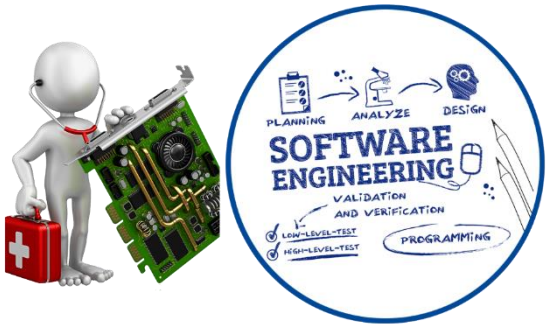
R. C. Patel Institute of Technology, Shirpur

Department of Computer Engineering

TechnoVerse 2020-21



TechnoVerse

EDITOR 2020-21

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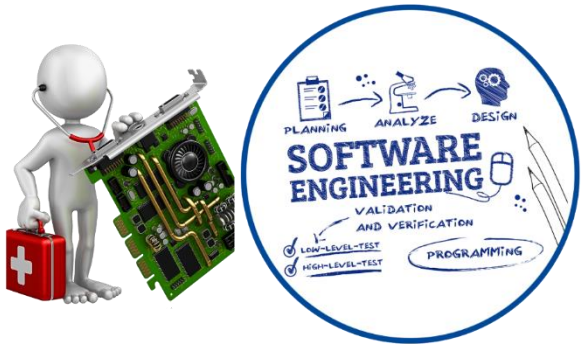


TechnoVerse

Message From HODs Desk

I am pleased and privileged to be able to share a few words with you while you read through the magazine's pages **"TechnoVerse"**. The computer department works hard to help students to get the most out of their environment. The information gathered thus serves as a stepping stone for them to rise to greater heights. The group efforts frequently lead to the discovery and realization of dreams.

I am delighted to be a part in shaping careers of the young engineers. In the Computer Department, we strive to shape every aspect of a student's personality. I would like to take this opportunity to thank the entire faculty members and supporting staff for their consistent and scrupulous efforts in producing this edition.

Dr. Nitin N. Patil

HOD (Computer Engineering)

VISION

To provide prominent computer engineering education with socio-moral values.

MISSION

M1 To provide state-of-the-art ICT based teaching-learning process.
M2 To groom the students to become professionally sound computer engineers to meet growing needs of industry and society.
M3 To make the students responsible human being by inculcating ethical values.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

- **PEO1** To provide the foundation of lifelong learning skills for advancing their careers being a professional, entrepreneur and leader.
- **PEO2** To develop computer professionals to fulfill industry expectations.
- **PEO3** To foster ethical and social values to be socially responsible human being.

PROGRAM OUTCOMES (POs)

- **PO1** Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization for the solution of complex engineering problems.
- **PO2** Problem analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
- **PO3** Design/Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for public health and safety, and cultural, societal, and environmental considerations.
- **PO4** Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

- **PO5** Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
- **PO6** The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
- **PO7** Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and the need for sustainable development.
- **PO8** Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
- **PO9** Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
- **PO10** Communication: Communicate effectively on complex engineering activities with the engineering community and with the society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions
- **PO11** Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
- **PO12** Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES (PSOs)

By the completion of Computer Engineering Program, the students will have following Program Specific Outcomes-

- **PSO1** Understanding of the fundamental and advanced concepts of Computer Engineering to analyze and design real world problems.

- **PSO2** Ability to provide solutions for problems in various domains like agriculture, healthcare, E-commerce etc.

NETWORK TOPOLOGIES

Introduction

Network topology is the method or type of the computer network's arrangement. In simple words computer network possesses a certain structure and organization and the experienced programmer is supposed to know about the pluses and minuses of every system to create the most appropriate systems for the clients who want to set up a computer network at home, in the office, etc. There are different types of the connection of computers between one another within the single network.

Every programmer knows that there are two main kinds of network topology: physical and logical. Physical network topology is characterized with the physical means of the connection of the computers, which depend on the location of the computers and the quality and types of the cables.

What is Topology?

Topology is derived from two Greek words topo and logy, where topo means 'place' and logy means 'study'. In computer networks, a topology is used to explain how a network is physically connected and the logical flow of information in the network.

