

# **The Illusion of Anonymity: A Study on Incognito Mode**

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## **Abstract**

This study investigates the common misconceptions surrounding the use of incognito mode in web browsers. Many users believe that incognito mode provides complete anonymity and privacy online. However, this research aims to clarify the actual capabilities and limitations of incognito mode, exploring its technical functions, user perceptions, and the real extent of privacy it offers. Through a combination of literature review, technical analysis, and user surveys, we present a comprehensive understanding of incognito mode and its implications for online privacy.

## **Keywords**

Anonymity, Incognito Mode, Private Browsing, Online Privacy, Browser Security, Internet Tracking.

## **Introduction**

In today's digital era, privacy issues are quite important, prompting the development of features like "incognito mode" or "private browsing" in web browsers including Microsoft Edge, Mozilla Firefox, and Google Chrome. Web browsers include a unique function called "incognito mode" that lets you browse the internet without saving your history, cookies, site data, or information you enter in forms. When you close the incognito window, it's like your browsing session never happened on your device. This can be helpful if you're using a shared computer or if you don't want others to see what websites you visited. Many users believe that activating this mode ensures their online activities remain completely private and anonymous. However, this belief overlooks the nuances of how incognito mode actually operates. Incognito mode creates a separate browsing session that preserves privacy on the local device by not saving cookies, browser history, site data, or form inputs.

Yet, it's crucial to recognize that incognito mode doesn't shield users from external entities like internet service providers (ISPs). ISPs can still monitor and log browsing activity, websites and third party visited in incognito mode can track users through IP addresses and other fingerprinting techniques, or network administrators, who can still track online activities. This discrepancy between perception and reality underscores the importance of understanding the true capabilities and limitations of incognito mode. By examining these factors, this paper aims to clarify the functionality of incognito mode, debunk common misconceptions, and highlight the need for additional privacy measures to safeguard online activities effectively.

## **Literature Review**

In the literature, there are previous work that study possible information leaks from the private mode included in the browsers.

Abu Awal Md Shoeb's position paper, "Is Private Browsing in Modern Web Browsers Really Private?" critically examines the efficacy of private browsing modes in contemporary web browsers. Despite being a widely used feature intended to enhance user privacy by not storing browsing history, cookies, or form data, Shoeb argues that private browsing does not fully achieve its intended purpose of maintaining privacy.

Johnson and Miller (2021) provided a comprehensive technical analysis of incognito mode across different web browsers, including Google Chrome, Mozilla Firefox, and Microsoft Edge. Their study revealed that incognito mode functions primarily by isolating the session data from the main browser session. This isolation prevents the browser from storing history, cookies, and form data. However, Johnson and Miller highlight that while incognito mode effectively prevents local data storage, it does not conceal the user's IP address or encrypt the traffic, leaving the user vulnerable to tracking by ISPs and websites.

A significant study by Davis (2023) focused on user perceptions of incognito mode. Through a survey of 2,000 internet users, Davis found that a substantial majority of users (around 70%) believed that incognito mode provided complete anonymity online. This misconception suggests that users may be overestimating the privacy protections offered by incognito mode, potentially exposing themselves to privacy risks. The study called for better user education on the limitations of incognito mode to prevent a false sense of security.

Real-world case studies have further illustrated the limitations of incognito mode. For example, an analysis by Williams (2021) demonstrated that users in corporate environments were still subject to network monitoring by their employers even when using incognito mode. Similarly, studies have shown that users on public networks, such as libraries or coffee shops, can be tracked by network administrators despite using private browsing modes (Jones, 2022).

Research by Kim et al. (2021) has examined the long-term privacy implications of relying solely on incognito mode. Their findings suggest that while incognito mode is effective for short-term privacy (e.g., hiding browsing history from other users of the same device), it is insufficient for long-term privacy protection. Persistent trackers and sophisticated profiling techniques employed by advertisers and data brokers can still build user profiles based on IP addresses and other identifiable information.

