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PERFORMANCE STUDY ON IR OBSTACLE SENSOR FOR AUTOMOBILE BRAKING SYSTEM

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Abstract - *Most of the accidents in four wheeled vehicles occur because of failure of braking systems. Manual method of applying brakes is always is dangerous as it leads to accidents. Unconsciousness of driver, failure in the linkages of braking systems, road conditions, uncontrollable speed of the vehicle, manual operation of braking systems are the reasons of accidents. It is necessary to control brakes automatically through electronics devices to minimize the accident problems. In this project we can propose methodology for automatic control of braking system to avoid accidents. In this technology we used ARDUINO, RELAYS, IR transmitter and IR receiver for effective function of braking control systems. This complete system can be fitted on to dashboard of a vehicle and effectively used for automatic control of braking system.*

Key Words: IR sensor, Arduino, ABS

1. INTRODUCTION

Road accidents are a common place in today's scenario. Accident prevention has been one of the leading area of research. In indian scenario normally vehicles are equipped with ABS (ANTI-LOCK BRAKING SYSTEM),traction control , brake assist etc. for driver's safety. This paper focuses on a system known as 'AUTOMOBILE BRAKING SYSTEM'(ABS) which employ several sensors to respond when emergency condition occur. The system includes an infrared wave emitter provided on the front portion of the car. An infrared receiver is also fitted to the signal. The reflected wave gives the distance between the obstacle and the vehicles. then a micro controller and arduino is used to detect the pulses and apply breaks to the vehicles.

Today's world requires speed on each and every engineers field are confronted to the challenges of efficient systems. ABS car provides the glimpse into the future of automotive safety.ABS system we can prevent more accidents and save more live. The primary objective of this paper is to develop a safety car braking system using IR sensor and to design a vehicle with less human attention to the driving. The paper is organised as follows: section 3 factors considered, section 4 describes various components used in this system, section 6 working of the ABS and last section 8 concludes the paper.

2. LITERARURE REVIEW

2.1 [1]G.V. Sairam,[2] B. Suresh, [3]CH. Sai Hemanth, [4]K. Krishna sai, IJETAE

The author proposed following:

The existing approaches in preventing accidents are:

1. Honda's idea of ABS which helps the rider get hassle free braking experience in muddy and watery surfaces by applying a distributed braking and pre vents skidding and wheel locking.[1].

2. Volvo launched XC60 SUV which was equipped with laser assisted braking. This capable to sense a collision up to 50 mps and apply brakes automatically[2]. Author proposed that when the driver comes to know that the vehicle is going to collide, they become nervous and they don't apply the brakes or apply brakes with insufficient braking force than that of required by the vehicle to slow down and come to rest and hence get collide with the obstacle. Majority of accident occurs this way. ABS eliminates such types of problems like semi-applied brakes, reaction time, stopping distance and distance between two vehicles to avoid accidents.

Drawbacks in the existing approaches:

1. ABS can only help if the rider applies it in right time manually and maintains the distance calculations. ABS has it own braking distance.

2. Moreover most of the commuter bikes in India don't have ABS because it's very expensive.[3]

3. Volvo's laser assisted braking could not work effectively in rainfall and snowfall season and laser is easily affected by atmospheric conditions.[4]

2.2 [1]C Grover, [2]I Knight, [3]F Okoro, [4]I Simmons, [5]G Couper, [6]P Massie and [7]B Smith, "Automated Emergency Breaking Systems:

Technical requirements cost and benefits", Published Project Report. 2008 The author proposed following –

The literature claims that the Honda CMBS is effective at detecting, large vehicles, cars, larger motorcycle in the center

of the lane, parked vehicles, and road side furniture. However, there are some limitation as described followed:

1. The sensor system is unable to accurately identify relative speeds less than 15 KM/hr[1]
2. Pedestrians cannot be detected.[2]
3. Smaller motorcycles and two wheeler traveling in
4. the edge of the road, diagonally parked vehicles and small objects such as fallen rock may not detected.[3]
5. The system will not function when the distance between vehicles is very short or when the conflict is very sudden such as at junctions.[4]
6. The system may not function in the adverse weather conditions.[5]
7. "AUDI Q7" in 2006 introduced BRAKING GUARD radar assisted forward collision warning system[6]
8. FIAT and MAZDA's autonomous emergency braking system is a urban low speed crash avoidance system.[7]

2.3 Minoru tamura, Hideaki tnoue, Takayuki watanable and Nuoki maruko, Nissan motor co.,Ltd "Research on Brake assist System with a preview Function."