In computer networks, there are mainly two types of topologies, they are:

Physical Topology:

A physical topology describes the way in which the computers or nodes are connected with each other in a computer network. It is the arrangement of various elements (link, nodes, etc.), including the device location and code installation of a computer network. In other words, we can say that it is the physical layout of nodes, workstations, and cables in the network.

Logical Topology:

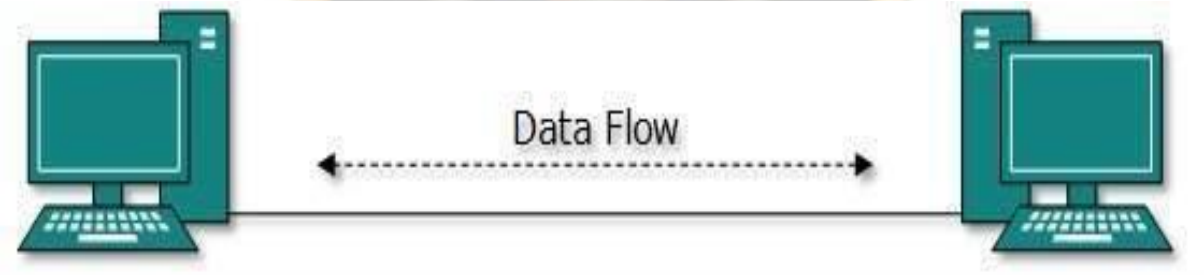
A logical topology describes the way, data flow from one computer to another. It is bound to a network protocol and defines how data is moved throughout the network and which path it takes. In other words, it is the way in which the devices communicate internally.

In a computer network, there are mainly four types of physical topology, they are:

1. Bus Topology
2. Ring Topology
3. Star Topology
4. Mesh Topology

A Network Topology is the arrangement with which computer systems or network devices are connected to each other. Topologies may define both physical and logical aspect of the network. Both logical and physical topologies could be same or different in a same network.

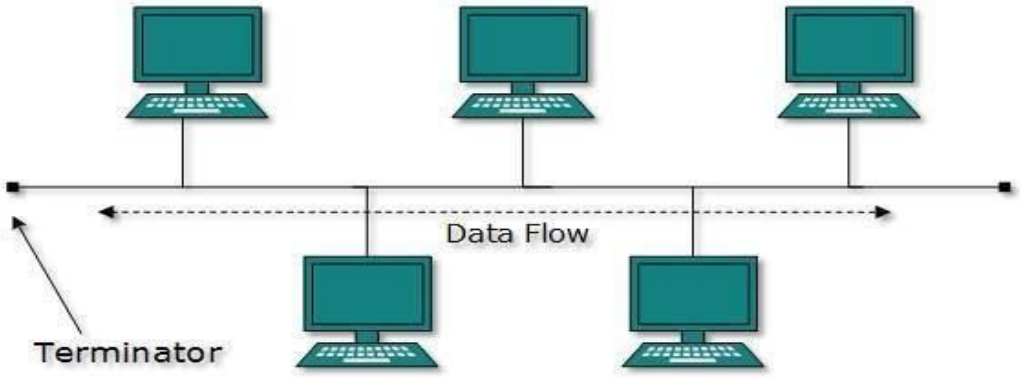
Point-to-Point



Point-to-point networks contains exactly two hosts such as computer, switches or routers, servers connected back to back using a single piece of cable. Often, the receiving end of one host is connected to sending end of the other and vice-versa.

If the hosts are connected point-to-point logically, then may have multiple intermediate devices. But the end hosts are unaware of underlying network and see each other as if they are connected directly.

1. Bus Topology :



Bus topology is the simplest kind of topology in which a common bus or channel is used for communication in the network. The bus is connected to various taps and droplines. Taps are the connectors, while droplines are the cables connecting the bus with the computer. In other words, there is only a single transmission line for all nodes.

When a sender sends a message, all other computers can hear it, but only the receiver accepts it and others reject it. Bus technology is mainly suited for small networks like LAN, etc.

In this topology, the bus acts as the backbone of the network, which joins every computer and peripherals in the network. Both ends of the shared channel have line terminators. The data is sent only in one direction and as soon as it reaches the end, the terminator removes the data from the communication line

In a bus topology, each computer communicates to another computer on the network independently. Every computer can share the network's total bus capabilities. The devices share the responsibility for the flow of data from one point to the other in the network.

