

CoreEL Edu Summit - 3.0

An Intelligent Parking System with Real-Time Slot Monitoring and Digital Payment Integration Using MATLAB

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ABSTRACT

This work presents a hardware-based intelligent parking system integrated with MATLAB for automated slot detection, vehicle management, and digital payment. The setup uses ultrasonic sensors for slot monitoring, IR sensors for entry/exit detection, servo motors for gate control, and an Arduino Uno for coordination, with Wi-Fi communication enabling real-time operation. A live dashboard displays slot status, while timestamps from IR-triggered cameras allow accurate fee calculation. MATLAB manages transaction logs, QR code generation, and database operations, with a mobile/web interface for live updates and payment confirmation. Prototype tests achieved over 95% slot detection accuracy and sub-100 ms barrier response, proving reliability in high-traffic scenarios. The system is scalable for hospitals, campuses, commercial areas, and smart cities, with planned upgrades including automatic number plate recognition, cloud storage, and predictive slot allocation.

PROBLEM STATEMENT & MOTIVATION

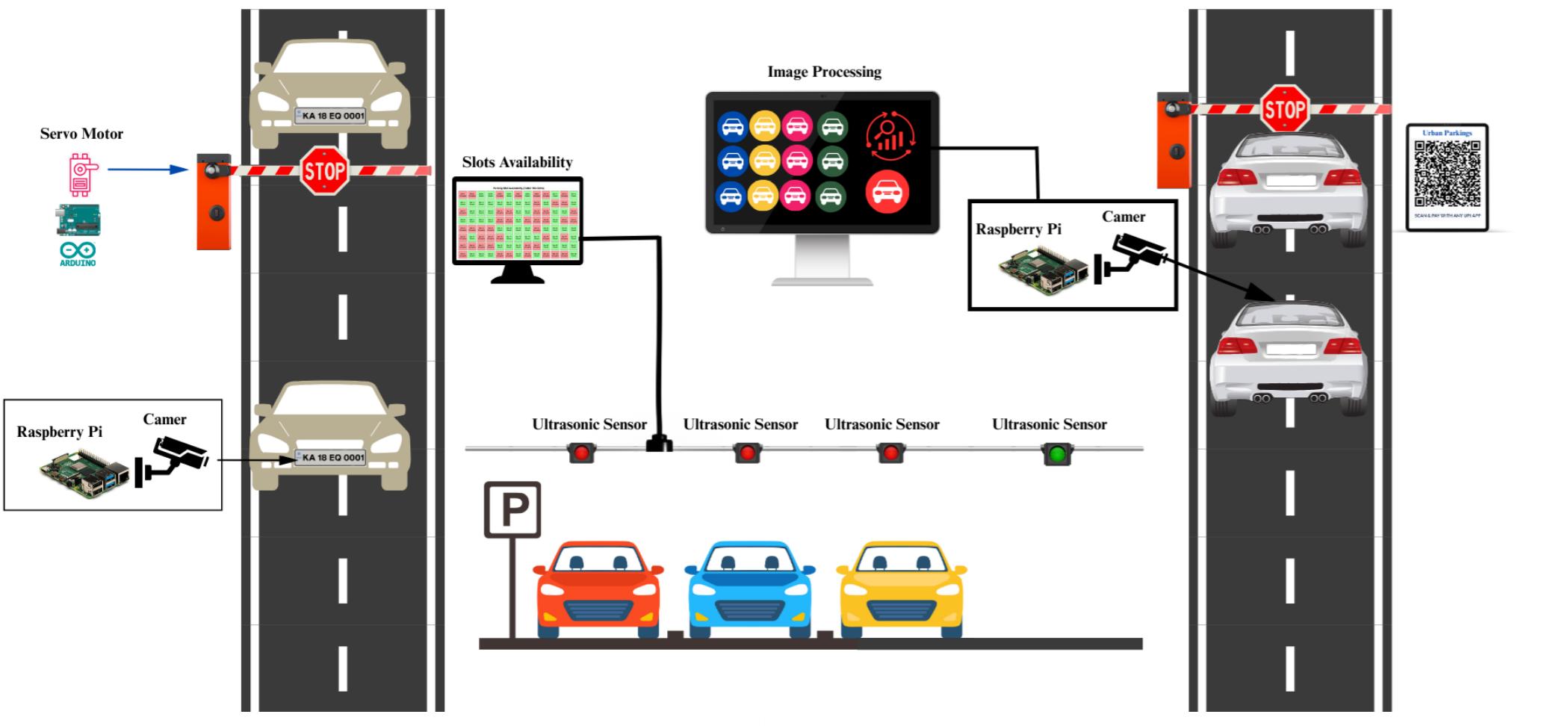
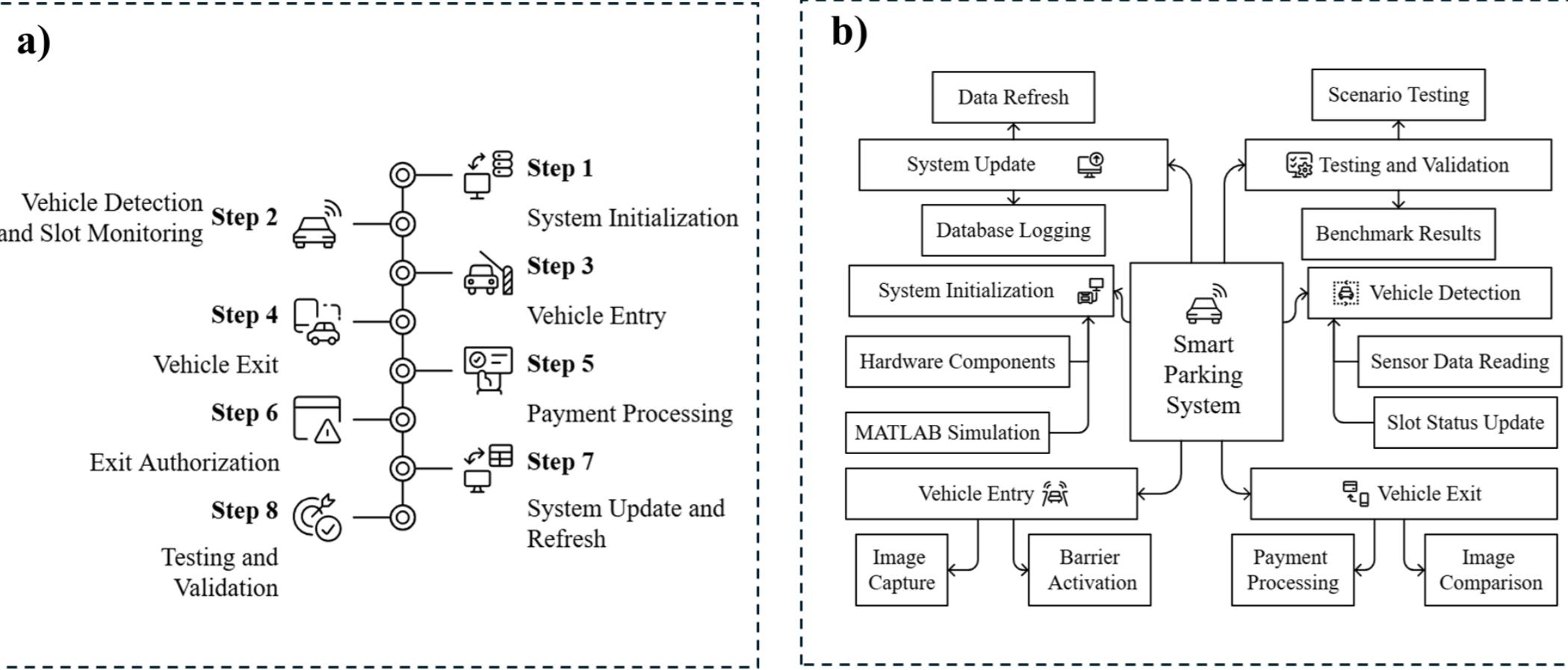
a). Existing challenges in traditional parking systems

