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Title Smart Road Safety and Vehicle Accidents Prevention System for Mountain Road

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Paper Authors

NookalaVenu, Govindu Rakesh, Kunta Maneesha, Kusumba Anusha , Samantha Merugu, Abbas Mohammad



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Smart Road Safety and Vehicle Accidents Prevention System for Mountain Road

Nookala Venu¹, Govindu Rakesh², Kunta Maneesha³, Kusumba Anusha⁴, Samantha Merugu⁵, Abbas Mohammad⁶

ABSTRACT

There are thousands of people died or injured in accidents in every year. In developing countries like India, accidents are the major cause of death. There are many dangerous roads at mountain places/ hill areas which are single line narrow curved roads. At those curved places, the drivers aren't able to see the vehicle or obstacles coming from the other end of the curve and if the vehicle isn't in good condition, then it is difficult to control those curved places. In order to minimize these accidents, we proposed a project to prevent accidents at U-turns by altering the driver about the vehicle coming from the opposite side. This is done by keeping an IR sensor on both sides of the U-turn and so that if vehicle comes from one end of the curve then sensor senses and this IR sensor gives signal to Arduino and Arduino gives command to Buzzer, LED lights and Buzzer rings on the other side in order to alert the driver.

Keywords: *Arduino Uno, sensors, curved roads, IR sensors, U-turn.*

I. INTRODUCTION

Internet of Things (IoT) connects various physical devices & objects over the globe via internet. IoT is a system that connects computing devices, machines etc. that are provided with unique identifiers (UIDs) and IoT provides ability to transfer data over a network without requiring any interaction between the devices [1]. IoT is largely expansion of services provided by Internet [2]. Internet of Things (IoT) is that the network of physical objects like devices, instruments and other items embedded with electronics, circuits, software, sensors and network connectivity that permits these objects to gather and exchange data over a network without requiring human-to-human or human-to-computer interaction [3]. Internet of Things allows objects to be sensed and controlled remotely across existing network infrastructure, also creating opportunities for more direct integration of the physical world into computer-based systems, and leading to improved efficiency and accuracy [4].

The evolution of the IoT we can classify it into five eras:

- The Internet of Documents: e-libraries.
- The Internet of Commerce: e-commerce.
- The Internet of Applications: Web 2.0.
- The Internet of People: Social networks.

- The Internet of Things: Connected devices/ machines.

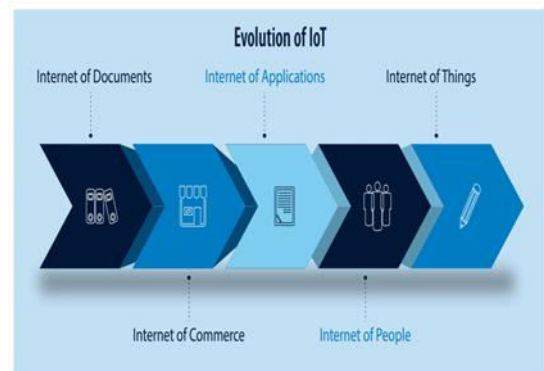


Fig.1. Evolution of IoT

IoT is able to interact without human intervention. Some primary IoT applications have been already developed in different fields [5]. IoT technologies are at their infant stages; however, many new developments have occurred in the integration of objects with sensors in the Internet [6].

One of those IoT systems is smart parking. It is to know the status of parking slot via internet. This is related to parking problems which one of them is the difficulty of knowing the condition of vacant space in the parking area [7]. Due to this problem, the driver spends his time in finding a parking place. Problems related to parking can be solved if driver can able to know the availability of parking space before reaching the destination [8].

Various approaches and researches have been done to overcome parking problems. Since the early 1970s, smart parking has been implemented throughout various countries [9]. The initial system will be displaying parking information such as availability status and/or the amount of space available. More complex smart parking incorporates more advanced technology to serve customers with advanced information like slot status, slot number which is empty [10]. And also providing an efficient feature of slot booking. Currently, there are certain parking systems that

are able to provide real-time information about available parking spaces[11]. Such systems require efficient sensors to be placed in parking lots to monitor parking spaces and rapid data processing units to collect the data from different sources. Hence, the IoT has been the trend of the next Internet. Every available thing is getting smart. There is a wide scope for research in IoT [12]. The future of IoT is very bright. From our bills to vehicles everything would be connected providing a better lifestyle[13].

