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Design Intelligent Traffic Light Controlling System Based on LabVIEW System with Distribution Center

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Abstract

An intelligent traffic light controlling (ITLC) system based on Lab View and Distribution center has been implemented in this paper to regulate road traffic in areas where roads and infrastructures are not well established to handle a high level of traffic congestion. This is due to the fact that current traffic signals in some areas are only set up once and does not make real-time traffic-based decisions. To complete the work, a proteus, distribution center, and Lab View were used. Proteus used AVR 32 studio to configure these traffic lights to function in their regular service interrupts were also introduced. Lab VIEW was linked to Proteus so that data from the microcontroller could be collected and monitored. Protocols for reading microcontroller data were created in Lab VIEW, and a graphical user interface was also provided. We provided a graphical user interface for microcontroller interrupts which were used to make real-time traffic-driven decisions. The microcontroller was connected to Lab VIEW in order to display data on a graphical user interface and one interrupt was performed as a demonstration of how the system worked. Using the Lab VIEW graphical interface, the system was able to track the traffic lights and executed the interrupt.

Keywords: Intelligent traffic lights, Microcontroller, Distribution center, LabVIEW, Simulation.

Introduction

Traffic congestion is unquestionably a serious issue that has prompted transportation experts and decision-makers all over the world to invest in preparing and implementing solutions [1]. This is due to an increase in the number of vehicles on the road all over the world, especially in urban areas and towns, which has resulted in an increase in traffic congestion [2]. The number of vehicles and supporting roads in various areas are not proportional, and in certain areas, the traffic red light system uses a timer to keep running on the basis of a fixed time, and both cars and pedestrians must respect this set time to prevent accidents [3]. Unfortunately, the traffic red light will signal a crossing of a vehicle or pedestrian that is not present. This tends to cause significant traffic congestion during peak hours, underscoring the value of a well-functioning traffic management system in order to prevent collisions, emissions, and wasted time [4,5]. Constructing large roads with several lanes, as well as tunnels and bridges at intersections, are some of the solutions to these problems; however, this is very expensive in most areas, and it is often difficult to construct wide roads, despite the fact that the number of vehicles continues to rise. Other potential solutions to the traffic jam have been discussed in a number of articles in order to provide performance [6,7]. Apparently, Violations such as talking on the

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phone while driving cannot be identified with the current system's linked sensors. The device uses GSM technology, which causes a performance delay; however, the delay can be minimized by using faster communication modules (Bluetooth, Wi-Fi, Ethernet, antenna, and so on) over some measured distances [6].

Other good technologies that could be used to solve these problems include:

- Vehicular ad hocNetwork (VANET): VANET is used to collect traffic data by traffic controllers in order to alternate signal phases.While vehicle to vehicle contact is possible, security concerns in VANET are not well researched. As all traffic lights communicate with the traffic controller, there is an issue with latency in making decisions (i.e. large decision latency) In the worst-case scenario, the VANET device will fail if the controller and traffic lights can't communicate with each other [8,9].
- WSN and RFID: Detecting nodes are used to detect traffic by distributed nodes along the road; they are also used to detect vehicles as they reach the monitored area. Unfortunately, a large number of nodes necessitates high maintenance costs. WSN security is a difficult task; detecting nodes can be compromised, interfered with, or forged by attackers, and corrupted or forged nodes can lead to control node misinterpretation [10-12].
- Other systems are based on camcorders: Allvehicle recognition features are available, but they are too costly, and their flexibility is restricted by hardware, software, and the development environment; a high level of human interaction is also needed. Video image recognition is a difficult task; environmental factors can affect camera detection accuracy, and personal information can be compromised [13,14].

The main goal of this paper is to design a new intelligent traffic light control (ITLC) system using LabView and a distribution center to predict traffic flow on congested road intersections. It is inexpensive since it is used for development and offers many operation functions as well as the ability to pass code directly from a PC to a microcontroller.

Related Works

Traffic management systems are usually not flexible and do not adapt to the ever-increasing number of vehicles to overcome this issue, in this paper the authors with an aid of LabView and Thingpeak they have designed a Development of the Flexible Traffic Control System grouped into two levels one of low level(driver part) and the other of higher level (server part) they used LabView at the lower level of the four-tier system and ThingSpeak at the higher level along with SW Server and Cloud and storing and receiving data HTTP and MQTT Protocols. Based on the work done the collected information for optimal traffic lights switching can be provided and also the information can be employed by route planning systems in order to save time on travel and prevent traffic congestion [15]. With this system it is possible to increase the capacity of the road and reduce the concentration of harmful emissions from vehicles on certain road sections and intersections.