- ✓ Traditional parking systems operate with manual supervision, physical tickets, and static payment methods that create delays and inefficiencies.
- ✓ These systems often fail to provide accurate real-time slot tracking, causing drivers to spend excessive time searching for available spaces.

b). Need for efficient slot monitoring and seamless payment

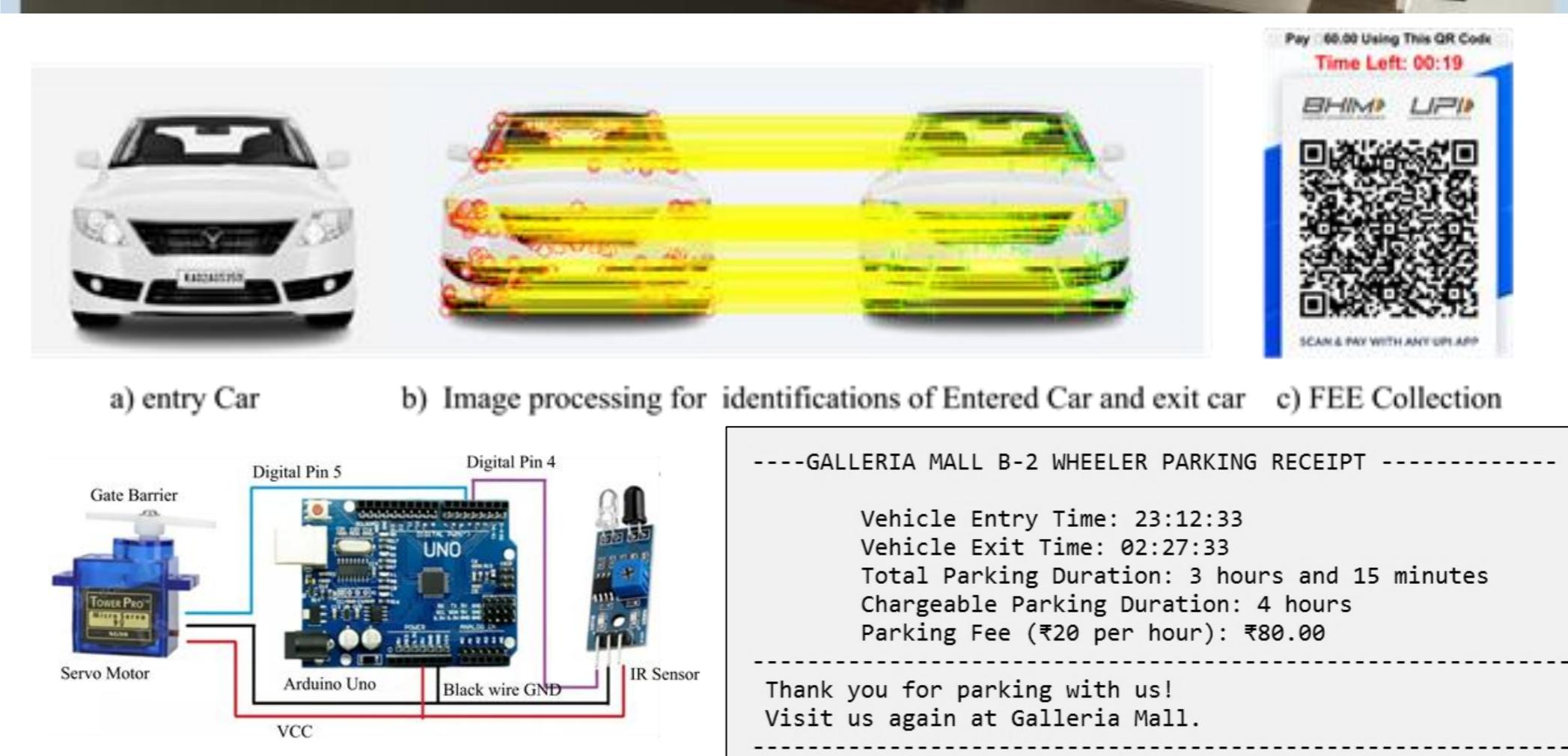
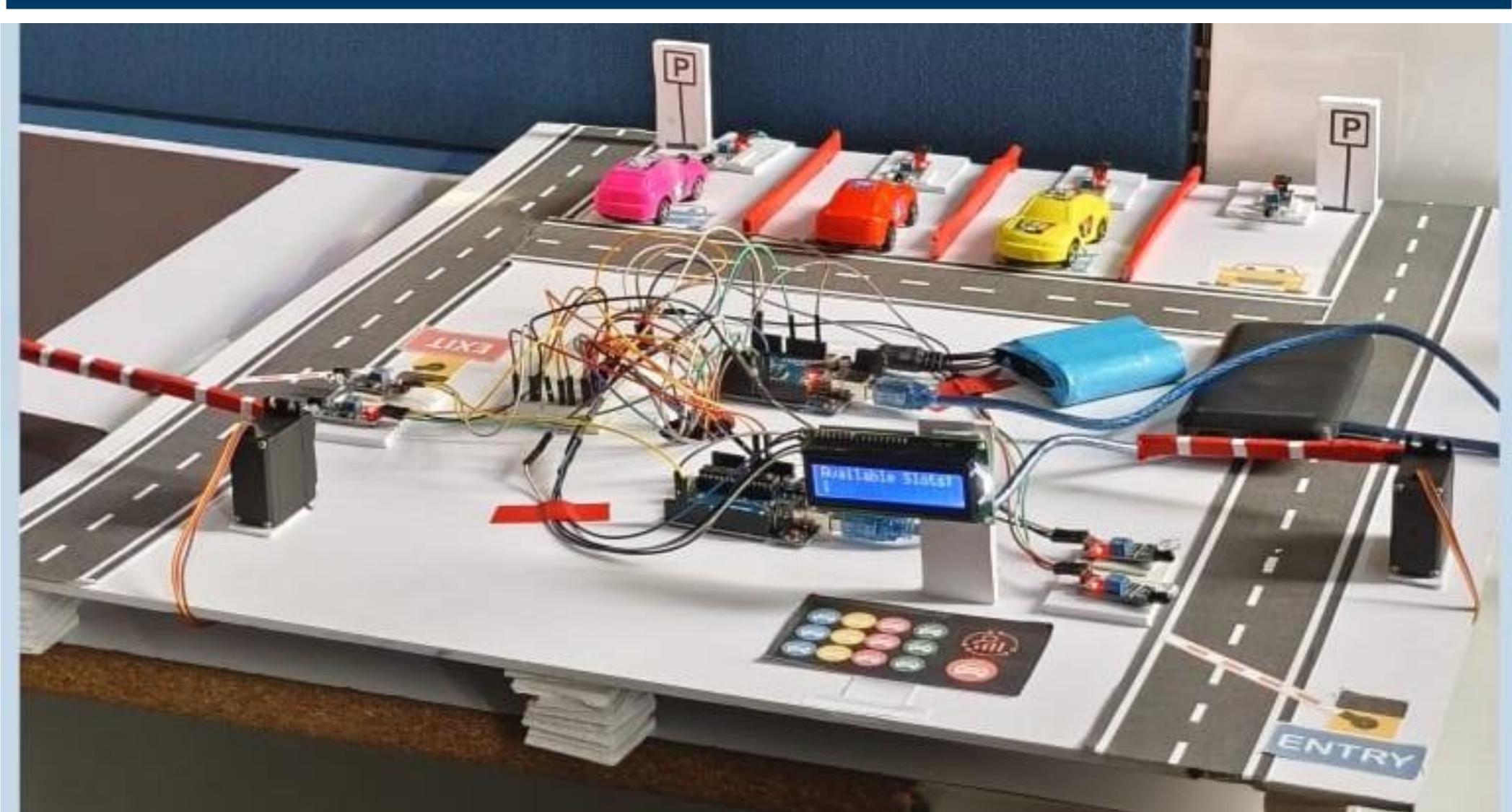
- ✓ Automated slot tracking reduces vehicle idle time, optimizes parking space utilization, and improves vehicle flow within parking areas.
- ✓ Seamless payment integration through QR codes and digital gateways eliminates manual cash handling and reduces user processing time. Contactless transactions increase system reliability and user satisfaction. Automated billing linked to entry and exit records provides accurate fee calculation without human intervention.

