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DENSITY BASED TRAFFIC SIGNAL CONTROLLING USING ARDUNIO

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Abstract: Congestion is a serious issue due to vehicular traffic. One of the known cause of traffic congestion is the amount of time spend waiting for the red light to change green. The changing of traffic light is hard coded and it is not reliant on traffic volume. There is therefore need to simulate and optimize traffic control to better accommodate density based traffic rather than time based. This system attempts to lessen possibilities of traffic jams brought about by traffic lights to a reasonable degree. This project, a density based traffic control system is been implemented to solve this problem. The system entails programming an Arduino using Arduino access to the road by selecting the lane with the high number of vehicles. The traffic lights are modified to chip away at an auspicious premise until there is a signal identified by the infrared sensors. The sensor identified an object (i.e. a car, a motor cycle etc.) and signals the Arduino to control the traffic lights for its individual path. Once there is o sign identified by any of the four sensors the traffic lights keep on delaying with an auspicious premise. The mean response time of the sensor was found to be 0.39 seconds. Further research is recommended to produce the device on a large scale to be deployed to all roads in the country.

KEYWORDS: - Traffic, Arduino, IR sensor, LED's

I. INTRODUCTION

In the present day world, with growing technologies and adverse development in the metropolitan cities, traffic administration has become one of the most important fields to be dealt with. The main role of a traffic administration is to constantly improve the traffic control system and effectively regulate the same. With the number of vehicle users constantly increasing, the facility provided by the current system is limited and inefficient with respect to the energy and time consumed. A survey shows that an average person spends about four to six months of his/her entire life just waiting for the green light to be turned ON at a signal. It is also been identified that this inadequate facility and irrational distribution of signal control is leading to such traffic issues. These inefficient traffic control system is also contributing to various traffic violation wherein the people don't possess the patience to wait for that interval of the signal which does not have much vehicle density than the other existing densities. Avoiding conditions of extreme traffic jams is highly important in the current situation. Hence in this proposed system of traffic control, we focus on the traffic density rather than just giving control to the signals on a fixed time basis. This proposed in based on vehicle detection by IR sensors, analysation and computation of the scenarios by the Ardunio UNO and the same gives the control depending on the control time in the code to the LED's. On a whole, this system senses the presence of the vehicle in that given lane and suitably gives control to the signals. Operational Model: - The model works on the principle of changing delay of Traffic signals based on the number of cars passing through an assigned section of the road. There are four sensors placed at four sides of a four way road which counts the number of cars passing by the area covered by the sensors.

II. THEORY

A. PROPOSED MODEL REVIEW:

Here we are using IR sensors replacing system to design an intelligent traffic control system. IR sensor contains IR transmitter IR receiver (photodiode) in itself. These IR transmitter and IR receiver will be mounted on same sides of the road at a particular distance. As the vehicle passes through these IR sensors, the IR sensor will Detect the vehicle & will send the information to the microcontroller. The microcontroller will count the number of vehicles, and prognosing time to LED according to the density of vehicles. If the density is higher, LED will glow for higher time than average or vice versa. The traffic lights are initially running at a fixed delay of 5 seconds, which in turn produces a delay of 20 seconds in the entire process. This entire embedded system is placed at that junction. Microcontroller is interfaced with led's and IR sensors .The total no of IR sensors required are 4 and Led's 12Therefore these are connected to any two ports of microcontroller. An IR transmitter and receiver pair, infrared sensor is used. The output voltage according to distance from an object comparator with a reference set. The reference is set by a variable resistance according to required range of sensing.

Components used:-

A. Ardunio UNO

Ardunio is an open source hardware based on the microcontroller Atmel ATmega328P. ATmega328P is an 8bit microcontroller based on the Reduced Instruction Set Computer (RISC) with an operational speed of 20 million instructions per second (MIPS) when operated at a 20MHz. It is also equipped with various other features which can be conveniently categorized into the various systems namely: memory system, port system, timer system, analog-to-digital converter (ADC), interrupt system and serial communication. Below is the detailed information of these various systems.

