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VIVA Institute of Technology

Approved by AICTE New Delhi, Recognized by DTE, Govt. of Maharashtra
And Affiliated to University of Mumbai

NAAC "B++" Grade

Criteria 1- Curricular Aspects

Key Indicator – 1.3 Curriculum Enrichment

1.3.2 - Number of courses that include experiential learning through project work/field work/internship during the year

Page numbers from 1 to 83 are endorsed by Principal

PRINCIPAL
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VISHNU WAMAN THAKUR CHARITABLE TRUST'S VIVA INSTITUTE OF TECHNOLOGY
At. Shirgaon Post: Virar, Tal.: Vasai Dist.: Palghar
VIRAR (EAST)

INDEX

Skill Lab Report Data for A.Y. 2024-25

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VIVA INSTITUTE OF TECHNOLOGY
At: Shirgaon
Post: Virar,
Tal.: Vasai,
Dist. Palghar
VIRAR (EAST)

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NAAC "B++" Grade

Department of Computer Engineering

Vishnu Waman Thakur Charitable Trust's

VIVA INSTITUTE OF TECHNOLOGY

DEPARTMENT OF COMPUTER ENGINEERING

Class: BE   Sem: VII

Subject Name: BDA

Experiment No:

Mini Project Title: Spotify Analysis Using Power BI.

D.O.P.:   D.O.S.:

Student Roll No: 52.

Student Name: MOHD MEHRAJ SHAIKH.

Sr. No.	Parameters	Out of (10 Marks)	Marks Obtained
1	Timely Submission	2	2
2	Novelty / Innovation	3	2
3	Implementation	5	3
	Total Marks	10	7

Subject In-charge Sign

(54)

DECLARATION BY STUDENT

This is certified that the work of MINI PROJECT done in this report on topic "**SPOTIFY ANALYSIS USING POWER BI**" was carried out by me under the supervision of PROF. SUNITA NAIK.

Student Signature

Guide Signature

Abstract

The analysis of Spotify data using Power BI offers valuable insights into user behavior, song performance, and market trends within the music streaming industry. By integrating various datasets from Spotify, such as song attributes (e.g., tempo, genre, duration), user engagement metrics (like play counts, skips, and saves), and demographic information, analysts can create dynamic visualizations that reveal patterns and correlations. Power BI's robust data visualization capabilities allow for the construction of interactive dashboards, enabling stakeholders to monitor key performance indicators (KPIs) related to both user engagement and content performance. For instance, using Power BI, one can track the popularity of different genres across various regions, assess the impact of new releases on user engagement, and analyze seasonal trends in listening habits. Overall, the synthesis of Spotify data through Power BI not only enhances understanding of current market dynamics but also informs strategic decision-making, contributing to more effective engagement with audiences and improved content curation. This approach ultimately supports Spotify's goal of optimizing user experience and maximizing artist visibility on the platform.

1. Introduction

The integration of Power BI into the analysis of Spotify data marks a transformative approach to understanding the complex dynamics of music consumption in the digital age. As one of the leading music streaming platforms globally, Spotify generates a vast array of data encompassing user interactions, song attributes, and demographic information. This data is invaluable for artists, marketers, and decision-makers looking to enhance engagement and optimize content strategies. Power BI, with its powerful data visualization and analytical capabilities, enables users to transform raw data into meaningful insights. Through intuitive dashboards and interactive reports, analysts can delve deep into trends such as listening habits, genre popularity, and the effectiveness of promotional campaigns. For instance, one can visualize changes in user engagement over time or identify which genres resonate most with specific demographics. Moreover, the ability to conduct real-time analysis facilitates agile decision-making, allowing stakeholders to respond promptly to emerging trends or shifts in user behavior. By harnessing the synergy between Spotify's extensive data and Power BI's analytical prowess, organizations can gain a competitive edge, enhance user experiences, and create targeted marketing strategies that resonate with their audience. This introduction sets the stage for a deeper exploration of the insights and implications derived from such analyses in the vibrant landscape of music streaming.

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2. Project Scope

The project scope for analyzing Spotify data using Power BI focuses on uncovering insights related to user behavior, song performance, and market trends to facilitate data-driven decision-making. The primary objective is to integrate and analyze various datasets from Spotify, including user engagement metrics, song attributes, and demographic information. Key deliverables will include the creation of interactive dashboards in Power BI that visualize critical performance indicators, such as user engagement over time, genre popularity by region, and seasonal listening trends. The project will also incorporate basic predictive analytics to forecast future listening behaviors based on historical data. Stakeholders involved in this project include data analysts, the marketing team, and management, each interested in leveraging insights for enhanced engagement and strategic planning. The timeline spans nine weeks, divided into phases for data collection, preparation, dashboard development, testing, and final delivery. Notably, the project will not delve into qualitative analyses of user feedback or develop custom algorithms beyond basic predictive modeling. Overall, this scope aims to provide actionable insights that enhance Spotify's user experience and content strategy, while ensuring focused efforts throughout the project's lifecycle

3. Project Description and Implementation

3.1 Project Description

The project involves an in-depth analysis of Spotify data using Power BI to gain actionable insights into user behavior and music trends. By leveraging Spotify's vast datasets—encompassing user engagement metrics, song attributes, and demographic information—we aim to create a comprehensive analytical framework that supports strategic decision-making for artists, marketers, and management.

The analysis will begin with data collection from the Spotify API or relevant sources, followed by rigorous data cleaning and preparation to ensure accuracy and consistency. Once the data is ready, we will develop interactive dashboards in Power BI that highlight key performance indicators (KPIs). These dashboards will provide visualizations of user engagement over time, regional genre popularity, and seasonal listening patterns, allowing stakeholders to quickly grasp essential trends.

3.2 Project Implementation

The implementation plan for analyzing Spotify data using Power BI begins with project initiation, where clear goals and objectives are established alongside stakeholder engagement to ensure alignment. The first step involves accessing relevant datasets through the Spotify API, gathering user engagement metrics, song attributes, and demographic information. Following data collection, rigorous data cleaning and transformation processes are conducted to ensure accuracy and consistency across the datasets. Once the data is prepared, interactive dashboards are designed and developed in Power BI, focusing on key performance indicators such as user engagement over time and genre popularity by region. Ongoing support and maintenance processes are established to ensure the dashboards remain up-to-date with new data, while regular performance reviews are scheduled to assess the impact of the insights on decision-making and user engagement strategies. This structured approach aims to deliver actionable insights that enhance Spotify's strategic initiatives in the competitive music streaming landscape.

3.3 Hardware and Software Requirements

Hardware Requirements:

Computer with specifications:

- Processor: Intel 5
- RAM: 8GB

Software Requirements:

- Power BI
- CSV Files
- Web Browser

4. Results

Figure 1. shows the data set for spotify analysis which content multiple overview of songs.

track_name	artist(s)_name	artist_count	released_year	released_month	released_day	in_spotify_playlists
Blind	SZA	1	2022	12	9	1484
Love Language	SZA	1	2022	12	9	1127
Special	SZA	1	2022	12	9	906
SOS	SZA	1	2022	12	9	827
Gone Girl	SZA	1	2022	12	9	892
F2F	SZA	1	2022	12	9	989
Notice Me	SZA	1	2022	12	9	819
Smoking on my Ex Pack	SZA	1	2022	12	9	811
Conceited	SZA	1	2022	12	9	899
Maroon	Taylor Swift	1	2022	10	21	2304
Too Late	SZA	1	2022	12	8	714
Far	SZA	1	2022	12	9	680
How Do I Make You Love Me?	The Weeknd	1	2022	1	7	1915
Gasoline	The Weeknd	1	2022	1	7	2297
Best Friends	The Weeknd	1	2022	1	7	1292
Dawn FM	The Weeknd	1	2022	1	7	811
Starry Eyes	The Weeknd	1	2022	1	7	1014
Donï¿½ï¿½ï¿½t Break My	The Weeknd	1	2022	1	7	1184
A Tale By Quincy	The Weeknd	1	2022	1	7	733
Every Angel is Terrifying	The Weeknd	1	2022	1	7	715

Figure 1. Data Set Page

Figure 2. shows the visualization results for songs with their stats and other major details.

Figure 2. Visualization Page

5. Conclusion

In conclusion, the analysis of Spotify data using Power BI represents a significant step toward harnessing the power of data to enhance user engagement and inform strategic decision-making. By integrating diverse datasets and employing advanced visualization techniques, stakeholders gain valuable insights into listening behaviors, genre trends, and demographic preferences. The project's structured implementation from data collection and preparation to dashboard development and user training ensures that the insights are not only accurate but also accessible and actionable. As the music streaming landscape continues to evolve, leveraging these insights will enable Spotify to stay ahead of trends, optimize content strategies, and create a more personalized user experience. Ultimately, this analytical approach empowers stakeholders to make informed decisions that enhance both user satisfaction and artist visibility, reinforcing Spotify's position as a leader in the industry.

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NAAC "B++" Grade

Department of Electrical Engineering

A Project Report on

"Automatic street light,

Full Wave Rectifier,

Water Level Indicator"

for Subject of

Skill Based Lab- II, PCB Design and Fabrication Lab

In

Second Year of Engineering

By

ABHISHEK RAJBHAR (21)

DEPARTMENT

OF

ELECTRICAL ENGINEERING

VIVA INSTITUTE OF TECHNOLOGY

UNIVERSITY OF MUMBAI

2024-25

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Automatic Street Light

Project Description

An automatic street light project uses light sensors and a microcontroller to control street lights based on ambient light levels and other factors. The microcontroller processes data from the sensors and activates relays to turn the lights on or off. Optional additions like motion sensors and wireless communication can enhance functionality. The project aims to improve energy efficiency and safety by ensuring lights are only on when necessary..

Circuit Design: The circuit operates as follows: When the ambient light level falls below a certain threshold, indicating darkness or low light conditions, the microcontroller triggers the relay module to turn the street lights on. Conversely, when the ambient light level rises above a certain threshold, indicating daylight or sufficient lighting, the microcontroller signals the relay module to turn the lights off.

PCB Design: To translate the circuit design into a physical prototype, a custom PCB layout is created using PCB design software such as Eagle, KiCad, or Altium Designer. The layout incorporates all the necessary components and interconnections in a compact and organized manner, optimizing space utilization and ensuring electrical integrity. Careful consideration is given to component placement, trace routing, and grounding to minimize signal interference and maintain circuit stability. Once the layout is finalized, it is exported to Gerber files, which are used for manufacturing the PCB.

Advantages

- **Environmental Impact**: Decreased energy consumption results in reduced carbon emissions, contributing to environmental sustainability.
- **Cost-effective** : Reduced energy consumption means lower electricity bills for municipalities or organizations responsible for street lighting..
- **Energy Efficiencyl**: By turning street lights on only when necessary, energy consumption is reduced, leading to cost savings and environmental benefits.

Disadvantages

- **Initial cost**: mplementing an automatic street light system involves upfront costs for purchasing and installing sensors, microcontrollers, and other necessary components, which can be higher than traditional manual systems
- **Complexity**: Automatic systems are more complex than manual systems, requiring skilled technicians for installation, maintenance, and troubleshooting. This complexity can lead to higher maintenance costs and longer downtime in case of failures.
- **Limited Practical Applications**: While educational and suitable for some simple applications like indicator lights or decorative lighting, blinking LED circuits may not have extensive practical uses beyond these.

Application

- **Urban Roads and Highways**: Automatic street light systems are commonly deployed along urban roads and highways to provide illumination for drivers and pedestrians. They enhance safety by ensuring visibility during nighttime hours, reducing accidents and improving traffic flow.
- **Residential Areas**: Automatic street lights are installed in residential neighborhoods to illuminate streets, sidewalks, and public spaces. They enhance security and safety for residents by deterring crime and providing visibility for pedestrians, cyclists, and vehicles.

