Project Name: SOMETHING COOL, MADE

Project Code: COOLMD

Collaboration:

Deepanshi   456807

Bow Valley College

Instructor: Dima Marachi

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PROJECT: Automatic Toll Palaaza

Q1. Please attach a .zip file containing your Arduino code for your made project (use file).

Ans: The code, the picture, and the video are submitted on d2l in the .zip folder

Here is the code of my project:

```
#include <Servo.h>
#include <Adafruit_Keypad_Ringbuffer.h>
#include <Adafruit_Keypad.h>

const byte Rows = 4;
const byte Columns = 4;

#define redLED 3
#define greenLED 4
#define motionLedPin 8

const int trigPin = 27;
const int echoPin = 25;
const int servoPin = 5;
const int motionSensorPin = 10; // Pin connected to the motion sensor

char keypadArr[Rows][Columns] = {
  {'1', '2', '3', 'A'},
  {'4', '5', '6', 'B'},
  {'7', '8', '9', 'C'},
  {'*', '0', '#', 'D'}
};

byte rowPins[Rows] = {52, 50, 48, 46};
byte columnPins[Columns] = {34, 32, 30, 26};
Servo gateServo;
Adafruit_Keypad    key    =    Adafruit_Keypad(makeKeymap(keypadArr),    rowPins,
columnPins, Rows, Columns);

const String password = "4512";
char keypadChar;
String userInput;

const int distanceThreshold = 5; // Adjust as needed
bool motionDetected = false;
```

```arduino
void setup() {
  key.begin();
  Serial.begin(9600);
