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Intelligence-Based Traffic Light Control Using Free Energy Generation

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Abstract

The energy production with no operating cost is free energy. Free energy generator is an example of perpetual machine operating on the principle of rotation of shaft using magnetic repulsions of strong neodymium magnets. This power output is used to drive the smart traffic light system in this article. The existing technology of traffic light is combined with artificial intelligence to reduce average trip waiting time, traffic congestions, and extra fuel consumption at traffic signals based on traffic density at particular roads. The system consists of a DC fan, neodymium magnets, a voltage booster circuit, PIC microcontroller, and IR sensors. The entire article is concerned with the development of a dynamic traffic system using the renewable power source.

Keywords: *Density-based traffic light system, free energy generator, neodymium magnets, smart traffic control, time-sharing concept*

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INTRODUCTION

Traffic congestion is the most prevailing problem in many metropolitan cities across the globe. The current existing technologies of traffic lights are automatic but nondynamic. It sometime requires power for its efficient operation and dynamic control of traffic. In this article, an approach is made for more fuel-efficient driving with dynamic traffic signals to avoid unnecessary fuel consumption in the intersection which is also a major cause of air pollution. The building and construction of new transport network is not sufficient to eradicate the existing traffic congestion but it also require development in existing technology in route guidance system and density-based smart traffic light operation [1]. The dynamic traffic light system can set the time of signal light according to density of lanes.

In this research, focus is made on the development of intelligent traffic light controller using the infrared (IR) sensors and microcontrollers. In this, the time for signal lights are adjusted dynamically through the time-sharing algorithm. To run this system power is required for the microcontroller along with IR sensors and traffic lights. The technology of free energy generation for power input is utilized for the same. Free energy generator is perpetual machine which works on the principal of magnetic field repulsion in which neodymium magnets are used for creating strong magnetic fields [2,3]. The complete system is developed such that the free energy generated is boosted and is provided to the components of the dynamic traffic light system controller and other components. This system as a whole reduces the average waiting time of vehicles as well as reduces the fuel wastage and pollution hazards in any city. This may help in creating green channel for an emergency situation such as saving life of people in an ambulance. This will also result in economising of time, energy, and capital.

The formulation of this article is as follows. In section 2, architecture of the smart traffic system is explained. Section 3 presents the working model for purposed system. Results and Conclusion are demonstrated in Sections 4 and 5, respectively.

ARCHITECTURE OF THE SMART TRAFFIC SYSTEM

Smart traffic light system is designed as an intelligent method for controlling the dynamic

traffic at the inter sections. It is based on density detection and time-sharing concept. The existing technology of traffic light system can be modified with the proposed technology of smart traffic system to avoid traffic congestion and reduce travel time as well as excess fuel consumption on traffic signals. The block diagram of the complete system consisting of different units such as traffic density detection unit, microcontroller, and light indication system is shown in Figure 1. The IR sensors comprises of the density detection unit are placed on all the four roads and on both side of lanes upto the distance of 100 meters. An IR sensor is an electronic instrument which is used to sense certain characteristics of its surroundings by either emitting and/or detecting IR radiation. IR sensors are also capable of measuring the heat being emitted by an object and detecting motion. Low-power microcontroller is combined with traffic lights which automatically controls the timings of traffic lights depending upon density of vehicles on roads.

In the proposed system, power required for the microcontroller along with IR sensors and traffic lights is provided through free energy generator. The free energy source consists of a generator working on magnetic repulsion along with a voltage booster circuit. This power system unit is an example of perpetual machine which produces power without any input energy or fuel. All the IR sensors are connected to the common microcontroller. They provide the digital data when blocked by vehicles and transfer it to microcontroller. The microcontroller will then analyse which lane has more traffic density and will provide corresponding delay time. Thus, the current traffic light system is converted into smart system which automatically analyses the traffic density on particular roads and control timing on its own according to whether there is queue of vehicles waiting for green lights or no vehicles at all.

