Smart Home Gate

Student Name	Group
Marwan Tosson	701
Mohamed Ibrahim	701
Mohamed Hamdy	701
Nada Ezzat	701

Samsung Innovation Campus

Group 701

Instructor: Ehab El-Sayed

Introduction

Benefiting from IoT technologies in our daily life has become an essential step toward smarter and more secure living. Enhancing security is now considered one of the most important features that improves our lifestyle and provide greater peace of mind. By integrating IoT with automation, we can build systems that are not only more efficient but also more reliable in protecting our homes and properties. Our project, Smart Home Gate, aims to apply these principles by creating a secure and automated gate system that uses sensors, communication protocols, and an IoT platform to ensure safe and convenient vehicle access.

Problem Facing Humanity

Conventional home gates present several issues:

- Unauthorized vehicles can enter without sufficient security.
- Manual operation leads to delays and inconvenience.
- No tracking system for recording authorized entries.

Idea & Concept

The idea is to build a Smart Home Gate that ensures automatic and secure vehicle entry using IoT components.

- An Ultrasonic sensor detects the approaching vehicle.
- A Camera captures the license plate number.
- The system checks if the number matches an authorized list:
  - If authorized → Green LED turns ON + Servo motor opens the gate.
  - If unauthorized → Red LED turns ON + Buzzer alarm is activated.
- Data is sent to Blynk for monitoring and remote control

Components

1-Ultrasonic (HC-SR04)

The ultrasonic sensor is used to detect the distance between the approaching vehicle and the gate. When the car reaches a predefined range, the sensor triggers the system to activate the camera and start the recognition process.

2-Camera Module

The camera is responsible for capturing the license plate of the approaching vehicle. The captured image is then processed and compared with an authorized database to decide whether access should be granted or denied

3-Servo Motor

The servo motor is used to physically open and close the gate. Once an authorized vehicle is detected, the servo is activated to move the gate into the open position, allowing entry. Afterward, it closes.

4-LEDs (Green and Red)

- **Green LED:** Lights up when the vehicle is authorized and the gate is opened.
- **Red LED:** Lights up when the vehicle is unauthorized, serving as a visual warning signal.

5-Buzzer

The buzzer provides an audible alarm when an unauthorized vehicle attempts to enter. This adds another layer of security by alerting nearby residents or security personnel

6-Raspberry Pi

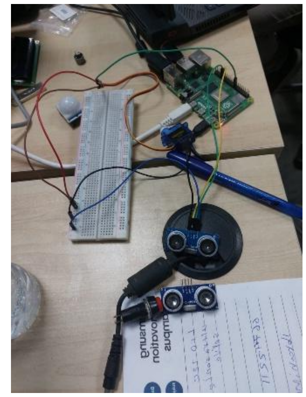
The Raspberry Pi acts as the central processing unit of the system. It handles sensor readings, camera input, decision-making algorithms, and communication with the IoT platform (Blynk)

7-Blynk

Blynk is IoT platform used to receive the readings of ultrasonic and visualize it on Dashboard

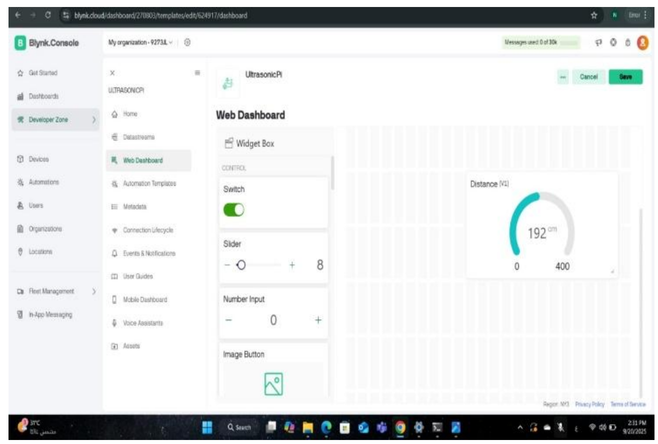
Prototypes

Ultrasonic Sensor Prototype Testing



In the first stage of prototyping, we tested the HC-SR04 ultrasonic sensor independently to verify its ability to measure the distance between the approaching vehicle and the gate. The sensor was connected to the Raspberry Pi, and a simple code was implemented to continuously measure and display the distance readings in real-time.

The purpose of this test was to simulate a vehicle approaching the gate and to determine the accuracy and stability of the sensor in different positions. The readings were successfully obtained, showing decreasing values as the vehicle moved closer to the gate, which confirmed that the sensor can reliably trigger the next step in our system (activating the camera).

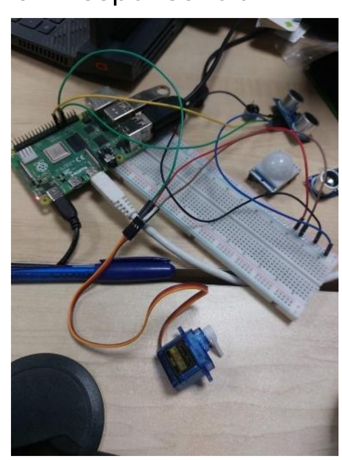


Servo Motor Prototype Testing

In the second stage of prototyping, we tested the servo motor independently to ensure it could reliably open and close the gate as required. The servo was connected to the Raspberry Pi, and a simple control code was implemented to rotate the motor to predefined angles.

The purpose of this test was to simulate the physical movement of the gate in response to an access decision. The motor successfully rotated between the "open" and "closed" positions, demonstrating that it can be used to control the gate mechanism effectively.

This test confirmed that the servo motor can provide smooth and precise movements, which is critical for ensuring consistent gate operation once integrated with the full system



Final Project Demonstration

To showcase the full operation of our Smart Home Gate, we created a video demonstration where the ultrasonic sensor measures the distance of an approaching vehicle and automatically controls the servo motor to open or close the gate. This visual test highlights the integration of sensing and actuation, proving the system's ability to provide secure and automated vehicle access. The video serves as a clear representation of the project's functionality and reliability.

Video link:
https://drive.google.com/drive/folders/1TsBsFycpDjdgO3piGOeCd1yntq7s8lyY?usp=drive_link

Future Modifications

In the current version of our project, the camera module is used to capture images of the vehicle's license plate, which are then processed to verify authorization. While this approach provides the required functionality, it can be further improved by introducing real-time image processing.

As a future modification, we plan to adapt and extend the existing algorithms (such as those available in the Smart Gate GitHub repository).

Conclusion

The Smart Home Gate project successfully demonstrates how IoT technologies can enhance home security and convenience by automating the entry process for vehicles. Through the integration of sensors, a camera module, actuators, and an IoT platform, we built a system that not only identifies authorized vehicles but also responds automatically with clear actions such as opening the gate, activating LEDs, or triggering an alarm.

This project highlights the core IoT components of sensing, connection, and action while applying real communication protocols and IoT integration. The teamwork process ensured that hardware, software, and platform integration were combined effectively to deliver a complete solution.

Future improvements could include expanding the database for license plates, adding cloud storage for entry records, and implementing mobile notifications for enhanced user interaction. Overall, this mini project provides a practical step toward applying IoT in real-life security applications.

GitHub repo: https://github.com/Tosson77/SIC-mini-project.git

#Samsung Innovation Campus

#Life Makers Foundation

#Ali-Hamed

#Ehab-El_Sayed

#Omar-Moselhy