Fabrication of brake overrides system with sleep detector

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Abstract. When compared with the olden day's life span of a human is decreased. The death rate due to accidents is extremely increased because of the rise in the number of vehicles. This automatic braking system will positively lessen the number of accidents due to brake failures. An Ultrasonic sensor is positioned in front of the vehicle and that system consists of an emitter and a receiver. The signal to the ultrasonic sensor module is based upon the distance of the object it actuates the motor shut down or brakes. Concerning the distance of the object from the vehicle the brakes are applied at long-distance input and the motor is shut down at shorter range input. Brakes are actuated by using the 12V wiper motor. The movement of the vehicle is powered by a 24V DC type box motor which is directly connected to the wheels by a chain-driven mechanism. In addition to the smart stop technology, an IR sensor also detects the movement of the eye and switches off the motor if no movement is found for 3 seconds or more. Even in the case of Autonomous vehicles, this will prevent accidents at the time of unintentional inputs.

1. Introduction
Accidents are the main contributors to the loss of life at present. Generally, accidents are caused due to carelessness and ignorance which not only takes away the life of the driver but also the people who are traveling along with him, automobile accidents are very common in the modern world. In many countries various methods have been employed such as constructing Krebs edgings, small humps on the sideways of the road to warn the driver if he crosses the hazardous zone which leads to the accident. This prototype will awaken the driver from the drowsy state without the need to stop the engine of the car and without any need to install external objects on the roadways. This system is also cost-effective [1-9]. This system will be more advantageous for heavy vehicles which are much prone to accidents due to the drowsy state of the driver since it is very much cheap in cost and the accuracy of the system varies with the amount of investment on the system Autonomous vehicle (AV) technique offers great ability to substantially alter transportation. Equipping automobiles and light commercial vehicles with this technology are anticipated to minimize accidents, low power consumption, and low emissions, thus lowering congestion costs [10-12]. This technology is developed utilizing the National Highway Traffic Safety Administration's (NHTSA) five-part continuum, with distinct technological assistances achieved at various degrees of automation:
Level 0: The human driver has complete control over all aspects of the vehicle.
Level 1: A single function has been mechanized.
Level 2: Multiple tasks are automated at the same time (e.g., acceleration and steering), but constant attention of the driver is needed.
Level 3: The driving operations are sufficiently autonomous that the driver may engage in other tasks safely.
Level 4: The automobile can drive itself without the assistance of a human driver. Careful planning will be required to maximize the societal benefits of this technology while limiting the drawbacks. However, policymakers are just now beginning to consider the difficulties and opportunities that new technology presents.

2. Materials & methodology

2.1 Chassis
A chassis is a skeleton structure on which mechanical components such as wheel assemblies, engine, tyres, motor, brakes, and so on are placed. The chassis is the most important component of a car. It is the last and most important component that makes the vehicle more stable and strength in various circumstances. The backbone of any automobile is the supporting structure on which the engine body and axle assemblies are joined. Tie bars are fasteners that link various automotive sections and are necessary parts of automobile frames.

2.2 DC Motor
Electric motors, at their most basic, transform electrical energy into mechanical energy. This is done by the interplay of two magnetic fields, one of which is fixed and the other of which is coupled to a moving component. Although there are numerous types of electric motors, most BEAM bots use DC motors in some form or another. DC motors have a high torque capability, are easy to miniaturise, and may be "throttled" by varying their supply voltage. DC motors are not only the smallest but also the most traditional form of electric motor. In the early 1800s, the fundamental concepts of electromagnetic induction were discovered.

A direct current (DC) motor is an electric motor that is mechanically commutated and driven by direct current. The stator is current by default since it is immobile in space. The commutator causes the current in the rotor to become stationary in space. This is how the relative angle between the stator and the rotor’s magnetic fluxes is kept close to 90 degrees, resulting in the maximum torque. The intrinsic speed/torque characteristics of armature winding connections and field differ. The speed of a direct current motor may be adjusted by changing the voltage applied to the field current or the armature. Speed control was made possible by the use of variable resistance in the field circuit or armature. Power electronics systems known as DC drives are commonly used to control advanced DC motors.

2.3 Wiper Motor
The wiper motor is also the same as the above-mentioned DC motor, this is used in the windshield wiping application, since the name.

