Design&Implementation OfMicrocontroller based SmartOver-Speeding Breaker



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Declaration

It is declared hereby that this thesis paper or any part of it has not been submitted to anywhere else for the award of any degree.



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Certification

This is to certify that this project entitled **"Smart Over-Speeding Breaker"** is done by the following students under my direct supervision. This project work has been carried out by them in the laboratories of the Department of Electrical and Electronic Engineering under the Faculty of Engineering, Sonargaon University (SU) in partial fulfillment of the requirements for the degree of Bachelor of Science in Electrical and Electronic Engineering.

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We are, indeed, grateful to all those from whom we got sincere cooperation and help for the preparation of this report.

ABSTRACT

According to “The Passenger Welfare Association of Bangladesh” - about 7,000 (6,749) road accidents across Bangladesh in last year 2022- resultnear about 10,000 (9,951) people were died and more then 12,000 (12,356) people were injured.

The number of road accidents increased by 18.89% and fatalities by 27.43% in 2022 compared with the number of 2021.

According to the WHO, approximately 1.3 million lose their lives in road accidents per year.

These accidents are mostly a result of over-speeding, and to keep over-speeding checked; speed breakers are a useful tool.
UK-based research, **Speed Breakers** are helpful to reduce road accidents by around 44%.

But ordinary **Speed Breakers** reduce all vehicles speed that are very annoying for normal speed vehicles driver, and can be a problem for emergency ambulances, fire truck.

Smart Over-speed breakercan be the smart solution for modern world.

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LIST OF ABBREVIATION

DC	Direct Current
LCD	Liquid Crystal Display
IR	Infra-Ray
LED	Light Emitting Diode
TX	Transmit
RX	Receive
PV	Polyvinyl

CHAPTER I

INTRODUCTION

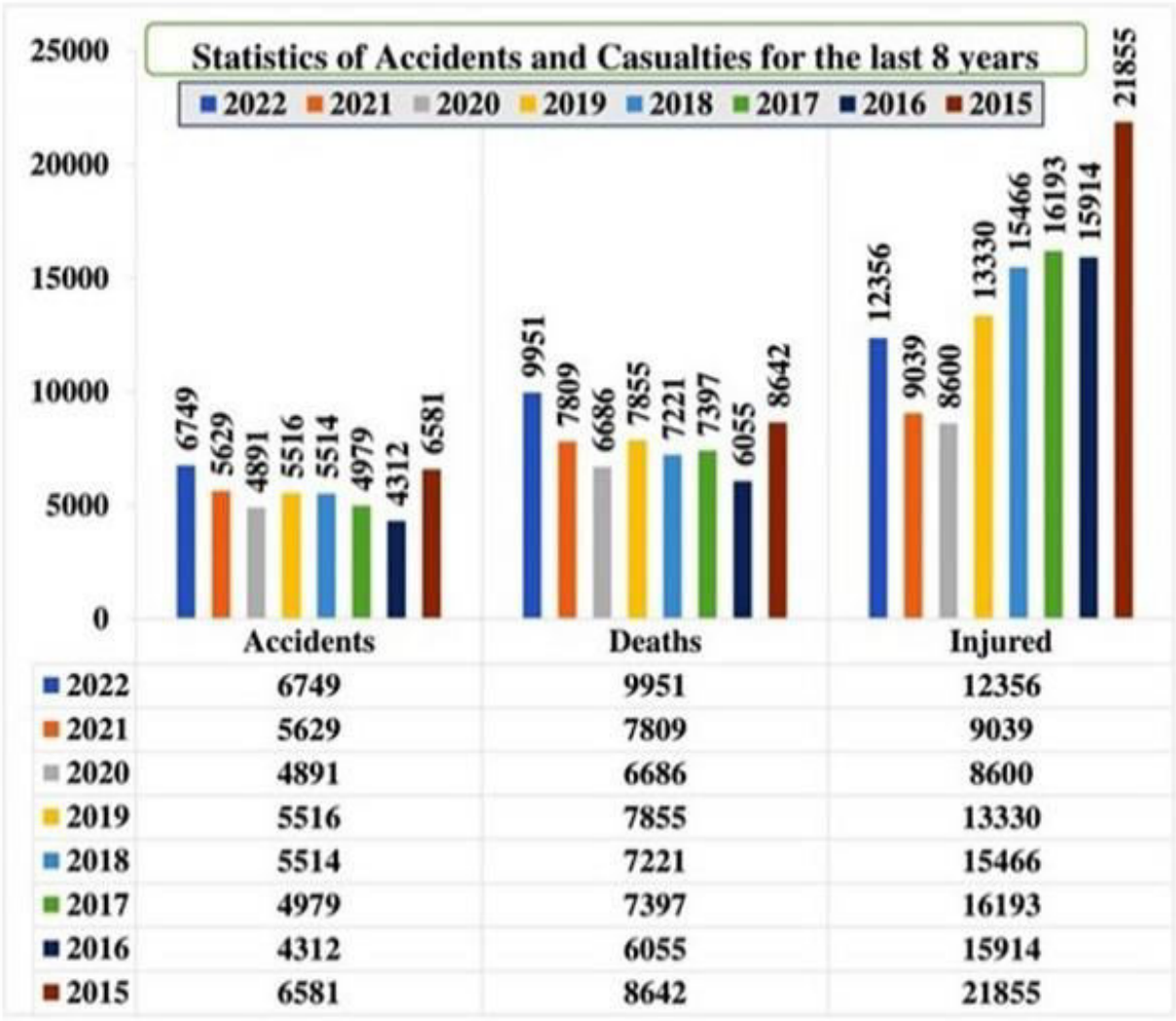
1.1 Introduction

At least 9,951 people were killed and 12,356 others were injured in 6,749 road accidents across Bangladesh in 2022. The number of road accidentsincreased by 18.89 per cent and fatalities by 27.43% in 2022 comparedwith the number of 2021, a reportof the “Passenger Welfare Association of Bangladesh”.

Most of accidents on the highway road cause by high speed driving. Some highway road has signboards signifying maximum speed limit permitted while driving such as **25Km/h** in town,**30Km/h** on rural main roads, **40 Km/h , 60 Km/h, 80Km/h**on highways in Bangladeshfor the driver’s safety, but some people does not follow speed limit. Therefore, the vehicles keep a constant speed within the speed limit over a particular area.To keep speed in limit authorities are using speed breaker.Ordinary **Speed Breakers** reduce all vehicles speed that are very annoying for normal speed vehicles drivers, and can be a problem for ambulancespatient sometime itcan be the reasonofaccident.

Smart over-speed breaker has microcontroller base intelligent processing unite that can identify over speeding and taking action automatically.

Microcontroller based**Smart Over-speed breaker**can be the smart solution for modern world.



	Accidents	Deaths	Injured
2022	6749	9951	12356
2021	5629	7809	9039
2020	4891	6686	8600
2019	5516	7855	13330
2018	5514	7221	15466
2017	4979	7397	16193
2016	4312	6055	15914
2015	6581	8642	21855

Table:1.1.1: StatisticsofAccidentsCasualties for the last 8 years

A large number of road accidents occur all over the world. The major cause is rash driving. Near about 7,000(6,749)traffic accidents were reported during the year 2022 in Bangladesh. According to the analysis chart as shown in fig1, the number is increasing day by day. The traffic has increased considerably in Bangladesh and yet there are no efficient measures to control this traffic or monitor the speed of the running vehicles. Thus, to overcome this problem and reduce the number of death rates occurring due to traffic collision's introduction of new innovative speed enforcement technology is necessary.

In our sub-continent**69%** accidents are happening by Over-speeding**.**

1.2 Background Study

- **ROAD:** Awideway leading from oneplace to another, especiallyonewith a speciallypreparedsurfacewhichvehiclescanuse.
- **VEHICLE:** a thingused for transporting people or goods, especially on land, such as a car, bus or a lorry.
- **ROAD ACCIDENTS:** An event thatoccursduring the movement, and with the participation, of a vehicle on a road, in whichpeoplearekilled or injured, vehicles, equipment or goodsaredamaged, or anyother material damage is caused;

- **Causesof RoadAccidents:**

- ***Over Speeding.***
- Drunken Driving.
- Distractions to Driver.
- Red LightJumping.
- AvoidingSafetyGears like Seat belts and Helmets.
- Non-adherence to lanedriving and overtaking in a wrongmanner.

- **Over Speeding:**

Most of the fatal accidents occur due to over speeding. It is a natural psyche of humans to excel. If given a chance man is sure to achieve infinity in speed. But when we are sharing the road with other users we will always remain behind some or other vehicle. Increase in speed multiplies the risk of accident and severity of injury during accident. Faster vehicles are more prone to accident than the slower one and the severity of accident will also be more in case of faster the severity of accident will also be more in case of faster vehicles. Higher the speed, greater the risk. At high speed the vehicle needs greater distance to stop i.e. braking distance. A slower vehicle comes to halt immediately while faster one takes long way to stop and also skids a long distance due to law of notion. A vehicle moving on high speed will have greater impact during the crash and hence will cause more injuries. The ability to judge the forthcoming events also gets reduced while driving at faster speed which causes error in judgment and finally a crash.

