

A Simple Architecture for the Safety of Road Travel

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Abstract— The city road is going to be congested day by day and lot of accidents occur every day due to human errors, bad weather conditions, failure of mechanical parts or the problems in the road such as lane geometry, pavement etc. The main type of accident which causes severe damage is of head on type and it is mainly due to the negligence of the driver or the traffic system. Now the time has come to use some sensor networks to cope up with this type of situation. An IR sensor can help us to some extent in this regard. The main advantage of this is the simplicity, easy availability and low cost but as this type of sensor is of optical type so dust, humidity can cause problems to this type of sensor. This paper presents an efficient architecture to prevent head on collision on streets completely and others to some extent under some conditions. The use of this arrangement in car parking area is also described in this paper.

I. INTRODUCTION

In recent times millions of road accidents occur [i] and vehicle accident contributes the sufficient number of calamity related to road accident [ii] also after taking a lot of precautionary measures. Now the time has come to use sensor network and to use artificial intelligence to reduce risk in road travelling. With the advancement in technology application of sensor network is increasing which may be wired or wireless. Wireless has some distinct advantage over wired and use extensively in recent days. Also with the advancement in the technology of micro electromechanical system the wireless sensor networks become very popular and it can be expected that within 5-10 years the world will be covered with sensor networks[iii].

A sensor network is the combination of hardware and software. The data collected from the sensor is manipulated using software and depending on the result some action has been taken. So in a sensor network a controller is needed which can control the hardware depending on the signal of the sensor. Qiang Yao ET. Al. in their paper developed a RAM based neural network for the application mobile robot controlled by a microprocessor. This type of neural network allows the robot to detect the obstacles on its path and it can also avoid it. Katiyar et. All in their paper gives a concept of an intelligent architecture that will increase the road safety using wireless sensor network accompanied with Bluetooth protocol. Promila Sinhmar in her paper described a system for intelligent traffic light controller using IR sensor and microcontroller. In this paper we are proposing an efficient and reliable system using IR sensor and a microcontroller which can be used for the purpose of road safety and also for car parking purpose. Here the IR sensor work as a sensing element and the microcontroller is the controlling element.

II. BLOCK DIAGRAM

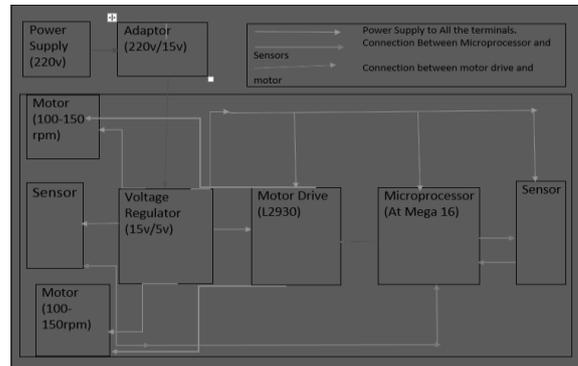


Fig. 1: the basic block diagram of the proposed architecture.

III. DESCRIPTION OF BLOCK DIAGRAM

A 220V Power unit has been used which has been converted into 12V which is further stepped down to 5V by the use of a voltage regulator. This 5V has been provided to all the electronic equipment used in the hardware. There are two sets of Sensor used in the car model situated at the front and at the back. These Sensors are of optical proximity type. They sense any obstruction present in front of them and provide a feedback signal to the microcontroller. The microcontroller then gives the command to the motor driver whether to decrease its speed or to remain constant. The motor Drive (L293D) controls the motor or the wheels.

IV. DESIGN AND DEVELOPMENT OF THE SYSTEM

A. Power Supply

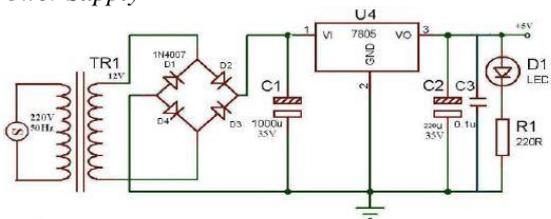


Fig. 2: +5V Regulated Power Supply

The above figure shows the circuitry of the +5V regulated power supply which fulfils the power requirement of the entire system. The circuit consists of 0-12V transformer which steps down 220V AC supply to 12V AC. A bridge rectifier which consists of four diodes (1N 4007) converts 12V AC to 12V DC. It is then filtered through a 1000µF capacitor C1 to remove the ripples. The IC 7805 which consists of three terminals V₀, V₁ and GND working as a voltage regulator. V₁ is connected to the input voltage; V₀ gives the regulated output voltage of +5V. In order to isolate the regulated output voltage from noise further filtering is done by 220µF capacitor.

