DESIGN OF ADVANCED BRAKING SYSTEM FOR THE DETECTION OF FOG AND CONTROL SPEED IN AUTOMOBILES

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Abstract: Especially on roads, fog makes it difficult for drivers to see. Fog detection and vehicle speed control with automatic breaking is a cutting-edge technique that keeps the car from colliding with anything during very dense fog. With the use of an image processing technology, this system, which consists of a camera and computer, continuously collects photographs of the area in front of the car in order to identify the existence of fog there. When fog is detected, the computer alerts the controller to its presence by sending signals, and the governor is then turned on. Additionally, whether there is a car in front of us in a fog or when our vehicle is likely to hit an object in the front.

KEYWORDS: Braking System, Sensors.

I. INTRODUCTION:

One of the cutting-edge techniques for preventing car accidents during heavy fog is fog detection and vehicle speed control with automatic braking system. By improving everyone's driving abilities, Smart Motorist is committed to raising the bar for safe driving. More expertise and greater judgment are needed than ever before to drive safely on today's roadways, especially in inclement weather. Here, we'll focus on the difficulty of fog. Spring and autumn are when this hazardous meteorological condition most frequently manifests. As always, drivers should respect the advice of car clubs, authorities, and law enforcement agencies to avoid going too fast or getting too near to other vehicles. Driving with a blindfold on is similar to driving in dense fog. According to statistics, it is the most dangerous driving hazard ever. No matter how necessary the journey is, risking your life is not worth it. Moving far off the road and waiting for the fog to clear is by far the safest course of action if you encounter fog.

The most practical answer may not always be the simplest or safest one, so keep reading to learn the best practices for driving in the fog. A car system called a collision avoidance system is made to stop collisions or lessen their impact. Precrash systems, forward collision warning systems, and collision mitigation systems are other names for it. When a collision is imminent, it uses radar, possibly LIDAR, and a camera (using image recognition). Through a position database, GPS sensors can identify stationary risks like approaching stop signs. Although each automaker has their own automated braking technology, they all rely on some sort of sensor input. These systems employ a variety of technologies, including lasers, radar, and even video data. The presence of any objects in the path of the vehicle is then ascertained using the sensor input.

The technology can then determine if the vehicle's speed is higher than the speed of the item in front of it if an object is detected. When there is a substantial speed difference, the likelihood of a collision increases, and the device is equipped to automatically apply the brakes. When driving through fog, slow down and use your headlights. Consider their vision range and the time it will take us to halt. Watch the speedometer carefully. According to studies, some drivers unwittingly increase their speed when it's foggy.

over time, their speed. Ensure that people can see you. Make sure the high beams aren't accidentally on before turning on your fog lights. Drivers have trouble seeing when high beams shine light up into the fog. Low beams illuminate the ground and make you more visible to other vehicles. Most European automobiles feature a switch that activates auxiliary, super-bright rear fog lamps. a laser radar-based vehicle collision avoidance technology that helps drivers avoid collisions. When compared to microwave radars, the extremely narrow beam width, extremely low angular resolution, and highly directed nature of laser radars offer a number of benefits. This system uses two sets of laser radars to precisely and precisely locate all obstacles and determine their size, location, and direction of motion. This system consists of computer, warning device, optional automated braking device, laser radars with transmitters and receivers, and computer.

To provide information on a system-equipped vehicle's directional change, a steering wheel rotation sensor or a laser gyroscope is used. Fog is frequently present during the winter, especially in the early mornings and late evenings, making it extremely challenging to view objects that are far away. Only extremely close objects

can be seen, even during periods of dense fog. There are many incidents of accidents caused by strong fog since driving in dense fog on roads and in cities is quite difficult.
During winter season, especially during early morning and late evenings, it is common to see fog around and it is very difficult to see objects which are little away. Also during heavy fog, it is only possible to see things when they are very near. Heavy fog in cities and highways causes lot of trouble to the drivers while driving and as a result there are lots of cases of accidents due to heavy fog.

Based on historical evidence, driving in heavy fog conditions is one of the most serious causes that lead to massive highway accidents. It has also caused various cases of mass vehicle collisions which eventually lead to lot of losses of life.

