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Arduino Based Car Speed Detector Circuit

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***Abstract:** The objective of this project is to create a device designed to identify instances of reckless driving on highways and promptly notify traffic authorities about speeding violations. Incidents resulting from careless driving on highways have been steadily increasing, leading to a growing number of fatalities caused by the errors of others. It is imperative that drivers adhere to the prescribed speed limits while on highways. Nevertheless, instances of speeding-related accidents persist, as drivers rely on their vehicle's speedometers to monitor their speed and decelerate when they perceive they are surpassing the acceptable limits. Highway speedometers prove to be a valuable tool for law enforcement, particularly in the battle against speeders, given their digital display and the incorporation of an alert mechanism, such as a buzzer or alarm, to detect and signal when a vehicle's speed exceeds the legalthreshold. To address this issue, we have implemented a circuit known as a highway speedometer.*
***Keywords:** Arduino IDE, GSM, ATmega328, IR sensor, Bootloader*

I. INTRODUCTION

An effective solution to the widespread issue of speeding and its associated road accidents involves the implementation of an automotive speed detection system utilizing both Global System for Mobile Communications (GSM) and Radio Frequency Identification (RFID) technologies. The concept revolves around creating a system capable of identifying instances of speeding violations on the road, subsequently sending SMS notifications to pre-defined mobile numbers, and activating a warning buzzer. This system incorporates various components, including an RFID reader and tags, a GSM modem, a buzzer, and an LCD display, all interconnected with a microcontroller. The LCD display provides a visual representation of the system's status.

The proposed system comprises an Arduino UNOmicrocontroller, Radio Frequency Identification (RFID)technology, and Global System for Mobile Communications (GSM). It incorporates two IR sensors for vehicle detection and passive RFID tags affixed to vehicles to monitor speed. The Arduino microcontroller assesses the vehicle's speed, communicates through GSM to send alerts, and triggers a buzzer alarm in the event of speeding. This system is not only cost-effective but also highly dependable, delivering efficientand real-time notifications. Furthermore, it offers the convenience of monitoring the vehicle's speed directly on theLCD display. The microcontrollers are programmed using theembedded C language.

Affordable and practical, this kit serves the purpose of monitoring the average and high speeds of vehicles traveling on highways and roads. With this objective in mind, we have developed a highway speed control circuit that utilizes a range of electronic components to detect instances of careless driving. Over the past years, numerous individuals have dedicated their efforts and some continue to do so in order to prevent these life-threatening accidents.

This cutting-edge speedometer not only digitally indicates a vehicle's speed but also issues warnings in case the highway speed limit is exceeded, providing invaluable assistance to lawenforcement agencies responsible for road safety. Additionally,it enables the real-time monitoring of individual vehicle speeds passing through the area. Thus, this speedometer fulfills a dual function, displaying speed digitally while also serving as a crucial tool for enhancing highway safety, particularly aiding vigilant road traffic police in their duties.

II. DESIGN METHODOLOGY

The primary objective of this system is to reduce the numberof accidents that occur in designated speed limit areas such asschool zones and clinic zones, especially when drivers exhibit irresponsible behavior like making abrupt U-turns. It ensures strict adherence to specified speed limits. As vehicles enter these speed limit zones, the system activates transmission blocks that transmit encoded data. The vehicle's receiver, equipped with a microcontroller, reads these encoded tags andcompares the vehicle's speed with the predefined speed for that particular zone. Utilizing microprocessors, DC motors, RFID modules, and tags, this system introduces a tailored vehicle auto cruise control feature. RFID technology plays a pivotal role in automatically detecting and enforcing speed reductions in vehicles.

This speed control system serves as a dependable means to prevent accidents, particularly in areas near schools and othersensitive zones, by promoting strict adherence to speed limits.

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It is characterized by its cost-effectiveness, low energy consumption, and strong protective capabilities, making it a valuable contribution to society. Implementation in various regions is also straightforward. Furthermore, the system accounts for adverse weather conditions, ensuring public safety by mitigating the risks posed by reckless and inconsiderate drivers.

The system's components include two sets of laser transmitters and LDR sensor pairs, strategically placed 100 meters apart along the highway, with each pair comprising a transmitter and an LDR sensor positioned on opposite sides ofthe road. The installation of these lasers and LDRs is depictedin the provided diagram. The system accurately measures thetime taken by a vehicle to traverse this 100-meter distance.