1.3 Abstract:

This is a traffic control system which includes a device that performs detection of vehicle speed which is running above specified speed on highways and other roads as well as notifies authorities in an event of violation of rules. In earlier times, a lot of ideas were implemented to detect harsh driving or over-speeding of vehicles. Many of these systems require human intervention and a lot of efforts which is very hard to implement. In this project we are designing the system that aims at early detection of over speeding vehicles and alert of those to the concerned authorities.

This in turn prevents occurrence of road accidents. The safe speed limit is specified by the authority which is responsible to control this system. The vehicle speed limit is depending on the traffic at particular location. System will capture the speed of vehicle and the time taken by vehicle to travel from one point to end point and it will display it on LCD where system is deployed. In addition to this, the buzzer gives a sound alert to the police-boxTwo unit of low-level speeding breaker active. One-unit high level speeding breaker active. One road **STOP** barrier  on the road.

1.4 Objectives:

The objectives of this project:

- To design and construct aAutomatic **Smart Over-speed breaker.**
- To create safe travel for vehicle drivers, passengers also for pedestrians.
- To take notes from our real-time tests so that those can be used for future improvements.

1.5 ProjectOrganization:

In thisreport, Chapterone covers introduction, background,Abstract, objectives. Chapter two represents theory, description of the microcontroller, servo motor, IR sensor, LCD display, LCD Adapter modul and other components. Chapterthree block diagram, circuit diagram, circuitdescription, projectoverview, real image ofproject, flowchart, flow chart-description,"command and cods",working principle of the project. In chapter four we have discussed result, advantages, disadvantages,discussion, costestimation, in chapter five conclusion future-work and references.

CHAPTER II

THEORY OF THE PROJECT

2.1 Introduction

This chapter includes the total over view of the device. In this chapter we have followed-up the theory of

- Microcontroller (Nano Arduino).
- Servo Motor.
- IR Sensor.
- LCD Adapter Module.
- LCD display 16x2.
- Buzzer module.
- LED Light.
- 5V DC power supply.

and other components. Here we can know that the total system overview of the projects. And we will also know that how the equipment are working with each other.

2.2 Theory

We've developed the **Smart Over speeding Breaker** that can measure vehicle speed perfectly. And if any vehicle violating the particular area speed limit the system will take some action automatically. The **Smart Over speeding Breaker**based on microcontroller to measure vehicle speed we used IR sensor, to show alarm we used LED light and buzzer module. And in this project we use servo motor to operate hidden speed breakers and road barrier.

2.3.1NodeMCU:

NodeMCU is a low-costopen source IoT platform. It initiallyincluded firmware whichruns on the ESP8266 Wi-Fi SoC from Espressif Systems, and hardware whichwasbased on the ESP-12 module. Later, support for the ESP32 32-bit MCU wasadded.

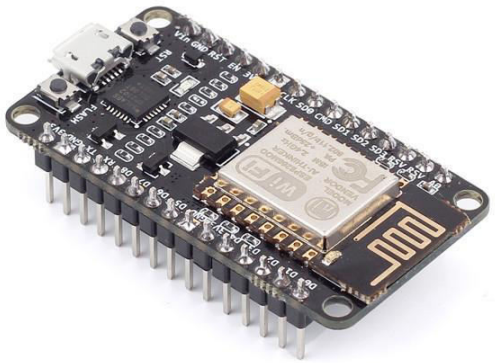


Fig 2.3.1.1: NodeMCU

2.3.2 Overview:

NodeMCU is an open source firmware for which open source prototyping board designs are available. The name "NodeMCU" combines "node" and "MCU" (micro-controller unit). Strictly speaking, the term "NodeMCU" refers to the firmware rather than the associated development kits. Both the firmware and prototyping board designs are open source.

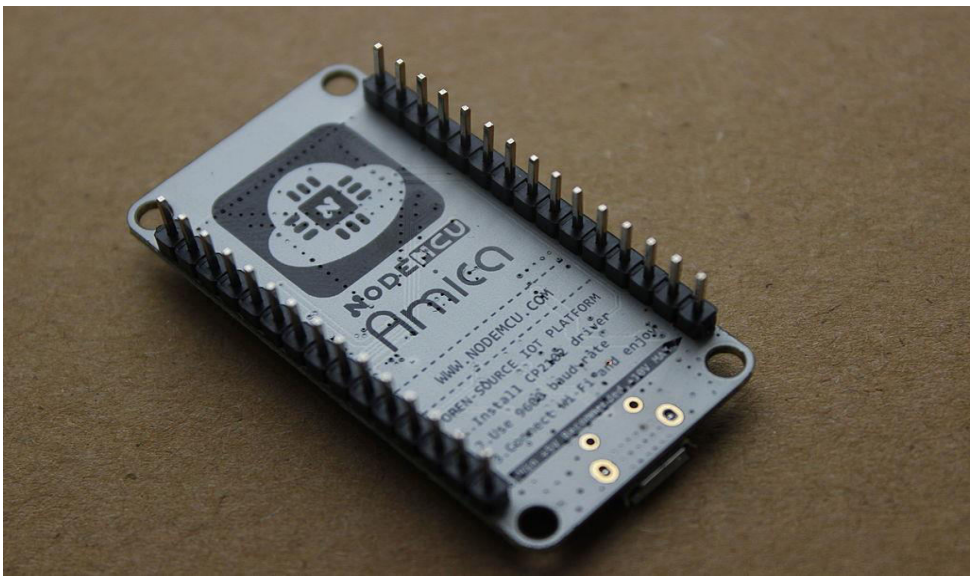


Fig 2.3.1.2: Overview

The firmware uses the Lua scripting language. The firmware is based on the eLua project, and built on the Espressif Non-OS SDK for ESP8266. It uses many open source projects, such as lua-cjson and SPIFFS. Due to resource constraints, users need to select the modules

relevant for their project and build a firmware tailored to their needs. Support for the 32-bit ESP32 has also been implemented.

The prototyping hardware typically used is a circuit board functioning as a dual in-line package (DIP) which integrates a USB controller with a smaller surface-mounted board containing the MCU and antenna. The choice of the DIP format allows for easy prototyping on breadboards. The design was initially based on the ESP-12 module of the ESP8266, which is a Wi-Fi SoC integrated with a Tensilica Xtensa LX106 core, widely used in IoT applications (see related projects).

2.3.3 TypesofNodeMCU:

Therearetwoavailable versions ofNodeMCU

as version 0.9 & 1.0 where

the version 0.9 contains **ESP-12** and

version 1.0 contains **ESP-12E** where E stands for "Enhanced".

2.3. 4 HistoryofNodeMCU:

NodeMCU was created shortly after the ESP8266 came out. On December 30, 2013, Espressif Systems[6] began production of the ESP8266. NodeMCU started on 13 Oct 2014, when Hong committed the first file of nodemcu-firmware to GitHub. Two months later, the project expanded to include an open-hardware platform when developer Huang R committed the gerber file of an ESP8266 board, named devkit v0.9. Later that month, Tuan PM ported MQTT client library from Contiki to the ESP8266 SoC platform, and committed to NodeMCU project, then NodeMCU was able to support the MQTT IoT protocol, using Lua to access the MQTT broker. Another important update was made on 30 Jan 2015, when Devsaurus ported the u8glib to the NodeMCU project, enabling NodeMCU to easily drive LCD, Screen, OLED, even VGA displays.

In the summer of 2015 the original creators abandoned the firmware project and a group of independent contributors took over. By the summer of 2016 the NodeMCU included more than 40 different modules.

2.3.5 ESP8266 WifiModuleboard layout:

The Nodemcuwifi module comprises of ESP12E chip(the brain of the module), GPIO pins for easy interfacing, 3.3 Volt Voltage regulator, onboard LED, USB to serial converter IC, USB port, and more.

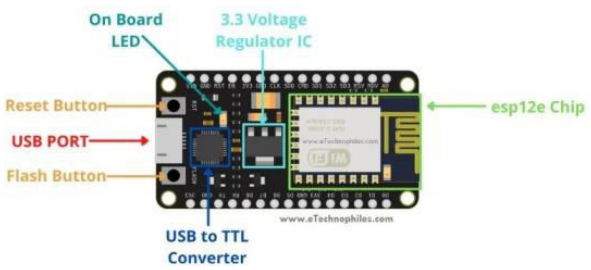


Fig 2.3.5.1: ESP8266board layout

2.3. 6 ESP8266 Pins:

The esp8266 board has 2 UART interfaces– RX0 and TX0 are UART0, RX2 and TX2 are UART1. The UART1 is used for uploading the firmware or program.

