



Solar Powered Traffic Control System

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Abstract

Traffic lights play such an important role in traffic management to control the traffic on the road. Situation at traffic light area is getting worse especially in the event of emergency cases. During traffic congestion, it is difficult for emergency vehicle to cross the road which involves many junctions. This situation leads to unsafe conditions which may cause accident. Traffic police gave authority to emergency vehicle driver to activate the traffic light remotely is developed and designed to help emergency vehicle crossing the road at traffic signal during emergency situation.

This system used Peripheral Interface Controller (PIC) to program a priority based traffic light controller for emergency vehicle. During critical cases, emergency vehicle such as ambulance can activate (trigger) the traffic light signal to change from red to green that's to make clearance for its path automatically. By help of Radio Frequency (RF) the traffic light will turn back to its normal operation when the ambulance finishes crossing the road.

Introduction

Due to rapid growth in population, the number of vehicles used by people is constantly increasing and hence its leading to high density of traffic which increases the waiting time of vehicles. Emergency vehicles such as fire disaster prevention vehicles, ambulances are required to reach their destination as quickly as possible. Time is the main thing which is been consumed by the vehicles in the form of high density of traffic signal. An adaptive control system can be developed where the traffic load and emergency vehicles are continuously measured by sensors connected to a microcontroller-based system which also performance all intersection control functions. Microcontroller based traffic control system is an application specific project, which is used to control the traffic.

Motivation

Many countries in the world are showing the many difficulties about the traffic light because of that accidents will be occurs between emergency vehicles and other public vehicles. In Malaysia, the traffic light control system specifically has not been worked appropriate or properly when emergency case occurs. Because of that, the emergency vehicles like ambulances difficult to reach their destination on the time because of the traffic delay. Since, the critical situation is occurs when emergency vehicles have to wait for other vehicles to give way to crossing the traffic lights. Due to delay in time may happens many emergency cases. All these problems faced by emergency vehicles can be solved by using this traffic light control system base on radio frequency (RF). Due to this problem, deciding take research project and literature review for related issues. The literature review can be provided information about the technology available and methodologies used on this topic.

Objectives

- Developing priority based signaling which helps to give priority to emergency vehicle on the road.
- To reach its destination on time for ambulance.
- Easy To Use.
- Human life can be saved.

Problem Statement

- There is loss of life due to the delay in the arrival of ambulance to the hospital in the golden hour due to the traffic signals.
- The cost of human life is more than any other. Due to all this problem we decided to implement a system which using remotely controlled traffic signal for emergency vehicle so that the ambulance would be able to cross all the traffic junctions without waiting.

Literature Survey Background Study

Intelligent transport systems and services can be defined as the integration of information and communication technologies with transport infrastructure, vehicles and users. Expanding urbanization and traffic congestion require our transportation systems to operate with maximum efficiency. Continuous traffic signal control is a fundamental part of the current urban traffic control system, which is planned to make ideal use of road planning. Signal system activity is additionally complicated by ongoing patterns that view the traffic signal system as a small part of an integrated multimodal transportation system.

In recent years, multi-specialist systems have become a critical innovation to adequately exploit the expanded accessibility of diverse, heterogeneous and distributed data sources. Over the years experts have acquired different procedures and used different equipment to implement multi-operator systems for their difficult areas. As the specialist grows in understanding of these self-contained multi-specialist systems, more salient points are integrated to improve their presentation, then the upgraded systems can be used for increasingly complex application areas.

Intelligent Programming Specialist is an independent PC program, which collaborates and assists end clients in specific PC related activities. In any expert, there is always a certain level of knowledge. Multi-agent systems are total operators, whose purpose is to decompose the huge system into a few smaller systems that provide and organize each other and can expand without any problems. People spend more of their valuable time at work, school, shopping and social events, as well as dealing with traffic lights. Ambulances and emergency response vehicles (police, fire services, etc.) are stuck in terrible logjams. On major roads, traffic is always heavy in all directions before, during or after work hours. It causes traffic jams. Due to all this we decided to implement a system which using remotely controlled traffic signal for emergency vehicle.

Flow Chart

The working flow of the system has been shown below.