2.4 Wheels and Brakes
Here in this prototype, a small-sized tire has been used. A shaft in which a sprocket is connected gives the motion from the motor. The output of the motor is connected to the sprocket with a chain drive. On the left rear wheel, a brake drum is fixed. Here this is an expanding drum brake that is connected to the wiper motor in terms of a cable. A drum brake is a form of brake that operates on friction made by a group of pads or shoes that forces outward across a rotating cylindrical structure known as a brake drum. Drum brakes are often used to describe brakes in which the shoes are pressed on the inner side of the drum. A clutch brake occurs when shoes press against the outside of the drum. A pinch drum brake is a form of brake in which the drum is pinched among both shoes, similar to a standard disc
brake, however these brakes are very uncommon. A related type is a band brake, which wraps an elastic belt or "band" around the outside of a drum.

2.5 Ultrasonic Sensor
An ultrasonic sensor is an electronic component that determines the distance of two elements by producing ultrasonic sound waves. It changes the reflected sound into an electrical signal. Compared to audible sound, ultrasonic are travels quickly.

2.6 HC-SR04 Ultrasonic sensor
When the ultrasonic transmitter was discharged, it created an ultrasonic wave in one direction and commenced timing. The ultrasonic wave spreads through the air and returns instantly if it encounters any barriers along the route. When the ultrasonic detector received the reflected sound wave, it would finally cease time. The ultrasonic distance measurement principle relied on the air spreading velocity, monitoring the time from start to reflection when it contacted an obstruction and then calculating the distance between the obstacle and the transmitter based on velocity and time. As a result, the ultrasonic distance measuring principle is similar to the radar.

Description: The HC-SR04 ultrasonic sensor, works like a bat, utilizes sonar to control objects’ distance. Its activity is not influenced by sunshine or dark materials. It has a receiver module and an ultrasonic transmitter.
VCC: +5VDC p
Trig: Trigger (INPUT)
Echo: Echo (OUTPUT)
GND: GND

2.7. IR Sensor module
An infrared sensor is a type of electrical gadget that detects certain characteristics of its surroundings. An infrared sensor can detect motion as well as the heat of an item. These sensors measure just infrared radiation instead of emitting it, which is known as a passive IR sensor.

2.8 IR Module
Infrared sensors are the most often used form of sensor by robots. Understanding how they behave may help answer many of your queries and enough to solve the bulk of problem statements for numerous robotics events around various cities of India. If you have an efficient control knowledge of Infra-red sensors, you can easily tackle all of these problematic statements and exercise granular control over your robot's performance, whether it is a wall follower, a standard white/black line follower, obstacle avoidance, a more sophisticated line follower like micro mouse, red line follower, etc.

2.9 Relay
We realize that most growing industrial application systems use relays to function properly. Relays are basic switches that may be operated both mechanically and electrically. Relays include a series of contacts as well as an electromagnet. The electromagnet is used to power the switching mechanism. There are additional operating principles for its operation. However, they differ depending on their use. Relays are used in the majority of electronics.

When just a low-power signal can be used to run a circuit, a relay is required. It is also used when just one signal may control a section of the circuits. With the introduction of telephones, the usage of relays began. They were critical in the switching of calls in telephone exchanges. They were also useful for long-distance communication. They were employed to route a signal from one source to a different destination. They were also utilized to conduct Boolean and other logical processes once computers were invented.
2.10 PIC Microcontroller
The Peripheral Interface Microcontroller (PIC) was created by General Instruments Microcontrollers in 1993. It is controlled by software and is capable of doing a variety of tasks as well as running a production line. PIC microcontrollers are being used in a variety of new applications, such as audio devices, smart mobile phones, and advanced medical equipment. PICs are available in a variety of sizes, from PIC16F84 to PIC16C84. These PICs are cost-effective flash microcontrollers.

2.11 Development Board
A single-board microcontroller is constructed on a single PCB. This board has all of the hardware required for a practical microprocessor control job, including RAM, I/O circuits, a stored program memory, clock generator, and any necessary support ICs. The goal is for a developer to be able to utilize the board right away, without having to invest time and effort in developing controller hardware. Single-board embedded systems have long been prominent in education due to their low cost and notably low initial cost for development. They're also a popular way for developers to get more hands-on time with a new processor family.

3. Working principle of brake override system
The primary objective of the system consists of two inputs in the form of distances. With the help of the Ultrasonic sensor, the primary concept is involved. Here it the detection of the distance of the object is the primary function. It is very well discussed the working principle of the ultrasonic sensor contains emission and transmission of rays which eventually calculates the distance of the object with a basic formula. Now it is important to give or set the values in which the detection is going to take place. Now with this concept of a brake override system, we require two actions with respect to the detection of distance. This also involves the motion and input to two different motors such as the dc motor and the wiper motor. The two actions to be performed in terms of the input areas

1. The brakes are applied through the wiper motor when the object is detected in the long-distance range.
2. The main DC motor is shut down when the object is detected in the short-range.