Visible cloud droplets or ice crystals hanging in the atmosphere at or close to the Earth's surface make up fog. Fog is a kind of low-lying cloud that is greatly impacted by the topography, wind, and adjacent bodies of water. Fog has also had an impact on a variety of human endeavors, including transportation, combat, and shipping. By definition, mist causes less visibility impairment than fog, which limits visibility to less than 1 kilometer (0.62 mi). Normal fog occurs when the relative humidity is close to 100%. Either increased air moisture or a decrease in the ambient air temperature causes this. Fog, however, can sometimes fail to form at 100% relative humidity and can occur at lower relative humidity levels. At 100% relative humidity, the air cannot absorb any more moisture; therefore, if more moisture is supplied, the air will become supersaturated.

Fog begins to form when water vapour condenses into tiny liquid water droplets suspended in the air. Six examples of ways that water vapour is added to the air are by wind convergence into areas of upward motion; precipitation or virga falling from above; daytime heating evaporating water from the surface of oceans, water bodies, or wet land; transpiration from plants; cool or dry air moving over warmer water; and lifting air over mountains. Water vapour normally begins to condense on condensation nuclei such as dust, ice, and salt in order to form clouds. Fog, like its elevated cousin stratus, is a stable cloud deck which tends to form when a cool, stable air mass is trapped underneath a warm air mass.Fog commonly produces precipitation in the form of drizzle or very light snow.

Drizzle occurs when the humidity of fog attains 100% and the minute cloud droplets begin to coalesce into larger droplets. This can occur when the fog layer is lifted and cooled sufficiently, or when it is forcibly compressed from above by descending air. Drizzle becomes freezing drizzle when the temperature at the surface drops below the freezing point. The height of the inversion border, which in coastal or oceanic areas also serves as the top of the marine layer where the air mass is warmer and drier, greatly influences the thickness of a fog layer. The weight of the air above it, which is expressed in terms of atmospheric pressure, affects the inversion boundary's altitude the most. When the pressure is high, the marine layer and any possible fogbank will be "squashed," and when the pressure is low, it may spread upward.

OBJECTIVES

• To avoid accidents involving the cars in very foggy conditions.
• To provide a system for vehicle speed control that uses a speed governor to limit vehicle speed when there is fog.
• To create a system that can detect the presence of fog and regulate the vehicle's speed accordingly.

II.LITERATURE SURVEY

A literature review is a text of a scientific publication that summarizes the existing knowledge on a certain topic, including significant discoveries as well as theoretical and methodological contributions. Reviews of the literature are secondary sources that don't present brand-new or unique experimental work. Such reviews, which are most frequently found in academic publications and are distinct from book reviews that might also appear in the same publication, are most frequently connected with academically oriented literature. The foundation of research in almost every academic discipline is a literature review. A peer-reviewed journal article presenting new research may contain a narrow-scope literature review to place the study in the context of the pertinent body of literature and to give the reader context.

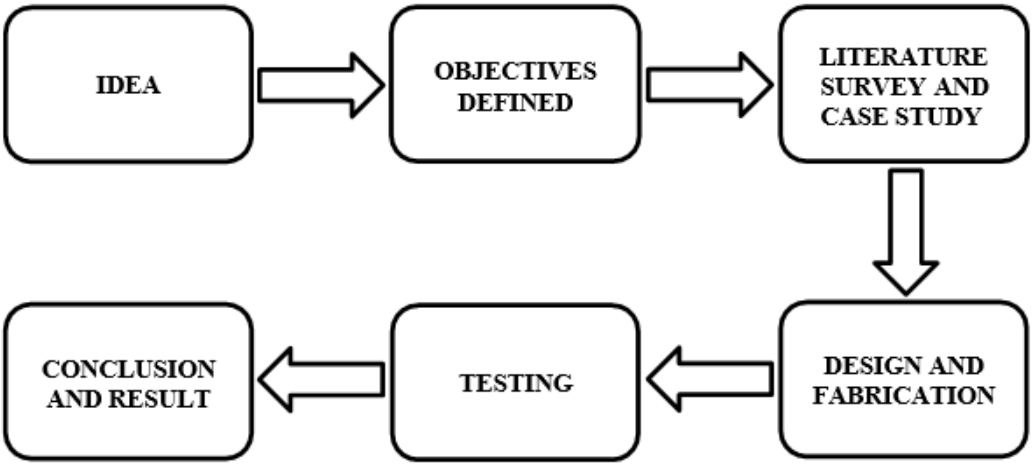
S. Bronte:The performance of real-time fog detection system using an on-board low cost b&w camera, for a driving application, is presented. This system is based on two clues: estimation of the visibility distance, which is calculated from the camera projection equations and the blurring due to the fog. Because of the water particles floating in the air, sky light gets diffuse and, focus on the road zone, which is one of the darkest zones on the image. The apparent effect is that some part of the sky introduces in the road. Also in foggy scenes, the border strength is reduced in the upper part of the image.
Oualid Walid Ben Ali:Based on historical evidence, driving in heavy fog conditions is one of the most serious causes that lead to massive highway accidents. For example, the Abu Dhabi - Dubai Highway (E10) faced two record accidents in recent times. The first accident was in March 2008 in which more than 200 vehicles were involved in a mass collision. The second was in April 2011 and it involved 130 vehicles. These two massive accidents, and several other relatively minor ones, were due to poor visibility conditions caused by dense fog.
Laurent Caraffa:The fog disturbs the proper image processing in many outdoor observation tools. For instance, fog reduces the visibility of obstacles in vehicle driving applications. Usually, the estimation of the amount of fog in the scene image allows to greatly improve the image processing, and thus to better perform the observation task. One possibility is to restore the visibility of the contrasts in the image from the foggy scene image before applying the usual image processing. Several algorithms were proposed in the recent years for defogging. Before to apply the defogging, it is necessary to detect the presence of fog, not to emphasis the contrasts due to noise.

