

**Project Name: SOMETHING COOL, MADE**

Project Code: COOLMD

Collaboration:

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## **Introduction of the project**

The automatic toll plaza system described utilizes motion and ultrasonic sensors, along with a keypad for monthly subscribers. A servo motor operates the gate. When a vehicle approaches straight on, the ultrasonic sensor detects it, causing a red LED to glow, indicating the gate is closed. After 9 seconds, the gate opens, signaled by a green LED, allowing passage.

Monthly subscribers can bypass the queue by entering a password on the keypad, triggering the gate to open and a green LED to illuminate. Incorrect passwords prompt a gate closure for 9 seconds, with a red LED indication.

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

The project requires an Arduino board connected with appropriate code to function effectively.

## 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;
```

```

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);
            }
        }
    }
}
}
}
}

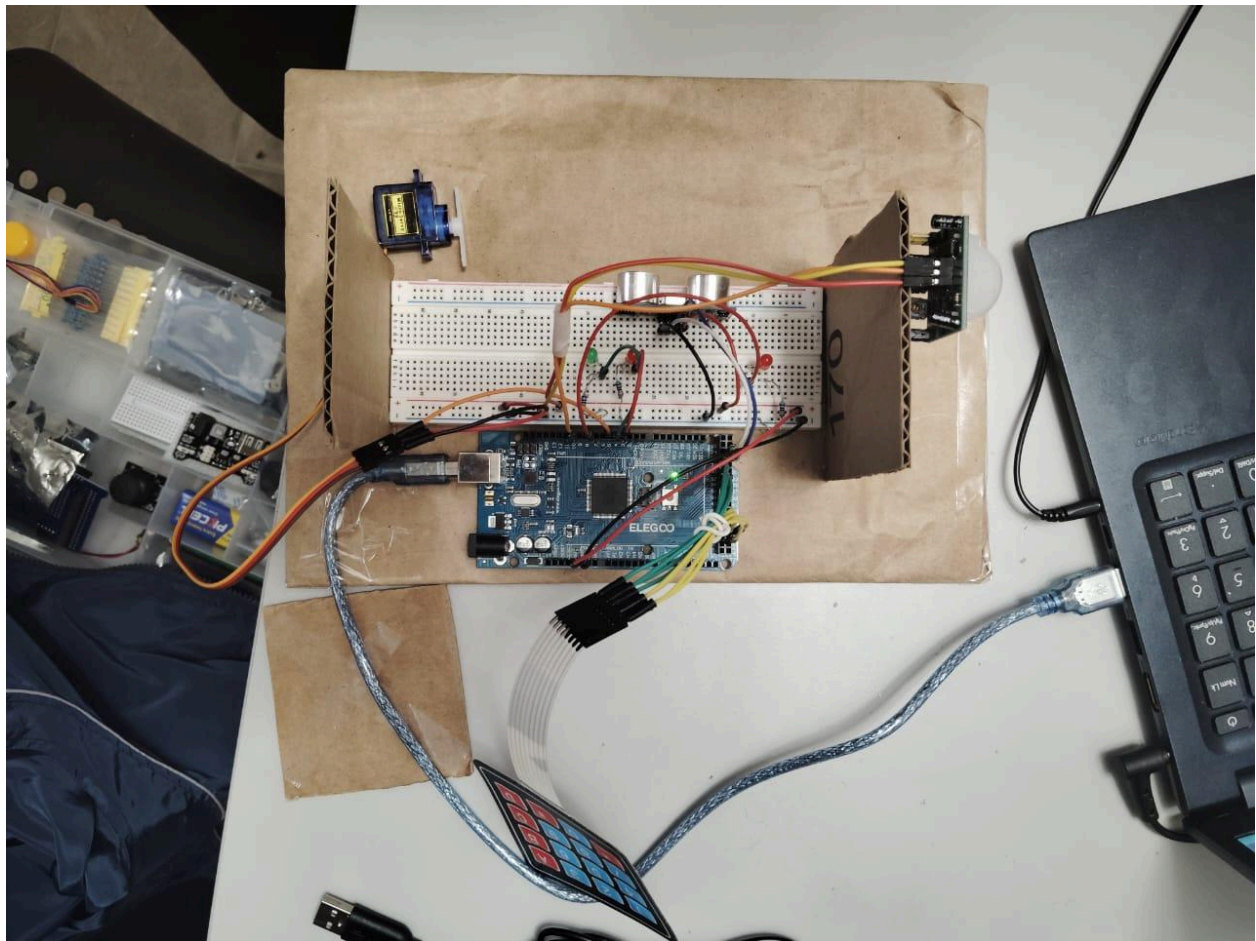
```

```
}
```

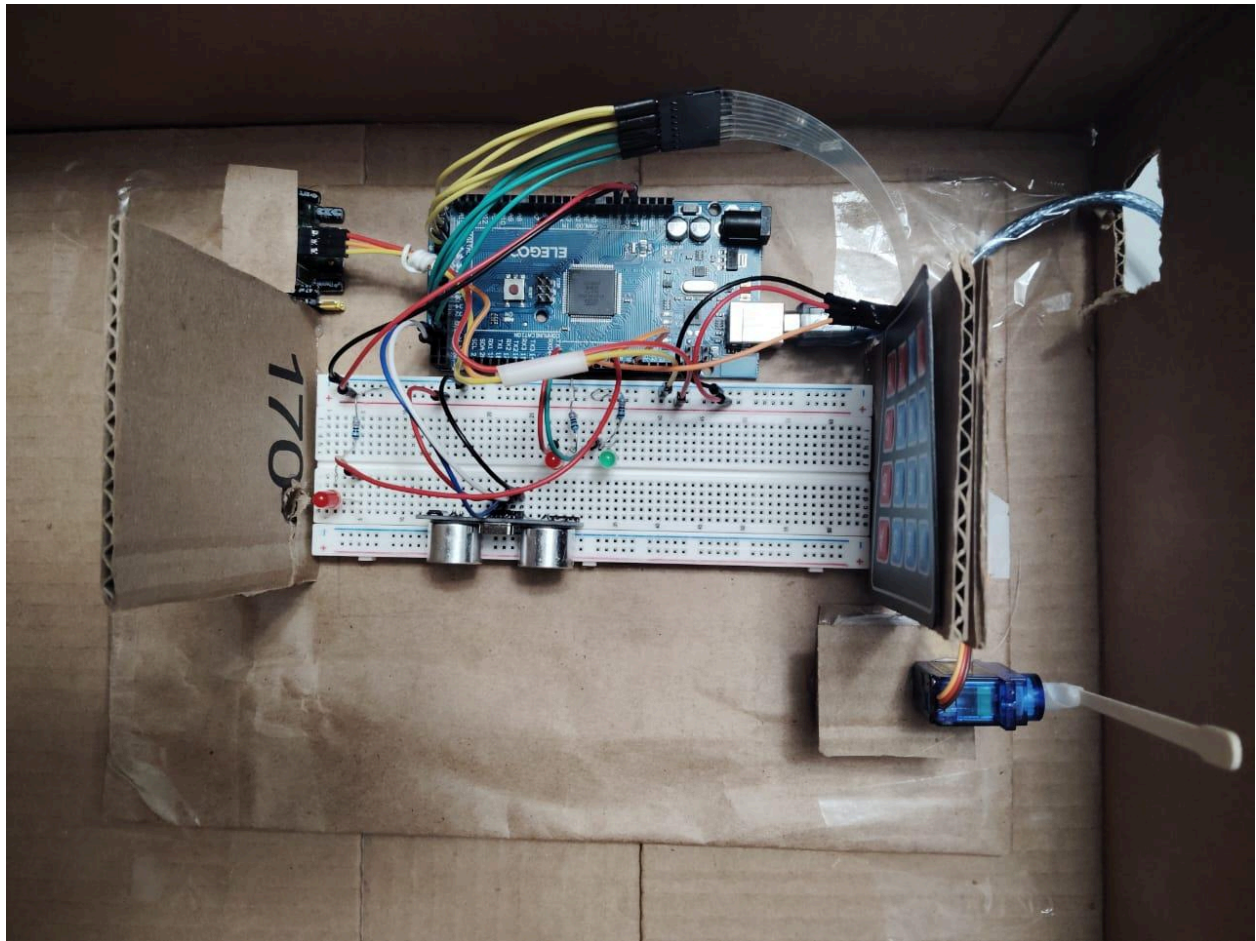
```
void openGate() {  
  gateServo.write(90); // Assuming 90 degrees is the open position  
  delay(9000); // Assuming 9 second to open  
  gateServo.write(0); // Return to closed position  
}
```

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