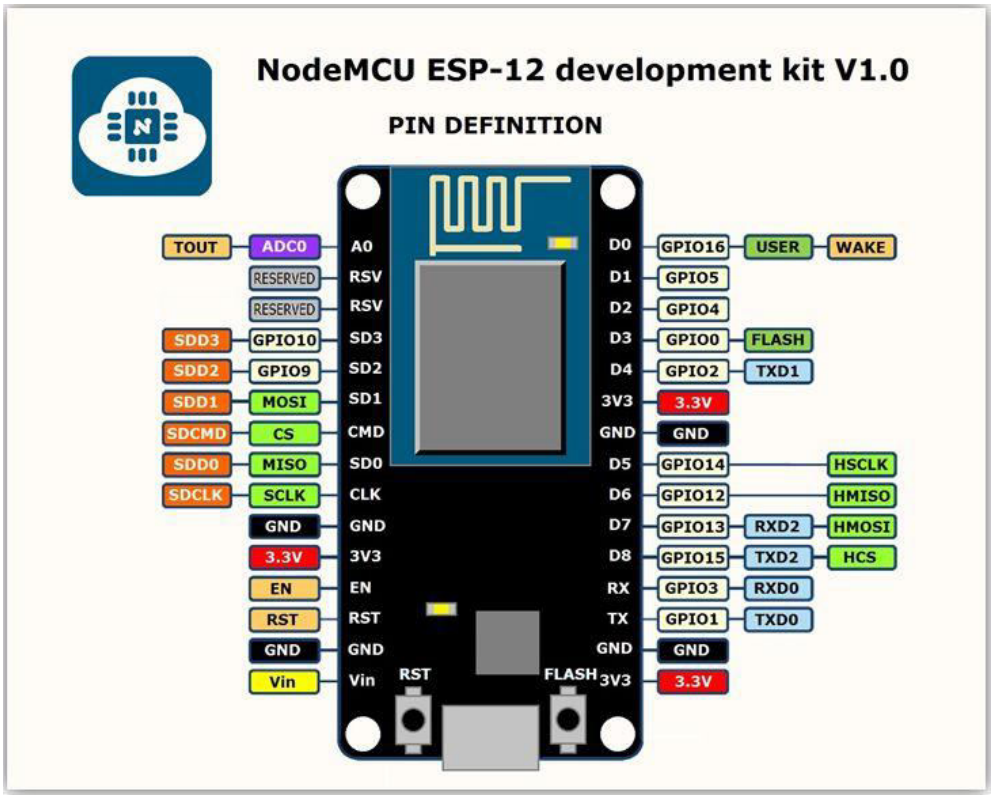


Fig 2.3.6.1 ESP8266 Pins

➢ Power Pins:

Vin: This pin can be used to power the esp8266 board. Up to 5V can be supplied to it. The Vin pin can be used to directly supply the Nodemcu esp8266 and its peripherals if you have a regulated 5V voltage source. This 5 volt is then converted to 3.3 volts using a voltage regulator as the esp12e chip requires 3.3V to operate.

Note: The Lolin ESP8266 module has one extra pin called **VU**. If the module is powered from a USB(5V), you can get 5V from the **VU** pin to power the external devices.

3.3 V: The board has **three 3.3V pins**. While the 3.3V pin is the output of a voltage regulator (CP2102), it can be used to power up the external components.

GND: There are a **total of 4** such pins.

Note: All the GPIO pins of the ESP8266 are 3.3 V compatible(I/O) and are not 5V tolerant. Supplying 5 volts or more directly to any of the pins may damage the board.

UART0 Pins:

- U0 TXD (GPIO1)
- U0 RXD (GPIO3)

UART1 Pins:

- U1 TXD (GPIO15)
- U1 RXD (GPIO13)
- **SPI Pins:**

Unlike the three UART interfaces, the Esp8266 Nodemcu has only one set of SPI pins. The SPI protocol requires 4 pins: MOSI, MISO, SCLK, and CS.

- GPIO 7: MISO
- GPIO 8: MISO
- GPIO 6: SCLK
- GPIO 11: CS

- **i2C display adaptor Pins:**

The ESP8266 does not support any hardware I2C protocol, but it is possible to implement it in the programming part. So you may use any GPIO pins as I2C as long as you are aware of the I2C programming. Only two pins are required for I2C: SDA and SCLK.

Usually, the following GPIOs are used as I2C pins:

- GPIO 4: SDA
- GPIO 5: SCL

- **PWM Pins:**

The board comes with 4 PWM-enabled pins. The PWM output can be used for driving digital motors and LEDs. PWM pins on the ESP8266 board are **GPIO 4, GPIO 12, GPIO 14, and GPIO 15**. OR digital pins **D2, D5, D6, and D8**.

- **EN orEnable Pin:**

EN stands for Enable, which enables the esp8266 chip i.e, ESP12E when pulled high. The chip works at minimum power when the EN pin is pulled low.

- **RST or Reset Pin:**

This pin resets the board when pulled low. It works like the onboard reset button.

- **Wake Pin(D0):**

This pin is used to wake up the esp8266 chip from a deep sleep.

NOTE: EN, RST, and Wake pin are called the **control pins of the ESP8266 board.**

2.3.7NodeMCU ESP8266 dimensions:

The physical dimension ofNodeMCU V2 is 48X26 mm.

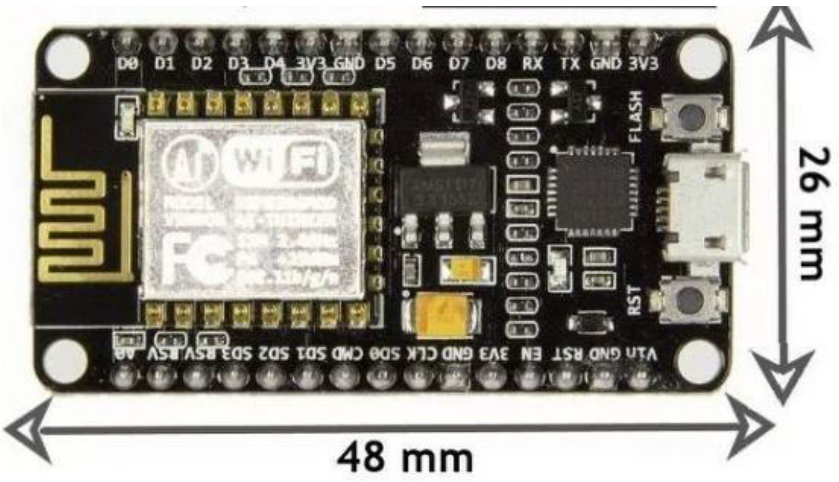


Fig 2.3.7.1 Nodemcu esp8266 dimensions

2.3.8ESP8266 ArduinoCore:

As Arduino.cc begandeveloping new MCU boards based on non-AVR processors like the ARM/SAM MCU used in the ArduinoDue, theyneeded to modify the Arduino IDE so it would be relativelyeasy to change the IDE to support alternatetoolchains to allowArduino C/C++ to be compiled for these new processors.



Fig 2.3.8.1 : ESP8266 ArduinoCore

Theydidthiswith the introductionof the Board Manager and the SAM Core. A "core" is the collectionof software componentsrequired by the Board Manager and the Arduino IDE to compile an Arduino C/C++ source file for the targetMCU'smachinelanguage. Some ESP8266 enthusiastsdeveloped an Arduinocore for the ESP8266 WiFiSoC, popularlycalled the "ESP8266 Core for the Arduino IDE".[18] This has become a leading software developmentplatform for the various ESP8266-based modules and development boards, includingNodeMCUs.

2.3.9ESP8266Technical specifications:

- Tensilica L106 32-bit micro controller unit at 80 MHz (or overclocked to 160 MHz)
- 32 Kbinstruction RAM
- 80 kB user data RAM
- 16 kB ETS system data RAM
- Flash Memory 4Mb
- USB – micro USB port for power, programming and debugging
- 13 GPIO pins
- 802.11 b/g/n, supporting WPA/WPA2
- STA / AP modes support
- TCP / IP protocol stack, One socket
- TCP / UDP Server and Client
- Serial port baud rate configuration:

  1200/2400/4800/9600/19200/38400/57600/74800/115200 bps
- Pin-compatible with Arduino UNO, Mega
- KEY button: modes configuration
- 32-bit hardware timer
- WiFi operation current: continuous transmission operation: ≈70mA (200mA MAX),

  deep sleep mode: <3mA
- SerialWiFi transmission rate: 110-460800bps
- Temperature: -40℃ ~ + 125 ℃
- Humidity: 10%-90% non-condensing
- Weight: about 20g (0.7oz)
- Pulse-Width Modulation (PWM)

- Interruptcapability
- 3.3V operating voltage, internal voltage regulator allows 5V on power input
- maximum current through GPIO pins: 12mA (source), 20mA (drain)
- availablefirmware for Arduino IDE
- Websocket librariesavailable
-

2.4Servo Motor:



Fig 2.4.1: Servo Motor

A servo motor is a type of motor that can rotate with great precision. Normally this type of motor consists of a control circuit that provides feedback on the current position of the motor shaft, this feedback allows the servo motors to rotate with great precision. If you want to rotate an object at some specific angles or distance, then you use a servo motor. It is just made up of a simple motor which runs through a servo mechanism. If motor is powered by a DC power supply then it is called DC servo motor, and if it is AC-powered motor then it is called AC servo motor. For this tutorial, we will be discussing only about the DC servo motor working.

