PRE-CRASH BRAKING SYSTEM

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Abstract— The World's population is increasing day by day, due to this the usage of automobiles is also increasing. As Automobiles increasing the death rate due to road accidents is also rising. Thousands of people are losing their lives due to major reason like brake failure, drunk and drive, late applying of brakes etc., to overcome from this risks, advanced ultrasonic braking system is introduced. It is an automatic braking system consists of Ultrasonic sensor, Arduino UNOR3 , DC gear motor IR sensor and LCD. This is an effective mechatronic system. In this system the ultrasonic sensor provided on the front portion of the vehicle to produce the ultrasonic pulse. This detected pulse is taken by the microcontroller to, control the speed of the vehicle. Ultrasonic sensor will measure objects in front of the vehicle. IR sensor is used for speed measurement. By making a combination of speed & nearby objects, it will decide time to apply breaks for stop the rotating of gear motor at the time display the command in LCD.

Indexed Terms- Ultrasonic sensor, Arduino, IR sensor, LCD and Relay, Gear motor.

INTRODUCTION

The main objective of this paper to design speed control & automatic braking system in the vehicle. The speed control & automatic braking system will involve the electronic circuits such as sensor, relay, control system, microcontroller, signal transmitter and signal receiver, LCD. In this project we will apply the skill and knowledge in designing electronic circuit for the speed control & automatic braking system. We will use the software Proteus to design the circuit. The concept in designing the speed control & automatic braking system is strategic control of an accident being vehicles. We will use ultrasonic sensor for detection the obstacle & IR sensor for Speed measure to automatic braking system purpose. The system will be design to prevent the driver and passenger inside the vehicle from accident. Automation is fundamentally changing the role of people in many systems, and driving is no exception. An increasing number of vehicles are being equipped with speed control system. This system uses ultrasonic sensor to detect the obstacle or moving vehicle ahead and warns to driver about collision risk. The ultrasonic sensor is fitted in front of vehicle. This ultrasonic sensor transmits the signal continuously towards the obstacle and when obstacle is detected this signal is reflected from obstacle and receiver received this echo-signal from obstacle. The receiver sends this signal to the microcontroller for the control system purpose. The controller controls the speed of motor using IR sensor as per the distance and reduces the speed of Motor and warns to the driver n LCD to reduce the speed. When diver or user is was fail to reduce the speed of vehicle then by controller automatically reduce the speed and when the distance between the vehicle & obstacle is minimum, means if accidents like situation is detected by IR sensor then the controller take total charge to control the speed of vehicle from driver or user and microcontroller make its own decision to activate the automatic braking system and our vehicle stop automatically. Means in simple language it gives the signal to driver to reduce the speed & about the danger.

LITERATURE SURVEY

[1]. I. Fletcher et al proposed "Automatic braking system control

"IEEE TRANSACTIONS ON INFORMATION FORENSICS AND SECURITY – 2018.

In this method based on the MATLAB simulation environment is described, which is then implemented with a 'Bang-Bang' controller strategy to provide a benchmark for the evaluation of altemative control strategies. The main alternatives investigated were centred around PI and Fuzzy Logic based systems which take advantage of information received from the dihbuted sensors. One of the main aims was to improve the driver comfort when the ABS is activated whilst maintaining optimal system performance in

terms of minimising the vehicle stopping distance under emergency conditions

2]. Chandan Kumar et al proposed "Hybrid braking: Future vehicle technology"IEEE TRANSACTIONS ON INFORMATION FORENSICS AND SECURITY – 2018.

The Existing system a new braking system known as hybrid braking system. This is the innovation in the research work which will overcome major disadvantages of conventional braking system. Hybrid braking system consists of various parts which is listed below electromechanical actuators [12], wireless system [13], electric motor [14], rack and pinion [15], brake calipers and brake rotor.. It will be a promising vehicular braking control scheme and will offer enhanced safety and comfort.

[3]. Varanasi Venkata et al proposed "Intelligent Braking System"IEEE TRANSACTIONS ON INFORMATION FORENSICS AND SECURITY – 2019.

The system is, when the collision becomes is about to happen, the system should act independently without any human's contribution (by braking or steering or both) . If the lanes are clear and if the vehicle speed is high, then the collision can be avoided by steering whereas in the case of low vehicle speed collision can be avoided by applying the brake.

[4]. Md. Symum Rezwan et al proposed "Vehicle Breaking Support System

"IEEE TRANSACTIONS ON INFORMATION FORENSICS AND SECURITY – 2020.

