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City Bus Tracking System

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Abstract

The objective of this project is to provide a city bus vehicle tracking system, it deals with two things. Firstly, it provides information about which bus coming to the stop. And secondly, it deals with the traffic management and safety to the road user by reducing the accidents. By the presently existing system we are dealing with three terminals, a device on bus, a device at bus stop and a device on the master bus stand so as to keep the track on the all city busses. By employing this tracking system the arrival of the bus is detected near the bus stop and also can be seen on the pc at the master bus stop. Further if we use GSM modem we can also transmit the bus information to the registered mobile numbers. Hence, we can control the bus traffic and can detect the arrival of particular bus at the bus stop..

Keywords: City Bus, public transport.

Introduction

In today's world transportation system has a very vital role to play in day to day life. Most of the people are being carried by the bus transportation system. Because of ever increasing development the requirement of this system is increasing day by day. The number of busses daily is huge. To keep the track of all the busses is a big challenge before bus authorities.

To solve this problem we have come up with a novel solution of city bus tracking. It consists of three terminals:-

1. **A device on bus**: This microcontroller based kit which sends its ID and other data wirelessly to the device on the bus stop. Once the bus stops in front of the bus stop it transmits its own ID.
2. **A device on the bus stop**: This device will receive the data from the device on the bus and then transmits it through RS485 using a dedicated RS485 interface. The data frame will take the bus ID and the bus stop ID.
3. **A device on the bus stand (Master stop)**: This device will receive the data from the device on the bus stop which contain the bus ID and the bus stop ID, and then transmit it to the PC which is located on the master terminal. PC will have a VB based map which indicates the location of the bus.

For the transmission of bus ID from the bus and other data(such as arrival and departure timing) we are using IR transmitter. To receive this data at the bus stop we are using TSOP1738 (IR receiver).

LCD is used in this project to visualize the received bus ID and other data. we used 16x2 LCD which indicates 16 columns and 2 rows. So, we can write 16 characters in each line. So, total 32 charters we can display on 16x2 LCD.

The power supply for the circuit consist of bridge rectifier and capacitor input filter which produce an unregulated DC voltage which is applied at the input of 7805(regulator IC). As the minimum dropout voltage is 2v for IC 7805, the voltage applied at the input terminal should be at least 7v.

Here, we are also using GSM (Global System for Mobile Communication) which is a digital mobile telephony system. With the help of GSM module interfaced, we can send text messages to the required authorities as per the request. It operates at either 900MHz or 1800MHz frequency band.

The main objectives of this project are:

1. Monitoring of the city bus traffic.
2. Real time tracking of city busses.
3. Effectively control and ensure incomes and secure people.

Related Work

Technological advances in telecommunications and information technology, coupled with state-of-the-art microchip, RFID (Radio Frequency Identification), and inexpensive intelligent beacon sensing technologies, have enhanced the technical capabilities that will facilitate motorist safety benefits for intelligent transportation systems globally. Sensing systems for ITS are vehicle- and

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infrastructure-based networked systems, i.e., Intelligent vehicle technologies. Infrastructure sensors are indestructible (such as in-road reflectors) devices that are installed or embedded in the road or surrounding the road (e.g., on buildings, posts, and signs), as required, and may be manually disseminated during preventive road construction maintenance or by sensor injection machinery for rapid deployment. Vehicle-sensing systems include deployment of infrastructure-to-vehicle and vehicle-to-infrastructure electronic beacons for identification communications and may also employ video automatic number plate recognition or vehicle magnetic signature detection technologies at desired intervals to increase sustained monitoring of vehicles operating in critical zones.

Inductive loop detection

Inductive loops can be placed in a roadbed to detect vehicles as they pass through the loop's magnetic field. The simplest detectors simply count the number of vehicles during a unit of time (typically 60 seconds in the United States) that pass over the loop, while more sophisticated sensors estimate the speed, length, and weight of vehicles and the distance between them. Loops can be placed in a single lane or across multiple lanes, and they work with very slow or stopped vehicles as well as vehicles moving at high-speed.