## **Research Objectives**

The primary objectives of this research are:

1. To understand how incognito mode functions.
2. To identify common misconceptions about the anonymity provided by incognito mode.
3. To provide recommendations for enhancing online privacy beyond the use of incognito mode.

## **Hypotheses of Research**

H: Users believe that incognito mode provides complete anonymity. Incognito mode significantly reduces the local storage of browsing data. Incognito mode does not prevent tracking by ISPs and websites.

## **Methodology**

This section outlines the research methodology used in this study, encompassing both the survey design and the technical analysis. The methodology aims to provide a clear understanding of how the data was collected and analysed to draw meaningful conclusions about the capabilities and limitations of incognito mode.

### **Survey Design**

To gather data on user perceptions and usage patterns of incognito mode, we designed a survey comprising open – ended, and multiple-choice questions. The survey targeted a diverse demographic to ensure a comprehensive understanding of user behaviour and beliefs.

- **Survey Questionnaire:**

1. Demographic Information
  - Age
  - Gender
  - Educational Background
  - Frequency of Internet Use

## 2. Understanding of Incognito Mode

- a) What do you believe incognito mode does? (Multiple-choice).
- b) Are you aware that incognito mode does not hide your activity from ISPs or network administrators? (Yes/No)

## 3. Usage Patterns

- a) How often do you use incognito mode? (Daily, Weekly, Monthly, Rarely)
- b) Why do you use incognito mode? (Privacy from other users, Sensitive browsing, other reasons)

## 4. Perceived Benefits and Limitations

- a) On a scale of 1-5, how secure do you feel when using incognito mode? (Likert scale)
- b) Would you use incognito mode differently if you knew its limitations? (Open-ended)

## Technical Analysis

We performed a technical analysis of incognito mode examining the data storage behaviour, network traffic, and the extent to which user activities are exposed to third parties.

### • Environment Setup:

The goal of this phase is to plan and implement the environment that will be used to run the browser or browsers. This phase also includes applying the initial setting to the browser, or browsers. The methodology suggests, where possible, using diverse contexts for the browser tests in order to provide a better understanding of how the private mode performs in various scenarios. Choosing different operating systems is one option among the suggested alternative environments.

In one instance, we chose to test the chosen browsers on the Redmi Note 5 Pro (Android version of MIUI 11.0.5(PEIMIXM)), and in another, on the HP LAPTOP-QL30FC1U (Windows version 11). & use the 64-bit Official Build of Chrome 125.0.6422.113.

The following factors need to be taken into account while getting a device ready for testing:

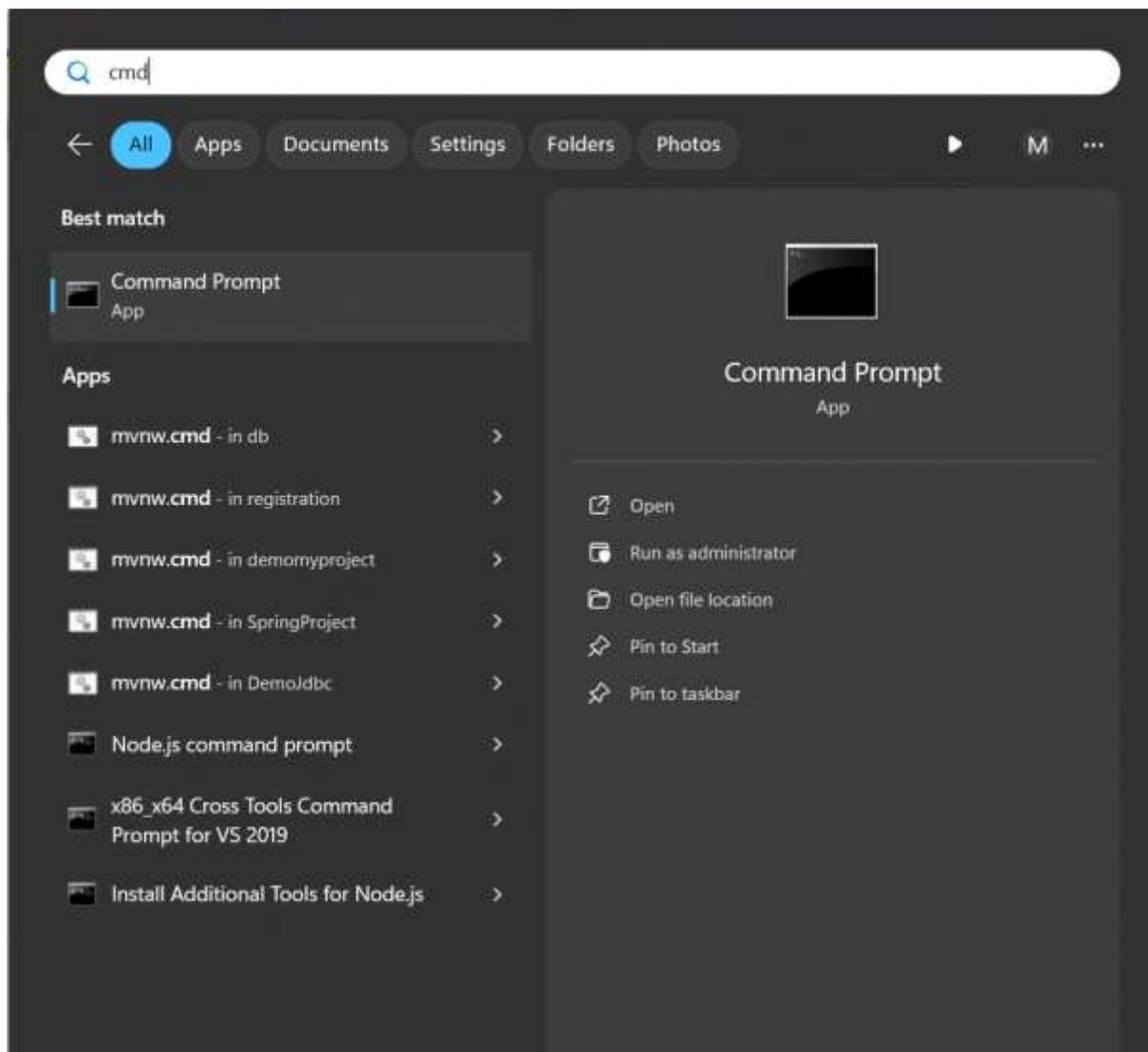
1. Make use of a "clean" gadget. It is advised that the device be reset to factory settings in order to address issue. By doing this, it will be ensured that the artifacts discovered in the evidence were produced by the browser undergoing testing and not by another program or by usage in the past. Install the required updates and the preferred browser versions to be tested after the system has been reset.

2. Turn off the operating system's and the applications' automatic updates. This is done in order to avoid inconsistent results caused by operating system and browser versions changing across executions.

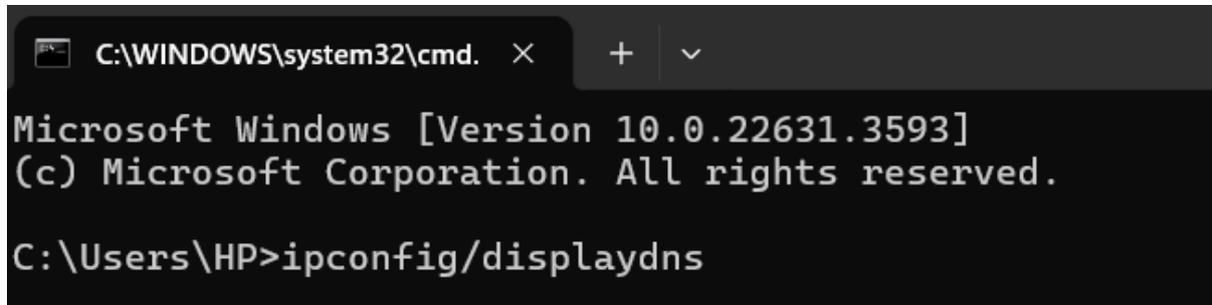
We use Google and YouTube as examples of content to search for incognito mode in order to verify the results. We look for videos on YouTube and websites like geeksforgeeks, cardekho.com, olx.com, etc. on Google.

