

# How important is it to understand the science behind coding and what are the various technological integrations and privacy implications of using an application like Snapchat?

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## ABSTRACT

In the 21st century, technology is a big part of our lives as most of the things we do or use today, from furniture to cars are either being designed using software or even machinery (robots) that use software which is made by coding. This paper aims to establish how coding is the basis via which we communicate with computers making it very vital in a world that is facing constant technological advancements. There is also mention of the complexity of coding as it has many different languages like Swift, Objective-C and JavaScript and can be costly and time consuming. The second half of this paper looks at the increasing reliance on online communication and social media apps, especially among the younger generation. Snapchat is such an app which allows its users to chat, call, video call and send each other self-destructing videos and photos. Snapchat was created by Evan Spiegel in 2011 and since then it has become very popular. It has almost more than 300 million Daily users today. But using such apps can also be dangerous as any application bearing on data communication technology has a few privacy implications. Though Snapchat uses end-to-end encryption for its chat, it can be very dangerous if the personal data of its users is viewed by someone who doesn't have the authority to view the same. This paper discusses few threats for Snapchat such as SQLi or DDoS attacks. Some key takeaways of how one can protect their account from data breaches is also mentioned towards the end of this paper.

## I. INTRODUCTION

Coding, also known as computer programming, is a way to communicate with computers. A computer does not understand our

language, a code tells a computer what actions to take. Writing a code is like creating a list of instructions. By learning how to code, one can tell computers what to do or how to behave in a much faster way. These skills can also be used to create websites and apps, process data, and do lots of other things. (Grasshopper, 2021)

Why is coding important? Without coding, computers would literally be able to do nothing. They would be completely useless. That's because source code is the set of instructions that tells the computers what to do. Computers don't have their free will, without us giving them explicit instructions, they're nothing but a box of metal. Think of anything you have ever done with a computer: Searched something on Google, written a word document, watched a movie on Netflix, Bought something from Amazon. All those applications are software written in code. In today's time, it would be harder to think of things we use that don't rely on software in one form or another (Forbes, 2018).

Online communication was always a big part of our lives with the pandemic highlighting the importance of such platforms even further. Many apps like Snapchat, WhatsApp and Instagram made it easier to communicate with friends and family during a time that everyone was locked away in their houses. Snapchat is a mobile app for Android and IOS devices, headed by Evan Spiegel. One of Snapchat's main and most popular features, out of the several, is that when any picture or video or message is sent, by default, it is made available to the receiver for only a short amount of time before it becomes inaccessible. This temporary nature of the app was originally designed to encourage a more natural flow of interaction (Tillman, 2021). In Snapchat, when the user clicks a photo or records a

video it is referred to as a snap. This snap can then be sent to a particular person in a private chat or posted to the user's story for all their friends to see. While clicking a picture or video, Snapchat also gives users the option of adding filters to their media such as a normal black and white filter or a filter that contains stars in it. When these photos are saved on Snapchat, they are saved as 'memories'. All in all, each feature that Snapchat offers entails some level of technological integration and coding.

But what about privacy? Are these memories safe and private? On the app, memories can only be viewed by the user. However, they are stored on Snapchat's servers. So, if Snapchat were to experience a hack, these photos and videos could be exposed. Additionally, Snapchat uses end-to-end encryption on photos and videos shared between its users. However, text messages and other messages sent on the app are not protected by the same encryption. Snapchat doesn't disclose much information about that. So, it can be truly difficult to understand what happens to our messages once they reach Snapchat's servers. (Choose To Encrypt, 2020)

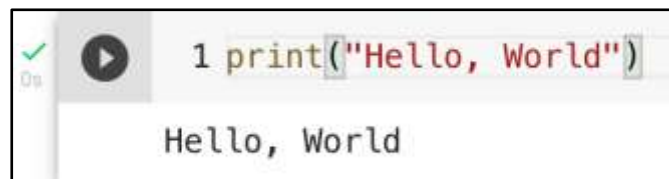
On the basis of the above, this research paper aims to answer the research question: **How important is it to understand the science behind coding and what are the various technological**

### **integrations and privacy implications of using an application like Snapchat?**

The main aim of this research paper is to explain and highlight the importance of coding in the world of tech while analysing a complex application like Snapchat and the technological integrations behind its features as well as the privacy implications of using it.