Video vehicle detection

Traffic flow measurement and automatic incident detection using video cameras are another form of vehicle detection. Since video detection systems such as those used in automatic number plate recognition do not involve installing any components directly into the road surface or roadbed, this type of system is known as a "non-intrusive" method of traffic detection. Video from black-and-white or color cameras is fed into processors that analyze the changing characteristics of the video image as vehicles pass. The cameras are typically mounted on poles or structures above or adjacent to the roadway. Most video detection systems require some initial configuration to "teach" the processor the baseline background image. This usually involves inputting known measurements such as the distance between lane lines or the height of the camera above the roadway. A single video detection processor can detect traffic simultaneously from one to eight cameras, depending on the brand and model. The typical output from a video detection system is lane-by-lane vehicle speeds, counts, and lane occupancy readings. Some systems provide additional outputs including gap, headway, stopped-vehicle detection, and wrong-way vehicle alarms.

Combined Bluetooth and Wi-Fi detection

By placing small sensors in strategic key points in road networks is possible to track Bluetooth and Wi-Fi signals from passing vehicles. This gives road authorities a wide range of new possibilities to provide real-time queue warning and road sign information evaluate and regulate traffic signals to optimize flow, reduce CO2 and more, for a fraction of the price compared to conventional technologies.

Bluetooth and Wi-Fi technologies can be used for travel time measurement, because the technologies are now ubiquitous. More and more people use smart phones with both built-in Bluetooth and Wi-Fi and at the same time, more and more cars have hands-free systems installed.

Compared with other traffic data collection technologies, combined Bluetooth and Wi-Fi tracking has some significant advantages, such as cost per measurement point due to:

► Fast, easy & low-cost roadside installation without disturbing traffic

► No sensor maintenance compared to competing technologies.

► Measures 24/7 in all weather conditions such as snow, rain and fog

► Measures in all traffic conditions such as in slow moving traffic (Bumper to bumper)

► Measures in multiple directions simultaneously

Combined Bluetooth and Wi-Fi tracking advantages:

► Measure travel time and immediately detect congestion

► Provide real-time queue warning and road sign information

► Evaluate and regulate traffic signals to optimize flow, reduce CO2 and more

► Collect data for Origin/Destination studies

► Provide real-time traffic information for Internet, phone apps, TMC feed, radio and more

► Identify bottlenecks and problem areas to optimize and plan future traffic models

► Understand weather related traffic patterns

► Understand congestion patterns at roadworks, accidents, sports events and more.

Proposed Work

1. By using GPS modem we can implement the intelligent system in future.
2. In Future it can be used as an advanced tracking and dispatching system for taxi or long distance.

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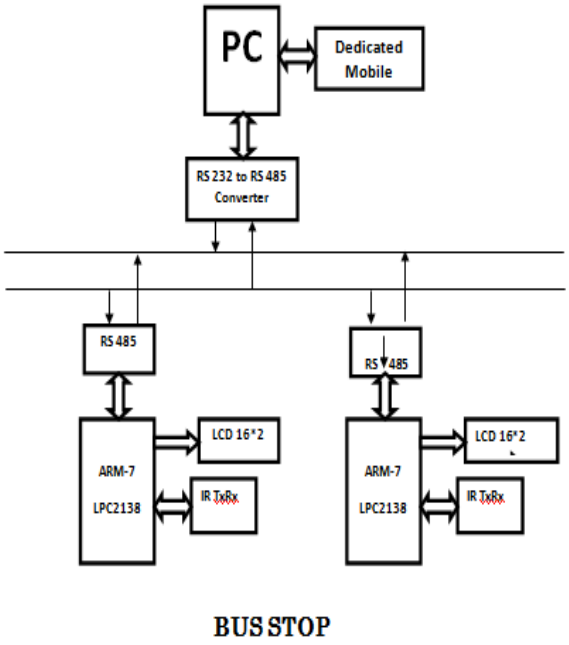
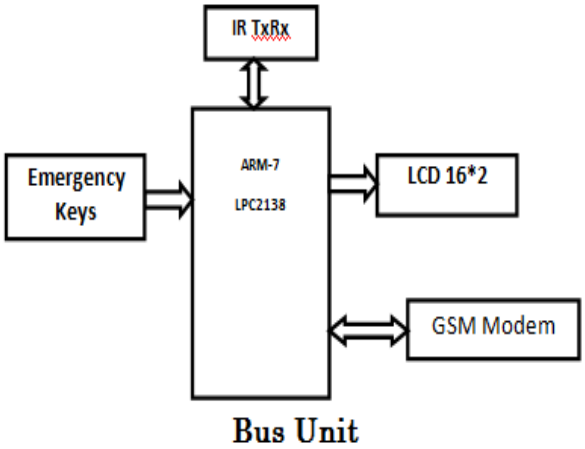
3. Another advantage of this system is that, we can use GPS and other sensors to see the moving vehicle anywhere in the world.

