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INTELLIGENT SYSTEM FOR TRAIN ENGINES TO AVOID ACCIDENTS

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Abstract: Now-a-days public is facing many threats from the railway department by which they are hesitating to plan a train journey. Railway accidents may occur due to various reasons like an obstacle on the railway track or near the railway gate, fire inside the train and so on. Though the railway department is trying to take actions to reduce such informal things but couldn't see the face of success completely. This project has designed a system which will help the railway department by overcoming accidents. This project is introduced to add automation in railway transportation. Here obstacle sensor is used to monitor the track and sense any obstacle, if sensed in short distance which will give horn i.e. buzzer and train stops. Fire sensor is used to detect fire which will buzzer to alert passengers when fire is detected. Here Arduino UNO microcontroller is employed for the functioning of the system.

1. INTRODUCTION

An embedded system is a special purpose computer system that is designed to perform very small sets of designated activities. Embedded systems date back as early as the late 1960s where they used to control electromechanical telephone switches. The first recognizable embedded system was the Apollo Guidance Computer developed by Charles Draper and his team. Later they found their way into the military, medical sciences and the aerospace and automobile industries.

Today they are widely used to serve various purposes like:

- Network equipment such as firewall, router, switch, and so on.
- Consumer equipment such as MP3 players, cell phones, PDAs, digital cameras, camcorders, home entertainment systems and so on.
- Household appliances such as microwaves, washing machines, televisions and so on.
- Mission-critical systems such as satellites and flight control.

The key factors that differentiate an embedded system from a desktop computer:

- They are cost sensitive.
- Most embedded systems have real time constraints.
- There are multitudes of CPU architectures such as ARM, MIPS, PowerPC that are used in embedded systems. Application-specific processors are employed in embedded systems.
- Embedded Systems have and require very few resources in terms of ROM or other I/O devices as compared to a desktop computer.

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2. LITERATURE SURVEY

1.In the article titled "Advanced Automation System for Metro Train Control and Management" written by G. Kaur and S. K. Singh, the authors discuss the implementation of an advanced automation system for the control and management of metro trains. This system includes the utilization of artificial intelligence (AI) and machine learning (ML) algorithms to improve safety and security.

2."Intelligent Train Monitoring and Control System Based on Wireless Sensor Networks" by C. Wang, Z. Cai, and X. Huang: This paper proposes an intelligent train monitoring and control system that makes use of wireless sensor networks (WSNs) to collect data and monitor the condition of various train components in real-time. These components include safety and security systems of the train.

3.The article "Metro Train Security System Based on Internet of Things (IoT) and Cloud Computing" written by S. M. Anwar, A. Javaid, and M. A. U. Khan describes the development of a metro train security system that makes use of Internet of Things (IoT) devices and cloud computing to improve security features such as surveillance cameras, access control systems, and fire alarm systems.

4."Design of an Automatic Train Protection System Based on Train Positioning System" by Y. Xu, J. Huang, and C. Wu: This paper proposes an automatic train protection system that makes use of a train positioning system to monitor the location and speed of the train, and that automatically applies brakes or triggers alarms in the event that there are any concerns regarding safety or security.

5."Enhanced Train Security Using Biometric Authentication and Machine Learning" by A. Ali and M. A. Akbar: This paper discusses the implementation of biometric authentication and machine learning algorithms to enhance security features in metro trains. These features such as facial recognition systems and predictive analysis of passenger behavior are included in the discussion.

6.The body of research indicates that developments in areas such as automation, artificial intelligence, machine learning, wireless sensor networks (WSNs), internet of things (IoT), cloud computing, and biometric authentication have the potential to significantly improve the safety and security characteristics of metro trains. The application of these technologies allows for the monitoring of train components, the detection of safety and security problems in real time, and the provision of prompt actions to reduce any possible dangers.

