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Analysis of The Use of Traditional and Modern Traffic Lights Used at Intersections

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Abstract: Fergana city is faced with a series of continuous traffic jams in the main and entrance to the city every year, which causes several problems and unfortunately, it often repeats. To reduce the number of such cases, traditional traffic lights are mainly used, but now, even in these cases, traffic jams and traffic accidents occur. Such factors, in this article, instead of conventional crossroads, crossroads that are currently used in several developed countries with artificial intelligence are used at the main and adjacent intersections in the Fergana region. This intelligent traffic light is designed to reduce the number of traffic jams and traffic jams in the central and adjacent roads of Fergana and to prevent them promptly.

Keywords: Road traffic incidents, intelligent traffic lights, GPS, IR sensors, traffic congestion, traffic types

INTRODUCTION

Traditional traffic lights, which have been used in Fergana since the year of independence, serve to regulate traffic flows at road intersections, pedestrian crossings, and other places. The traffic lights currently in use consist of three main color lights that are often observed: green light directs the free movement of traffic in the direction, yellow light directs the driver to stop for a short time and prepare to move, and red light prohibits any movement and the motor vehicle is ordered to maintain its position without sudden movements [1]. The problem of traffic jams arises and is being discussed due to the sudden and wide forecast growth of vehicles the number of road users, and the corresponding increase in the number of road users. These parameters, intelligent traffic lights are planned to be used at intersections of Fergana city.

Analysis of methods. First, traffic flow depends on the time of day, with peak traffic times typically occurring in the morning and near sunset. Second, the local

traffic light system is implemented with a hard-coded procedure, where the duration of the lights is fixed continuously and does not depend on the real-time traffic flow. Thirdly, it is related to the position of one light at the intersection, which affects the traffic flow at the adjacent intersections. In addition, the traditional road system does not accidents, road works, and vehicle breakdowns that worsen traffic congestion. Partial solutions are proposed by building new roads, increasing the number of overpasses and roundabouts, creating loops, and rehabilitating roads [2]. However, due to the involvement of various parameters, the transportation problem is very complex. Of course, these traffic jams encourage the traditional road transport system to eliminate serious traffic jams, minimize the flow and density of traffic, reduce the waiting time of drivers and passengers, optimize the safety and efficiency of participants in the transport system, and reduce harmful features for the economy and the environment.

Results. This article proposes a real-time intelligent traffic light control system to reduce congestion and maintain the safety of participants at the intersections of Fergana city, and aims to eliminate many shortcomings and improve traffic management. The system consists of a PIC microcontroller that manages various operations, monitors the traffic volume and density flow through infrared sensors, and changes the lighting transitions accordingly [3]. In addition, this device differs from other traffic lights in that it can communicate wirelessly with the traffic controller through XBee transmitters to run the corresponding small programs and ensure the smooth movement of emergency vehicles at the intersection [4].

The design of this intelligent system is the main part of the article because this system is now widely used in many developed countries. In the city of Fergana, perhaps in the Republic of Uzbekistan, we can see that new approaches and innovative systems are being invented to solve this complex problem. Algorithm-based digitized models are used to calculate intersection waiting time, number and line of cars, and optimal time interval for traffic lights, which consists of complex combinatorial programmed codes. Traditional sweaters currently in use cannot reproduce these results.

Thus, finding a dynamic, consistent, and convenient solution is quite impossible. Therefore, various solutions are constantly being proposed by professors and independent researchers, and many techniques are introduced using the technological advances of microcomputers, recently produced devices and sensors, as well as innovative algorithms for modeling the complexity of traffic lights as much as possible. For example, Infrared sensors are used in many transportation systems. An IR transmitter and an IR receiver are installed on both sides of the track [5]. When the vehicle passes on the road between the IR sensors, the system is activated and the vehicle counter is incremented. Data collected on

the traffic density of different lanes of the intersection is analyzed to dynamically change green light delays on a busy lane. The entire system can be controlled by a PIC microcontroller or even a PLC.

They are powered by RF emitters that send warning signals to radio frequency receivers located at each traffic light intersection to notify the traffic system that ambulances and highway patrol vehicles have arrived at the intersection. The sequence of operation of the traffic lights will be changed accordingly to provide a dedicated route for emergency vehicles. Other researchers use the Global Positioning System (GPS) to communicate with traffic light controllers and send early warning signals [6]. This tool makes it possible to estimate traffic flow density and flow based on the theory of accurate image processing of traffic jams and road traffic incidents occurring at intersections. However, some natural conditions harm the operation of this system. For example, the quality of the weather, especially in rainy, snowy, and foggy situations, requires better images.

