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Solar powered automatic one way traffic control system

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Abstract
Automatic One-way traffic control technique employs a microcontroller and different types of sensing circuits, to control the movement of the vehicles in one direction only, thus avoiding a head on collision between the two cars. In this method, a sensor detects the presence of the vehicle in front of the barrier and gives input to the microcontroller, which provides a command to the H-bridge. By using the concept of H-bridge, the direction of DC motor was controlled. An LCD was provided which indicates the current status of barrier gate. A solar panel is used which charges the battery and provides a necessary power supply of 5 Volts along with a voltage regulator. Thus the concept of renewable energy is implemented.

Keywords: one way traffic, microcontroller, sensor, solar panel, dc motor

1. Introduction
Wrong way driving is a typical scenario nowadays. It is the driving of the vehicle against the movement of the traffic it is seen commonly on the highways, parking lots or in the parking garage. It may be due to the negligence of the driver or impairment or because of the wrong road markings. People intentionally drive in the wrong way traffic just because they had missed a cut, for thrill-seeking or for a shortcut. On a divided highway, especially a freeway the chances of head-on collision are high, so there arises a need for implementing a technology that enables the vehicles to limit them from moving in the wrong direction. Zhou [1] stated that in the United States, that there are a total of 355 people killed by road accidents driving in the opposite direction on the highways. Rouholamin [2] in his research paper gave an average of 265 fatal Wrong-way driving crashes, out of which 1.34 fatalities per WWD fatal crash can be calculated. The significance of these kinds of accidents was corroborated when this number was compared to the casualties per fatal crash rate of 1.10 for all other crash types, which translates to 24 more fatalities per 100 fatal crashes for Wrong-way driving crashes than for deadly accidents in general. The paper focuses on the implementation of one-way traffic control system for a parking lot having a single entry. This technique uses PIC 16F87X 28/40 – Pin 8-Bit CMOS FLASH Microcontroller along with L293D H-BRIDGE and a DC gear motor for opening or closing the gate as and when required. Ultrasonic sensors are used for sensing the vehicle and giving the command to the circuitry board for its successful operation.

2. Overview of the system
One way traffic control system aims at prohibiting the direction of traffic in a single direction so that head-on collision between the two approaching vehicles is barred, especially at sightless curves. The traffic control is achieved with the help of an ultrasonic sensor installed on the roadside which is directly coupled to the microcontroller. The microcontroller then accordingly actuate the barrier according to the time required for opening or closing of the gate. When a vehicle comes in front of a sensor, the circuit receives the incoming signal sent from the sensor, which permits the current to pass through to the gear motor affecting the motor to run and the barrier opens. Once the barrier is entirely open (depending on where the sensor is located) the motor stops running causing the gate to stop moving upwards. When the vehicle precedes the sensor, the same thing happens but this time the motor rotates in the opposite direction, thereby causing the barrier to close. A microcontroller is used for operating the system. An L293D H-bridge for controlling the motor. A DC gear motor for rotating the gate in clockwise or anti-clockwise direction is also used. An LCD for indicating the current status of the gate. For power supply a solar panel of the rated power of 10 V is employed along with a battery of 12 V, 18 AH.

3. Prototype design

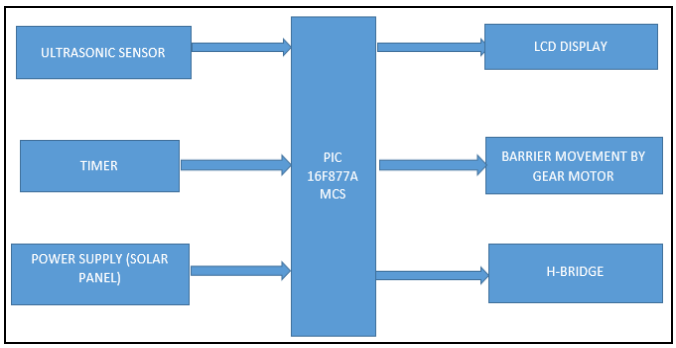

Fig 1: Prototype design

4. Components

4.1 Sensor

The sensor used in one way traffic control system is used to detect the presence of vehicles and controls entry only from one side. Ultrasonic transducers operate at a frequency higher than 25 KHz. The sensing range of the sensor used is between 0-200 cm.
Operating current: 15mA
Voltage: DC 5V
Measuring angle: 15

4.2 LCD Display

Liquid crystal display is formed of the array of pixels which displays information of the current status of the barrier. Size of LCD used is 1x16. LCD is attached to micro-controller.

