A Course Based Project Report on

IPV4 AND IPV6 ADDRESSING AND SUBNET CALCULATOR TOOL

Submitted to the

Department of CSE-(CyS, DS) and AI&DS

in partial fulfilment of the requirements for the completion of course

Computer Networks and Ethical Hacking Laboratory (22PC1CY201)

BACHELOR OF TECHNOLOGY

IN

CSE-DATA SCIENCE

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CERTIFICATE

This is to certify that the project report entitled "**IPV4 and IPV6 Addressing and Subnet Calculator Tool**" is a bonafide work done under our supervision and is being submitted by **Miss. Divya (24075A6711) ,Miss Tulsi Prasanna (23071A67A0),Miss R. Akhila (24075A6712), Miss U. Vyshnavi (24075A6714), Mr. Jayaraj (24075A6713), Mr. Pradeep (23071A6799)** in partial fulfillment for the award of the degree of **Bachelor of Technology** in **CSE-Data Science**, of the VNRVJIET, Hyderabad during the academic year 2025-2026.

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DECLARATION

We declare that the course based project work entitled "**IPV4 AND IPV6 ADDRESSING AND SUBNET CALCULATOR TOOL**" submitted in the Department of **CSE-(CyS, DS) and AI&DS**, Vallurupalli Nageswara Rao Vignana Jyothi Institute of Engineering and Technology, Hyderabad, in partial fulfillment of the requirement for the award of the degree of **Bachelor of Technology in CSE-Data Science** is a bonafide record of our own work carried out under the supervision of **Mrs. G.Usharani, Assistant Professor, Department of CSE-(CyS, DS) and AI&DS, VNRVJIET.** Also, we declare that the matter embodied in this thesis has not been submitted by us in full or in any part thereof for the award of any degree/diploma of any other institution or university previously.

Place: Hyderabad.

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We take immense pleasure to express our deep sense of gratitude to our beloved Guide, Mrs **G.Usharani**, Assistant Professor in CSE-(CyS, DS) and AI&DS, VNR Vignana Jyothi Institute of Engineering & Technology, Hyderabad, for his/her valuable suggestions and rare insights, for constant source of encouragement and inspiration throughout my project work.

We express our thanks to all those who contributed for the successful completion of our project work.

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ABSTRACT

In modern networking, efficient IP address management is a fundamental requirement for designing and maintaining reliable communication systems. With the exponential growth of devices connected to the Internet, understanding and implementing IP addressing has become a crucial skill for network engineers and learners. This project, titled **"IPv4 and IPv6 Addressing and Subnet Calculator Tool,"** focuses on developing a comprehensive software tool that simplifies the complex task of subnet calculation for both IPv4 and IPv6 addressing schemes.

The tool allows users to input an IP address and subnet mask (or prefix length) and automatically calculates essential network parameters such as network ID, broadcast address, subnet mask, wildcard mask, range of valid host addresses, and the total number of possible hosts. For IPv6, the tool computes the network prefix, compressed and expanded forms of the address, and the subnet boundaries. By automating these calculations, the tool eliminates human error and enhances accuracy in network planning and configuration.

Additionally, the project provides a user-friendly interface and clear visual representation of subnet divisions, making it particularly useful for students, network administrators, and professionals in the field of computer networks. The integration of both IPv4 and IPv6 functionalities ensures adaptability for current and future networking standards. Ultimately, this project contributes to improved understanding of subnetting concepts and supports efficient, error-free network design and address allocation in real-world applications.

CHAPTER-1

INTRODUCTION

In today's digital era, computer networks play a vital role in connecting millions of devices across the world. Every device connected to a network requires a unique address to identify and communicate with others, which is achieved through the Internet Protocol (IP). The two main versions of IP currently in use are **IPv4 (Internet Protocol version 4)** and **IPv6 (Internet Protocol version 6)**. IPv4, a 32-bit addressing scheme, has been the backbone of the Internet for decades. However, due to the rapid expansion of the Internet and the exhaustion of IPv4 addresses, IPv6 — a 128-bit addressing system — was introduced to overcome this limitation and provide a vastly larger address space.

