УДК 621.865.8

K. A. OZHIKENOV, R. M. UTEBAYEV, A. T. ISIMOVA

(Kazakh national technical university after K. I. Satpayev, Almaty, Kazakhstan)

MODELING THE REMOTE CONTROL SYSTEM OF TRAFFIC LIGHT THOUGH COMPUTER

Annotation. This work considers the ways of solving traffic jam and vehicle crash issues on the roads and ways of facilitating policemen's work. It suggests the remote control method of traffic light and models the traffic light operation. Arduino Uno platform was used for modeling.

Keywords: traffic light, remote control, modeling, microcontroller, program.

Тірек создер: бағдаршам, алыстан басқару, модельдеу, микроконтроллер, бағдарлама.

Ключевые слова: светофор, удаленное управление, моделирование, микроконтроллер, программа.

Nowadays not only Almaty city, but also many large cities face the problem of traffic jam on the roads. Especially, the morning and evening traffic jams cause the road block. In the specified times traffic policemen switch off the traffic lights and set for the adjustment of road movement themselves. On big crossroads, because of a large traffic stream there are lots of vehicle crashes as the vehicles behind don't see the traffic policeman, i.e. though the vehicles in front see the policeman and stop, the vehicles behind don't manage to stop and crash on the vehicles in front.

In different countries traffic jams occur due to different reasons. Lots of methods were offered to avoid this situation, and also the issue is being solved through the usage of new technologies (for example, to make the driver turn around the traffic jam on the road an information about the situation on the road is written in special announcement board). For example, in USA and Finland traffic jam is controlled by means of special technologies, i.e. determining the number of mobile telephones, the place with cars' backup is defined and traffic stream is directed other way. In Israil there are special boards along the roads, they indicate less loaded roads to drivers. In Germany and Spain public transport is offered, and in England in order to avoid the traffic jam in the center of the city drivers pay the fee to drive in the center [1].

In big cities that suffer from big traffic jams, traffic lights connect to one movement adjustment system (trough GSM-modem). It makes it possible to change the traffic light operation program (temporary, to several days or hours) and synchronize the traffic lights.

In this study the manual adjustment works of traffic policemen in the working days (from Monday to Friday) in the crossroads of Remizovka and Al-Farabi streets of Almaty city between 7-9 a.m. and 5-9 p.m. was considered as investigation objects (Figure 1). 1-10 - traffic lights.

First of all, traffic policemen's job is complicated due to weather conditions, the concentration of exhaust gas from the cars and the adjustment of large amount of vehicle movement. Secondly, because of a large traffic stream vehicle crashes take place due to the situations when the vehicles behind don't see the adjustment signal of traffic ploceman, i.e. though the vehicles in front see the «STOP» signal of policeman and stop to it, the vehicles behind can't manage to stop and crash on the vehicles in front. We can suggest to solve this issue by reducing the vehicle movement speed and setting an appropriate distance between vehicles, but this suggestion will only be left as is because nowadays the movement in the cities is very dense due to the large number of cars and a high power of vehicle motors. That is, if we move along Al-Farabi street keeping a big distance with a car in the front, other cars will definitely fill this distance. Therefore, nowadays, to avoid the traffic crashes on the crossroads, one of the efficient methods that can be realized is the usage of traffic lights.

The traffic lights on the crossroads are established high and are seen to all the vehicles. Besides, the counting boards established next to traffic lights give the opportunity for the drivers to prepare for stop.

As mentioned above, in order to avoid the vehicle crashes, as one of the ways of solving these issues it is suggested to change the automatic mode of traffic lights to manual remote control mode, it means that traffic policeman can adjust the traffic movement by manual remote control of the traffic light.

