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Fall Semester 2022-23

School of Electronics Engineering

Raspberry-Pi based Car Parking System Using MQTT Protocol

Project Report For

ECE 3003 Microcontrollers And Its Applications

Proposed By: -

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SUBMITTED TO: **Dr. S. SUNDAR**

DATE – **12/11/2022**

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ABSTRACT

Raspberry pi is a miniature of computer which has the adaptability with the sensors. This paper study contains an automated car parking system that uses the Raspberry Pi. This paper proposes an automated car parking system that uses MQTT protocol and infrared sensors. The infrared sensor reports the state of the car parking slot periodically to the main control unit which mainly refers to the Raspberry Pi. Same is conveyed to mobile MQTT dashboard application through the usage of MQTT protocol. The sensor senses the movement of the vehicle and transmits the signal to the pi. LCD display is installed at the main entrance of the parking area and at each parking level, to provide enough information about the slot availability. The proposed work is implemented for four slots in each level. In a real-time scenario, the proposed work can be enhanced further for multiple levels containing n number of slots with multiple Raspberry Pi.

I. INTRODUCTION

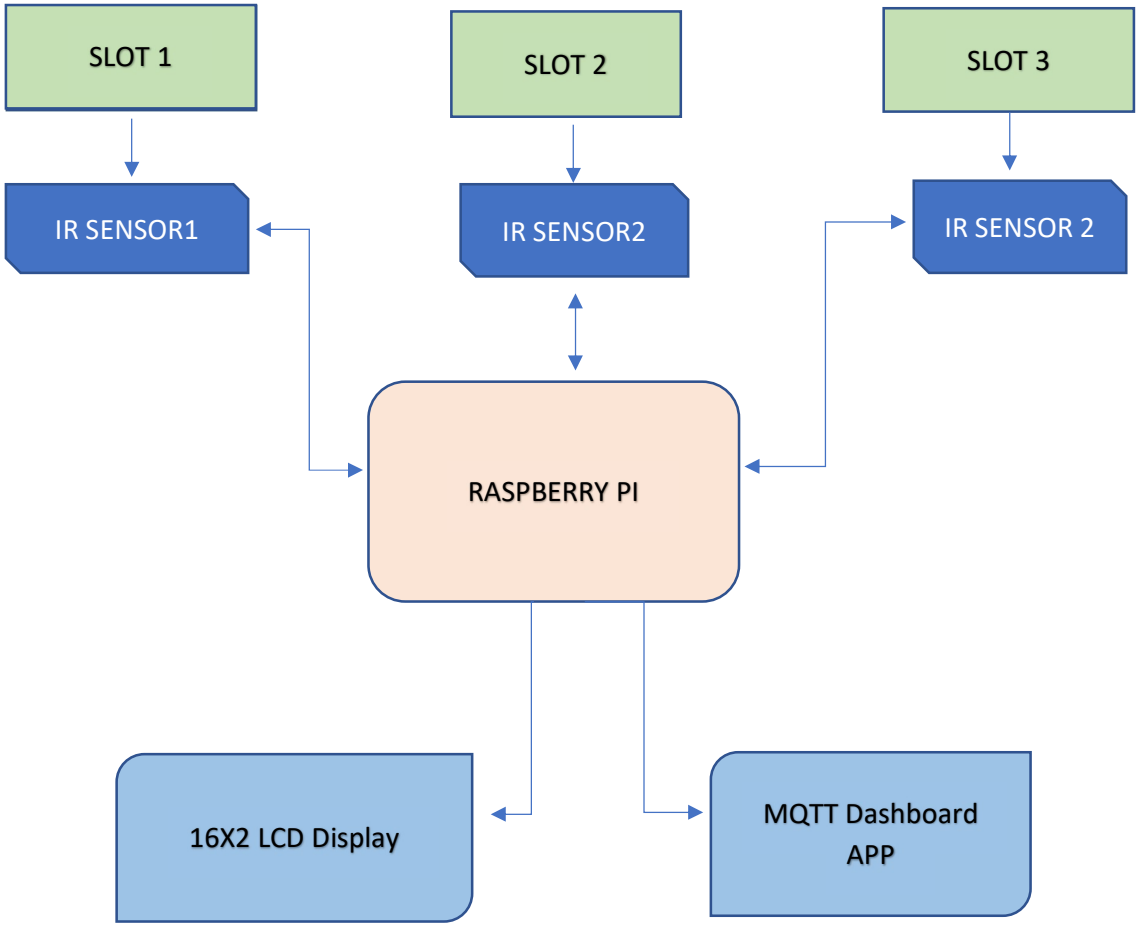
In the present era where space has become a thing of utmost value as well as a matter of prime concern, it has become very crucial to avoid the wastage of space. In places where more than 500 cars need to be parked, this project proves to be a boon. The project enables the parking of vehicles, level after level. Hence space is utilized in the best efficient way i.e. maximum cars are accommodated in minimum space. The parking system built traditionally does not employ any intelligent monitoring system. Rather, human beings are employed to serve the purpose. All vehicles after entering the parking area are found wasting time searching for parking slots. Sometimes, a blockage is created.