Subnetting, an important concept in IP networking, involves dividing a large network into smaller, more manageable subnetworks. It helps in efficient IP address utilization, enhances security, and reduces network congestion. However, manual subnet calculations can be time-consuming and prone to human errors, especially when dealing with complex network topologies or IPv6 addresses.

The **IPv4 and IPv6 Addressing and Subnet Calculator Tool** has been developed to address this challenge by providing an automated solution for subnet calculations. The tool enables users to enter an IP address and subnet mask (or prefix length) and instantly obtain detailed results such as the network ID, broadcast address, subnet mask, valid host range, and the number of available hosts. For IPv6, it also displays the expanded and compressed forms of addresses and identifies subnet boundaries.

This project not only simplifies the subnetting process but also serves as an educational aid for students and network professionals to better understand IP addressing and subnetting concepts. It aims to improve accuracy, efficiency, and comprehension in the field of computer networking.

CHAPTER-2

METHODOLOGY

The development of the **IPv4 and IPv6 Addressing and Subnet Calculator Tool** follows a structured methodology aimed at creating a functional, efficient, and user-friendly web-based application. The project is implemented primarily using **JavaScript** along with built-in browser libraries and standard web technologies such as **HTML** and **CSS** for the interface design. The tool operates completely on the client side, requiring no external dependencies or server connections.

1. Requirement Analysis

The first step involved understanding the core concepts of IPv4 and IPv6 addressing and identifying the parameters required for subnet calculation, including network ID, broadcast address, host range, subnet mask, prefix length, and total hosts. For IPv6, the requirements included address compression, expansion, and prefix identification.

2. Design Phase

A simple and interactive web interface was designed using HTML and CSS to allow users to input an IP address and subnet mask or prefix length. The layout was designed to display all calculated results clearly and neatly, ensuring easy readability for both students and professionals.

3. Implementation

The backend logic was developed using **pure JavaScript**. Built-in functions such as string manipulation, bitwise operations, and array methods were used to parse and validate IP addresses.

- For **IPv4**, conversion between binary and decimal representations was implemented to calculate network and broadcast addresses.

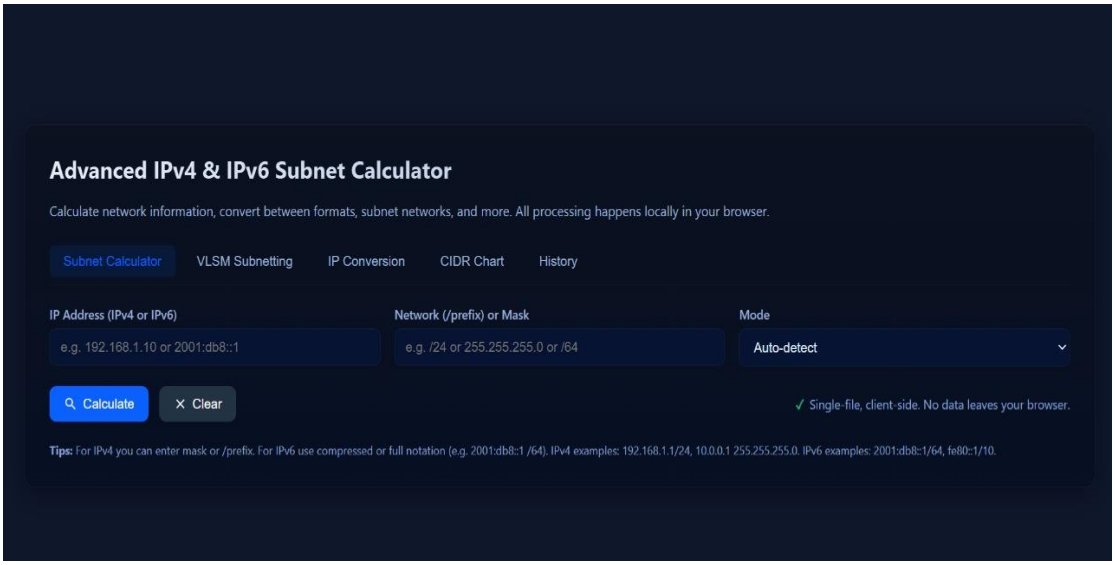
- For **IPv6**, JavaScript functions handled hexadecimal conversions and compression rules according to IPv6 standards.

