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Dynamic Traffic Light System

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Abstract - *one of the main issues faced in any metro city is traffic jam. Getting stranded in between significant traffic could be a headache for every and each person driving the vehicle and even to the traffic police in controlling the traffic. Traditional traffic light controllers used a fixed predetermined schedule for traffic flow for every direction within the junction. How-ever the entire idea of a fixed time traffic signal controller isn't convenient for cities wherever traffic flow is variable. For this dynamic traffic control system is required, that controls the traffic signals in line with the density of traffic. We developed a system in which we are using IR (Infrared) sensors to test the traffic density, according to that the system will set the traffic passing period dynamically. An RF Transmitter and Receiver modules are used for emergency vehicles detection that helps the system to clear the path for vehicles like ambulance, fire Brigade, etc. These operations are controlled by ATmega328p microcontroller through a special algorithm.*

Keywords: *Dynamic traffic control System, IR Sensors, RF Module, ATmega328p*

1. INTRODUCTION

Traffic lights, developed since 1912, are signalling devices that are formed to regulate the traffic flows at road intersections, pedestrian crossings, rail trains, and different locations. Traffic lights accommodates 3 varied coloured lights: the green light permits traffic to proceed within the indicated direction, the yellow light warns vehicles to prepare for slowdown, and also the red signal stops all vehicles from proceeding. The aim of this project is to resolve traffic congestion that could be a severe problem in several modern cities over the globe in efficient cost management. The present dynamic system employed in the developed country is just too much costly to install in real world. to resolve this drawback, we've designed a framework for a dynamic traffic control system and developed a simulation model that facilitate to create the system in less price for developing countries like India. Generally, every traffic signal on an intersection is appointed a constant green signal time. It's possible to propose dynamic time-based coordination wherever the green signal time of the traffic lights is allotted based on the current conditions of traffic. Each time while changing the status of signal according to our algorithm it'll automatically check for the emergency vehicles in its surrounding space which can help to indicate the alert for the usual traffic by special signal at the traffic light. This system additionally features a subsystem for emergency vehicles that uses a transmitter and receiver to clear the road for the emergency vehicle by setting the priority to that road, by that the signal set to green till vehicle passes from that junction

2. LITERATURE SURVEY

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3. EXISTING SYSTEMS

There are two kinds of systems exists:

3.1 Traditional System

Traditional traffic signal controllers used a fixed predetermined schedule for traffic flow for every direction in the junction. The controller was an electro mechanical controller that consists of mechanical systems operated electrically. It consists of three major parts- a dial timer, a solenoid and a cam assembly. A motor and a gear assembly operate the dial timer that successively are accountable to energize or de energize a solenoid which in turn operates a cam assembly which are responsible to supply current to every signal indication. The dial timer is used to supply repetition of fixed duration intervals.

3.2 Induction Loop Traffic Controller

It simply works on induction principle. Iron core (car) passing through a coil (simple wire) produces giant

inductance in comparison to air. Take a coil of wire 5 feet in diameter, containing five or six loops of wire. Cut some grooves in a road and place the coil within the grooves. Attach an inductance meter (electrical meter below) to the coil and see what the inductance of the coil is. Now park a car over the coil and check the inductance once more. The inductance will be much larger due to the large steel object positioned within the loop's magnetic field. The car parked over the coil is acting just like the core of the inductor, and its presence changes the inductance of the coil. This is often how the signals in developed countries work.

4. HARDWARE

4.1 Arduino Uno

The Arduino Uno is a microcontroller board supported the ATmega328p. It has twenty digital input/output pins (of that six will be used as PWM outputs and six will be used as analogue inputs), a sixteen MHz resonator, a USB connection, a power jack, associate in-circuit system programming (ICSP) header, and a button. It contains everything needed to support the microcontroller; just connect it to a laptop (or applicable wall power adapter) with a USB cable or power it with an AC-to-DC adapter or battery to get started. The Arduino Uno contains a variety of facilities for communication with a laptop, another Arduino, or different microcontrollers. The ATmega328p provides UART TTL (5V) serial communication, that is available on digital pins zero (RX) and one (TX). An ATmega16U2 on the board channels this serial communication over USB and looks as a virtual com port to computer code on the laptop. The '16U2firmware uses the standard USB COM drivers, and no external driver is needed. However, on Windows, a .inf file is needed. The Arduino code includes a serial monitor that allows straightforward matter information to be sent to and from the Arduino board. The RX and TX LEDs on the board will flash once information is being transmitted via the USB-to-serial chip and USB connection to the computer (but not for serial communication on pins 0 and 1).

