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Pv Powered Electronic Circuits Designed to Decrease Road Accidents

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Abstract

One way of the utilizing solar energy is to use pv panel which generates electricity energy as expose to the solar radiation on it. Pv panels are utilized[1] in many areas such as lighting and stand-alone systems, the grid connected systems, pv power plants, satellite, space, communications..etc. Especially in today's green areas and parks, they are used for lighting and irrigation. The usage of pv panels on the roads is a different usage aim of renewable energy sources. Some of them in highways are as follows: the lighting on motorways, traffic signaling, routing sheets, bridges and viaducts lighting, the needed energy of petrol stations, the charger unit of hybrid vehicles, and the determination of car numbers on the road. An electronic circuit design can be placed onto the highways. With the help of electronic sensors in electronics circuit placed on the road is to aim for reducing traffic accidents. It was particularly sharp bend and the angle where very tight, sending a place of warning signal in the lane against the emergence or ramp into the corner with the help of designing electronic circuits on the road if you have a vehicle coming in the opposite direction to help the driver. As a result, it prevents damage to that or give incorrect overtaking a vehicle enters the opposite direction.

Keywords: Renewable energy, road accidents, sensors.

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1. Introduction

Solar energy has the advantages of being renewable, continuous and environmentally-friendly. Solar panels have a wide panel of use in buildings, factories, roads, car parks, grid dependent and independent pv (photovoltaic) systems, pv stations, satellites, communications systems and hotels, among others (Chambouleyron, 1996, EIE, 2016, Green et al., 2001, Kuwano, 1998). Solar panels are also used at the present time for illuminating green spaces and parks as well as small scale irrigation projects. They can also help to meet the energy needs of resort hotels over summer months by helping with outdoor and ambient lighting. Pv panels are also used to meet the electricity needs of remote settlements. There are many accidents on different roads due to different reasons (Hobbs et al., 1996, Ansari et al., 2000, Elvik et al., 2004, Valent et al., 2002, Kumar et al., 2008, Entezami et al., 2015, WHO, 2015, Taravatmanesh et al., 2015). Some of the accidents on highways consist of faulty overtaking process. Most road accidents result in injuries and fatalities. In the present study, the aim was to design a prototype electronic circuit powered by a pv panel in order to alert drivers about oncoming reckless overtaking in undivided highways (single carriageways) and prevent accidents.

2. System Design

For the electronic circuit designed to reduce accidents on roads is utilizing from solar energy. One of the using methods of solar energy as electricity is to use pv cells generating electrical energy as a result of the solar radiation incident on it. Current generated by pv cell is proportional with effect of solar radiation on cell. The amount of power obtained from pv cell is low because the amount of current and voltage obtained from only a single pv cell is also low. Therefore, in order to obtain the adequate output power, pv cells are connected in series to form a pv module. If higher voltages or currents than are available from a single module are required, modules must be connected into panels (Messenger, 2000, Beckman and Duffie, 1991). A novel and advantageous use of solar panels involves highways. Panels are used today for traffic signaling, road signs, illuminating bridges and viaducts, hybrid vehicle charge units, supplying electrical energy in petrol stations, and illuminating highways and their surrounds (Xing et al., 2005, Hsieh, 2004, Sazanov et al., 2009). The electronic circuit designed for this study has 5 basic parts: the pv panel, sensors, battery and charge unit, alert lamp and electronic control circuit. If Ac load is needed, an additional inverter may also be used.

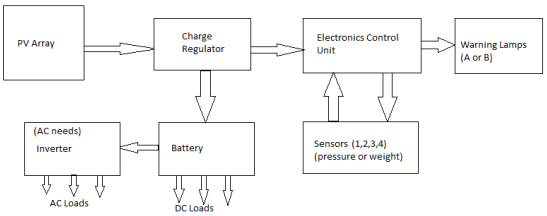


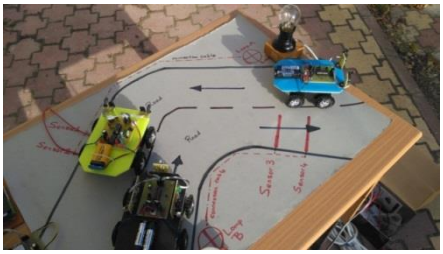
Figure 1. The block schema of the designed pv system