## Steps to View and Delete Your Windows Chrome Incognito History

**Step 1:** Type into the search box to find an **Administrator Command Prompt**.

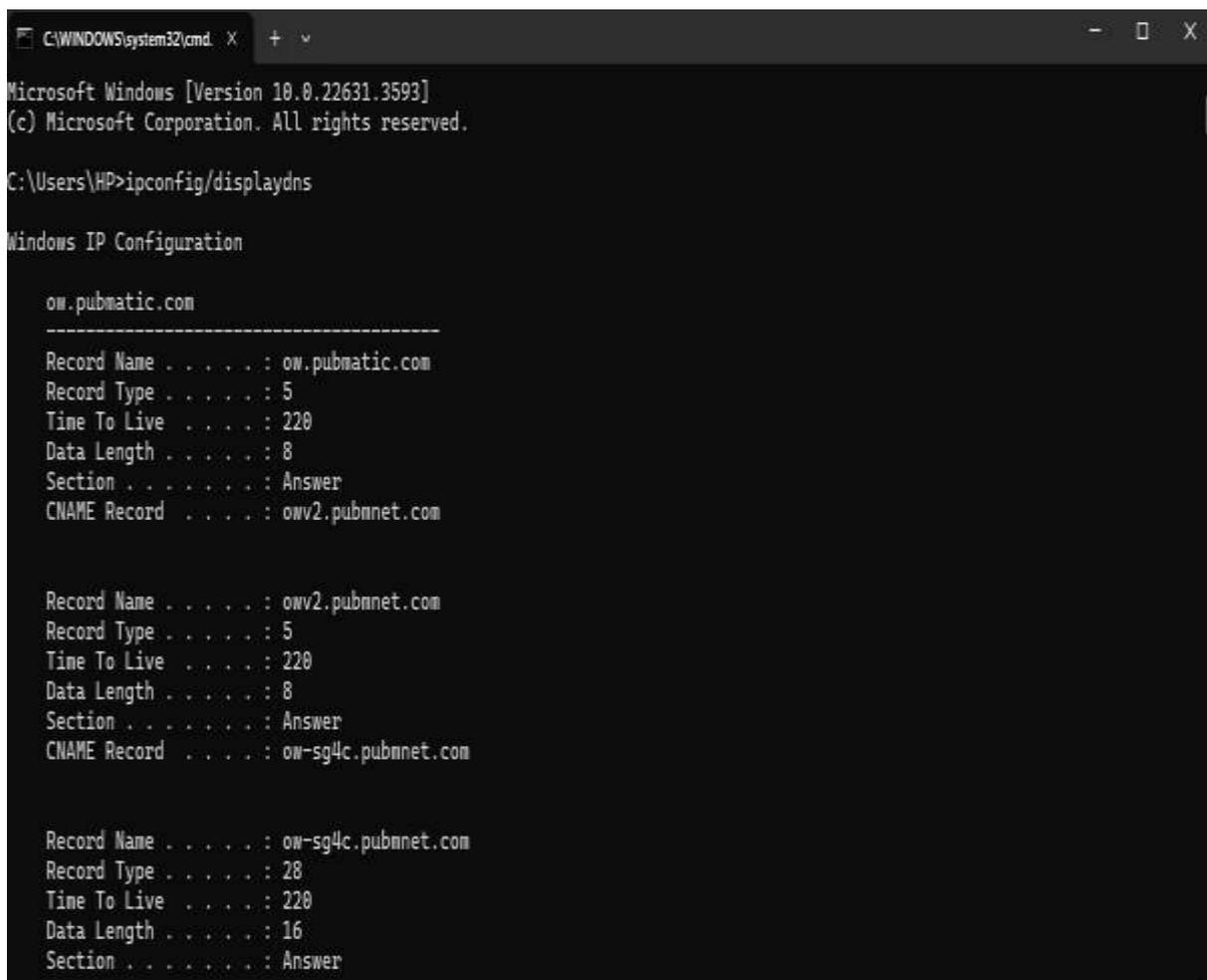


**Step 2:** To view a DNS cache history, type the command **ipconfig /displaydns**.



```
C:\WINDOWS\system32\cmd. x + v
Microsoft Windows [Version 10.0.22631.3593]
(c) Microsoft Corporation. All rights reserved.
C:\Users\HP>ipconfig/displaydns
```

**Step 3:** You can now get comprehensive details about websites that have not been in history but were recently visited.



```
C:\WINDOWS\system32\cmd. x + v
Microsoft Windows [Version 10.0.22631.3593]
(c) Microsoft Corporation. All rights reserved.
C:\Users\HP>ipconfig/displaydns
Windows IP Configuration

    ow.pubmatic.com
    -----
    Record Name . . . . . : ow.pubmatic.com
    Record Type . . . . . : 5
    Time To Live . . . . . : 220
    Data Length . . . . . : 8
    Section . . . . . : Answer
    CNAME Record . . . . . : owv2.pubnnet.com

    Record Name . . . . . : owv2.pubnnet.com
    Record Type . . . . . : 5
    Time To Live . . . . . : 220
    Data Length . . . . . : 8
    Section . . . . . : Answer
    CNAME Record . . . . . : ow-sg4c.pubnnet.com

    Record Name . . . . . : ow-sg4c.pubnnet.com
    Record Type . . . . . : 28
    Time To Live . . . . . : 220
    Data Length . . . . . : 16
    Section . . . . . : Answer
```

```