From the aforementioned literature review, it can be inferred that numerous studies on fog detection systems have been conducted, and nearly all of them use fundamental camera and image processing techniques to identify it. The existing technology in cars merely detects the presence of fog and warns the driver to slow down, and none of them are totally successful in preventing accidents during fog because the driver fails to pay attention to the alert. Additionally, numerous types of fog sensors that measure fog intensity have been developed. The speed can therefore be automatically lowered without human intervention using these fog sensors to detect the fog and improve the current system.

III.PROJECT METHOD AND METHODOLOGY:

This system basically consists of a Camera, a microcontroller, a Speed Governor, and a automatic breaking system.
Camera: Here the camera uses the image processing technique to detect the presence of the fog in the atmosphere. Whenever the camera detects the fog the computer connected to the camera sends a digital signal to the controller indicating the presence of fog.
Speed Governor: A speed governor is a device which limits the speed of a vehicle. Here when fog is detected, the controller sends signal to turn on the governor, thereby limiting the maximum speed of the vehicle by decreasing the amount of fuel supply to the engine.
Automatic Braking System: This system consists of an Ultrasonic sensor which on detection of an obstacle sends a signal to the controller and the controller sends signal to actuate the solenoid valve which actuates the pneumatic cylinder connected to the brake arrangement.