In this project is, cars can automatically brake due to obstacles when the sensor senses any. The automatic braking system is an assistant system for vehicles that prevents or reduces any kind of causalities from an accident or collision with another vehicle, person or obstacles.

[5]. Ping-Fan Jin et al proposed "Design of unmanned vehicle advanced braking system using smart motor "IEEE
TRANSACTIONS ON INFORMATION FORENSICS AND SECURITY – 2021.

In this project analyze the longitudinal direction of the vehicle control when the obstacle or target vehicle ahead of the vehicle. Several manufacturers have developed technologies which can help car driver to avoid these kinds of accidents or, at least, to reduce their severity.

PROPOSED SYSTEM:

The idea of a pre-crash braking has recently become an important subject in Travel appliances. Security is a top priority for everyone nowadays. The speed control & automatic braking system will involve the electronic circuits such as sensor, relay, control system, microcontroller, signal transmitter and signal receiver, LCD. The proposed Pre-crash braking application to monitor the status of the vehicle, manage the speed, and increase security in a travel time. Automation is fundamentally changing the role of people in many systems, and driving is no exception. An increasing number of vehicles are being equipped with speed control system. This system uses ultrasonic sensor to detect the obstacle or moving vehicle ahead and warns to driver about collision risk. The ultrasonic sensor is fitted in front of vehicle. This ultrasonic sensor transmits the signal continuously towards the obstacle and when obstacle is detected this signal is reflected from obstacle and receiver received this echo-signal from obstacle. The receiver sends this signal to the microcontroller for the control system purpose. The controller controls the speed of motor using IR sensor as per the distance and reduces the speed of Motor and warns to the driver n LCD to reduce the speed.

HARDWARE REQUIREMENTS:

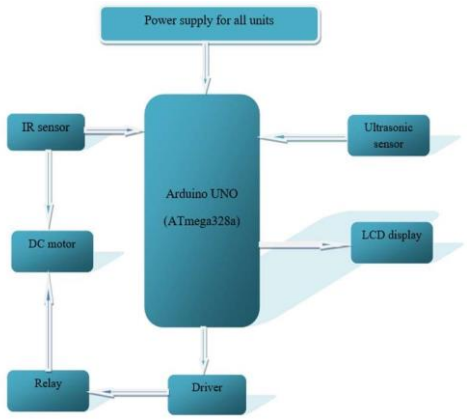
- Arduino(ATmega328a)
- Ultrasonic sensor
- IR sensor

- Driver
- Relay
- LCD

SOFTWARE REQUIREMENTS:

- Arduino IDE

BLOCK DIAGRAM :



HARDWARE DESCRIPTION

POWER SUPPLY

Power supply is a reference to a source of electrical power. A device or system that supplies electrical or other types of energy to an output load or group of loads is called a power supply unit or PSU. The term is most commonly applied to electrical energy supplies, less often to mechanical ones, and rarely to others.

Power supplies for electronic devices can be broadly divided into linear and switching power supplies. The linear supply is a relatively simple design that becomes increasingly bulky and heavy for high current devices; voltage regulation in a linear supply can result in low efficiency. A switched-mode supply of the same rating as a linear supply will be smaller, is usually more efficient, but will be more complex.

Linear Power supply:

An AC powered linear power supply usually uses a

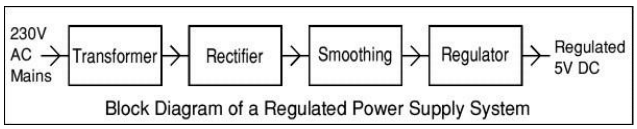
transformer to convert the voltage from the wall outlet (mains) to a different, usually a lower voltage. If it is used to produce known as ripple. These pulsations occur at a frequency related to the AC power frequency (for example,

DC, a rectifier is used. A capacitor is used to smooth the pulsating current from the rectifier. Some small periodic

deviations from smooth direct current will remain, which is a multiple of 50 or 60 Hz).

The voltage produced by an unregulated power supply will vary depending on the load and on variations in the AC supply voltage. For critical electronics applications a linear regulator will be used to stabilize and adjust the voltage. This regulator will also greatly reduce the ripple and noise in the output direct current. Linear regulators often provide current limiting, protecting the power supply and attached circuit from over current.

Adjustable linear power supplies are common laboratory and service shop test equipment, allowing the output voltage to be set over a wide range. For example, a bench power supply used by circuit designers may be adjustable up to 30 volts and up to 5 amperes output. Some can be driven by an external signal, for example, for applications requiring a pulsed output.