Further advancement could make this system useful for the following applications:-

1. **Solutions for various industries:-**
   Fleet Management System provides real time information on the location and the status of the vehicles and operators. With the information, we can increase the efficiency, utilization, security and safety of entire fleet.
2. **Fuel Monitoring:-**
   This is another important usage of vehicle tracking to monitor the fuel through tracking device.
3. **Transit tracking**:-
   This is a temporary tracking of assets from one point to another. Users will ensure that the assets do not stop in the route of do a U-turn in order to ensure the security of assets.
4. **Distance calculation**:-
   This is an important usage of vehicle tracking to calculate the distance travel by the fleet.
5. **Asset tracking**:-
   Companies needing to track valuable assets for insurance or other monitoring purposes, can now plot the real time asset location on a map and closely monitor movement and operating status.
6. **Stolen vehicle recovery**:-
   Both consumer and commercial vehicles can be outfitted with RF and GPS unit to allow police to do the tracking and recovering. In the case of LoJack, the police can activate the tracking unit in the vehicle directly and follow the tracking signal.
7. **Dispatching and tracking**:-
   It displays operating status of vehicles in different areas and effectively dispatching.
8. Instant message service:-
   Monitoring center notice or news distribution.
9. **Handset free calling**:-
   Convenient in car telephone service to know the bus working status of a bus on duty.
10. **Burglar proof and anti highjack**:-
    Calling and SMS for help and site location and remotely control engine to stop cars.
11. **Over speed alarm**:-
    Setup is fixing for speed alert that reminds to slow down when car speed exceed a certain value.
12. **Geo-fence alarm**:-
    A Geo-fence is a virtual boundary on geographic area. When this boundary is entered or exited it can be recognize as an event and the user can be notified for that event. This notification will tell the user that which vehicle has entered or left the area and where it is.

Block Diagram





Hardware:-

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- ARM7(microcontroller)
- RS485 and RS232
- Liquid crystal display
- Transmitter-IR LED
- Receiver-TSOP1738
- GSM modem
- IC555 based 38KHz modulation
- Power Supply

Block Description

Arm7 (Microcontroller)

The ARM7 is a low-power, general purpose 32-bit RISC microprocessor for use in application or Customer-specific integrated circuits (ASICs or CSICs). It's simple, elegant and fully static design is particularly suitable for cost and power-sensitive applications. The ARM7's small die size makes it ideal for integrating into a larger custom chip that could also contain RAM, ROM, logic, DSP and other cells.

Enhancements

The ARM7 is similar to the ARM6 but with the following enhancements:

- Fabrication on a sub-micron process for increased speed and reduced power consumption
- 3V operation, for very low power consumption, as well as 5V operation for system compatibility
- Higher clock speed for faster program execution.

