Project Summary

Faculty of Engineering

American International University – Bangladesh (AIUB)

Four Way Traffic Light Controller System

Group # 04

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Four Way Traffic Light Controller System

Abstract— **Traffic management at the road intersection, which was carried out purely by human effort, appears to be unreliable due to the increasing pace of both. This inadequacy has contributed to the use of discrete solid-state electronics before the use of solid-state electronics. However, computer-operated microprocessors' intelligence was only limited to satisfying the modern era's demands. The need, therefore, for the creation of a traffic light control device based on a microcontroller. This paper discusses the architecture and implementation of traffic dependent on microcontrollers—the light device for monitoring the road's intersection. The built traffic light control system is being tested by building a prototype that resembles a real one. We used the ultrasonic Sensor to measure the traffic light's distance to make the drivers aware of their position. If they came too close to the traffic light (60cm), the Sensor would show a message through the GROVE OLED display. Thus, the other lanes vehicles will not collide with other lanes vehicle. The test functionality demonstrates that the device built can be used for real-life traffic control at the lane's intersection. Apart from that, the. The system built can be used as a training kit to design and maintain traffic light control systems.**

Index Terms— Arduino UNO. a control system, Road intersection, microcontroller, traffic light, Grove OLED.

I. INTRODUCTION

Traffic chaos is a phenomenon that has had a significant effect on the transport system in land, country. This causes many issues, particularly emergency traffic light intersections that are still busy with many vehicles. The traffic light control system is designed to solve these problems.

Traffic control lays out a series of rules and guidelines for passengers, pilots, train engineers, and ship captains to prevent crashes and other hazards. Motorists rely on traffic control systems to avoid collisions and drive safely to their homes. Traffic control systems for highway traffic include signage, warning lights, pavement markers, and many devices positioned above, close, or below the roadway.

The signal light is perhaps the most easily-recognized traffic control system. At a busy intersection in a major city, a traffic signal can monitor the movements of more than 100,000 cars every day. Less than 30% of all miles traveled by each year are on the roads operated by traffic signals. Traffic signals cars and pedestrians' natural movement where to go, halt, or continue with caution. Signals improve the traffic handling capability of most intersections. They can run individually on timers or connect to a computer-controlled device that runs over various crossroads. In a computerized machine, traffic detectors are positioned at multiple locations—usually on the pavement. This signal management helps speed up medical situations.

In comparison, cars minimize the risk of crashes at intersections with other traffic. Traffic lights at intersections control and direct travel on urban road networks to increase vehicles' safety and performance. A flexible, microcontroller-enabled traffic light control system/trainer has also been adopted. However, the proposed design requires a wireless sensor network to monitor traffic at junctions and therefore redirect traffic based on traffic intensity in the desired direction. To make traffic light control more effective, the advent of a new methodology called "Intelligent Traffic Controller" has been exploited. This makes use of Sensor—networks in combination with Embedded Technologies.

LITERATURE REVIEW

Rongrong Tian, Xu Zhang [1] proposed using TRANSYT traffic modeling software to find an optimal fixed-time signal plan and VISSIM micro-simulation software to validate and validate the TRANSYT model and to help assess the optimal signal plan; create an adaptive frame signal plan and optimize and evaluate the program using VISSIM with VS-PLUS simulator. Microsimulation found that the delay in the adaptive signal control was significantly shortened than in the fixed time control. Gustav Nilsson Giacomo Como [2] centered on a class of complex feedback traffic signal management policies based on a generalized proportional allocation law. The consequence is differential inclusion. In the particular case of orthogonal phases, there is proof of existence, the beauty of continuous solutions by the generalization of the theory of contemplation. Stability is then shown by defining the generalized proportional allocation controllers as minimizing a specific entropy-like function used as a Lyapunov function for the closed-loop system. Chandrasekhar.M and. al. [3] proposed a framework that applies an image recognition algorithm in real-time traffic light control to accurately control traffic light. It's Ramteke Mahesh K. Et.al, man. [4] The proposed FPGA (Field Programmable Gate Array) controller based on the Neuro-Fuzzy system was thought to provide an efficient solution for traffic control. It can be used to minimize the disadvantages of traditional traffic controllers with the precision of the given variance in green cycle cycles depending on the heavy traffic loads that have shifted at each lane at a four-leg intersection. Naren Athmaraman and Srivathsan Soundararajan[5] have implemented an adaptive predictive signal control method that performs a real-time queue length estimate and uses an effective signal synchronization algorithm APTTCA-based system. Prof. Jayesh Juremalani and Dr. Krupesh A. Chauhan [6], author of the paper, identified various soft computing strategies to tackle the traffic management system. These include fuzzy methods, neural networks, genetic algorithms, ant colony algorithm, particle swarm optimization, and simulation model.

