WCM555 – Wireless Design

Group Project Report

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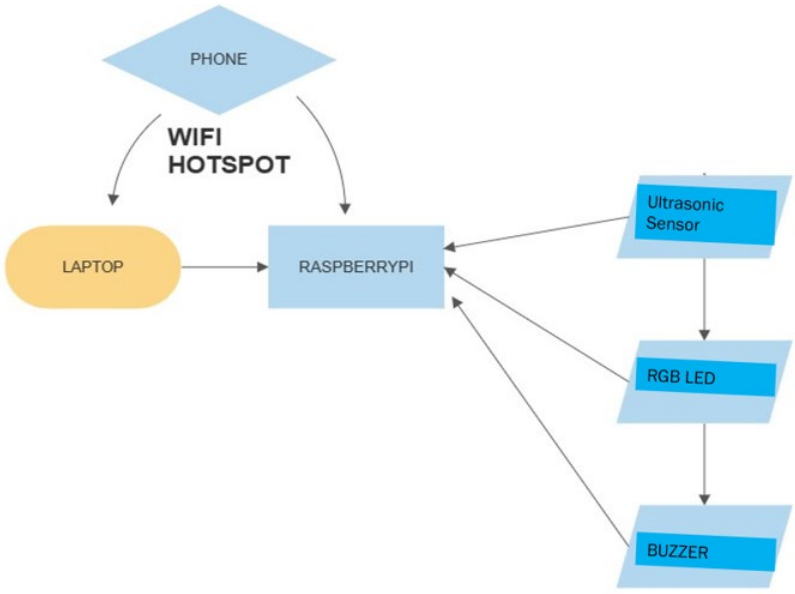
Introduction

In the dynamic landscape of urban transportation, effective bus parking is paramount for safety and efficiency. Addressing the challenges of precise parking and collision prevention, we present the "Bus Safe" system—a pioneering fusion of Raspberry Pi technology and ultrasonic distance sensing. By providing real-time proximity notifications to bus drivers, this innovation aims to revolutionize parking practices, bolster road safety, and navigate congested urban spaces with confidence. This report outlines the development, integration, and potential impacts of the "Bus Safe" parking system, ushering in a new era of intelligent and secure bus parking solutions.

Block Diagram



Purpose and Objectives

The primary objective of this project is to design, develop, and implement a Bus Safe parking system utilizing Raspberry Pi and an Ultrasonic Distance Sensor. The technology intends to improve the safety and efficiency of bus parking by delivering real-time proximity warnings to drivers, lowering the chance of crashes and enhancing overall road safety in urban situations.

Objectives:

1. **System Development**: Create a full hardware and software solution that incorporates a Raspberry Pi and an Ultrasonic Distance Sensor to precisely measure and transmit distances between the bus and nearby obstructions during parking operations.

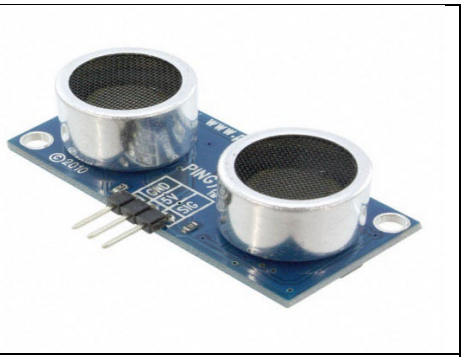
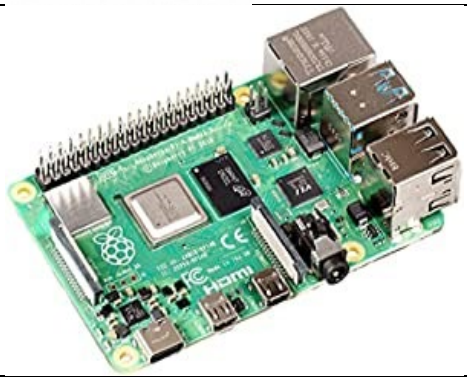
2. **Real-time Feedback**: Implement a user-friendly interface that provides real-time proximity notifications to the bus driver, allowing them to make educated judgments and modifications when parking.

3. **Wireless Communication**: Create a wireless communication link between the Bus Safe parking system and other devices, allowing for remote monitoring, data retrieval, and possible integration with centralized fleet management systems.

4. **Documentation and Training**: Create comprehensive documentation and user guides to facilitate easy installation, maintenance, and training for bus drivers and maintenance personnel.