Free Energy Generation

The basic prototype of free energy generator consists of a small electric motor, set of neodymium magnets and the voltage booster circuit. A neodymium magnet is a type of rare earth permanent magnets made from an alloy of neodymium, iron, and boron. These magnets produce very strong fields. They are light in weight. So it can be placed on the circumference of moving rotor without offering large moment of inertia to the rotating system. The block diagram of the proposed

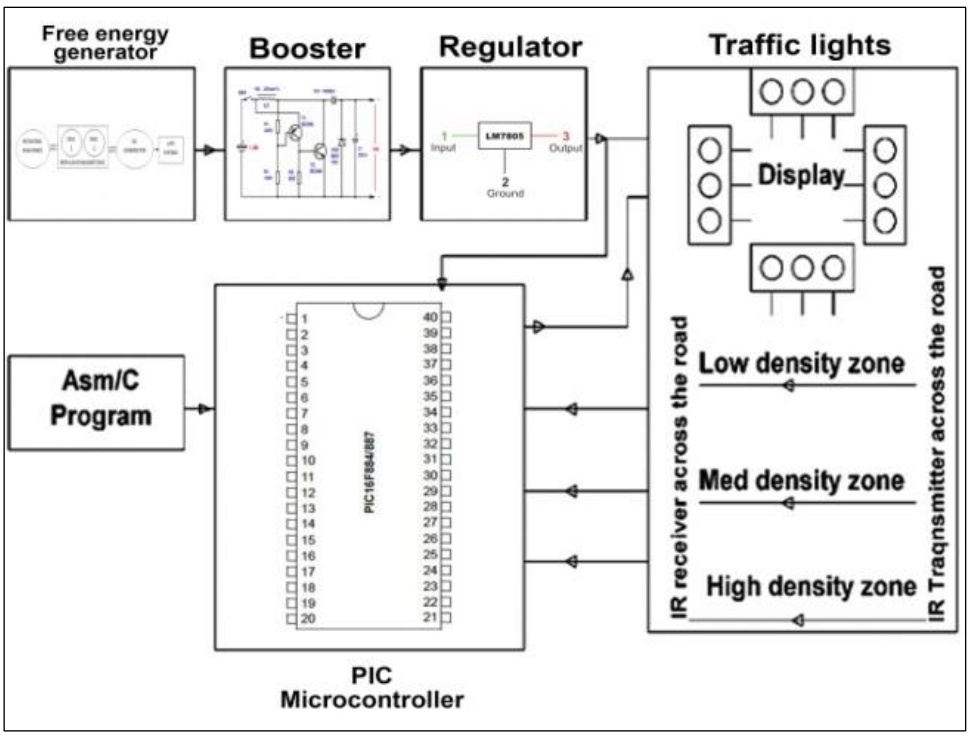

Fig. 1: *Architecture of the Complete Dynamic Traffic Light System.*

system is shown in Figure 2. A rotating machine is coupled with neodymium magnets placed on the circumference of rotor windings. In repulsive magnetic disc, the permanent magnet are placed in opposite poles, which produce repulsive force [4,5]. There are two discs, Disc 1 is coupled with rotating machines and Disc 2 is coupled with the DC generator. These two discs are separated by a small distance since this distance is inversely proportional to the repulsive force. The generated power from DC generator is fed to the UPS system following through the voltage booster circuit. This booster circuit boosts the initial voltage of 2.5 V to almost 15 V.

The magnets produces magnetic fields which interact with each other fields results in the production of a constant torque acting tangentially on rotor magnets. This causes the rotor to move which in-turn moves the shaft connected to it. The output of generator is fed to the voltage booster circuit to amplify the input voltage, which drives the smart traffic light system.The magnetic field in ordinary motor is produced by electric coils wound on rotor windings. These coils continuously need electric supply to produce field. But this neodymium magnetic motor does not need such coils. There is no such loss due to rotor windings. The practical aspects of this generator is possible only due to neodymium magnets which produce very strong fields to drive motor and is also very light in weight.