Applications

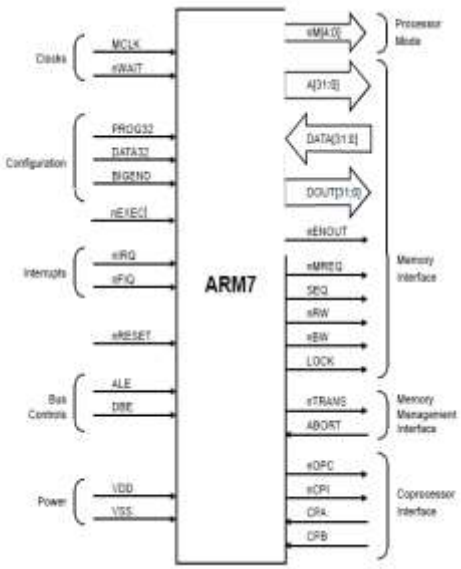
The ARM7 is ideally suited to those applications requiring RISC performance from a compact, Power-efficient processor. These include:

Telecomms GSM terminal controller
Datacomms Protocol conversion
Portable Computing Palmtop computer
Portable Instrument Handheld data acquisition unit
Automotive Engine management unit
Information Systems Smart cards
Imaging JPEG controller

Feature Summary

- 32-bit RISC processor (32-bit data & address bus)
- Big and Little Endean operating modes
- High performance RISC
- 17 MIPS sustained @ 25 MHz (25 MIPS peak) @ 3V
- Low power consumption
- 0.6mA/MHz @ 3V fabricated in .8µm CMOS
- Fully static operation
- Ideal for power-sensitive applications
- Fast interrupt response for real-time applications
- Virtual Memory System Support
- Excellent high-level language support
- Simple but powerful instruction set

Functional Diagram



RS485 and RS232

RS 232:

RS 232 IC is a driver IC to convert the µC TTL logic (0-5) to the RS 232 logic (+-9v).Many device today work on RS 232 logic such as PC, GSM modem , GPS etc. so in order to communicate with such devices we have to bring the logic levels to the 232 logic (+/-9v).

RS 485:

RS 232 is well-known due to popularity of today's PC's, unlike the RS422 and RS 485. These are used in industry for control systems and data transfers (small volumes, NO hundreds of Mb/s).

So, what is the main difference between RS 232 and RS 422 & 485? The RS 232 signals are represented by voltage levels with respect to ground. There is a wire for each signal, together with the ground signal (reference for voltage levels). This interface is useful

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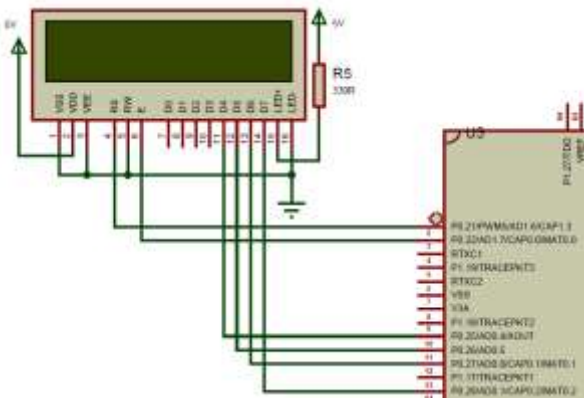
for point-to-point communication at slow speeds. For example, port COM1 in a PC can be used for a mouse, port COM2 for a modem, etc. This is an example of point-to-point communication: one port, one device. Due to the way the signals are connected, a common ground is required. This implies limited cable length - about 30 to 60 meters maximum. (Main problems are interference and resistance of the cable.) Shortly, RS 232 was designed for communication of local devices, and supports one transmitter and one receiver.

RS 422 & 485 uses a different principle: Each signal uses one twisted pair (TP) line - two wires twisted around themselves. We're talking 'Balanced data transmission', or 'Differential voltage transmission'. Simply, let's label one of the TP wires 'A' and the other one 'B'. Then, the signal is inactive when the voltage at A is negative and the voltage at B is positive. Otherwise, the signal is active, A is positive and B is negative. Of course, the difference between the wires A and B matters. For RS 422 & 485 the cable can be up to 1200 meters (4000 feet) long, and commonly available circuits work at 2.5 MB/s transfer rate.