Block diagram

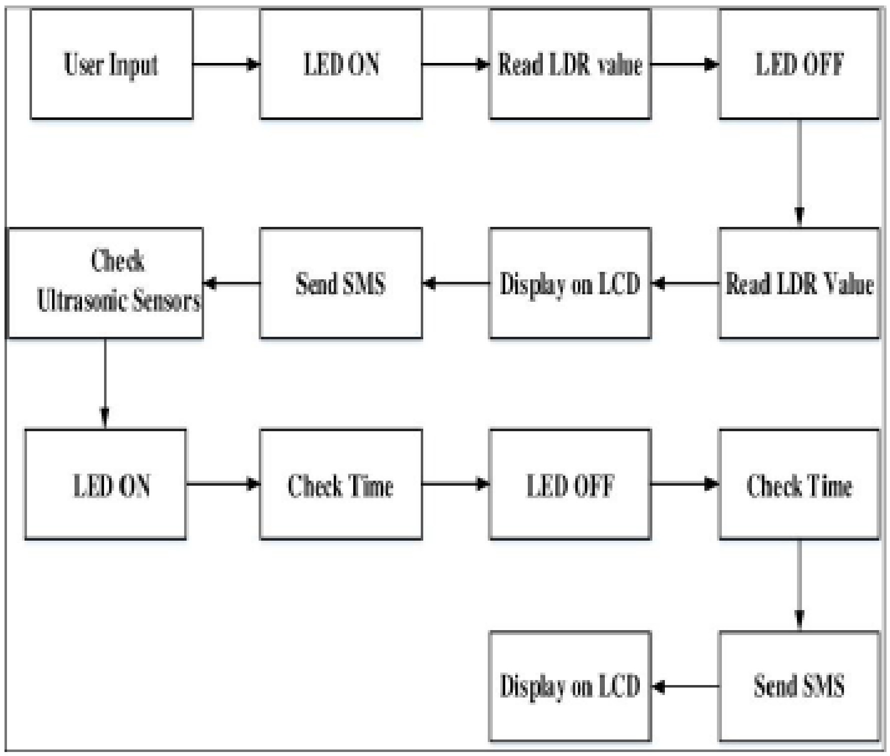


Figure : Block Diagram

Schematic Diagram

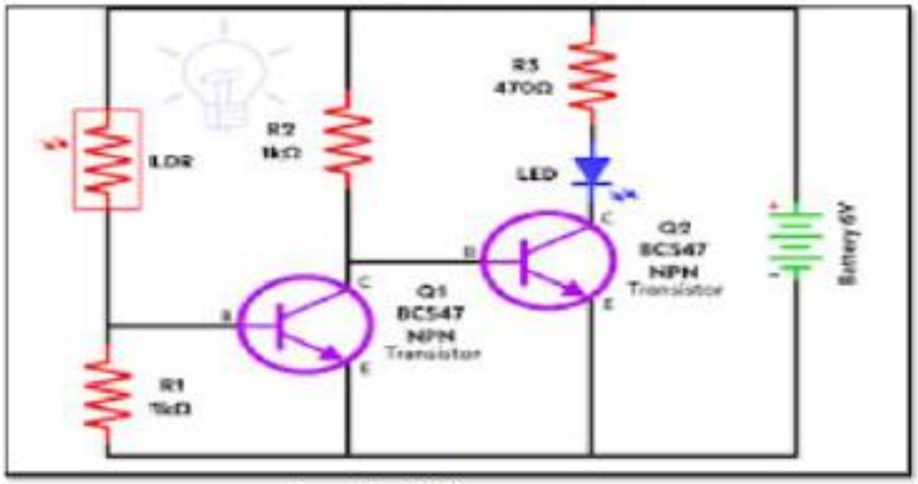
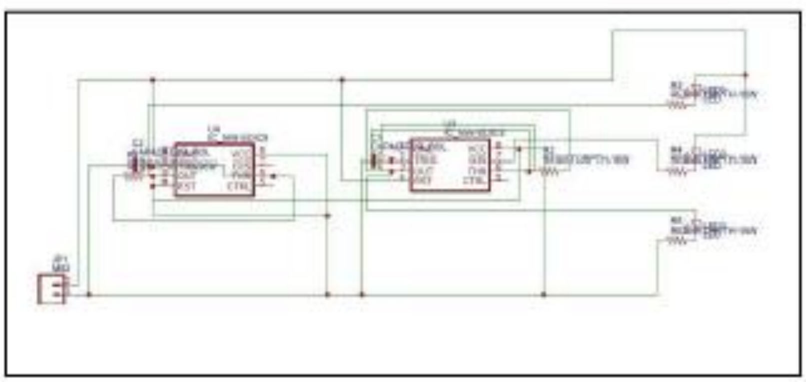
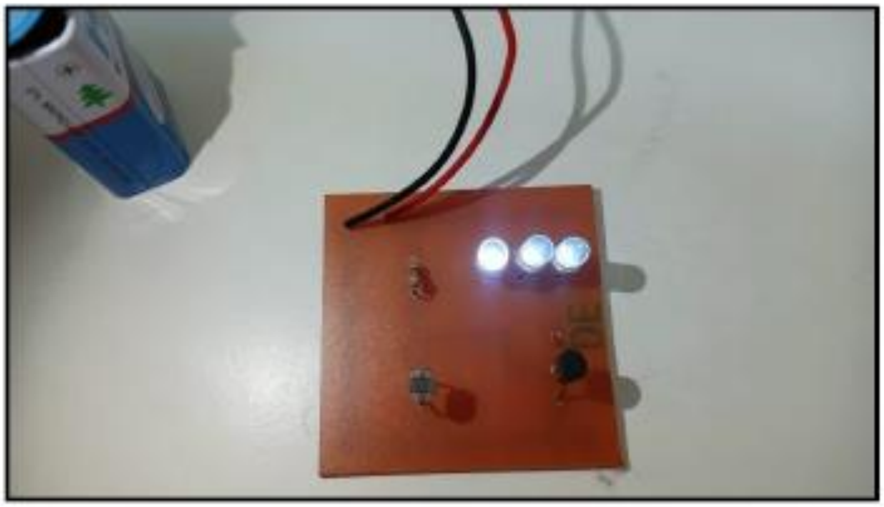


Figure : Schematic Diagram

Simulation Model Diagram



3D model



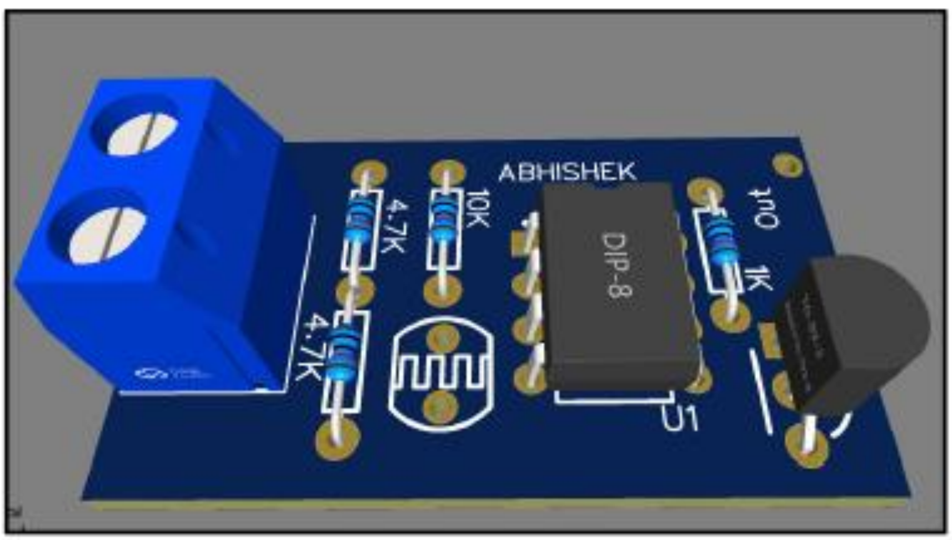


Figure : 3d model

Bills Of Materials

ID	Name	Designator	Quantity	Manufacturer	Supplier	Price
1	Lm358Gn	U1	1	Htc	Lcsc	0.198
2	Conn-Th_2P-P5.00	Vcc	1		Lcsc	
3	10k	10K	1			
4	1k	1K	1			
5	Bc547Cta	Q1	1	Onsemi	Lcsc	0.081
6	4.7k	4.7K,4.7K	2			
7	Light-Dependent Resistor (Squared) 1	R5	1			

Full-Wave Rectifier

Project Description

The Full-Wave Rectifier is designed to convert AC (alternating current) to DC (direct current) by utilizing both the positive and negative half cycles of the AC waveform. It uses two diodes to rectify the input signal and provide a smooth DC output. The system operates by allowing current to pass through the diodes during both halves of the AC cycle, effectively doubling the frequency of the rectified signal. This process provides more efficient power conversion compared to a half-wave rectifier. The output can be used to power various electronic devices that require DC power. This project is simple yet crucial for applications requiring stable DC voltage. It uses basic electronic components such as diodes, resistors, and capacitors, making it cost-effective. The full-wave rectifier can be applied in various power supply circuits and is widely used in electronic devices.

Circuit Design:

The circuit design of a Full-Wave Rectifier involves two diodes arranged in a bridge configuration. The AC input is supplied to the bridge, where during each half cycle, one diode conducts, allowing current to pass through the load resistor. In the positive half-cycle, one diode conducts, and in the negative half-cycle, the other diode conducts, ensuring current always flows in the same direction through the load. A filter capacitor is often added across the load to smooth the output DC voltage. The design is simple and effective, making it a common choice for many power supply applications. The diodes must be chosen based on the voltage and current requirements of the application. The output provides a pulsating DC voltage that can be further regulated if necessary.

PCB Layout:

The PCB layout for the Full-Wave Rectifier should clearly separate the AC input and DC output sections. The diodes should be positioned in the bridge configuration, ensuring minimal trace lengths between components for efficient current flow. Thicker traces should be used for the power side of the circuit to handle higher currents, especially through the diodes and load resistor. Capacitors should be placed near the output to smooth the voltage, and appropriate grounding should be done to reduce noise. The diode placement should also allow easy heat dissipation. The layout should keep the AC and DC sides isolated to prevent accidental short circuits, with clear labeling for the input and output connections.

Advantages

- **Higher Efficiency**: Unlike the half-wave rectifier, the full-wave rectifier utilizes both half cycles of the AC input, providing a more efficient conversion to DC power.
- **Smoother Output**: The full-wave rectifier produces a smoother DC output with fewer ripples compared to a half-wave rectifier, making it ideal for sensitive electronic applications.
- **Better Performance:** Due to its ability to use both positive and negative half cycles of the AC waveform, it delivers higher average output voltage and current, improving overall performance.

Disadvantages

- **Transformer Requirement**: A center-tapped transformer is required for the basic full-wave rectifier, which adds to the complexity and cost of the circuit.
- **Higher Cost**: With more components, such as two diodes (or a bridge rectifier with four diodes), the full-wave rectifier can be more expensive and complex to design compared to a half-wave rectifier.

Applications

- **Power Supplies**: Full-wave rectifiers are commonly used in power supply circuits to provide a stable DC voltage for various electronic devices like radios, TVs, and computers.
- **Battery Charging**: The full-wave rectifier is widely used in battery charging circuits, where a smooth DC output is essential for charging batteries efficiently.
- **Signal Processing**: Full-wave rectifiers are also used in signal processing applications, such as in audio systems, where they convert AC signals into a usable DC form for further processing.