Things become worse when multiple parking lanes exist as a person in order to park needs to look for all the lanes. This project finds the nearest parking level and assigns the parking slots in that respective level. This way it minimizes fuel consumption which in turn minimizes the traces of carbon footprints in the atmosphere. The system captures the images of number-plates and stores the details in database for further actions like generation of bills and then allows the vehicles to pass. Since not even a single manpower is involved, maintenance and operation cost is low. This idea can be applied on the entrance of public places like malls, amusement parks, tech parks for visitors etc. The project follows "pay-as-you-go" model. During exit, the information stored in the database about car details, time of entrance etc. is extracted and is used to compute the time for which the car was parked. Based on the computed time, bill is generated. At entrance, the ultrasonic sensor detects the presence of a car. The sensor transmits the signal to the camera. The camera upon receiving the signal captures the image of the number plate and sends it to the raspberry pi. The raspberry pi stores the details of the car in the database. Based upon the availability of the slots in any of the levels, appropriate message is displayed in the LED display. If slot is available, level number is displayed. Otherwise "no space available" message is displayed. After displaying the level number, automatic boom barrier allows the car to enter. The car goes to the allotted level and checks further for the allotted slot. The car is parked at the allotted slot and it is sensed by an ultrasonic sensor attached to Xbee (device to transmit wirelessly). This sensor checks the status of the slots and sends the availability details to the level control unit. Level control unit of each and every level is connected to the main control unit at the entrance which are connected to a single network. Meanwhile the IR sensor will detect the motion in particular level and it passes on the signal to the surveillance camera. Upon receiving the signal, the camera starts recording for fixed duration of time and waits for next signal by IR sensor. At the time of exit, the camera again captures the Image of the car and sends it to the raspberry pi. The raspberry pi extracts the details of the car on the basis of the image and computes the number of hours for which the car was parked. Finally, the bill is generated.

II. LITERATURE REVIEW

Sl.No.	Paper Title	Author Name/Year
1	Smart Car Parking System Solution for the Internet of Things in Smart Cities	W. Alsafery, B. Alturki, S. Reiff-Marganiec and K. Jambi, 2018 1stInternational Conference on Computer Applications & Information Security(ICCAIS), 2018.
2	Smart Car Parking Management System	L. H. Chowdhury, Z. N. M. Z. Mahmud, I. -U. Islam, I. Jahan and S. Islam, 2019 IEEE International Conference on Robotics, Automation, Artificial-intelligence and Internet-of-Things (RAAICON),2019,
3	IoT based smart parking system	A. Khanna and R. Anand, 2016 International Conference on Internet of Things and Applications (IOTA), 2016
4	Low cost smart parking system for smart cities	Vakula and Y. K. Kolli, 2017International Conference on Intelligent Sustainable Systems (ICISS),2017
5	Smart Car Parking System in Smart Cities using IR	M. Meenaloshini, J. Ilakkiya, P. Sharmila, J. C. Sheffi Malar and S. Nithyasri, 2019 3rd International Conference on Computing and Communications Technologies (ICCCT), 2019
6	Smart Parking System for Cars	B. K. Patil, A. Deshpande, S. Suryavanshi, R. Magdum and B. Manjunath 2018 International Conference on Recent Innovations in Electrical, Electronics & Communication Engineering (ICRIEECE), 2018,

