

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

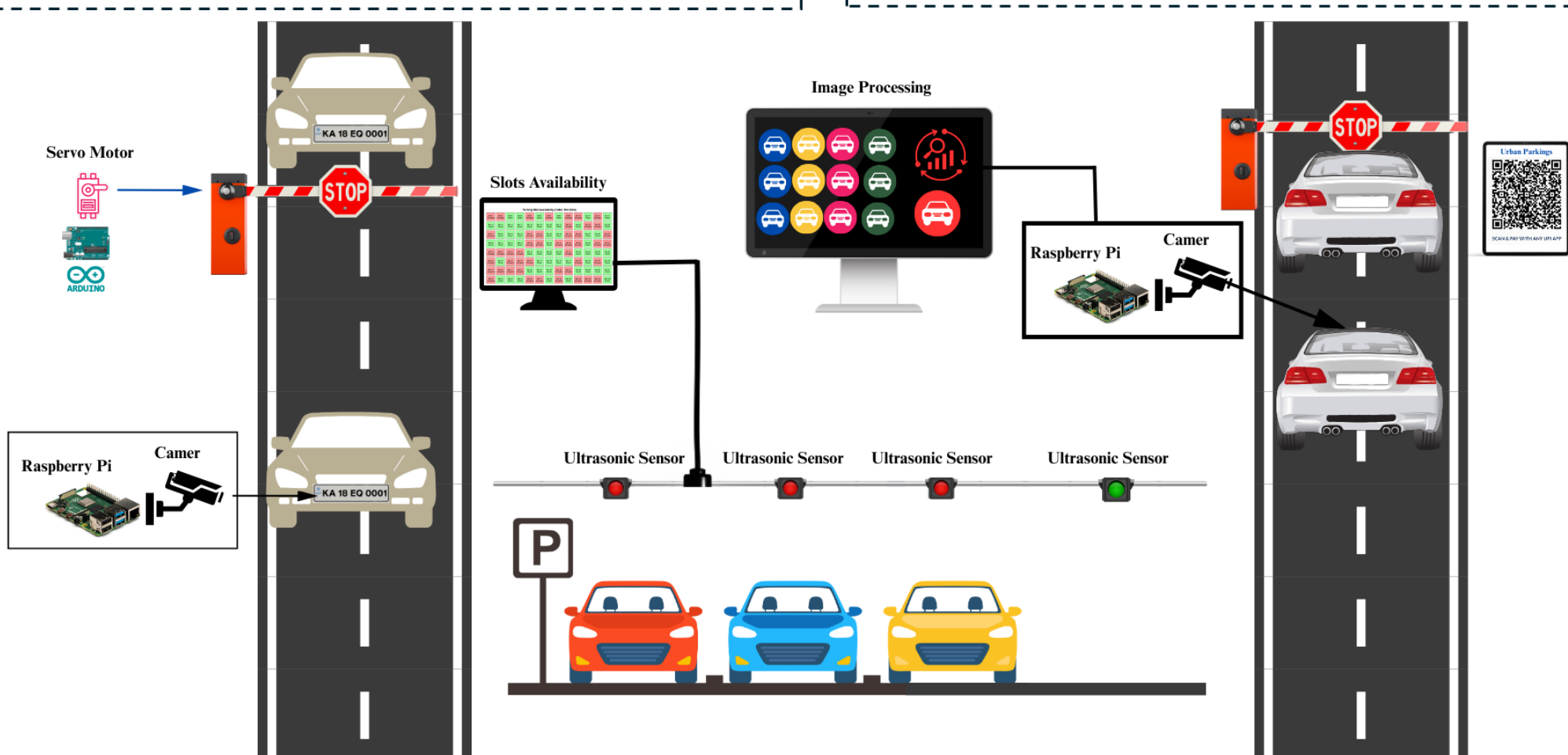
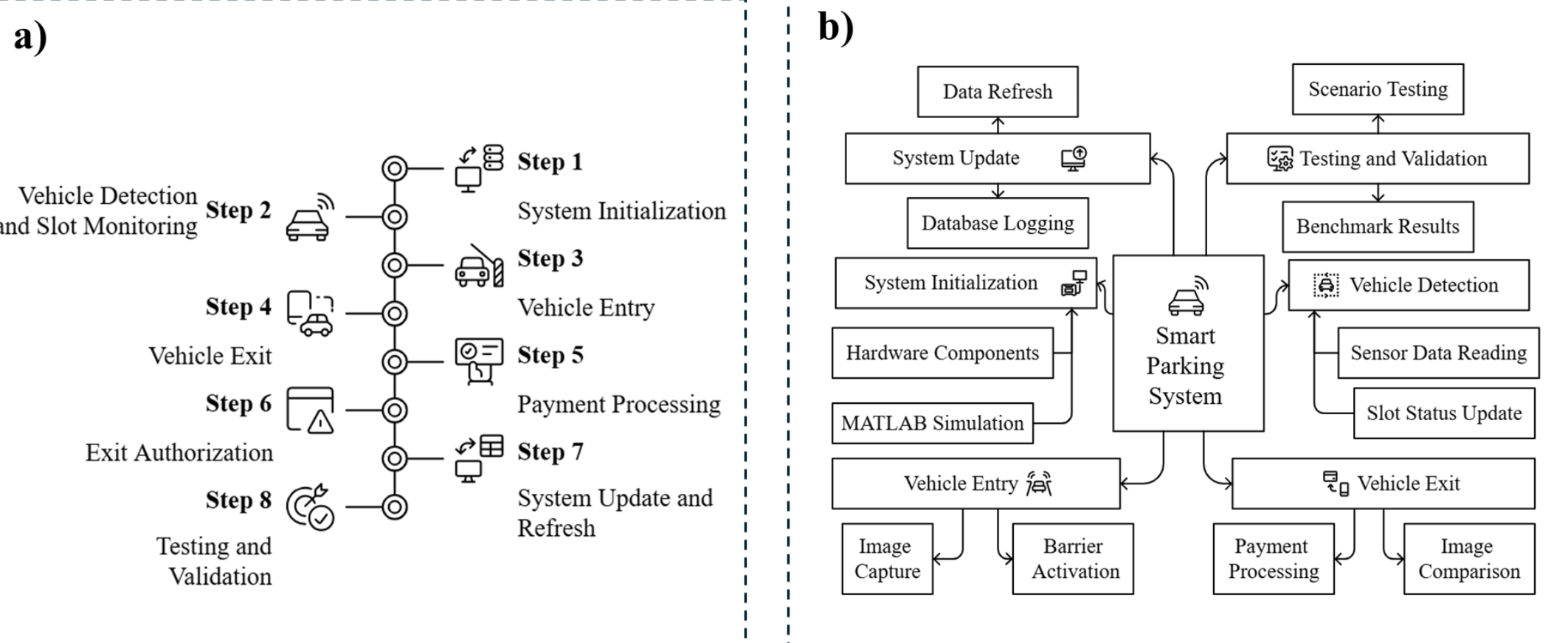
a). Existing challenges in traditional parking systems