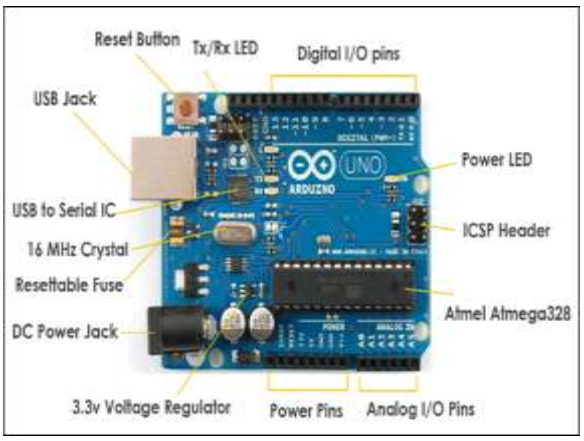

Fig. 1 – Arduino Uno

4.2 IR Sensor

An infrared sensor circuit is one of the fundamental and popular sensors in an electronic device. This device is analogous to human's visionary senses, which might be accustomed detect obstacles and it is one of the common applications in real time. The transmitter section includes an IR sensor, that transmits continuous IR rays to be received by an IR receiver module. An IR output terminal of the receiver varies depending upon its receiving of IR rays. Since this variation can't be analysed intrinsically, so this output may be fed to a comparator circuit. Here an operational amplifier is used as comparator circuit. Once the IR receiver doesn't receive a signal, the potential at the inverting input goes beyond that non-inverting input of the comparator. So, the output of the comparator goes low, however the LED doesn't glow. Once the IR receiver module receives signal to the potential at the inverting input goes low. So, the output of the comparator goes high and therefore the LED starts glowing. resistor R1 (100), R2 (10k) and R3 (330) are used to make sure that minimum 10 mA current passes through the IR LED Devices like Photodiode and traditional LEDs respectively. Resistor VR2 is used to regulate the output terminals. Resistor VR1 is used to set the sensitivity of the circuit.

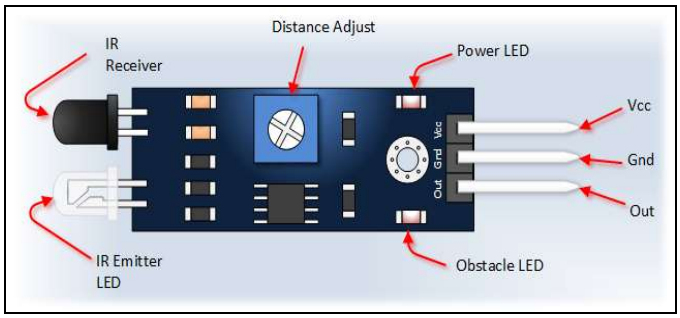

Fig. 2 – IR Sensor

4.3 RF 433 MHz Module

The RF modules are 433 MHz RF transmitter and receiver modules. The transmitter draws no power once transmitting logic zero whereas absolutely suppressing the carrier frequency thus consume considerably low power in battery operation. Once logic one is distributed carrier is totally on to about 4.5mA with a 3volts power supply. The information is sent serially from the transmitter that is received by the tuned receiver. Transmitter and also the receiver are duly interfaced to two microcontrollers for data transfer. In several projects we have a tendency to use RF modules for transmit and receive the information because it's high volume of applications than IR. RF signals travel within the transmitter and receiver even when there's an obstruction. It operates at a particular frequency of 433MHz. RF transmitter receives serial data and transmits to the receiver through an antenna that is connected to the 4thÂ pin of the transmitter. When logic 0 applied to transmitter then there's

no power supply in transmitter. When logic 1 is applied to transmitter then transmitter is ON and there's a high-power supply within the range of 4.5mA with 3V voltage supply.