Liquid crystal display



LCD has 2 Power Sources

1. VCC and GND is at 1 and 2 NO. Pins of LCD. Used to drive the LCD 3mA current consumption.
2. VCC and GND is at 15 and 16 NO. pins of LCD used to drive the backlight of LCD 100 mA current

Total current consumption = 3mA + 100mA = 103 mA

So, in order to reduce the current requirement we are connecting a 330 ohm resistance in series with the backlight pin VCC. This reduces the current consumption (100mA / 330ohm =0.303 mA).

Therefore new total current consumption = 0.303mA+3 mA =3.303 mA.

LCD Data and Control lines-

LCD has 8 / 4 data lines and 3 control lines .The 4 data lines of LCD (pin 11 to pin 14) are connected to the B port of PIC µC (B4 to B7) .

The control lines of LCD are RS,R/W ,E.

Register Select (RS)-

The LCD RS pin is for selecting the data or the code register, it connected to pin 35 i.e B2.

If RS=0 , the instruction command code register is selected, allowing the user to send a command such as clear display , cursor at home,etc.

If RS=1, the data register is selected, allowing the user to send data to be displayed on the LCD.

Read/ Write (R/W)-

The LCD R/W is for choosing between reading or writing on LCD.

R/W=1 when reading.

R/W=0 when writing.

Here R/W is connected to ground ie R/W=0.

Enable (E)-

LCD pin E is for enabling or disabling the LCD which connected to pin 34 ie B1.

The enable pin is used by the LCD to latch information presented to its data pins. a high-to-low pulse must be applied to this pin.

Transmitter-IR LED

MXB79 series are LED lamps encapsulated in a 1.9mm x 3.97mm round rectangular bar epoxy package with color diffused lens.

MGB79D is a green chip with a green diffused lens.

MSB79D is a red chip with a red diffused lens.

MYB79D is a yellow chip with a yellow diffused lens.

The data to be transmitted id given through µc (or computer) is given to transistor BC547.The BC547 Transistor is et in saturation mode,depending on the sequence transmitted from µC or computer this transistor turns ON/OFF accordingly. Thus the visible LED D9 also turns ON/OFF accordingly.

These pulses are given to the reset (pin no. 4) of the IC 555 and the corresponding HIGH / LOW are outputted at the OUT pin of IC 555.These pulses are then given to the transmitter IR LED's which transmit the original sequence. Here we are connecting 10 OHM resistance in series with the 2 LRD's, so that maximum current can flow through them and we can get a longer range. Since very low drive current is used, use of high-efficiency visible LED's, which light up at 1mA, is needed.

The electrical pulses sent by the COM port are now converted into corresponding modulated pulses of IR light. In the transmitter section we have used IC555 in astable mode to generate a 38 kHz (also works from 36 kHz to 40 kHz) modulated pulse to select a data of

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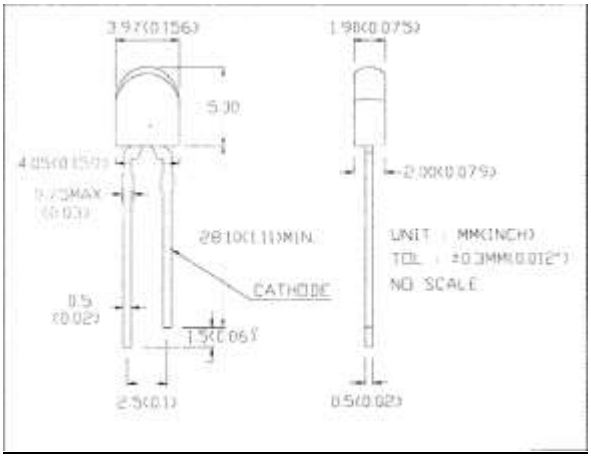
particular frequency only. Frequency can be adjusted by using variable resistor R25. Duty cycle of IR beam is about 25%, this allows us to pass more current from LED's achieving a longer range.