Block Diagram of a Regulated Power Supply System

Transformer :

Transformers convert AC electricity from one voltage to another with little loss of power. Transformers work only with AC and this is one of the reasons why mains electricity is AC.

Step-up transformers increase voltage, step-down transformers reduce voltage. Most power supplies use a step-down transformer to reduce the dangerously high mains voltage (230V in UK) to a safer low voltage.

The input coil is called the primary and the output coil is called the secondary. There is no electrical connection between the two coils; instead they are linked by an alternating magnetic field created in the soft-iron core of the transformer. The two lines in the middle of the circuit symbol represent the core.

Transformers waste very little power so the power out is (almost) equal to the power in. Note that as voltage is stepped down current is stepped up.

The ratio of the number of turns on each coil, called the turn's ratio, determines the ratio of the voltages. A step-down transformer has a large number of turns on its primary (input) coil which is connected to the high voltage mains supply, and a small number of turns on its secondary (output) coil to give a low output voltage.

Turns ratio=Vp/Vs=Nn/Ns and Power out=Power in

Vs*Is=Vp * Ip

Vp = primary (input) voltage

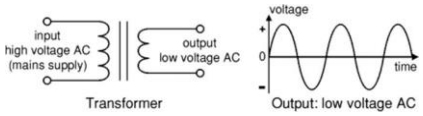
Np = number of turns on primary coil

Ip = primary (input) current

Vs = secondary (output) voltage

Ns = number of turns on secondary coil

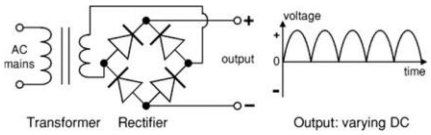
Is = secondary (output) current



The low voltage AC output is suitable for lamps, heaters and special AC motors. It is not suitable for electronic circuits unless they include a rectifier and a smoothing capacitor.

Rectifier:

There are several ways of connecting diodes to make a rectifier to convert AC to DC. The bridge rectifier is the most important and it produces full-wave varying DC. A full-wave rectifier can also be made from just two diodes if a centre-tap transformer is used, but this method is rarely used now that diodes are cheaper. A single diode can be used as a rectifier but it only uses the positive (+) parts of the AC wave to produce half-wave varying DC.



The varying DC output is suitable for lamps, heaters and standard motors. It is not suitable for electronic circuits unless they include a smoothing capacitor.

LCD display:

- Liquid crystal displays (LCDs) are used in similar applications where LEDs are used.
- LCD is used to visualize the status of our project, which is programmed to display the Sensor values, so that Farmers can easily able to notice.
- Its operating voltage is 5v dc supply.
- These applications are display of numeric and alphanumeric characters in dot matrix and segmental displays.

- The liquid crystal material may be one of the several components, which exhibit optical properties of a crystal though they remain in liquid form.
- Liquid crystal is layered between glass sheets with transparent electrodes deposited on the inside faces.

Arduino UNO:

- Arduino UNO is ATmega328 based microcontroller board. Its operating voltage is 5v dc and its operating frequency is 16MHz.
- It is one of the most popular prototyping boards.
- The board comes with built-in Arduino boot loader.
- It has 14 GPIO pins, 6 PWM pins, 6 Analog inputs and on board UART, SPI and TWI interfaces, an on-board resonator, a reset button, and holes for mounting pin headers.
- While programming the board, it can be connected to the PC using USB port and the board can runs on USB power.
- The Arduino UNO has 32 Kb Flash memory, 1 Kb EEPROM and 2 Kb SRAM.
- The board can be connected to different Arduino Shields for connectivity with Ethernet, Bluetooth, Wi-Fi, Zigbee or Cellular network and it can be connected to most of the IoT platforms.
- In our project, we use 3 types of sensor- PH, soil moisture, Float level sensor.
- Arduino consists of 14 digital pins and 6 Analog pins. Soil moisture and Float level sensor were connected in the 2 of those 6 Analog pins
- Since PH sensor gives the value in UART protocol, TX of the PH sensor is connected to the RX of the Arduino UNO.
- In Arduino UNO 6 digital pins(8,9,10,11,12,13) is used to connect the data pins of the LCD.
- Driver Relay is used to switch the Pumps, those Two driver relays are connected to the two digital pins of Arduino (6,7).