### **What is coding and why is it important?**

So, as highlighted in the introduction above, coding in the simplest of terms is telling a computer what you want it to do, it includes step-by-step commands for the computer to follow. Computers are not clever things; however, they are very obedient. They will do exactly as you want them to, as long as you tell them how to do it correctly. Learning to code has been similar to learning a foreign language, or perhaps more specifically a family of foreign languages (Spaces, 2020). A code is made up of many statements and commands that, with some knowledge of coding, can be read and understood easily. For example, one easy example of a beginner's code is the simple command "print('Hello, World!')". Even without any knowledge of coding, it is understandable that the intention behind this code is that the coder wants to display the phrase "Hello, World!" (Johnson, 2021).



A nuance is that this command's destination also needs to be further specified - will it be printed on a screen, or a printer, for example. Coding is the simple command extrapolated to encompass creating complex programs, often with hundreds of thousands of lines in code, with the proper syntax to make the code understandable to the computer and run error-free (Johnson, 2021).

There are many different coding languages, each one designed with certain things in mind. Language is just a medium to convey your logic, they can vary in their syntax or philosophy, but the concepts involved will be quite similar. In total there are about 700 programming languages! One of the first languages created for a computer was Plankalkül developed by Konrad Zuse for the Z3 between 1943 and 1945. But aren't they all the same? In a sense, yes. People can create a website using Java, JavaScript, Python, Ruby, C++, Go or

Rust. The fact is that all these languages solve the same purpose of turning human thoughts into the language computers understand. But as we talk about it in-depth, programming languages are tools, and we choose different tools for different jobs. A few common languages used for making websites are HTML, people use HTML as it makes up the layout and structure for websites. Java is one of the most popular programming languages of all time. It is used for developing website content, Android apps, games and software. Over 15 billion devices are using Java in some form or other. Python is known to be one of the easiest languages to work with, it can create a framework for basically any website as it uses simple and straightforward syntax, making it easy for web developers to work with. Its main uses are machine learning and AI. It is also the fastest-growing programming language in the world. Its high-level, interpreted, and object-

oriented architecture makes it ideal for all types of software solutions. Some big companies such as Instagram and Pinterest use Python to build their website (Moyers, n.d.). Uber, Goldman Sachs, PayPal, Netflix and Google also use Python for their apps or websites. Swift is a language that helps develop apps on iOS (for Apple products). Android apps can also be created with languages such as Java, Python, C and C++. C and C++ are both very low-level programming languages, offering blazing fast performance, which is why they were and are still being used to develop operating systems, file systems, and other system-level applications. While C was released in the 70s by Dennis Ritchie, C++, an extension to C with classes and many other additions, such as object-oriented features, was released later by Bjarne Stroustrup in the mid-80s. Even after 50 years, both languages are being used to create some of the fastest applications of all time (Costa, 2021).

Now, why is coding important? I live in a comfortable household in New Delhi, India, and within our family, there are 4 smartphones (small touch screen computers with apps made by software), 3 laptops (software in application and operating system), 2 gaming consoles (games and control system, all software), and 4 smart TVs (again built with software). Even if you do not reside in a household of all modern electronics, if you live in the developed world then you will have items in your household, from furniture to cars that will have either been designed using software or constructed by machinery (or even robotics) that use software which is made by coding. It is not necessarily important for everyone to learn how to code, not everyone will want to do it. There are some professions where writing code is not necessary, but it makes the job easier, and there are some professions where writing software at some level is important. Coding literacy can help in other ways too. It can mean that you are quicker to learn other aspects of tech and that you are more digitally fluent. Coding also helps a person boost their skills of logic and problem solving and it also builds up confidence. It is also very helpful in automating tasks that can take up a lot of time, for example, gathering and reading data.