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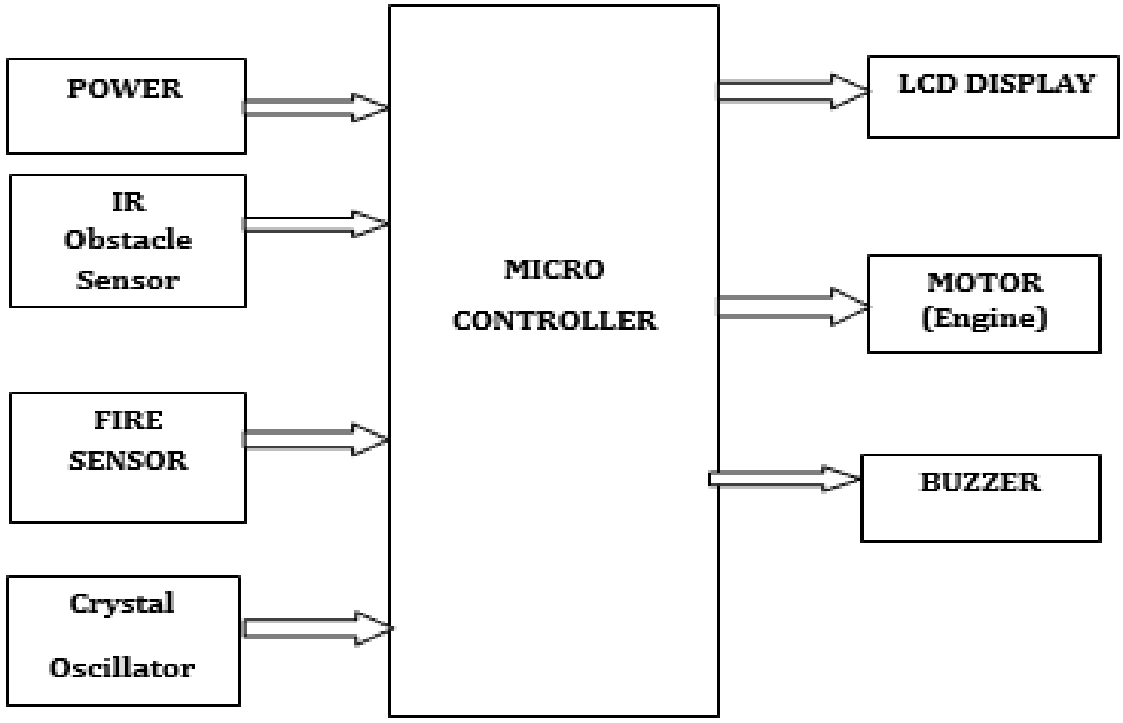
3. HARDWARE DESCRIPTION

BLOCK DIAGRAM:



ARDUINO

The Arduino Uno is a microcontroller board based on the ATmega328 (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.

The Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega16U2 (Atmega8U2 up to version R2) programmed as a USB-to-serial converter. The Uno board has a resistor pulling the 8U2 HWB line to ground, making it easier to put into DFU mode.

The board has the following new features:

1.0 pinout: added SDA and SCL pins that are near to the AREF pin and two other new pins placed near to the RESET pin, the IOREF that allow the shields to adapt to the voltage provided from the board. In future, shields will be compatible with both the board that uses the AVR, which operates with 5V and with the Arduino Due that operates with 3.3V. The second one is a not connected pin, that is reserved for future purposes.

- Stronger RESET circuit.

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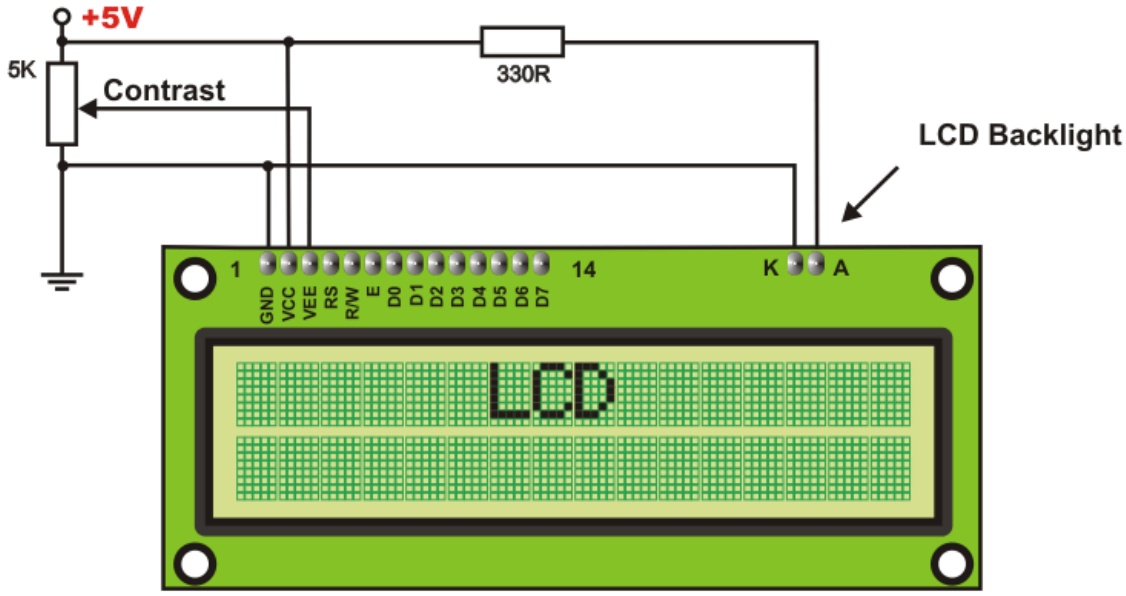
- Atmega 16U2 replace the 8U2.