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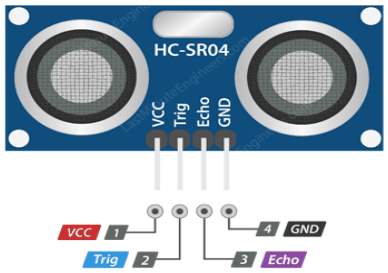
ULTRASONIC SENSOR:

- Ultrasonic sensor is an electronic device that measures the distance of a target object by emitting ultrasonic sound waves, and converts the reflected sound into an electrical signal. Ultrasonic waves travel faster than the speed of audible sound (i.e. the sound that humans can hear).
- Ultrasonic sensors have two main components: the transmitter (which emits the sound using piezoelectric crystals) and the receiver (which encounters the sound after it has travelled to and from the target). An ultrasonic transmitter sends a sound frequency of above 18 kHz in the air at the speed of 344 meter per second (at 20°C) and the

receiver receives the reflected sound from the object.

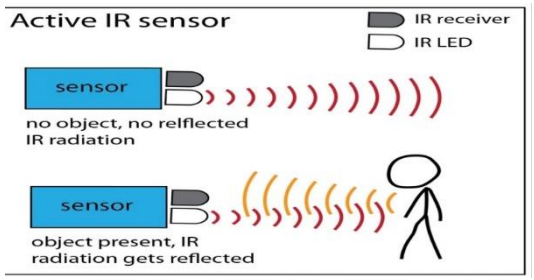


IR sensor:

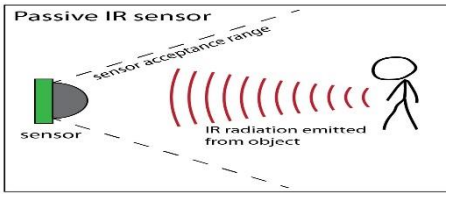
An infrared (IR) sensor is an electronic device that measures and detects infrared radiation in its surrounding environment. While measuring the temperature of each color of light (separated by a prism), he noticed that the temperature just beyond the red light was highest. IR is invisible to the human eye, as its wavelength is longer than that of visible light (though it is still on the same electromagnetic spectrum).

There are two types of infrared sensors: active and passive.

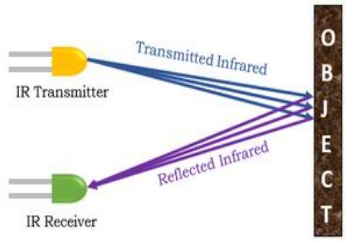
Active infrared sensors both emit and detect infrared radiation:Active IR sensors have two parts: a light emitting diode (LED) and a receiver. When an object comes close to the sensor, the infrared light from the LED reflects off of the object and is detected by the receiver. Active IR sensors act as proximity sensors, and they are commonly used in obstacle detection systems (such as in robots).



Passive infrared (PIR) sensors only detect infrared: radiation and do not emit it from an LED. PIR sensors are most commonly used in motion-based detection, such as in-home security systems. When a moving object that generates infrared radiation enters the sensing range of the detector, the difference in IR levels between the two pyroelectric elements is measured. The sensor then sends an electronic signal to an embedded computer, which in turn triggers an alarm.

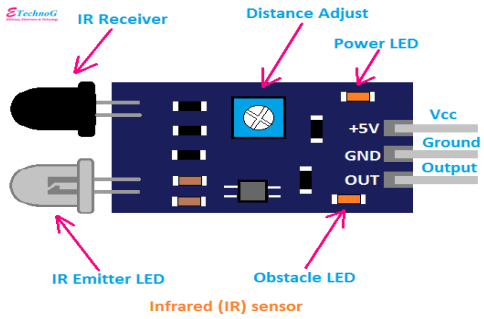


- The working of an IR sensor as an Object Detection Sensor can be explained as below. As discussed earlier, IR sensor consists of an IR LED and an IR Photodiode which together called as Photo – Coupler or Opto – Coupler.
- When there is an obstacle present in the path then a portion of emitted IR rays are reflected back to the receiver. The output of sensor depends on the intensity of reflected rays received by the receiver.
- There is an IC operational amplifier (as voltage comparator) which compares the intensity of reflected rays to the threshold value set bythe photodiode (used to calibrate the output of the sensor) and gives the corresponding output. Also, the position of IR transmitter and receiver also plays a major role in detecting the radiation. When they are kept opposite to each other then it is called direct incidence where almost all radiation from the transmitter will be received by the receiver.
- In this project we are using them in indirect mode i.e., they are kept adjacent to each other so the reflected radiation is detected and measured.