II. BASIC IDEA OF PROJECT

In this project, an Arduino based Traffic Light Controller system is designed. The four-way traffic light controller system will be implemented through a microcontroller. These can be applied in high traffic areas to avoid traffic blocks or accidents by controlling traffic flow. It is a simple implementation of a traffic lights system but can be extended to a real-time system with programmable timings, pedestrian lighting, etc. The central part of this project is the Arduino, which will control the LEDs and their timings to guide the vehicles. The proposed

project will be designed using Arduino UNO, where the traffic is maintained in a pre-defined timing system.
There are four states of direction for users in a modern traffic light control system, shown in figure 1(a) to 1(c).

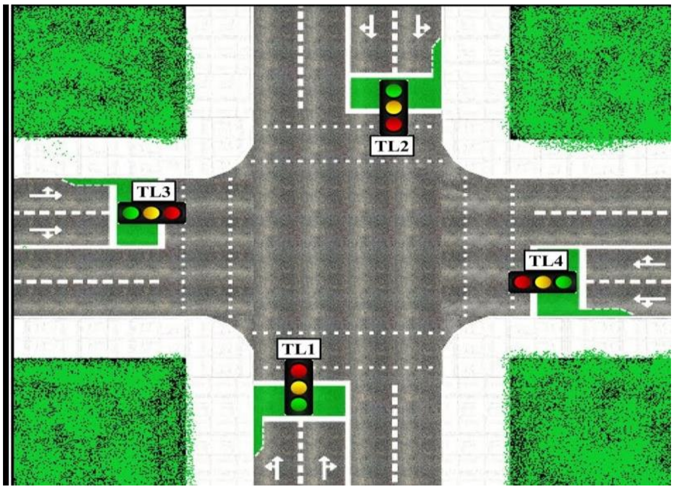

Figure 1(a): 4-way traffic system and the LED lights

Figure 1(b): Imagined Situation in real-life

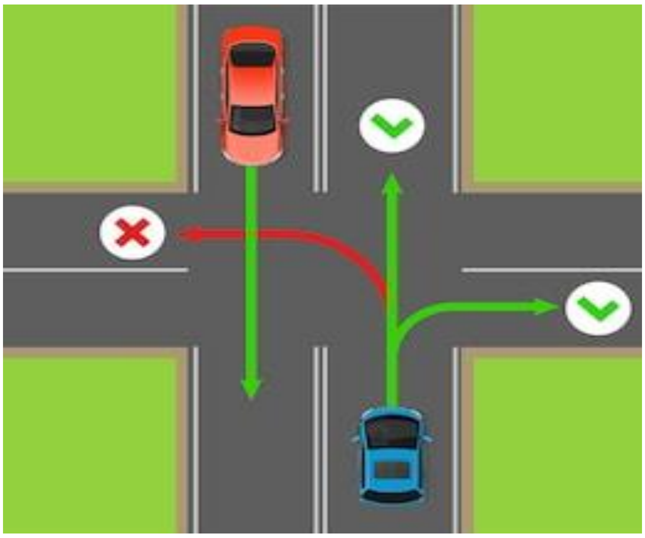

Figure 1(c): Visual Implementation of the project

III. SOFTWARE IMPLEMENTATION FOR FOUR-WAY TRAFFIC LIGHT CONTROLLER SYSTEM

After creating a new project with a flowchart and Arduino UNO, we began to take our necessary components. Firstly, we took elements for North Left Side. We took 4 Arduino LED (Green, Red, Yellow & Blue) breakout boards, 1 Grove Ultrasonic Ranger from project clip, and Grove 128×64 OLED display Module from Visual Designer (Add Peripheral). We connected North Left Red to IO8 pin, North Left Yellow to IO4 pin, North Left-Green to IO2 pin, and North Left Blue to IO10 pin of the Arduino. UR1 for North Left is connected to the D6 port, and LCD1 for North Left is connected to the 12C port. We took 4 Arduino LED (Green, Red, Yellow & Blue) breakout boards, 1 Grove Ultrasonic Ranger from the project clip for East Left Side. East Left Red to IO3 pin, East Left Yellow to IO11 pin, East Left-Green to IO9 pin, and finally East Left Blue to IO5 pin of the Arduino. UR2 for East Left is connected to the D7 port. After joining the components, we did the visual design and made 2-way traffic light.
Another 2-way traffic light was done through another Arduino. For this, we had to insert Arduino Library in the proteus Library folder. After this, in the Schematic Capture, we had to select Component Mode, and from there, we went to Pick Devices and took Arduino SIMULINO 2 Red LED, 2 Green LED, and 2 Yellow LED. North Right-Side LED-Red (D2) is connected to pin 13, LED-Yellow (D3) is connected to pin 12, and LED-Green (D4) is connected to pin 11. For East Right-Side LED-Red (D7) is connected to pin 7, LED-Yellow (D6) is connected to pin six, and LED-Green (D5) is connected to pin 5. For this Arduino SIMULINO, we had to do some code in Arduino Software and had to put the code in Arduino SIMULINO Program File to make the working traffic light.