4. Testing and Validation

Extensive testing was performed with various IP address ranges and prefix values to ensure accuracy and correctness. Edge cases such as invalid inputs and out-of-range subnet masks were also handled using validation techniques.

5. Output and User Interaction

The final tool displays calculated subnet details dynamically on the webpage, allowing users to quickly view and understand network parameters without manual calculations.



CHAPTER-3

CODING

```
<!DOCTYPE html>
<html lang="en">
<head>
  <meta charset="UTF-8">
  <meta name="viewport" content="width=device-width, initial-scale=1.0">
  <title>Advanced IPv4 & IPv6 Subnet Calculator</title>
  <style>
    :root {
      --bg-primary: #0f172a;
      --bg-secondary: #0b1220;
      --bg-tertiary: #071024;
      --bg-card: #05102a;
      --text-primary: #e6eef8;
      --text-secondary: #9fb0d8;
      --text-muted: #8aa1d6;
      --accent-primary: #0b61ff;
      --accent-secondary: #223344;
      --border-color: rgba(255, 255, 255, 0.06);
      --success-color: #10b981;
      --error-color: #ef4444;
      --warning-color: #f59e0b;
      font-family: Inter, system-ui, Segoe UI, Roboto, Arial;
      margin: 0;
    }

    body {
      background: var(--bg-primary);
      color: var(--text-primary);
      display: flex;
      align-items: center;
      justify-content: center;
      min-height: 100vh;
      padding: 24px;
      margin: 0;
    }

    .card {
      max-width: 1200px;
```

```
    width: 100%;
    background: linear-gradient(180deg, var(--bg-secondary), var(--bg-tertiary));
    border-radius: 12px;
    padding: 28px;
    box-shadow: 0 6px 30px rgba(2, 6, 23, 0.6);
    border: 1px solid var(--border-color);
}

h1 {
    font-size: 24px;
    margin: 0 0 16px;
    background: linear-gradient(90deg, #e6eef8, #9fb0d8);
    -webkit-background-clip: text;
    -webkit-text-fill-color: transparent;
    background-clip: text;
}

.description {
    color: var(--text-secondary);
    font-size: 14px;
    margin-bottom: 24px;
    line-height: 1.5;
}

.tabs {
    display: flex;
    gap: 8px;
    margin-bottom: 20px;
    border-bottom: 1px solid var(--border-color);
    padding-bottom: 8px;
}

.tab {
    padding: 8px 16px;
    background: transparent;
    border: none;
    color: var(--text-secondary);
    cursor: pointer;
    border-radius: 6px;
    font-size: 14px;
    transition: all 0.2s ease;
}
.tab.active {
    background: rgba(11, 97, 255, 0.1);
```