II PROPOSED SYSTEM

The proposed system is shown in below fig.2 in which we used a vehicle accident prevention system which will alert the drivers on both sides of the blind spot on mountainous roads about the oncoming traffic from the other side. It would change colors and alert the drivers with the help of LEDs. Our paper proposes a system which would be installed on mountain roads and will use sensors to detect vehicles. It would also be a major safety booster for mountain roads

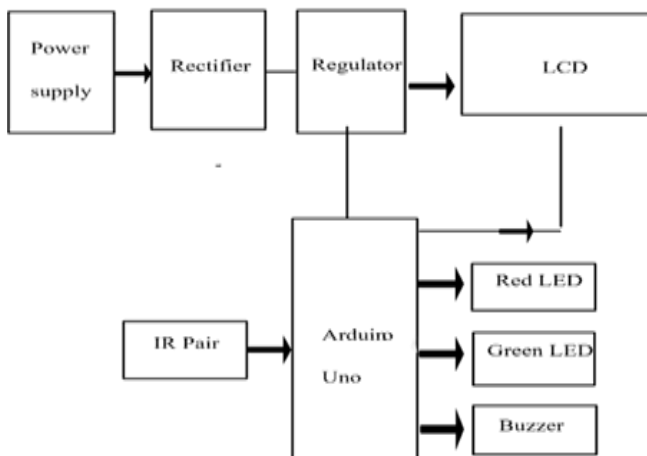


Fig.2. Proposed System Block Diagram

III SYSTEM ARCHITECTURE

“IoT Enabled Parking System” has two major sections. First section consists of Arduino UNO, RFID Reader and Servo Motor. Authorized user must place his card over the reader to enter into parking zone, so that the servo opens the entry gate. If unauthorized user tries to get into parking zone the access will be denied and the gate remains closed [14]. The second section consists of NodeMCU board, IR Sensors, Servo Motor and LCD display which is used to acknowledge about the availability of free parking space. As this section is connected with Cloud platform and application over internet, using this section user can acknowledge about the parking slot availability from the remote place[15].

3.1 Hardware Requirements

The hardware components required for our project are:

3.1.1 LED:

A light-emitting diode (LED) is a semiconductor light source that emits light when current flows through it. Electrons in the semiconductor recombine with electron holes, releasing energy in the form of photons. The colour of the light (corresponding to the energy of the photons) is determined by the energy required for electrons to cross the band gap of the semiconductor.[5] White light is obtained by using multiple semiconductors or a layer of light-emitting phosphor on the semiconductor device. LED is a PN-junction diode that mainly used as a replacement of incandescent lights. It is based on the electroluminescence effect – A process where diode converts electric current to light when electrons change their state inside the LED semiconductors. The P-N junction is nothing but a combination of both N-type and P-type semi-conductor materials. The material forming the junction diode is not identical to other mainstream diodes, as it comes with a transparent package, allowing the infrared and visible light to pass through the junction. The LED contains two terminals known as anode and cathode. The former contains a positive charge on it and comes with the longer lead as compared to other, and later contains negative charge on it. LED will be working under one condition: the anode terminal should be put at a higher potential than cathode terminal as current flows from anode to cathode (positive to negative). LED won't conduct if the respective terminals are connected in the reverse order.



Fig.3. LED

3.1.2 Arduino UNO:

Arduino UNO is a microcontroller board developed by Arduino.cc and is based on Atmega328 Microcontroller. There are 14 digital pins and 6 analog I/O pins. Arduino IDE software is used to program this board. Type B cable is used to connect computer and Arduino board. An external source between 7-20 volts can be used to power this board. The microchip ATMEGA328P is pre-programmed. Boot loader is used to upload new code in this microchip [16]. It has flash, EEPROM storage of 32 kb. 0.5kb of this 32kb is used by boot loader. Operating voltage of this board is 5v. It consists of 2kb SRAM

memory. Weight is around 25g. 6 of the digital pins give PWM output [17]. This board has various facilities for communication with other microcontrollers. There is a library named software serial, which allows serial communication for all digital pins.