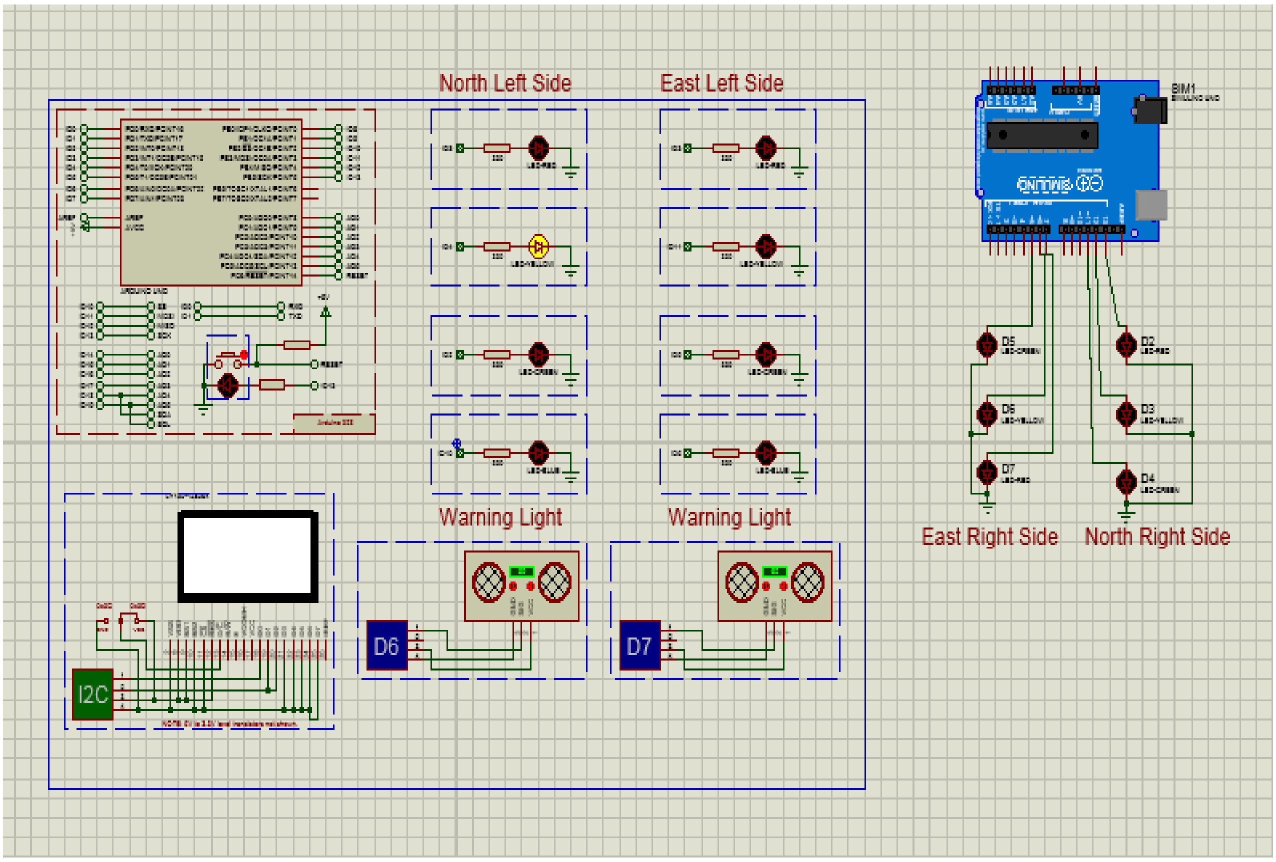

Figure 2: Simulation of Arduino UNO, Ultrasonic sensor and groove LED in Proteus software

In Figure 2, the whole system is designed. Here, we will be able to see the entire simulation running visually.

