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Density Based Traffic Congestion Control Using IR Sensors on Each Lane

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Department of ECE, AVN Institute of Engineering & Technology, Hyderabad, India*Abstract* - **Traffic congestion is a severe problem in most of the cities across the world and it has become a nightmare for the citizens. It is caused by delay in signal, inappropriate timing of traffic signaling etc. The delay of traffic light is hard coded and it does not depend on traffic. Therefore, for optimizing traffic control, there is an increasing demand in systematic quick automatic system. This paper is designed to develop a density based dynamic traffic signal control. The signal timing changes automatically on sensing the traffic density at the junction. The microcontroller used in this project is ARDUINO. The system contains IR sensors (transmitter and receiver) which will be mounted on the either side of the road on poles. It gets activated and receives the signal as the vehicles passes close by it.**

Keyword - **Traffic signals, Arduino, IR sensors, LEDs, AT mega 328P, USB etc**.

I. INTRODUCTION

Mostly cities, traffic is becoming a prime problem for day to day life. So, lots oftechniques are taken into concern to subdue the traffic. We have also presented our technicality by designing the density- based traffic signal system using Arduino Uno AT Mega 328P. For the same at first, we have considered four IR sensors, eight LED's, eight 220 ohms resistors and one Arduino Uno which acts as the microcontroller. Here he IR sensors are used to measure the traffic density i.e., the number of vehicles are counted that are passing through the each IR sensor whichis called as traffic density and the four IR sensors are interfaced with the Arduino Uno. The Arduino Uno has 28 pin configurations and also consists of 14 digital I/O pins, six analog inputs, 16hmz crystal, USB connection, power jack, ICSP header, reset button. Here three different color light emitting diode i.e. red, yellow and green are applied, accordingly to the traffic conditions.

II. SYSTEM CONFIGURATION

Every embedded system consists of custom-built hardware built around a Central Processing Unit (CPU). This hardware also contains memory chips onto which the software is loaded. The software residing on the memory chip is also called the 'firmware'. The embedded system architecture can be represented as a layered architecture as shown in Fig. The operating system runs above the hardware, and the application software runs above the operating system. The same architecture is applicable to any computer including a desktop computer. However, there are significant differences. It is not compulsory to have an operating system in every embedded system. For small appliances such as remote control units, air conditioners, toys etc., there is no need for an operating system and you can write only the software specific to that application. For applications involving complex processing, it is advisable to have an operating system. In such a case, you need to integrate the application software with the operating system and then transferthe entire software on to the memory chip. Once the software is transferred to the memory chip, the software will continue to run for a long time you don't need to reload new software.

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Now, let us see the details of the various building blocks of the hardware of an embedded system the building blocks are :Memory (ROM&RAM), Input Devices, Communication interface, Application specific supply.

III. DESIGN OF THE PROPOSEDSYSTEM

A. Regulated Power Supply

The power supply section is the section which provide +5V for the components to work. IC LM7805 is used for providing a constant power of +5V.The ac voltage, typically 220V, is connected to a transformer, which steps down that ac voltage down to the level of the desired dc output. A diode rectifier then provides a full-wave rectified voltage that is initially filtered by a simple capacitor filter to produce a dc voltage. This resulting dc voltage usually has some ripple or ac voltage variation. A regulator circuit removes the ripples and also retains thesame dc value even if the input dc voltage varies, or the load connected to the output dc voltage changes. This voltage regulation is usually obtained using one of the popular voltage regulator IC units. The Arduino Nano can be powered via the Mini- B USB connection, 6 -20V unregulated external power supply (pin 30), or 5V regulated external power supply(pin 27). The power source is automatically selected to the highest voltage source.

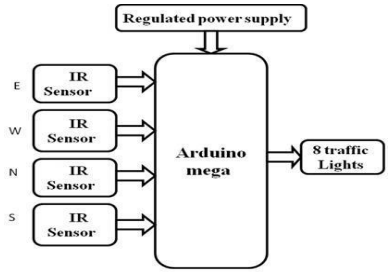

Figure 1 Regulated Power supply

B. Arduino Board

The Arduino Nano is a small, complete, and breadboard-friendly board based on the ATmega328P (Arduino Nano 3.x). It has more or less the same functionality of the Arduino Duemilanove, but in a different package. It lacks only a DC power jack, and works with a Mini- B USB cable instead of a standard one. The Nano board is the first in a series of USB Arduino boards, and the reference model for the Arduino platform; for an extensive list of current, past or outdated boards see the Arduino index of boards.

C. IR SENSOR

Infrared (IR) light is electromagnetic radiation with a wavelength longer than that of visible light, starting from the nominal edge of visible red light at 0.7micro meters, and extending conventionally to 300 micro meters. These wavelengths correspond to a frequency range of approximately 430 to 1 THz, and include most of the thermal radiationemitted by objects near room temperature. Microscopically, IR light is typically emitted or absorbed by molecules when they change their rotational-vibrationmovements.

D. LED

Led indicators have a life of at least ten years and consume 90 per cent less power than conventional indicators. Depending on the type of the materials (Ga,As,p) led will gives the output in different colors (red, Yellow, green etc..)LED's emitted low-intensity red light, but modern versions are available across the visible,ultraviolet and infrared wavelengths, with very high brightness. LED's are used as indicator lamps in many devices, and are increasingly used for lighting. Introduced as a practical electronic component

E. PIN DESCRIPTION

Arduino Nano Pinout contains 14 digital pins, 8 analog Pins, 2 Reset Pins & 6 Power Pins.Each of these Digital & Analog Pins are assigned with multiple functions but their main

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function is to be configured as input or output.They are acted as input pins when they are interfaced with sensors, but if you are driving some load then use them as output.