"Uno" means one in Italian and is named to mark the upcoming release of Arduino 1.0. The Uno and version 1.0 will be the reference versions of Arduino, moving forward. The Uno is the latest in a series of USB Arduino boards, and the reference model for the Arduino platform; for a comparison with previous versions, see the index of Arduino boards.

LCD screen:

LCD screen consists of two lines with 16 characters each. Each character consists of 5x7 dot matrix. Contrast on display depends on the power supply voltage and whether messages are displayed in one or two lines. For that reason, variable voltage 0-Vdd is applied on pin marked as Vee. Trimmer potentiometer is usually used for that purpose. Some versions of displays have built in backlight (blue or green diodes). When used during operating, a resistor for current limitation should be used (like with any LE diode).



4. SENSORS

IR SENSOR

IR the same principle in ALL Infra-Red proximity sensors. The basic idea is to send infra red light through IR-LEDs, which is then reflected by any object in front of the sensor.

Then all you have to do is to pick-up the reflected IR light. **For detecting the reflected IR light, we are going to use a very original technique: we are going to use another IR-LED,** to detect the IR light that was emitted from another led of the exact same type. This is an electrical property of Light Emitting Diodes (LEDs) which is the fact that a led produce a voltage difference across its leads when it is subjected to light. As if it was a photo-cell, but with much lower output current. In other words, the voltage generated by the leds can't be - in any way - used to generate electrical power from light, It can barely be detected. that's why as you will notice in the schematic, we are going to use a Op-Amp (operational Amplifier) to accurately detect very small voltage changes.