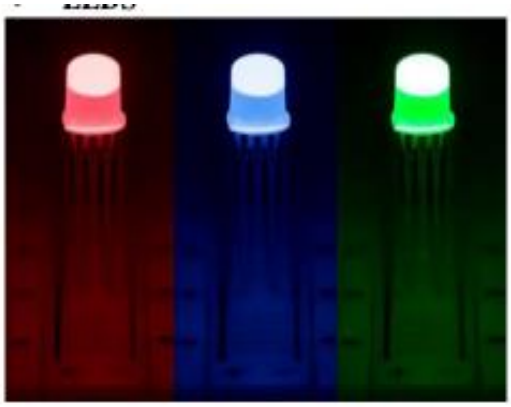
- 32 K byte, ISP programmable flash
- 1 K byte, byte addressable EEPROM
- 2 K byte RAM
- Port system
- 14 digital I/O pins (6 provide Pulse wave
- Modulation [PWM])
- 6 analog I/O pins
- Timer system
- Two 8 bit-timer/counter
- One 16 bit-timer/counter
- Six PWM channels
- Analog-to-digital converter
- 6 channel 10-bit ADC (PDIP)
- Interrupt system
- 26 total interrupts
- 2 external pin interrupts
- Serial communication
- Serial USART
- Serial peripheral interface
- Two wire interface (TWI)

B. IR SENSORS

IR proximity sensor is an electronic instrument which comprises of an IR light emitting diode, an IR photodiode, an op-amp (as comparator), couple of resistors (including a variable resister) and capacitors whose basic operation is to detect the presence of any kind of object or obstacle in the vicinity of the sensor within the particular range. In this particular type of IR sensor module used in the project, IC LM 393 op-amp is used as comparator. When the IR receiver does not detect any of the signals from the IR LED, thepotentialattheinvertinginput of the comparator will be higher than that corresponding to the non-inverting terminal. Hence the resulting output of the comparator becomes low. On the other hand, if the IR receiver detects some signals which are sent back

after encountering an obstacle/object, the potential at the inverting terminal will be low than the non-inverting terminal. Hence the output of the comparator will be high. This voltage level of the comparator is used in arriving at the conclusion of whether the object is present or not. The variable resistor connected helps in changing the sensitivity of the IR sensor module