Pin Configuration:

- Its consists the 3 pins
- Vcc - the first pin connected in the 5V supply.
- GND - the second pin connected in the GND.
- Out - the thrid pin connected in the digital pin.



In this our project , We will use IR sensor for Speed measure to automatic braking system purpose.

VCC is connected to the 5V of arduino UNO ,

OUT pin is connected to the digital pin 5 and GND is connected to the GND of microcontroller.The IR sensor detect the speed continuously and to stop the motor when detecting obstacle.

SOFTWARE DESCRIPTION

SKETCH:

In the getting started guide (Windows, Mac OS X, Linux), you uploaded a sketch that blinks an LED. In this tutorial, you'll learn how each part of that sketch works.

A sketch is the name that Arduino uses for a program. It's the unit of code that is uploaded to and run on an Arduino board.

Arduino is an open source, computer hardware and software company, project, and user community that designs and manufactures microcontroller kits for building digital devices and interactive objects that can sense and control objects in the physical world. The project's products are distributed as open-source hardware and software, which are licensed under the GNU Lesser General Public License (LGPL) or the GNU General Public License (GPL),[1] permitting the manufacture of Arduino boards and software distribution by anyone. Arduino boards are available commercially in preassembled form, or as do-it-yourself kits.

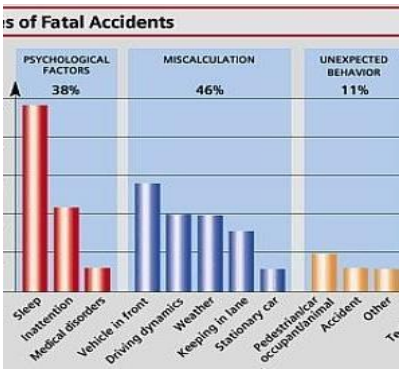
Arduino board designs use a variety of microprocessors and controllers. The boards are equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits. The boards feature serial communications interfaces, including Universal Serial Bus (USB) on some models, which are also used for loading programs from personal computers. The microcontrollers are typically programmed using a dialect of features from the programming languages C and C++. In addition to using traditional compiler toolchains, the Arduino project provides an integrated development environment (IDE) based on the Processing language project.

The Arduino project started in 2003 as a program for students at the Interaction Design Institute Ivrea in Ivrea, Italy,[2] aiming to provide a low-cost and easy way for

novices and professionals to create devices that interact with their environment using sensors and actuators. Common examples of such devices intended for beginner hobbyists include simple robots, thermostats, and motion detectors.

RESULT AND DISCUSSION:

During the design of system there are some terms considered. There are as follows Vehicle is at highest speed (MaxSpeed) > 120 RPM Vehicle is at high speed (HighSpeed) > 80 & <= 80 RPM Object at lowest distance (leastDist) < =25cm Considerable object at distance (minDist) >1cm & 30cm These distance are considered with respect to sensors used and need to update with further advancement. Depending on these terms there are different cases on which system responds. An increasing number of vehicles are being equipped with speed control system and reduce the accident.



FUTURE SCOPE:

System can be attached to steering of the vehicle, so that it will change its direction with steering to detect objects and obstacles on turns. This system can be modify & use with trains. Since trains travel in a straight line, it will provide good results.

CONCLUSION:

People are always in a rush to reach their destination as early as possible to save their time or to reach their destination on time without thinking about their lives' value, what would happen if they met up with an accident which means colliding with another vehicle for their tendency to go somewhere within a flash. This results in injury or loses of their lives. In this project the system for Pre-crash braking system is implemented successfully for electric vehicles. The prime motive behind the project is to reduce the accidents. In this project,, vehicle stops automatically when any object come closer to it. It also considers vehicle speed while considering distance. Use of Arduino board and IDE was so helpful during development of project. We also learn to design circuits in Proteus design software. Though till now, complete design is ready, actual hardware implementation will begin in the next phase of the project.

REFERENCES:

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2) Mahesh A. Rakhonde; S. A. Khoje; R. D. Komati, “Vehicle Collision Detection and Avoidance with Pollution Monitoring System Using IoT”, IEEE Global Conference on Wireless Computing and Networking (GCWCN) 2018

3) D.Kumar, S.Gupta, S.Kumar, S.Srivastava “Accident Detection and Reporting System Using GPS and GSM Module” Dept. of Electronics and Instrumentation Engineering, 35 Galgotias College of Engineering and Technology, Greater Noida,India, Volume 2, Issue 5, May 2015.