  Serial.println("Press * to clear and press # to submit.");
  pinMode(trigPin, OUTPUT);
  pinMode(echoPin, INPUT);
  pinMode(redLED, OUTPUT);
  pinMode(greenLED, OUTPUT);
  pinMode(motionLedPin, OUTPUT);
  pinMode(motionSensorPin, INPUT);
  gateServo.attach(servoPin);
}

void loop() {
  sensorMotion();

  // Check ultrasonic sensor only if motion is not detected
  if (!motionDetected) {
    // Ultrasonic sensor part
    long duration, distance;
    digitalWrite(trigPin, LOW);
    delayMicroseconds(2);
    digitalWrite(trigPin, HIGH);
    delayMicroseconds(10);
    digitalWrite(trigPin, LOW);
    duration = pulseIn(echoPin, HIGH);
    distance = duration * 0.034 / 2;

    if (distance < distanceThreshold) {
      digitalWrite(redLED, HIGH);
      digitalWrite(greenLED, LOW);
      openGate();
      delay(50); // delay is for when led changes from red to green
    } else{
      digitalWrite(redLED, LOW);
      digitalWrite(greenLED, HIGH);
      keypadGateOpening();
      delay(1000);
    }
  } //
  delay(1000);
}


void sensorMotion() {
  // Check motion sensor
```

```
    int motionState = digitalRead(motionSensorPin);

  if (motionState == HIGH) {
    digitalWrite(motionLedPin, HIGH);
    delay(500);
    digitalWrite(motionLedPin, LOW);//
    motionDetected = true;
  } else { // Turn off red LED
    motionDetected = false;
  }
}

void keypadGateOpening() {