Block Diagram

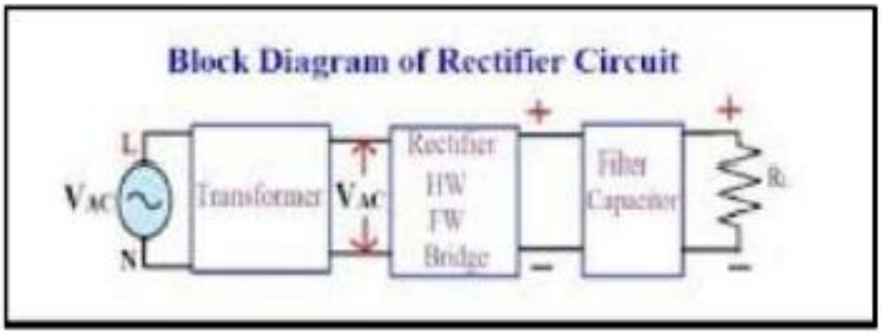


Figure : Block Diagram

Simulation Diagram

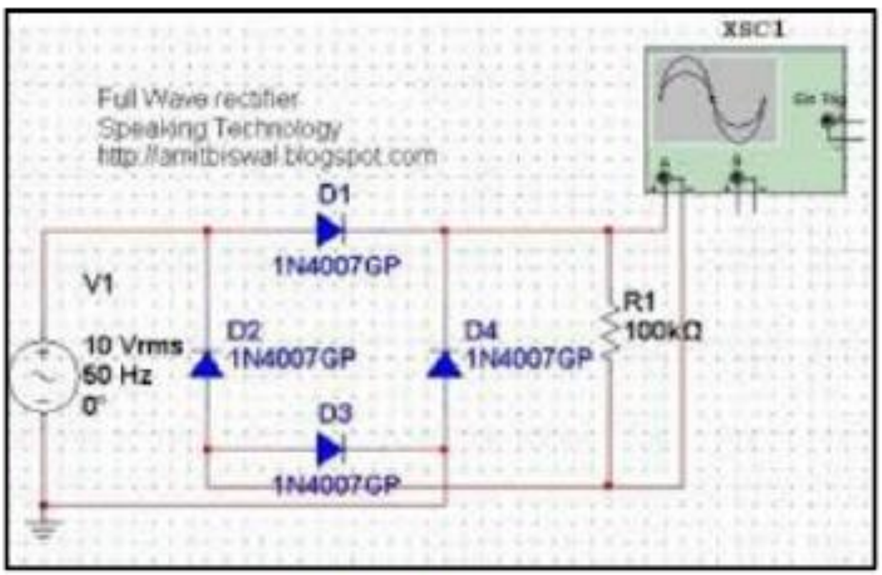
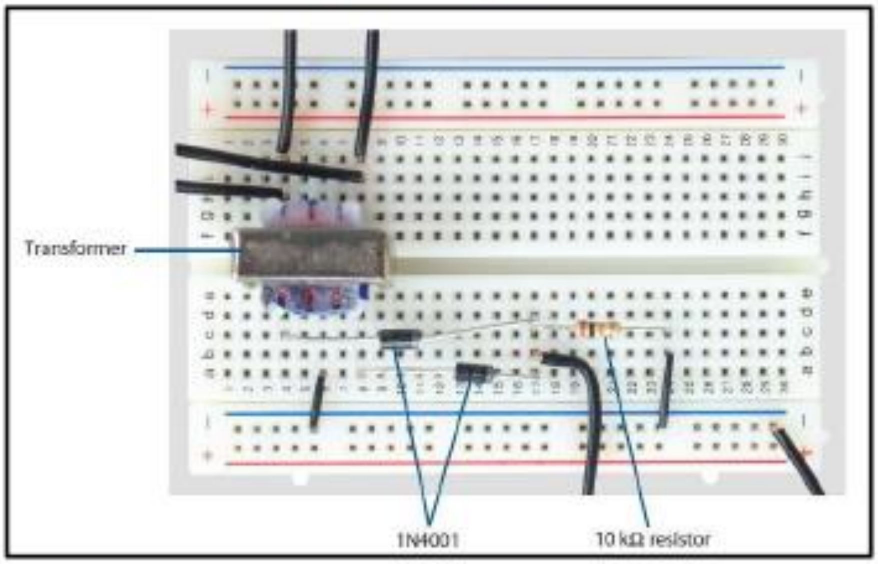
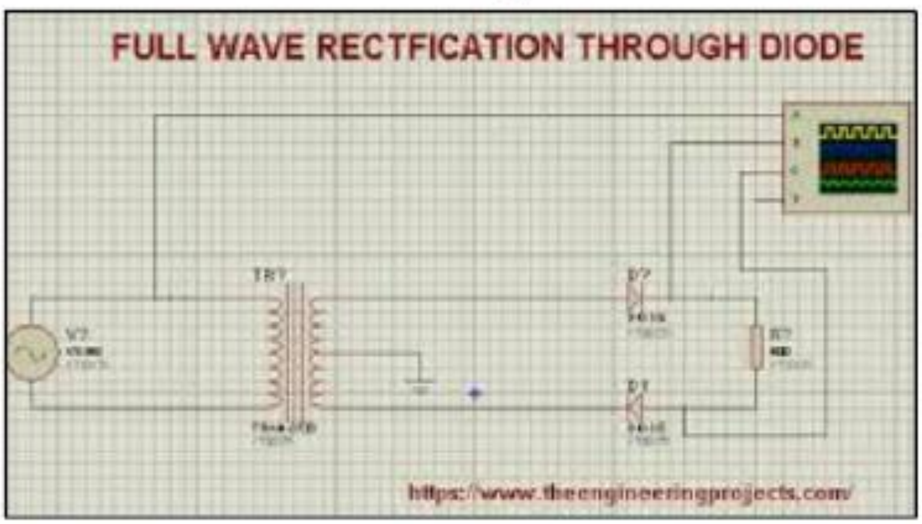


Figure : Schematic Diagram

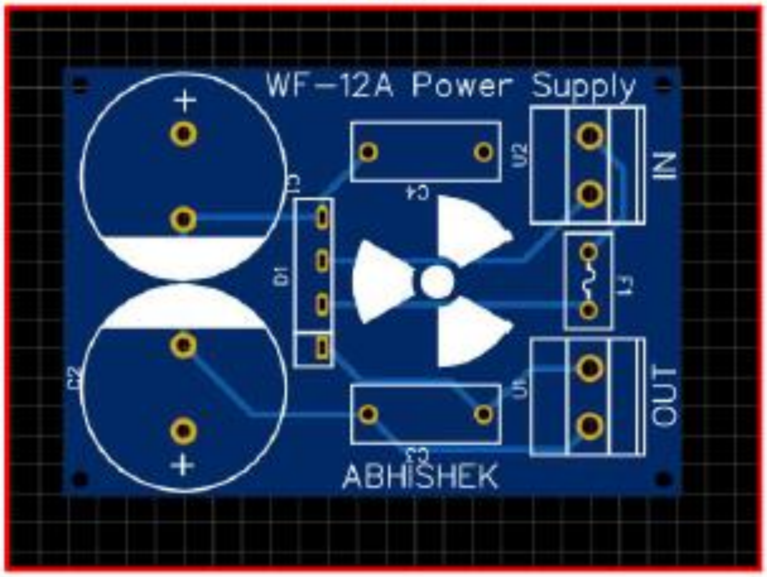
Connection Diagram



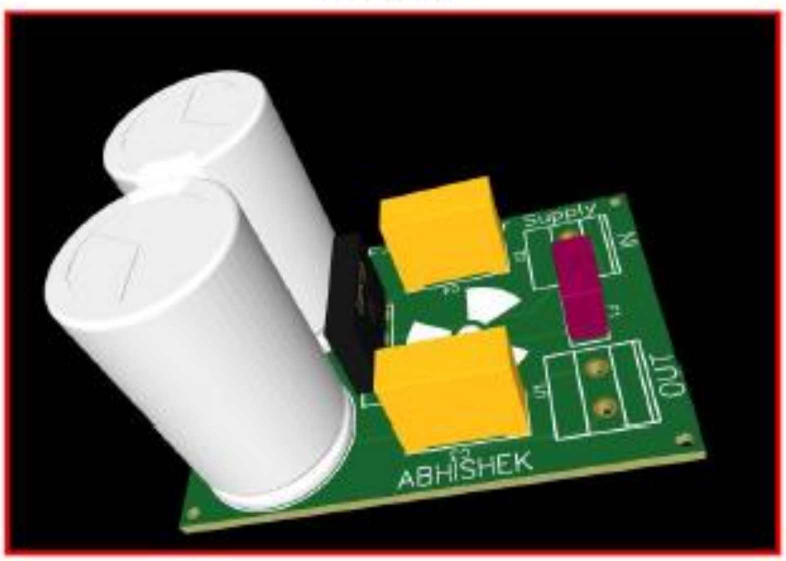
Schematic Diagram



PCB Art Work



3D model



Bills Of Materials

Item No.	Component	Description	Quantity	Part Number / Model
1	Diode	1N4007 (Rectifier Diode)	2	1N4007
2	Capacitor	Electrolytic Capacitor (100 [illegible] F, 25V)	1	Electrolytic 100 [illegible] F
3	Transformer	12V AC, 1A	1	12V AC, 1A
4	Resistor	1k [illegible] Resistor	1	1k [illegible]
5	Fuse	1A Fuse (Optional)	1	1A Fuse
6	PCB	Printed Circuit Board	1	Custom/Prefabricated

Water Level Indicator

Project Description

The Water Level Indicator project is designed to monitor and display the water level in a tank, preventing overflow and ensuring efficient use of water. It uses a set of sensors (usually conductive) placed at different heights in the water tank to detect the water level. When the water reaches a certain level, the corresponding sensor activates and triggers an indicator (such as an LED or buzzer) to alert the user. This system is particularly useful for overhead water tanks, ensuring that tanks are filled or emptied at the correct levels. The project helps in water conservation by preventing unnecessary overflow and enabling timely water management. It is cost-effective and uses basic electronic components like sensors, transistors, and indicators. This system can be implemented in homes, industries, and water treatment plants to monitor water levels effectively.

Circuit Design

The circuit design for the Water Level Indicator involves multiple sensors arranged at different levels in the water tank. Each sensor is connected to the base of a transistor. When the water level rises to a particular sensor, it completes the circuit, activating the transistor. The transistor, in turn, triggers an LED or buzzer to indicate the water level. A relay can be used to control the filling mechanism, turning off the water pump when the tank reaches a certain level. Resistors are used to limit the current and ensure proper operation of the sensors and transistors. The circuit is simple yet effective for real-time monitoring of water levels in any container.

PCB Layout:

For the Water Level Indicator PCB layout, it is important to keep the sensor connections clearly separated from the control circuit. The sensors should be placed in a way that the traces from the PCB to the water tank are as short as possible to minimize interference. Transistors and indicators (LEDs or buzzers) should be placed close to the control unit to reduce trace length and improve efficiency. A ground plane should be used to prevent noise and ensure reliable sensor operation. The relay connections should be designed to handle higher current loads, and appropriate safety measures (like fuses) should be included. Overall, the layout should ensure easy connectivity between the sensors and the control circuit for smooth operation.

Advantages

- **Water Conservation:** This system helps conserve water by preventing overflow and ensuring the tank is filled efficiently, avoiding waste.
- **Low Cost:** The Water Level Indicator system is affordable and can be built using basic electronic components like sensors, LEDs, and transistors.
- **Easy to Implement:** The project is simple to design and implement, making it suitable for homes, industries, and small-scale water management systems.