ELECTRO-OPTICAL CHARACTERISTICS (Ta=25°C)

PARAMETER		SYMBOL	MGB79D	MSB79D	MYB79D	UNIT	CONDITIONS
Forward Voltage	MAX	V_F	3	3	3	V	I_F=20mA
Reverse Breakdown Voltage	MIN	BV_R	5	5	5	V	I_R=100μA
Luminous Intensity	MIN	I_V	5	*1.2	9	mcd	I_F=20mA
	TYP		10	*2.5	18		
Peak Wavelength	TYP	λp	570	700	589	nm	I_F=20mA
Spectral Line Half Width	TYP	Δλ	30	100	35	nm	I_F=20mA
Viewing Angle	TYP	2θ 1/2	86	86	86	degree	I_F=20mA

Receiver-TSOP1738

We are using TSOP1738 as receiver-

The TSOP17 series are miniaturized receivers for infrared remote control systems. PIN diode and preamplifier are assembled on lead frame, the epoxy package is designed as IR filter. The demodulated output signal can directly be decoded by a microprocessor. TSOP17 is the standard IR remote control receiver series, supporting all major transmission codes.

Features-

-Photo detector and preamplifier in one package
- Internal filter for PCM frequency
- Improved shielding against electrical field disturbance
-TTL and CMOS compatibility
- Output active low
- Low power consumption
- High immunity against ambient light
- Continuous data transmission possible (up to 2400 bps)
-Suitable burst length .10 cycles/burst

In the receiver section, IR signals are detected by a photodiode which is inside a **IR RECEIVER MODULE TSOP1738**. A photodiode is reversed biased and breaks down when IR light falls on its junction. The detected TTL level signals are coupled to pin 10 of MAX 232 IC. These TTL levels are then converted into ± 9V levels internally. The data from the output of the receiver module is amplified and given back to the micro controller or PC.

Here the IR receiver TSOP 1738 has a band pass filter of 38 KhZ that's why we are setting the transmitter pulses to 38 khz so that any signal that rides upon 38 khz is accepted by the IR receiver TSOP 1738.The pulses at the output of TSOP1738 should ideally be at TTL logic (0-5 v) ,but the o/p pulses of TSOP 1738 are lower than that of TTL Logic ,that's why we are connecting a BC547 transistor which is in the saturation region to amplify the o/p of IR receiver and make it up to TTL logic.

GSM MODEM

GSM uses a variation of time division multiple access (TDMA) and is the most widely used of the three digital wireless telephony technologies (TDMA, GSM, and CDMA). GSM digitizes and compresses data, then sends it down a channel with two other streams of user data, each in its own time slot. It operates at either the 900 MHz or 1800 MHz frequency band.

Designed for global market, SIM300 is a Tri-band GSM/GPRS engine that works on frequencies EGSM 900 MHz, DCS 1800 MHz and PCS1900 MHz. SIM300 provides GPRS multi-slot class 10 capability and support the GPRS coding schemes CS-1, CS-2, CS-3 and CS-4.

With a tiny configuration of 40mm x 33mm x 2.85 mm , SIM300 can fit almost all the space requirement in your application, such as Smart phone, PDA phone and other mobile device.

The physical interface to the mobile application is made through a 60 pins board-to-board connector, which provides all hardware interfaces between the module and customers' boards except the RF antenna interface.

- The keypad and SPI LCD interface will give you the flexibility to develop customized applications.
- Two serial ports can help you easily develop your applications.
- Two audio channels include two microphones inputs and two speaker outputs.

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This can be easily configured by AT command.

SIM300 provide RF antenna interface with two alternatives: antenna connector and antenna pad. The antenna connector is MURATA MM9329-2700. And customer's antenna can be soldered to the antenna pad.

The SIM300 is designed with power saving technique, the current consumption to as low as 2.5mA in SLEEP mode.

The SIM300 is integrated with the TCP/IP protocol, Extended TCP/IP AT commands are developed for customers to use the TCP/IP protocol easily, which is very useful for those data transfer applications.