Long-range and short-range distance are some of the inputs to be set through the development board with the help of the LED interfaced display. The maximum range this sensor is capable of sensing is a maximum of 90 cm. Since this is a prototype, we have chosen such a range. Real-time sensors are capable of sensing up to various meters of range.

On discussing the working principle of each component we know how to process them. Now it is important to set the sensor in such a way that it allows the braking and shut down of the motor according to the distance. Thus it is important to program the Interface. Since this is a microcontroller with 40 pins, we also have to designate the pins following output pins that are connected to the motors, the input pins which is connected to the sensors and the other interconnected pins. Since all these connections are done with the help of simple wirings and solders, now once the connection is over it is important to set the parameters to the microcontroller. And also all these inputs to sensors, output to motors and the possible relay circuits must be accessed through programing code work to enable them. Such code work of programming is done through a software named MP Lab with the help of PIC.

4. Calculations
4.1 Brake System
Drum brakes have long been featured in automobiles and buses. Its dependability and high-efficiency braking capabilities have contributed to its widespread use now-a-days. Two semi-circular brake pads are fitted onto the inner wheel ring in a drum brake, which uses the leverage theory notion to slow or stop the car through friction between the wheels and pads. Large-tonnage vehicles frequently utilise drum brakes. The working principle is as follows: when the driver applies pressure to the brakes with two semi-circular brake pads on the inner side of the wheels, hydraulic piston rods connected to the brake pad bring the motionless pads into contact with fast-moving wheels, creating a massive amount
of friction. As a result, the speed of rotation of the wheels is lowered or the vehicle is stopped. Its advantages include excessive braking force and the automated tightening-braking feature. Parts preparation and assembly are basic and straightforward. Another advantage is the low cost of manufacture. The essential calculation and the major need are with respect to the braking system, according to this brake override system. The major calculations are in terms of the proposed braking effect.

4.2 Stopping Distance Formula
An automobile does not come to a complete halt when a driver applies the brakes. The stopping distance is the distance travelled by a vehicle before it comes to a complete stop. The vehicle's speed and the coefficient of friction between the road and the wheels define it. This equation ignores the effects of brake pumping and anti-lock brakes. Stopping distance is measured in metres in the SI system. Because speed is neither regulated nor determined in this system, we prefer to assume the speed factor.

d is the stopping distance in m, v is the velocity of the car (m/s), μ is the coefficient of friction (unit less), g is the acceleration due to gravity (9.80 m/s²)

Let us assume the following values for the calculation purpose.
V= 50.0 km/h; μ = 0.60; v = 13.89 m/s
The stopping distance can be calculated using the formula, d = 16.40 m
For an another example of v = 100.0 km/h; μ = 0.15; v = 27.78 m/s

By applying all the values found in the formula the stopping distance obtained is d = 262.4 m
Since this value is highly dependent on the coefficient of friction. Let us consider constant friction for a certain value. Such calculations are tabulated as such Braking distance is one of the important factors. It refers to the distance between when the brakes are engaged and when the vehicle comes to a complete stop.
Braking Distance, d= v²/2μg
μ=coefficient friction of road = 0.8
g (acceleration due to gravity) = 9.8m/s
Calculations:

For the velocities 60km/hour, 50km/hour, 40 km/hour, 30 km/hour, 5 km/hour, the braking distance are 17.69m, 12.28m, 7.86m, 4.42m, and 0.2m respectively.

5. Conclusion
In this project, we are implementing the safeness in vehicles by using an ultrasonic sensor and IR sensor by an electrical circuit. Here we using a 24V motor for running the wheel and a 12V motor wiper motor for the braking system with the help of an electrical circuit board and the board is connected with lead batteries. The ultrasonic sensor and IR sensor are connected to another end of the board. When the ultrasonic sensor detects the obstacle from a distance of 20 cm then the 12V wiper motor function is started to brake to reduce the speed and when it detects 10 cm, it functions to stop the engine. In an IR sensor when the sensor detects the obstacle for more than three seconds, it will automatically shut down the engine. Thus, we implement to improve the safeness in a vehicle using ultrasonic sensor and IR sensor by an external circuit.

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