GENERAL FLOW CHART



BASIC BLOCK DIAGRAM AND WORKING

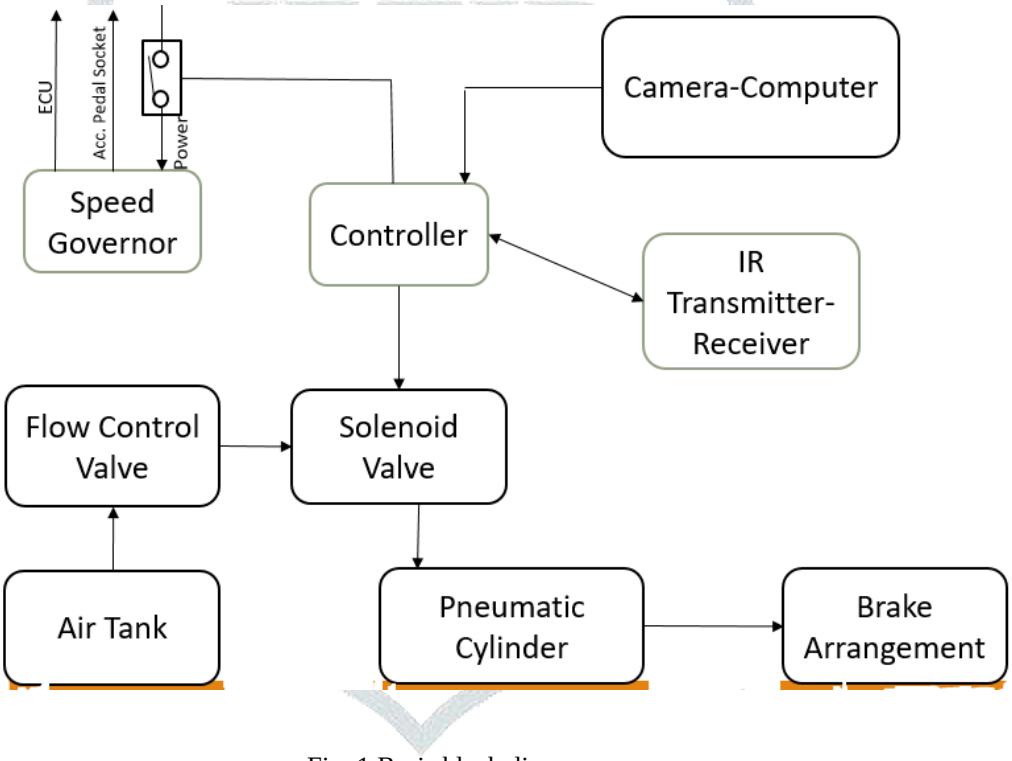


Fig: 1 Basic block diagram

Speed Governor

One of the most popular ones is the Fly by Wire Governor. It is a fully electronic, integrated circuit-based device that obtains electricity from the ignition switch. accepts speed signals through the CAN bus or from a gear box-mounted vehicle speed sensor. The Engine Management System of the vehicle receives control output from the Position Sensors of the Accelerator Paddle to regulate the speed of the vehicle by reading the travel and displacement of the accelerator paddle.

Flow Control Valve

A flow control valve controls a fluid's flow or pressure. Typically, control valves react to signals sent by separate instruments like flow meters or temperature gauges.

Solenoid Valve

An electromechanically operated valve is a solenoid valve. Through a solenoid, an electric current regulates the valve. The most often utilized control components in fluidics are solenoid valves. Their duties include turning off, releasing, dosing, distributing, and mixing fluids. They are utilized in numerous fields. Fast and

secure switching, long service life, high reliability, good medium compatibility of the materials employed, low control power, and compact design are all advantages of solenoids.

Brake

A mechanical brake is a device that prevents motion by sapping the power from a moving system. It is used to slow down or stop a moving vehicle, wheel, or axle, or to prevent its motion. Friction is most frequently utilized to achieve this.

BASIC WORKING

Here, the Speed Governor's wires are connected to the Engine Control Unit, the Accelerator Pedal Socket, and the Power Supply of the Ignition System. The third wire is connected to the Power Supply of the Ignition System using a switch, allowing it to be turned on and off. Therefore, when the car is moving, the camera continually records video and sends it to the computer or processor, where MatLab is used to process the image in order to create a final product.

The controller (Arduino) sends a High signal to the computer whenever fog is detected, and the computer sends a specific signal to the controller (computer) indicating the presence of fog. the governor limits the vehicle's top speed after the electrical switch closes.

IV.COMPONENTS USED:

Arduino Uno:

A microcontroller board called Arduino/Genuino Uno is based on the ATmega328P (datasheet). It has a 16 MHz quartz crystal, 6 analog inputs, 14 digital input/output pins (of which 6 can be used as PWM outputs), a USB port, a power jack, an ICSP header, and a reset button. It comes with everything needed to support the microcontroller; to get started, just plug in a USB cable, an AC-to-DC adapter, or a battery.With your UNO, you can experiment without worrying too much about making a mistake; in the worst case, you can replace the chip for a few dollars and start over.Uno, which translates to "one" in Italian, was chosen to signify the launch of the Arduino Software (IDE) 1.0.

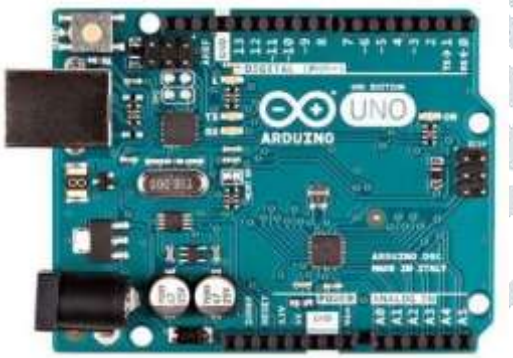


Fig 2: Arduino uno

L293D Motor Driver:

L293D is a dual H-bridge motor driver integrated circuit (IC). Motor drivers act as current amplifiers since they take a low-current control signal and provide a higher-current signal. This higher current signal is used to drive the motors. L293D contains two inbuilt H-bridge driver circuits. In its common mode of operation, two DC motors can be driven simultaneously, both in forward and reverse direction. The motor operations of two motors can be controlled by input logic at pins 2 & 7 and 10 & 15. Input logic 00 or 11 will stop the corresponding motor. Logic 01 and 10 will rotate it in clockwise and anticlockwise directions, respectively

Fig 3: L293D motor driver

L293D Pin:

Two integrated H-bridge driver circuits are present in L293D. Two DC motors can be run concurrently in both forward and reverse directions in its usual mode of operation. The input logic at pins 2 & 7 and 10 & 15 can control the motor operations of two motors. The associated motor will stop if the input logic is 00 or 11. It will rotate counterclockwise for logic 01 and clockwise for logic 10, accordingly.