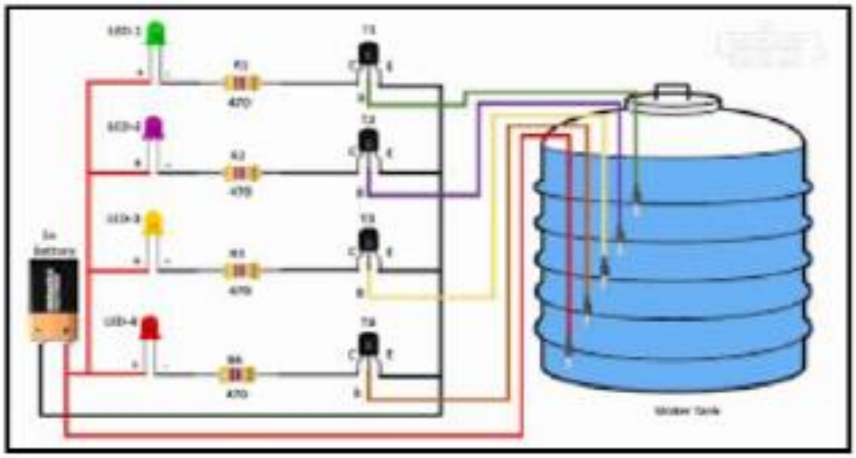
Disadvantages

- **Limited Range:** The system can only detect the water level at preset points, and additional sensors may be needed for more precise monitoring.
- **Corrosion of Sensors:** Over time, the water sensors may corrode or degrade due to constant exposure to water, requiring maintenance or replacement.

Applications

- **Home Water Tanks:** Used to monitor and control water levels in overhead tanks, preventing overflow and ensuring timely filling.
- **Industrial Water Management:** Implemented in factories and industries to monitor large water storage tanks and avoid water wastage or shortage.
- **Agriculture:** Used in irrigation systems to maintain optimal water levels in tanks, preventing overuse or depletion of water resources.

Circuit Diagram



Schematic Diagram

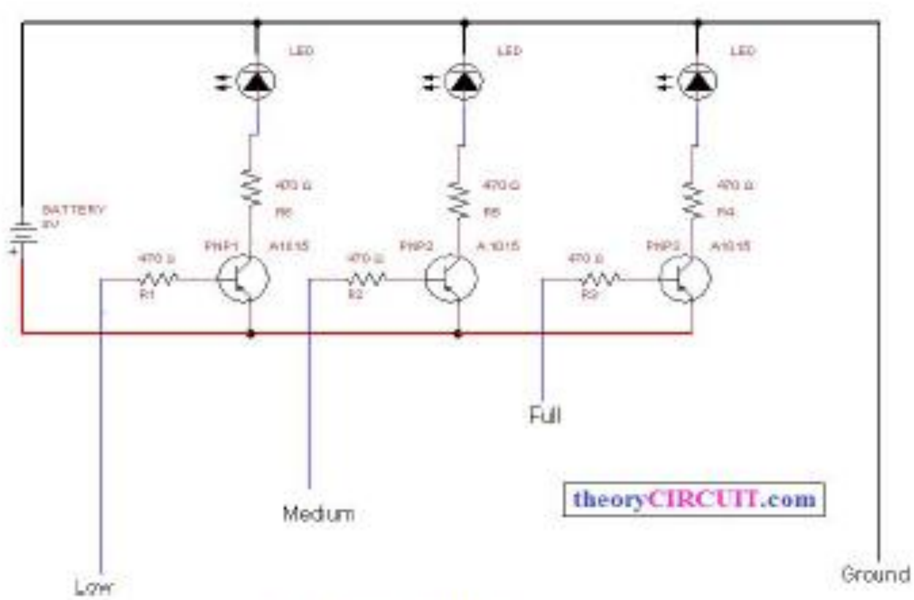
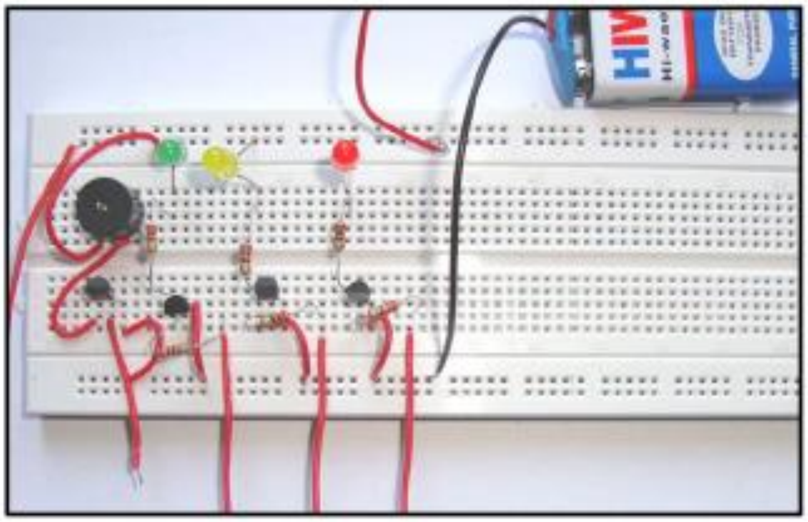
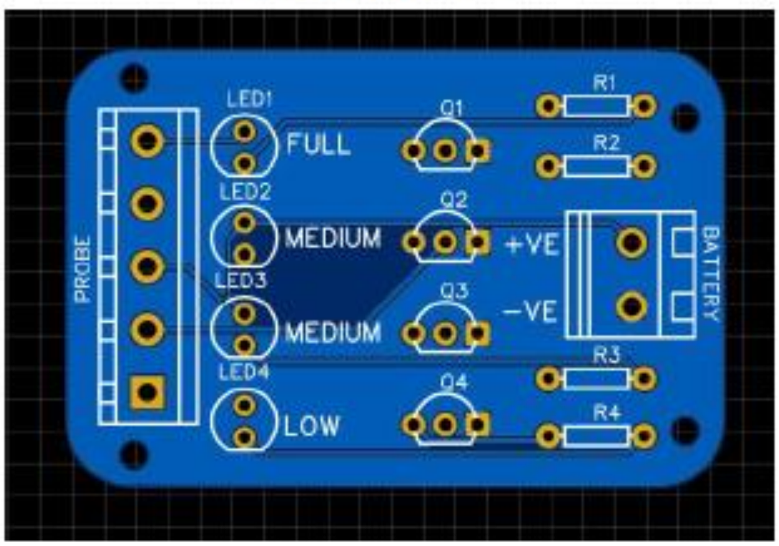


Figure : Schematic Diagram

Connection diagram



Art Work Of PCB



3D model

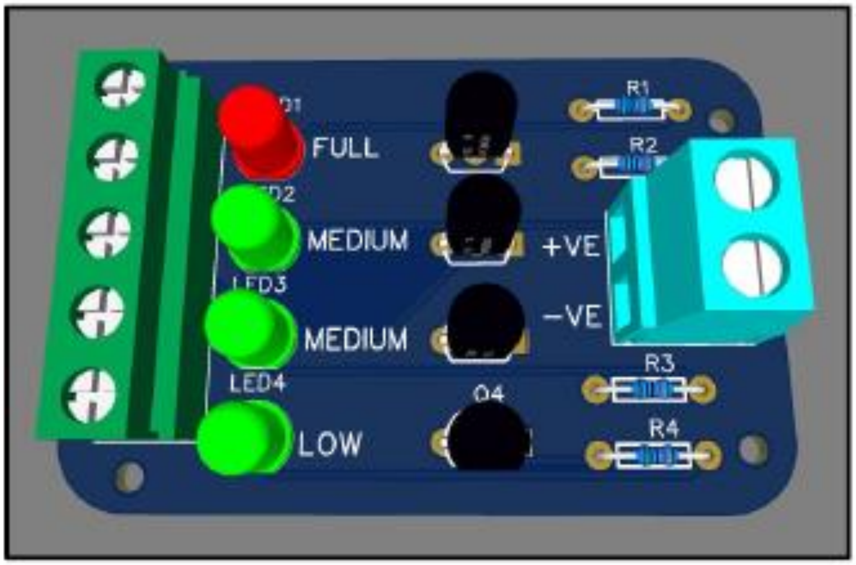


Figure : 3D model

Bills Of Materials

ID	Name	Quantity	Manufacturer	Price
1	LED-TH-5mm_R	1	EVERLIGHT(台湾亿光)	0.034
2	LED-TH-5mm_G	3	EVERLIGHT(台湾亿光)	0.039
3	BC547-B	4	BLUE ROCKET(蓝箭)	0.031
4	220k resistor	4		
5	PROBE	1	JILN(锦凌)	0.272
6	BATTERY	1	JILN	0.161

Department of EXTC Engineering

ROCK-PAPER-SCISSOR

for

Python Project of Second Year, (Sem-IV)

Electronics & Telecommunication Engineering

by
3. Swapnil Biradar
5.Shubham Dangle
7.Sahil Kadam

Under the guidance of
Dr. Archana Ingle
HOD (EXTC)

VIVA INSTITUTE OF TECHNOLOGY

AFFILIATED TO UNIVERSITY OF MUMBAI

Vishnu Waman Thakur Charitable Trust's

VIVA Institute of Technology

Approved by AICTE New Delhi, Recognized by DTE, Govt. of Maharashtra
And Affiliated to University of Mumbai

NAAC "B++" Grade

CERTIFICATE

This is to certify that the project entitled ROCK -PAPER -SCISCOR is a Bonafide work of

3.Swapnil Biradar
5.Shubham Dangle
7.Sahil Kadam

submitted to the University of Mumbai in partial fulfillment of the requirement for the award of **Python Project Second Year, (Sem-IV)** in **Electronics & Telecommunication Engineering** as laid down by **University of Mumbai** during academic year 2024-25

(____________________)
Examiner / Reviewer

Dr. Archana Ingle	. Archana Ingle	Dr. Arun Kumar
Project Guide	**Head of Department**	**Principal**

VIVA INSTITUTE OF TECHNOLOGY At: Shirgaon Post: Virar, Tal.: Vasai, Dist. Palghar VIRAR (EAST)

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INTRODUCTION

This Python program is a **Rock-Paper-Scissors** game with a graphical user interface (GUI) built using **Tkinter**. Unlike the traditional version, this game introduces a **time-based challenge**, adding excitement and urgency to each round. Players must make their moves quickly, as the timer counts down based on the selected difficulty level—**Easy (50 seconds), Medium (40 seconds), or Hard (35 seconds)**. The game features **visual hand art** for both the player and AI, enhancing the interactive experience.

The AI opponent makes **random choices**, ensuring fair gameplay, while the score system keeps track of wins. If time runs out, the game resets, prompting the player to try again. Additional features include a **reset button** for restarting the game and a **level selection** option to adjust difficulty. This project demonstrates **Python programming fundamentals, event-driven GUI development, and game logic**, making it both a fun game and a practical learning exercise. Whether for entertainment or educational purposes, this Rock-Paper-Scissors game offers a **dynamic and engaging** experience.

SOFTWARE

Visual Studio Code (VS Code) is a free, open-source code editor developed by Microsoft, widely used by developers for its versatility, speed, and extensive customization options. It supports multiple programming languages, including Python, which was used to develop this Rock-Paper-Scissors game. VS Code provides features like **IntelliSense (smart code completion), debugging tools, Git integration, and a built-in terminal**, making it an excellent choice for both beginners and experienced programmers. Its lightweight design and rich ecosystem of extensions—such as Python support, linting, and auto-formatting—help streamline coding, testing, and debugging processes.

One of the key advantages of VS Code is its **user-friendly interface**, which includes a file explorer, syntax highlighting, and customizable themes. For this project, VS Code's **Python extension** was particularly useful, offering real-time error detection, code navigation, and easy execution of scripts. Additionally, the editor's **integrated terminal** allowed for seamless running of the Tkinter-based GUI without switching between applications. The ability to install third-party extensions—like **Pylance for type checking** or **Live Share for collaborative coding**—further enhances productivity. Whether for small projects like this game or larger software development, VS Code remains a powerful and efficient tool for modern programming.