A. Hardware Description

1) Micro Controller

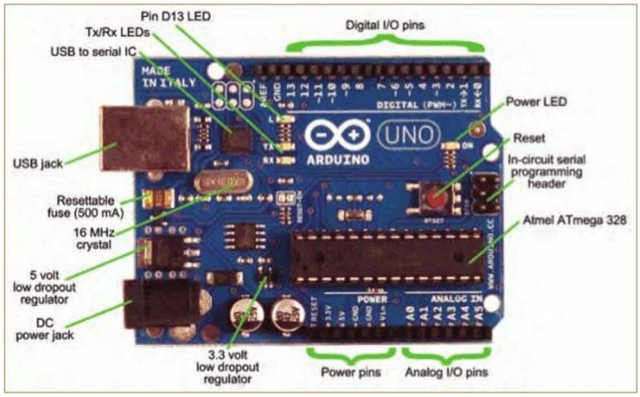


Fig. 1 Micro controller

The Arduino Uno is a microcontroller board featuring the ATmega328 microcontroller from the AVR family shown in figure 1. It boasts 14 digital input/output pins, 6 analog pins, and a 16MHz ceramic resonator for precise timing. Additionally, it includes essential features like a USB connection, a power jack, and areset button. The Arduino Uno's software is complemented bya variety of libraries, simplifying the programming process and enhancing its versatility.

2) RFID Module

The EM18 RFID Reader is a module designed for reading theunique ID information stored in RFID tags. This ID information is distinct for each tag and cannot be duplicated. The EM-18 module has a nine-pin configuration. Among these nine pins, two pins are not connected, leaving seven terminals that need to be taken into consideration.

3) IR Sensor

The IR sensor module primarily comprises an IR Transmitter ar d Receiver, Opamp, Variable Resistor (Trimmer pot), and an output LED. IR LED emits light within the Infrared frequency range, which is invisible to the human eye due to its wavelength (700nm – 1mm) being significantly higher than that of visible light. IR LEDs typically have a light emitting angle of approximately 20-60 degrees and a range varying from a few centimeters to several feet, depending onthe type of IR transmitter and its manufacturer. Some transmitters even offer ranges in kilometers. IR LEDs are usually white or transparent in color, allowing them to emit a substantial amount of light.

4) GSM

GSM, which is short for Global System for Mobile communications, holds a paramount position as the most extensively utilized cell phone technology worldwide. Cell phones connect to a GSM network provided by a cell phoneservice carrier by searching for cell phone towers within theirvicinity. The Global System for Mobile communication (GSM) is an internationally recognized standard for digital cellular communication. GSM also refers to the name of a standardization group that was established in 1982 with the aim of creating a uniform European mobile telephone standard. This standardization group set out to develop specifications for a pan-European mobile cellular radio system operating at a frequency of 900MHz. It is expected that many countries beyond Europe willalso become part of the GSM partnership.

B. Software Description

1) Arduino IDE Compiler

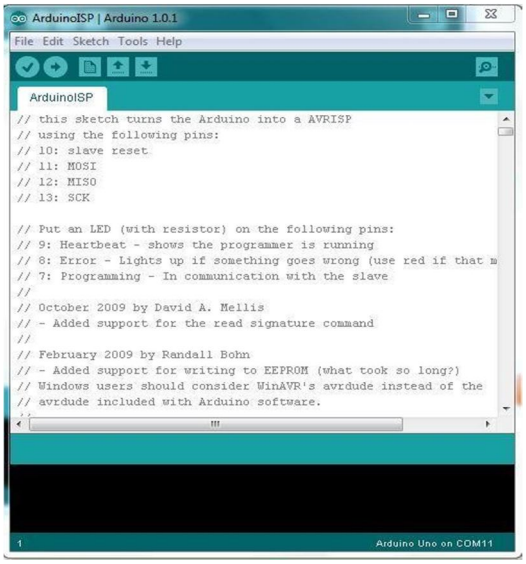


Fig. 2 Arduino Complier

This instructable serves as a valuable supplement to any of theArduino on a Breadboard guides. The Arduino integrated development environment, commonlyreferred to as the Arduino software, establishes a connection with an Arduino board for program uploading and communication as shown in figure 2.

The Vehicle's speed is calculated by this equation: Speed = Distance/Time (1)

This equation is used to calculate the time taken between the two sensors:

C. Block Diagram

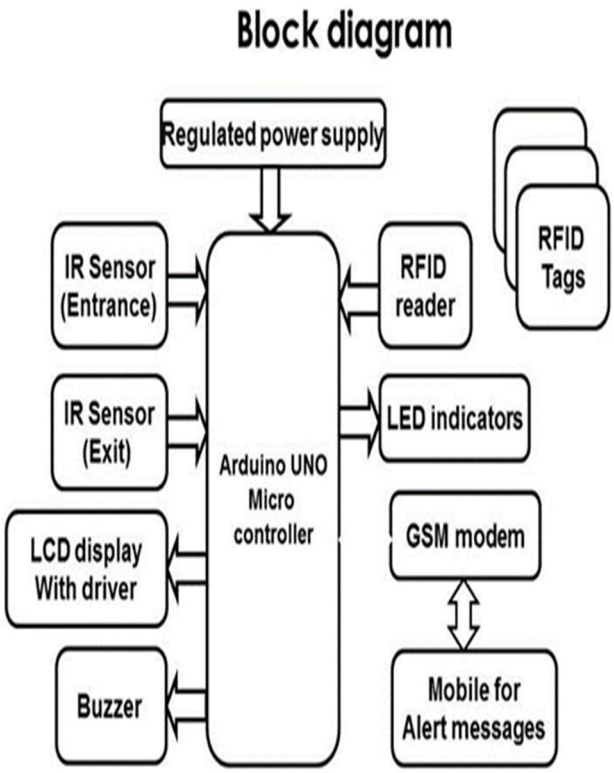


Fig. 3 Block diagram of System

D. Flowchart

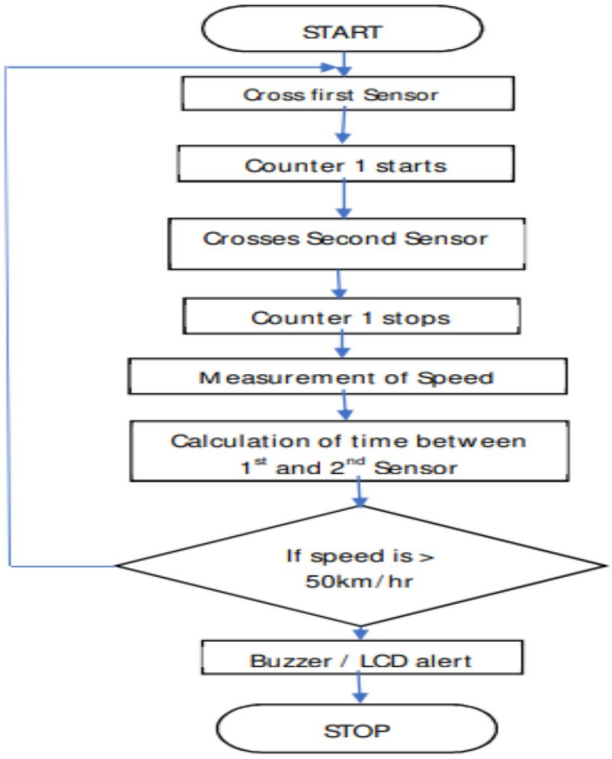


Fig. 4 Flowchart of project

Figures 3 and 4 gives blocks representation and flow of mechanism. When a vehicle passes through the first sensor, the infrared rays cross the vehicle that the sensor has detected. The LED 1for sensor 1 is connected to the pin 13 of the Arduino and theoutput of IR sensor 1 is connected to the pin 8 of the Arduino.In similar manner, 2nd sensor's infrared ray touches the objectand reflects to the sensor which the sensor has sensed the object. The LED 2 for sensor 2 is connected to the pin 12 of the Arduino and the output of IR Sensor 2 is connected to thepin 9 of the Arduino. 16x2 LCD is used to display the speed Time = (t2-t1) milliseconds. In this part, the power supply circuit used 12V step down transformer. Regulator LM 7805 is used to convert 12V to DC5V. The ground pin of the power supply is connected to the GND pin of the Arduino and the power supply DC 5V is connected to the VIN pin of the Arduino.

III. RESULTS AND DISCUSSIONS

The "Arduino-based Car Speed Detection Circuit" project was developed with the primary aim of detecting a vehicle's speedutilizing RFID technology and providing alerts via GSMcommunication. Additionally, it offers the capability to monitor the vehicle's speed through an LCD display. Furthermore, RFID technology enables the identification of the vehicle's registration number.

Whenever a vehicle exceeds the designated speed limit, this system promptly sends alert messages containing the vehicle'sspeed and registration number to a mobile device in the formof SMS, all accomplished through the utilization of RFID technology. Figure 5, shows module development. Figures 6, 7 represents the display information messages.

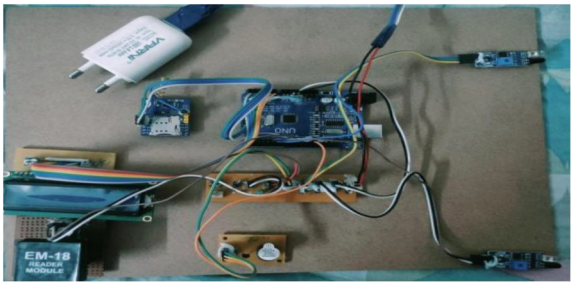


Fig. 5 Module Design

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Fig. 6High Speed Alert



Fig. 7 LCD Display

IV. CONCLUSION

This project encompasses the integration of features from all the hardware components used, with careful consideration given to the placement and reasoning behind the inclusion ofeach module. This meticulous approach contributes significantly to the optimal functionality of the unit. Furthermore, the project's success has been realized through the utilization of highly advanced ICs and the application of evolving technology.