  // Check keypad
  key.tick();
  while (key.available()) {
    keypadEvent e = key.read();
    keypadChar = (char)e.bit.KEY;
    if (e.bit.EVENT == KEY_JUST_PRESSED) {
      if (keypadChar == '*') {
        userInput = ""; // Clear the input
        Serial.println("Password Cleared.");
      } else {
        if (keypadChar == '#') {
          // Check if the password is correct
          if (userInput == password) {
            Serial.println("The Password is correct!");
            digitalWrite(greenLED, HIGH);
            digitalWrite(redLED, LOW);
            openGate();
            delay(500);
          } else {
            Serial.println("The Password is incorrect");
            digitalWrite(redLED, HIGH);
            digitalWrite(greenLED, LOW);
            openGate(); // close the gate for unauthorized access
          }
          userInput = ""; // Clear the input after checking
        } else {
          // Add the pressed key to the input
          userInput += keypadChar;
          Serial.print(keypadChar);
        }
      }
    }
  }
```
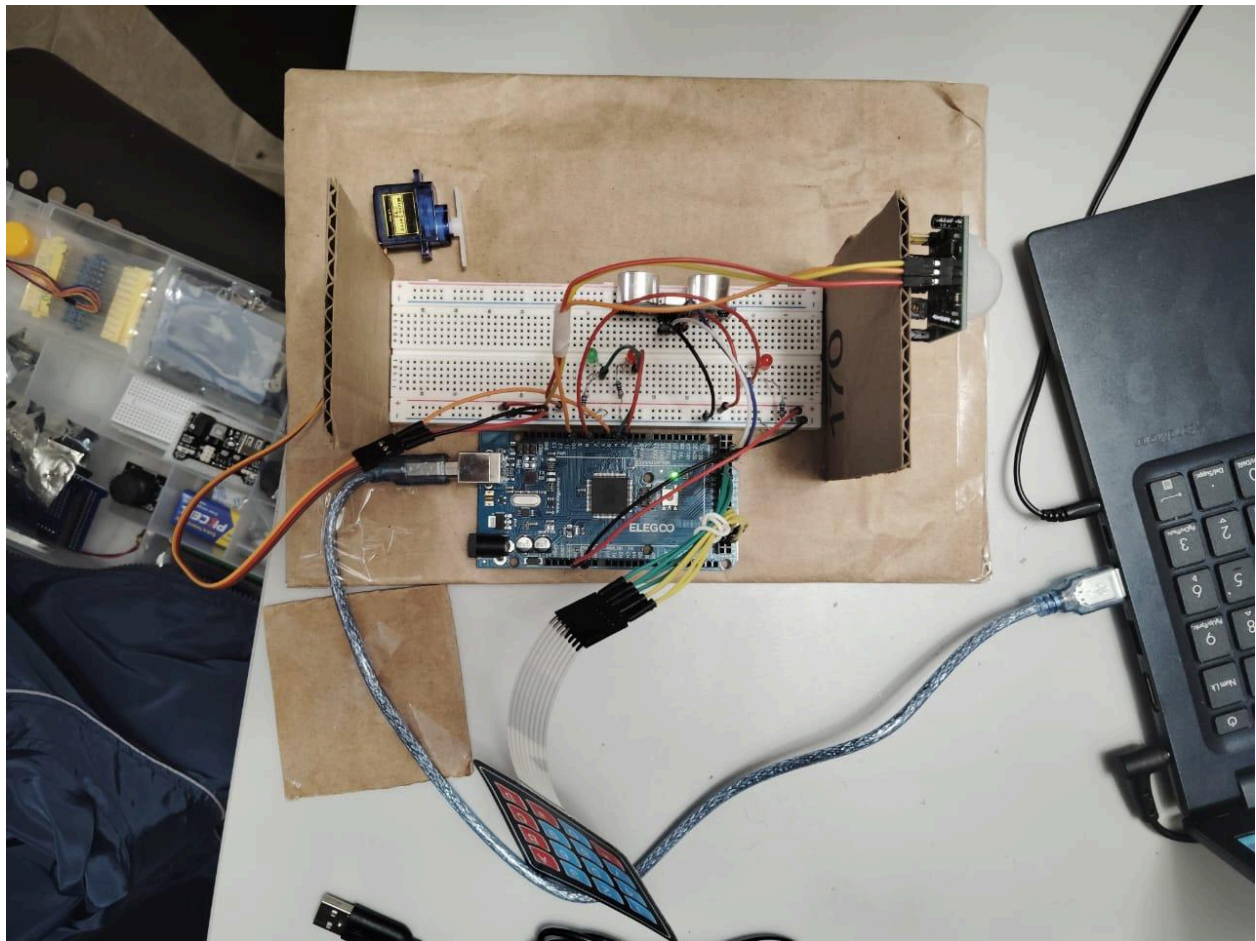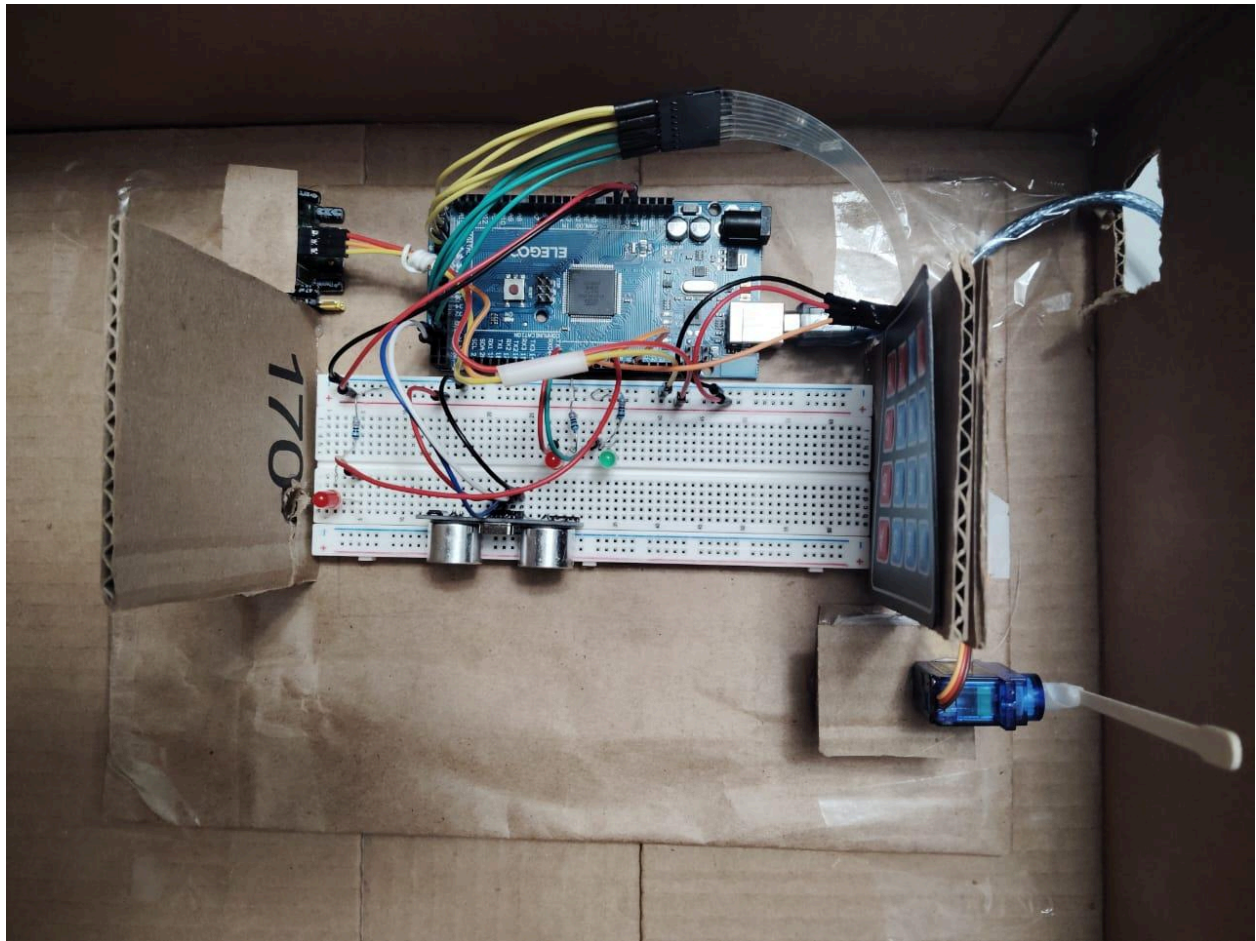
```
}

void openGate() {
  gateServo.write(90); // Assuming 90 degrees is the open position
  delay(9000); // Assuming 9 second to open
  gateServo.write(0); // Return to closed position
}
```