CODE

```
import random
import tkinter as tk
from tkinter import messagebox

levels = {"Easy": 50, "Medium": 40, "Hard": 35}  # Time in seconds for
each level
time_left = levels["Easy"]  # Default time limit
score = 0
level = "Easy"

def get_hand_art(choice):
    hands = {
        "Rock": "Rock\n    _______\n---
'    ____)\n      (_____)\n      (_____)\n      (____)\n---.__(___)",
        "Paper": "Paper\n    _______\n---
'    ____)____\n          ______)\n          _______)\n          _______)\n---
.__________)",
        "Scissors": "Scissors\n    _______\n---
'    ____)____\n          ______)\n       __________)\n      (____)\n---
.__(___)"
    }
    return hands.get(choice, "")

def start_timer():
    global time_left
    time_left = levels[level]
    update_timer()

def update_timer():
    global time_left
    if 'You Win' in result_label.cget('text'):
        return
```

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```
    if time_left > 0:
        timer_label.config(text=f"Time left: {time_left}s")
        time_left -= 1
        root.after(1000, update_timer)
    else:
        messagebox.showinfo("Time's up!", "You ran out of time! Try
again.")
        reset_game()

def get_user_choice(choice):
    global player_move, ai_move, result_label, score
    if time_left <= 0:
        return

    player_move = choice
    ai_move = get_ai_choice()
    result = determine_winner(player_move, ai_move)

    if "You Win" in result:
        score += 1

    result_text = f"You chose:
{player_move}\n{get_hand_art(player_move)}\nAI chose:
{ai_move}\n{get_hand_art(ai_move)}\n{result}\nScore: {score}"
    result_label.config(text=result_text)
    start_timer()

def get_ai_choice():
    return random.choice(["Rock", "Paper", "Scissors"])

def determine_winner(player, ai):
    if player == ai:
        return "It's a Tie!"
    elif (player == "Rock" and ai == "Scissors") or \
         (player == "Paper" and ai == "Rock") or \
```

```
        (player == "Scissors" and ai == "Paper"):
        return "You Win!"
    else:
        return "AI Wins!"

def set_level(new_level):
    global level, time_left
    level = new_level
    time_left = levels[level]
    level_label.config(text=f"Level: {level}")
    start_timer()

def reset_game():
    global score, time_left
    score = 0
    time_left = levels[level]
    result_label.config(text="")
    start_timer()

def main():
    global result_label, timer_label, level_label, root
    root = tk.Tk()
    root.title("Rock Paper Scissors")
    root.geometry("400x600")  # Increased height to accommodate hand
art

    tk.Label(root, text="Choose your move:", font=("Arial", 14)).pack()

    btn_frame = tk.Frame(root)
    btn_frame.pack(pady=10)

    btn_rock = tk.Button(btn_frame, text="Rock", font=("Arial", 12),
width=10, command=lambda: get_user_choice("Rock"))
    btn_paper = tk.Button(btn_frame, text="Paper", font=("Arial", 12),
width=10, command=lambda: get_user_choice("Paper"))
```

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```
    btn_scissors = tk.Button(btn_frame, text="Scissors", font=("Arial",
12), width=10, command=lambda: get_user_choice("Scissors"))

    btn_rock.pack(side=tk.LEFT, padx=5)
    btn_paper.pack(side=tk.LEFT, padx=5)
    btn_scissors.pack(side=tk.LEFT, padx=5)

    level_label = tk.Label(root, text=f"Level: {level}", font=("Arial",
12))
    level_label.pack(pady=5)

    level_frame = tk.Frame(root)
    level_frame.pack()

    btn_easy = tk.Button(level_frame, text="Easy", font=("Arial", 10),
command=lambda: set_level("Easy"))
    btn_medium = tk.Button(level_frame, text="Medium", font=("Arial",
10), command=lambda: set_level("Medium"))
    btn_hard = tk.Button(level_frame, text="Hard", font=("Arial", 10),
command=lambda: set_level("Hard"))

    btn_easy.pack(side=tk.LEFT, padx=5)
    btn_medium.pack(side=tk.LEFT, padx=5)
    btn_hard.pack(side=tk.LEFT, padx=5)

    result_label = tk.Label(root, text="", font=("Courier", 12),
justify="left")
    result_label.pack(pady=10)

    timer_label = tk.Label(root, text=f"Time left: {time_left}s",
font=("Arial", 12))
    timer_label.pack(pady=5)

    reset_button = tk.Button(root, text="Reset Game", font=("Arial", 12),
command=reset_game)
```

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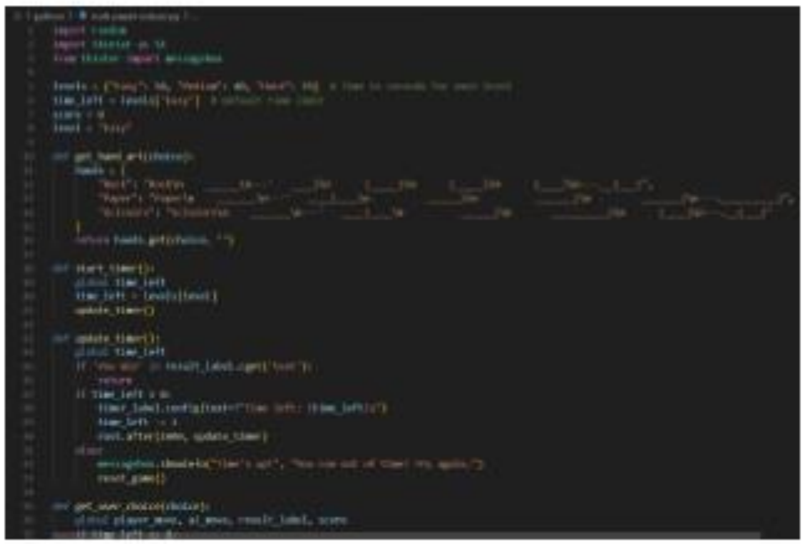
```
    reset_button.pack(pady=10)

    start_timer()
    root.mainloop()

if __name__ == "__main__":
    main()
```



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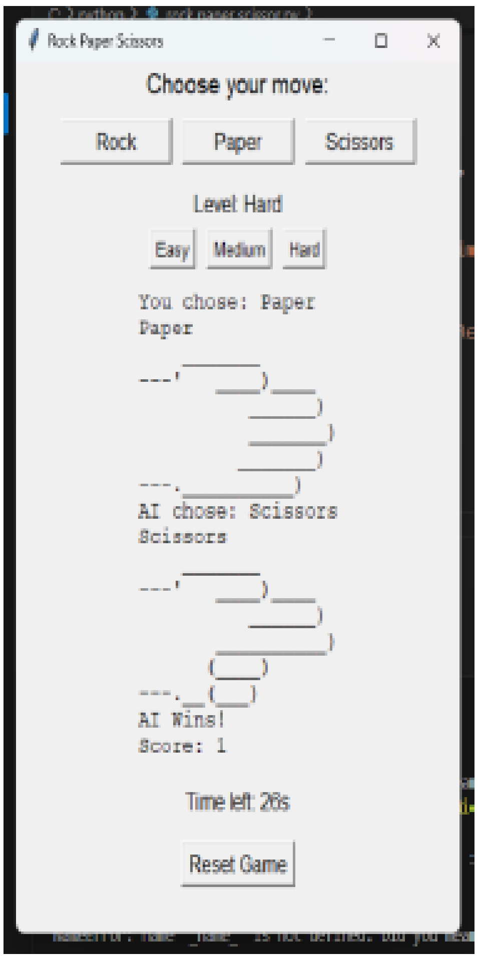
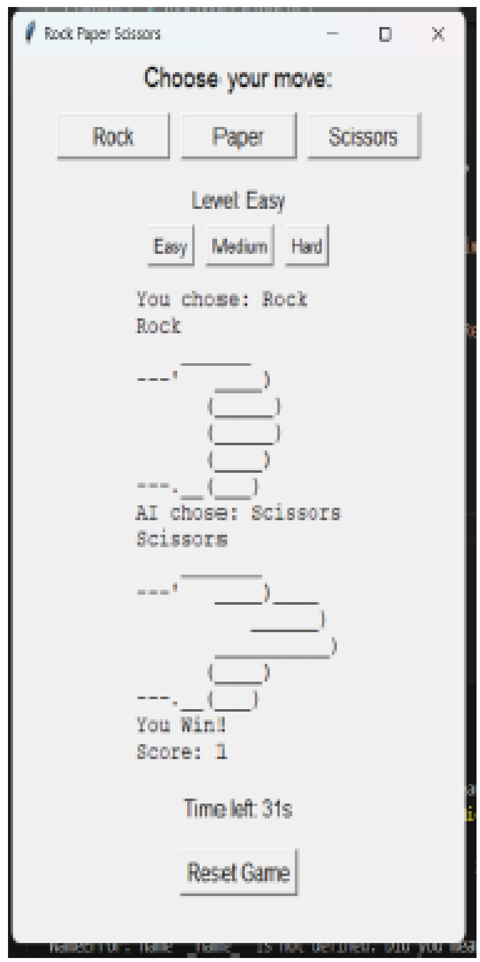
RESULT


Rock Paper Scissors
Choose your move:
Rock
Paper
Scissors
Level: Hard
Easy
Medium
Hard
You chose: Paper
Paper
AI chose: Scissors
Scissors
AI Wins!
Score: 1
Time left: 26s
Reset Game


Rock Paper Scissors
Choose your move:
Rock
Paper
Scissors
Level: Easy
Easy
Medium
Hard
You chose: Rock
Rock
AI chose: Scissors
Scissors
You Win!
Score: 1
Time left: 31s
Reset Game

CONCLUSION

This Rock-Paper-Scissors game project effectively combines Python programming with Tkinter GUI development to create an interactive and timed version of the classic game, featuring difficulty levels, ASCII art visuals, and score tracking. The implementation demonstrates core programming concepts including event-driven design, conditional logic, randomization for AI moves, and dynamic interface updates through a countdown timer that varies by selected difficulty (Easy, Medium, Hard). While providing an entertaining gaming experience, the project also serves as an excellent learning tool for GUI development and game logic implementation in Python, with potential for expansion through enhanced graphics, sound effects, or multiplayer functionality. The game successfully balances simplicity with engaging mechanics, showcasing how fundamental programming skills can transform traditional games into modern, interactive applications that offer both entertainment value and educational insight into software development principles.

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Vishnu Waman Thakur Charitable Trust's
VIVA Institute of Technology
Approved by AICTE New Delhi, Recognized by DTE, Govt. of Maharashtra
And Affiliated to University of Mumbai
NAAC "B++" Grade

A Course Project Report

on

"Design of Belt Conveyor"

Submitted in partial fulfillment of the requirements

For the degree of

Final Year of Engineering

by

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CONTENTS

ABSTRACT

This project focuses on the design and analysis of belt conveyors, essential components in modern material handling systems used across various industries, including mining, manufacturing, agriculture, and logistics. Belt conveyors efficiently transport bulk and unit loads, offering significant advantages in terms of speed, reliability, and energy efficiency compared to traditional manual handling methods. The history of belt conveyors traces back to the late 19th century, evolving from rudimentary systems to advanced technologies that support complex industrial processes.

The project investigates the working principles of belt conveyors, emphasizing key components such as the belt, pulleys, rollers, and drive systems. It explores how these elements interact to facilitate continuous motion, maintain tension, and ensure proper alignment, crucial for effective material transport. The working principle involves the frictional interaction between the drive pulley and the belt, powered by an electric motor, allowing materials to be loaded, conveyed, and discharged efficiently.

In addition to the operational aspects, the project delves into various applications of belt conveyors across different sectors. These applications highlight the versatility of belt conveyors in handling a wide range of materials, from agricultural products to heavy mining ores. The research also emphasizes the importance of safety, energy efficiency, and sustainability in conveyor design, addressing modern industry demands for environmentally friendly solutions.

The project aims to provide a comprehensive understanding of belt conveyor systems through theoretical analysis and practical design considerations. By examining factors such as belt material selection, tensioning mechanisms, and energy consumption, the project seeks to optimize conveyor performance for specific industrial applications. Advanced features like variable frequency drives and modern belt materials will be explored to enhance system efficiency and reduce operational costs.