- ✓ 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



Parking Slot Availability (Total: 104 Slots)

Slot 1 Occupied	Slot 2 Occupied	Slot 3 Vacant	Slot 4 Vacant	Slot 5 Occupied	Slot 6 Vacant	Slot 7 Occupied	Slot 8 Vacant	Slot 9 Occupied	Slot 10 Occupied	Slot 11 Vacant	Slot 12 Occupied	Slot 13 Vacant
Slot 14 Vacant	Slot 15 Vacant	Slot 16 Vacant	Slot 17 Vacant	Slot 18 Vacant	Slot 19 Vacant	Slot 20 Vacant	Slot 21 Occupied	Slot 22 Occupied	Slot 23 Occupied	Slot 24 Occupied	Slot 25 Occupied	Slot 26 Vacant
Slot 27 Occupied	Slot 28 Vacant	Slot 29 Vacant	Slot 30 Vacant	Slot 31 Occupied	Slot 32 Occupied	Slot 33 Occupied	Slot 34 Vacant	Slot 35 Occupied	Slot 36 Occupied	Slot 37 Vacant	Slot 38 Occupied	Slot 39 Occupied
Slot 40 Occupied	Slot 41 Occupied	Slot 42 Occupied	Slot 43 Occupied	Slot 44 Occupied	Slot 45 Occupied	Slot 46 Occupied	Slot 47 Occupied	Slot 48 Occupied	Slot 49 Occupied	Slot 50 Occupied	Slot 51 Occupied	Slot 52 Occupied
Slot 53 Occupied	Slot 54 Occupied	Slot 55 Occupied	Slot 56 Occupied	Slot 57 Occupied	Slot 58 Occupied	Slot 59 Occupied	Slot 60 Occupied	Slot 61 Occupied	Slot 62 Occupied	Slot 63 Occupied	Slot 64 Occupied	Slot 65 Occupied
Slot 66 Occupied	Slot 67 Occupied	Slot 68 Occupied	Slot 69 Occupied	Slot 70 Occupied	Slot 71 Occupied	Slot 72 Occupied	Slot 73 Occupied	Slot 74 Occupied	Slot 75 Occupied	Slot 76 Occupied	Slot 77 Occupied	Slot 78 Occupied
Slot 79 Occupied	Slot 80 Occupied	Slot 81 Occupied	Slot 82 Occupied	Slot 83 Occupied	Slot 84 Occupied	Slot 85 Occupied	Slot 86 Occupied	Slot 87 Occupied	Slot 88 Occupied	Slot 89 Occupied	Slot 90 Occupied	Slot 91 Occupied
Slot 92 Occupied	Slot 93 Occupied	Slot 94 Occupied	Slot 95 Occupied	Slot 96 Occupied	Slot 97 Occupied	Slot 98 Occupied	Slot 99 Occupied	Slot 100 Occupied	Slot 101 Occupied	Slot 102 Occupied	Slot 103 Occupied	Slot 104 Occupied