IC555

The **555 timer IC** is an integrated circuit (chip) used in a variety of timer, pulse generation, and oscillator applications. The 555 can be used to provide time delays, as an oscillator, and as a flip-flop element. Derivatives provide up to four timing circuits in one package.

Power supply design of the Project :

The average voltage at the output of a bridge rectifier capacitor filter combination is given by

$$Vin(DC) = Vm - Idc / 4 f C1$$

Where , $Vm=\sqrt{2}\ Vs$ and Vs = rms secondary voltage

Assuming Idc to be equal to max. load current, say 100mA

C = 1000 Gf / 65v , f=50hHz

$$19 = Vm - 0.1 / 4*50*1000*10^{-}6$$

$$19= Vm - 0.1 / 0.2$$

$$Vm=19.5 \text{ volts}$$

Hence the RMS secondary Voltage

$$Vrms = vm / \sqrt{2}$$

$$= 19.5 / \sqrt{2}$$

$$=19,5 / 1.4421$$

$$=13.5 \text{ volts}$$

So we can select a 15v secondary Voltage

In our system most of the components used require 5 V as operating voltage such as micro controller, MAX 232, MCT2E etc. The total current, which our circuit sinks from the power supply, is not more than 100 mA. We have used Regulator IC 7805 that gives output voltage of 5V.The minimum input voltage required for the 7805 is near about 7 v. Therefore we have used the transformer with the voltage rating 230v-10v and current rating 500 mA. The output of the transformer is 12 V AC. This Ac voltage is converted into 12 V DC by Bridge rectifier circuit.

The reasons for choosing the bridge rectifier are

a) The TUF is increased to 0.812 as compared the full wave rectifier.
b) The PIV across each diode is the peak voltage across the load $=V_m$, not $2V_m$ as in the two diode rectifier

Output of the bridge rectifier is not pure DC and contains some AC some AC ripples in it. To remove these ripples we have used capacitive filter, which smoothens the rippled out put that we apply to 7805 regulators IC that gives 5V DC. We preferred to choose capacitor filters since it is cost effective, readily available and not too bulky.

v design

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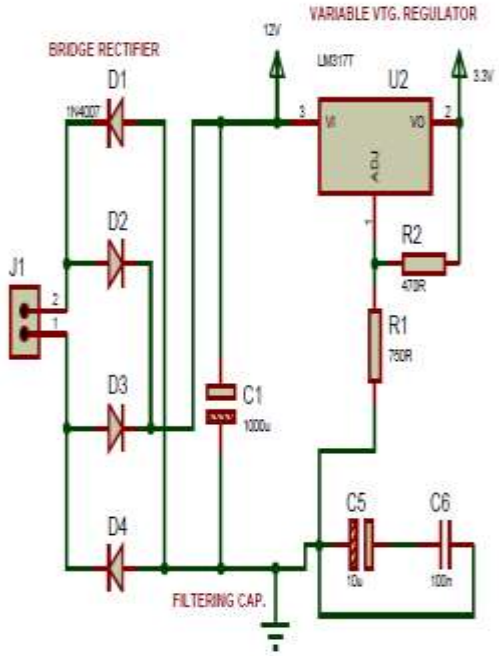


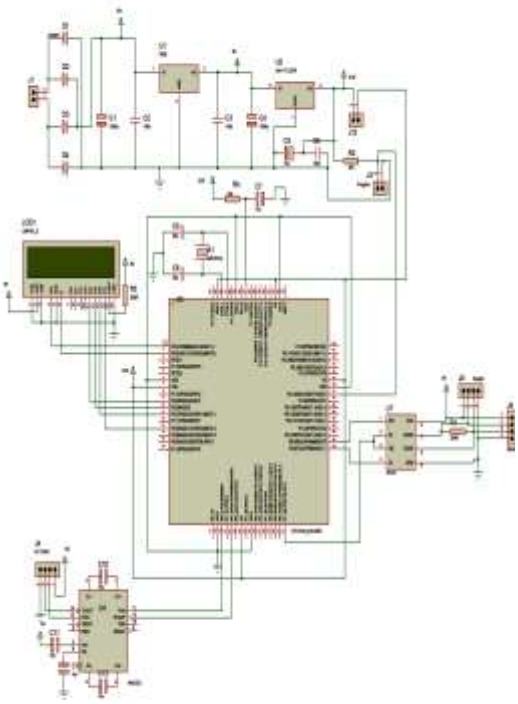
The formula for calculating the output voltage of ARM is (As given in the datasheet of LM317)