The author proposed following-

Nissan's intelligent brake assists uses laser radar sensors to detect the distance to proceeding vehicles and the relative velocity when there is risk of collision with the vehicle in front and the driver must take avoidance action immediately the system sounds a warning to prompt action by the driver to help avoid a rare end collision. When a rare end collision cannot be avoided by the drivers action the system activates the brake to decelerate the vehicle at maximum deceleration of 0.5 g, thereby helping to reduce occupant injuries resulting from the collision.

3. FACTORS CONSIDERED

Factors considered in designing the system are:

1. Braking distance
2. Distance of obstacle in front.

3.1 Braking distance:

The braking distance is the main factor considered in this system. Braking system for a particular speed is the distance between the point of application of the brakes and the point at which the vehicle comes to a complete stop from the present speed, it is calculated by using following formula.

Braking distance= $v^2/2\mu g$ (meter)

Where,

V=velocity of the vehicle (m/s)

μ=coefficient of friction of road=0.8 (in all Indian roads)

g=acceleration due to gravity=9.81 (m/s^2)

In this formula the condition of brakes and the road conditions are not considered for coefficient of fraction μ.

The table showing the braking distance:

Velocity (km/hr)	Braking distance(m)
60	17.69
50	12.28
40	7.86
30	4.42

3.2 Distance of obstacle in front:

The distance of any obstacle ,a parked or a moving vehicle or a road block is sensed using an infrared sensor(IR) and it is fed to microcontroller.

4. BASIC COMPONENTS

4.1 IR SENSOR:

An infrared sensor is a device that emits and/or receives infrared waves in the form of heat. while most infrared sensors transmit and receive infrared waves, some can only receive them. These types of infrared sensors are known as PASSIVE INFRARED SENSORS (IR) or motion detectors.

Its is also used to for data communication for monitoring and control applications.

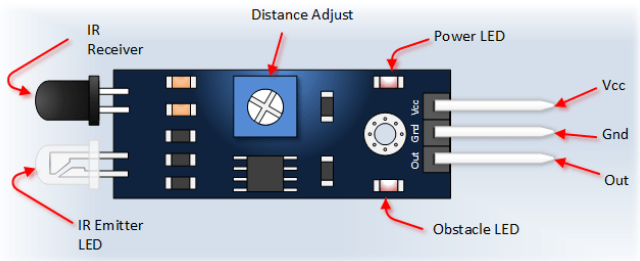


Figure-1 IR SENSOR

IR DETECTION CIRCUIT

Components Used:

- Transmitter and Receiver IR sensors
- LED and secondary power supply (for whole of the ckt.)
- Two 22 ohm and two I kilo ohm resistors
- Relay

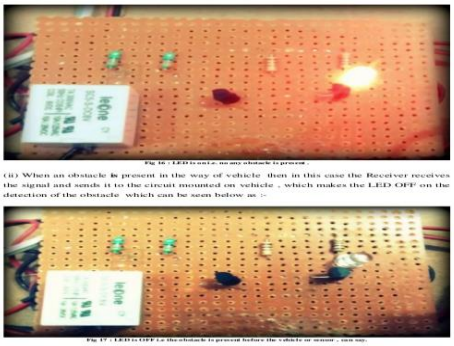
ALARM CIRCUIT

Components Used:-

- An alarm
- A relay

MAIN POWER SUPPLY

- 2 Batteries of 12V and 7.5A each
- Used to provide supply for all the circuits (extent IR circuit) and motors.
- When any obstacle is not present in the range of IR sensor.
  LED is OFF
- When any obstacle is present in the range of IR sensor.
  LED is ON



SECONDARY POWER SUPPLY

- 9V battery
- Only for the LED and IR circuit activation

MECHANICAL PART:

- Steel Frame
- Steel board used for chesses
- Sprocket
- Chain drive
- 4 simple wheels

4.2 CONTROL UNIT

The control unit(CU) is a component of a computer's central processing unit(CPU) that directs the operation of the processor. It tells the computer's memory, arithmetic/logic unit and input and output devices how to respond to a program instruction's. In this project we have used Arduino Uno as a control unit. Arduino Uno is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller.

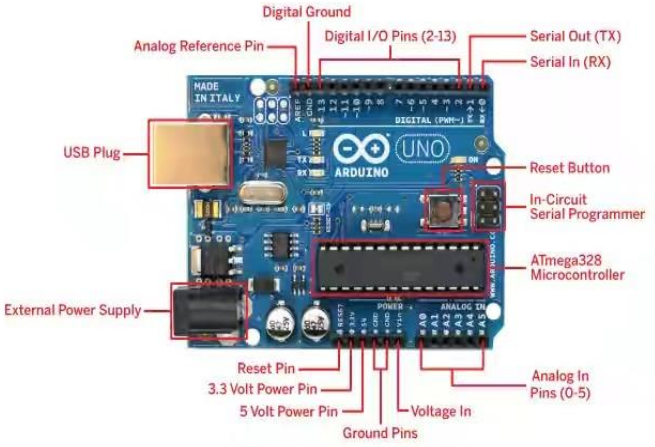


Figure-2 Arduino UNO

4.3 WIPER MOTOR

In this project we have used wiper motor to move the device.