METHODOLOGY



Sl. No.	Hardware	Sl. No.	Software
1	Ultrasonic Sensors	1	Arduino IDE
2	Servo Motors	2	Embedded C
3	Arduino Uno	3	Razorpay
4	QR Codes	4	MATLAB

RESULTS and DISCUSSION



Scan this QR code to view the work



The digital payment process is integrated through QR code generation, ensuring a seamless transaction experience. The system calculates the parking fee based on duration, applying a 15-minute rounding policy, and displays a unique QR code for each payment. The user can scan the code via UPI applications like Google Pay or Paytm, and payment confirmation is automatically linked to gate control.

CONCLUSION

- The intelligent parking system developed in this project successfully provides a fully automated solution to urban parking challenges by integrating real-time vehicle detection, automated barrier control, and seamless digital payment processing.
- The system leverages Arduino with Embedded C for hardware control, MATLAB for real-time data processing and visualization, and Razorpay-generated UPI QR codes for contactless fee transactions. This integration eliminates the need for human intervention, offering a smooth, efficient, and secure parking experience.
- The system's ability to manage entry and exit, calculate parking fees automatically, and generate payment options based on vehicle-specific data demonstrates its effectiveness in real-world applications.

REFERENCES

1. MATLAB and Simulink support for Arduino programming. *Arduino Programming with MATLAB and Simulink*. MathWorks. <https://in.mathworks.com/discovery/arduino-programming-matlab-simulink.html>
2. Basic DC Motor Control by Arduino UNO & Simulink. <https://in.mathworks.com/company/technical-articles/motor-control-with-arduino-a-case-study-in-data-driven-modeling-and-control-design.html>
3. MathWorks. *ultrasonic – Connection to ultrasonic sensor on Arduino hardware*. <https://in.mathworks.com/help/matlab/supportpkg/arduinoio.ultrasonic.html>
4. Integration of IR sensor to MATLAB using Arduino UNO <https://in.mathworks.com/help/matlab/legomindstormsev3io-ir-sensors.html?requestedDomain=>