In fact, in recent years, there has been an increased focus on getting children to learn coding

from relatively early ages. This connects significantly to the many advantages there are to learning to code. Through coding, children can learn that there's often more than one way to solve a problem, and the simpler and more efficient solutions are often better. It also encourages children to become creators, not just consumers of the technology they use. While learning to code at the primary school level, children are encouraged to think strategically to solve problems- often puzzles like getting an onscreen character to move around a maze. For even younger children, visual blocks are used to represent programming concepts and terminology, such as 'procedures', 'loops' (meaning a sequence of instructions that are repeated until a certain condition is reached.), and 'conditional instructions' (meaning it controls whether or not the code will execute an instruction) (Learning Potential, 2020).

That being said, alongside the benefits there are also a lot of challenges faced by the people who start learning how to code. A few major challenges are that people want to learn to code fast. When people try to learn fast and finish every task or assignment as quickly as possible, they tend to miss out on the basic concepts that are hard to digest. While learning to program, learning well instead of learning fast will help a lot more in the process of becoming a coder or a programmer (Liew, 2021). Another problem faced by new learners and even experienced coders is understanding the syntax of the language. Syntax problems occur when we write the code wrong. The accounts for parenthesis as in () or semicolons that are out of place, a rogue opening bracket that doesn't have a match or a missing closing one. As we start learning a new language to code in, we run into all sorts of new syntax. For someone learning their 10th language, they know what they want to do, the only thing left to do is nail down the syntax (Bromander, 2019). Syntax errors often pop up even for long-time developers. One more challenge faced while coding is keeping up with the technology, frameworks, tools, libraries that become outdated pretty quickly. For example, front-end frameworks usually last for a year or two before new, updated versions come along (Shahzeb, 2017).

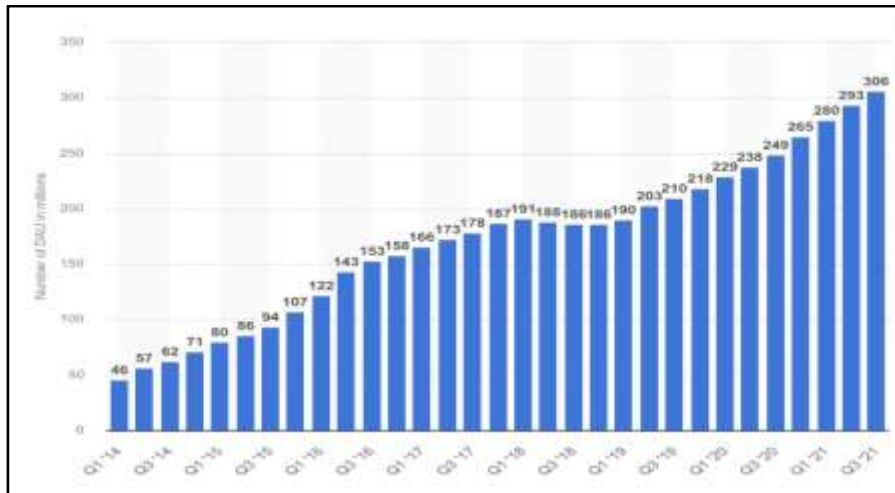


### An introduction to Snapchat and how they use coding

Snapchat is a mobile networking application and as already mentioned in the introduction, it was founded by Evan Spiegel, Bobby Murphy, Reggie Brown (all former students of Stanford University) on 8th July 2011. Reggie Brown brought the idea for a disappearing pictures app to Evan because he had prior business experience. Brown and Evan then pulled in Bobby Murphy, who had experience in coding. The three worked together closely for several months and launched Snapchat as "Picaboo" on the iOS operating system on July 8 2011 (Gallagher, 2013). Reggie Brown was ousted after the first couple of months and then the application was relaunched as Snapchat in September 2011 (Masunaga, 2017). The app is best known for letting the users send photos, videos and chats to each other that

disappear after some time.

Since its conception, the app's popularity has grown quickly, and it is now one of the most buzzed-about social networks. In 2016, Snapchat rebranded as Snap Inc. and revealed a new product, spectacles-fashion-forward sunglasses with built-in video cameras that allow the wearer to record and post directly to the Snapchat app. They went on to achieve a very successful IPO in March 2017 (Hootsuite Academy, n.d.). As of July 2021, Snapchat had 293 million daily active users, and in the third quarter of 2021, Snapchat had a total of 306 million daily active users worldwide, and a 23% growth over a year. In 2021, Snapchat is valued at \$90.9 billion. On average more than four billion Snaps are sent each day. Snapchat is popular among the younger generation, particularly those below the age of 16, leading to many privacy concerns for parents (Lee, 2021).