2.5IR Sensor:

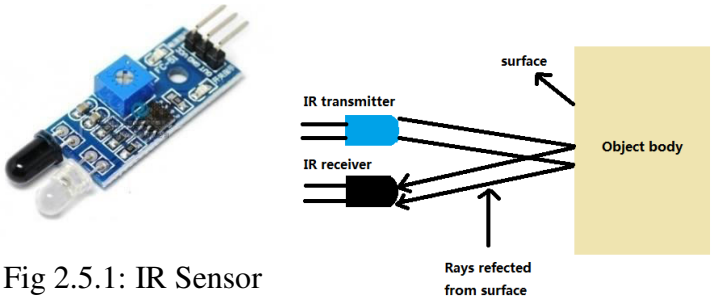


Fig 2.5.1: IR Sensor

The KY-032 IR Infrared Distance Obstacle Avoidance Detection Sensor Module returns a signal when it detects an object within a fixed range which can be adjusted by the onboard potentiometer from 5 – 50 cm.

The IR sensor moduleincludesfiveessential parts like IR Tx, Rx, Operationalamplifier, trimmer pot (variable resistor) & output LED.

pin configuration.

- VCC Pin is power supply input
- GND Pin is power supply ground
- OUT is an active-high o/p

The main specifications and features of the IR sensor module include the following.

- The operating voltage is 5VDC
- I/O pins – 3.3V & 5V
- Mounting hole
- The range is up to 20 centimeters
- The supply current is 20mA
- The range of sensing is adjustable
- Fixed ambient light sensor

2.6I2C LCD Adapter Module:

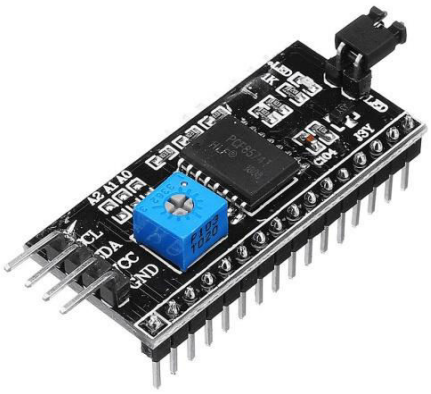


Fig 2.6.1: i2c LCD Adapter

- Serial I2C control of LCD display using PCF8574
- Backlight can be enabled or disabled via a jumper on the board.
- Contrast control via a potentiometer.
- Can have 8 modules on a single I2C bus (change address via solder jumpers)address, allowing
- I2C Serial LCD Daughter board that can be connected to a standard 16×2 or 20×4 Character Display Module that supports 4-bit mode. All Character Modules sold on our site support 4-bit mode, and nearly all commercially available 16×2 and 20×4 line character modules support it too.

2.7LCD Display 16x2:

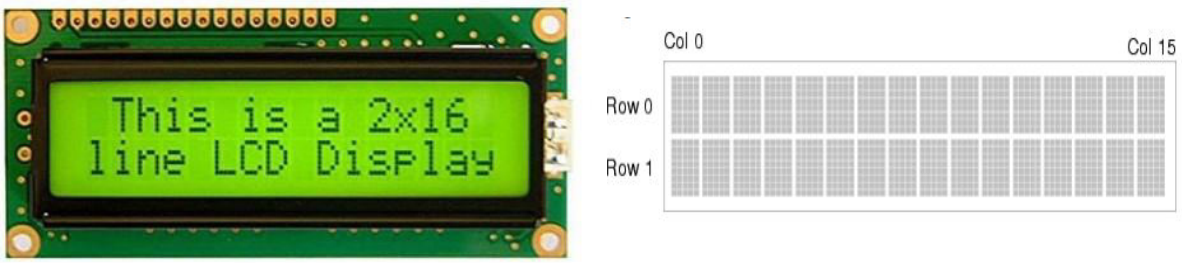


Fig 2.7.1: LCD Display 16X2

The Character LCD component contains a set of library routines that enable simple use of one, two, or four-line LCD modules that follow the Hitachi 44780 standard 4-bit interface. The component provides APIs to implement horizontal and vertical bar graphs, or you can create and display your own custom characters. When to Use a Character LCD Use the Character LCD component to display text data to the user of the product or to a developer during design and debug

This is the great yellow backlight LCD Display. It is fantastic for Arduino-based projects. This Standard LCD 16x2 with Yellow Backlight is very easy to interface with Arduino or Other Microcontrollers.

2.8Bridge rectifier based 5V DC supply:

A bridge rectifier circuit is a common part of the electronic power supplies. Many electronic circuits require rectified DC power supply for powering the various electronic basic components from available AC mains supply. We can find this rectifier in a wide variety of electronic AC power devices like home appliances, motor controllers, modulation process, welding applications, etc.

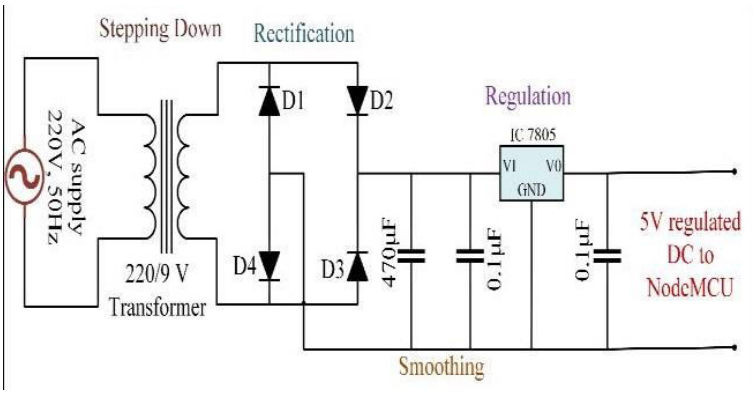


Fig: 2.8.1: Bridge rectifier based 5V DC supply

In order to use the 220V AC supply as 5V DC supply, voltage step down transformer and a rectifier

circuit are used, which is shown in Fig. 3. In this circuitry, a step-down transformer is used to convert 220V AC to 9V AC. This 9V AC is then transformed into 9V DC by a full bridge rectifier circuit. The DC produced in the output of full bridge rectifier has a significant amount of ripples and in order to reduce it, a smoothing capacitor is used in parallel. Finally, this 9V DC is transformed into 5V DC.

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CHAPTER III

DESING & FEBRICATION

3.1 Introduction

In this chapter fully cover with discuss design and fabrication of this project. Here we will discuss about developed block diagram and briefly describe about the circuit description and also learn about working principle.