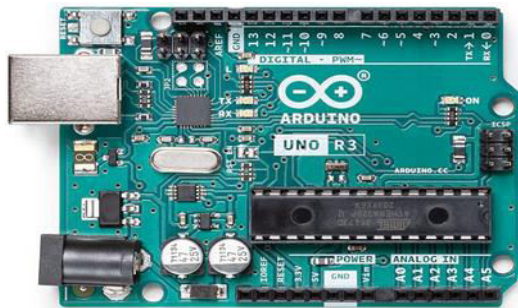


Fig.4: Arduino UNO (ATMega328P)

3.1.3 Infrared Sensor:

It is used as Obstacle detector. The IR Sensor Module or infrared (IR) sensor is a basic and most popular sensor in electronics which is used in wireless technology like remote controlling functions and detection of surrounding objects/ obstacles. The IR sensor is one kind of electronic component, used to detect specific characteristics in its surroundings through emitting and detecting IR rays. IR sensors mainly consist of an Infrared (IR) LED and a Photodiode, this pair is generally called IR pair. An IR LED is a special purpose LED, it is can emitting infrared rays ranging from 700 nm to 1 mm wavelength. IR LED transmit an infrared signal, this infrared signal bounces back if there's any obstacle and the signal is received at the infrared receiver. These types of rays are invisible to our eyes. In contrast, a photodiode or IR Receiver LED detects the infrared rays..



Fig.5. Infrared Sensor

3.1.4 Buzzer:

There are many ways to communicate between the user and a product. One of the best ways is audio communication using a buzzer IC. So during the design process, understanding some technologies with configurations is very helpful. So, this article discusses an overview of an audio signal ling device like a beeper or a buzzer and its working with applications. A buzzer or beeper is an audio signal ling device, which may be

mechanical, electromechanical, or piezoelectric (piezo for short). Typical uses of buzzers and beepers include alarm devices, timers, and confirmation of user input such as a mouse click keystroke.



Fig 6: Buzzer

3.1.5: 16*2 LCD Display:

The term LCD stands for liquid crystal display. It is one kind of electronic display module used in an extensive range of applications like various circuits & devices like mobile phones, calculators, computers, TV sets, etc. These displays are mainly preferred for multi-segment light-emitting diodes and seven segments. The main benefits of using this module are inexpensive; simply programmable, animations, and there are no limitations for displaying custom characters, special and even animations, etc. It includes 16 Columns & 2 Rows so it can display 32 characters (16x2=32) in total & every character will be made with 5x8 (40) Pixel Dots. So, the total pixels within this LCD can be calculated as 32 x 40 otherwise 1280 pixels.

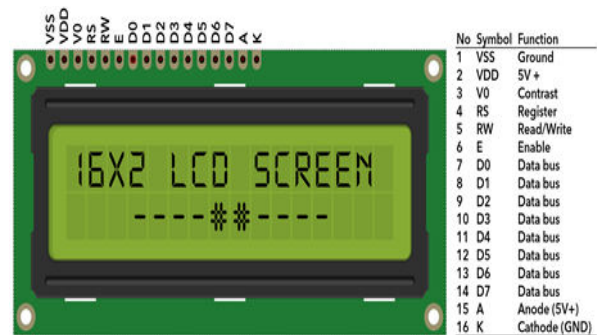


Fig.7: 16*2 LCD Display

3.1.6 Adaptor:

An AC adapter, AC/DC adapter, or AC/DC converter is a type of external power supply, often enclosed in a case similar to an AC plug. Other common names include wall wart, power brick, wall charger, and power adapter. Adapters for battery-powered equipment may be described as chargers or rechargers (see also battery charger). AC adapters are used with electrical devices that require power but do not contain internal components to derive the required voltage and power from mains power. The internal

circuitry of an external power supply is very similar to the design that would be used for a built-in or internal supply. External power supplies are used both with equipment with no other source of power and with battery-powered equipment, where the supply, when plugged in, can sometimes charge the battery in addition to powering the equipment. Use of an external power supply allows portability of equipment powered either by mains or battery without the added bulk of internal power components, and makes it unnecessary to produce equipment for use only with a specified power source; the same device can be powered from 120 VAC or 230 VAC mains, vehicle or aircraft battery.



Fig 8: Adaptor

3.2 Software Requirements

3.2.1 Arduino IDE:

The Arduino Integrated Development Environment contains a text editor for writing code, a message area, a text console, a toolbar with buttons for common functions and a series of menus. It connects to the Arduino and Genuino hardware to upload programs and communicate with them. Programs written in Arduino IDE are considered to sketches. These sketches are written in the text editor and are saved with the file extension .ino. The toolbar buttons allow you to verify and upload programs, create, open, and save sketches, and open the serial monitor. It supports C/C++ language. Programming can be done for different boards using Arduino IDE.

4.2.2 Firebase

Firebase is a platform developed by Google for creating mobile and web applications. It was originally an independent company founded in 2011. In 2014, Google acquired the platform and it is now their flagship offering for app development. Firebase first product was the Firebase Realtime Database, an API that synchronizes application data across iOS, Android, and Web devices, and stores it on Firebase's cloud. The product assists software developers in building real-time, collaborative applications.