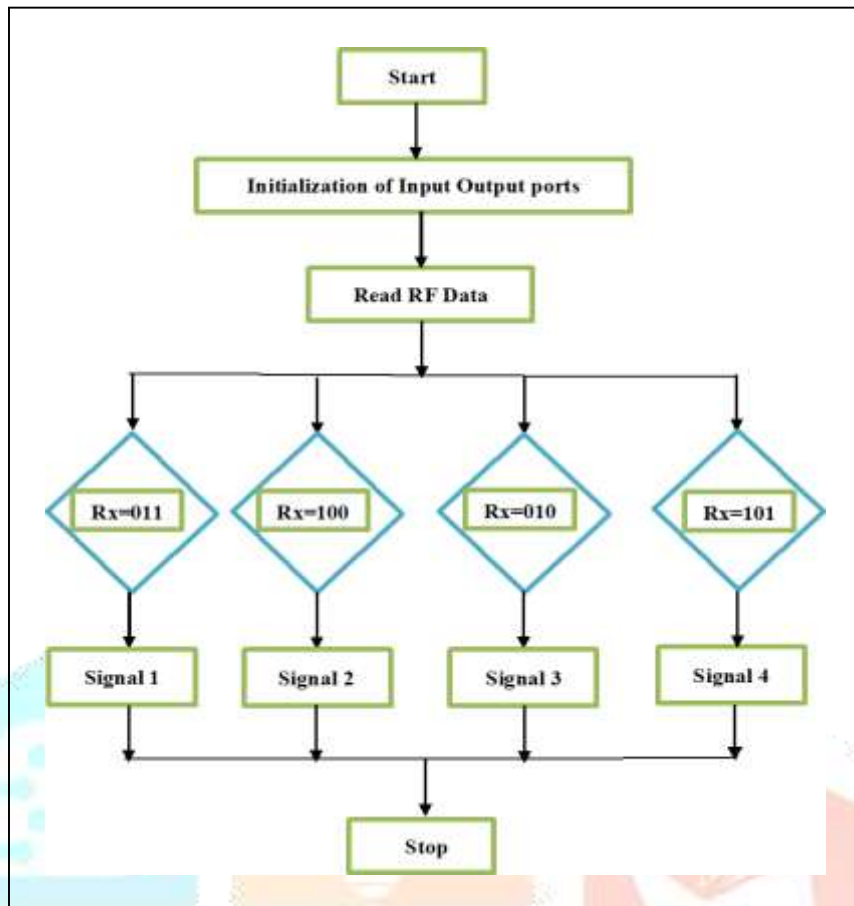


Fig. Flow Chart

Working Principle

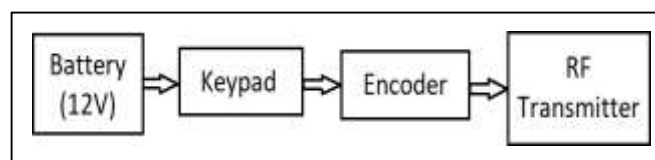
The main motive of this project is use solar energy with remote facilities in power density based traffic control system. Since solar energy is a major renewable source and is non-polluting, this energy is sought to be used in traffic control systems. Photovoltaic systems are used to continuously power the system. This system has 2 sections. One is the junction node and the other is the vehicle section. The signal timing is automatically changed after sensing the traffic density at the junction through IR interference method in normal timing. But in case of any emergency Ambulance, fire brigade etc....preferably required vehicle is prepared with RF remote control unit and override the set time by providing immediate green signal in desired direction by blocking other lane through red signal. High traffic density on one side of the junction demands more green time than the specific allocated time. The proposed traffic control system using Arduino Uno (Atmega328p) interfaces properly with photo sensors, automatically modifies junction timings to accommodate vehicular movement smoothly to avoid unnecessary waiting time at junctions. The vehicular density is measured in three zones, i.e. low traffic area, medium traffic area, and high traffic area, based on which timings are decided accordingly. In this the unit is activated using the override feature web camera. The on board RF transmitter operated from the emergency vehicle provides high priority for all emergency vehicles.

System Implementation

Basically, we are building a model that is ready to eliminate traffic due to red light delays. For this we will use certain sensors on each side. Here we can use 2 or 3 sensors on each road. We can also count the number of vehicles from the sensor. Similarly we can know the separation up to which line of vehicles. Different examples of good paths from stop lines to traffic can be taken and can have different results. The delay is balanced according to the length of the traffic. We are developing a smart traffic light control system that will reduce traffic congestion and also clear the way for emergency and VIP vehicles without disturbing other vehicles on the road. For this purpose microcontroller is used in this work and IR transmitter and beneficiary.

These are two commonly important equipment sections in this enterprise. Basically here we are building a little model so red, green and yellow LED is used. Then we can take hardware part by circuit. An embedded system is developed which includes a microcontroller, IR transmitter and receiver, LED. The project is implemented by placing IR transmitters, receivers and LEDs at the 4th junction, the four paths are denoted as R1, R2, R3 and R4. IR transmitters can be scaled up or down as per our desire or desire to know traffic density. A block wise representation of the system is shown below.

At Vehicle



At Junction

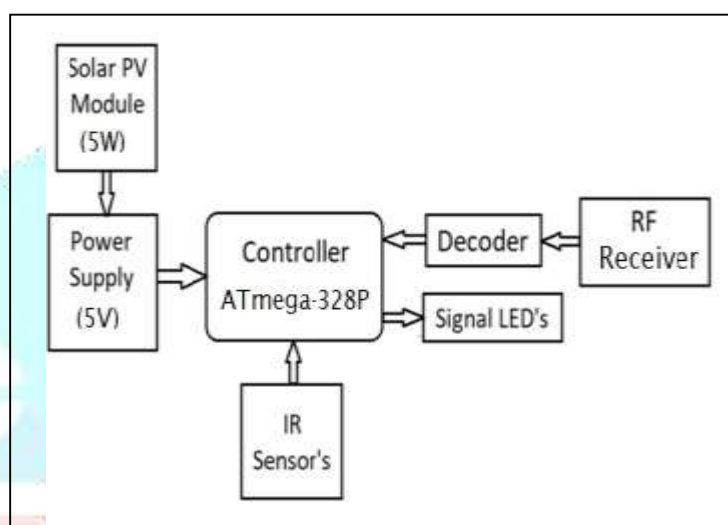


Fig. Block Diagram

Hardware Implementation

In this section, we have to discuss the hardware used in this project.

