set the peak segment current
19	V+	Positive supply voltage. Connected to 5V
24	DOUT	Serial data output. The data into DIN is valid at DOUT 16.5 clock cycles later. This pin is used to daisy chain several MAX7221's & is never high-impedance.

6. SEVEN SEGMENT DISPLAY (COMMON CATHODE

A seven-segment display (SSD), or seven-segment indicator, is a form of electronic display device for displaying decimal numerals that is an alternative to the more complex dot matrix displays. Seven-segment displays are widely used in digital clocks, electronic meters, basic calculators, and other electronic devices that display numerical information. Seven-segment displays may use a liquid crystal display (LCD), a light-emitting diode (LED) for each segment, or other light-generating or controlling techniques such as cold cathode gas discharge, vacuum fluorescent, incandescent filaments, and others. Hexadecimal digits can be displayed on seven-segment displays. A combination of uppercase and lowercase letters is used for A–F this is done to obtain a unique, unambiguous shape for each hexadecimal digit (otherwise, a capital D would look identical to an 0/O and a capital B would look identical to an 8). Also the digit 6 must be displayed with the top bar lit to avoid ambiguity with the letter b. In addition, seven segment displays can be used to show various other letters of the Latin, Cyrillic and Greek alphabets including punctuation, but few representations are unambiguous and intuitive at the same time. Short messages giving status information (e.g. "PLAY or PAUSE" on a CD player) are also commonly represented on 7-segment displays[8]. In the case of such messages it is not necessary for every letter to be unambiguous, merely for the words as a whole to be readable. Similar displays with fourteen or sixteen segments are available allowing less-ambiguous representations of the alphabet. Using a restricted range of letters that look like (upside-down) digits, seven-segment displays are commonly used by school children to form words and phrases using a technique known as "calculator spelling".

Table 5. Status of individual LED'S

	INDIVIDUAL LED's							
DIGIT	A	B	C	D	E	F	G	DP
1	OFF	ON	ON	OFF	OFF	OFF	OFF	ON
2	ON	ON	OFF	ON	ON	OFF	ON	ON
3	ON	ON	ON	ON	OFF	OFF	ON	ON
4	ON	ON	ON	OFF	OFF	ON	ON	ON
5	ON	OFF	ON	ON	OFF	ON	ON	ON
6	ON	OFF	ON	ON	ON	ON	ON	ON
7	ON	ON	ON	OFF	OFF	OFF	ON	ON
8	ON	ON	ON	ON	ON	ON	ON	ON
9	ON	ON	ON	OFF	OFF	ON	ON	ON
0	ON	ON	ON	ON	ON	ON	OFF	ON
A	ON	ON	ON	OFF	ON	ON	ON	ON
B	ON	ON	ON	ON	ON	ON	ON	ON
C	ON	OFF	OFF	ON	ON	ON	OFF	ON
D	OFF	ON	ON	ON	ON	OFF	ON	ON
E	ON	OFF	OFF	ON	ON	ON	ON	ON
F	ON	ON	OFF	OFF	ON	ON	ON	ON

II. PROPOSED MODULE DESCRIPTION

In school, colleges, institute etc. the students/peoples know the bus with their single digit number assigned to every bus by the management and not by their registration numbers. So we are using seven segment LED's for displaying the single digit number of buses.

