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Railway Tunnel Intelligent Lighting Using Microcontroller and Solar Panel

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Abstract: *With the growing urban population and the concern for traffic congestion and pollution (emissions control), public transportation is becoming more and more attractive to both city dwellers and managers. To gain access to the central area of the city, the subway remains the most viable alternative, despite its higher cost when compared to above ground or elevated transportation systems. There are relatively few regulations and criteria for subway ventilation, particularly when compared with mine ventilation. The main document that provides guidance and general recommendations for subway ventilation and environmental control is the Subway Environmental Design Handbook, published in 1976 (2nd edition) by the U.S. Department of Transportation, Office of Research and Development. Many of the subway systems in existence today have been designed and built with ventilation features adequate for normal train operation, but their design does not consider stringent criteria for such emergency conditions as a train fire in a tunnel.*

Keywords: IR-Sensor, Relay, LED, Microcontroller AT89S52

I. INTRODUCTION

From 80's of last century, flood control departments started to deal with flood control information, forecast flood control information and research dispatch program with computer. They have proposed a lot of schemes, build many models, and also much application software was developed for data processing and flood control solution, such as Decoding Hydrological Information program, flood forecasting, analysis and calculation of flood control operation, etc. Historical hydrologic database of the whole country has been built at the beginning of 90's, which is the important fundamental database of country's development, and it has serviced many departments. After the cataclysm in 1998, with the direction of design brief of National Flood Control and Command Systems, Flood Control Decision Support System (FCDSS) was built in many cities and provinces. Through automatic collection, realtime transmission, comprehensive analysis, and intelligent processing of different flood prevention information which is based on computer technology, network communications technology, geographic information technology, remote sensing technique and etc, we could make decision of Emergency Service and Disaster Relief promptly and accurately Flooding is a disaster that occurs in many places on Earth. The main causes of flooding are heavy rain, hurricanes and undersea earthquakes. For railway tunnels, the space to be secured above the rail level is settled by the loading gauge (clearance profile) and by the free section, depending on the train speed, the safety and the comfort of the passengers . For high speed trains, over about 160 km/h : numerical simulations with an aero dynamical model including the shock wave occurrence and the tunnel length are necessary to design the free space, eventually combined with decompression shafts. A ventilation concept should be integrated in the preliminary studies for the construction and for the operation phases. The profile must include the air ducts for fresh and waste air, usually with a ceiling and a partition wall above the clearance section in horseshoe profile. In a circular profile, the space for ventilation ducts can be organized with fresh air in the invert and waste air in the roof. The need for a cable duct or a utility duct should be carefully studied and planned in the invert, especially for horseshoe profile where space adaptations are often required. This is equally valid for railway tunnels.

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II. Problem Statement

The current illumination system as well as the ventilation system in the Railway tunnels are not as efficient. The lights as well as fans remain operational even when the not required i.e. even when the train is not passing through the tunnel. Our project gives the solution for this problem.

2.1 Technical Approach

A. Block Diagram

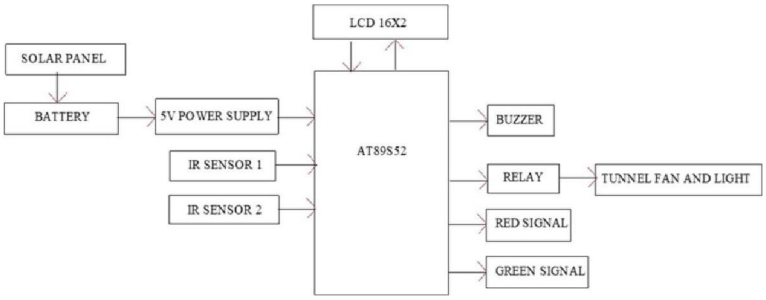

Figure 1: Block Diagram of the Project

1. **Microcontroller AT89S52**: Microcontroller AT89S52 IC is the heart of the System.
2. **Power Supply**: 5V power supply is required in our system it supplies voltage to microcontroller IC.
3. **LCD Display**: here we used 16*2 LCD Display, on LCD Display the status of train is shown.
4. **IR Sensor**: IR Sensor is used to sense the presence of train. IR Sensors are implemented to both sides i.e. to turn LED Light and tunnel fan on/off.
5. **Relay**: SPDT relay is use in our project it is use to switch on/off the circuit.
6. **LED**: LED's (red and green) indication about train is coming or not.
7. **Solar panel**: Here 5Watt solar panel is used.
8. **Battery**: Battery is used to store the solar energy.
9. **Buzzer**: Buzzer is used for indication purpose. When train passing through tunnel buzzer gets ON.