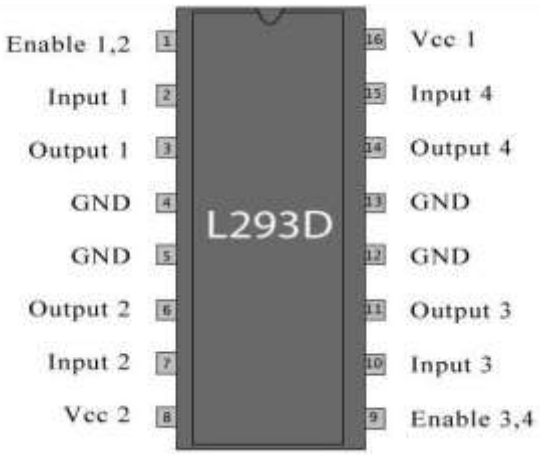


Fig 4: L293D Pin diagram

Pin No	Function	Name
1	Enable pin for Motor 1; active high	Enable 1,2
2	Input 1 for Motor 1	Input 1
3	Output 1 for Motor 1	Output 1
4	Ground (0V)	Ground
5	Ground (0V)	Ground
6	Output 2 for Motor 1	Output 2
7	Input 2 for Motor 1	Input 2
8	Supply voltage for Motors; 9-12V (up to 36V)	Vcc 2
9	Enable pin for Motor 2; active high	Enable 3,4

DC Motor:

Any of a group of rotary electrical machines known as DC motors transform electrical energy from direct current into mechanical energy. The majority of types rely on the magnetic field's forces. For a portion of the motor's current to occasionally shift direction, almost all types of DC motors contain an internal mechanism that is either electromechanical or electronic. Since they could be driven by existing direct-current lighting power distribution networks, DC motors were the first type that was widely employed. A DC motor's speed can be varied across a large range by varying the supply voltage or the amount of current flowing through its field windings. Appliances, toys, and gadgets all employ tiny DC motors.

Fig 5: Image of a pump

Ultrasonic Sensor:

The ultrasonic sensor emits the short and high frequency signal. These propagate in the air at the velocity of sound. If they hit any object, then they reflect back echo signal to the sensor. The ultrasonic sensor consists of a multi vibrator, fixed to the base. The multi vibrator is combination of a resonator and vibrator. The resonator delivers ultrasonic wave generated by the vibration. The ultrasonic sensor actually consists of two parts; the emitter which produces a 40 kHz sound wave and detector detects 40 kHz sound wave and sends electrical signal back to the microcontroller.

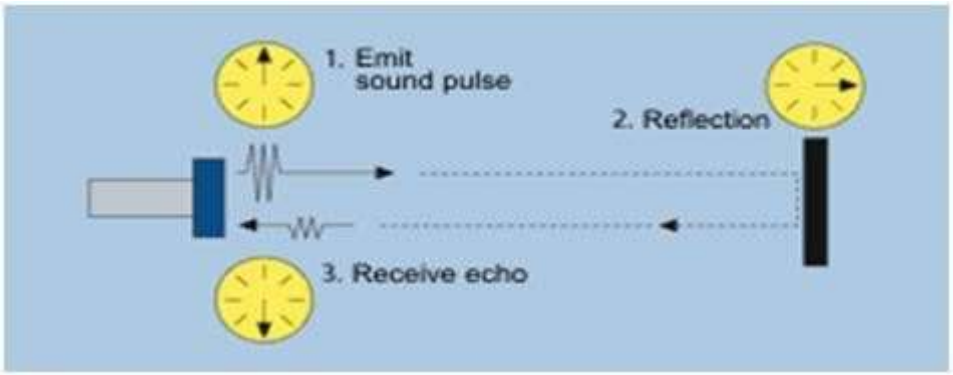


Fig 6: Ultrasonic Working Principle

HC-05 Bluetooth module:

HC-05 module is an easy to use Bluetooth SPP (Serial Port Protocol) module, designed for transparent wireless serial connection setup.The HC-05 Bluetooth Module can be used ina Master or Slave configuration, making it a great solution for wireless communication.This serial port bluetooth module is fully qualified Bluetooth V2.0+EDR (Enhanced Data Rate) 3Mbps Modulation with complete 2.4GHz radio transceiver and baseband.