$$\dagger\dagger V_{OUT} = 1.25V\left(1 + \frac{R2}{R1}\right) + I_{ADJ}(R_2)$$

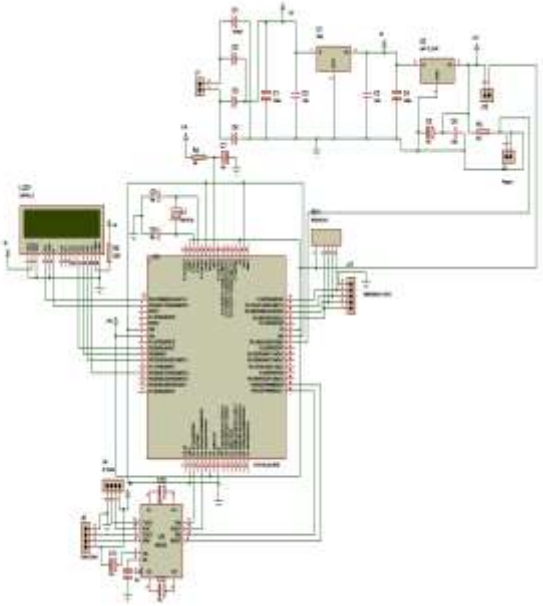
Assuming R2=470 ohms and I adj =0 then,

Circuit Diagram

Bus Stop



Bus Unit



Software:-

1. PROGRAMMING OF ARM7 USING 'ASSEMBLY/C' IN KEIL SOFTWARE. Icon

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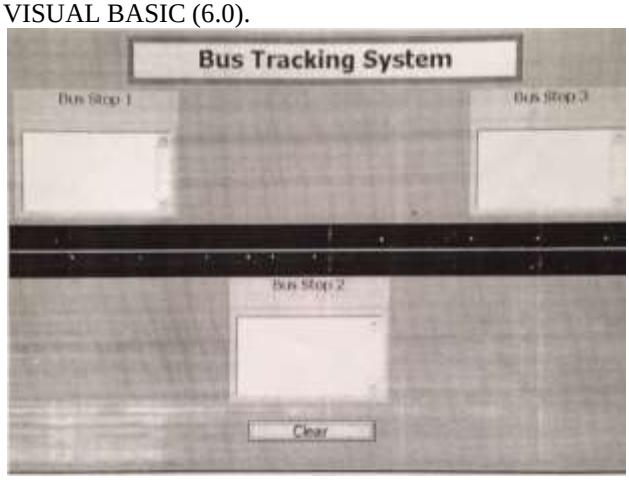
PROGRAMMING AT BASE STATION USING VISUAL BASIC (6.0).



Conclusion

By using this system we can monitor the city bus traffic by real time tracking which can effectively control and ensure incomes and secure people. Further advancement in the system can be done by using GPS which can make this system useful for fuel monitoring, stolen vehicle recovery, asset tracking, distance calculation, transit tracking, banking, use of debit card in hotels and malls, burglarproof and anti-hijack etc.

Acknowledgement

The project is an important part of B-tech curriculum. It enables the student to understand other developing and upcoming technologies besides theoretical concepts. It acquaints the students with the latest development in the field of engineering and technology.

The words are sometimes hard to find, when we try to say thanks for something, so priceless, like helpfulness and variable guidance. Too much gratitude and sincerity repeal and honest thankfulness must be unequivocally stated.

I express my profound sense of regards to **Mr. S.V.Dhole** for giving me an environment and to teach me how to proceed in right direction and getting correct and wholesome information about the concerned technology.

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