One of the problems faced by people today is the traffic congestion. It occurs especially in mega cities which increases noise pollution, air pollution, delay in arrival, and accidents. Traffic jams surely have impacted the lives of people severely as highlighted,in this paper a Development of an Intelligent Traffic Control System using NI LabVIEW has been used to deal with traffic congestion [16].They calculated density and Queuing analysis were then Using the measured density per junction, the time of the traffic light obtained by comparing the values between two junctions. Then, the calculated data were implemented using LabVIEW which showed the simulation per junction.using the system Queuing analysis was applied in order to compute for the arrival and service rate of all the junctions and to test if the design is possible to perform in actual road conditions.

Intelligent Traffic Monitoring System (ITMS) in have been introduced to alleviate traffic congestion. The infrastructure consists of an Internet of Things, a traffic control center, a traffic information service center, a cellular mobile communication system, and an in-vehicle terminal (GPS tracer), all of which are linked through a wireless communication network [11,17]. Through using the intelligent traffic management system, the in-vehicle terminal communicates with the traffic control center and the traffic information service center, respectively..

System Design

The overall system design for the intelligent traffic light system with distributed control center entails four subunits and its control center:

- power supply unit,
- the sensing unit,
- LED display and
- Control unit.

The power supply unit to be used is going to provide the voltage to the control unit from primary source. The implementation of the intelligent traffic light system in the Proteus software was made possible through the use of a Programmable Atmega128 which enable us to use software to achieve an adaptable and flexible solution. The figure 1 details overall design of the microcontroller for road intersection. The lanes of each intersection consist of four infrared sensors to detect the traffic (for instance a car). Three LEDs display each with a combination of GREEN and RED colors, LEDs are placed on each of the four lanes for displaying purposes. The controller was designed in such a way that it samples all the lanes in turn to detect whether

Logical signal(0/1)for i/p	Logical signal for output(colors)		
E=1110	G	R	R
D=1101	R	R	G
C=1100	R	G	G
9=1001	G	R	G
8=1000	G	G	R
0=0000	G	G	G
Where **G**: Green; **R**: Red			

Table 1: The signaling table.