3.2 Block Diagram

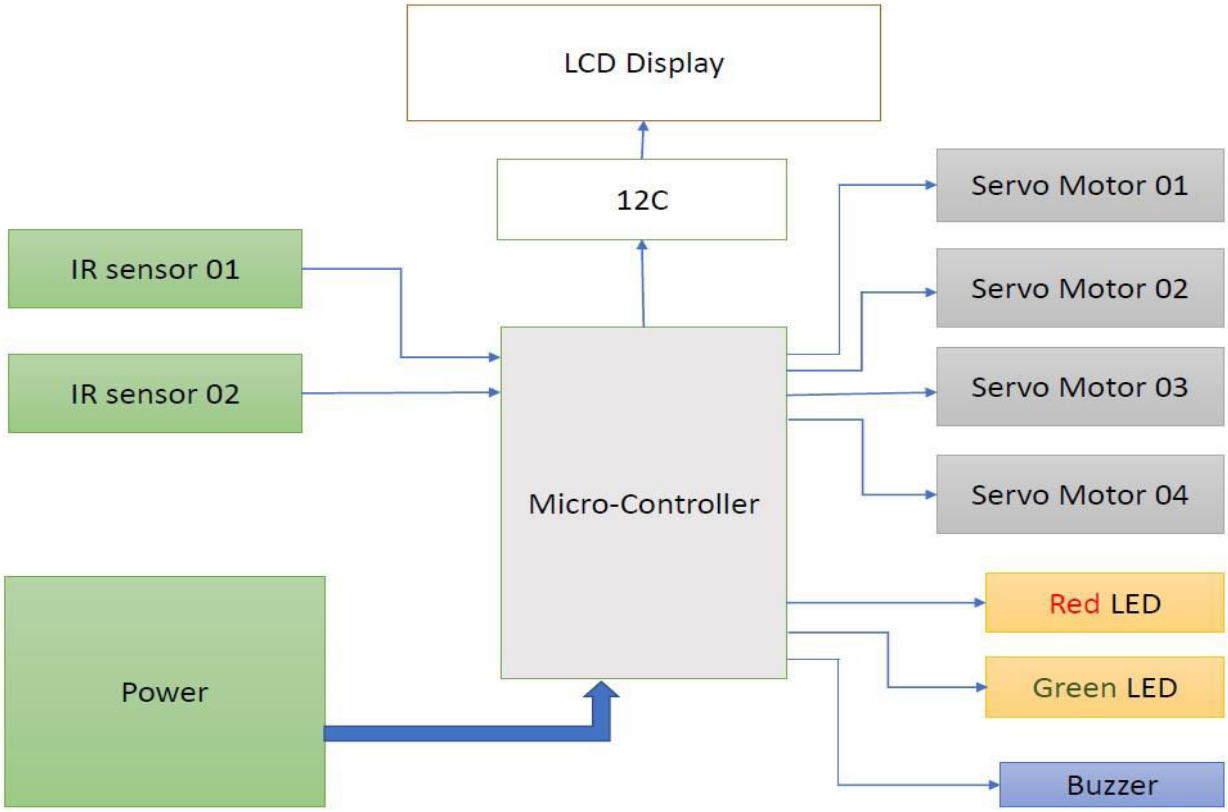


Fig: 3.2.1: Block diagram of project

3.3 Circuit Diagram

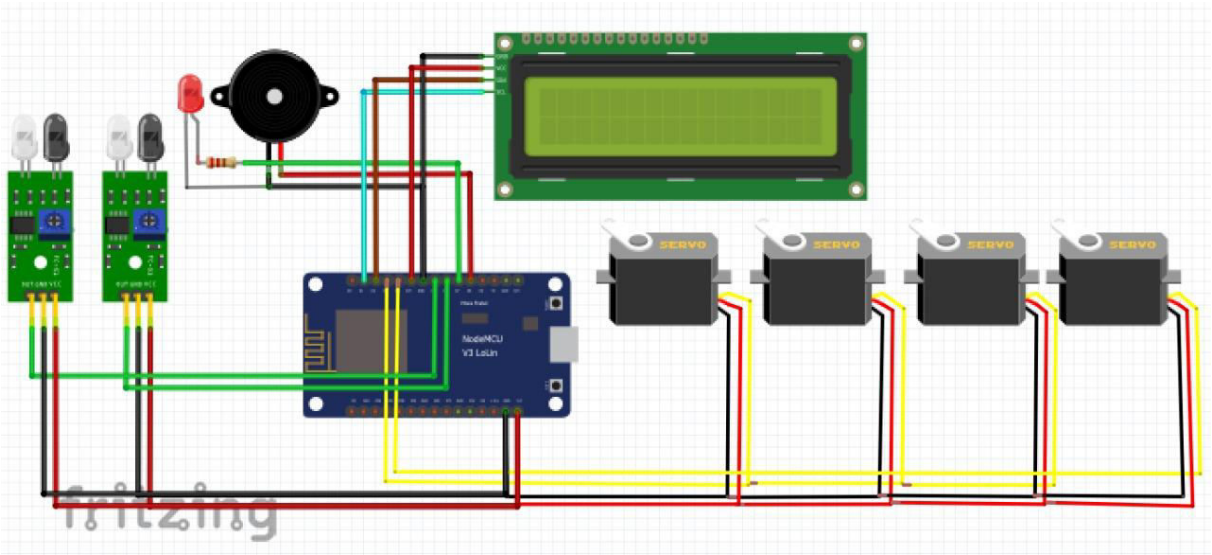


Fig: 3.3.1: Circuit diagram of the Project

3.3.1Circuit Description

The overall circuit diagram of speed detection system using IR sensor is shown in figure. When a vehicle passes through the first sensor, the infrared ray touches the vehicle that the sensor has detected the object. The output of IR sensor 1 is connected to the Microcontroller. The second IR sensor's infrared ray touches the object and reflects to the sensor and the sensor has sensed the object. The output of IR Sensor 2 is connected to the Microcontroller. 16×2 LCD is used to display the vehicle's speed. The LCD is connected to the Microcontroller by i2c LCD Adapter.And then the LCD shows the speed. LCD displays last counted speed and "searching. If the speed is over 12 km/hour, the buzzer will be alarmed andREDLED will be ON. LCD displays the speed and "Over Speed". The vehicle speed is calculated in microcontroller as km/h. The speed of the vehicle is calculated by this equation.

$$Speed = \frac{Distance}{Timetaken}(km/h)$$

The time taken between the two sensors is calculated by this equation.

Time taken =(T2- T1)s

In this system, the power supply circuit used a power supply DC 5V is connected to the Microcontroller.

3.4Overview of Smart Over-speeding breaker:

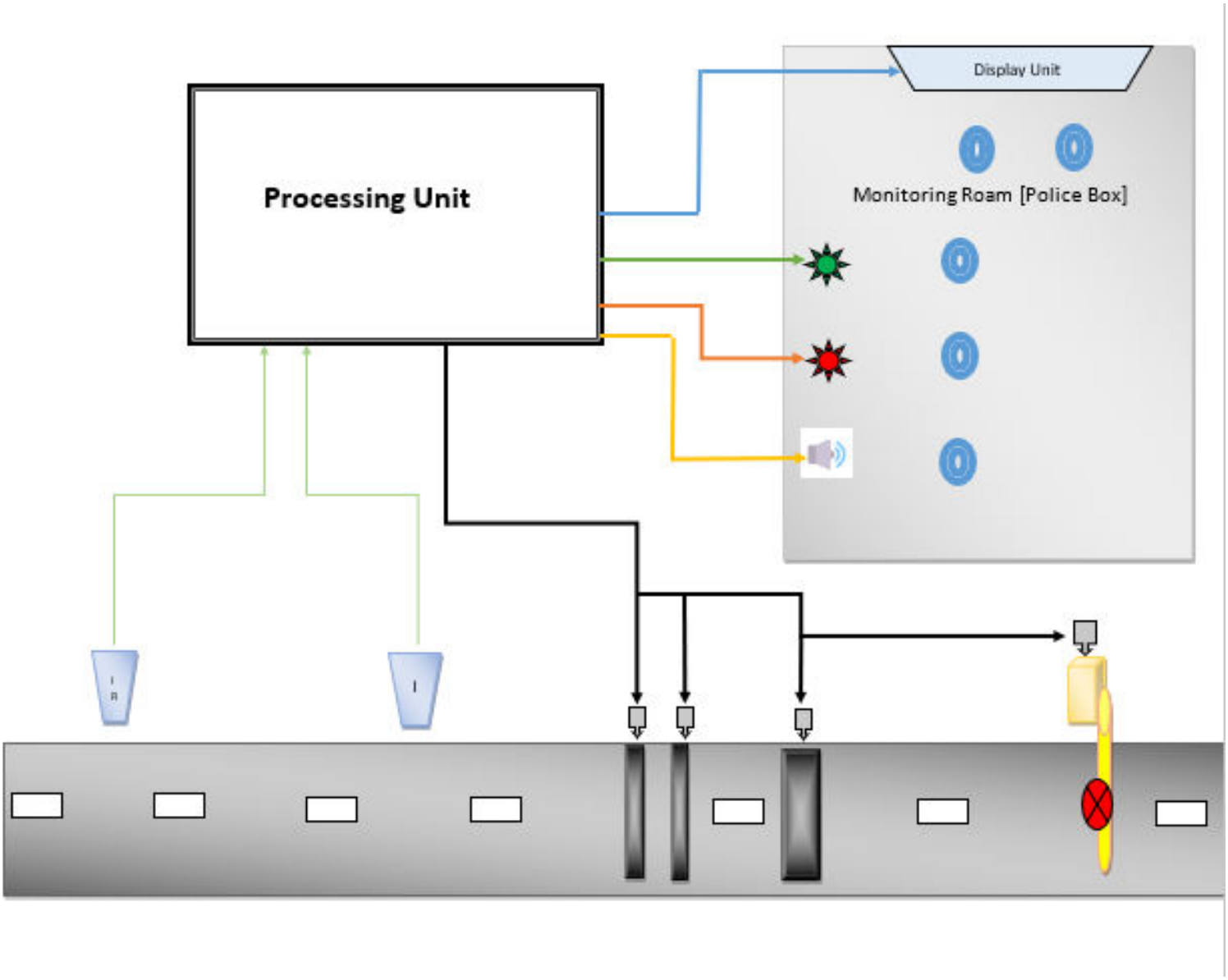


Fig: 3.4.1: Overview of **Smart Over-speeding breaker.**

3.5 Working Principle:

- At first, we start our system.
- To ON the system, we need power 5V DC supply.
- When any vehicle passing in front of IR sensor 01 and 02, the micro controller counting the speeding of the vehicle.
- In this system we set the high-speeding limit 12m/s.
- so, if vehicle speeding less then 12m/s then the green light **ON** LCD will print **LOW SPEEDING** then**.**
- if any vehicle passing the sensor area more then 12m/s the system will take some **OVER SPEEDINGaction.**

  ► OVER SPEEDING Action:
- RED LED light **ON**.
- Alarm buzzer alert sound.
- Two unit of low-level speeding breaker active.
- One-unit high level speeding breaker active. One road **STOP** barrier on the road.
- Then the system will return in normal mood within 8 sec.