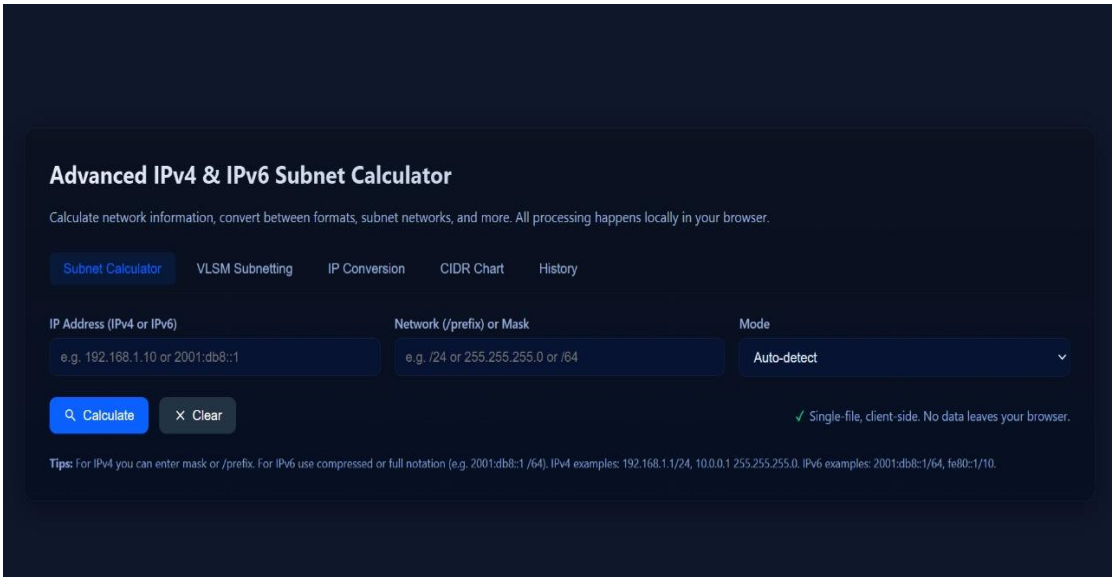
```
    color: var(--accent-primary);
}

.tab-content {
    display: none;
}
button.secondary {
    background: var(--accent-secondary);
}

button.secondary:hover {
    background: #2a4455;
}

.status-message {
    margin-left: auto;
    font-size: 13px;
    color: var(--text-muted);
    display: flex;
    align-items: center;
    gap: 6px;
}

.status-message::before {
    content: "✓";
    color: var(--success-color);
    font-weight: bold;
}

pre {
    background: var(--bg-card);
    padding: 16px;
    border-radius: 8px;
    overflow: auto;
    font-size: 13px;
    border: 1px solid var(--border-color);
    margin-top: 8px;
}

.output-grid {
    display: grid;
    grid-template-columns: repeat(auto-fit, minmax(220px, 1fr));
    gap: 16px;
```

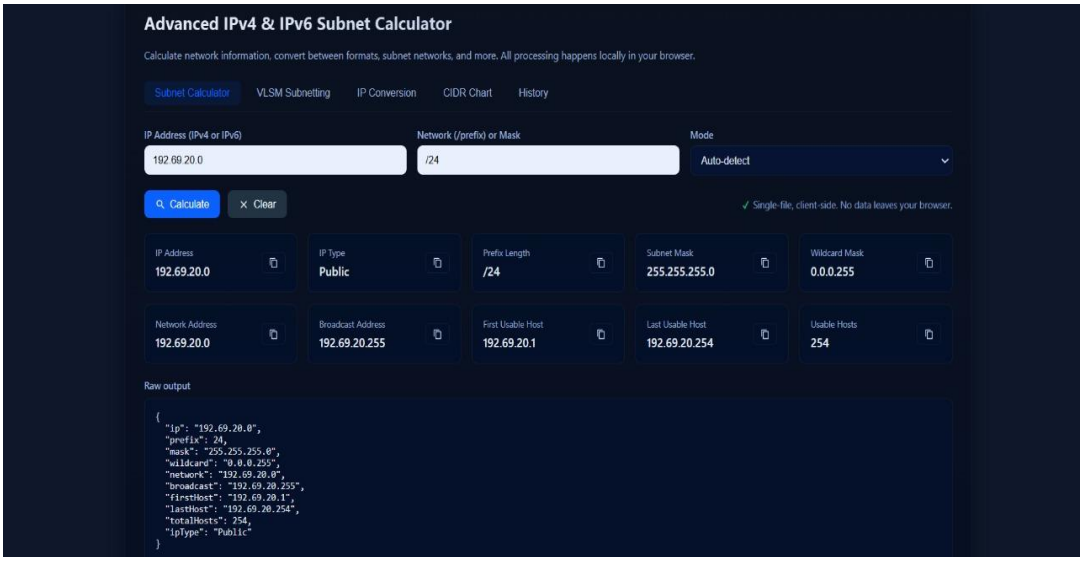
```
        margin-top: 20px;
    }

    .card-mini {
        background: linear-gradient(180deg, #031126, #04102a);
        padding: 16px;
        border-radius: 8px;
        border: 1px solid var(--border-color);
        transition: all 0.2s ease;
    }
.card-mini:hover {
        transform: translateY(-2px);
        box-shadow: 0 4px 12px rgba(0, 0, 0, 0.2);
    }

    .small {
        font-size: 12px;
        color: var(--text-secondary);
    }

    .muted {
        color: var(--text-muted);
    }

    .copy {
        margin-left: 8px;
        padding: 6px 10px;
        background: transparent;
        border: 1px solid var(--border-color);
        border-radius: 6px;
        color: #cfe1ff;
        font-size: 12px;
        transition: all 0.2s ease;
    }

    .copy:hover {
        background: rgba(255, 255, 255, 0.05);
    }

    .copy.copied {
        background: var(--success-color);
        border-color: var(--success-color);
    }
```