Components used for the Project

The motion-detecting Bus security system works well because many important parts work together smoothly:

Ultrasonic Sensor	This sensor detects motion by monitoring changes in radiation emitted .	
Buzzer	The buzzer generates attention-grabbing siren-like sounds to alert users to potential intrusions.	
RGB LED	A tri-color LED provides visual cues by emitting different colors to indicate the system's status.	
Raspberry Pi	The central processing unit orchestrates device interactions, facilitating communication and control.	

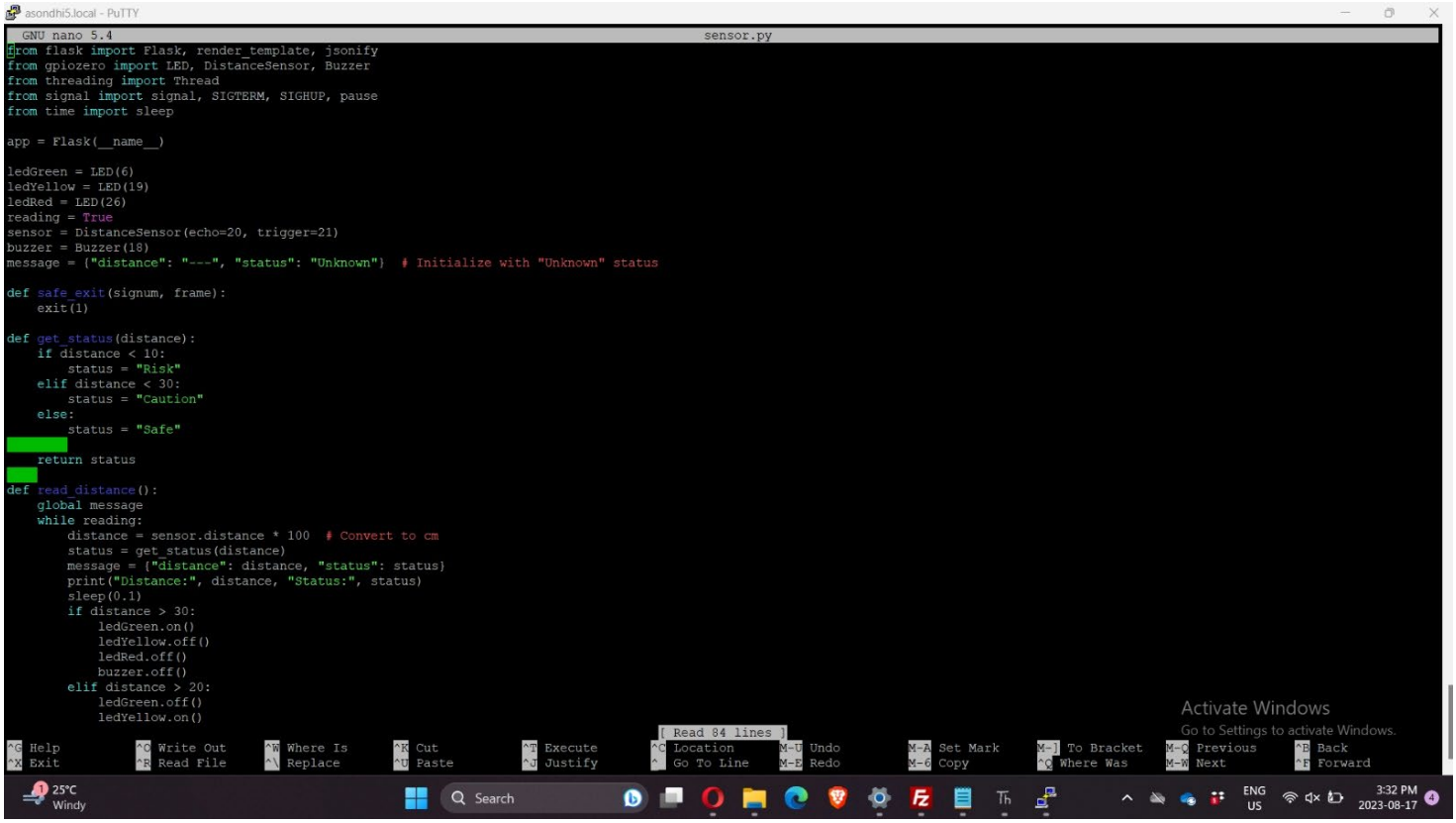
Working of the Project

The ultrasonic motion sensor operates on the principle of emitting sound waves beyond the range of human hearing. These sound waves propagate outward and interact with nearby objects, subsequently rebounding back towards the sensor. The sensor then calculates the time it takes for these waves to return, essentially measuring the distance between itself and the object. This ingenious technique allows the sensor to discern motion by detecting fluctuations in the time it takes for the waves to bounce back. When an object—a pedestrian, another vehicle, or an obstacle—moves within the sensor's scope, the alterations in the reflected wave patterns trigger a motion alert. In our current undertaking, we harness this technology for the development of a Bus Safe parking system.