C. LED's

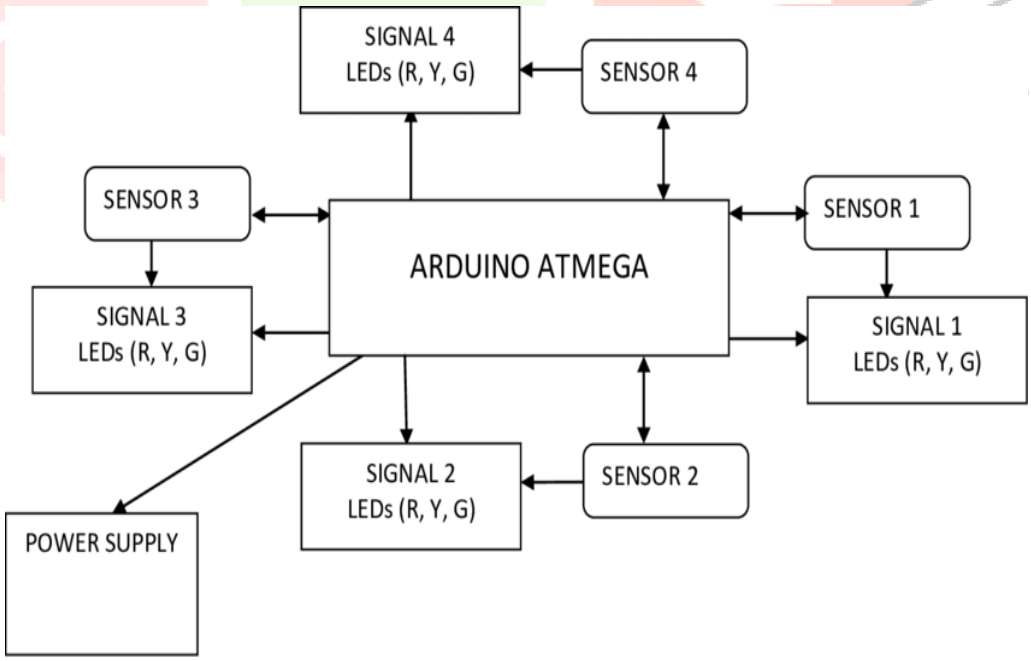


LED is an active electronic device, comparable to a general purpose diode except for its ability to emit light with different wavelengths. When a suitable potential difference is applied across its terminals, electrons recombine with the holes within the device thereby releasing the energy in the form of photons. This phenomenon is known as electroluminescence.
Following are the specific semiconductor combination employed for obtaining a LED emitting radiation of characteristic wavelength:
1. Gallium Arsenide (GaAs) – Infrared light
2. Gallium-Arsenide-Phosphorous (GaAsP) – yellow/red light
3. Gallium-Phosphorous (GaP) – green light

D. RESISTORS

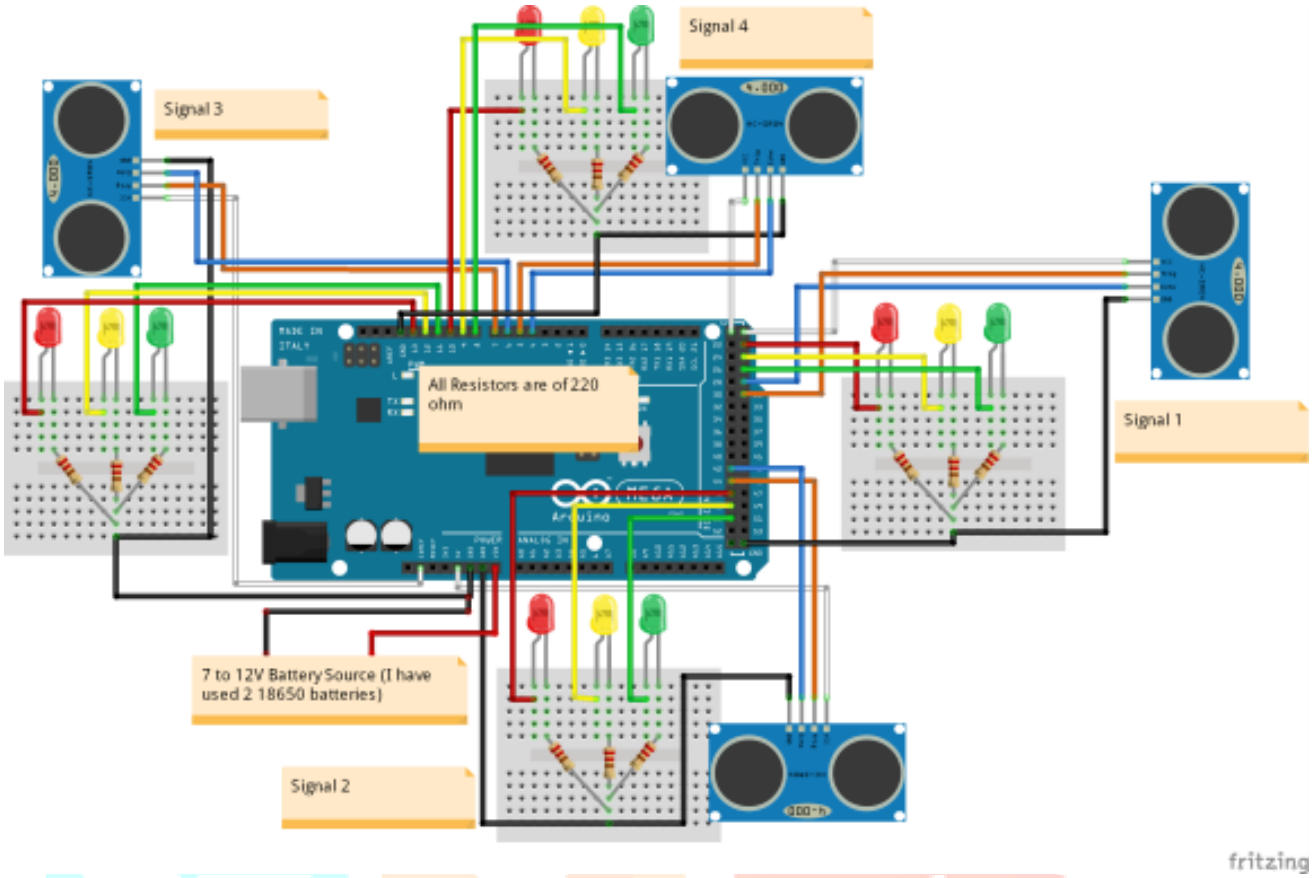
Resistor are basically used as current limiters for LED's in order to prevent damage of the LED's due to high current.