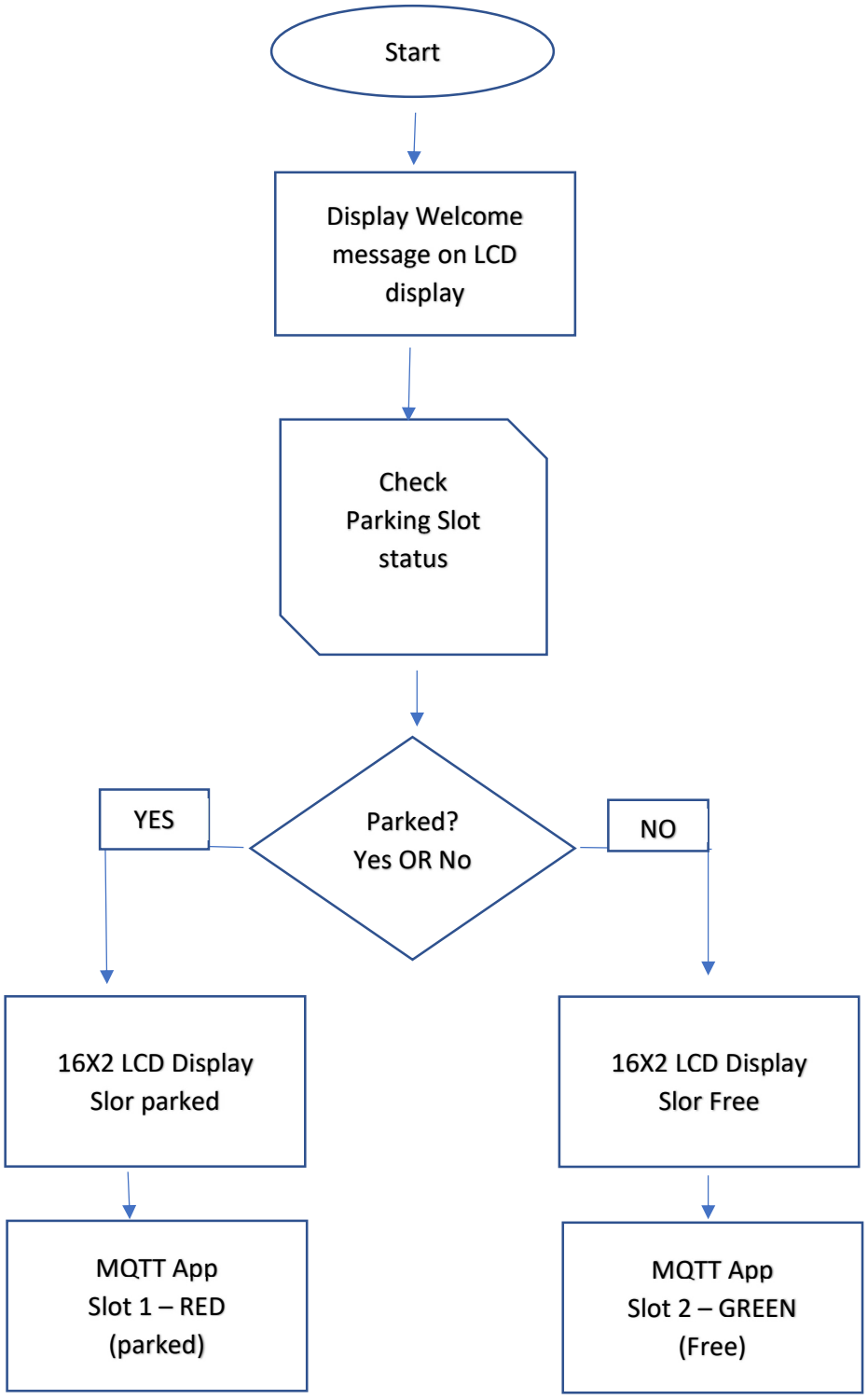
III . BLOCK DIAGRAM:



IV . BLOCK DISCRIPTION:

- **SLOT1, SLOT2,SLOT3** – refers to car parking slots.
- **IR SENSORS** – sensors used to collect data from parking slots.
- **RASPBERRY PI** – main processing UNIT of project.
- **16X2 LCD** – display used to present car parking slots status i.e. whether they are free or not.
- **MQTT Dashboard APP** – Mobile application used to present car parking status.

V . FLOWCHART:

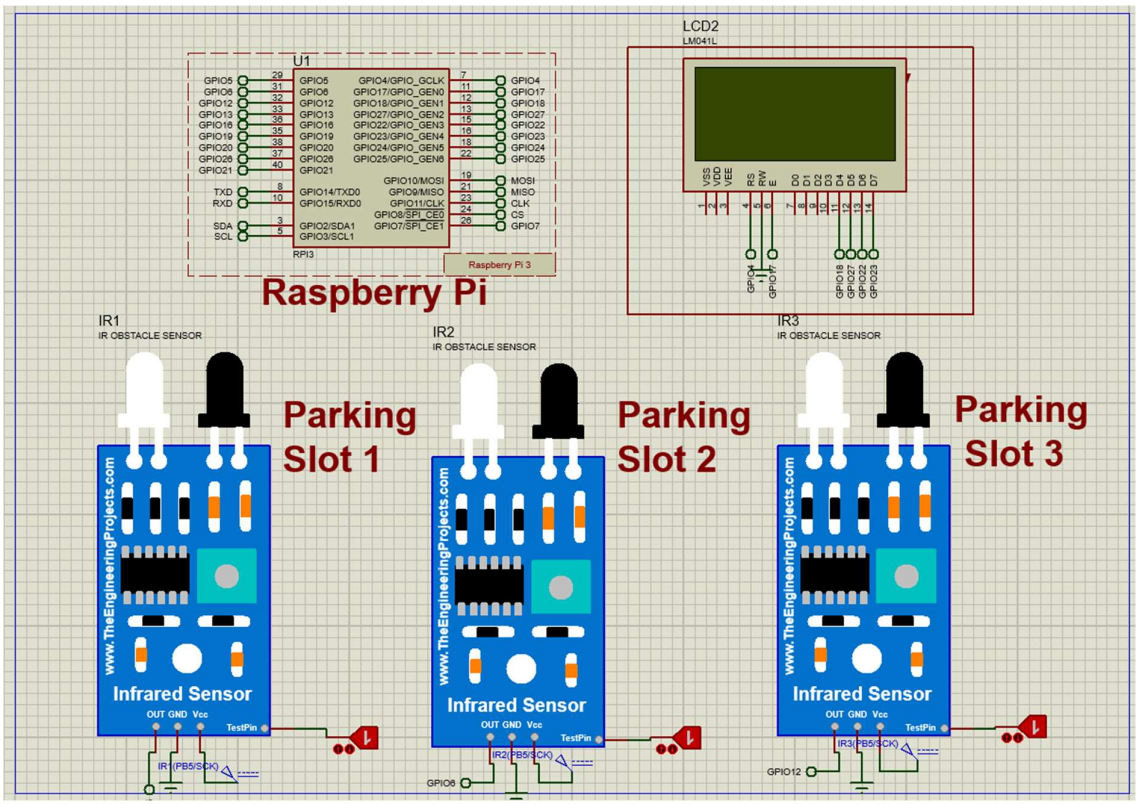

Start
Display Welcome message on LCD display
Check Parking Slot status
Parked? Yes OR No
YES
NO
16X2 LCD Display Slor parked
16X2 LCD Display Slor Free
MQTT App Slot 1 – RED (parked)
MQTT App Slot 2 – GREEN (Free)

VI . PROTEUS SIMULATION

COMPONENTS USED:

- IR Obstacle Sensor
- Raspberry pi 3
- 16x2 LCD
- Logicstate
- GPIO Pins

PROTEUES PROTOTYPE:

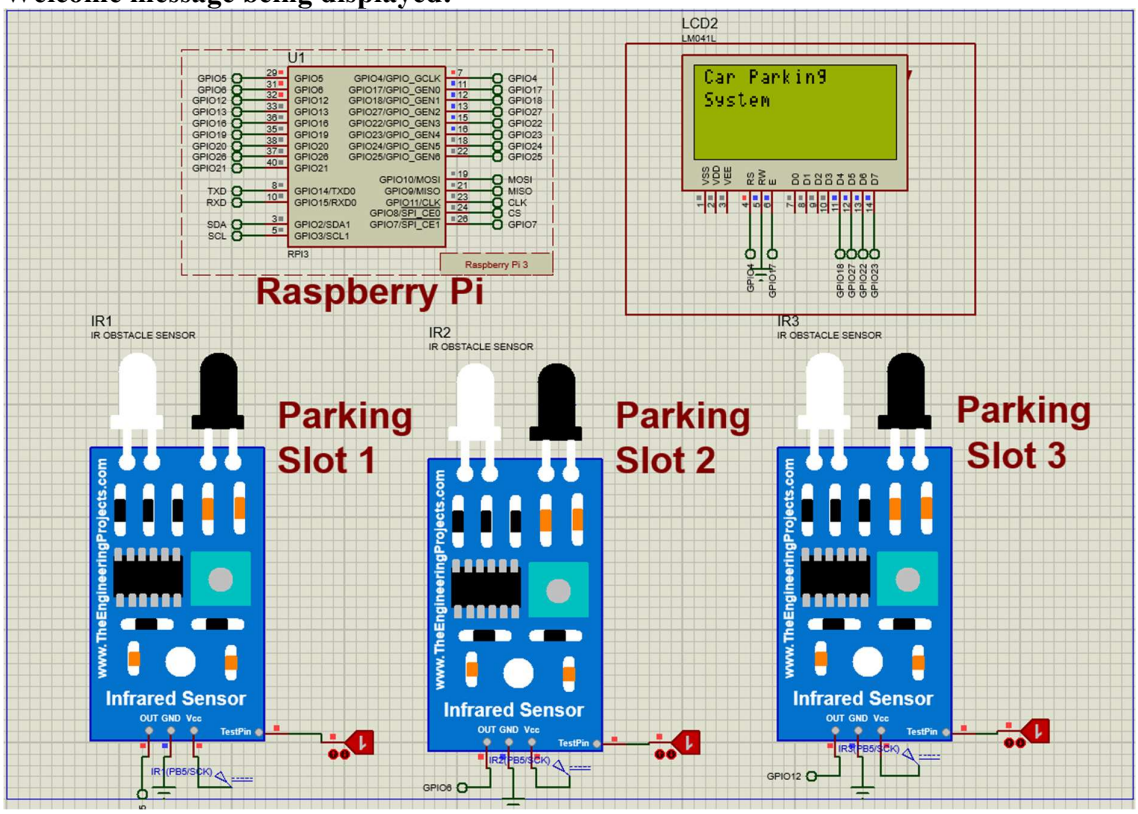


PROCEDURE:

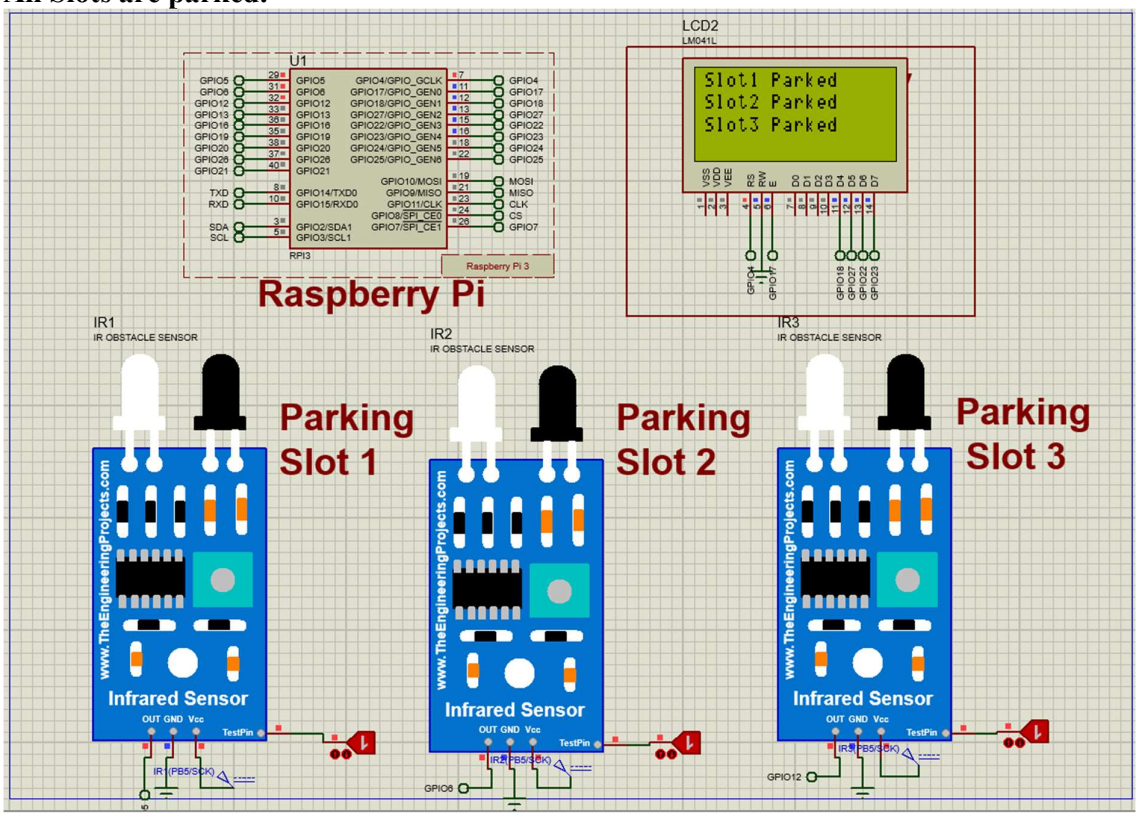
Raspberry Pi is connected with LCD Display and IR Sensor using GPIO Pins. Logicstate is used to give input for IR sensors. When simulation is runs “welcome to parking system” is displayed on LCD screen. When logicstate value is one , message displayed on LCD is “ Slot parked”. When logicstate value is zero , message displayed on LCD is “ Slot free”. Same is conveyed to MQTT Dashboard application present on our mobile through mqtt protocol.