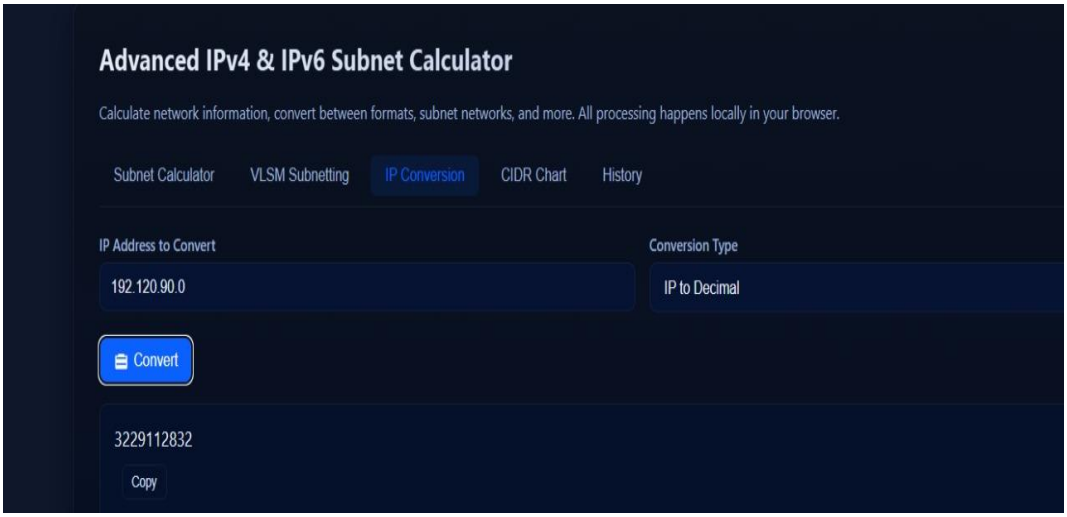
```
footer {
    margin-top: 20px;
    font-size: 12px;
    color: var(--text-muted);
    line-height: 1.5;
}

.error-message {
    color: var(--error-color);
    font-size: 13px;
    margin-top: 6px;
    display: flex;
    align-items: center;
    gap: 6px;
}

.error-message::before {
    content: "⚠";
}

.loading {
    opacity: 0.7;
    pointer-events: none;
}

.fade-in {
    animation: fadeIn 0.3s ease;
}

@keyframes fadeIn {
    from { opacity: 0; transform: translateY(10px); }
    to { opacity: 1; transform: translateY(0); }
}

.subnet-list {
    margin-top: 16px;
    max-height: 300px;
    overflow-y: auto;
    border: 1px solid var(--border-color);
    border-radius: 8px;
}
```