Through this investigation, the project will contribute valuable insights into the mechanical design and operational optimization of belt conveyor systems, preparing solutions that meet the evolving needs of various industries. The findings will serve as a foundation for further research and development, highlighting the role of belt conveyors in enhancing productivity and sustainability in material handling processes. This project ultimately aims to showcase the critical importance of belt conveyors in the global supply chain, demonstrating their impact on operational efficiency and industrial advancements

LIST OF FIGURES

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Chapter 1

INTRODUCTION

A belt conveyor is one of the most essential material handling systems, widely used for the transportation of bulk and unit loads in industries such as mining, manufacturing, food processing, and logistics. Belt conveyors have a long history, with early versions dating back to the late 19th century. The first belt conveyor systems were rudimentary, often powered by manual or animal labour, and used in simple applications such as grain handling. However, the Industrial Revolution brought about significant advancements in belt conveyor technology. In 1901, Sandvik introduced the first steel conveyor belt, marking a pivotal moment in the evolution of these systems. By the mid-20th century, with the development of synthetic and reinforced rubber belts, belt conveyors became integral to large-scale industrial operations, revolutionizing material transport in sectors like mining and manufacturing.

The modern belt conveyor as we know it today is a highly efficient system, capable of transporting large quantities of materials over long distances with minimal human intervention. It consists of a continuous belt loop, supported by pulleys and rollers, and is typically powered by an electric motor. The design has evolved to meet the demands of high-speed, high-capacity, and heavy-duty applications, making it a critical component in the global supply chain.

Several design considerations are essential when constructing a belt conveyor system:

1. **Belt Material and Type Selection**: Over time, belt materials have evolved from basic woven fabrics to highly specialized materials designed for specific applications. Modern belt conveyors use materials such as rubber, PVC, or metal mesh, depending on the operating conditions and type of materials being transported. The belt must be resistant to wear, chemicals, and extreme temperatures to ensure a long service life.
2. **Power and Drive System**: Early belt conveyors were manually powered or driven by simple mechanical systems. Today, electric motors power most belt conveyors, with modern systems utilizing variable frequency drives (VFDs) to control speed and improve energy efficiency. The power requirements of a conveyor system depend on factors such as belt length, load capacity, and operating speed.
3. **Pulley and Roller Design**: The design of pulleys and rollers has advanced significantly since the early days of belt conveyors. Modern pulleys are engineered to provide the optimal amount of tension and grip for the belt, while rollers are designed to reduce friction and wear, thus improving system efficiency. Proper design and alignment of these components are essential for preventing belt slippage and ensuring smooth operation.
4. **Belt Tension and Tracking**: Early belt conveyors often faced issues with belt tension and misalignment, which could lead to excessive wear or system failures. Today, sophisticated tensioning systems ensure that the belt remains properly tensioned during operation, while advanced tracking systems prevent misalignment by keeping the belt cantered on the rollers.
5. **Load Capacity and Speed**: The load capacity and speed of modern belt conveyors have significantly increased over time, allowing them to handle heavier materials at faster speeds. This increase in efficiency has been made possible by improvements in belt strength, motor power, and system design. Optimizing these factors is crucial for meeting the demands of high-capacity industrial operations.
6. **Environmental and Safety Considerations**: Safety features have become an integral part of belt conveyor design. Modern systems are equipped with emergency stop mechanisms, safety guards, and monitoring systems to protect workers from potential hazards. Additionally, in industries where hygiene is critical, belt conveyors are designed for easy cleaning and are often made from materials that meet strict hygiene standards.

7. **Energy Efficiency and Sustainability**: Belt conveyor design has become increasingly focused on energy efficiency and sustainability. Lightweight materials, energy-efficient motors, and friction-reducing components are now standard in modern conveyor systems. Additionally, some conveyors are equipped with regenerative drives that can recover energy during deceleration, further improving their environmental impact.

Figure 1.1 Belt Conveyor

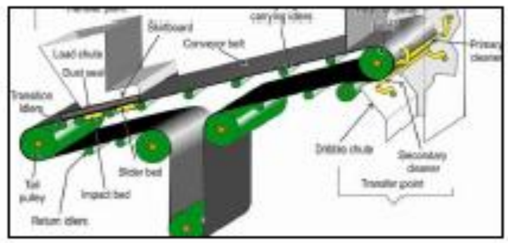

Figure 1.2 Structure of Belt Conveyor

Chapter 2

WORKING PRINCIPLE

The working principle of a belt conveyor is relatively simple yet efficient, relying on continuous motion and friction to move materials from one point to another. The system operates through a combination of mechanical components designed to keep the belt moving and maintain proper tension. Below is an explanation of the key elements involved in the operation:

1. Basic Setup:

A belt conveyor consists of three main components:

- **Belt**: A continuous loop that serves as the carrying medium for the material. It can be made from various materials such as rubber, fabric, or metal mesh, depending on the application.
- **Pulleys**: The belt is supported and moved by pulleys at either end. The **drive pulley** is powered by a motor and is responsible for moving the belt, while the **tail pulley** helps maintain tension in the belt.
- **Rollers/Idlers**: These are placed along the length of the belt to provide support, reduce friction, and help guide the belt.

2. Conveyor Motion:

The belt moves continuously in a loop, driven by a motor attached to the drive pulley. The rotation of the drive pulley causes the belt to move along the idlers, forming a continuous moving surface for transporting materials.

3. Material Handling:

Materials are loaded onto the belt at the input section (also known as the **loading chute**) and transported to the desired location. The belt's surface, combined with friction between the belt and the load, keeps the material in place as it moves along the conveyor's length.

4. Friction and Power Transmission:

The motion of the belt is powered by friction between the belt and the drive pulley. The motor generates rotational motion, which is transferred to the drive pulley. The friction between the belt and the drive pulley ensures that the belt moves in the desired direction without slipping. This friction can be enhanced by using crowned pulleys, lagging materials, or applying tension to the belt.

5. Belt Tension:

For a belt conveyor to function correctly, maintaining the proper amount of tension is crucial. Too little tension can cause the belt to slip on the drive pulley, leading to inefficiencies and potential system failure. Conversely, too much tension can lead to excessive wear and tear on the belt and other components. Proper tensioning systems, such as gravity take-up or screw take-up mechanisms, are used to ensure optimal belt tension.

6. Speed Control:

The speed at which the belt moves can be controlled by adjusting the motor's speed or using a variable frequency drive (VFD). Controlling the belt's speed is important for ensuring smooth material flow and preventing issues like material spillage or jams. Higher speeds are used for light materials or when fast throughput is necessary, while lower speeds are used for heavier materials or when precise control is required.

7. Incline and Decline Conveyors:

In cases where the belt conveyor is used on an incline or decline, additional factors come into play. Gravity can assist in moving the material, but it can also cause slippage if the belt does not provide sufficient friction. Special belts with a textured surface, or additional cleats, are often used in such applications to prevent materials from slipping or rolling back.

8. Discharge:

Once the material reaches the end of the conveyor, it is either discharged into another process or system (such as a hopper, chute, or storage bin) or directly into the next phase of the operation. At this point, the belt loops back around to the tail pulley, ready to carry the next load.

9. Tracking and Alignment:

A properly designed belt conveyor must maintain alignment (or tracking) to function efficiently. Misalignment can cause the belt to drift off-centre, leading to wear on the belt and other components. Tracking mechanisms, such as crowned pulleys or adjustable idlers, help keep the belt cantered on its path.

Summary of the Working Principle:

- The motor powers the drive pulley, causing it to rotate.
- The friction between the drive pulley and the belt moves the belt in a continuous loop.
- Materials are loaded onto the moving belt and transported to the desired location.
- The belt is supported by rollers to reduce friction and keep it aligned.
- The tension in the belt is maintained to prevent slipping and ensure smooth operation.
- The materials are discharged at the conveyor's endpoint, and the belt loops back for another cycle.

This simple yet effective working principle allows belt conveyors to handle large volumes of materials across various industries, ensuring efficient and continuous material transport.

Chapter 3

APPLICATION

Belt conveyors have a wide range of applications across various industries, thanks to their efficiency, versatility, and ability to transport materials over both short and long distances. Below are some of the key applications of belt conveyors, each tailored to meet specific industrial needs:

1. Mining and Quarrying:

In the mining industry, belt conveyors are critical for transporting bulk materials such as coal, ore, gravel, and other minerals. These conveyors are used in both surface and underground mining operations, where they handle large volumes of heavy materials over long distances. The ability to efficiently transport raw materials from mining sites to processing plants or storage areas makes belt conveyors essential for reducing operational costs and improving productivity.

2. Agriculture:

Belt conveyors are widely used in agriculture for the handling of grain, seeds, fertilizers, and other bulk materials. They are essential in farming and food processing operations, where they assist in the loading, unloading, and storage of crops. For example, grain conveyors transport harvested crops from fields to storage silos or trucks. Conveyors in the agricultural sector often need to be flexible, durable, and resistant to environmental conditions such as moisture and dust.

3. Manufacturing:

In manufacturing, belt conveyors are used to move products and materials along assembly lines and between different stages of production. They are vital in industries such as automotive, electronics, textiles, and packaging, where they facilitate the continuous flow of goods through the production process. Belt conveyors can also be customized for specific manufacturing needs, such as handling delicate products or moving heavy loads at high speeds.

4. Food Processing:

Belt conveyors play a critical role in the food processing industry, where they are used to transport raw ingredients, processed food, and packaged goods. These conveyors are often designed to meet strict hygiene and safety standards, ensuring that food products remain uncontaminated during transport. Conveyor belts in food processing applications are made from food-grade materials that are easy to clean and maintain, and they can be equipped with additional features like cooling, heating, or sorting mechanisms.

5. Warehousing and Distribution:

In warehouses and distribution centres, belt conveyors are used to move packages, cartons, and pallets through sorting, storage, and shipping processes. They enable the efficient movement of goods from one part of the facility to another, ensuring that items are sorted and dispatched quickly and accurately. Belt conveyors can be integrated with other automated systems, such as barcode scanners and robotic arms, to enhance logistics operations.

6. Airport Baggage Handling:

Airports rely on belt conveyor systems to handle baggage. These systems are responsible for transporting checked luggage from check-in counters to the sorting area and finally to the appropriate aircraft. On the other side, belt conveyors are used to carry arriving baggage from the plane to the baggage claim area. These conveyors must be reliable, efficient, and capable of handling high volumes of luggage in a busy airport environment.

7. Recycling and Waste Management:

Belt conveyors are commonly used in recycling plants and waste management facilities to sort, separate, and transport recyclable materials such as plastics, paper, glass, and metals. They are also used to convey waste materials to disposal sites or compacting stations. In recycling, conveyors can be integrated with sorting technologies such as magnetic separators or optical scanners to help segregate materials for further processing.

8. Construction:

In the construction industry, belt conveyors are used for the movement of construction materials such as sand, gravel, cement, and concrete. They are often employed in large-scale building projects where the efficient handling of materials is critical. Belt conveyors help transport materials to different areas of the construction site, ensuring that materials are delivered where needed in a timely manner, reducing labour costs and increasing productivity.

9. Pharmaceutical Industry:

In pharmaceutical manufacturing, belt conveyors are used to transport delicate products like pills, capsules, and medical devices along production lines. These conveyors must meet strict hygiene and contamination control standards, as well as provide gentle handling to avoid damaging the products. Conveyor systems in the pharmaceutical industry often incorporate automated sorting, counting, and packaging processes to improve efficiency and accuracy.

Belt conveyors are indispensable in industries that require the efficient movement of materials. From heavy-duty applications in mining and construction to delicate handling in food processing and pharmaceuticals, belt conveyors provide a reliable, versatile, and cost-effective solution for material handling. They improve productivity, reduce labor costs, and enable the seamless transport of materials across different sectors, making them a key component in modern industrial processes.