SIMULATION RESULT:

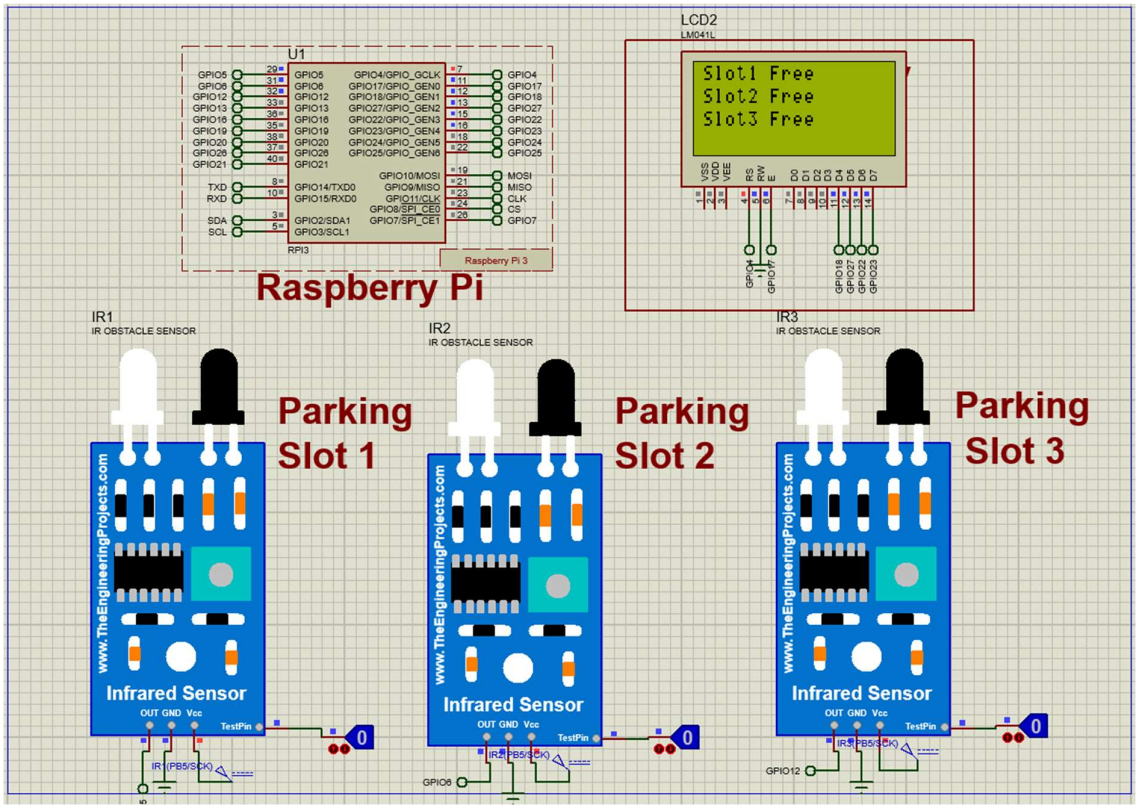
Welcome message being displayed:



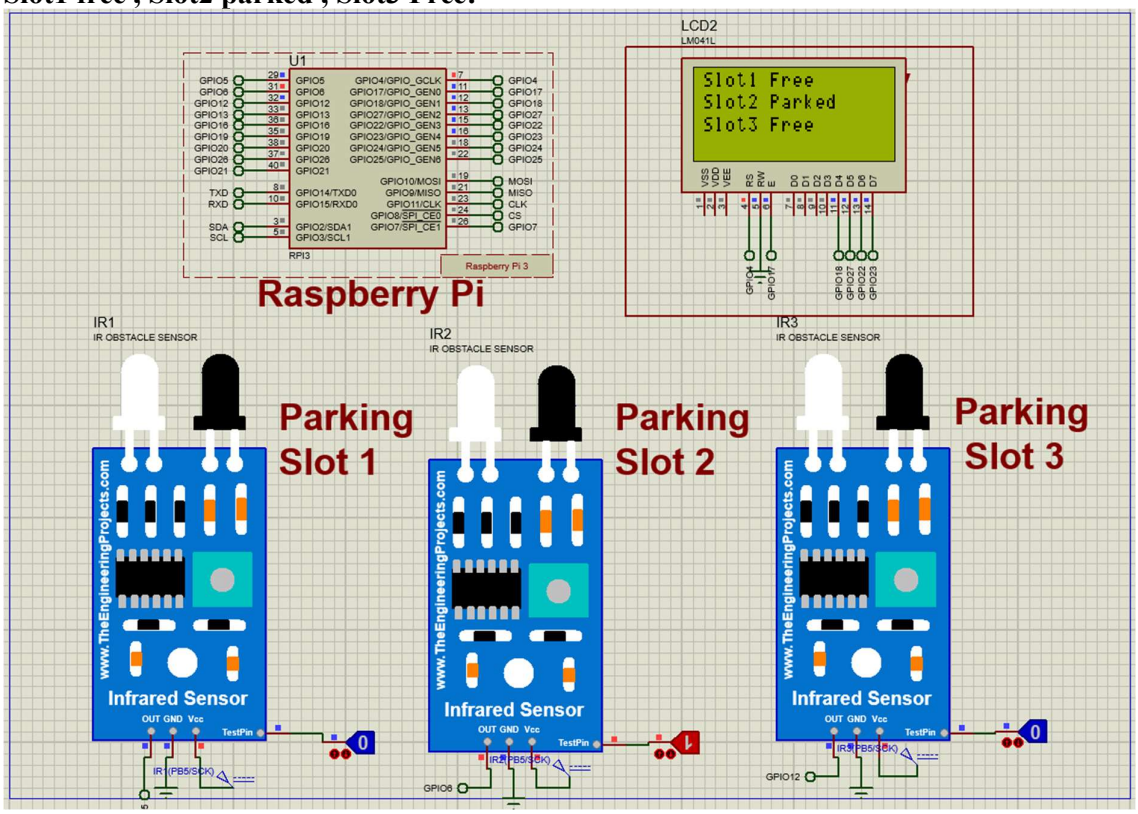
All Slots are parked.



