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**DEPARTMENT OF**

**ARTIFICIAL INTELLIGENCE AND DATA SCIENCE**

**NAAN MUDHALVAN - INTERNET OF THINGS**

**SMART PARKING**

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**Phase 3: Development Part 1**

**Building a smart parking system using IoT sensors and Raspberry Pi integration**

**Materials and Components Needed:**

1. Raspberry Pi (with Wi-Fi and Bluetooth capabilities)

2. IoT Sensors (e.g., ultrasonic or PIR motion sensors)

3. Power source for Raspberry Pi

4. Breadboard and jumper wires

5. LEDs (optional, for visual indicators)

6. MicroSD card with Raspbian OS

7. Internet connection for Raspberry Pi

8. Python programming environment on the Raspberry Pi

9. Cloud platform (optional, for remote data storage and access)

**Procedure:**

***1. Set up Raspberry Pi:***

- Install Raspbian OS on the microSD card.

- Configure Wi-Fi and connect the Raspberry Pi to the internet.

- Install necessary libraries for sensor communication (e.g., GPIO for Python).

***2. Connect IoT Sensors:***

- Connect the IoT sensors to the Raspberry Pi using jumper wires. Depending on the sensor type, you'll need to connect power (3.3V or 5V), ground (GND), and data pins to the appropriate GPIO pins on the Raspberry Pi.

- Ensure you've connected the sensors correctly and securely to the GPIO pins.

***3. Write Python Code:***

- Developing Python code to interface with the IoT sensors. Use the GPIO library to read sensor data.

- Implementing code to detect parking space occupancy. For example, if you're using an ultrasonic sensor, you can measure distance. If the distance is below a certain threshold, consider the space occupied.

- Add code for real-time data processing.

***4. Data Processing and Decision Making:***

- Implementing logic to decide if a parking space is vacant or occupied based on the sensor data.

- To set up thresholds and timers to account for sensor noise and transient changes in readings.

***5. Display and Communication:***

- LEDs or other visual indicators to show the occupancy status of each parking space.

- Set up communication with a user interface (e.g., a website or mobile app) to display the parking availability information to users.

***6. Optional: Cloud Integration***

- To store and access data remotely, integrating the system with a cloud platform (e.g., AWS, Azure, Google Cloud).

- Send sensor data to the cloud for storage and real-time monitoring**.**

***7. User Interface:***

- Creating a user-friendly interface for users to check parking availability.

- Display real-time information about parking spaces on a website or mobile app.

***8. Testing and Calibration:***

- Thoroughly testing the system to ensure it accurately detects parking space occupancy.

- Calibrate the sensors as needed to reduce false positives or negatives.

***9. Deployment:***

- Install the sensors and Raspberry Pi in the parking facility.

- Ensure reliable power sources and internet connectivity.

***10. Maintenance and Updates:***

- Regularly maintain and update the system as needed.

- Monitor for hardware failures or connectivity issues.

**Python Scripts on Raspberry Pi**

import time

import RPi.GPIO as GPIO

import time

import os,sys

from urllib.parse import urlparse

import paho.mqtt.client as paho

GPIO.setmode(GPIO.BOARD)

GPIO.setwarnings(False)

'''

define pin for lcd

'''

# Timing constants

E\_PULSE = 0.0005

E\_DELAY = 0.0005

delay = 1

# Define GPIO to LCD mapping

LCD\_RS = 7

LCD\_E = 11

LCD\_D4 = 12

LCD\_D5 = 13

LCD\_D6 = 15

LCD\_D7 = 16

slot1\_Sensor = 29

slot2\_Sensor = 31

GPIO.setup(LCD\_E, GPIO.OUT) # E

GPIO.setup(LCD\_RS, GPIO.OUT) # RS

GPIO.setup(LCD\_D4, GPIO.OUT) # DB4

GPIO.setup(LCD\_D5, GPIO.OUT) # DB5

GPIO.setup(LCD\_D6, GPIO.OUT) # DB6

GPIO.setup(LCD\_D7, GPIO.OUT) # DB7

GPIO.setup(slot1\_Sensor, GPIO.IN)

GPIO.setup(slot2\_Sensor, GPIO.IN)

# Define some device constants

LCD\_WIDTH = 16 # Maximum characters per line

LCD\_CHR = True

LCD\_CMD = False

LCD\_LINE\_1 = 0x80 # LCD RAM address for the 1st line

LCD\_LINE\_2 = 0xC0 # LCD RAM address for the 2nd line

LCD\_LINE\_3 = 0x90# LCD RAM address for the 3nd line

def on\_connect(self, mosq, obj, rc):

self.subscribe("Fan", 0)

def on\_publish(mosq, obj, mid):

print("mid: " + str(mid))

mqttc = paho.Client() # object declaration

# Assign event callbacks

mqttc.on\_connect = on\_connect

mqttc.on\_publish = on\_publish

url\_str = os.environ.get('CLOUDMQTT\_URL', 'tcp://broker.emqx.io:1883')

url = urlparse(url\_str)

mqttc.connect(url.hostname, url.port)

'''

Function Name :lcd\_init()

Function Description : this function is used to initialized lcd by sending the different commands

'''

def lcd\_init():