For Example Ethernet cable, etc.

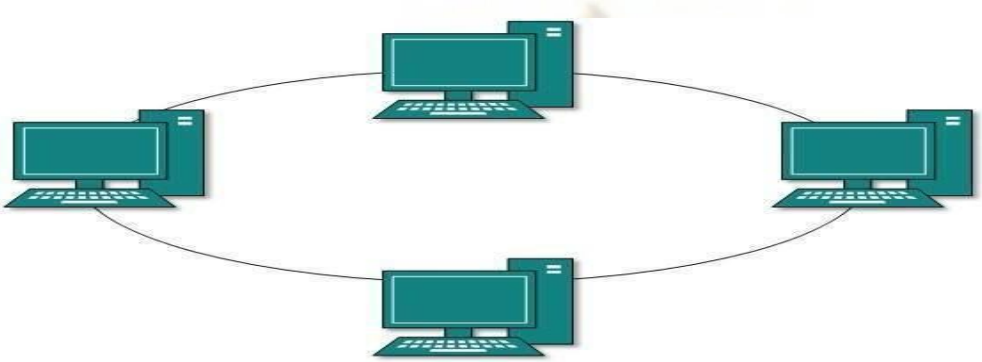
Following are the advantages of Bus topology:

- Simple to use and install.
- If a node fails, it will not affect other nodes.
- Less cabling is required.
- Cost-efficient to implement.

Following are the disadvantages of Bus topology:

- Efficiency is less when nodes are more(strength of signal decreases).
- If the bus fails, the network will fail.
- A limited number of nodes can connect to the bus due to limited bus length.
- Security issues and risks are more as messages are broadcasted to all nodes.

2. Ring Topology:



Ring topology is a topology in which each computer is connected to exactly two other computers to form the ring. The message passing is unidirectional and circular in nature.

This network topology is deterministic in nature, i.e., each computer is given access for transmission at a fixed time interval. All the nodes are connected in a closed-loop. This topology mainly works on a token-based system and the token travels in a loop in one specific direction.

In a ring topology, if a token is free then the node can capture the token and attach the data and destination address to the token, and then leaves the token for communication. When this token reaches the destination node, the data is removed by the receiver and the token is made free to carry the next data.

For Example, Token Ring, etc.

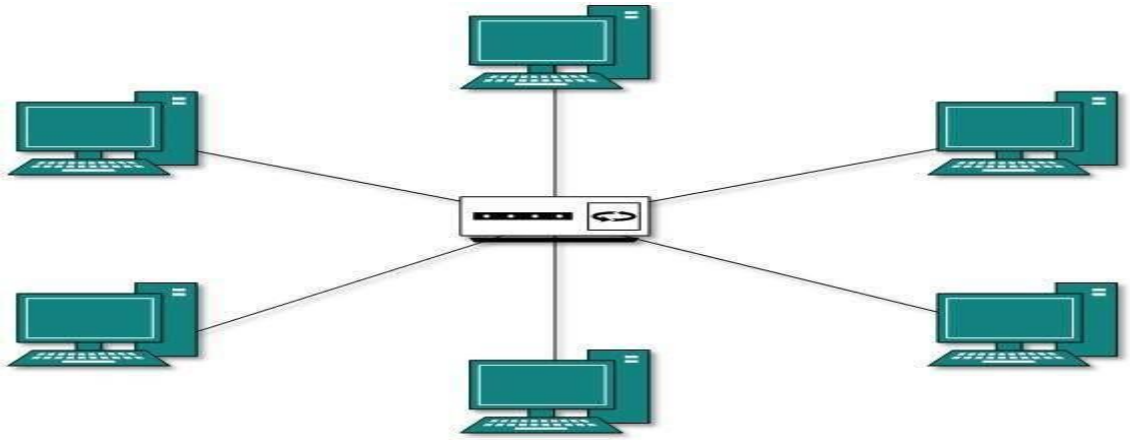
Following are the advantages of Ring topology:

- Easy Installation.
- Reduces chances of data collision (unidirectional).
- Easy to troubleshoot (the faulty node does not pass the token).
- Each node gets the same access time.