B. SENSOR MODULE

The sensor module detects the presence of any obstacle in front of the vehicle within a certain range of distance. The sensor module consists of Infrared (IR) LED, a photo detector, resistors, a variable resistor and a LM358M which is basically a comparator. The emitter i.e. IR LED emits the infrared light, when this emitted light hits any kind of obstacle within a certain range of distance it reflects back and received by the receiver as soon as the photodiode receives the light of certain intensity, due to absorption of photons of certain energy by the absorption layer electron hole pairs are generated, these charge carriers are further swept from the junction by the electric field of the depletion layer, hence due to movement of charge carriers photocurrent is produced. The potential difference due to the photocurrent is compared with the reference voltage by the LM358. If the potential difference is greater than reference voltage the LM358 gives the output voltage which will be equal to the operating voltage of the LED, hence the LED glows.

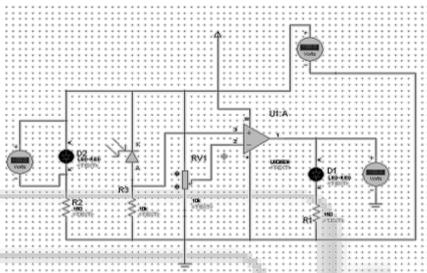


Fig. 2: Circuit Diagram of Sensor Module

Thus the glowing of LED will indicate the presence of an obstacle within the particular distance. Further this sensor module is interfaced with a microcontroller (At mega 16) The microcontroller is programmed such that when a signal is received by it, a command is given to the Motor Drive (L2930) which checks the speed of the motor and hence the speed of the vehicle is also controlled. This would prevent the collision or damaged caused by collision between a vehicle and an obstacle or collision of two vehicles can also be prevented.

V. FLOWCHART FOR MICROCONTROLLER PROGRAM

A. For Phase Difference Measurement

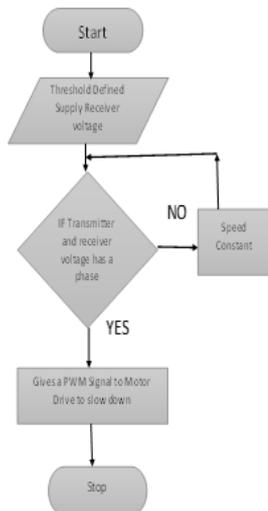


Fig. 3: Phase Difference Measurement

B. For Distance Measurement

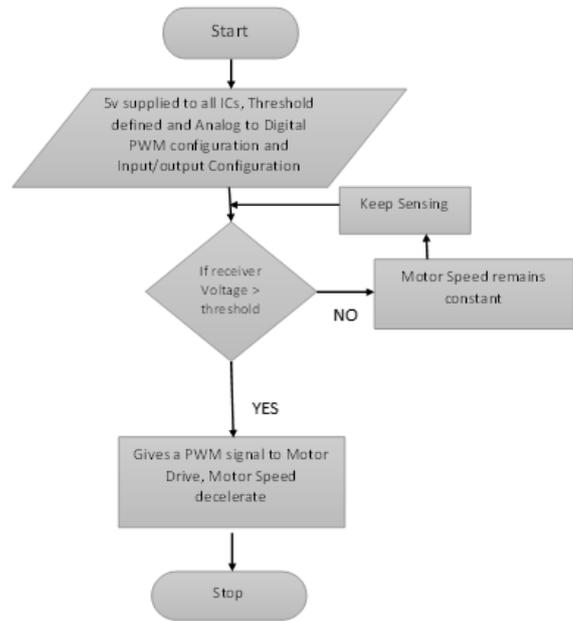


Fig. 4: Distance Measurement

VI. CONCLUSION AND FUTURE SCOPE OF WORK

This work is proposed for an IR sensor receiver module along with microcontroller to increase the road safety. Also this module can be modified to reduce the traffic problems in city roads. Using those two flowcharts this module is capable of avoiding head on collision and back to back collision.

In future this system can be modified by using RF sensor, GSM modules to make it less accident prone. Also the range of the IR sensor can be increased using a lens assembly and 555 timer. Also the implementation of fuzzy logic will make this system more user friendly and helpful.

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