B. Hardware Description

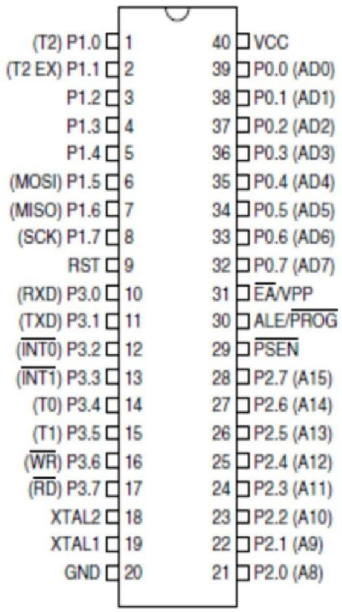

Figure 2: pin diagram of microcontroller AT89S52

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A. Description

The AT89S52 is a low-power, high-performance CMOS 8-bit microcontroller with 8K bytes of in-system programmable Flash memory. The device is manufactured using Atmel's high-density nonvolatile memory technology and is compatible with the Indus-try-standard 80C51 instruction set and pin out. The on-chip Flash allows the program memory to be reprogrammed in-system or by a conventional nonvolatile memory programmer. By combining a versatile 8-bit CPU with in-system programmable Flash on a monolithic chip, the Atmel AT89S52 is a powerful microcontroller which provides a highly-flexible and cost-effective solution to many embedded control applications.

The AT89S52 provides the following standard features: 8K bytes of Flash, 256 bytes of RAM, 32 I/O lines, Watchdog timer, two data pointers, three 16-bit timer/counters, a six- vector two-level interrupt architecture, a full duplex serial port, on-chip oscillator, and clock circuitry. In addition, the AT89S52 is designed with static logic for operation down to zero frequency and supports two software selectable power saving modes. The Idle Mode stops the CPU while allowing the RAM, timer/counters, serial port, and interrupt system to continue functioning. The Power-down mode saves the RAM con-tents but freezes the oscillator, disabling all other chip functions until the next interrupt or hardware reset.

2.2 Pin Description

- **VCC:** Supply voltage.
- **GND:** Ground.
- **Port 0:** Port 0 is an 8-bit open drain bidirectional I/O port. As an output port, each pin can sink eight TTL inputs. When 1s are written to port 0 pins, the pins can be used as high- impedance inputs. Port 0 can also be configured to be the multiplexed low-order address/data bus during accesses to external program and data memory. In this mode, P0 has internal pull-ups. Port 0 also receives the code bytes during Flash programming and outputs the code bytes during program verification. External pull-ups are required during program verification.
- **Port 1:** Port 1 is an 8-bit bidirectional I/O port with internal pull-ups. The Port 1 output buffers can sink/source four TTL inputs. When 1s are written to Port 1 pins, they are pulled high by the inter-nal pull-ups and can be used as inputs. As inputs, Port 1 pins that are externally being pulled low will source current (IIL) because of the internal pull-ups. In addition, P1.0 and P1.1 can be configured to be the timer/counter 2 external count input (P1.0/T2) and the timer/counter 2 trigger input (P1.1/T2EX), respectively, as shown in the following table. Port 1 also receives the low-order address bytes during Flash programming and verification.
- **Port 2:** Port 2 is an 8-bit bidirectional I/O port with internal pull- ups. The Port 2 output buffers can sink/source four TTL inputs. When 1s are written to Port 2 pins, th ey are pulled high by the internal pull-ups and can be used as inputs. As inputs, Port 2 pins that are externally being pulled low will source current (IIL) because of the internal pull-ups. Port 2 emits the high-order address byte during fetches from external program memory and during accesses to external data memory that uses 16 -bit addresses (MOVX @ DPTR). In this application, Port 2 uses strong internal pull-ups when emitting 1s. During accesses to external data memory that uses 8-bit addresses (MOVX @ RI), Port 2 emits the contents of the P2 Special Function Register. Port 2 also receives the high -order address bits and some contr ol signals during Flash programming and verification. Port Pin Alternate Functions P1.0 T2 (external count input to Timer/Counter 2), clock-out P1.1 T2EX (Timer/Counter 2 capture/reload trigger and direction control) P1.5 MOSI (used for In -System Programming) P1.6 MISO (used for In -System Programming) P1.7 SCK (used for In-System Programming)
- **Port 3:** Port 3 is an 8-bit bidirectional I/O port with internal pull-ups. The Port 3 output buffers can sink/source four TTL inputs. When 1s are written to Port 3 pins, they are pulled high by the inter-nal pull-ups and can be used as inputs. As inputs, Port 3 pins that are externally being pulled low will source current (IIL) because of the pull -ups. Port 3 receives some control signals for Flash programming and verification. Port 3 also serves the functions of various special features of the AT89S52, as shown in the following table.
- **RST:** Reset input. A high on this pin for two machine cycles while the oscillator is running resets the device. This pin drives high for 98 oscillator periods after the Watchdog times out. The DISRTO bit in SFR AUXR

