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## CROWD CONTROL IN CITY BUSES USING ADVANCED EMBEDDED TECHNOLOGY

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### ABSTRACT

With the budding embedded technologies that bring about drastic changes in the world in terms of technical development, a concept of solving various social issues related to security to resolve overcrowding in the city buses is applied in this paper. Imagination can bring up new innovative ideas that can be put into reality. Nowadays the city buses become overcrowded and people travel in footsteps risking their valuable lives. In order to put a full stop to this problem accommodation of passengers is restricted to predetermined value (i.e., to fixed seats or number). This is implemented by using a piezoelectric effect so that particular count of person entering and leaving the bus is monitored. Thus the number of available seats is always displayed outside the bus in the LCD and the opening and closing of the entry door is controlled based on the vacant place available. Another technology of card swiping is also implemented to issue tickets thus avoiding the messiness, and people cannot enter the bus without tickets.

**Keywords:** Crowd control, city bus, card swiping.

### INTRODUCTION

Accidents have increased a lot in India due to overcrowding of buses especially due to travelling in footboards. This paper emphasizes on accident control by limiting the number of passengers as per the number of seats available inside the bus. Here we use a microcontroller ATMEGA16 to control and measure the number of passengers entering and leaving the bus so that always the count is maintained accurately thus preventing overcrowding and footboard travelling. Also issuing tickets has become a great problem that has lead to unwanted malpractices.

### CARD SWIPING MECHANISM

Each person in the city is provided a card in which he/she should maintain a desired amount. During travelling in the bus this card should be swiped in the external source provided. The external source provided is a card swiping machine. Special buttons are provided for various destination places. The list of places the bus covers is displayed outside the bus along with the number for each destination. The machine recognizes the card details and asks for the number of tickets. As the person enters the number the amount for the particular number of tickets gets detected. This may appear to be a long process. But this consumes only 1 to 2 seconds as the passenger is not going to receive any sort of ticket for confirmation as he/she can enter the bus only if he takes ticket.

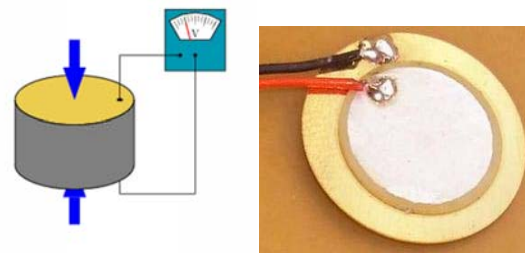
### PIEZOELECTRIC EFFECT

A mechanical vibration is converted into electrical voltage by the use of piezoelectric crystal. This effect is called piezoelectric effect.

With the help of this concept, we are implementing a technique where the piezoelectric crystal

is placed at the foot step of the bus at the entry and exit side so that the weight of a person given to the foot step induces a mechanical vibration which then gets converted into an electrical voltage. This electrical voltage is given as one of the input to the microcontroller and the microcontroller counts the number of voltages generated from the crystal accordingly so that we can program it and display the number of seats available in the bus based on the voltages generated at the entry and exit side. This voltage is fed to be counted only after the person books the ticket using the card he owns. Thus he enters the bus only if he books the ticket outside.

Piezoelectricity is the electric charge that accumulates in certain solid materials such as crystals like quartz crystal in response to applied mechanical stress. It also means electricity resulting from pressure. It is derived from the Greek *piezo*, which means to squeeze or press, and *electric* which means amber, an ancient source of electric charge. Piezoelectricity was discovered in 1880 by French physicists Jacques and Pierre Curie.



**Figure-1.** Piezoelectric crystal, working of Piezoelectric crystal.



Piezoelectricity is found in useful applications such as the production and detection of sound, generation of high voltages, electronic frequency generation, to drive an ultrasonic nozzle, and ultrafine focusing of optical assemblies. It is also the basis of a number of scientific instrumental techniques with atomic resolution, the scanning probe microscopies such as STM, AFM, MTA, SNOM, etc., and everyday uses such as acting as the ignition source for cigarette lighters, push-start propane barbecues, and quartz watches.

### ATMEGA16

The AVR is a modified Harvard architecture 8-bit RISC single-chip microcontroller, which was developed by Atmel in 1996. The AVR was one of the first microcontroller families to use on-chip flash memory for program storage, as opposed to one-time programmable ROM, EPROM, or EEPROM used by other microcontrollers at the time. ATMEGA AVR chips became popular after they were designed into the 8-bit Arduino platform.

We here use the arduino platform for programming in this paper.

The high-performance, low-power Atmel 8-bit AVR RISC-based microcontroller combines 16KB of programmable flash memory, 1KB SRAM, 512B EEPROM, an 8-channel 10-bit A/D converter, and a JTAG interface for on-chip debugging. The device supports throughput of 16 MIPS at 16 MHz and operates between 4.5-5.5 volts.

By executing instructions in a single clock cycle, the device achieves throughputs approaching 1 MIPS per MHz, balancing power consumption and processing speed.



Figure-2. Atmega 16 configuration and Atmega 16 chip.