# Initialise display

lcd\_byte(0x33,LCD\_CMD) # 110011 Initialise

lcd\_byte(0x32,LCD\_CMD) # 110010 Initialise

lcd\_byte(0x06,LCD\_CMD) # 000110 Cursor move direction

lcd\_byte(0x0C,LCD\_CMD) # 001100 Display On,Cursor Off, Blink Off

lcd\_byte(0x28,LCD\_CMD) # 101000 Data length, number of lines, font size

lcd\_byte(0x01,LCD\_CMD) # 000001 Clear display

time.sleep(E\_DELAY)

'''

Function Name :lcd\_byte(bits ,mode)

Fuction Name :the main purpose of this function to convert the byte data into bit and send to lcd port

'''

def lcd\_byte(bits, mode):

# Send byte to data pins

# bits = data

# mode = True for character

# False for command

GPIO.output(LCD\_RS, mode) # RS

# High bits

GPIO.output(LCD\_D4, False)

GPIO.output(LCD\_D5, False)

GPIO.output(LCD\_D6, False)

GPIO.output(LCD\_D7, False)

if bits&0x10==0x10:

GPIO.output(LCD\_D4, True)

if bits&0x20==0x20:

GPIO.output(LCD\_D5, True)

if bits&0x40==0x40:

GPIO.output(LCD\_D6, True)

if bits&0x80==0x80:

GPIO.output(LCD\_D7, True)

# Toggle 'Enable' pin

lcd\_toggle\_enable()

# Low bits

GPIO.output(LCD\_D4, False)

GPIO.output(LCD\_D5, False)

GPIO.output(LCD\_D6, False)

GPIO.output(LCD\_D7, False)

if bits&0x01==0x01:

GPIO.output(LCD\_D4, True)

if bits&0x02==0x02:

GPIO.output(LCD\_D5, True)

if bits&0x04==0x04:

GPIO.output(LCD\_D6, True)

if bits&0x08==0x08:

GPIO.output(LCD\_D7, True)

# Toggle 'Enable' pin

lcd\_toggle\_enable()

'''

Function Name : lcd\_toggle\_enable()

Function Description:basically this is used to toggle Enable pin

'''

def lcd\_toggle\_enable():

# Toggle enable

time.sleep(E\_DELAY)

GPIO.output(LCD\_E, True)

time.sleep(E\_PULSE)

GPIO.output(LCD\_E, False)

time.sleep(E\_DELAY)

'''

Function Name :lcd\_string(message,line)

Function Description :print the data on lcd

'''

def lcd\_string(message,line):

# Send string to display

message = message.ljust(LCD\_WIDTH," ")

lcd\_byte(line, LCD\_CMD)

for i in range(LCD\_WIDTH):

lcd\_byte(ord(message[i]),LCD\_CHR)

lcd\_init()

lcd\_string("welcome ",LCD\_LINE\_1)

time.sleep(0.5)

lcd\_string("Car Parking ",LCD\_LINE\_1)

lcd\_string("System ",LCD\_LINE\_2)

time.sleep(0.5)

lcd\_byte(0x01,LCD\_CMD) # 000001 Clear display

# Define delay between readings

delay = 5

while 1:

# Print out results

rc = mqttc.loop()

slot1\_status = GPIO.input(slot1\_Sensor)

time.sleep(0.2)

slot2\_status = GPIO.input(slot2\_Sensor)

time.sleep(0.2)

if (slot1\_status == False):

lcd\_string("Slot1 Parked ",LCD\_LINE\_1)

mqttc.publish("slot1","1")

time.sleep(0.2)

else:

lcd\_string("Slot1 Free ",LCD\_LINE\_1)

mqttc.publish("slot1","0")

time.sleep(0.2)

if (slot2\_status == False):

lcd\_string("Slot2 Parked ",LCD\_LINE\_2)

mqttc.publish("slot2","1")

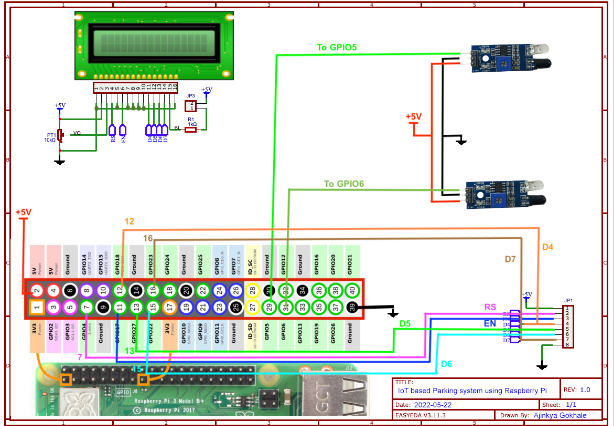
time.sleep(0.2)

else:

lcd\_string("Slot2 Free ",LCD\_LINE\_2)

mqttc.publish("slot2","0")

time.sleep(0.2)



**Schematic for IoT based Smart Parking Sensor**

**CONCLUSION:**

In conclusion, building a smart parking system using IoT sensors and Raspberry Pi integration is a valuable project that offers solutions to urban parking challenges. By following the step-by-step procedure outlined above, we can create a reliable and efficient parking management system.