Following are the disadvantages of Ring topology:

- If a node fails, the whole network will fail.
- Slow data transmission speed (each message has to go through the ring path).
- Difficult to reconfigure (we have to break the ring).

3. Star Topology:



Star topology is a computer network topology in which all the nodes are connected to a centralized hub. The hub or switch acts as a middleware between the nodes. Any node requesting for service or providing service, first contact the hub for communication.

The central device (hub or switch) has point to point communication link(the dedicated link between the devices which can not be accessed by some other computer) with the devices. The central device then broadcast or unicast the message based on the central device used. The hub broadcasts the message, while the switch unicasts the messages by maintaining a switch table. Broadcasting increases unnecessary data traffic in the network.

In a star topology, hub and switch act as a server, and the other connected devices act as clients. Only one input-output port and one cable are required to connect a node to the central device. This topology is better in terms of security because the data does not pass through every node.

For Example High-Speed LAN, etc.

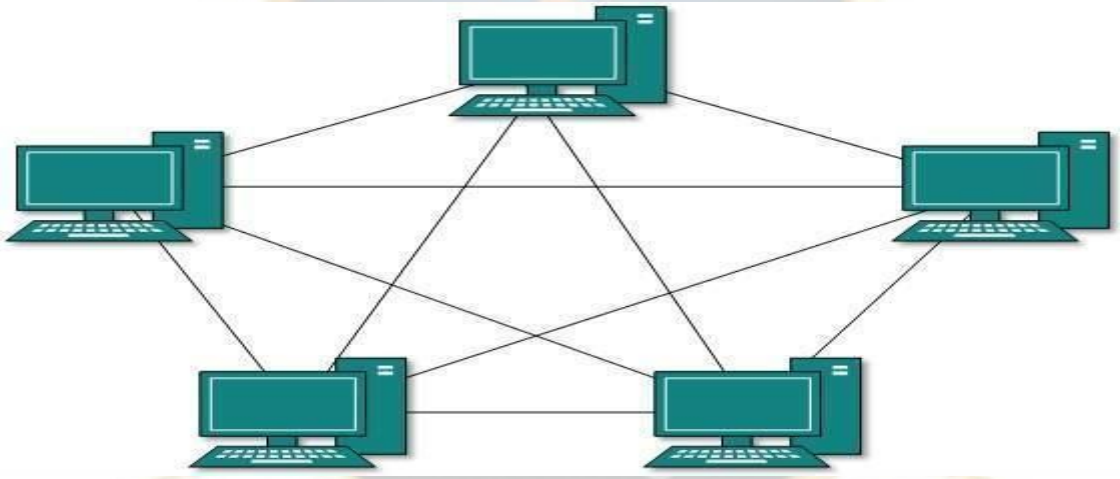
Following are the advantages of Star topology:

- Centralized control.
- Less Expensive.
- Easy to troubleshoot(the faulty node does not give response).
- Good fault tolerance due to centralized control on nodes.
- Easy to scale(nodes can be added or removed to the network easily).
- If a node fails, it will not affect other nodes.
- Easy to reconfigure and upgrade(configured using a central device).

Following are the disadvantages of Star topology:

- If the central device fails, the network will fail.
- The number of devices in the network is limited(due to limited input-output port in a central device).

4. Mesh Topology:



In this type of topology, a host is connected to one or multiple hosts. This topology has hosts in point-to-point connection with every other host or may also have hosts which are in point-to-point connection to few hosts only. Hosts in Mesh topology also work as relay for other hosts which do not have direct point-to-point links. Mesh technology comes into two types:

Full Mesh: All hosts have a point-to-point connection to every other host in the network. Thus for every new host n(n-1)/2 connections are required. It provides the most reliable network structure among all network topologies.

Partially Mesh: Not all hosts have point-to-point connection to every other host. Hosts connect to each other in some arbitrarily fashion. This topology exists where we need to provide reliability to some hosts out of all.

Following are the advantages of Mesh topology:

- Dedicated links facilitate direct communication.
- No congestion or traffic problems on the channels.
- Good Fault tolerance due to the dedicated path for each node.
- Very fast communication. If a node fails, other alternatives are present in the network.
-

Following are the disadvantages of Mesh topology:

- Very high cabling required.
- Cost inefficient to implement.
- Complex to implement and takes large space to install the network.
- Installation and maintenance are very difficult.