The designed intelligent traffic light control system corresponds to the intersection of 4 roads as shown in Figure 1. Also, we tried to test the proposed integrated design on the example of architecture, software tools, and devices. Next, our research objective is to adapt the existing traffic light system to two-way roads.

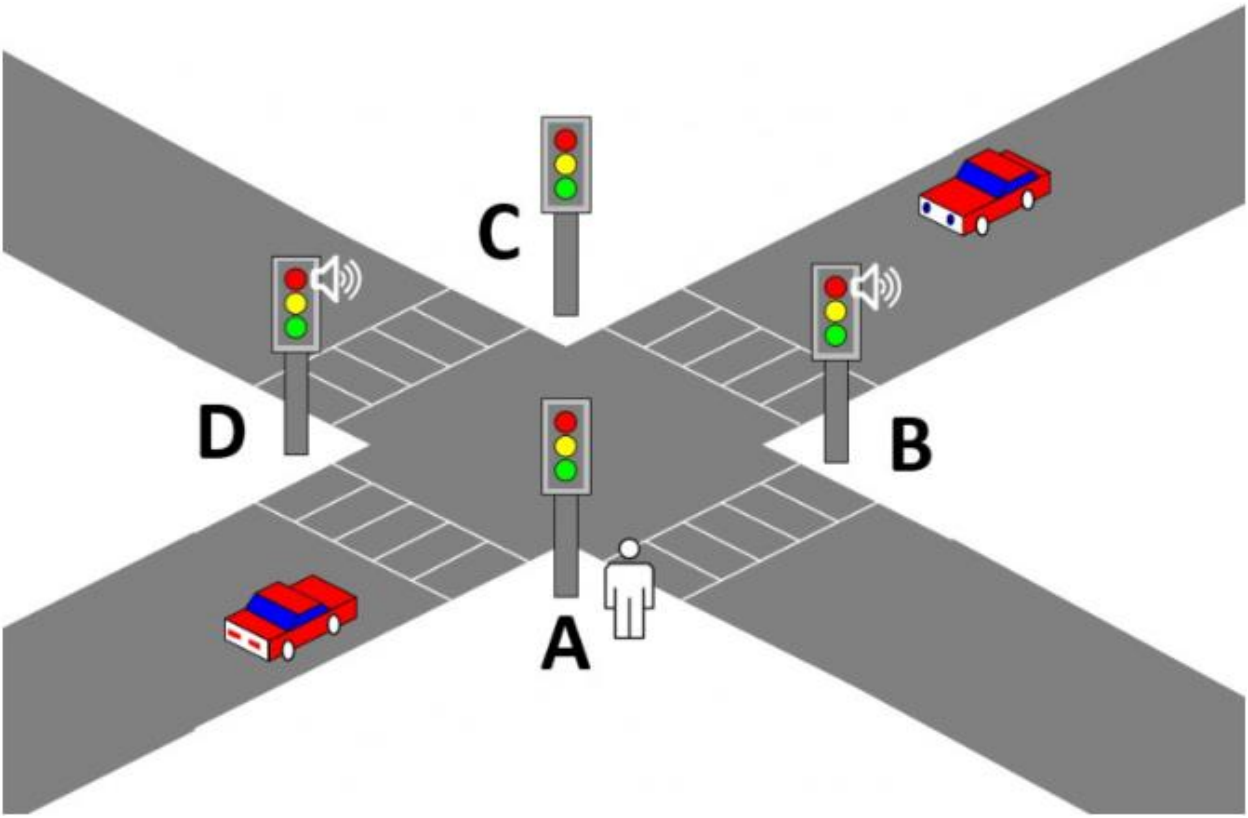

Figure 1. Crossing of 4 one-way roads

This intersection is equipped as follows. That is, two traffic lights of three colors labeled A and B are combined to mark the right and left lanes, respectively, and two traffic lights of two colors labeled R and L are connected to the flow of cars

coming from roads 1 and 2. Two pairs of IR transmitters and receivers are installed on two sides of paths 1 and 2 [7].

The proposed Intelligent Traffic Light System provides two configurations: the first configuration allows the vehicle to move forward from lane 1 to lane 3 and thus turn right along lane 4, and the second allows the vehicle to move forward, The lane 2 to move to lane 4 without turning, or to move left to continue lane 3. Such a system cannot solve the situation where the traffic is observed only in one direction. This situation is often found in many cities, where mainly government employees drive to the city center in the morning and return home in the evening. In addition, if the flow of vehicles approaching the intersection is observed or reduced during peak traffic times, the green light should be extended or shortened accordingly. Therefore, when a vehicle crosses the path between the IR receivers, infrared radiation is generated and the system is activated. This activation process is analyzed by the traffic master controller, where the vehicle density counter is installed. Then, a traffic controller equipped with a PIC microcontroller responds to the received data. This process consists of three modes: normal mode, traffic, and stable. These modes are dynamic and implemented in real-time. Normal, congested, and stable modes of traffic will be 30, 50, and 15 seconds, respectively. These levels are coded and analyzed by software.