Ans: (i) Connection

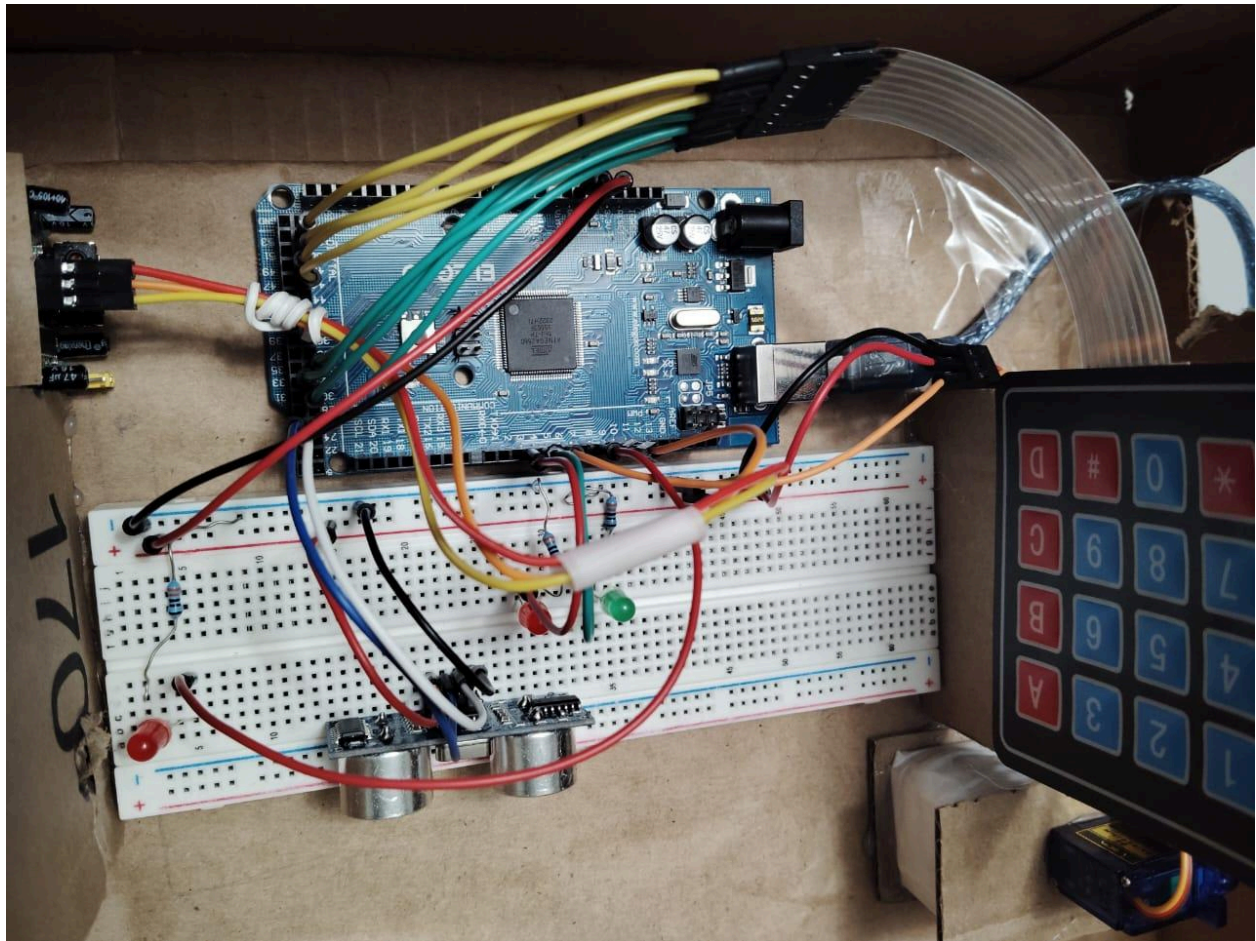


(ii) inner\_part Connection



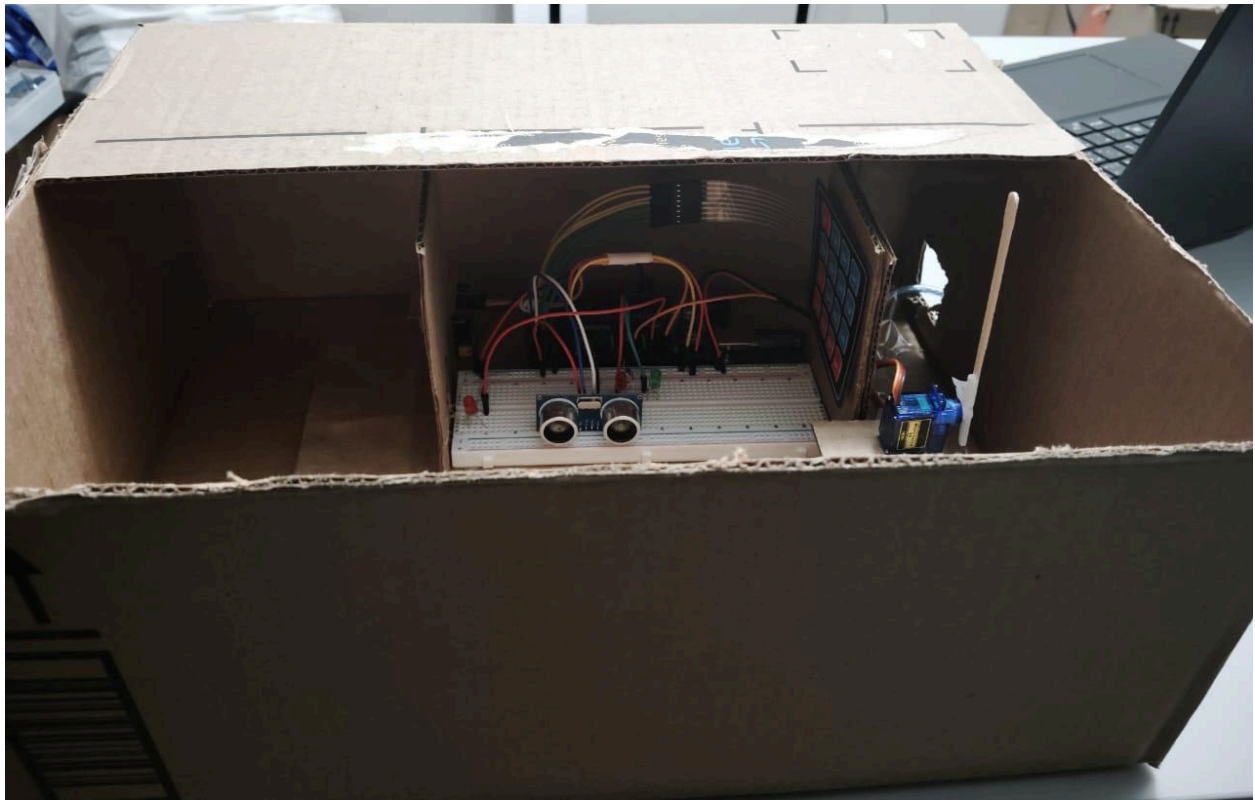


(iii) zoomIn\_InnerPartConnection





(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:

1. The proposal aims to simplify toll payment procedures by automating them. The prototype achieves this by using sensors (motion sensor, ultrasonic sensor) and a keypad to detect vehicles, verify subscriptions, and lift the barrier without manual intervention. This aligns with the vision of automating toll plaza operations.
2. The proposal emphasizes ensuring the safety of vehicles by preventing mishaps at toll booths. The prototype incorporates a motion sensor to detect traffic approaching from different directions, ensuring that vehicles can stop safely. This feature directly addresses the safety concerns outlined in the proposal.
3. The proposal suggests using a keypad for monthly subscription users to pass through the toll plaza smoothly. The prototype implements this feature by allowing authorized users to enter a password via the keypad, which, when verified, opens the barrier. This enhances user convenience and aligns with the proposed vision.

## **How Project Will Work**

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 nine 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.electronicclinic.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.