Q2-Q4. Please attach three clear distinct .jpg format photos of your made project (use
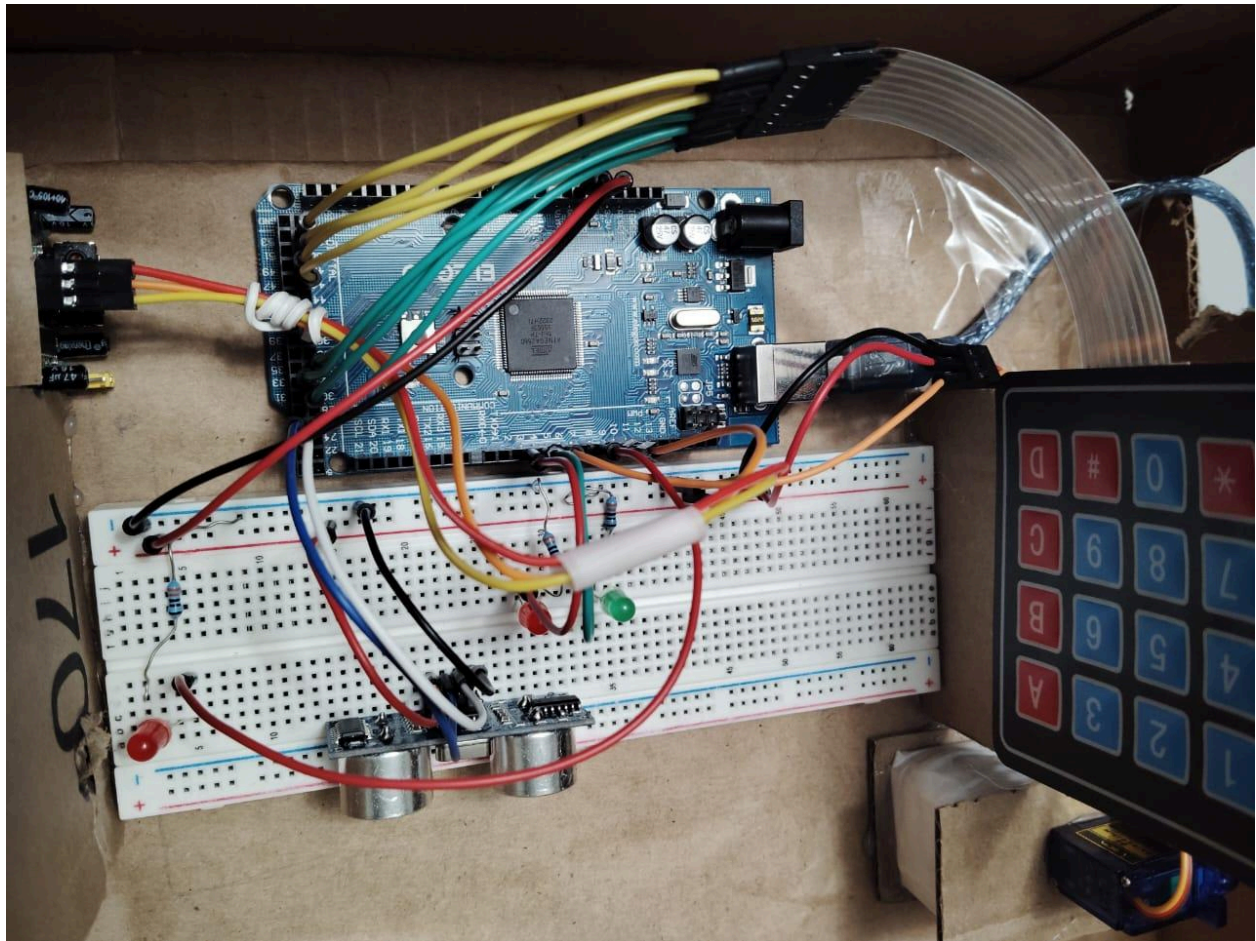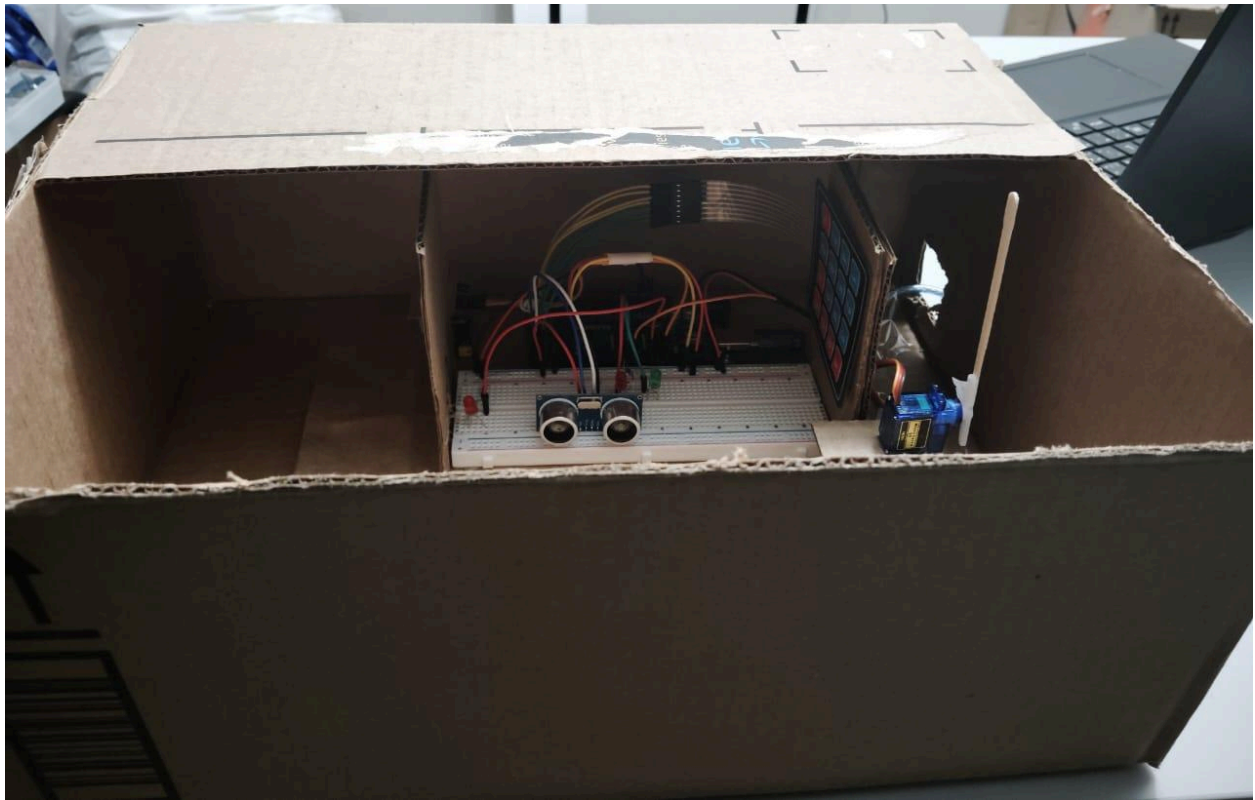
file).