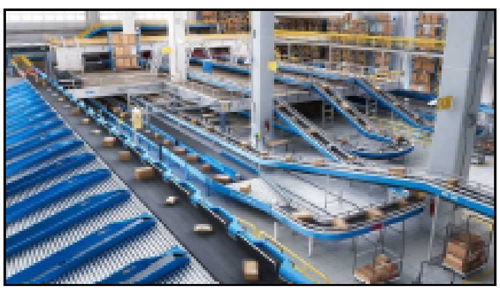

Figure 3.1 Automated sorting conveyor systems

Chapter 4

DESIGN

Q] A 20 troughing belt conveyor has the following data: -
Material conveyed: - Coal (for Mine)
Indication of Conveyor: - 15
Lump Size: - 100mm
Capacity: - 200 TPH
Length of Conveyor: - 50m

Design the conveyor for: -

1. Motor Power Capacity
2. Belt Width
3. No. of troughing idlers and return idlers
4. Belt Drive Pulley

Solution: -

- **STEP 1: - Finding width (B) and actual belt Speed (V)**

  B= x × a +200mm
  B = (3.5 × 100) + 200
  B = 650mm

  From PSG 9.20
  B = 650mm & Belt Speed (v) =2m/s
  Checking the selected for Conveying capacity,

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From PSG 9.18

$$Bmin = 1.11 \times \left[\left\{\frac{Q}{\rho \times C \times V}\right\}^{\frac{1}{2}} + 0.05\right]$$

Now,

$C = 460$ & $\rho = 0.65 - 0.75\ ton/m^3$

Taking Average,

$\rho = 0.715\ m/s$

$$0.65 = 1.11 \times \left[\left\{\frac{Q}{0.75 \times 460 \times 2}\right\}^{\frac{1}{2}} + 0.05\right]$$

$Q = 188.69\ TPH < 200\ TPH$

Here Selected belt Fails, select next standard belt width.

$B = 800mm$ & $V = 2.75\ m/s$

We get,

$Q = 406.9\ TPH > 200TPH$

Now, for actual velocity,

$Q = 200\ TPH$

$Bmin = 0.8m$

$\rho = 0.715 ton/m^3$

$C = 460$

$Vact = 1.352\ m/s$

- **STEP 2: - Motor Selection**

From PSG 9.18

$Wo = C \times f \times l \times [(Gg + Gb)] \pm H \times (Gg + Gb)$

Calculate value of Gg, H, Gro

I. $Gg = q = \frac{Q}{3.6 \times V}$

$= \frac{200}{3.6 \times 1.352}$

$= 41.1\ kgf/m$

II. $sin\delta = \frac{H}{L}$

$sin15 = \frac{H}{50}$

$H = 12.94$

III. $Gro = \frac{26.2}{1.5}$

$Gro = 17.46\ kgf/m$

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Now, PSG 9.18 graph,
We get, value of $C = 2.4$

$C = 2.4$
$f = 0.02$
$L = 50m$
$Gb = 12\ kgf/m$
$\delta = 15$

Put the Value in Wo formula
$Wo = 852.13kgf$

Now, From PSG 9.18
$Wu = C \times F \times L \times [Gb \times \cos + Gru] + H \times Gb$
$Gru = \frac{Wr}{S}$
$Gru = \frac{18.2}{3.0}$
$Gru = 6.07kgf/m$

From PSG 9.18
$\rho = Wo + Wu$
$\rho = 852.13 - 112.89$
$\rho = 7392.4\ N$

Now,
$Motor\ power = \left[\frac{P \times V}{nmech}\right] \times ka$

Assume,
Ka = Adhesive Factor of belt has tendency to stick
$ka = 1.2$
$nmech = 0.75$

$M.P = \frac{739.24 \times 1.325}{0.75} \times 1.2$
$M.P = 15.99kw$

From PSG 5.124
Selecting Std Motor,
$M.P = 18.5kw$
$Motor\ RPM\ (300\ to\ 1500)$

Calculation. Actual RPM,
$Actual\ RPM = 0.96 \times Theoritical\ RPM$
$18.5\ kw\ (2880\ RPM\ to\ 1440\ RPM)$

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We are selecting 1440 RPM

- STEP 3: - Belt Cross Section

I. Calculating maximum tension on belt

$T = P\left[\frac{e^{\mu\alpha}}{e^{\mu\alpha} - 1}\right]$

$\alpha = angle\ of\ wrap\ over\ pulley\ in\ radians$

$\alpha = 240° \times \frac{\pi}{180}$

$\alpha = 4.18\ rad$

$\mu = Coeffeicent\ of\ friction$

Assuming, $\mu = 0.25$

$T = 7392{,}4 \times \left[\frac{e^{0.25\times4.18}}{e^{0.25\times4.18} - 1}\right]$

$T = 11.402 \times 10^3\ N$

$T = 1140.23 kgf$

II. For number of plie

$i = \frac{T}{B \times F}$

F = working tension of belt for 1mm width, kgf/mm per ply

Now,

$f = 0.62 kgf/mm$

We select $32oz\ grade$

$i = \left[\frac{1140.23}{800 \times 0.62}\right]$

$i = 2.3$

Checking for imin and imax value

From PSG 9.21

[I min = 4, imax=7]

Selecting

$i = 4$

Tt = Top Cover = 3mm

Tb = Bottom Cover= 1mm

Ti = Total Thickness of plies

= 4×2

Ti = 08mm

$t = Total\ thickness = Tt + Tb + Ti$

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Considering 2mm Thickness of each Ply
$t = 3 + 1 + 8$
$t = 12mm$
$Belt\ Cross\ Section = 800 \times 12mm$

- **STEP 4: - Design of Drum, Drum Shaft, Selection of drum Shaft& Bearing**

I. Calculation Diameter of pulley,
$D = k1 \times k2$

$k1 = 1.25$ factor that depends on material
$k2 = 100$ factor that depends on belt tension & lap angle

$D = 1.25 \times 100 \times 4$
$D = 500mm$

II. Width of drum= $B + (2 \times edge\ clearence)$
For edge Clearance
50mm, if B is up to 650mm
75mm, If B is up to 1000mm
100mm, If B is up to 1000mm

Width of drum $= 800 + (2 \times \times \backslash 75)$
Width of drum $= 950mm$

Tension at Slack side,
For $T2 = T1 - P$
$T2 = 11.402 \times 10^3 - 7392.36$
$T2 = 4009.64\ N$

Total weight acting on drum
$W = T1 + T2$
$W = 11.402 \times 10^3 + 4009.64$
$W = 15.412 \times 10^3 N$

III. Shaft is Subjected to following two Efforts,

I. For Bending Moment (BM)= $M = \frac{Wl}{4}$

$M = 15.412 \times 10^3 \times \frac{1000}{4}$

$M = 3.85 \times 10^6\ N/mm$

II. For Torque

$P = \frac{2 \times \pi \times NdrumT}{60}$

$$V = \frac{\pi \times D \times Ndrum}{60}$$
$$1.352 = \frac{\pi \times 0.5 \times Ndrum}{60}$$
$$Ndrum = 51.64 rpm$$

Now,
$$P = \frac{2 \times \pi \times Ndrum \times T}{60}$$
$$18.5 \times 10^3 = \frac{2 \times \pi \times 51.64 \times T}{60}$$
$$T = 3.42 \times 10^3 N/mm$$

Now,
$$Te = \sqrt{(kb \times M)^2 + (kt \times T)^2}$$

$Kb = Bending\ factor = 2$
$Kt = Torque\ factor = 1.5$

$$Te = \sqrt{(2 \times 3.85 \times 10^6)^2 + (1.5 \times 3.42 \times 10^3)^2}$$
$$Te = 7.70 \times 10^6 N/mm$$
$$Te = \frac{\pi}{16} \times \pi \times ds^3$$

Material Selection for Shaft from PSG 1.9
Selection C45 Material,
$\sigma yt = 360\ n/mm^2$
$FOS = 4$

We know,
$$\sigma t = \frac{\sigma yt}{FOS}$$
$$\sigma t = \frac{360}{4}$$
$$\sigma t = 90\ N/mm^2$$

Shear Stress$(\tau) = 0.5 \times \sigma t$
$= 0.5 \times 90$
$\tau = 45\ N/mm$

$$Te = \frac{\pi}{16} \times 45 \times ds^3$$
$ds = 95.51mm$
$ds \approx 100mm$
(Stepping of 2.5mm)
d/s/ Bearing $= 95mm$

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Bearing selection of drum shaft

$$Fr = \frac{W}{2}$$

$$Fr = \frac{15.412 \times 10^3}{2}$$

$$Fr = 7706\ N\ \&\ Fa = 0$$

Select bearing type drum shaft
Selecting DGBB

I. $Lh = Days\ \times Years \times Hrs/Day$

$$= 300 \times 5 \times 8$$

$$Lh = 12000 hrs$$

II. $Lmr = \frac{Ndrum \times 60 \times Lh}{10^6}$

$$= \frac{51.64 \times 60 \times 12000}{10^6}$$

$$Lmr = 37.18$$

III. $L10 = 1mr$

IV. Equivalent Load,

$$Pe = (X \times Fr + Y \times Fa)s$$

$$Pe = [(1 \times 7706) + 0] \times 1.3$$

$$Pe = 10.02 \times 10^3\ N$$

V. Dynamic Capacity,

$$C = (\frac{Lmr}{L10})^{\frac{1}{k}} \times Pe$$

$$C = (\frac{37.18}{1})^{\frac{1}{3}} \times 10.02 \times 10^3$$

$$C = 33442.91\ N$$

$$C = 3344.291\ kgf$$

From PSG 4.12 Onwards

Bearing Number	Diameter	Dynamic Capacity
6019	95	4750
6219	95	8500
6319	95	12000

Table 4.1: Bearing Selection Table - 1

Selecting Bearing Number 6019 with diameter 95mm & C 4750 kgf.

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- **Step 5: - Design of Roller (Idlers)**
  Tube diameter (Da) = 140mm & Bearing diameter = 20mm
  Now,
  Inner diameter (Di) $= Do - (2 \times 6)$
  $= 140 - 12$
  $Di = 128mm$

  Now,
  $Wt = [Gg + Gb + Gro] \times S$
  $= [41.1 + 12 + 17.47] \times 1.5$
  $Wt = 105.86$ kgf/ idler set
  Or
  $Wt = 1058.6$ N/ idler set

  Now, Weight distribution for troughing roller is 70% control roller & 30% Either side roller (15%) each
  So, assuming,
  Centre rollers takes 70% load,
  $= 0.7 \times 1058.6$
  $W = 741.02\ N$

  Now,
  $l = \frac{B + 100}{3}$
  $= \frac{800 + 100}{3}$
  $= \frac{900}{3}$
  $l = 300$

  Now,
  Checking the rollers for bending,
  We Know that,
  $\sigma b = \frac{M}{z}$
  Here,
  $M = \frac{WL}{4}$
  $= \frac{741.02 \times 300}{4}$
  $M = 55.57 \times 10^3\ N/mm$

  For, Section modulus (z)
  $Z = \frac{Ixx}{y}\ \ or\ \ Z = \frac{\pi}{32 - Do} \times [Dd^4 - Di^4]$
  $Z = \frac{\pi}{32 \times 140} \times [140^4 - 128^4] = 81.15 \times 10^3\ m^3$

$Z = 81.15 \times 10^3 m$

Now,

$\sigma b = \frac{M}{z} = \frac{55.57 \times 10^3}{81.15 \times 10^3}$

$\sigma b = 0.6847\ N/mm^2$

Now,

Selecting bearing for Idlers,

$Fr = \frac{W}{2} = \frac{741.02}{2} = 370.51$

$Fr = 370.51\ N \quad \& \quad Fa = 0$

Now,

$V = \frac{\pi \times Do \times Nidler}{60}$

$1.352 = \frac{\pi \times 0.14 \times Nidler}{60}$

$Nidler = 184.43\ rpm$

Now,

Assuming for DGBB,

$Lh = 12000hrs, L10 = 1mr, S = 1.3, X = 1, Y = 0$

So,

$Lmr = \frac{Nidler \times 60 \times Lh}{10^6} = \frac{184.43 \times 60 \times 12000}{10^6}$