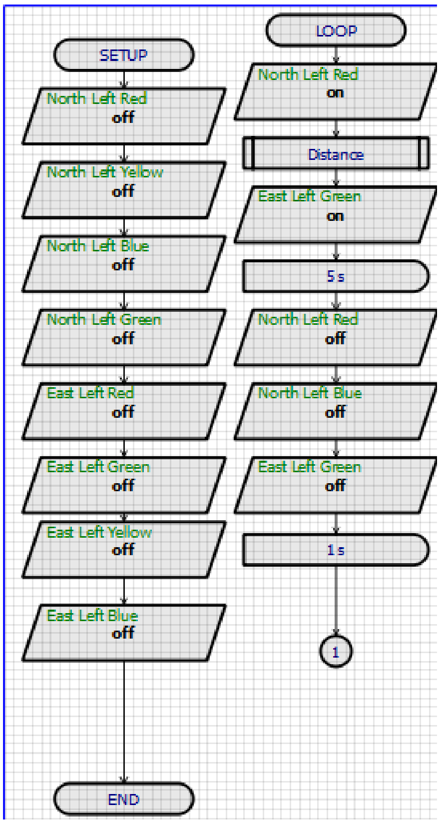

Figure 3(a): LED Part Visual Design and their functions

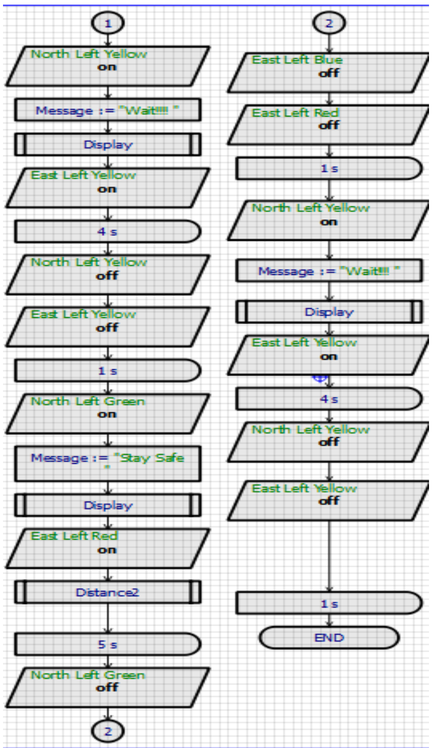

Figure 3(b): LED Part and Message Showing Visual Design and their functions

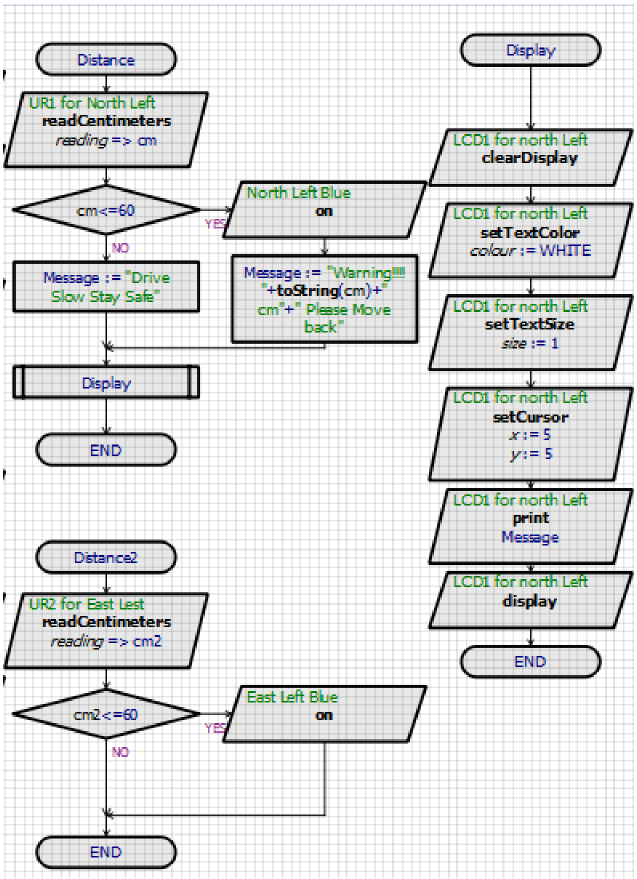