The investigation suggests the traffic light control by means of compact hand-held computer (notebook or tablet computer). And the control is carried out using Processing program language. Processing language – the program based on Java.
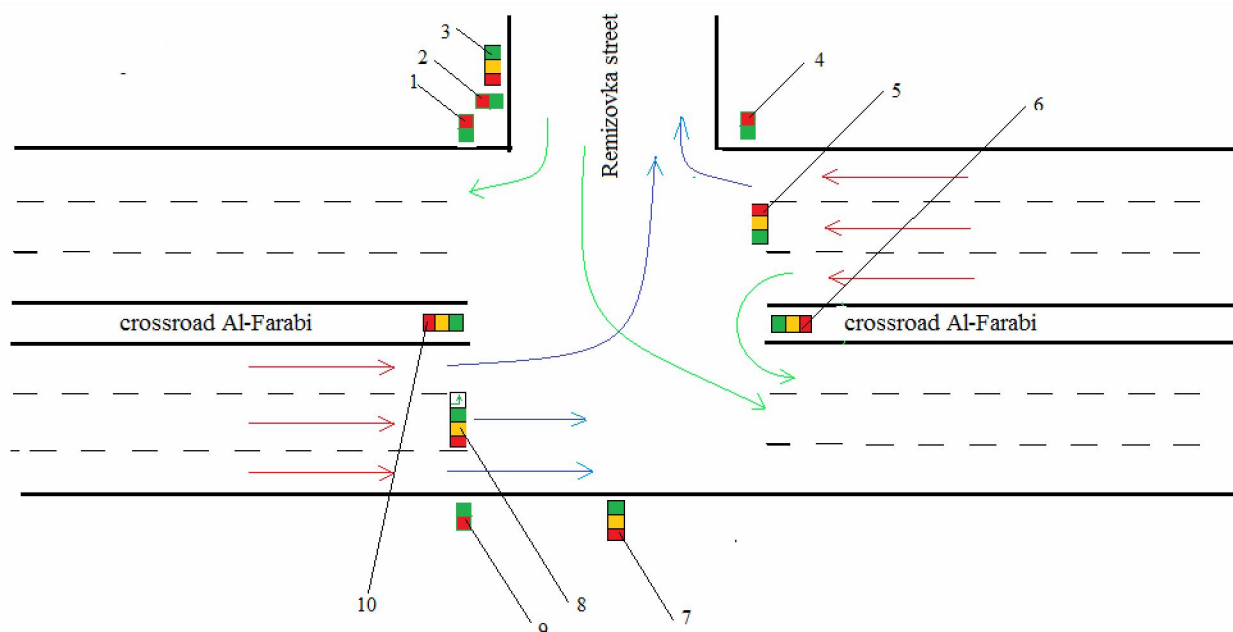
Figure 1 – Crossroads of Remizovka and Al-Farabi streets

In this study a traffic light operation was modeled. Arduino Uno platform was used for modeling. Arduino Uno platform is a controller based on Atmega328. Platform consists of 14 digital input/outputs, 6 analogue inputs, 16 MHz crystal generator, USB connector, power connector, ICSP connector and a switch button. To set for operation it is connected to computer through USB cable or power supply through AC/DC adapter or battery [2].

Compared to Mega, Mega2560 and Nano boards that have been in usage until today, Arduino Uno ATmega8U2 microcontroller with more capacities is recently used [3]. In this platform a model indicating computer control operation of a particular traffic light was developed. Arduino board, 3 light diods (red, yellow, green), and accordingly, 3 resistors, USB, a panel with connection cells and mounting cables are necessary for that. A principal scheme of light diods connected to Arduino is shown in figure 2.
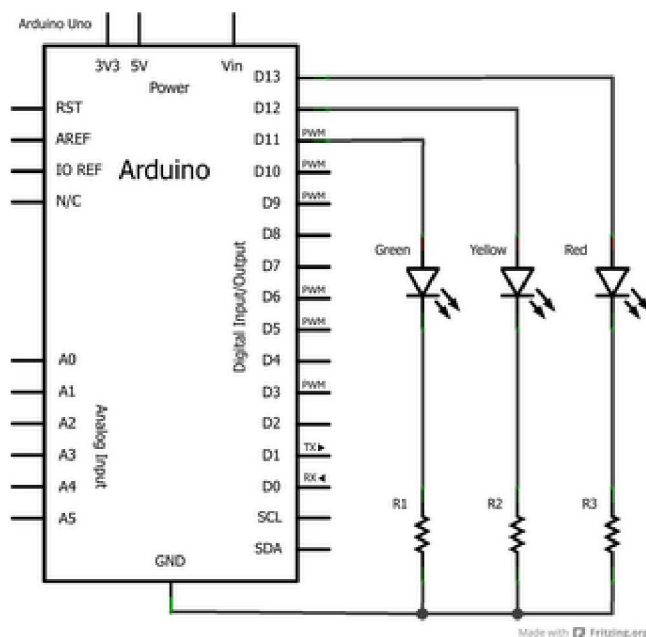
Figure 2 – A principal scheme of light diods connected to Arduino