The block diagram of the designed pv powered electronic circuit is shown in Figure 1. The operating principle of the electronic circuit is based on electronic signals received from sensors installed in highways. The circuit aims to decrease accidents resulting from reckless overtaking in sharp bends and ramps particularly in undivided highways, where the range of visibility is strictly limited. The electronic control unit energizes the warning lamp according to the information received from the sensors. In these sections of highways, reckless and careless drivers may cause life-threatening risks for oncoming traffic day and night. In such cases, drivers are alerted to the danger with a lamp on the electronic circuit and are given an opportunity to stop, and potentially dangerous accidents are prevented.

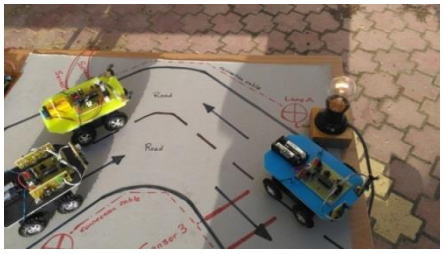
3. Experimental Study and Results

The pv powered electronic system designed for the study is an automatic one that depends on sensors. Two sensors are needed if the circuit is to be used in one single direction in undivided highways, and 4 are needed if it is to be used in both directions. To begin with, the pv panel is connected to the battery over the charge unit. This enables the pv panel to both operate the electronic system and charge the battery during daytime. Later, at night, the battery meets the power need of the electronic system. The circuit works in the following way:

(a)



(b)

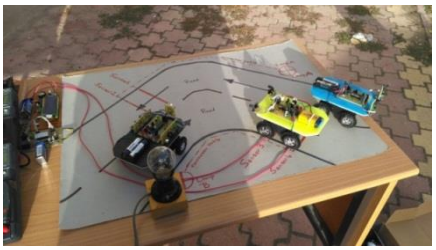


(c)

Figure 2. (a-c). Overview of the experimental system and the first direction of cars

The vehicles in Figure 2 are driving in an undivided highway under normal conditions. The yellow car starts to overtake the black car inappropriately, which sends a signal to the electronic control circuit via sensors. The electronic circuit energizes lamp A, which is installed further forward from the yellow car. Consequently, the driver of the oncoming blue car in its right lane sees lamp A and stops in time to prevent a collision. Thus, a potential accident resulting from reckless overtaking on an undivided highway may be prevented. Similarly, in the opposite direction, the yellow car in Figure 3.(a-b) may try to overtake the blue car inappropriately. The sensors send an alert signal to the

electronic control circuit, which then energizes lamp B for the driver of the black car in its right lane. Upon seeing that lamp B has come on, the driver can stop and prevent a collision.



(a)

(b)

Figure 3. (a-b) The opposite direction of cars

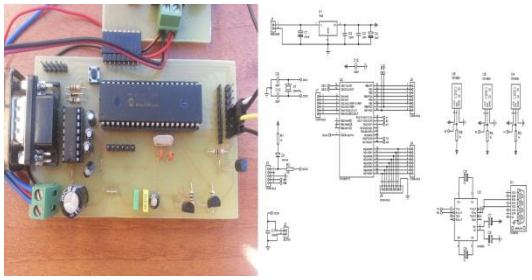


Figure 4. The electronics circuit

The electronics control circuit (Figure 4) designed here is powered by a pv panel. The energy consumption needed for this circuit and its sensors is approximately between 5-10 watts. If led light technology is used for the alert lamps, the energy need is then between 3-5 watts. In this case, the total power needed is approximately 10-15 watts. As the system developed here as a prototype in laboratory conditions is simple, small and powerful, it is also economical. In the trial run, the energy needed for the system was supplied by the 42-watt panel available in the laboratory.

4. Conclusion

The negative environmental effects of conventional energy sources make renewable energy a more important solution each passing day. Using renewable energy on highways may reduce the number of accidents resulting in injuries and casualties. In other words, with a simple, feasible and inexpensive pv powered electronic circuit in prototype, accidents resulting from reckless overtaking may be largely prevented. It is estimated that such a system would significantly reduce the number of accidents in undivided highways and bring moral and material support to both drivers and the country. Overall, the laboratory results of the designed electronic system were satisfactory.

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