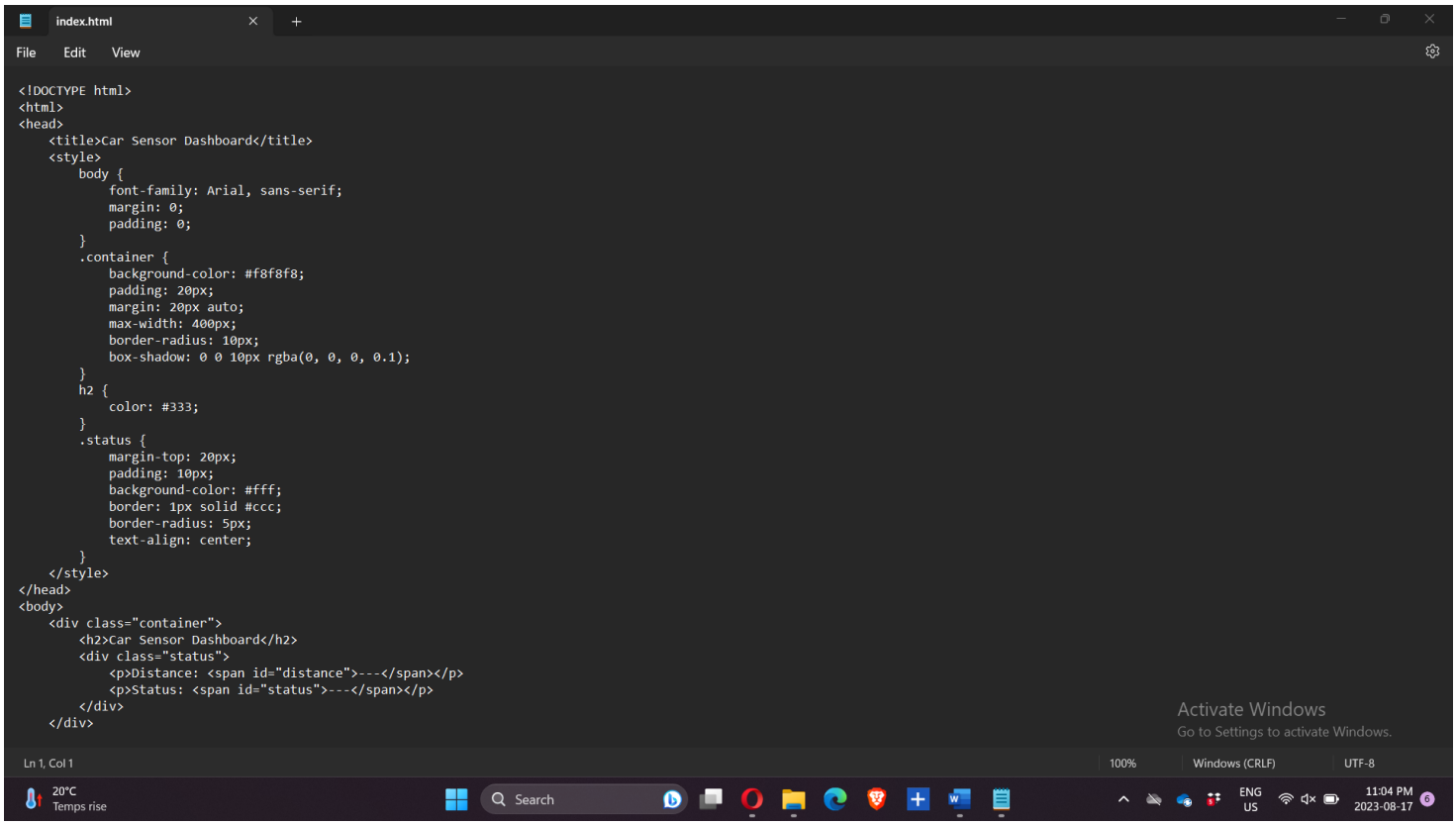
In this project, the sensor's real-time motion data serves as the foundation for a web-based visualization system. This system facilitates the transformation of raw data into a user-friendly interface accessible through a dedicated website. As the ultrasonic motion sensor continues to monitor the immediate environment, the obtained data is transmitted to the website's server. This server processes the data, classifying it into distinct distance zones: a "Safe Zone" indicates a secure clearance from obstacles, a "Caution Zone" denotes moderate proximity, and a "Risk Zone" highlights close vicinity that demands immediate attention. The website's graphical representation of these zones empowers users, particularly bus drivers, to make well-informed decisions during the parking process. By displaying real-time distance information and associated risk levels, the