E. BLOCK DIAGRAM



The circuit design involves an IR sensors being placed at the left side of each of the four roads in a '+' type junction. These identify the presence of vehicle in that road of the junction. When the IR signals from them are obstructed by a vehicle, the output of the sensors go high and thereby indicate the same to the Ardunio UNO. Based on as how many roads have vehicle density out of the four roads, the signals are turned ON. The Ardunio UNO is either powered by a power bank or using a laptop which is used to upload the code as well. The coding is done in Ardunio IDE platform using C/C++ language. The IR sensors are powered using the voltage ranges i.e. 5V and 3.3V available in the Ardunio board. The analog outputs of the IR sensors are connected to the analog pins of the Ardunio UNO. The code is written so as to set a value to the variable holding the analog value. If the analog value is well above a threshold value, then the variable is set to 1; else to 0. Here the code for turning ON or OFF of a particular signal is written in the form of functions. Depending on whether the variable is 0 or 1, a particular set of functions are called by the code and executed. The entire execution is in the form of a loop which continuously checks for the presence of the vehicle density in any of the roads in that junction. If detected, the green signal is turned on for a period of 10000ms.

F. CIRCUIT DIAGRAM:-



Three sets of LEDs viz Green, Yellow and Red are used to indicate the GO state, Ready to Go state and WAIT state. This change of events from LOW to HIGH indicating passing of a vehicle. The objective of the IR sensor is to detect obstacles. It comprises an emitter (IR LED), detector (IR photodiode) and ancillary circuitry. The stronger the reception of IR radiation source, greater is the output voltage. Amp LM324 for the comparator operation where Vin is compared against V ref with no feedback resistance and very high gain. Here +Vcc is Vcc is connected to Ground and as digital HIGH or LOW for the amp Comparator Circuit When Vin is found lesser than V ref (Vin<V ref), the output of the comparator produces a LOW signal and when Vin is greater than V ref (Vin > V Ref), the comparator output produces a HIGH. Three sets of LEDs viz Green, Yellow and Red are used state, ready to Go state and WAIT The LEDs G (green), Y (yellow) and R (red) glow following sequence .

- G1-Y2-R3-R4
- G2-Y3-R4-R1
- G3-Y4-R1-R2
- G4-Y1-R2-R3

Therefore G1 and Y2 are connected to same ports similarly G2-Y3, G3-Y4, G4-Y1. The Red LEDs are connected to separate ports and glows according to the logic given in the Program.

G. RESULT:-

1. When there is vehicle density present in all the four roads of the junction, then the signal functionalizes normally, similar to the existing system.
2. When there an absence of vehicle density in one or more roads but present in at least one road, then the signal for green light skips that particular road with no vehicle density and moves forward with the ones with density present.
3. When no vehicle density is recoded in any of the roads at the junction, the yellows light is triggered in all of the signals with time delay of 800ms which gives a blinking effect in the signals.

III. CONCLUSION

There is exigent need of efficient traffic management system in our country, as India meets with 384 road accidents every day. To reduce this congestion and unwanted time delay in traffic an advanced system is designed here in this project. With field application of this technology, the maddening chaos of traffic can be effectively channelized by distributing the time slots based on the merit of the vehicle load in certain lanes of multi junction crossing. We have successfully implemented the prototype at laboratory scale with remarkable outcome. The next step forward is to implement this schema is real life scenario for first hand results, before implementing it on the largest scale. We believe that this may bring a revolutionary change in traffic management system on its application in actual field environment.

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