Density-Based Traffic Light Control System

The proposed traffic system consists of detection unit, control unit, and indication unit. The detection unit consists of IR sensor modules having both transmitter and receiver. An IR sensor is an electronic device which can measure the heat of an object as well as detects the motion. These types of radiations are invisible to our eyes that can be detected by an IR sensor. It consists of IR LED which works as emitter and detector is simply an IR photodiode which is sensitive to IR light of the same wavelength as that emitted by IR LED. IR sensors are placed in each lane which detects the density of vehicles on road and

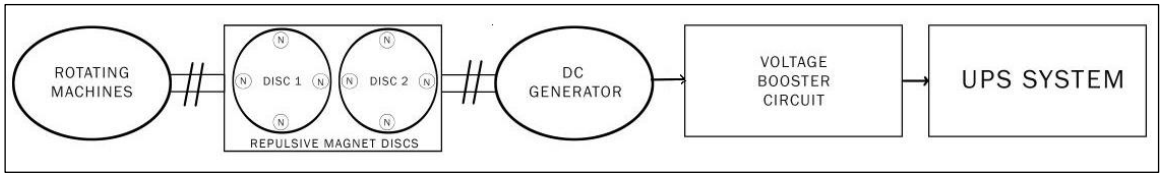

Fig. 2: *Block Diagram of Free Energy Generator.*

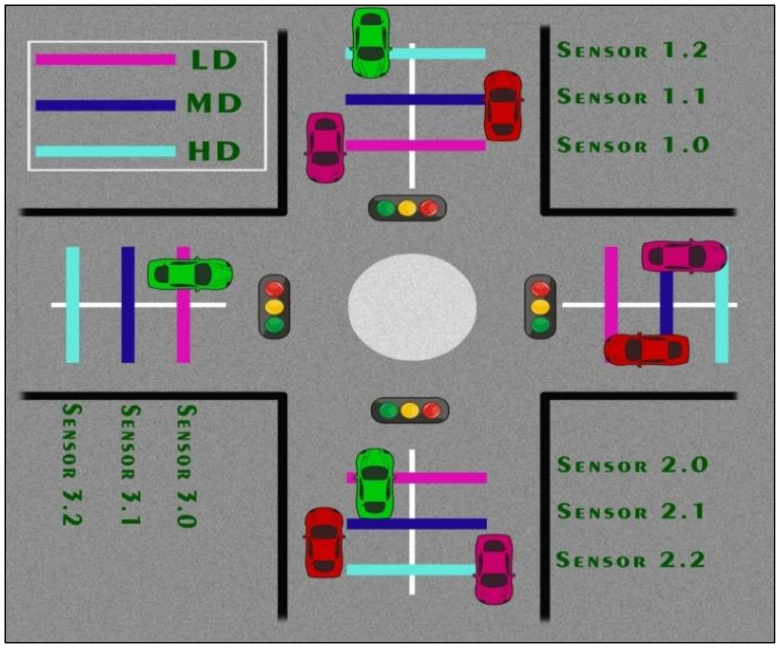

Fig. 3: *Architecture of Dynamic Traffic System.*

sends the information to microcontroller [1, 6]. The array of IR sensors decides the density of vehicles in road and the microcontroller controls the time of traffic light accordingly. Figure 3 indicates the detection unit placement along with the low density (LD), medium density (MD), and high density (HD) traffic areas at a traffic signal. The control unit comprises of peripheral interface controller (PIC) microcontroller with crystal oscillator and power circuit connected with it along with IR sensors and traffic lights. PIC uses flash memory for program storage, and it allow the PIC to reprogram itself. The IR sensors inform PIC microcontroller that which of the lane has more traffic density and which one has lower density. It then manages the time to share between the different signals. Indication unit consists of traffic light with Red, Yellow, and Green led connected for display.

Time-Sharing System

The microcontroller uses the algorithm shown in the Figure 4 to manage the time of traffic lights according to the density detected by the IR sensors. Using the algorithm, the microcontroller decides whether density of all the lanes are equal or not, if it is equal than it shares equal time between every lane else it checks for the maximum density lane and feeds the lane with maximum time by sharing the time of free lane or the lane which has less density compared with maxim one. This process is continuous until there is an interruption in power or it is manually turned off.