ATmega-328P

This is the component of the whole process. This microcontroller comes under AT Mega Microcontroller. It has chip ROM which is in flash memory format. Flash memory can be erased after some time which provides faster processing. We are choosing this microcontroller ATmega because of its ease of programming, sufficient many input output lines, arrange able size of RAM and ROM and easy architecture. System programs and application programs are stored using RAM and ROM.

Solar Panel

A solar power supply unit consists of solar cells connected in parallel or series to generate DC power with desired parameters. The charge controller/DC-DC converter device is a two in one component it's a mainly two functions. This device protects the battery from overcharging and deep discharging, which is very important to protect the battery and to increase its life span. It basically takes voltage supplied by solar panel and drops it down to 12 Volts and supplies both battery and the light panel. This is mainly because the solar panel output may vary up to 25V which can result in damage of the circuit components.

Voltage Regulator 7805

It is the member of the 78xx series of voltage regulator ICs. It is a fixed linear voltage regulator. The xx represents the value of the fixed output voltage in 78xx specific IC provides. It's a +5v DC power supply for 7805 IC.

Features-

Output Current up to 1A.

Output Voltages of 5-12V.

Thermal Overload Protection.

Short Circuit Protection.

Output Transistor Safe Operating Area Protection

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Keypad

A keypad is a set of buttons arranged in blocks or "pads" that usually contain numbers, symbols, and usually a full set of alphabetic letters. If it contains mostly numbers, it can also be called a numeric keypad. on many alphanumeric keyboards and on other devices keypads are mount, such as calculators, push-button telephones, combination locks, and digital door locks, that require primarily numeric input.

IR Sensor

The IR sensor use to detect the vehicle and also used to calculate the traffic density at the junction. In the infrared spectrum, the thermal radiation is emitted by all objects. Infrared is a type of radiation that is invisible to the human eye.

Advantages

Interfacing is easy

Readymade present in market working

The basic idea is to use IR LEDs to send infrared waves to an object. Another IR diode of the same type is used to detect the reflected wave from the object. For example, when a vehicle approaches a junction, a sensor detects the vehicle and increments a counter on the microcontroller. The signal generated from the sensor will be applied to the input switching circuit. These input signals generated from the sensors will be in the form of digital signals indicating the presence or absence of the vehicle. The digital signals of sensors from each road will be send to the input port of the microcontroller, where the microcontroller will determine the length of the vehicle on each road and measure the length of each road and decide on which road the signal will flash. This information is input to the microcontroller to determine the various timing signals where the on and off times of the four junctions will be measured by the microcontroller.

RF Technology

It is a compact electronic device used to send or receive radio signals between two devices. This wireless communication can be done through optical communication or radio-frequency (RF) communication. For most applications, the preferred medium is RF because it does not require line of sight. RF communications involve a transmitter and a receiver. They are of various types and categories. Range of some RF modules can up to 500 feet. RF modules are typically manufactured using RF CMOS technology.

RF modules are less used in electronic design because the critical of designing radio circuitry. Good electronic radio design is extremely complex due to the sensitivity of radio circuits and the precision of components and layouts required to achieve operation at specific frequencies 65. Additionally, a reliable RF communication circuit requires careful monitoring of the manufacturing process to ensure that RF performance is not adversely affected. Finally, radio circuits are generally subject to limits on radiated emissions and require conformation testing and approval using a standards organizations such as ETSI or the U.S. Federal Communications Commission (FCC). For these reasons, design engineers often design a circuit for an application that requires radio communication and then "drop in" a prefabricated radio module instead of attempting a different design, saving development time and money.

Conclusion

In this project, we successfully developed and implemented a sensor-based technology for traffic control. Our intelligent traffic light control system accurately determines the density of vehicles and adjusts the delay of traffic signals accordingly. The system was developed using both physical hardware and software. Our result demonstrate that our system is a powerful solution to enhance existing traffic control systems with new intelligent traffic light controllers.

Our project consisted of two major phases. The first phase involved the blinking of traffic signal lights based on the current traffic level on the road. The second phase focused on managing traffic in emergency situations, such as for ambulance or fire bridge vehicles. The proposed system has a wider future scope, as it can provide information to traffic police about traffic violations during overrides at junctions.

We calculated delays for green, red, yellow, and cycle length, which are crucial parameters for designing a proper traffic light control system. By adjusting the sensor and delay according to the density, our proposed model is useful in eliminating traffic jams at traffic lights and allowing emergency vehicles to pass through without waiting for the green light. Overall, our project is a significant step towards improving traffic control and reducing congestion on roads.

References

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