Ans: (i) Connection

(ii) inner_part Connection

(iii) zoomIn_InnerPartConnection

(iv) outer_Image

Q5. Please attach a video of your made project in action (use file) showing all and every feature and functionality you have added.

Ans: The introduction video, the video with working and full explanation, and the video where only working is shown are submitted on d2l in the .zip folder.

Q6. How does this prototype actualize the vision you articulated in your proposal (use text)?

Ans: The prototype for the Automatic Toll Plaza aligns closely with the vision articulated in the proposal. Here's how it actualizes that vision:

What this project will do before actually digging into it

Components:

- Motion Sensor: Prevent any mishappening by indicating the LED.

- Ultrasonic Sensor: Used for getting automatic ticket

- Keypad: for VIPs who have monthly subscriptions.

- Servo Motor- Used for the opening of the gate.

- Three LEDs (one with the motion sensor, two LEDs used with the opening of the barrier when a vehicle passes through the ultrasonic sensor, same with the keypad if the password is correct the green LED will turn on, and the servo motor opens the gate for the vehicle) or maybe used the LCD.

Explanation:

This project introduces a simplified procedure for passengers to pay tolls at toll booths by automating the process. All these activities are facilitated through the use of a motion sensor, ultrasonic sensor, and keypad, thus eliminating the need for manual operation of the barrier.

In this project, I am making a replica found in toll plaza centers that is called a stopping system, The idea for this project was inspired by the actual system, in actual tolls they stop the vehicles using a stopper that is completely automated and it is activated when any vehicle passes in front of the ultrasonic sensor. In our case, we are using an HC-SR04

sensor to detect a vehicle(obstacle), and later to lift the barrier we are using a micro servo, which is the mechanism involved in this project. The ultrasonic sensor **detects objects**, causing a **red LED to glow**, indicating the **gate is closed**

The motion sensor is responsible for detecting traffic approaching from different directions. This ensures that vehicles approaching from a straight direction can stop safely, thereby preventing any mishaps. The motion sensor **activates**, illuminating the **second red LED** to **alert drivers and prevent accidents.**

The keypad serves users with monthly subscriptions, allowing them to pass through the traffic smoothly and without hassle. By entering the correct password, verified by the system, the **servo motor opens** the barrier, **green LED glows up**, enabling free movement for authorized users.

Incorrect passwords prompt a **gate closure**, with a **red LED indication.**

How the Project Will Work after arranging all in one

Let's take a closer look at how our project works, where smart ideas meet real-life usefulness.

Imagine this: When a car drives up, our special sensor keeps watch, glowing red. When the driver gets their ticket and heads to the gate, something amazing happens. The sensor talks to a green light and a motor, making the gate open smoothly after just 9 seconds. The green light shines brightly, showing it's okay to go through.

But what about VIPs with monthly cards who hate waiting in line? They can breeze through the sensor, enter the right password, and the gate opens automatically. But if they get the password wrong, the gate stays closed to keep things safe.

In the event of traffic approaching from an unintended direction, the motion sensor activates, illuminating the leftmost LED to alert drivers and prevent accidents

Think about how great it is when a car waits in front of the ultrasonic sensor and The motion sensor sees it and knows to stay quiet, so everything stays nice and orderly.

With all these clever sensors and lights working together, our project makes life smoother and safer for everyone involved.

References

1. Arduino Get Started. (n.d.). Arduino-keypad-servo motor, from https://arduinogetstarted.com/tutorials/arduino-keypad-servo-motor

2. Fahad E. November 25, 2021. Toll Tax System using Arduino: Ultrasonic Sensor with Servo Motor, from https://www.electroniclinic.com/toll-tax-system-using-arduino-ultrasonic-sensor-with-servo-motor/

3. Arduino Get Started. (n.d.). Arduino-motion sensor- led, from https://arduinogetstarted.com/tutorials/arduino-motion-sensor-led

4. Barros R. February 2024. How to Use a PIR Sensor with Arduino: Wiring & Code for Motion-activated Projects, from https://www.youtube.com/watch?v=-jPw4BWou5s&t=1425s

5. Some of the references are taken from class notes and class homework code such as the keypad code.