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(address 8EH) can be used to disable this feature. In the default state of bit DISRTO, the RESET HIGH out feature is enabled.

- **ALE/PROG:** Address Latch Enable (ALE) is an output pulse for latching the low byte of the address during accesses to external memory. This pin is also the program pulse input (PROG) during Flash programming. In normal operation, ALE is emitted at a constant rate of 1/6 the oscillator frequency and may be used for external timing or clocking purposes. Note, however, that one ALE pulse is skipped during each access to external data memory. If desired, ALE operation can be disabled by setting bit 0 of SFR location 8EH. With the bit set, ALE is active only during a MOVX or MOVC instruction. Otherwise, the pin is weakly pulled high. Setting the ALE-disable bit has no effect if the microcontroller is in external execution mode. Port Pin Alternate Functions P3.0 RXD (serial input port) P3.1 TXD (serial output port) P3.2 INT0 (external interrupt 0) P3.3 INT1 (external interrupt 1) P3.4 T0 (timer 0 external input) P3.5 T1 (timer 1 external input) P3.6 WR (external data memory write strobe) P3.7 RD (external data memory read strobe)
- **PSEN:** Program Store Enable (PSEN) is the read strobe to external program memory. When the AT89S52 is executing code from external program memory, PSEN is activated twice each machine cycle, except that two PSEN activations are skipped during each access to external data memory.
- **EA/VPP:** External Access Enable. EA must be strapped to GND in order to enable the device to fetch code from external program memory locations starting at 0000H up to FFFFH. Note, however, that if lock bit 1 is programmed, EA will be internally latched on reset. EA should be strapped to VCC for internal program executions. This pin also receives the 12-volt programming enable voltage (VPP) during Flash programming.
- **XTAL1:** Input to the inverting oscillator amplifier and input to the internal clock operating circuit. 12. XTAL2 Output from the inverting oscillator amplifier

III. WORKING

We have 2 sources of the supply the first one is MSEB supply & second one supply is from solar panel converter Solar energy into electrical energy. This electrical energy is given to battery which stores the energy & act as backup. This energy by solar panel can also be used as primary energy during summer season. In case of MSEB supply, The supply is given to transformer to step down the voltage to the required value . This stepped down voltage is then given to a rectifier which converts AC voltage to DC voltage which is required by the circuit. This Supply is feed to or supply to the microcontroller circuit

We have used 2 IR sensors in our project, one placed at entrance side & another is on exit side of tunnel, So when the train arrives at the entrance of tunnel, The IR sensor at the entrance detected. The IR sensor detects the train and gives signal to the microcontroller. Then the microcontroller gives signal to turn on the lights and fans. Similarly, when train leaves the tunnel the IR sensor placed at exit senses this & give signal to microcontroller to turn off the lights & fans. Even if the train comes from the opposite direction the working of the project is same.

3.1 Advantages

1. Saves electricity.
2. Improves quality and life of appliances

3.2 Applications

1. Used in railway tunnel.
2. Underground path.

3.3 Limitations

1. Programming is difficult

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IV. CONCLUSION

Railway platform air quality is markedly influenced by the power setting of tunnel ventilation fans and whether or not the platform air is being introduced by impulsion or removed by extraction. At neither night when neither trains nor platform ventilation fans are operational, platform air quality improves when tunnel fans are working at lower power, whether or not they are operating on impulsion or extraction.

V. FUTURE SCOPE

The project can be modifying by using various sensor such as fire sensor to and GSM module.

5.1 Project Photo

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