Figure 3(c): Display and Distance function and their Visual Design

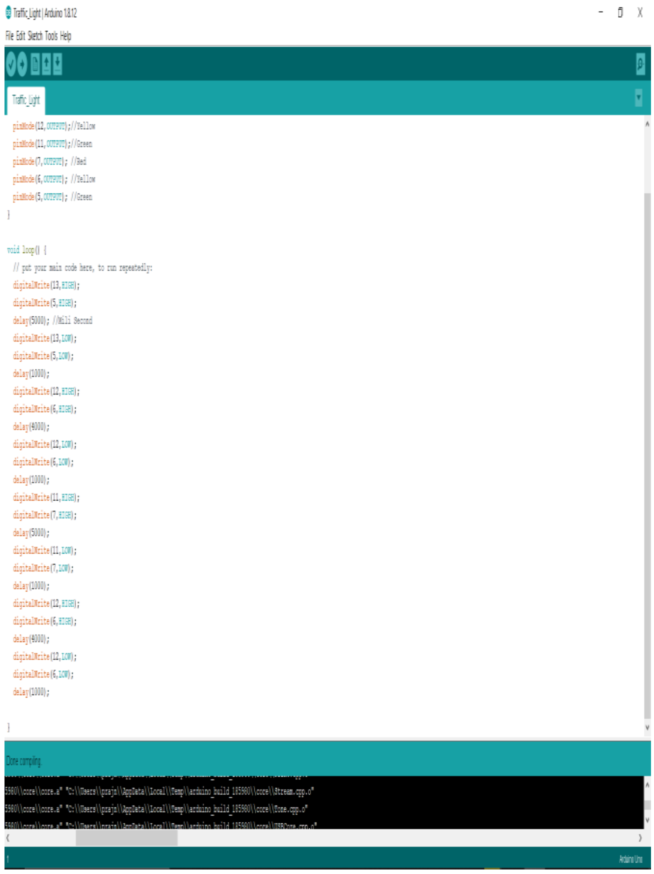

Figure 4: Implemented Coeds for other two traffic light

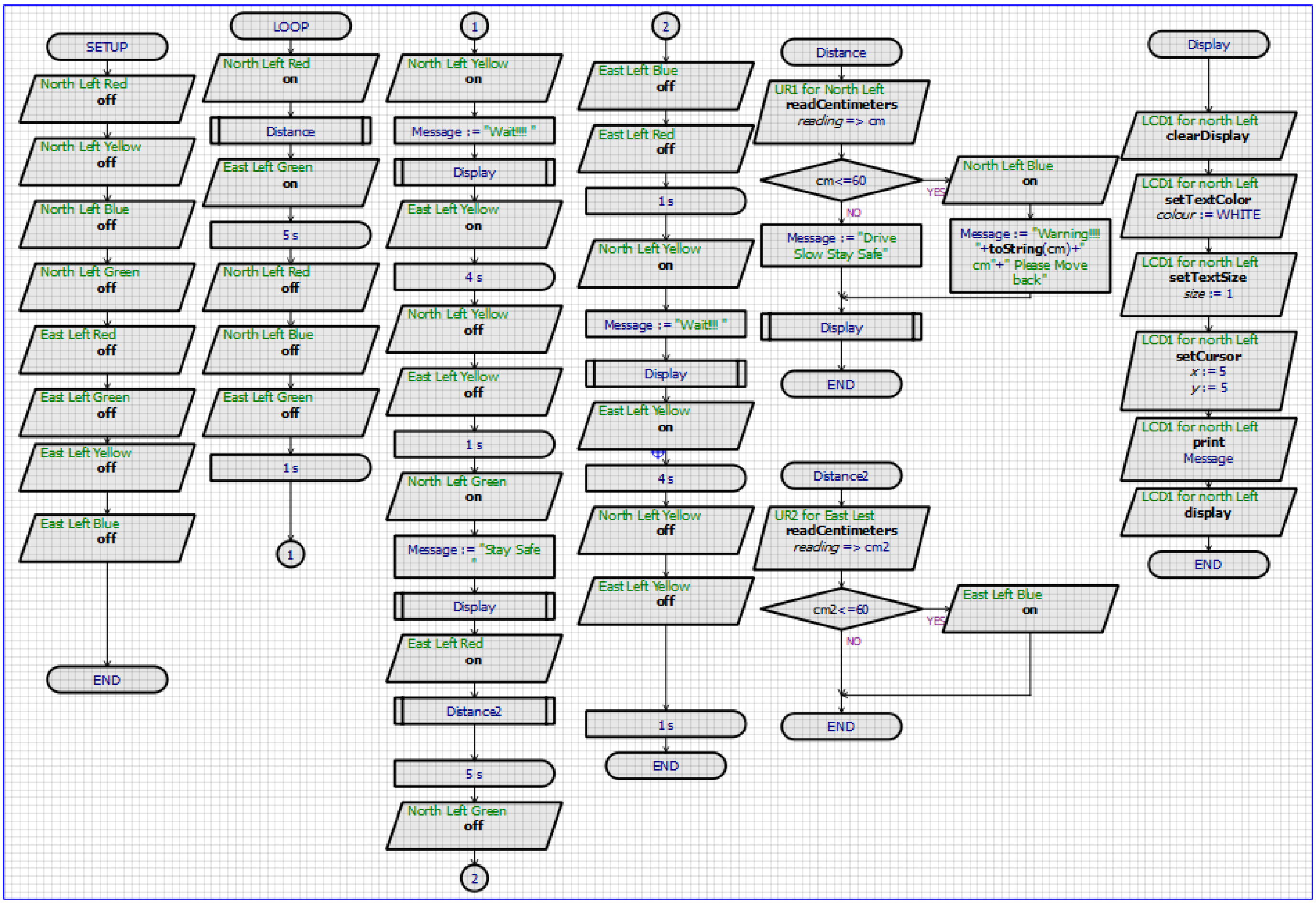

Figure 3(d): Completed Visual Design