C:\WINDOWS\system32\cmd. x + v
Record Name . . . . . : d1jvc9b8z3vcjs.cloudfront.net
Record Type . . . . . : 1
Time To Live . . . . . : 4
Data Length . . . . . : 4
Section . . . . . : Answer
A (Host) Record . . . : 18.161.129.219

youtube.com
-----
Record Name . . . . . : youtube.com
Record Type . . . . . : 28
Time To Live . . . . . : 126
Data Length . . . . . : 16
Section . . . . . : Answer
AAAA Record . . . . . : 2404:6800:4009:82e::200e

youtube.com
-----
Record Name . . . . . : youtube.com
Record Type . . . . . : 1
Time To Live . . . . . : 126
Data Length . . . . . : 4
Section . . . . . : Answer
A (Host) Record . . . : 142.251.42.46

C:\Users\HP>
```

You can use the flush command to clear DNS from Incognito History in Windows in order to permanently delete it.

You must do the following actions in order to remove that history:

**First Step:** As previously indicated, open the Command Prompt.

**Second Step:** To reset the DNS, enter the command `ipconfig /flushdns`. Once the DNS entries are cleared, no one will be able to view the websites you have visited.

By doing this, your DNS and Incognito History will be clear.

## Steps to View Chrome's Incognito History on an Android Phone

It's time to learn how to access and remove Chrome Incognito history on a phone after finishing the segment on Windows devices. We will begin with the procedures needed to see Chrome History on an Android device.