Figure-3 Wiper motor

4.4. MOTORDRIVER:

A motor driver is a little current amplifier; the function of motor drivers is to take a low-current control signal and then turn it into a higher-current signal that can drive a motor. In this project we have used L293D motor driver circuit. L293D is a typical Motor driver or Motor Driver IC which allows DC motor to drive on either direction.

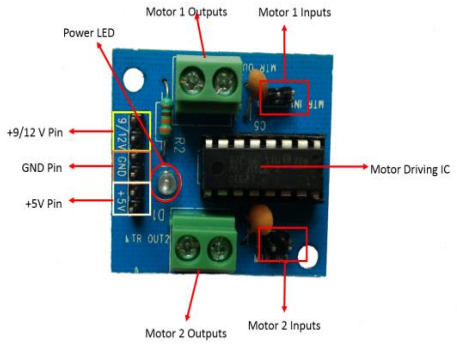
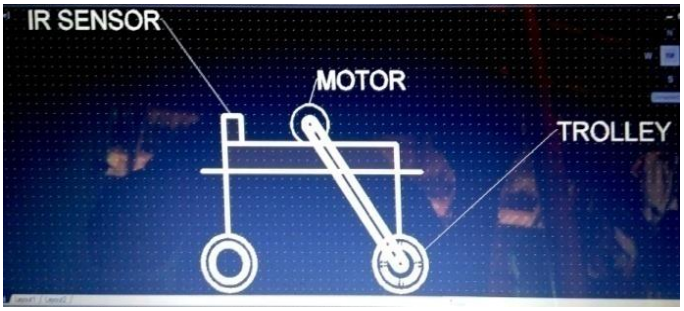


Figure-4 Motor driver

4.5 FIRMWARE USED: - ARDUINO SOFTWARE

We are using Arduino software to make the program which will run the system of Intelligent Braking assembly.

5. ASSEMBLY OF THE COMPONENTS



The arrangement is shown in schematic diagram of proposed intelligent braking system. We have fabricated prototype of 'Intelligence Braking Material'. In this prototype there are two basic units.

i. Mechanical unit

ii. Electronic unit.

SPECIFICATION

These machines are small enough to operate with PMDC (Permanent Magnet Direct Current) motor.

Function: Material handling trolley.

Specification:

i. Type: Mechanical mechanism

ii. Power:- Motor operated.

iii. Man power requirement:- No Requirement

iv. Overall dimensions (Tentative): 530 x 650 x 335 mm

v. General Information: The machine consists of a structure for holding and IR sensors for start and stops the motor.

6. WORKING

Our projects working on following two conditions or cases:

CASE1:

If there is no obstacle in front of vehicle then the sensor output remains unchanged that means LOW and so that motor drives the vehicle as its output is HIGH.

CASE2:

If there is obstacle detects by the IR sensor in front of our vehicle then sensor outputs the value HIGH and so that motor stops running as its value will be LOW and our vehicle will be stops.

Working Flowchart:

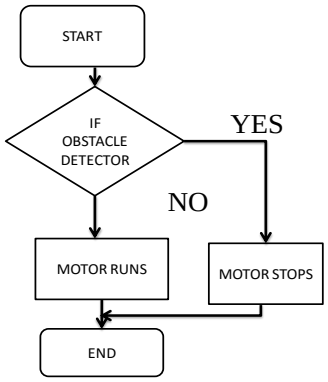


Figure-5 Flow chart of the system

7. RESULT

When the distance between the vehicle and the object (or vehicle) is decreasing continuously with a rapid rate, the active brake assist system comes into play. Almost 20-40% of braking energy is utilised in automatic braking action with proper amount of brake boosting, during this the audio and video warning catches the driver's attention to respond towards braking. Still if the diver doesn't respond and the distance is in decreasing manner then complete braking energy is utilised automatically to stop the vehicle gradually and safely. This reduces the overall braking distance. It will negotiate many hazardous accidents which harshly harm human life, vehicle and environment resources.

8. CONCLUSIONS

Proposed arrangement used for automobile braking system has a lot of potential applications especially in developed countries where research on smart vehicle and intelligent highway are receiving ample attention. We can use this system in the four wheeler vehicle and can reduce the number of accidents taking place on road.

The system when integrated with other subsystems like automatic traction control system, intelligent throttle system, and auto cruise system etc., will result in smart vehicle maneuver. In modern industries also for material handling trolley and machinery it requires and it is industries need.

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