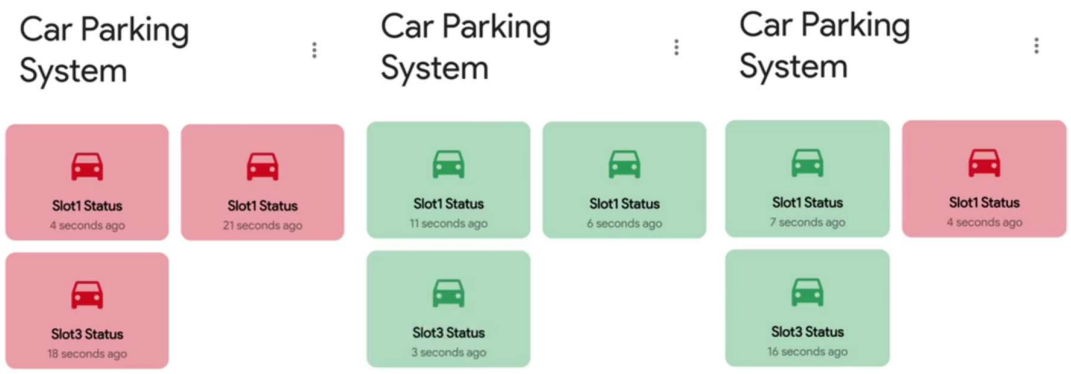
All Slots are free:

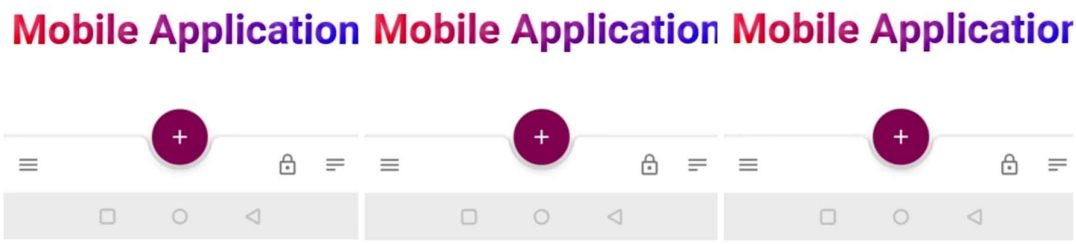


Slot1 free , Slot2 parked , Slot3 Free:



MOBILE APP SCREENSHOTS: (For Above simulations)