IV. Analysis of Simulation Results and Discussion

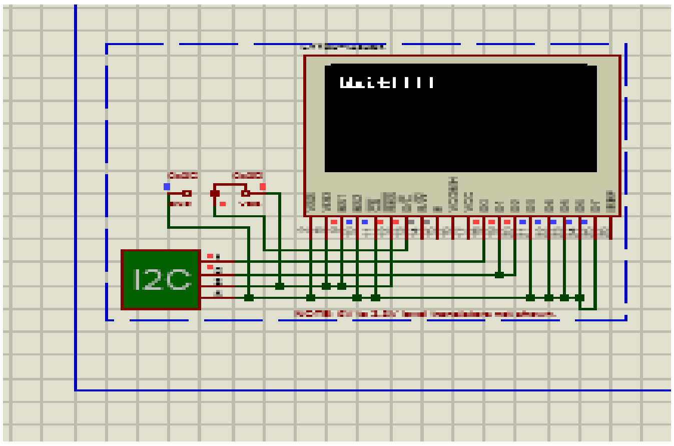

Figure 5(a): Grove Display Panel showing the drivers to wait for the green LED

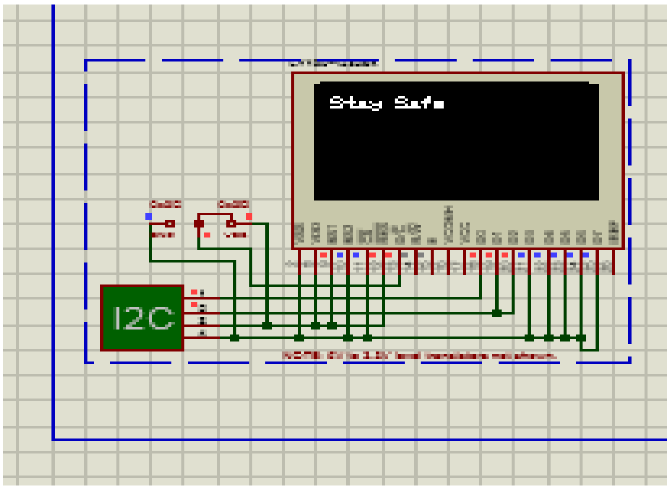