3.6Real Image of the Project:

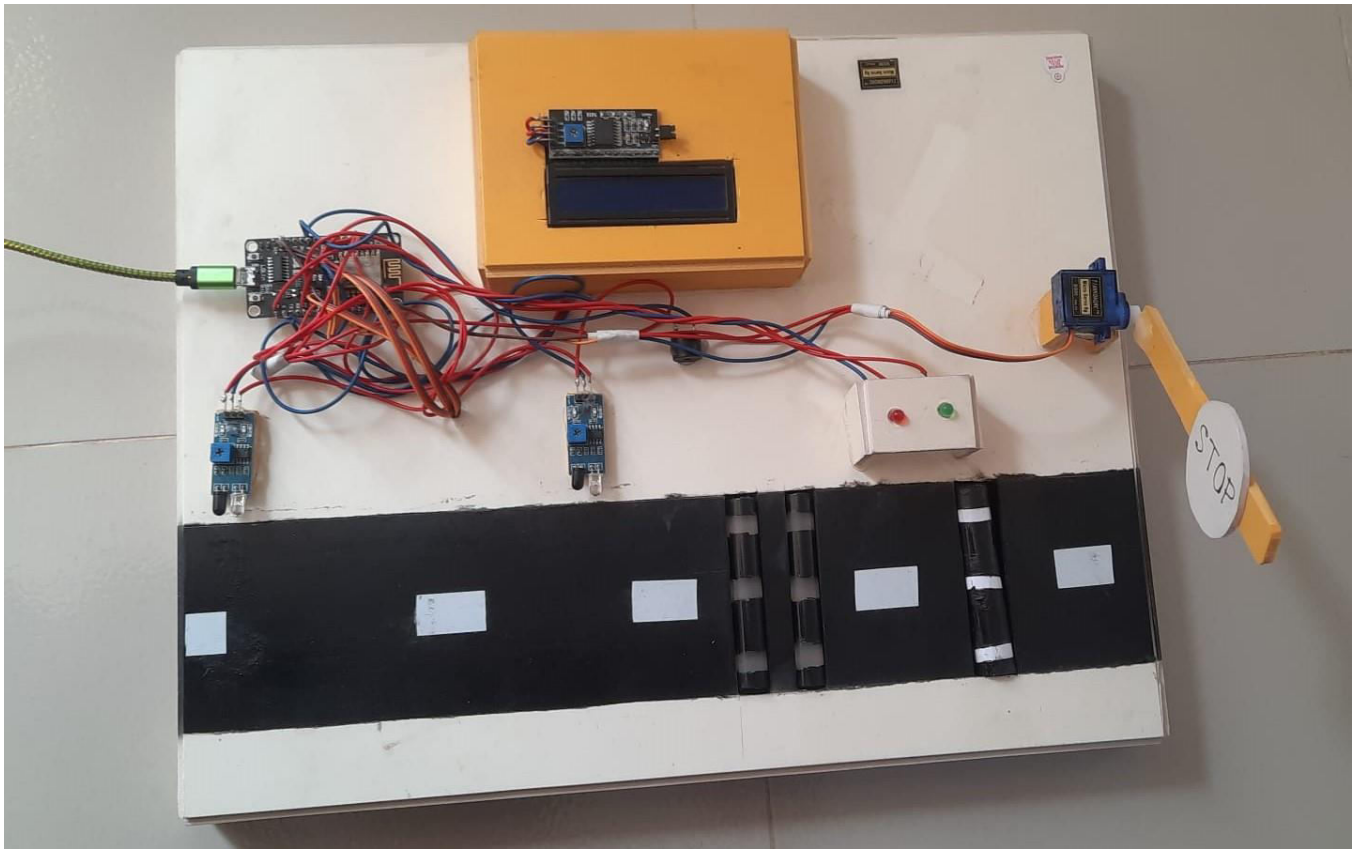


Fig: 3.6.1: Real image of the project

3.7FlowChart

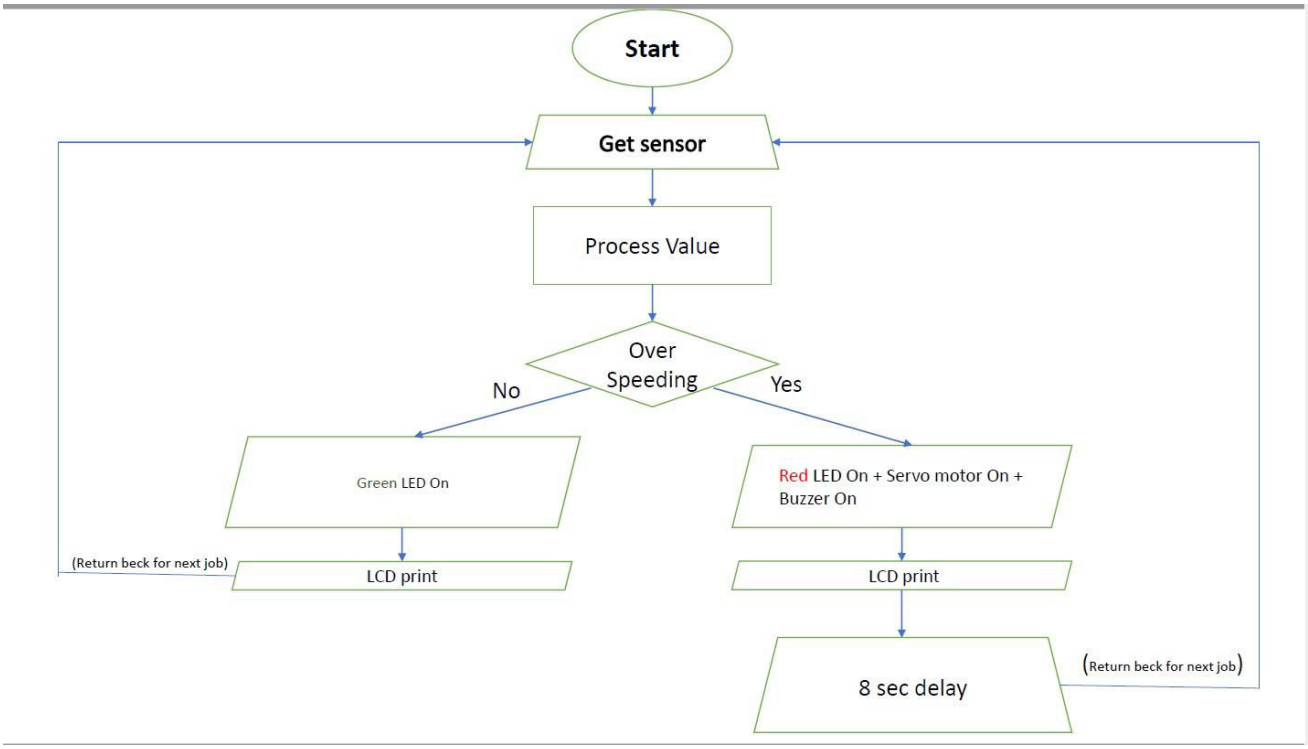


Fig: 3.7.1: Flow chart of the project

3.7.1Flow chart description's:

The overall flow chart of the system is shown in figure. Firstly, it initializes the input/output pins of the device. IR sensor 1 is activated and the vehicle is detected come in. If the sensor senses the vehicle, the program starts to IR sensor 2 senses the vehicle and continuously the program stops counting and starts to calculate the speed of the vehicle. Microcontroller is counted start time and stop time, and time interval will get from start time and stop time and vehicle speed. And then, the calculated speed is compared with the limited speed.

1. When the calculated speed is less than limited speed 12km/h, The LCD displays normal speed and the vehicle's speed only.
2. When the calculated speed is greater than limited 12km/hspeed, buzzer alarms ON, RED LED ON and LCD displays Over Speed and the vehicle's speed, Servo motors ON to active hidden speed breaker and road barrier Finally, the program is ended.