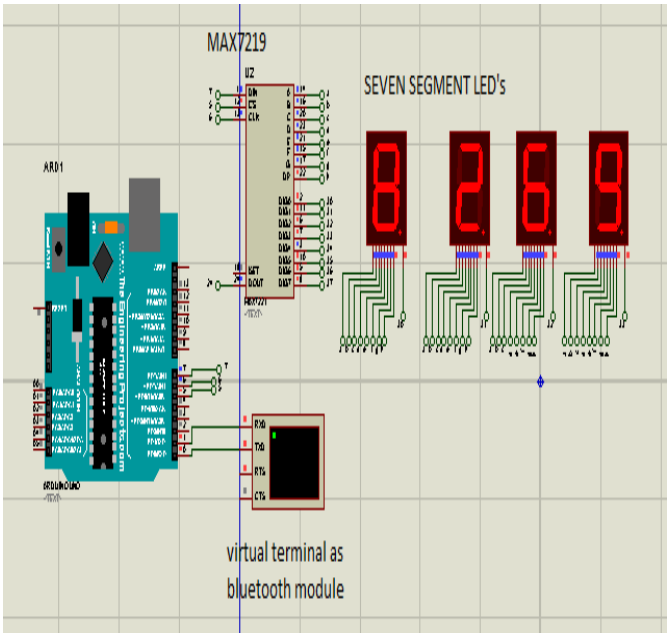

Figure 1. Schematic of Rx part in Proteus Design Suite

The fig shows the circuit of our proposed designed on Proteus simulation software. In the circuit the components used are one MAX7219/21 driver, 4 common cathode seven segment displays, one Arduino uno development board & virtual terminal is used as Bluetooth module. Virtual terminal's of Rx and Tx is connected with Tx and Rx

pin of Arduino uno respectively. Here we are using 4 seven segment display (common cathode), these 4 seven segment LED's are controlled by only three pins of Arduino uno. For this we used MAX 7219/21 drivers, one driver can control 8 seven segment LED's. the three pins if Arduino control the drivers and drivers control the seven segment LED's. From the circuit Pin 7, 6 & 5 of Arduino are connected with Pin 1(DIN), 13(CLK) & 12($\overline{CS}$) of first of second MAX7219/21 driver respectively. The segment pins of driver is connected with the anodes of 4 seven segment LED's. There are 8 digit pins(DG) on each driver, one digit pin is connected with one seven segment LED's cathode terminal ,so first 4 seven segment LED's cathodes are connected with 4 first digit pins of driver.

Our Rx part is an android phone through which we send the bus numbers for different routes to the scheduler . Bluetooth module is input to receiver, it connects the Rx section with Tx section and sends the route information to the microcontroller . The microcontroller is connected with the driver, microcontroller controls the driver ,it sends the bus numbers to the driver and give information that which number is for which seven segment display. In our proposed hardware model we have used only 4 seven segment displays, we can also use more seven segment display. With our proposed model we can update routes of 4 buses. If we want to display routes for more buses than we have to use more Seven segment LED's. Our Rx part is shown in fig.

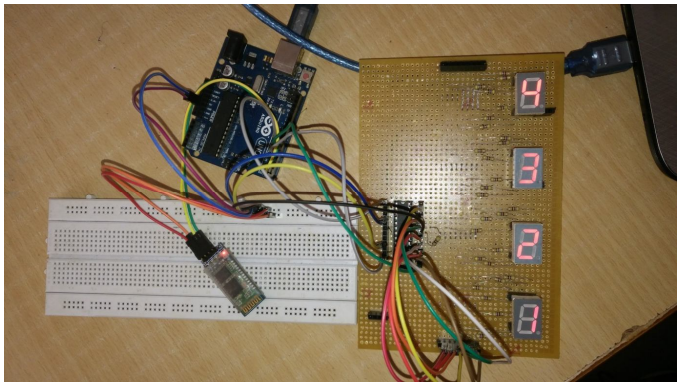

Figure 2. Proposed prototype hardware Design of Rx part

Electronic bus scheduler is a very useful tool for the school, colleges, institutes, offices etc. where there is no fixed daily route of buses. It is a low cost electronic equipment , easy to install and operate, maintenance cost is low . As we know that Bluetooth has maximum 10m range so it can only work in 0-10m range. It cannot show the registration number of buses, it shows the single digit number assigned to the buses by management.

We can also use GSM and infrared technology in place of Bluetooth technology. With some improvement we can use this at public bus stands, auto stands etc.

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