Conclusion:

In conclusion, network topology plays a crucial role in the design and functionality of computer networks. It determines how devices are connected and how data flows within the network. Different network topologies offer varying levels of performance, scalability, and fault tolerance, allowing network administrators to choose the most suitable option for their specific requirements.

The star topology provides a centralized hub through which all devices are connected, offering simplicity in installation and ease of troubleshooting. However, it can be a single point of failure if the central hub fails.

On the other hand, the bus topology allows for easy scalability and is cost-effective for smaller networks. However, the failure of a single node can disrupt the entire network.

The ring topology offers improved fault tolerance by creating a closed loop where data travels in one direction. It provides redundancy and ensures that if one node fails, the network remains operational. However, troubleshooting and adding or removing nodes can be more complex.

Mesh topologies provide the highest level of fault tolerance and redundancy. Each device is interconnected with multiple paths, ensuring alternative routes in case of failures. This architecture is commonly used in large-scale networks, but it can be expensive and complex to implement.

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Dinesh Devidas Bachhav

SY-Computer

NEW GENERATION HOTSPOT

Next-Generation Hotspot

In today's interconnected world, access to fast and reliable internet connectivity has become a necessity. As technology continues to advance at a rapid pace, a new generation of hotspots is emerging to meet the growing demands of users. These cutting-edge hotspots aim to revolutionize the way we connect and interact with the digital realm. The new generation hotspot, known as "Hyper Connect," represents a leap forward in the realm of wireless connectivity. Building upon the foundation of traditional hotspots, Hyper Connect combines the latest advancements in networking technologies to deliver unparalleled performance, enhanced user experiences, and seamless connectivity. With a focus on speed, capacity, and reliability, Hyper Connect leverages state-of-the-art wireless standards, such as Wi-Fi 6 (802.11ax), to provide blazing-fast internet access.

By harnessing the power of advanced wireless technologies, users can enjoy lightningquick download and upload speeds, ensuring smooth streaming, lag-free online gaming, and seamless browsing. Moreover, Hyper Connect is designed to handle the everincreasing number of connected devices that are prevalent

in today's world. Whether in busy public spaces, bustling cafes, or enterprise environments, HyperConnect's robust infrastructure can support a high density of simultaneous users without compromising on performance. This means that users can stay connected and enjoy a consistently fast and reliable internet experience, even in crowded environments.

In addition to its technical capabilities, HyperConnect also prioritizes user convenience and security. With seamless roaming functionality, users can effortlessly transition between access points without experiencing disruptions or dropped connections. Advanced authentication mechanisms and secure captive portals ensure that users' data and privacy are protected, providing peace of mind in an increasingly interconnected world. HyperConnect represents the next frontier in hotspot technology, bringing us closer to a world of ubiquitous connectivity and enhanced digital

experiences. With its exceptional performance, increased capacity, and unwavering reliability, HyperConnect sets the stage for a new era of wireless connectivity, where fast and seamless internet access becomes an everyday reality for users across the globe.

While there have not been major advancements in the concept of hotspots in recent years, there have been improvements in the underlying technologies and standards that enable hotspot connectivity. Some of these advancements include:

1. Wi-Fi Standards: The introduction of newer Wi-Fi standards, such as Wi-Fi 6 (802.11ax), has brought significant improvements in terms of speed, capacity, and efficiency. Wi-Fi 6 is designed to handle multiple devices simultaneously and offer faster data transfer rates, making it suitable for crowded hotspot environments.

2. Seamless Roaming: Seamless roaming allows users to move between different access points within a hotspot without experiencing a dropped connection. This technology ensures a smooth transition when a device switches from one access point to another, providing uninterrupted connectivity.
3. Captive Portals and Authentication: Captive portals are web pages that require users to authenticate or agree to certain terms and conditions before accessing the internet through a hotspot. Advancements in captive portal technology have made the authentication process more user-friendly and secure, offering various options such as social media login, SMS authentication, or self-registration.
4. Mobile Hotspots: Mobile hotspots are portable devices that create a Wi-Fi network using cellular data connections. They allow users to access the internet on their devices while on the go, using cellular networks as the primary source of connectivity. Some mobile hotspots also support features like high-speed LTE or 5G connectivity and multiple device sharing.