3.8 Material List:

Device name	Model	Quantity
Microcontroller	ES8266	1
IR Sensor	TX and RX	2
Micro Servo Motor	SG90	4
Buzzer	5V to 5V	1
LCD Adapter module	12C	1
LED light	5v Red, Green	2
LCD Display	16x2	1
Power Supply	5V-DC/2A	1
Wire	As per need	10ft
Soldering cost		
PV Bord		$3ft^2$

Table 3.8.1: Material list

3.9Conclusion:

In this chapter we have discussed the block diagram, circuit description, working principle, flow chart also show the real image of the project and others. In the later part of this paper we discussed the result & discussion of the project to make the concept clear to anyone.

Chapter IV
RESULT& DISCUSSION

4.1 Introduction:

This chapter contains the results obtained and discussion about the project. We have also covered discussions about advantages, disadvantages and limitation of **Smart Over-speeding breaker.**

4.2 Result:

Our project **Smart Over-speeding breaker**. In our project making we used PVC boards for total hardware making. After finally completing this project, we ran it & we observed the output of this project.

We can see that it is working well as expected. After making our project we observe it very careful. It works as we desire. Our project give output perfectly and all equipment are work perfectly.

4.3.Stopping, Reaction & Braking Distance Calculation:

For an object in motion to stop, it needsthreethings: force, time, and distance. Newton'sFirstLawtellsusthat an object in motion willstay in motion unlessacted on by an outside force, butwhenthat force is applied, the objectdoesn'tinstantly come to a complete a total stop. In fact, Newton's Second Law tells us what happens when an object encounters an outside force.

$$F=ma$$

Force leads to acceleration, and accelerationchanges the velocity. When the velocity is zero, the object has stopped. Wecanusephysics and kinematicsequations to findouthow fast somethingcomes to a stop, butthattimewill never be zero. Thismeansthat the object still travelsbetween the time the force is applied and it comes to a stop. The distance it covers is thattime is called the **stopping distance**.

Imagine that a deer runs out in front of a speeding car. The stopping distance for the car will depend on the force of the brakes and the mass of the car, so there is a **braking distance**, but remember that the deer's appearance was unexpected. The driver has to see the deer, the brain has to recognize the threat, and it has to send a signal down to the driver's foot so that the brake can be pressed. That all takes time, and during that time the car is still traveling at full speed, so there is a **reaction distance** as well.

➢ **STOPPING DISTANCE = REACTION DISTANCE + BRAKING DISTANCE**

- The **reaction distance**(X_r) is how far you travel during your reaction time, which is the time interval from you perceiving a hazard and actually starting to take action e.g. apply the brakes.
- The **braking distance** (X_b) is the actual distance you travel from when you first apply the brakes until you come to a halt.
- The **stopping distance (X)** is the total time required from initial visual stimulus to actually stopping moving.

The stopping distance *x* is then the sum of the reaction distance and the braking distance:

$$X = x_r + x_b$$

X_r= reaction distance

X_b =brakingdistance

4.3.1 Distance Formula:

First, stopping distance for different vehicles can probably be looked up in a table, because it is important information used in several different professions. Aside from that, it can be calculated. Velocity is defined as distance divided by time $v = \frac{x}{t}$, and that equation can be solved to give a distance formula.

$$X = vt$$

To describe an object that comes to a stop, distance can be related to the vehicle's velocity and its acceleration.

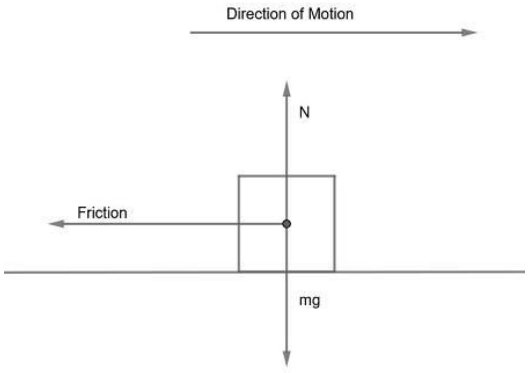


Fig:4.3.2.1: In thisfreebody diagram, friction is slowingthe object by workingopposite the directionof motion.

To describe an objectthatcomes to a stop, distancecan be related to the vehicle'svelocity and its acceleration.

$$v_f^2 = v^2 + 2ax$$

Where,

x = distance (m)

u_f = final velocity (m/s). Thisvaluewill be zero, since the object stops
v = initial velocity (m/s)

a = acceleration. If the car is slowing down, thiswill be a negative value.

Sincethis is an emergency situation and reactiontime is a factor, wecanprobablyassumethat the tireshavelockedup and the vehicle is sliding on the road. In thatcase, the only source offriction is between the wheels and the road. Frictioncan be thoughtof as a force thatactsagainst the directionof an object's motion, so friction is the outside force that stops the car, according to Newton'sFirstLaw. The force offriction (F_μ) is determined by the coefficient of friction (μ), which is a value that describes the "roughness" or the amount of friction between two surfaces. The coefficient is multiplied by the Normal Force, which on a flat surface is the same magnitude as the weightof the car.
The calculation for braking distance begins with Newton's Second Law, $\boldsymbol{F = ma}$. The weight of the car is found by multiplying its mass by the acceleration from gravity.

$$\boldsymbol{W = mg}$$

The force offriction from the brakes is the weightof the carmultiplied by the coefficientoffriction.

$$\boldsymbol{F_\mu = \mu mg}$$

Noneof the kinematicsequationsuse force as a variable, butwecanrelate force to acceleration. Start by solving F = ma for acceleration.

$$\boldsymbol{a = \frac{F}{m}}$$

The force in thiscase is the force offriction, so thatcan be substituted directly into the equation.

$$\boldsymbol{A = \frac{\mu mg}{m}}$$

Noticethat the massof the vehicle will divide out.

$$\boldsymbol{A = \mu g}$$

Remember that *a* and *g* point in different directions. *g* points straight down, and *a*, points in the direction against the vehicle's motion, since the vehicle is braking. Since *a* applies directly to the motion of the vehicle, it can be inserted directly into a kinematics equation, like this one

$$\boldsymbol{u_f^2 = u^2 + 2ax}$$

Since we are calculating stopping distance, the first step is to solve this equation for distance.

$$\boldsymbol{x_b = \frac{u_f^2 - u^2}{2a}}$$

Next, there are substitutions that can be made. Since the vehicle is coming to a stop, the final velocity is zero. Also, the value that includes friction can be substituted in place of the acceleration. Note that μg is a negative value since it works against the direction of motion, but so is v, so the negatives cancel out.

$$x_b = v^2 \mu g$$

This is the equation for stopping distance. The actual mass of the vehicle isn't needed at all. Notice that braking distance depends on the square of the velocity. If the velocity doubles, the braking distance quadruples! The total stopping distance is the sum of the reaction distance and the braking distance, so we now have equation or the entire stopping distance.

$$x_b = \frac{u^2}{\mu g}$$

In the end, if reaction time, gravity, the coefficient of friction are known (and they often are), the main factor in a vehicle's stopping distance is its velocity.

4.3.2 Factorswhichaffect the brakingdistance:

- **Road co1nditions:** The best road condition, whichresult in the shortest braking distance, is dryasphalt. If the road condition sareslippery, then the braking distancewill be longer.
- **Tyre traction:** If the tyres areworn, they will have poortraction and the braking distance will be longer.
- **The brakes:** The type of brakes and their condition will also affect the braking distance. Most carshave so-called ABS brakes, which shorten the braking distance on mostsurfaces.
- **Weight:** The heavier the load or the more the carweighs, the longer the braking distance will be.
- **Slope:** If the road has an upward slope then the braking distance will be shorter and if it has a downward slope then it will be longer.
- **Speed:** The higher your speed, the longer the braking distance. Braking distance increases quadratically with speed.

➢ Stopping, Reaction & Braking Distance Examples:

The following examples, demonstrate how to find the reaction, braking, and stopping distance.

➢ Reaction Distance Example 1

Driver is driving down the highway at 70 mph. Driver is a professional dodgeball player, and her reaction time is better than average, at .9 seconds.

What is Driver's reaction distance?

Reaction distance is how far theDriver travels before she hits the brakes, so his going at full speed?

v = 70 mph = 31.3 m/s

t = .9 s

$$x_r = (31.3m/s)(.9s)$$

$$xr \approx 28.2m$$

➢ ReactionDistanceExample 2

Driver is driving down the road at 70 mph. Driver is also texting his friends while he is driving. If Driver looks down at his phone for 3 seconds at a time, what is his maximum reaction distance? Driver's reaction time is average, at 1.5 seconds.