Functions like pinMode() and digitalWrite() are used to control theoperations of digital pins while analogRead() is used to control analog pins. The analog pins come with a total resolution of 10bits which measure the value from zero to 5V. Arduino Nano comes with a crystal oscillator of frequency 16 MHz. It is used to produce a clock of precise frequency using constant voltage. There is one limitation using Arduino Nano i.e. it doesn't come with DCpower jack, means you can not supply external power source through a battery. This board doesn't use standard USB for connection with a computer, instead, it comes with Mini USB support. Tiny size and breadboard friendly nature make this device an ideal choice for most of the applications where a size of the electronic components are of great concern. Flash memory is 16KB or 32KB that all dependson the Atmega board i.e Atmega168 comeswith 16KB of flash memory while Atmega328 comes with a flash memory of 32KB. Flash memory is used for storing code. The 2KB of memory out of total flash memory is used for a bootloader. TheSRAM can vary from 1KB or 2KB and EEPROM is 512 bytes or 1KB for Atmega168 and Atmega328 respectively. This board is quite similar to other Arduino boards available in the market, but the small size makes this board stand out from others.It is programmed using Arduino IDE which is an Integrated Development Environment that runs both offline and online. No prior arrangements are required to run the board. All you need is board, mini USB cable and Arduino IDE software installed on the computer. USB cable is used to transfer the program from computer to the board. No separate burner is required to compile and burn the program as this board comes with a built- in boot-loader. Each pin on the Nano boardcomes with a specific function associated with it. We can see the analog pins that canbe used as an analog to digital converter where A4 and A5 pins can also be used for I2C communication. Similarly, there are 14 digital pins, out of which 6 pins areused for generating PWM. 3.3V: This is a minimum voltage generated by the voltage regulator on the board. GND: These are the ground pins on the board. There are multiple ground pins on the board that can be interfaced accordingly when more than one ground pin is required. Reset: Reset pin is added on the board that resets the board. It is very helpful when running program goes too complex and hangs up the board. LOW value to the reset pin will reset the controller. Analog Pins: There are8 analog pins on the board marked as A0 –A7. These pins are used to measure the analog voltage ranging between 0 t 5V. Rx, Tx: These pins are used for serial communication where Tx represents the transmission of data while Rx represents the data receiver13: This pin is used to turnon the built-in LED. AREF: This pin is used as a reference voltage for the input voltage. PWM: Six pins 3,5,6,9,10, 11 can be used for providing 8-pit PWM (Pulse Width Modulation) output. It is a method used for getting analog results with digital sources. SPI: Four pins10 (SS), 11(MOSI), 12(MISO), 13 (SCK) are used for SPI (Serial Peripheral Interface). SPI is an interface bus and mainly used to transfer data between microcontrollers and other peripherals like sensors, registers, and SD card. External Interrupts: Pin 2 and 3 are used as external interrupts which are used in case of emergency when we need tostop the main program and call important instructions at that point. The main program resumes once interrupt instruction is called and executed I2C: I2C communication is developed using A4 and A5 pins where A4 represents the serial data line (SDA) which carries the data and A5 represents the serial clock line (SCL) which is a clock signal, generated by the master device, used for data synchronization

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between the devices on anI2C bus. RESET: There are two ways to reset the board i.e. electronically or programmatically.In order to reset the board electronically, you need to connect the reset pin of the board with any of digital pins on the controller. Don't forget to add 1K or 2K Ohm resistor whilesetting up this connection. Now, use the digital pin as an output and keep it HIGH before the reset. Once the reset is required,set this digital pin to LOW. This method is very useful because using it sends a hardware reset signal to the controller once the digital pin is set to LOW. You can use the following program to reset the controller electronically. Another method we can use to reset the board is by software only without using any hardware pin. Nano board comes with a built-in function known as reset Func (). The board will reset automatically as we define this function and then call it. Without using any hardware pin you can upload the following program to reset the board programmatically. However, this method comes with some limitations. Once the board is connected to the computer, the board will be reset each time the connection is laid out between the board and the computer. So, it is preferred toreset the controller electronically using a digital pin

IV. WORKING METHOD

Arduino Mega2560 has a number of facilities for communicating with a computer, another Arduino, or other microcontrollers. The ATmega2560 provides four hardware UARTs for TTL (5V) serial communication. An ATmega8U2 on the board channels one of these over USB and provides a virtual com port to software on the computer (Windows machines will need a .inf file, but OSX and Linux machines will recognize the board as a COM port automatically. The Arduino software includes a serial monitor which allows simple textual data to be sent to and from the board. The RX and TX LEDs on the board will flash when data is being transmitted via the ATmega8U2 chip and USB connection to the computer (but not for serial communication on pins 0 and 1).

V.APPLICATIONS

Arduino Nano is a very useful device that comes with a wide range of applications and covers less space as compared to other Arduino board. Breadboard friendly naturemakes it stand out from other board. Following are the main applications of the board. Arduino Metal Detector, Medical Instruments, Industrial Automation ,Android Applications, GSM Based Projects, Automation and Robotics, Home Automation and Defense Systems, Virtual Reality Applications

VI. CONCLUSION AND FUTURE SCOPE

The density based traffic control systemhas been designed, constructed and tested to ensure validation of its function and operations. In this research, we have succeeded in minimizing the traffic congestions created by the fixed time based traffic light system. The system is effective and the cost of production is very low. Future work is recommended in order to produce the device on a large scale and deploy to all roads in order to reduce traffic congestion in places like Lagos where traffic

congestion has become a big issue.

VII. ACKNOWLEDGMENT

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