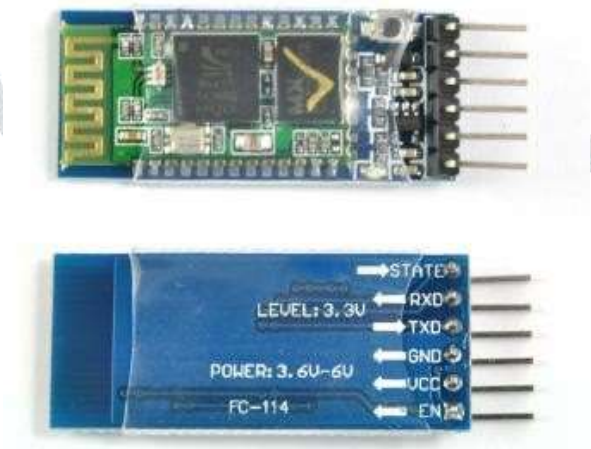


Fig: 7: HC-05 Bluetooth module

V.RESULTS AND DISCUSSION:

CIRCUIT DIAGRAM:

An electric vehicle does not require the use of a speed governor to set a speed restriction. In this case, speed restriction can be accomplished by regulating the electric motor's current. Therefore, a prototype whose circuit is shown above has been designed for this reference. The prototype described above includes an Arduino, two motors, a motor controller, an ultrasonic sensor, a Bluetooth module, a potentiometer, and a battery.

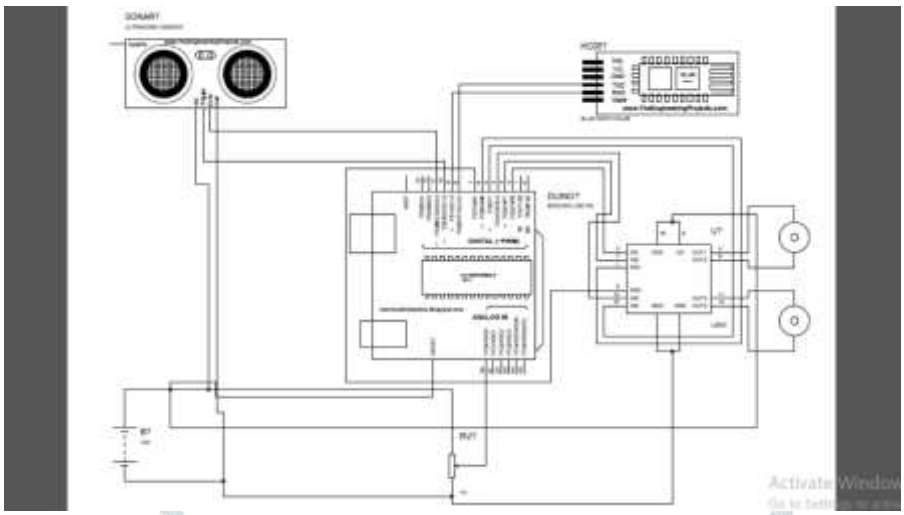


Fig 8: Circuit diagram

Here initially the circuit is switched on and the MatLab program is started and the camera starts capturing images and is sent to the computer and these images are being processed in MatLab program where these images are continuously compared with the pre- trained sets of data. The MatLab checks the presence of fog in these images and if the fog is being detected the program sends a signal to the Arduino indicating the presence of fog. When fog is detected the current to the motor is limited to a pre-defined value in the Arduino program. Hence as a result the motors doesn't increase its speed above that particular limit. Simultaneously, the ultra-sonic sensor turns on and starts detecting any obstacle in front and the distance is sent to the Arduino program. If the distance between the vehicle and the obstacle is very less, the Arduino program stops the current flow to the motor and the motor stops.

VI . CONCLUSION:

The fog detection and vehicle speed control with automatic braking system is aninnovative project that can detect the presence of fog in the atmosphere and can correspondingly limit the peak speed of the vehicle to reduce the number of accidents caused in the cities due to heavy foggy conditions.

This system can also detect the presence of any vehicle ahead which is not visible bythe human eye during the presence of heavy fog. This system also prevents the vehicle from colliding with any obstacle in front during heavy foggy conditions by automatically applying brakes causing the vehicle to stop whenever the vehicle is about to collide with the obstacle.

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