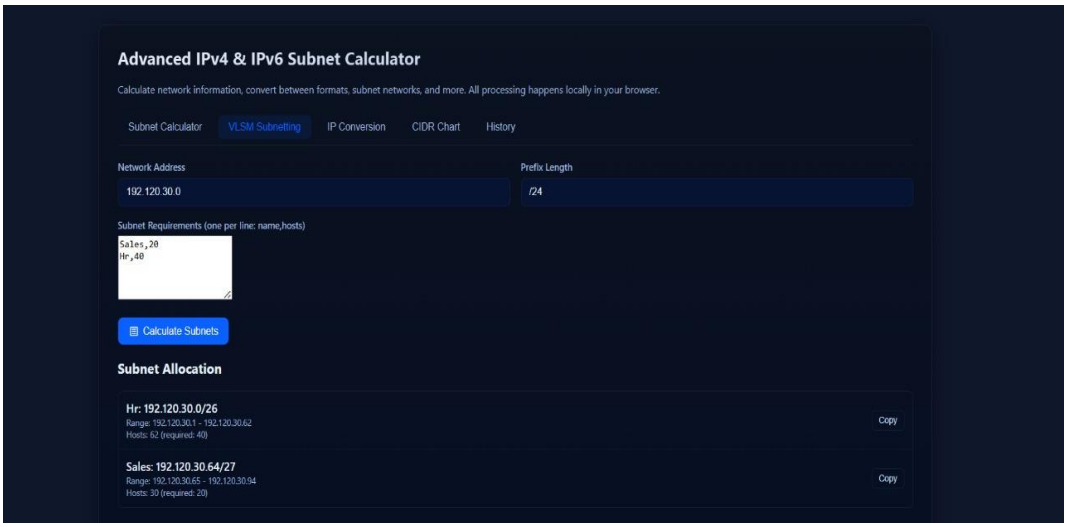
CHAPTER-4

RESULTS






Advanced IPv4 & IPv6 Subnet Calculator
Calculate network information, convert between formats, subnet networks, and more. All processing happens locally in your browser.
Subnet Calculator
VLSM Subnetting
IP Conversion
CIDR Chart
History
IP Address to Convert
192.120.90.0
Conversion Type
IP to Decimal
Convert
3229112832
Copy


Advanced IPv4 & IPv6 Subnet Calculator
Calculate network information, convert between formats, subnet networks, and more. All processing happens locally in your browser.
Subnet Calculator
VLSM Subnetting
IP Conversion
CIDR Chart
History
Network Address
192.120.30.0
Prefix Length
/24
Subnet Requirements (one per line: name,hosts)
Sales,20
Hr,40
Calculate Subnets
Subnet Allocation
Hr: 192.120.30.0/26
Range: 192.120.30.1 - 192.120.30.62
Hosts: 62 (required: 40)
Copy
Sales: 192.120.30.64/27
Range: 192.120.30.65 - 192.120.30.94
Hosts: 30 (required: 20)
Copy

CHAPTER 5

CONCLUSION

The **IPv4 and IPv6 Addressing and Subnet Calculator Tool** successfully demonstrates the practical application of networking concepts through an interactive and automated approach. The project simplifies one of the most complex tasks in computer networking — subnetting — by enabling users to quickly and accurately calculate network parameters such as network ID, broadcast address, host range, and total hosts for both IPv4 and IPv6 addressing schemes.

By using **JavaScript** and its built-in functionalities, the tool operates efficiently within any modern web browser without requiring additional software installations. It provides a lightweight, responsive, and user-friendly interface that makes subnet calculation intuitive and educational. The integration of IPv6 support also makes the project relevant to modern networking standards, ensuring its usefulness for current and future applications.

This project not only enhances accuracy in network design but also serves as a valuable learning aid for students and professionals who wish to deepen their understanding of IP addressing and subnetting. The testing and validation phase confirmed that the tool performs consistently across various input scenarios, including edge cases and invalid inputs.

In conclusion, the project achieves its primary objectives of simplifying subnetting, minimizing human error, and promoting a clearer understanding of network structure and address allocation. Future enhancements could include adding features such as Variable Length Subnet Masking (VLSM), visual network diagrams, and integration with networking simulation tools to further improve its functionality and educational value.

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