The core objective of this endeavor is the implementation of “speed detection on the highway” with a focus on enhancing safety along the Mega Highway. It is our belief that by equipping the Mega Highway with such a reliable system, wecan not only enforce traffic regulations effectively but also mitigate the occurrence of accidents. The system's compact design and user-friendly interface ensure that it can be efficiently managed by a single individual.

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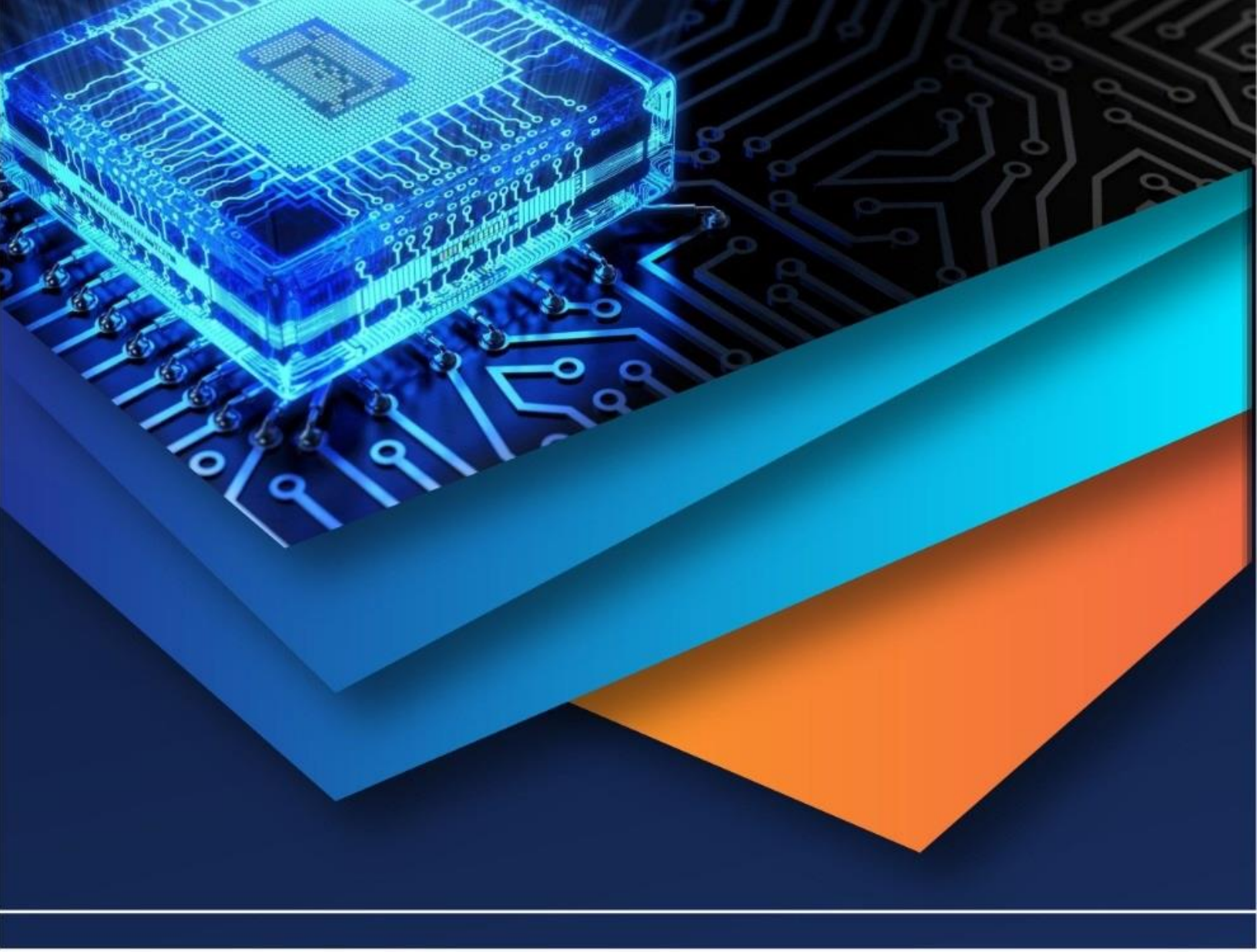
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