$Lmr = 132.78\ rev$

Now,

Equivalent Load,

$Pe = (X \times Fr + Y \times Fa) \times s$

$= (1 \times 370.51 + 0) \times 1.3$

$= 481.66\ N$

Now,

Dynamic Capacity,

$C = \left[\frac{Lmr}{l10}\right]^{\frac{1}{k}} \times Pe$

$C = \left[\frac{132.78}{1}\right]^{\frac{1}{k}} \times 481.66$

$C = 2457.26N \ \ or \ \ C = 245.726kgf$

Now,

Selecting bearing available from PSG4.12

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Bearing Number	Bearing Diameter(mm)	Dynamic Capacity (kgf)
6004	20	735
6204	20	1000
6304	20	1250

Table 4.2: Bearing Selection Table - 2

Selecting bearing number 6004 having diameter of 20mm & Dynamic Capacity 735kgf (DGBB)

Chapter 5

SOLID MODEL

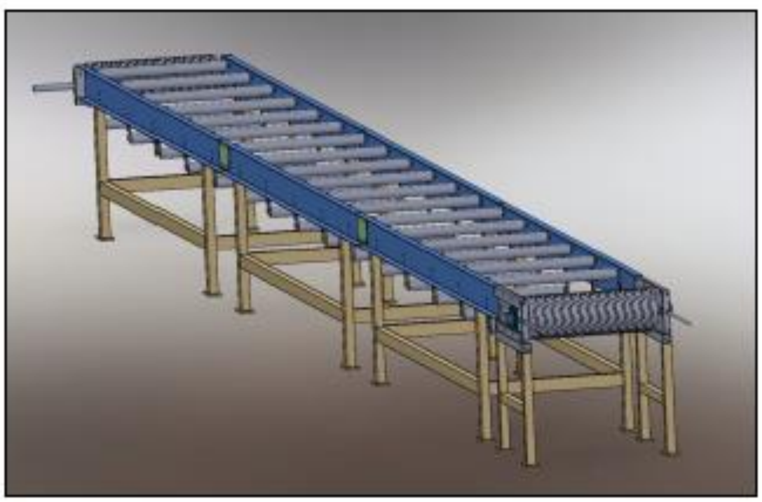

Fig 5.1: Solid Model of Belt Conveyor

Chapter 6

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NAAC "B++" Grade

Mini Project on

SMART CHESS INSIGHT

Submitted in partial fulfilment of the requirements of the
degree of

Bachelor of Engineering in Computer Science and Engineering
(AI & ML) Department

Submitted by

Karan Kale (17)

Sarthak Mudras (30)

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2024 – 25

Table of Contents

Introduction

Smart Chess, a game that demands strategic thinking, foresight, and tactical precision, has evolved significantly with the integration of artificial intelligence. Smart Chess Insight aims to bridge the gap between casual and professional play by providing real-time analysis, immediate feedback, and personalized learning experiences. This AI-driven platform leverages powerful chess engines such as Stockfish to assess each move during gameplay, identifying mistakes like blunders, inaccuracies, or missed opportunities.

By suggesting optimal moves instantly, it helps players make better decisions on the board and improve their performance mid-game. Beyond live assistance, the platform offers post-game analysis that highlights key mistakes, turning points, and critical patterns, enabling players to reflect and learn from their matches. With tailored training modes, interactive practice scenarios, and progress tracking tools, the system caters to chess enthusiasts of all levels, from beginners building foundational skills to advanced players refining strategies.

Features

- **Sleek Design:** Bryght Chessboard boasts a minimalist and elegant design, making it a beautiful addition to any chess player's collection.
- **Intuitive Interface:** The intuitive interface ensures a seamless and enjoyable gaming experience for players of all skill levels.
- **Advanced AI:** The built-in AI offers personalized coaching, allowing players to refine their skills and strategy.
- **Light indicators:** A simple touch and your piece illuminates potential moves in real time and signifies your move strength
- **Companion app:** The app unlocks extra features and lets you play with friends, even if they don't have a ChessUp board.

Resources Used

Smart Chess Insight is an intelligent analytical tool designed to assist chess players in understanding and improving their game. The project leverages basic artificial intelligence and data analysis techniques to evaluate chess games, provide move-by-move insights, and suggest better alternatives based on standard strategies and engine evaluations.

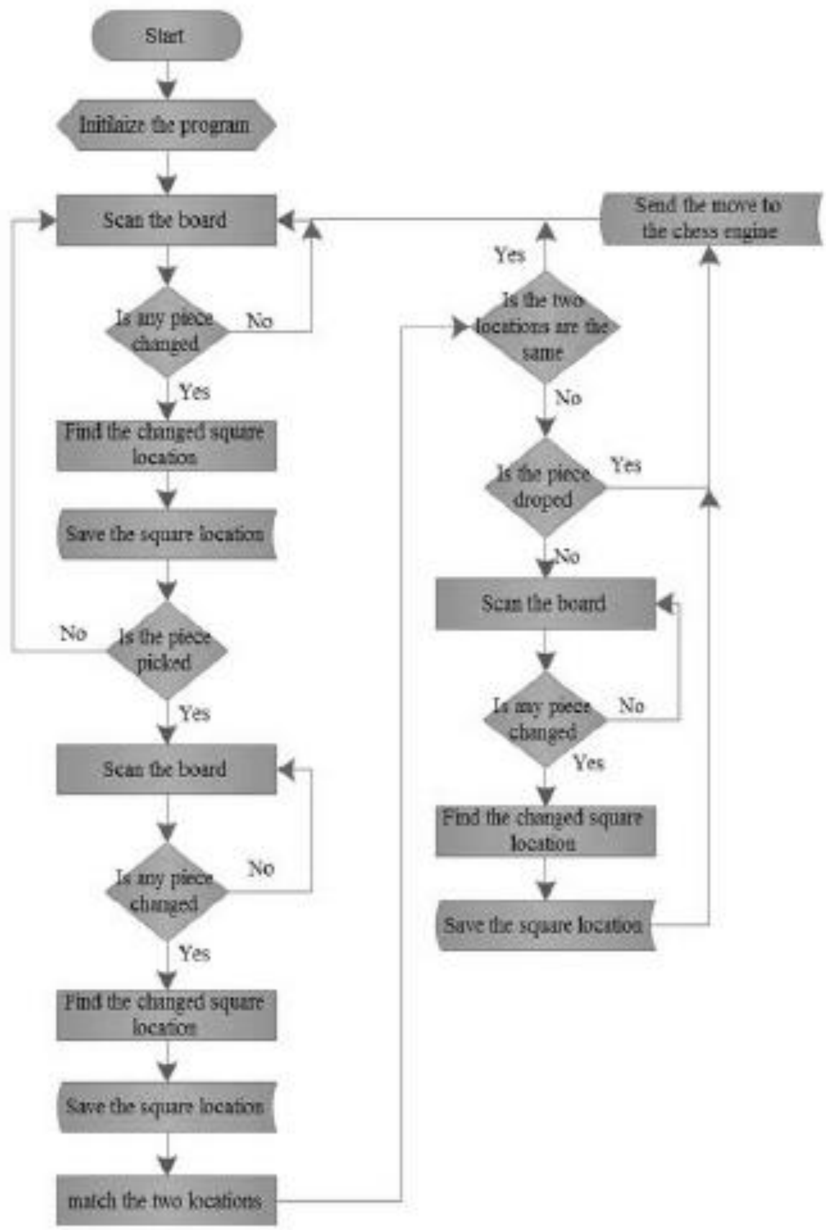
This mini project aims to bridge the gap between beginner-level players and professional analysis by offering real-time feedback, highlighting blunders and inaccuracies, and visualizing patterns such as common openings, threats, and tactical opportunities.

Here is the list of various software and hardware that will be used in designing the application:

Software Specification:
Operating System: Windows
Editor: VS Code
Language: Javascript, React
Database: Postgres, neon

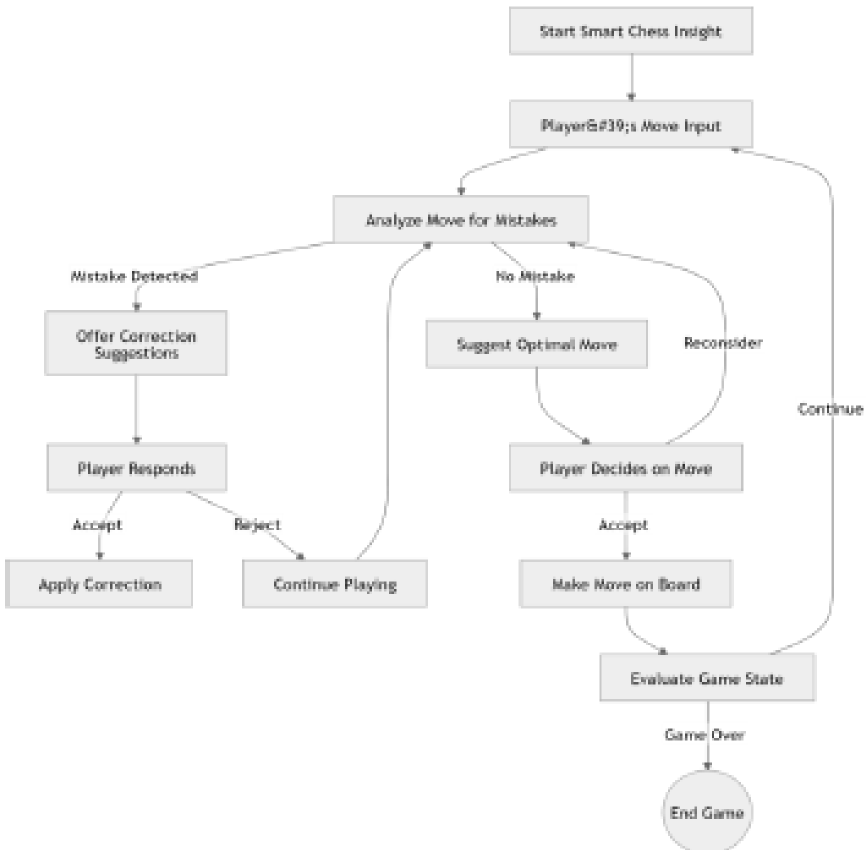
Hardware Specification:
Processor: i5
Hard Disk: 256GB
RAM: 8 GB

Algorithm


Start
Initilaize the program
Scan the board
Is any piece changed
No
Yes
Find the changed square location
Save the square location
Is the piece picked
No
Yes
Scan the board
Is any piece changed
No
Yes
Find the changed square location
Save the square location
match the two locations
Send the move to the chess engine
Yes
Is the two locations are the same
No
Is the piece droped
Yes
No
Scan the board
Is any piece changed
No
Yes
Find the changed square location
Save the square location

4

Flowchart


Start Smart Chess Insight
Player's Move Input
Analyze Move for Mistakes
Mistake Detected
No Mistake
Offer Correction Suggestions
Suggest Optimal Move
Reconsider
Continue
Player Responds
Player Decides on Move
Accept
Reject
Accept
Apply Correction
Continue Playing
Make Move on Board
Evaluate Game State
Game Over
End Game

5

Output

Fig 6.1 Load Game Page

Fig 6.2 Accuracies Page

Fig 6.3 Game Review Page

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Conclusion

In conclusion, the Smart chess insight project has successfully developed a robust system for automated mistake detection and optimal move suggestions. By leveraging advanced algorithms and machine learning techniques, our tool not only identifies potential errors in players' moves but also provides strategic recommendations to enhance their gameplay. This dual functionality fosters a deeper understanding of chess strategy, enabling players of all levels to improve their skills and decision- making abilities. As chess continues to gain popularity, our project contributes to a more accessible and engaging learning experience, promoting the growth of the chess community. Future developments could explore further integration of AI insights, user customization, and real-time gameplay analysis, making Smart Chess Insight an invaluable resource for chess enthusiasts everywhere.