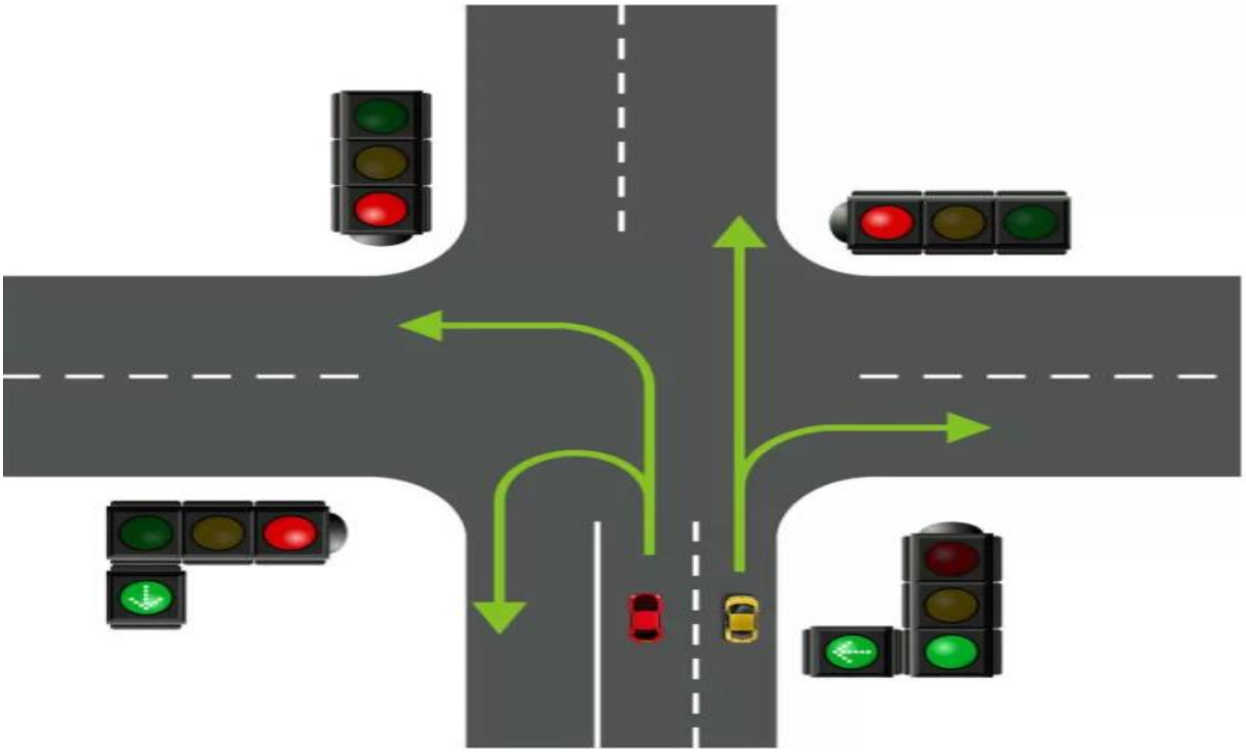

Figure 2 is the mutual configuration of traffic lights

The traffic lights at the intersection are placed together with the traffic controller, while these tools analyze the passage of light and their time interval. Its implemented design includes: PIC 16F877A microcontroller [8], three lights of

traffic lights A and B connected to tracks 1 and 2, two lights for traffic lights R and L tracks 3 and 4 related to right and left turn, two IR receivers to measure traffic volume, XBee transmitter system and other main components. The traffic master controller provides the duration and schedule of the two configurations for different traffic modes as well as their separated phases. This will help us to assess the traffic congestion and quickly report the accidents that have occurred. Traditional traffic lights do not use these features and work based on one fixed algorithm, and cannot inform the relevant operator of the oncoming traffic and the committed RTP.

Conclusion

The problem of traffic lights is undoubtedly one of the main problems that concern citizens and society. The effects of the inefficient traditional transport system have negative economic, health, and environmental consequences. Failures in the transport system and poor monitoring can lead to accidents, traffic jams, and many violations. Technological development and the miniaturization of unusual controls and sensors allow solving human problems and making life easier, especially in the road transport system, so our proposed Intelligent Traffic Light Control System has been found to help improve existing traffic light systems and reduce traffic congestion at busy intersections. If we have the opportunity to use this system at the intersections, we can save a lot of traffic jams, road traffic accidents, and even the health and lives of people.

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