Figure 5(b): Grove Display Panel showing the drivers to stay safe as the green LED turns on

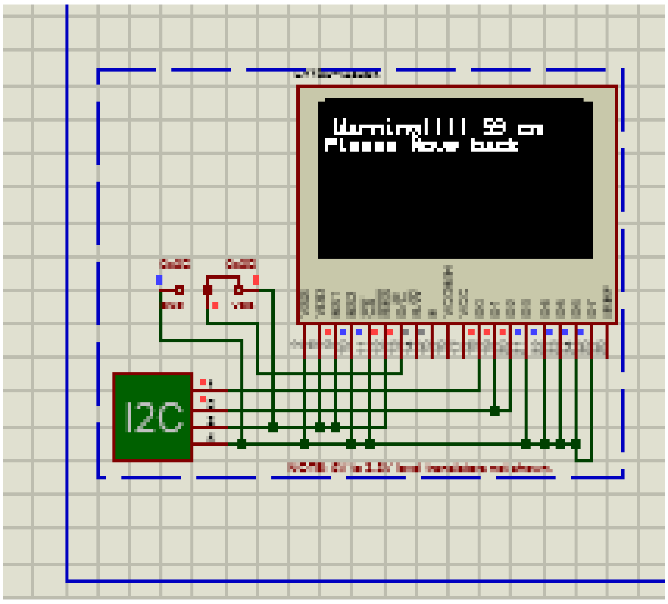

Figure 5(c): Grove Display Panel showing the drivers warning as they are crossing the minimum distance (60 cm) to wait for the Red LED