IV. IMPLEMENTATION & WORKING

To prevent accidents at U-turns by altering the driver about the vehicle coming from the opposite side. This is done by

keeping an IR sensor and buzzers and one red led and one green led on both sides of the U-turn and so that if vehicle comes from one end of the curve then sensor senses and this IR sensor gives signal to Arduino and Arduino gives command to Buzzer, LED lights and Buzzer rings on the other side in order to alert the driver.

CASE 1: Whenever vehicle comes from right side then the IR sensor senses the vehicle and gives signal to arduino then arduino makes Red LED will glow and buzzer rings on the opposite side of the U-turn in order to alert the driver. This will reduce accidents on the curved roads.

CASE 2: Whenever vehicle comes from right side then the IR sensor senses the vehicle and gives signal to arduino then arduino makes Red LED will glow and buzzer rings on the opposite side of the U-turn in order to alert the driver. This will reduce accidents on the curved roads.

CASE 3: Whenever vehicle comes from both sides then both sides sensors can senses the vehicle and gives signals to arduino then arduino makes Red LED will glow and buzzer rings on both opposite sides of U-turn in order to alert the driver on both sides. This will reduce the accidents on both sides of curved roads.

V. RESULTS & DISCUSSIONS

After implementing system as we shown in the Schematic, then after we provide power supply to it, the model start executing the code and peripherals starts responding to according to the code. The working model of “Smart Road Safety and Vehicle Accidents Prevention System for Mountain Roads” has been checked and the following results have been produced.

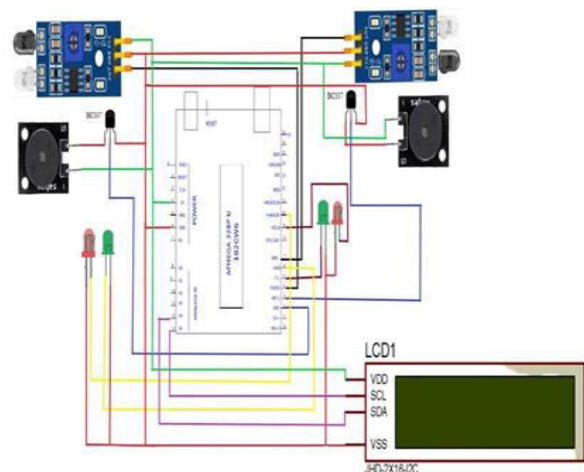


Fig.9: Schematic Diagram

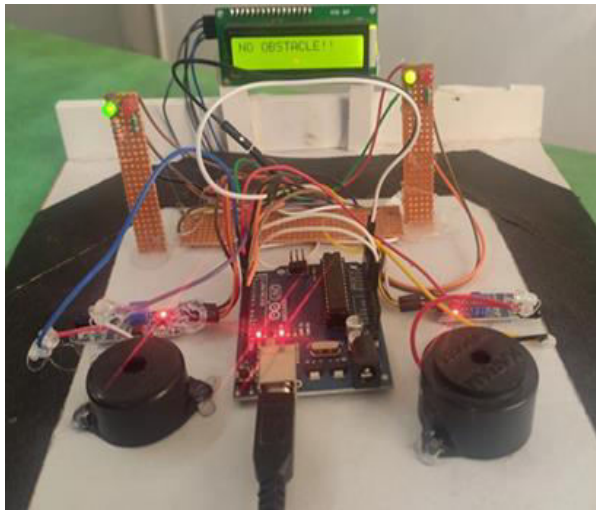


Fig.10: Initial Stage of Output

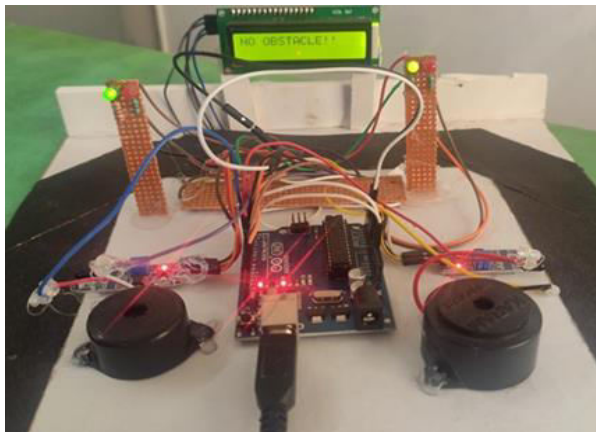


Fig.11: No vehicle from both the sides .