CONCLUSION

New generation hotspots offer faster speeds, broader coverage, and enhanced capabilities compared to previous iterations. They leverage

advanced wireless standards, such as 5G and Wi-Fi 6, to provide ultrafast internet access and support multiple devices simultaneously.

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Hemant Bhimrao Patil

TY-Computer

SMART SHELVES

Since the visual and sensory experience that the shoppers will get through the physical stores cannot be replicated in ecommerce space with even the most sophisticated technology ,retailers are exploring ways to optimize the in-store experience by enabling innovative technologies like Smart Shelves in retail.

why Smart Shelves invented?

> Smart shelves, which are also known as “intelligent shelves”, are electronically connected shelves which are designed to automatically keep track of inventory in any retail establishment.
>
> smart shelves technology enables automated tracking of stock availability and informs retail stores if the items are running low or if they have been misplaced from the original place.

Technology use in Smart Shelves

Smart shelves use RFID technology (e.g., RFID tags, RFID readers and antennas) to automatically track inventory in retail stores. Smart Shelves use weight sensors that are installed within shelves or underneath them. The sensors are used to track the amount of inventory sitting on the shelves.

how it Works

Smart Shelves allow retailers and manufacturers use real-time inventory data to optimize stock availability. Retailers can focus on providing customer-centric retail space to enhance customers in-store shopping experience. Manufacturers get closer to customers by gaining more visibility, thus enabling branding.

The store shelves are equipped with weight sensors, proximity sensors, 3D cameras, microphones, RFID tags, NFC, electronic printed tags, LED sensors, optical sensors, IOT sensors, etc., to monitor the shelf stock. When the customer picks an item from the shelf, product levels get low, Smart Shelves send a refill notification to employees/ store keepers on their connected mobile device. The stock is replenished by the store keepers.

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Durgesh Shantaram Mahajan
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ADVANCED ANRP & FRS SOLUTION

IDEA:

The proposed solution uses ML & Deep Learning algorithm i.e. Haar Cascade Classifier to identify and track number plate and facial feature, while utilizing MIRNet model and Canny edge for image correction and edge detection as well as implementing a mechanism to generate legitimate report containing particulars about vehicle and person driving it.

APPROACH TO OUR SOLUTION:

- Our approach preprocesses number plate from CCTV footage, by providing inputs to Haar Cascade algorithm for further conversion of RGB to grayscale, contour and masking and then applying OCR to extract text.
- The retrieved picture will go through image correction, which includes blurring of image to make it clear using Robinson-Lucy, improving the low-light quality with MRINet, and removing noise using a Gaussian filter.
- The final rendered image comprising of number plate and face will be coordinated and matched with the database generating full fledge report including metrics like owner details, registration date, regional credentials and specifics of person driving it.

USE CASES:

- Customer Service
- Defence and Law Enforcement
- Traffic Management
- Logistics and Transportation
- Parking and Event Management
- Public Safety & Security

EXPLICIT FEATURES OF OUR PROJECT:

- The system can detect and match faces and number plates moving in realtime, with a high degree of accuracy.
- The primary flaw in the existing ANPR & FRS system is the identification of many automobiles. We can recognize numerous automobiles using our technique.
- The fastest and efficient “Haar Cascade” algorithm is used for recognizing number plates that are written in typical non-standard ways using varying font styles, sizes, designs, symbols, languages etc.
- When compared to existing algorithms like Histogram of Oriented Gradients (HOG) + Linear SVM, the aforementioned algorithm provides more reliability by using a sliding window approach.
- Low-maintenance, cost-effective, and optimized programme

PROJECT DEPENDECIES:

- CCTV must generate high quality feed
- Every vehicle should have number plate
- To rely on database for identification
- Defend against unauthorized access and data breaches

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DARK WEB CRAWLER

Abstract: The Dark Web, a secret section of the internet that is inaccessible to normal users, has long been a source of fascination and mystery. This article digs into the realm of Dark Web crawlers, providing information on their functionality, ethical issues, and future uses. We look at the technological components of Dark Web crawling, the difficulties that researchers encounter, and the tools and tactics used to navigate this hidden terrain. In addition, we explore the legal and ethical implications of Dark Web crawling, emphasizing the delicate line between research and illegal activity.

