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Teaching Students the Technology of Creating (Programming) a "Smart Traffic Light" in a Technology Class at a General Secondary School

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A B S T R A C T
In the robotics section of a secondary school technology class, students are taught the technology of making smart traffic lights.

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Improving the system of training personnel in the field of information technologies is one of the important conditions for the successful implementation of the “Digital Uzbekistan - 2030” strategy, the development of digital technologies and their widespread introduction into the daily lives of the population.

The measures taken to increase the efficiency of the system of professional training and retraining in the field of information technologies create a solid foundation for providing state bodies and sectoral organizations with qualified IT specialists.

At the same time, the shortage of qualified personnel in the republic's labor market requires improving training programs and methods in the field of information technologies, and strengthening cooperation between educational institutions and IT companies.

To raise the level of information technology education to a qualitatively new level, to meet the demand of the labor market for qualified IT specialists, as well as to ensure the implementation of the tasks set out in the State Program for the Implementation of the Strategy of Actions in Five Priority Areas of Development of the Republic of Uzbekistan in 2017-2021 in the “Year of Science, Education and Development of the Digital Economy” [1].

Robotics is an applied science that develops automated technical systems and is the most important technical basis for the intensification of production. Robotics is closely related to such disciplines as electronics, mechanics, computer science, physics, mathematics, as well as radio and electrical engineering.

There are construction, industrial, household, aviation and extreme (military, space, underwater) robotics. The demand for engineers capable of designing, creating, managing and modernizing high-tech and

robotic devices has increased more than ever. Accordingly, an educational scheme for personal development in the engineering and technical direction has been developed.

The field of development continues from preschool age to graduation from a higher educational institution. This sector is divided into two areas: subject-based robotics, which is an integrated modern educational environment, and educational robotics.

Subject-based robotics, which is an integrated modern educational environment, is:

- interactive equipment;
- hardware and software complexes;
- digital laboratories;
- digital interactive educational programs;
- Modern material and technical base of subject clusters.

They are aimed at the formation of information and communication, natural science, technical competence [2].

In Chapter V of the general secondary school technology lesson of the continuing education programs of the Republic of Uzbekistan in the field of technology, 16 hours are allocated to the basics of robotics, which covers the following topics:

Arduino. Arduino and its capabilities. *Arduino and its origins. Views of Central Asian thinkers in the field. Purpose and tasks of Arduino. Types of Arduino. Arduino and its additional components.*

Practical training: Turning LEDs on and off using a program. (Introducing LEDs, switches, breadboard. Introducing pinMode(); digitalWrite(); delay() functions. Turning LEDs on and off using a program.)

The development of the education system in the country based on international standards, the successful implementation of sectoral reforms, the widespread introduction of advanced foreign experiences, innovative pedagogical and information and communication technologies into the educational process, the initiative and dedication in teaching students the basics of science and modern professions, improving their intellectual potential, training highly qualified personnel, forming a physically and spiritually well-developed generation, and educating young people as worthy successors of their great ancestors in the spirit of patriotism, respect for national and universal values [1] require every teacher to work tirelessly on himself, be aware of innovative technologies, and constantly develop himself. In particular, by keeping students informed about modern technologies in technology classes in general secondary schools, it is possible to teach students creativity, entrepreneurship, and modern professions.

The content of technology subjects for grades 5-6-7 of general secondary education includes the following topics.

Practical training: Introduction to the Serial function (Serial.begin (9600); Serial.print(); Serial.println(); Introduction to variables)

Getting to know the if conditional operator. *Information about the operator. Comparison, mastering operators.*

Practical exercise: Making a traffic light.

Practical exercise: Getting acquainted with a sensor that senses temperature and humidity.

Practical exercise: Controlling a motor using a program.

Practical exercise: Controlling a servo motor using a program.

Project work: Making a smart greenhouse (motor + Servo motor + DHT11 + Arduino)[3].

General secondary education 6th grade IV quarter lessons have the topic "Turning LEDs on and off using a program"[4].

For this topic, below we present the technology of making a traffic light from various unnecessary

materials that we have tested in our own experience.

Project work: Making a traffic light. Below we present the methods for teaching the technology of making a "Smart traffic light" that we propose:

Aim of the lessson: Teach students how to turn LEDs on and off using a program.

Required equipment: Arduino –UNO, ,sensor, ultrasonic sensor, LEDs, wires.

```
-// Code for a traffic light
#define TRIG_PIN 9 // Ultrasonic sensor TRIG
#define ECHO_PIN 10 // Ultrasonic sensor ECHO
#define RED_CAR 3 // Red light for cars
#define YELLOW_CAR 4 // Yellow light for cars
#define GREEN_CAR 5 // Green light for cars
#define RED_PED 6 // Red light for pedestrians
#define GREEN_PED 7 // Green light for pedestrians
#define BUZZER 8 // Buzzer
void setup() {
pinMode(TRIG_PIN, OUTPUT);
pinMode(ECHO_PIN, INPUT);
pinMode(RED_CAR, OUTPUT);
pinMode(YELLOW_CAR, OUTPUT);
pinMode(GREEN_CAR, OUTPUT);
pinMode(RED_PED, OUTPUT);
pinMode(GREEN_PED, OUTPUT);
pinMode(BUZZER, OUTPUT);
// Initial traffic light state
digitalWrite(GREEN_CAR, HIGH); // Green to cars
digitalWrite(RED_PED, HIGH); // red to pedestrians }
void loop() {
long duration;
int distance;
// Measure distance
digitalWrite(TRIG_PIN, LOW);
delayMicroseconds(2);
digitalWrite(TRIG_PIN, HIGH);
delayMicroseconds(10);
digitalWrite(TRIG_PIN, LOW);
duration = pulseIn(ECHO_PIN, HIGH);
distance = duration * 0.034 / 2; // Calculate distance in cm
// If a wheelchair or cane approaches
```

```
if (distance > 0 && distance <= 50) {
// When the green light goes out
digitalWrite(GREEN_CAR, LOW);
digitalWrite(YELLOW_CAR, HIGH);
delay(2000); // The yellow light is on for 2 seconds
// The red light is on, the cars stop
digitalWrite(YELLOW_CAR, LOW);
digitalWrite(RED_CAR, HIGH);
// Green light for pedestrians
digitalWrite(RED_PED, LOW);
digitalWrite(GREEN_PED, HIGH);
// Sound signal
for (int i = 0; i < 5; i++) { // Give signal 5 times
digitalWrite(BUZZER, HIGH);
delay(500);
digitalWrite(BUZZER, LOW);
delay(500);}
delay(5000); // 5 seconds for pedestrians
// Turn off pedestrian traffic light
digitalWrite(GREEN_PED, LOW);
digitalWrite(RED_PED, HIGH);
// Give green light to cars
digitalWrite(RED_CAR, LOW);
digitalWrite(GREEN_CAR, HIGH); }
delay(500); // Sensor check intervals }
```

In conclusion, we can say that since we live in the age of robots, students should have an idea of the structure of robots, mechanisms, diodes, their functions, sensors and devices that detect temperature, sound, humidity, light.

In this regard, it is important to deliver the above topics, which are included in the content of the technology lesson for grades 5-7 of general secondary education schools, to students at a high level, to form knowledge, skills and qualifications related to robotics, and to determine their interest and abilities in modern professions.

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