website equips drivers with the tools they need to navigate confined spaces with heightened precision, ultimately minimizing the potential for collisions. This innovative integration of ultrasonic sensing and web-based visualization reinforces not only safe parking practices but also bolsters overall road safety and transportation efficiency within bustling urban landscapes.

Python Code


asondhi5.local - PuTTY
GNU nano 5.4
sensor.py
from flask import Flask, render_template, jsonify
from gpiozero import LED, DistanceSensor, Buzzer
from threading import Thread
from signal import signal, SIGTERM, SIGHUP, pause
from time import sleep
app = Flask(__name__)
ledGreen = LED(6)
ledYellow = LED(19)
ledRed = LED(26)
reading = True
sensor = DistanceSensor(echo=20, trigger=21)
buzzer = Buzzer(18)
message = {"distance": "---", "status": "Unknown"} # Initialize with "Unknown" status
def safe_exit(signum, frame):
exit(1)
def get_status(distance):
if distance < 10:
status = "Risk"
elif distance < 30:
status = "Caution"
else:
status = "Safe"
return status
def read_distance():
global message
while reading:
distance = sensor.distance * 100 # Convert to cm
status = get_status(distance)
message = {"distance": distance, "status": status}
print("Distance:", distance, "Status:", status)
sleep(0.1)
if distance > 30:
ledGreen.on()
ledYellow.off()
ledRed.off()
buzzer.off()
elif distance > 20:
ledGreen.off()
ledYellow.on()
[Read 84 lines]
^G Help ^O Write Out ^W Where Is ^K Cut ^T Execute ^C Location M-U Undo M-A Set Mark M-] To Bracket M-Q Previous ^B Back
^X Exit ^R Read File ^\ Replace ^U Paste ^J Justify ^_ Go To Line M-E Redo M-6 Copy ^Q Where Was M-W Next ^F Forward
Activate Windows
Go to Settings to activate Windows.
25°C
Windy
Search
ENG
US
3:32 PM
2023-08-17

HTML Code



Bill of Materials

Quantity	Part Number	Manufacturer Part Number	Description	Unit Price	Extended Price CAD
6	CF14JT1K00CT-ND	CF14JT1K00	RES 1K OHM 5% 1/4W AXIAL	0.15	0.90
3	1568-1196-ND	COM-11448	LED RGB CLEAR T/H	0.82	2.46
1	490-4697-ND	PKM13EPYH4002-B0	BUZZER PIEZO 1.5V 12.6MM TH	0.58	0.58
1	28015-ND	28015	ULTRASONIC SENSOR PING 40KHZ	52.21	52.21
2	1568-1511-ND	PRT-12794	JUMPER WIRE M/F 6" 20PCS	2.94	5.88

Conclusion

In conclusion, the "Bus Safe" system represents a ground-breaking improvement in urban transportation by solving the vital demands of accurate bus parking and collision prevention. This invention offers real-time proximity warnings to drivers, guaranteeing safer parking and enhancing road safety in congested metropolitan areas. It effortlessly integrates Raspberry Pi technology with ultrasonic distance detection. The project's key goals are the construction of an extensive system, user-friendly real-time feedback, wireless connectivity for remote monitoring, and the provision of readily available documentation and training materials. The "Bus Safe" system represents our continued commitment to transforming urban transportation into a sector of increased efficiency, security, and sustainability, as well as its potential to revolutionize parking practices.

References

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- gpiozero. (n.d). ledboard — Gpiozero documentation. Read the Docs. https://gpiozero.readthedocs.io/en/stable/api_boards.html#ledboard
- Heidenreich, M. (Year, Month Day). How to Use the HC-SR04 Ultrasonic Sensor with Raspberry Pi (Python Tutorial with Multi-Threading) [Video]. YouTube. https://youtu.be/JvQKZXCYMUM