Traffic light operation program is constructed in below method:

```
// traffic light
int led1 = 13;
int led2 = 12;
int led3 = 11;

// the setup routine runs once when you press reset:
void setup() {
// initialize the digital pin as an output.
pinMode(led1, OUTPUT);
pinMode(led2, OUTPUT);
pinMode(led3, OUTPUT);
}

// the loop routine runs over and over again forever:
void loop() {
digitalWrite(led1, HIGH); // red
delay(3000); // wait for a second
digitalWrite(led1, LOW); // turn the LED off by making the voltage LOW
digitalWrite(led2, HIGH); //yellow
delay(400); // wait for a second
digitalWrite(led2, LOW);
delay(400); // wait for a second
digitalWrite(led2, HIGH); //yellow
delay(400); // wait for a second
digitalWrite(led2, LOW);
delay(400);
digitalWrite(led2, HIGH); //yellow
delay(400); // wait for a second
digitalWrite(led2, LOW);
delay(400); // wait for a second
digitalWrite(led2, HIGH); //yellow
delay(400); // wait for a second
digitalWrite(led2, LOW);
digitalWrite(led3, HIGH);
delay(3000);
digitalWrite(led3, LOW);
delay(400);
digitalWrite(led3, HIGH);
delay(400);
digitalWrite(led3, LOW);
delay(400);
digitalWrite(led3, HIGH);
delay(400);
digitalWrite(led3, LOW);
}
```

An example of a type of color change algorithm is shown in the table below, an absciss here is shown in seconds.

Traffic light operation algorithm on color change

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25

Light diod colors in the table are shown in the colors of changeable states of the traffic light.

Concluding, by modeling the operation of traffic light controlled manually in a distance with the help of Arduino we can control several traffic lights in big crossroads. Thus, we can prevent vehicle crashes in Almaty city, to solve the traffic jam situations and facilitate the traffic policemen's work.

REFERENCE

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Резюме

К. А. Өжікенов, Р. М. Өтебаев, А. Т. Исимова

(Қ. И. Сәтбаев атындағы Қазақ ұлттық техникалық университеті, Алматы, Қазақстан)

БАҒДАРШАМДЫ КОМПЬЮТЕР АРҚЫЛЫ
АЛЫСТАН ҚОЛМЕН БАСҚАРУ ЖҰМЫСЫН МОДЕЛЬДЕУ

Жұмыста қазіргі таңда өзекті мәселелердің бірі болып табылатын, жол кептелістерінің алдын алу мәселесі қарастырылған. Жол полиция қызметкерінің қауіпсіздігі мен негізгі атқаратын қызметін жеңілдету барысында алыстан реттеу және басқару мәселелерін шешудің жаңа тәсілі ұсынылған. Алыстан басқару алгоритмі Java бағдарламалау тіліне негізделген Processing тілі арқылы іске асырылып, Arduino Uno платформасы Atmega328-ге негізделіп жасалған контроллер арқылы модельдеу жүргізілген. Модельдеу нәтижесін қолдана отырып, бағдаршам жұмысын шағын қол компьютері (ноутбук немесе планшет) арқылы басқару мүмкіндігі пайда болады.

Тірек сөздері: бағдаршам, алыстан басқару, модельдеу, микроконтроллер, бағдарлама.

Резюме

К. А. Ожикенов, Р. М. Утебаев, А. Т. Исимова

(Казахский национальный технический университет им. К. И. Сатпаева, Алматы, Казахстан)

МОДЕЛИРОВАНИЕ УДАЛЕННОГО РУЧНОГО УПРАВЛЕНИЯ
РАБОТЫ СВЕТОФОРА ЧЕРЕЗ КОМПЬЮТЕР

В работе рассмотрен вопрос предотвращения пробок на дороге, который является одной из актуальных проблем сегодняшнего дня. В целях безопасности и облегчения основной работы сотрудника дорожной полиции предложен новый метод, а именно удаленная регулировка и управление дороги. Алгоритм удаленного управления осуществлен на языке Processing, основанном на язык программирования Java, а моделирование проведено с помощью платформы Arduino Uno, основанной на контроллере Atmega328. Применяя результаты моделирования, появляется возможность управления работы светофора с помощью мини компьютера (ноутбут или планшет).

Ключевые слова: светофор, удаленное управление, моделирование, микроконтроллер, программа.