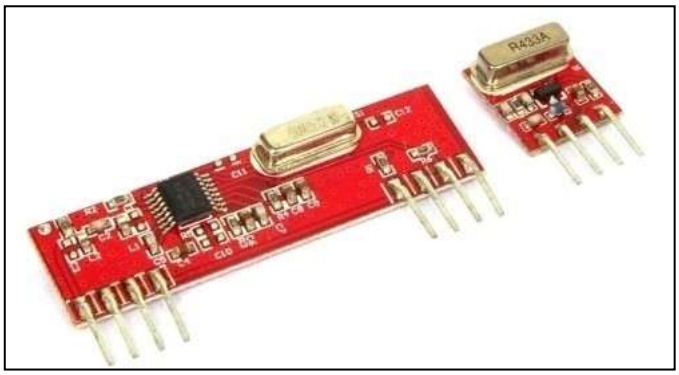

Fig. 3 – 433MHz RF Transmitter/Receiver module

5. WORKING

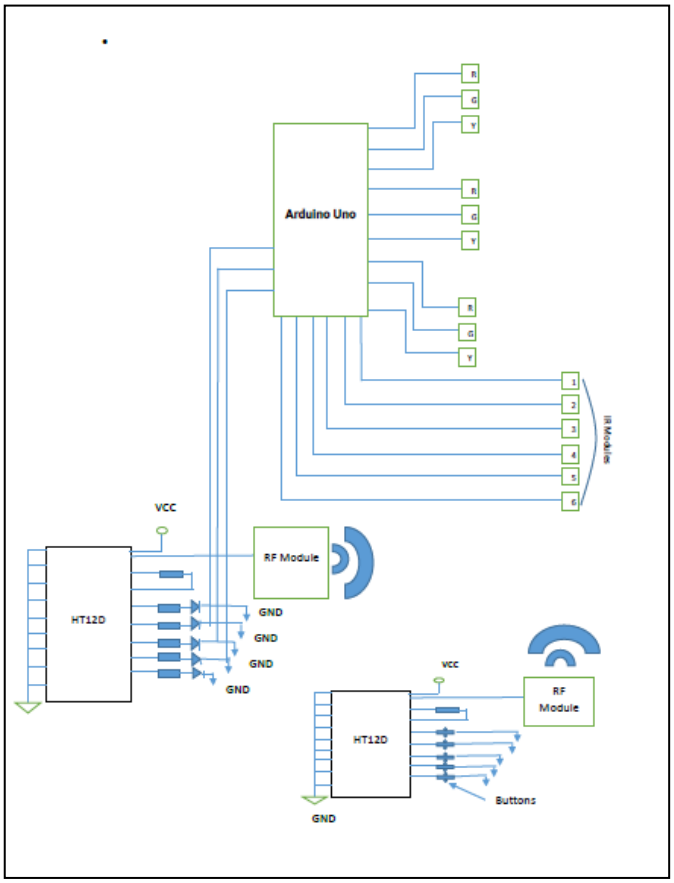

Fig. 4 – Circuit Diagram

This circuit consists of 6 IR sensors (for two completely different levels), ATmega328p microcontroller, 3 traffic lights (3 Red, 3 Yellow, 3 green LEDs). This IR transmitter continually emits IR rays from it. The operational voltage of this IR transmitter is 3 to 5v. These IR (infrared) rays are invisible to the human eye. However, we can read these IR rays through camera. IR receiver receives IR rays that are transmitted by IR transmitter. Normally IR receiver has high resistance in order of mega ohms, when it's receiving IR rays the resistance is extremely low.

We've got to put these IR pair in such a way that the first one is placed on the beginning of the road and other is placed on certain distance. Once the primary IR detects an object in front of it, the signal for that specific road turns into green for certain amount of fixed time. And if while turning the signal back to red, the system checks the second IR whether or not the vehicles are present till that point. If it detects the vehicle it instantly turns signal into green, or flip the signal back to red. This procedure can apply to all the signal. If all the roads obtaining the input for vehicles then the system organize the sequence in first come first out manner, for a particular instance. We used an RF transmitter in emergency vehicle that continuously transmits a signal, if the emergency vehicle come close to the receiver that in placed at each single signal junction it'll send the message to the receiver that the vehicle is incoming. Then the microcontroller sets the priority to that road and switch the signal green till that vehicle passes the junction then the microcontroller can resume its operation.

6. BENEFITS

[1] Advantages of the new system embrace dynamically adaptative controlled temporal order of sunshine signals and managing them to adapt to the changes within the traffic flow that interprets into low congestion at junctions.

[2] Emergency service can now not be laid low with traffic jams. Improving the protection and efficiency of each pedestrian and traffic.

[3] We will stop gratuitous traffic jams so resulting in sleek traffic flow.

[4] Over a wide range applicability.

[5] A modernised approach of controlling traffic.

[6] Simple traffic guideline in busy cities like Delhi, Mumbai etc.

[7] Facilitate the traffic police in simple management of traffic.

7. FUTURE SCOPE

In future we will add GPS module to our system for an emergency vehicle. Once emergency vehicle departs from its starting point it'll set its path for the destination on their respective GPS system. This GPS system are going to be connected to all or any light systems, by that it'll set the traffic lights to clear the road for them. As soon as the emergency vehicle approach towards the signal of about

500m it'll increase the duration of green light for 5sec, at about 250m it'll increase the length of green light for 10sec and at the 100m it will turn the signal into green no matter what are the traffic condition. In future different priorities may be given to vehicles like ambulance, fire brigade.

8. CONCLUSION

In practice presently in India we are following time-based control of traffic signals and we are experiencing a heavy traffic jams all over which in turn consumes lot of time and fuel. We hope these methods will be adopted as soon as possible so that the limitations we are experiencing with present method can be overcome. The traffic light issue is obviously a critical problem that worries citizens and governments. The influence of low efficient conventional traffic system affects the economy, health, financial, and environmental domains. The transportation system trouble and the bad monitoring may cause car accidents, traffic jam, and roads congestion that put heavy loads on businesses and works. Our Dynamic traffic light control system endeavors to contribute to the scientific society to ameliorate the existing traffic light systems and manage the flow of automobiles at the intersections by implementing innovated hardware and software design systems. The designed system is implemented, realized electronically, and tested.

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