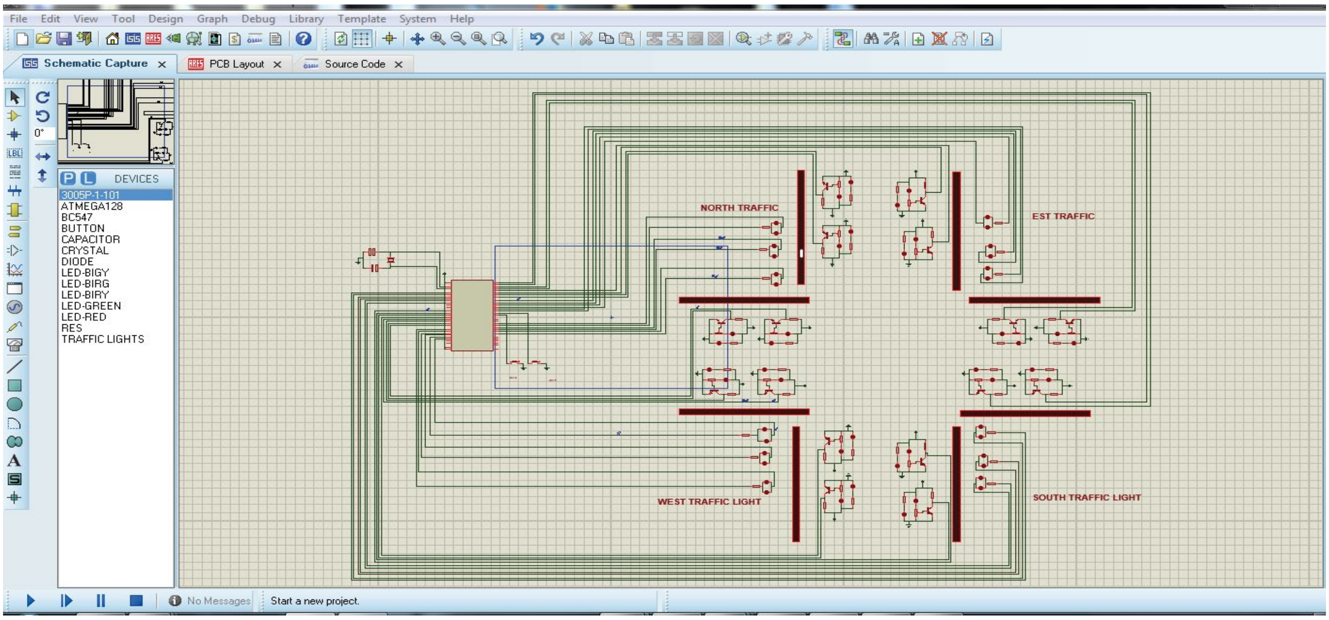


Figure 1: Design of the system for road intersection.

there is a vehicle on any lane. Once the input status from the IR sensor is low, the microcontroller coordinates the action by giving cars of the lane with high density traffic the priority move in their intended directions. Microcontroller does this by lighting the three Green LEDs of that lane and other lane will light Red. Passage immediately allowing the traffic to pass in the direction indicated by the display and indicates Red on the LED output of the two other lanes since in our system design we prefer to allow at least two lanes simultaneous that are facing each other.

If there is no low input on the lane means that there is no traffic is present. The system will keep running unless no traffic is present, the microcontroller is programmed in the way that it keeps the LED REDs ON any lane. This system is designed with the external interrupt; it is however configured in the microcontroller to disrupt the current execution of the microcontroller and starts execution of codes related to it. This will happen manually when done by the operator in the control room to let preferred traffic on any selected lane to pass the intersection. This selection will depend on which lane among the four seems to have traffic jamming than others and it is offered much time than the normal set time. In the codes we've created four interrupts each correspond to one lane and also are going to be related to the toggle buttons in the LabVIEW being used in the control room.

The system operation

This road intersection control system, which is based on sensors and a microcontroller, was created to adaptively guide the movement of vehicles meeting at a road intersection without causing a collision. This is accomplished by the use of a programmed microcontroller that sets aside time for each lane when the vehicles in that lane will travel and the vehicles in the opposite lane will stop. When the time allotted for a particular route has expired, the red light will light, signaling a halt, and the next line will light, signaling that traffic in that lane can begin moving. The RED light will turn ON when the time limit for this lane has expired. When the toggle button is pressed, the microcontroller will switch all three green lights for that lane with a fixed time delay of about one-minute set in the microcontroller, and when the timer runs out, the RED lights for that lane will turn on, while the green lights for another lane will turn green. Based on measured data or data obtained from a microcontroller, the Lab VIEW software module precisely assesses current traffic conditions. This control system is much more successful than traditional systems in terms of traffic optimization at both the local and central levels (figure 2):

- Timely response to the real traffic situation in the individual phase
- Traffic jams dissolved in a targeted fashion
- Ability to manage quickly with fluctuating traffic volumes
- The complex modification of green waves is a particular focus of ours. It is possible to significantly reduce fuel consumption and pollution, especially during morning and evening rush hour traffic.

Implementation and Results

First task and its outcomes

We started the project implementation by connecting the microcontroller Atmega128 in Proteus software to a number of different lights as shown in the figure 3 below,

We concentrated on twelve lights, each of which controls one lane. Since there are three red lights on each of the two roads for a predetermined delay, all directions are closed (two perpendicular road like west road and north road). When there is a high amount of traffic, the interrupt button