### COUNTING PROCESS

The generated voltage is fed to the microcontroller. Note that the voltage produced by the

piezoelectric effect should be stepped up to the voltage that is acceptable by the microcontroller, probably 5V. This 5V is given to the loop1 which counts to 1. The loop1 at the entry point used is predefined to a particular value say 50(number of passengers). It is incremented as per the number of persons entering the bus. This incremented value is subtracted from the predefined value which gives the number of available seats and is displayed outside in LCD. As the loop becomes full (meaning it has attained 50) it does not allow passengers into the bus by maintaining the entry door closed. Similarly, input voltage from exit end of the bus is given to the loop2. Thus if the loop2 at the exit gets incremented by 2 meaning 2 members have exited the bus and there are 2 more seats available. Then the entry loop (available) seats gets incremented by 2 and the door opens normally at the entry enabling 2 users to enter the bus again.

Entry loop1 = 50 → Stop allowing passengers. Close the entry gate.

Entry loop2 = 38 → Allow Passengers, Open the door as bus stops. This means 38 seats are available inside and 22 members are inside the bus.

### LCD

The LCD used here is 16 2x matrix format. It is used to display the number of seats available inside the bus. The value calculated from the loop1 and loop2 is compared and the final value is displayed.

### RFID

RFID is a technology similar in theory to bar code identification. With RFID, the electromagnetic or electrostatic coupling in the RF portion of the electromagnetic spectrum is used to transmit signals.

### RFID Systems

Radio Frequency Identification is a device that is used for transmitting and receiving data through wireless communication. It works based upon tags or labels that may or may not be visible to the user. The tags are attached to any object like cloth, utensils, food items and any objects that need unique identification. These tags consist of two main circuits. The integrating circuit is used for processing the received information, modulating and demodulating them and doing other special functions. The antenna is used for transmitting and receiving the signals. The signals are of Radio frequency. The data may be specific to the product like date, serial number cost, secret code etc. which is unique for every product. Thus data gets transmitted, processed and the actions are taken based upon the result arrived. This is one of the safest method of data transmission and reception which has its application world-wide.



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Figure-3. RFID card and RFID card reader.

### BLOCK DIAGRAM

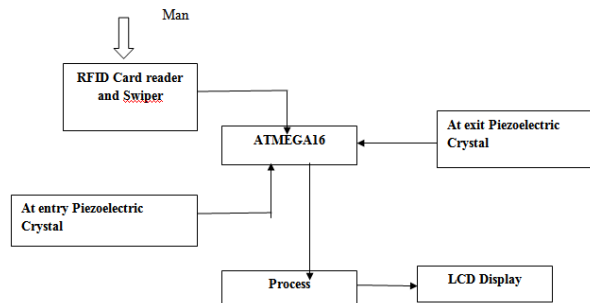
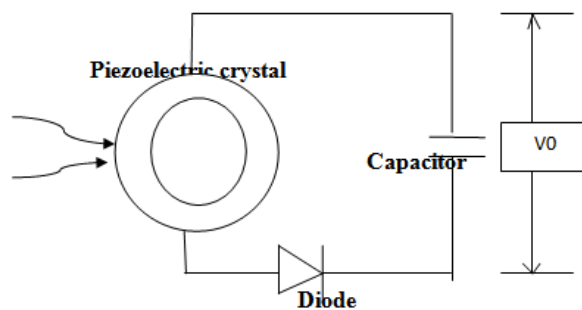


Figure-4. BLOCK DIAGRAM.

### WORKING

#### Operation of piezoelectric crystal



The weight of a person is given as a mechanical vibration to the crystal and the crystal converts it to electrical voltage. As the electrical voltage is in analog form, it is rectified by using a diode and the corresponding voltage generated is measured across the capacitor.

#### ENTRY SIDE

When the voltage generated at entry side of the bus is given as input to the microcontroller, the program is

done such that a fixed count is made and it increments as a count one by one when it receives the voltage and the count operation works only when it is less than the fixed count. This can be done by using the FOR STATEMENT in the program.

for (initialization; condition<fixed count; increment)

#### EXIT SIDE

When the voltage generated at exit side of the bus is given as input to the microcontroller, the program is done such that it decrements the count one by one from the entry side count. This is also done by using the WHILE STATEMENT in the program.

while(exit side input ==High)

```
{
count ++;
}
```

Liquid crystal display is used to display the number of seats available in the bus by adding the entry side count to the exit count.

#### RFID Swipe Card

Every member of this society should have a RFID swipe card which is very much similar to our day-to-day food card or debit cards. Thus this card should be used while travelling in city buses or metro trains to automatically take tickets. Debit cards can also be used but it is not that much secure. So a separate card for travelling must be used.

#### CONCLUSIONS

This technique provides a proper way of transport facility, which also provides comfort and convenient travel to the passengers. It also avoids the conductor in the bus for ticket processing as the card reader technique is used. This will turn our society into a developed city which progress in the way of changing developing India to developed India. "Change is the only thing that doesn't change"



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