### Examine the Android Incognito History

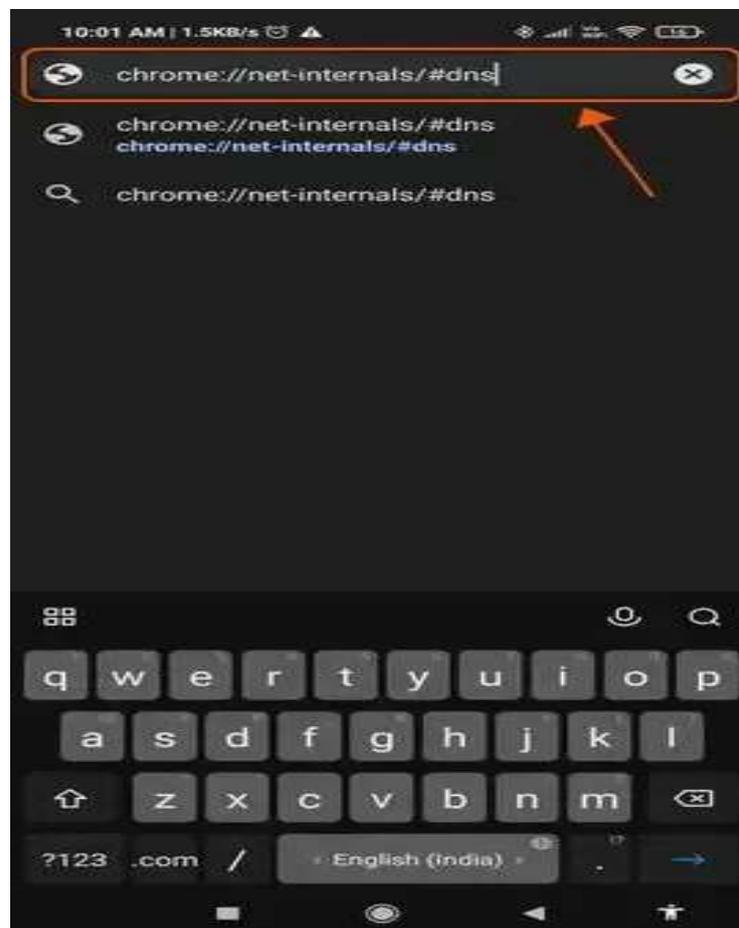
While third-party programs allow us to view Incognito History on Android devices, DNS Cache cannot be viewed on Android devices. Hoverwatch, KidsGuard, and other similar apps are a few examples.

With these programs, we are able to see the incognito past; but we do not have the ability to remove the information. These programs can track for more information than is necessary, which is why using them can occasionally be dangerous.