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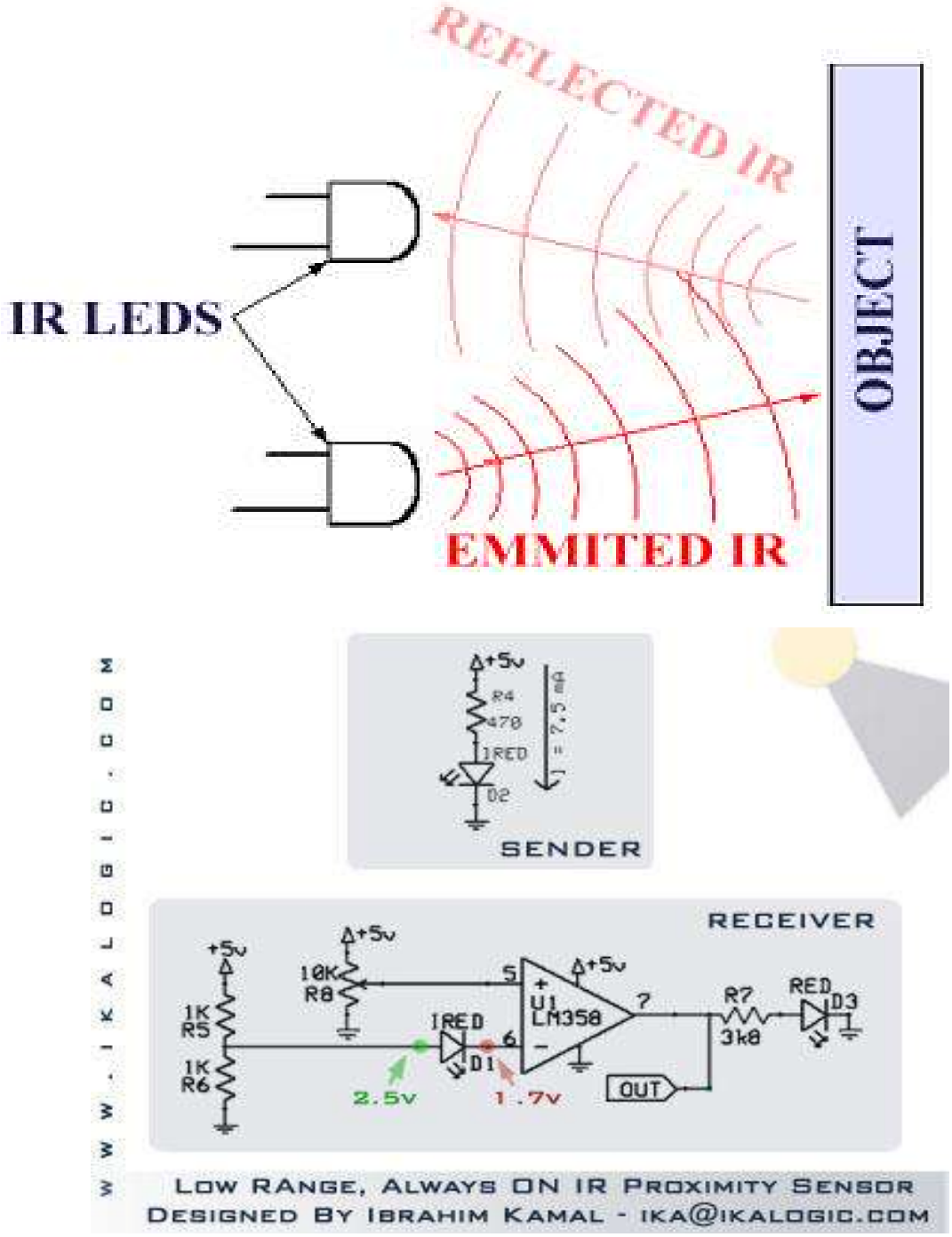

The sender is composed of an IR LED (D2) in series with a 470 Ohm resistor, yielding a forward current of 7.5mA. **The receiver** part is more complicated, the 2 resistors R5 and R6 form a voltage divider which provides 2.5V at the anode of the IR LED (here, this led will be used as a sensor). When IR light falls on the LED (D1), the voltage drop increases, the cathode's voltage of D1 may go as low as 1.4V or more, depending on the light intensity. This voltage drop can be detected using an Op-Amp (operational Amplifier **LM358**).

You will have to adjust the variable resistor (POT.) R8 so the the voltage at the positive input of the Op-Amp (pin No. 5) would be somewhere near 1.6 Volt. if you understand the functioning of Op-Amps, you will notice

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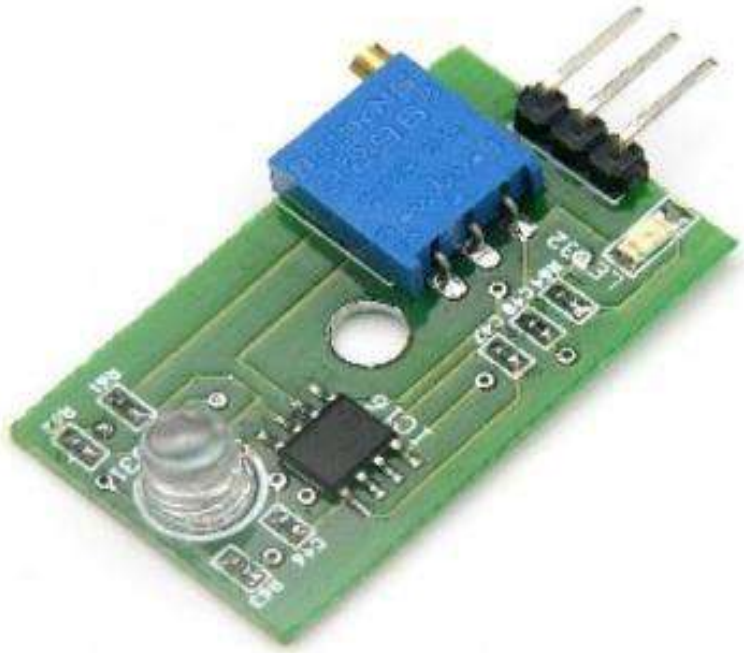
that the output will go High when the volt at the cathode of D1 drops under 1.6. So the output will be High when IR light is detected, which is the purpose of the receiver.