Maximum reaction distance in this case refers to a worst case scenario where Driver would have noticed an obstacle in the same instant he looked down at his phone. This means 3 seconds go by before he even looks up and notices, all while the car is going at full speed.

v = 70 mph = 31.3 m/s

t = 4.5 s

$$x_r = (31.3m/s)(4.5s) \approx 140.9m$$

➢ Braking Distance Example:

The *coefficient of friction on a **dry road is 0.8.***

What is the braking distance of a truck that is travelling at **50 mph**?

$$v = 50mph = 22.35m/s$$

μ=0.8
g=9.8m/s2g=9.8m/s2

$$x_b = \frac{(22.35m/s)^2}{(2)(0.8)(9.8m/s^2)}$$

$$x_b \approx 31.9m$$

- **Stopping Distance** Example:

If a vehicle 35 mph,

and driver reaction time is 1.5 seconds.

The coefficient of friction for a wet road is 0.4.

What is the stopping distance?

$$v = 35mph = 13.65m/s$$

μ=0.4

g=9.8m/s2

t=1.5s

Stopping distance is going to be the reaction distance plus the braking distance.

$$x = (15.65m/s)(1.5s) + \frac{(15.65m/s)2}{(2)(0.4)9.8m/s^2}^2$$

$$x = 23.475m/s + 31.24m/s$$
$$\boldsymbol{x \approx 54.7m}$$

4.4 Advantages of Smart Over-speeding breaker:

- **The Smart Over-speeding breaker** is to create safe travel for vehicle drivers, passengers also for pedestrians.
- It helps to control the traffic conditions to a larger extent.

- **The Smart Over-speeding breaker** can be use before ZEBRA CROSS to ensure safe road crossing of pedestrians.
- There are numerous advantages **The Smart Over-speeding breaker** in densely populated areas with schools or hospitals in close proximity.
- **The Smart Over-speeding breaker** can be use before railroad 🚧 crossing to ensure safe rail crossing.

4.5 Disadvantages of Smart Over-speeding breaker:

Although our project has many applications and benefits but there are some limitations of the project as well and the good thing is that these limitations are minor and doesn't affect the efficiency of the system.

- During the action time road will stop by barrier to dominate the over-speeding vehicle this time will be disturbance for vehicles carrying Emergency services like Ambulances, Fire trucks, Police cars.

But we know "**LIFE IS MUCH VALUABLE THEN TIME**".

4.6 Cost Estimation

SI	Particulars	Specification	Qty.	Unit Price (BDT)	Total Price (BDT)
1	Microcontroller	ES8266	1	450	450
2	IR Sensor	TX and RX	2	120	240
3	Micro Servo Motor	SG90	4	160	640
4	Buzzer	5V to 5V	1	20	20
5	LCD Adapter module	12C	1	100	100
6	LED light	5v Red, Green	2	10	20
7	LCD Display	16x2	1	250	500
8	Power Supply	5V-DC/2A	1	250	250
9	Wire	As per need	10ft	20	100

10	Soldering cost				30
	PV Bord		$3ft^2$	200	200
11	Others				100
				Total	**2,650**

Table:4.6.1: CostEstimation

4.7 Applications:

Some of the application areas of the project has been pointed out below:

- The project is mainly used in the **Smart Over-speeding breaker** in metropolitan cities to provide uniform distribution of traffic.
- **Useful in School and Residential Zones** These zones have high children's population, and markets and local shops for residential people make them even more crowded. Therefore, any high speeding motor vehicles cannot be allowed to run freely in these areas for the safety of local people and children**.**
- **Smart Over-speeding breaker** not only tames speeders but also restrict other drivers and riders within the adequate speed limit in densely populated areas.

Chapter V

CONCLUSION

5.1 Discussion:

Design and construction of Smart Over-Speeding Breaker for vehicles was designed in this paper. This design is based on Microcontroller. The timing condition for the vehicle detection system must be set base on distance between these sensor and speed which can be easily changed and modified using microcontroller. In this project, the speed limit is specified with 12km/h. The calculation of vehicle's speed and the time taken by it to cross between the sensors is an approximate value. And the speed sensing from sensors is also delay due to the far distance which is installed from one to other. If more accuracy of the speed and time is required, more number of sensors has to be used. The Smart Over-Speeding Breaker can be further advanced by using GSM module and CCTV camera in the circuit. If any vehicle has crossed the maximum limited speed then this camera will be triggered to take a picture of the vehicle. Employing the over Smart Over-Speeding Breaker offer not only several advantages for traffic but also safety to road users.

5.2 Conclusion

The Smart Over-speeding breaker system has been designed, constructed and tested to ensure validation of its function and operations. In this research, we have succeeded in minimizing the Over-speeding vehicle

accident by Smart Over-speeding breaker system. The system is effective and the cost of production is very low.

The Smart Over-speeding breaker system has been designed, constructed and tested to ensure validation of its function and operations. In this research, we have succeeded in minimizing the **Over-speeding** vehicle accident by **Smart Over-speeding breaker** system. The system is effective and the cost of production is very low.

5.3 Future Modification:

We are thinking about adding many features to our project in the future to get more desirable outcomes. Some of the future scopes are given below:

· We look forward to future improvements to make our **Smart Over-speeding breaker** system design more efficient.

· In the future, we plan to add additional features to the system, such as

- Surveillance motion detector camera monitoring.
- Ultrasonic sensor for vehicles speed counting and.
- Voice broadcasting system to alert on road vehicles.

· In the future, we are planning to launch an IoT system that can be tracked wirelessly by traffic police for any occurrence

References:

Material Type	Works Cited
eBook	[1] (PDF) IoT based Vehicle Speed Monitoring and Controlling System for Reducing Accident occurs on the Road in Bangladesh (researchgate.net)
Journal article	[2] (PDF) IoT based Vehicle Speed Monitoring and Controlling System for Reducing Accident occurs on the Road in Bangladesh (researchgate.net)
e-Journal (from database)	[3] International Journal of Trend in Scientific Research and Development (IJTSRD) Volume: 3 | Issue: 3 | Mar-Apr 2019 13, no. 2, p. 21+, April-June 2005. [http://find.galegroup.com] .[Accessed May 31, 2005].
eJournal (from internet)	[4]Causes of Road Accidents | Transport Department, Government of Jharkhand (jhtransport.gov.in)
Conference paper	[5] IR Sensor : Circuit, Types, Working Principle & Its Applications (watelectronics.com)
Newspaper article	[6] Road accidents kill 9,951 in 2022 (newagebd.net)
Standard	[7] IEEE Criteria for Class IE Electric Systems, IEEE Standard 308, 1969.
Font	Times New Roman

Appendix

COMMAND AND CODS:

```
#include <Servo.h>

Servo myservo;

Servo myservo2;




#include<LiquidCrystal_I2C.h>

LiquidCrystal_I2C lcd(0x27,16,2);



int timer1;

int timer2;



float Time;



int flag1 = 0;

int flag2 = 0;



float distance = 5.0;

float speed;

int ir_s1 = D5;
```

```
int ir_s2 = D6;



int buzzer = D7;

int led=D8;



void setup(){



Serial.begin(9600); //Serial Com for debugging



pinMode(ir_s1, INPUT);

pinMode(ir_s2, INPUT);

pinMode(led, OUTPUT);

pinMode(buzzer, OUTPUT);

myservo.attach(D3);

myservo2.attach(D4);



lcd.begin();

lcd.clear();

lcd.setCursor(0,0);

lcd.print(" WELCOME To Our ");

lcd.setCursor(0,1);

lcd.print("     Project");
```

```
delay(500);

lcd.clear();

}



void loop() {



if(digitalRead (ir_s1) == LOW && flag1==0){timer1 = millis(); flag1=1;}



if(digitalRead (ir_s2) == LOW && flag2==0){timer2 = millis(); flag2=1;}



if (flag1==1 && flag2==1){

if(timer1 > timer2){Time = timer1 - timer2;}

else if(timer2 > timer1){Time = timer2 - timer1;}

Time=Time/1000;//convert millisecond to second

speed=(distance/Time);//v=d/t

speed=speed*3600;//multiply by seconds per hr

speed=speed/1000;//division by meters per Km

}

if(speed==0){

lcd.setCursor(0, 1);

if(flag1==0 && flag2==0)

{
```

```
lcd.print("No car  detected");
myservo.write(0);
myservo2.write(0);
}
else{lcd.print("Searching...    ");}
}
else{
lcd.clear();
lcd.setCursor(0, 0);
lcd.print("Speed:");
lcd.print(speed,1);
lcd.print("Km/Hr  ");
lcd.setCursor(0, 1);

if(speed > 12)

{
lcd.print("  Over Speeding  ");
digitalWrite(buzzer, HIGH);
digitalWrite(led, HIGH);
myservo.write(170);
myservo2.write(90);
```

```
delay(8000);

}

else{lcd.print("  Normal Speed   "); }

delay(500);

digitalWrite(buzzer, LOW);

digitalWrite(led, LOW);

myservo.write(0);

myservo2.write(0);

speed = 0;

flag1 = 0;

flag2 = 0;

}

}
```



We will rise up!

We will shine !!