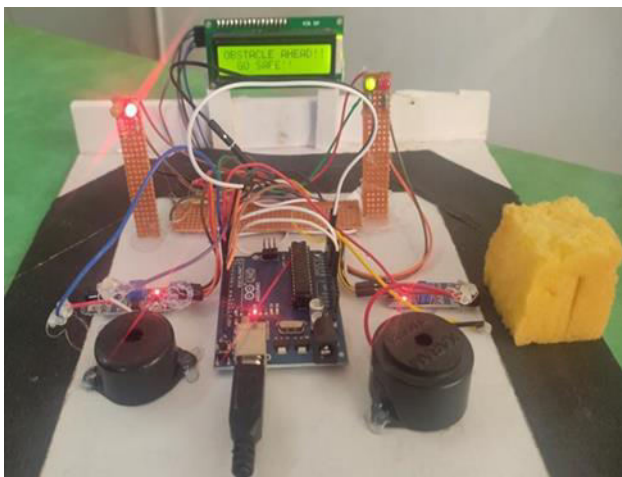


Fig.12. When vehicle comes from right side

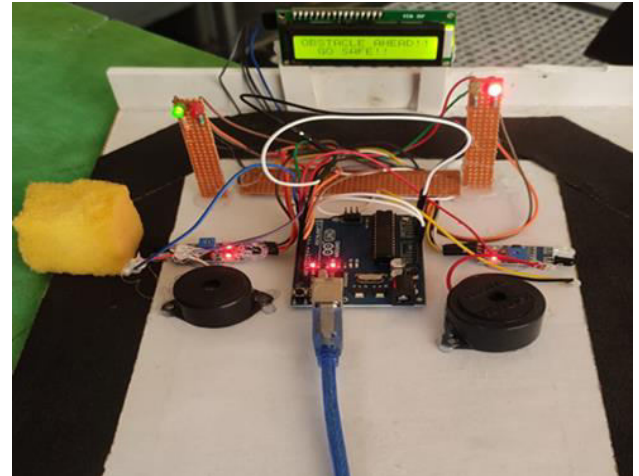


Fig 13: . When vehicle comes from left side

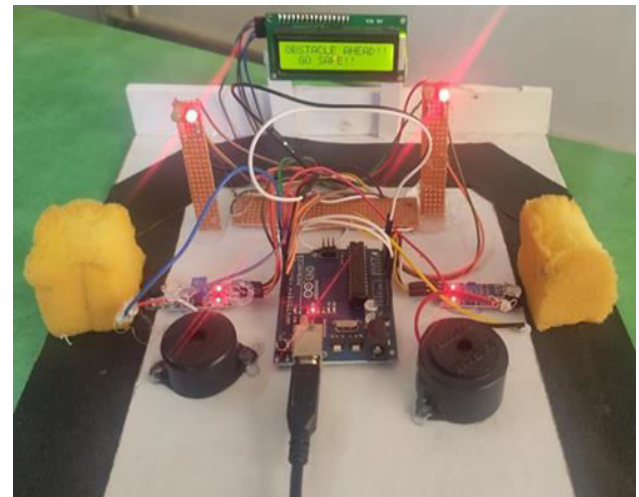


Fig.14: When vehicle comes from both Sides

V. CONCLUSION

We conclude that Growth in population has led to growth in technology. People use car on large number and number of accidents taking place, is increasing day-by-day. Road accidents are undoubtedly the most frequent happening cases and overall, the cause of the most damage. There are many dangerous roads in the world like mountain roads, narrow curve roads, T roads. Some mountain roads are very narrow and they have many curves. The problems in these curve roads is that the drivers are not able to see the vehicle

or obstacles coming from another end of the curve. If the vehicle is in great speed then it is difficult to control and there are chances of falling off a cliff. Hence there is a need of many road safety systems. To avoid these problems in curve roads of mountain areas, has proposed this vehicle accident prevention system. This accident prevention system using sensors is powered by Arduino board, it consists of IR sensors, LED lights, and buzzer. When two cars pass from the opposite side of a mountain curve the IR sensor senses the car and LED colour changes to red and raises the buzzer giving signal of danger and then it changes one LED colour into green to allow the one car to pass and then the other LED colour turns green. In this way we can prevent the accidents of curved road.

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Conflict of interest

The authors declare that there is no conflict of interest in this paper.

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