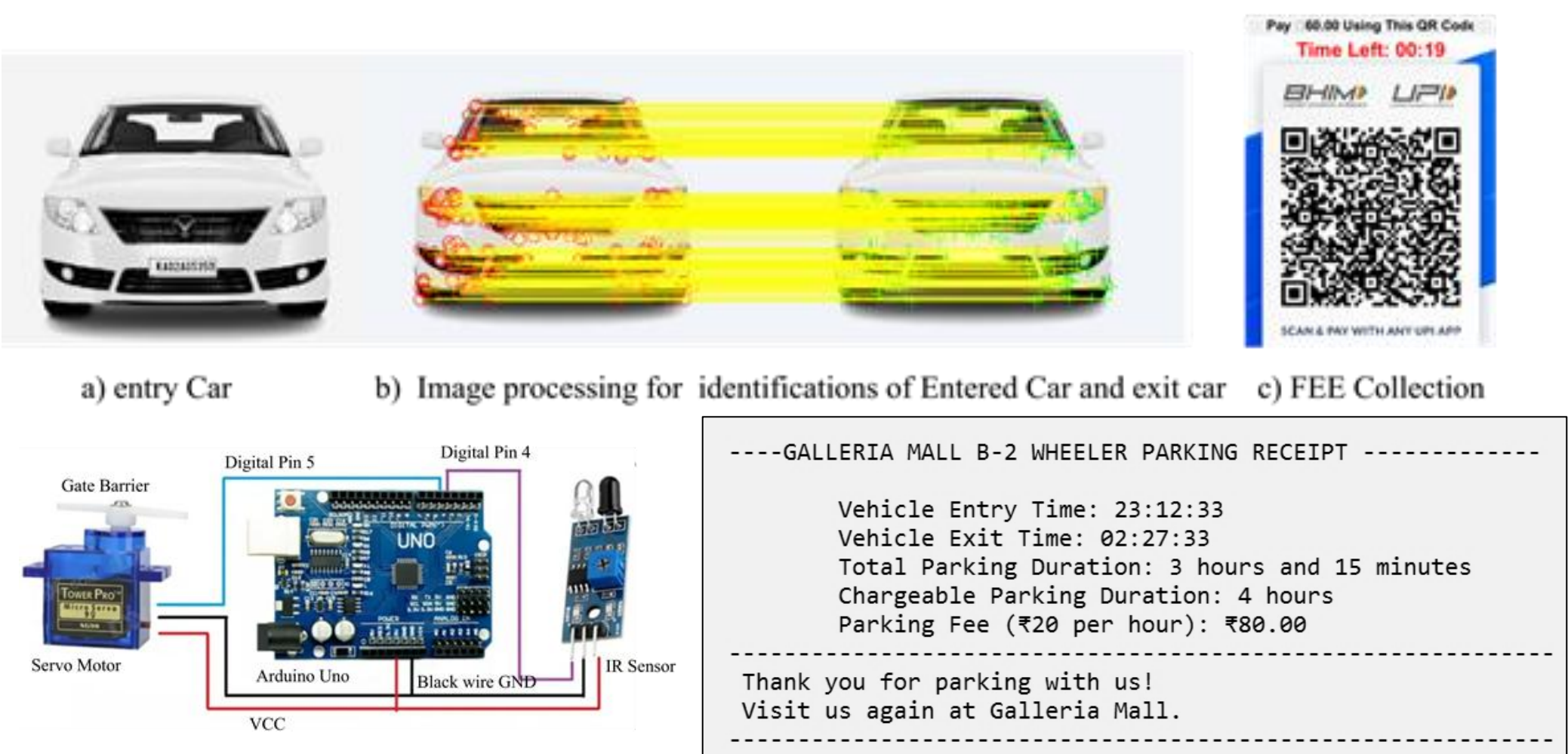
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Sl. No.	Hardware
1	Ultrasonic Sensors
2	Servo Motors
3	Arduino Uno
4	QR Codes

Sl. No.	Software
1	Arduino IDE
2	Embedded C
3	Razorpay
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.

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