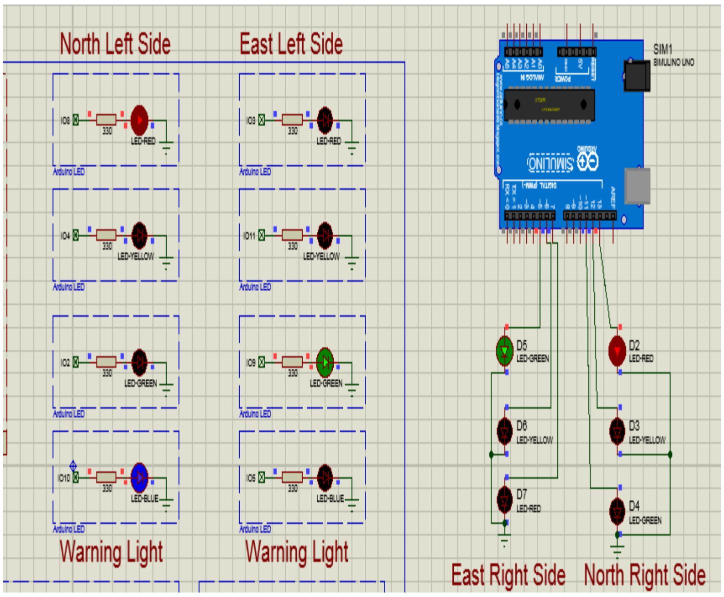

Figure 5 (d): Fully Functional Traffic Light System

V. Future Work / Society and Environmental Impact

The primary purpose of the project will be to solve the traffic jam problem in our country. These can be applied in high traffic areas to avoid traffic blocks or accidents by controlling traffic flow. It is a simple implementation of a traffic lights system but can be extended to a real-time system with programmable timings, pedestrian lighting, etc. The central part of this project is the Arduino, which will control the LEDs and their timings to guide the vehicles. In our real-life, we lose a considerable amount of time in traffic jams. If we implement this control system, the traffic jam will be lesser. Thus, humankind will be able to utilize their valuable energy and time to better the universe.

In our project, there was no U-Turn implemented. Also, we have worked for a single lane only. As there was difficulty while simulating proteus, we only use the ultrasonic Sensor in two ways. But it can be implemented in other two ways also. In the future, we can improve this project by using the U-Turn signals, 4-way lane sensor for the busier area. The camera can be added for security purposes.

We can say that our project will make a remarkable change in our daily life by reducing our time wastage. Thus, we will be able to contribute more to humankind.

VI. Conclusion

A practical and low-cost, microcontroller-based traffic light system for road intersection control has been successfully presented to this project. The traffic light system is constructed using the Arduino Uno microcontroller, the Ultrasonic sensor, and the light system (LED). Then for successful traffic management, the other two traffic lights are SIMULINO Uno written in Simple Language. The traffic light established the control mechanism is evaluated by building a sample that is identical to the current program. The prototyping functionality demonstrates that the framework created can be used for a prototype.

Proper life traffic control at the intersection of the road. The designed device can also be used as a teaching kit for the learning lighting system.

REFERENCES

[1] Rongrong Tian, Xu Zhang, "Design and Evaluation of an Adaptive Traffic Signal Control System – A Case Study in Hefei," China 2016, International Symposium of Transport Simulation (ISTS'16 Conference), June 23~25, 2016.

[2] Gustav Nilsson _ Giacomo Como, "On Generalized Proportional Allocation Policies for Traffic Signal Control," International Federation of Automatic Control, 50-1 (2017) 9643–9648,

[3] Chandrasekhar.M, Saikrishna. C, Chakradhar. B, phaneendra Kumar. p. Sasanka.c, "Traffic Control Using Digital Image Processing," International Journal of Advanced Electrical and Electronics Engineering ISSN 2278-8948, Vol.2, May 2013.

[4] Ramteke Mahesh K., Nikalaje Mahesh J., Prof.D.B.Rane, FPGA implementation of intelligent traffic signal controller based on neuro-fuzzy system, International Journal Of Engineering And Computer Science ISSN:2319-7242 Volume 3 Issue 3 March 2014.

[5] Naren Athmaraman and Srivathsan Soundararajan, "Adaptive Predictive Traffic Timer Control Algorithm," Continent Transportation Research Symposium, Ames, Iowa, Iowa State University, August 2005.

[6] Prof. Jayesh Juremalani and Dr. Krupesh A. Chauhan, "A Critical Appraisal on Traffic Signal Timing Optimization Techniques Recently Used Worldwide" International Journal of Futuristic Trends in Engineering and Technology ISSN: 2348-5264 (Print), ISSN: 2348-4071 (Online)Vol. 1 (06), 2014