If the +ve input's voltage is higher than the -ve input's voltage, the output goes High (5v, given the supply voltage in the schematic), otherwise, if the +ve input's voltage is lower than the -ve input's voltage, then the output of the Op-Amp goes to Low (0V). It doesn't matter how big is the difference between the **+ve** and **-ve** inputs, even a 0.0001 volts difference will be detected, and the the output will swing to 0v or 5v according to which input has a higher voltage.

FIRE SENSOR



There are several types of flame detector. The optical **flame detector** is a detector that uses optical sensors to detect flames. There are also ionization flame detectors, which use current flow in the flame to detect flame presence, and thermocouple flame detectors.

Infrared Flame Detector

Infrared (IR) flame detectors work within the infrared spectral band. Hot gases emit a specific spectral pattern in the infrared region, which can be sensed with a thermal imaging camera (TIC) a type of thermo graphic. False alarms can be caused by other hot surfaces and background thermal radiation in the area as well as blinding from water and solar energy. A typical frequency where single frequency IR flame detector is sensitive is in the 4.4 micrometer range. Typical response time is 3-5 seconds.

5. SOFTWARE DESCRIPTION

Arduino IDE compiler:

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Arduino is an open-deliver electronics platform based mostly on smooth-to-use hardware and software utility. Arduino boards can observe inputs - slight on a sensor, a finger on a button, or a Twitter message - and flip it into an output - activating a motor, turning on an LED, publishing a few components online. You could tell your board what to do by sending a hard and fast of commands to the microcontroller at the board. To do so that you use the Arduino programming language (based totally mostly on Wiring), and the Arduino software (IDE), based on Processing.

Over the years Arduino has been the brain of lots of obligations, from regular gadgets to complex medical gadgets. A worldwide community of makers - college students, hobbyists, artists, programmers, and specialists - has collected spherical this open-deliver platform, their contributions have brought as much as a terrific amount of available know-how that can be of terrific assist to novices and experts alike.

Arduino has become born on the Ivrea interaction format Institute as a clean tool for instant prototyping, geared towards university college students without a historic past in electronics and programming. As quickly as it reached a miles wider community, the Arduino board started converting to conform to new dreams and traumatic situations, differentiating its provide from smooth eight-bit boards to merchandise for IoT

Programs, wearable, three-d printing, and embedded environments. All Arduino boards are without a doubt open-deliver, empowering clients to assemble them independently and ultimately adapt them to their unique dreams. The software program, too, is open-supply, and its miles growing thru the contributions of customers globally.

ADVANTAGES:

- Manpower required for operation of train can be reduced.
- • Reduced installation and integration time in the system.

DISADVANTAGES:

- • Due to complex operations switching from a state to the end state might be difficult.
- • Hackers getting into the vehicle's software and controlling or affecting its operation would be a major security worry.
- • The efficiency of the solar panel drops in case of cloudy or rainy days.
- • A single glitch in the computer may cause a major accident.

6. CONCLUSION

The project **"INTELLIGENT SYSTEM FOR TRAIN ENGINES TO AVOID ACCIDENTS"** has been successfully designed and tested. It has been developed by integrating features of all the hardware components and software used and tested.

Presence of every module has been reasoned out and placed carefully thus contributing to the best working of the unit.

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Secondly, using highly advanced Arduino board and with the help of growing technology the project has been successfully implemented.

1. FUTURE SCOPE

- Mass rapid transit or rapid mass transit (RMT) was introduced to provide a transport system with very less or no traffic transportation more efficiently than the traditional railway systems. This project is implemented with automations that help us to overcome the drawbacks in the current metro train system. The automations implemented in this project is not limited to metro trains alone, it can be implemented in other domains according to the requirements of the user.
- This project can be developed further by installing cameras in the coach with image processing in order to report any unseemly activity to the concerned authorities.

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