WORKING

The schematic of traffic light system is shown in Figure 5. The prototype model has been designed in Proteus 7.8. The traffic lights are represented using LEDs and IR sensors using SIL3 connector. These IR Sensors and LEDs are connected to common microcontroller (PIC16f887) in individual ports. Microcontroller is set to operate on particular frequency using crystal oscillators and capacitors connected to it. The program/algorithm developed in Embedded C is burnt through PICKIT2 module using USB connected to the PC. PICKIT2 is USB PIC programmer. It is a complete open source product from microchip which is capable to

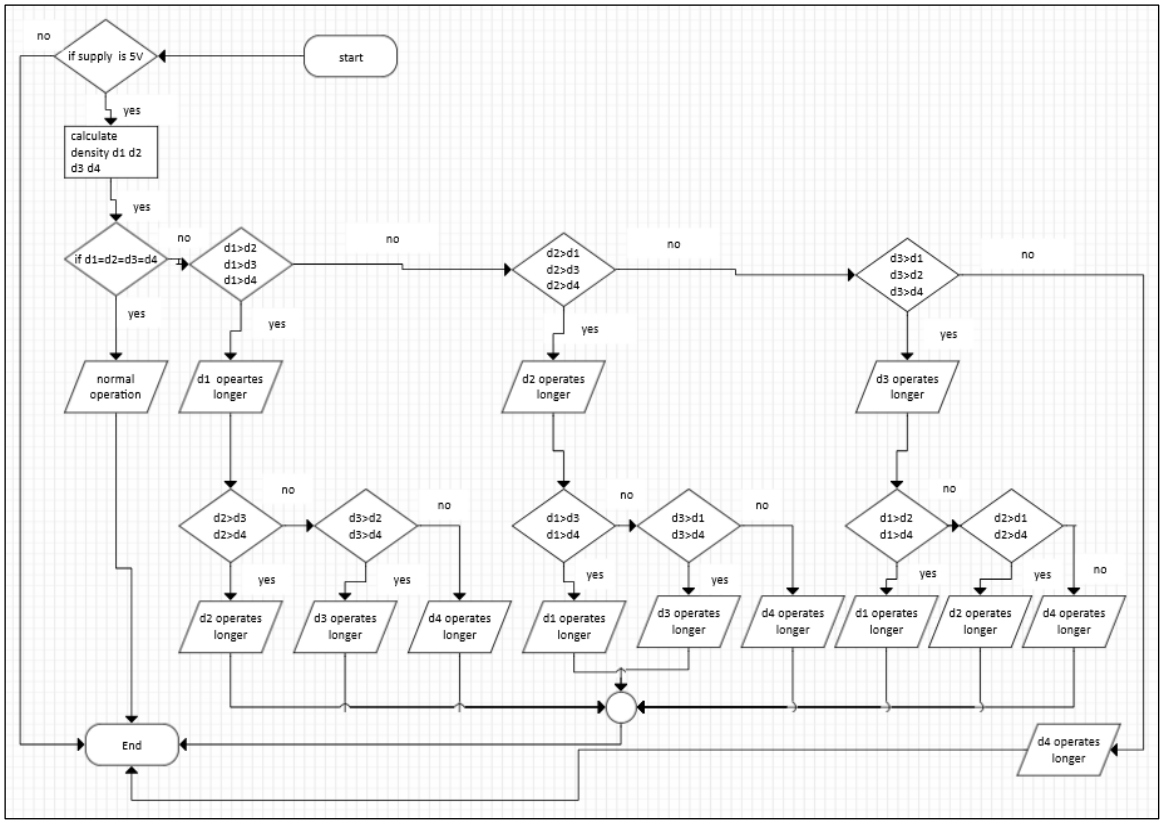

Fig. 4: *Flowchart of Time-Sharing Algorithm.*

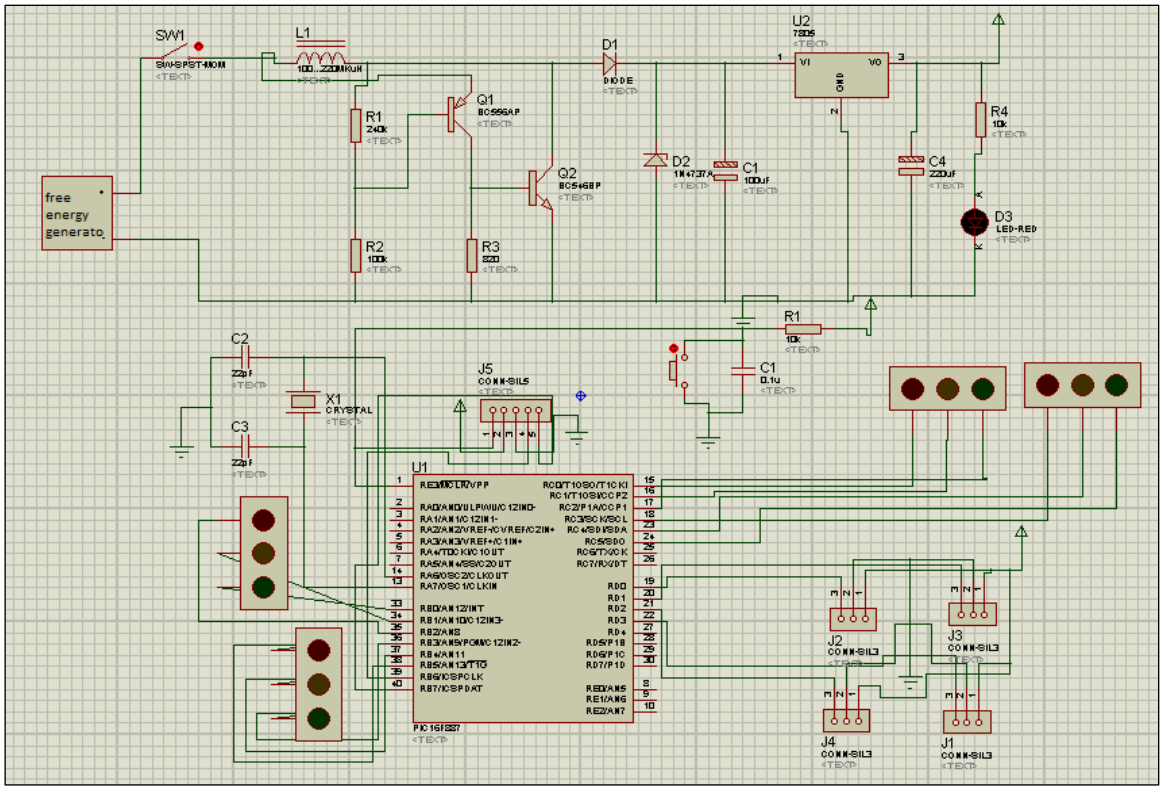

Fig. 5: *Schematic on Proteus 7.8.*

program all PIC Microcontrollers. The microcontroller fetches the information from the sensors and stored, then it will analyze which lane has a more traffic density and allocate the time. The input power is supplied using free energy generator, which is amplified using the voltage booster circuit. IC LM7805 is used as voltage regulator for constant 5V DC output. This power is used to drive microcontroller and traffic light systems.

RESULTS

The results include the successful implementation of intelligent dynamic traffic light system using free energy generator. It reduces the average waiting time of each vehicle and also the fuel wastages in traffic jams. It reduces the social hazards environment is facing due to the continuous increase of greenhouse gases by reducing pollution due to vehicles. So the prime concern with this research is to create an economical system where pollution level can be reduced using the renewable energy source.

CONCLUSION

This article presents how generated free energy is used as power supply for driving smart traffic light system to reduce traffic congestion at signals. Traffic densities on roads are observed through sensor and the information is provided to the microcontroller. According to the time-sharing algorithm programmed in microcontroller, the microcontroller decides priorities of lanes and optimizes traffic flow.

In future, this system can be developed where special vehicles like ambulance can be coupled with smart traffic light so that the corresponding lane will be given more priority. This system can also be used to inform people in advance about the traffic in the lanes using enhanced route guidance GPS enabled systems. Data transfer and information sharing between microcontrollers and computer can also be done through telephone network channels. This traffic light control can be implemented to all existing signals in the whole city.

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