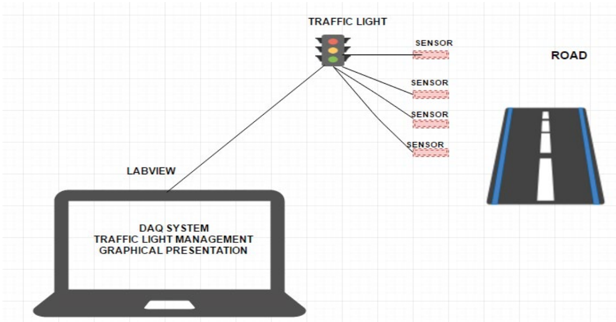
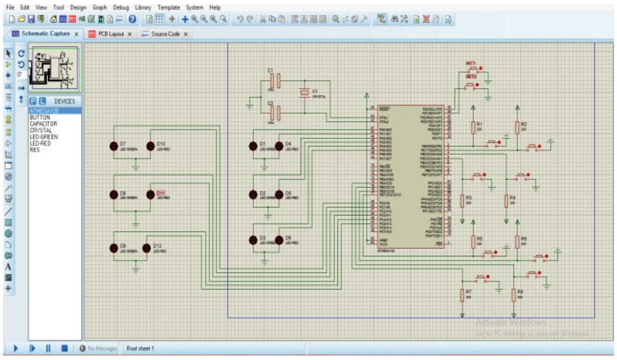
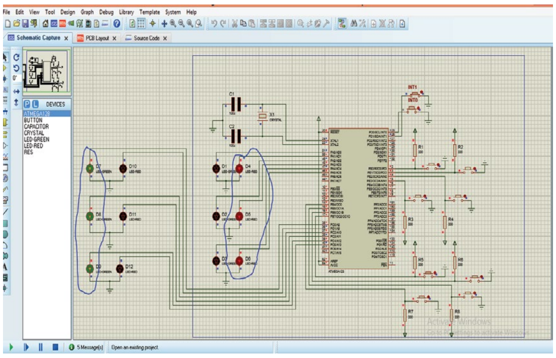


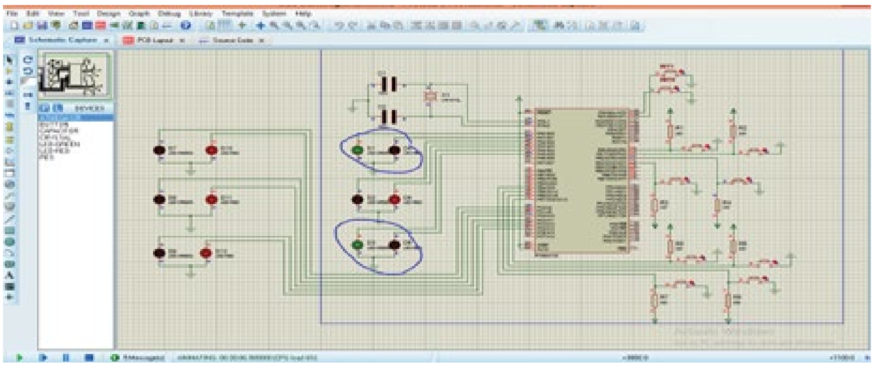
Figure 2: Intelligent traffic lights systems with a distribution center.



a)



b)



c)

Figure 3: System Design in Proteus.

INT1 can be pressed to run a code that closes one road in all three directions (lighting three red lights for the road) and opens it entirely (light three green light for the road), Figure 3c depicts a configuration in which one path is blocked and the other is open in both directions, allowing vehicles to exit the lane in just two directions with green lights. The switches are acting like road sensors in the following ways:

• To begin, one sensor serves as a transmitter, while the other serves as a receiver for real sensors. The receiver sensor can detect the signal from the transmitter even when there are no cars on the road. The receiver port will now be open (1). When there are vehicles, there is no communication between the receiver and the transmitter, resulting in a low receiver port (0).

• In the diagram above, the switches act as receiver ports. When the switch is set to OFF (Low), it means there are vehicles on the lane. There are no cars on the road while the turn is ON (high). We generated the codes to control these two lanes pathway amongst the four of whole system (Table 1).

Second task and its outcomes

Since our primary goal is to use a distribution center to monitor traffic lights, we must link our microcontroller to Lab VIEW in order to handle these lights. Lab VIEW provides a graphical user interface that will be used by the cops to monitor lights that are directly connected to the microcontroller. We developed a protocol to read data from port COM6 in LabVIEW in figure 4a which is connected