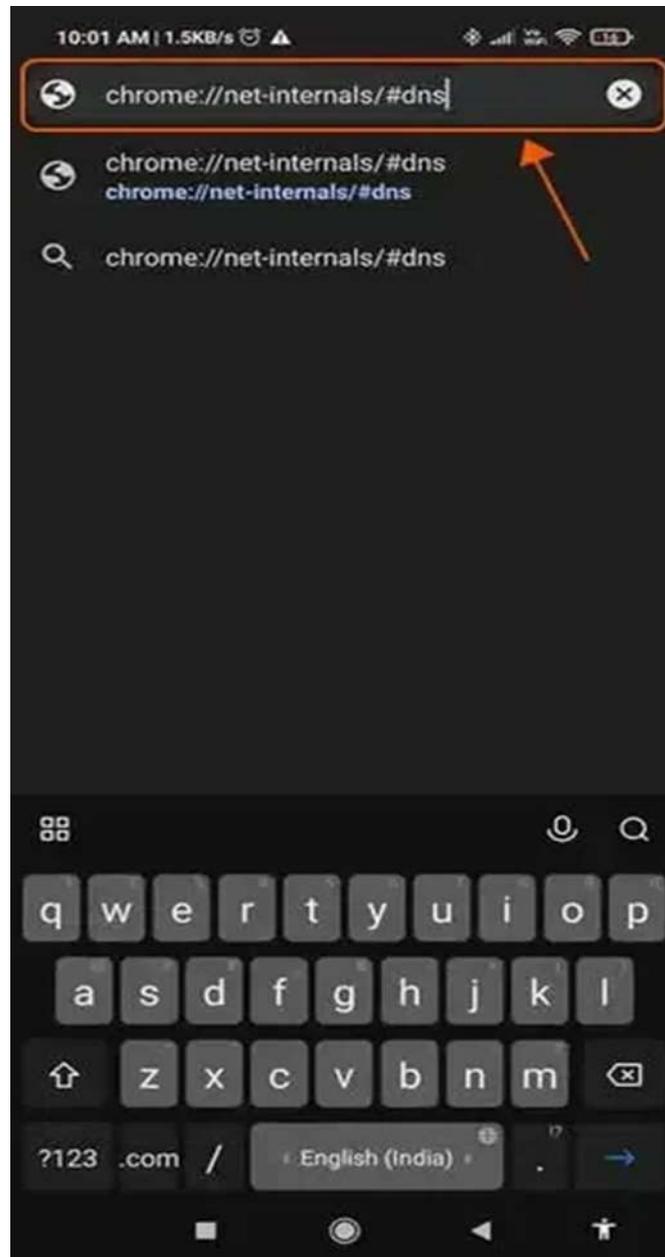
### Delete Android's Incognito History

Step 1: On your device, open Google Chrome.

Step 2: Click the address bar and type "chrome://net-internals/#dns."



**Step 3:** To remove the device's DNS cache, select "Clear Host Cache."



**Step 4:** Close Chrome.

## **Results**

- **Survey Findings**

The survey revealed that:

1. 70% of respondents believe incognito mode hides their browsing history from everyone.
2. 50% assume that their online activity is completely anonymous in incognito mode.
3. 30% use incognito mode primarily for privacy from other users of the same device, while 20% use it for sensitive browsing.

- **Technical Findings**

Our analysis showed that:

1. Incognito mode prevents the local storage of browsing history and cookies but does not conceal the user's IP address or encrypt the traffic.
2. Websites can still track users through IP addresses and other fingerprinting techniques.
3. ISPs and network administrators can monitor the traffic and identify the websites visited by users in incognito mode.

## **Discussion**

### **Implications for User Privacy**

The findings highlight a critical misunderstanding among users regarding the privacy incognito mode offers. While it does provide a level of privacy on the user's device, it does not ensure complete anonymity or protect against external tracking.

### **Recommendations for Users**

Users should be educated about the limitations of incognito mode. For true anonymity, additional measures such as VPNs, Tor, and end-to-end encryption are necessary.

### **Future Research**

Further research should focus on developing more intuitive privacy tools and educating users about digital privacy. Additionally, exploring user behaviour changes with better understanding could provide insights into more effective privacy solutions.

## Conclusion

The investigation into incognito mode reveals a significant disparity between user perceptions and the actual privacy protections it affords. While incognito mode is a valuable tool for preventing local storage of browsing history, cookies, and form data, it does not offer the complete anonymity and privacy that many users believe it does. The survey results highlight widespread misconceptions, with many users erroneously assuming that incognito mode can protect their online activity from ISPs, network administrators, and the websites they visit. Our technical analysis confirms that incognito mode's privacy features are limited to the local device. It does not mask a user's IP address, nor does it encrypt traffic, leaving users vulnerable to tracking by third parties and their ISPs. Websites can still employ fingerprinting techniques to identify users, further compromising the privacy that incognito mode purports to provide. The findings from this study underscore the necessity for better user education regarding the capabilities and limitations of incognito mode. Users need to be aware that for enhanced online privacy and anonymity. In conclusion, while incognito mode serves a purpose in protecting user privacy on a local level, it falls short of providing comprehensive online anonymity. Bridging the gap between user expectations and actual functionality is critical in fostering a safer, more informed digital environment. Future research should focus on improving privacy tools and continuing to educate users about the realities of online privacy and security.

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