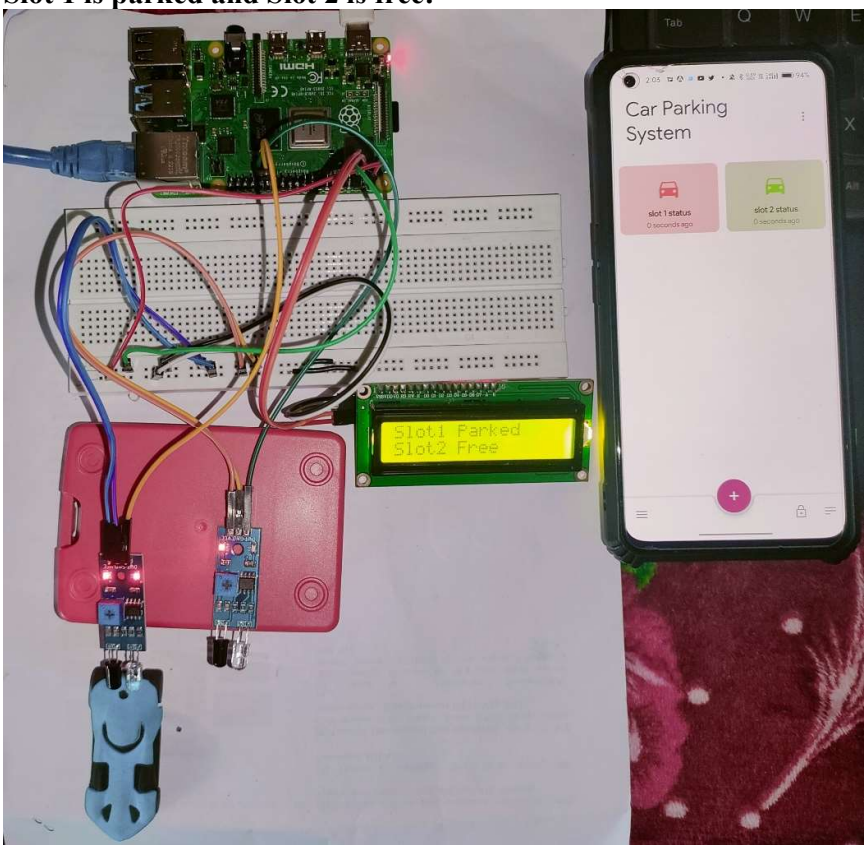
VII . HARDWARE SIMULATION:

PROCEDURE:

Raspberry Pi is connected with LCD Display and IR Sensor using GPIO Pins.IR sensors detect whether car is parked in slot or not. If car is parked LCD is used to display “Slot parked” and if car is not parked LCD display ‘Slot free’.Same is conveyed to MQTT Dashboard application present on our mobile through mqtt protocol.

Both Slots are free:

Slot 1 is parked and Slot 2 is free:



VIII. PROS & CONS OF THIS PROJECT:

PROS:

- Helps driver in making more informed decision when parking vehicles.
- Helps in avoiding accidents which may occur due to blind sidedness of drivers.
- Helps in saving fuel as driver can directly go to the free slots without going around in circles.
- Increased Security.

CONS:

- Expensive Construction & Installation.
- Requires Regular Maintenance
- System Breakdown.

REFERENCE:

- D. Vakula and Y. K. Kolli, "Low cost smart parking system for smart cities," 2017 International Conference on Intelligent Sustainable Systems (ICISS), 2017, pp. 280-284, doi: 10.1109/ISS1.2017.8389415.

- M. Meenaloshini, J. Ilakkiya, P. Sharmila, J. C. Sheffi Malar and S. Nithyasri,"Smart Car Parking System in Smart Cities using IR," 2019 3rd International Conference on Computing and Communications Technologies (ICCCT), 2019,pp. 178-182, doi: 10.1109/ICCCT2.2019.8824953.

- L. H. Chowdhury, Z. N. M. Z. Mahmud, I. -U. Islam, I. Jahan and S. Islam, "Smart Car Parking Management System," 2019 IEEE International Conference on Robotics, Automation, Artificial-intelligence and Internet-of-Things (RAAICON), 2019, pp. 122-126, doi: 10.1109/RAAICON48939.2019.49.

- B. K. Patil, A. Deshpande, S. Suryavanshi, R. Magdum and B. Manjunath, "Smart Parking System for Cars," 2018 International Conference on Recent Innovations in Electrical, Electronics & Communication Engineering (ICRIEECE), 2018, pp.1118-1121, doi: 10.1109/ICRIEECE44171.2018.9008662.

- W. Alsafery, B. Alturki, S. Reiff-Marganiec and K. Jambi, "Smart Car Parking System Solution for the Internet of Things in Smart Cities," 2018 1st International Conference on Computer Applications & Information Security (ICCAIS), 2018, pp. 1-5, doi: 10.1109/CAIS.2018.8442004.

- D. Ashok, A. Tiwari and V. Jirge, "Smart Parking System using IoT Technology," 2020 International Conference on Emerging Trends in Information Technology and Engineering (ic-ETITE), 2020, pp. 1-7, doi: 10.1109/ic-ETITE47903.2020.457.

- Khanna and R. Anand, "IoT based smart parking system," 2016 InternationaL Conference on Internet of Things and Applications (IOTA), 2016, pp. 266-270, doi: 10.1109/IOTA.2016.7562735.