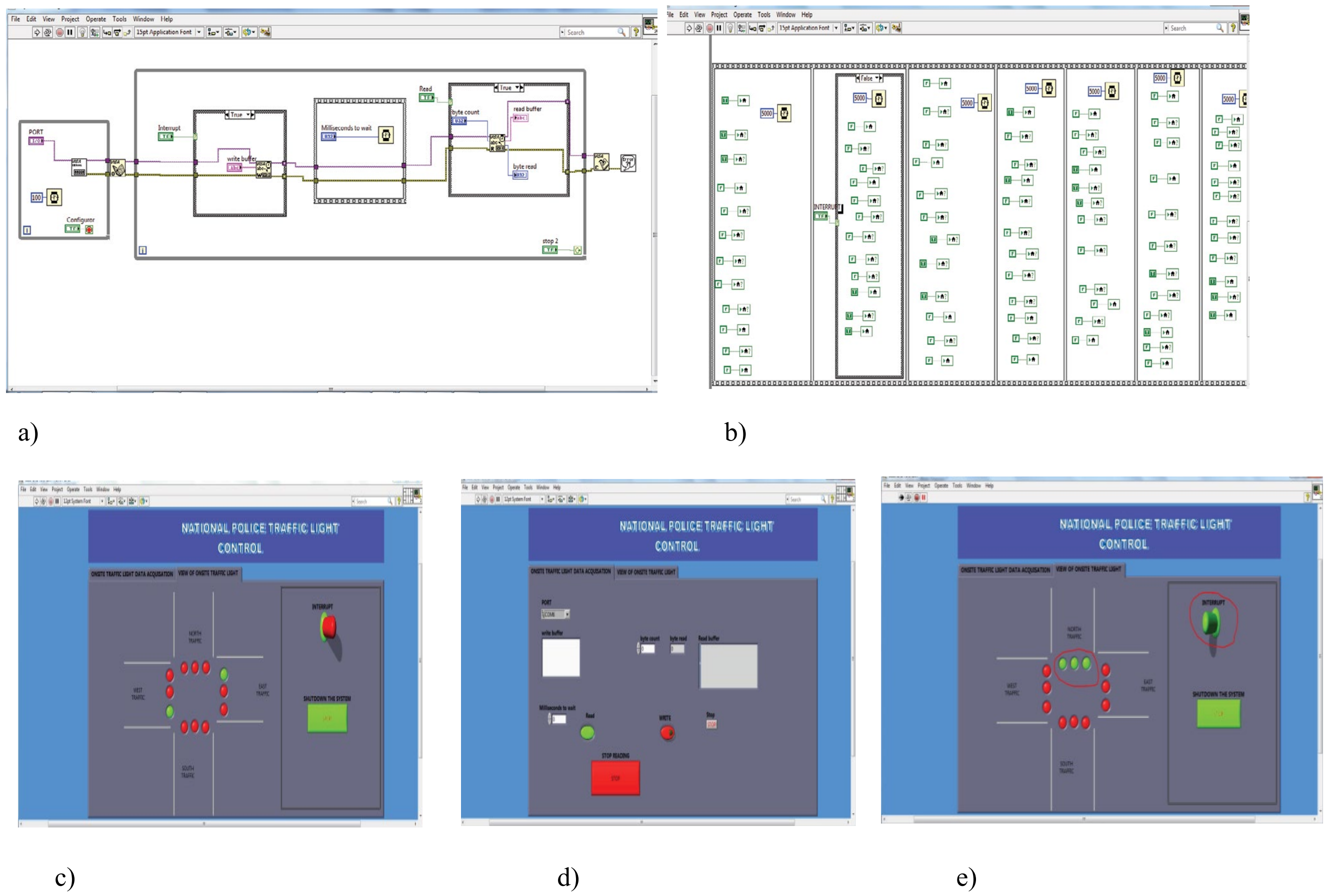


Figure 4: Graphical User Interface for panel of onsite traffic light data acquisition.

to COM3 from Proteus COMPIM, so that we will be able to interpret data from microcontroller and make some decisions like interrupts, to be able to simulate traffic lights in LabVIEW codes were developed in figure 4b so that when data will be acquired we will be able to visualize current traffic light situation and able control it through graphical interface which is shown in figure 4c, 4d and 4e.

Lab View was used to read and manage data from the microcontroller on figure 4e after the link had already been created. We used Proteus and Lab VIEW to run the simulation, which included data from the microcontroller and traffic light simulations in Lab VIEW. Eventually, the interrupt was performed, and we were able to see and track the current traffic light situation. We suggest placing the interrupt so that if the lights come from the west lane, they return to the north lane lights instead of the south lane lights during heavy traffic volumes in the north and no traffic in the south of the lane.

Conclusion

Using Lab View and a distribution center, we built a better framework for flexible traffic control. Recommendations for the best traffic light switching can be made based on the data gathered. Path planning systems may also use this knowledge to reduce folding time and avoid traffic jams. This will help to improve road capacity while also lowering the concentration of hazardous pollution from vehicles on some stretches of road and intersections.

Future Work

Over the next five months, we intend to dive deeper into this project by incorporating the internet of things and offering various devices such as cameras, wireless network-based devices, and so on.

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