Overview: A dark web crawler is a specialized software or tool designed to navigate and explore the dark web, a hidden part of the internet that is not indexed by conventional search engines. Dark web crawlers play a crucial role in mapping and indexing the content available on the dark web, providing researchers, law enforcement agencies, and cybersecurity professionals with valuable insights into this obscure digital landscape.

fig 1- Internet Layer

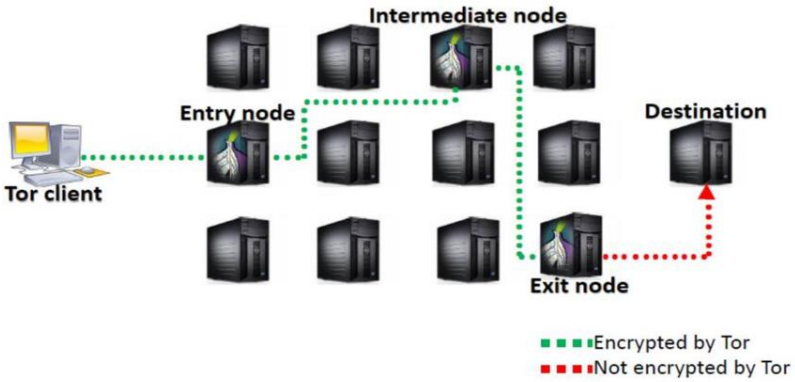
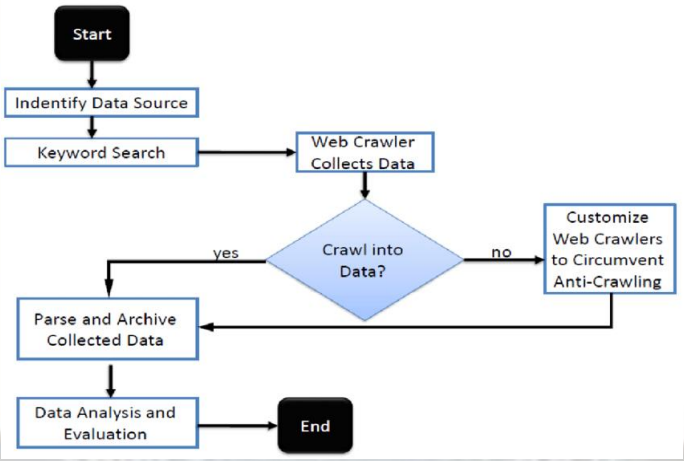


Fig: Components of TOR network.



Common Tools and Techniques:

1. Tor Network: Dark web crawlers utilize the Tor network to access hidden websites anonymously. Tor enables traffic routing through a series of relays, making it challenging to trace the origin and destination of the requests.
2. Crawling Frameworks and Libraries: Several frameworks and libraries have been developed specifically for dark web crawling. These frameworks provide functionalities such as website discovery, link extraction, content extraction, and data storage.
3. Crawling Strategies: Dark web crawlers employ various strategies to discover and crawl hidden websites. These strategies include random crawling, focused crawling based on specific topics or keywords, and seed-based crawling using known websites as starting points.
4. Data Extraction and Analysis: Crawlers extract and analyze data from dark web websites to understand their content, structure, and

relationships. Techniques such as natural language processing, entity recognition, and sentiment analysis may be used to extract meaningful information from unstructured dark web data.

5. Visualization and Interpretation: Visualizing and interpreting the crawled data helps researchers and investigators gain insights into the hidden ecosystem of the dark web. Visualization techniques such as network graphs, heatmaps, and timelines can reveal connections, patterns, and trends within the dark web.

Applications Of Dark Web Crawler:

1. Cybersecurity and Threat intelligence.
2. Law Enforcement and Investigation
3. Academic Research and Societal Studies
4. Counteracting illegal activity.
5. Dark Web Mapping and Indexing.
6. Monitoring Data Leaks and Breaches.

Conclusion:

In conclusion, web crawlers are an essential tool for organizing and indexing the vast amount of information on the internet. They play a crucial role in the discovery and ranking of web pages, and are used by search engines to help users find the information they are looking for. Web crawlers also have the ability to track changes to websites over time, and are important in the field of dark web monitoring.

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