4.3 Gear Motor

Single shaft gear motor gives an output torque of 0.8 Kg/cm at 150 rpm. Operating voltage is between 3-12V.

4.4 H-Bridge

H-Bridge is a motor driver used to control the motor. The L293D is designed to deliver bidirectional drive currents of up to 600mA at a voltage from 4.5V to 36V.

4.5 Solar panel

A solar panel converts the energy of the sun into electricity. A solar panel is a collection of solar cells. Many small cells spread over a considerable area work together to provide enough power.

5. Working Diagram

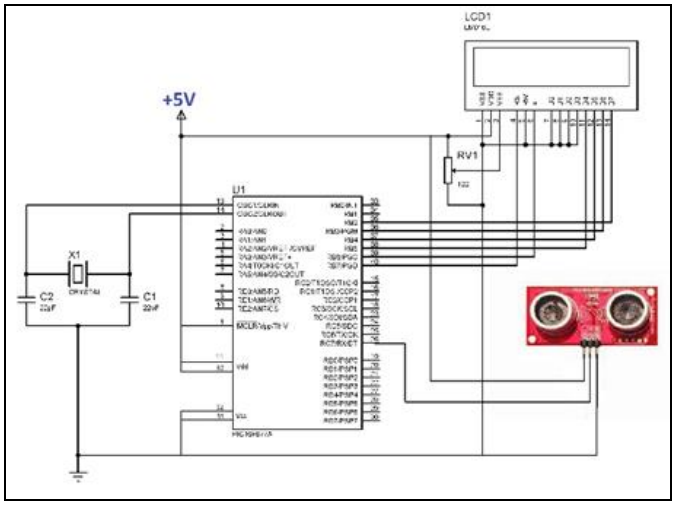

Fig 2: Working diagram

6. Working Principle

One way traffic control system works on the principle of actuation of a barrier with the aid of sensors. The primary tactic behind this is that the sensor is placed only on the one side of the barrier. The other side of the barrier does not contain any sensing device, so the barrier always remains closed for vehicles which enter the road through the wrong side. This paves the way for the vehicles which are coming through the right side and reduces the chances of accidents. The sensor senses the incoming object and commands the barrier gate to open through an H- bridge which is connected to the motor.

7. Flowchart

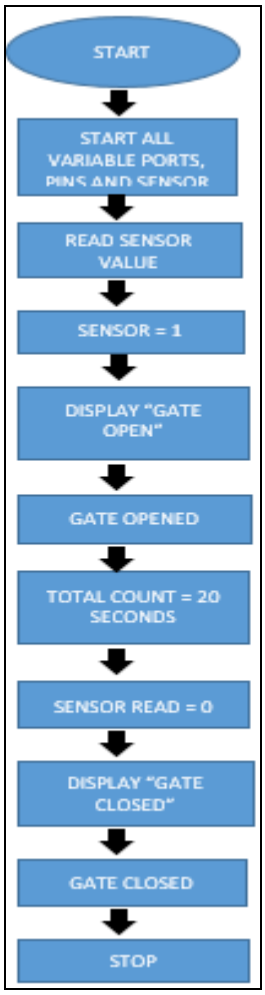

Fig 3

8. Testing Process

Testing of the system is done with the help of a vehicle. When a car comes in front of the sensor which is fitted on the wall accordingly, the sensor transmits and receives the signals successively and sends the received signal to the microcontroller. The microcontroller, therefore, sends the message to the h-bridge according to the time set up by the timer. The h –bridge automatically controls the direction of the dc motor and opens or closes the gate according to the prescribed time span. The output is displayed on the LCD screen connected to the microcontroller.

9. Advantages of one way traffic control system

1. Accidental situations are reduced. Thus security is increased.
2. Efficient.
3. Less excavation is required.
4. Cost-effective traffic control.

5. Low maintenance.
6. Renewable sources of energy can be applied (solar energy).
7. Reduction in human resources

10. Applications

1. Autonomous sensors
2. Industrial automation and process control software
3. Mastering the complexity of applications

11. Conclusion

Automatic one way traffic control system aims at reducing the risk of accidents a great extent. The automated barrier system will prevent the movement of vehicles from the wrong side. Automating the barrier system is a necessary objective as it will reduce the human effort and error in opening and closing of the barrier, so that unidirectional movement of vehicles can be maintained and hence accidents can be prevented. The obstacle detection system is implemented with ultrasonic sensors which detect the presence of vehicles and will actuate another system to control the barrier. In case of power shutdowns, our system will on work solar energy which can be used as a primary power source in future. It is an appropriate solution for the restriction of head-on collisions.

12. Acknowledgement

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