(Statista, 2021)

With regards to features, Snapchat has many interesting ones.

Firstly, Snapchat is an application that offers a platform for users to communicate through chat messages, voice and video calls. Chat allows users to send messages when they cannot talk and/or get creative with sending chats over snaps. All these Chats disappear after opening, but what if a user wants to save that message or voice note or

even a photo? In that case, snap allows users to save the chat just by tapping on it, they also have a feature that automatically saves the chat for 24 hours and then disappears. However, if a person tries to take a screenshot of the chat or an image in the chat or tries to screen record anything, Snapchat gives an alert to the sender. Personal messages also



allow users to send and receive money from each other, this feature is called Snapcash and the payment system is powered by Square. Snapscore is a feature that combines the number of snaps you've sent and received, the stories you've posted and other factors.

We already know that we can save our photos and videos in our Memories but in 2016, Snapchat introduced a feature that allows users to save their photos and videos in a password-protected area called "My eyes only" where people

can only view the content after putting in the personal identification number (PIN). You can also add your stories and you can even combine stories to form a bigger story to add in the "My Eyes Only".

Another feature that users tend to love is the friend emojis that are emojis that appear next to a friend's name on the chat. These emojis have different meanings, as seen in the table below, and can be customisable.

Emoji	Name	Snapchat meaning
	Super BFF	Appears next to the user's number 1 Best Friend when they are also their number 1 Best Friend for two months in a row.
	BFF	(Best Friend Forever) Appears next to the user's number 1 Best Friend when they are also their number 1 Best Friend for two weeks in a row.
	Besties	Appears next to the user's number 1 Best Friend when they are also their number 1 Best Friend.
	BFs	Appears next to one of the user's Best Friends.
	Mutual Besties	Appears next to someone when the user's number 1 Best Friend is also their number 1 Best Friend.
	Mutual BFs	Appears next to someone whom the user shares a best friend with.
	Snapstreak	Appears next to the number of days that the user and a friend have Snapped each other. If the user and their friend do not both send a Snap within 24 hours, they will lose their Snapstreak. <sup>[99]</sup>
	Group Chat	Appears next to all of the user's group chats.
	Hourglass	Appears next to someone's name if the user's Snapstreak is going to end soon.
	Birthday Cake	Appears next to someone when it is their birthday.

(Snapchat, n.d.)

Another very interesting feature of Snap is that every user has their own unique snap QR code, which can be scanned only by the Snapchat camera which doubles as a QR code scanner to add another user as your friend in the app (KOKALITCHEVA, 2016). The 3D Bitmoji is another integrated feature that is essentially a character that can be personalised based on the options available and the customization one chooses. It allows users to make the Bitmoji look whatever way they want, most commonly mimicking themselves. It can be personalised with skin colour, hairstyle, eye colour, over 1200 new body poses, facial expressions, gestures, background and different types of clothing (Khare, 2021).

Now my favourite feature about the app, the Snap Map. This map allows us to view snaps submitted to Snap Map from all across the world including sporting events, celebrations, breaking news, and more. Users can also share their locations with each other if they would wish to. The map feature is highly interactive and shows users where their friends are, how nearby they might be as well as if someone is travelling

somewhere in a car or flight! However, in a bid to maintain privacy, your friends can only see your Bitmoji if you decide to share your location, else you can turn on ghost mode which hides your location from everyone on the Snap Map (Snapchat, n.d.).

Furthermore, Snapchat's World Lenses are a collection of augmented reality (AR) 3D enhancements to live real-world environments as viewed through Snapchats mobile app, which allows users to send and receive 'self-destructing' photos and videos. The lenses feature includes different face filters like cute, cartoon-like 3D emojis on the user's screen. Word bubbles, text, objects, and characters are added on the screen sieved through the rear-facing camera (TechTarget, 2017). For example, one of Snapchat's famous features is the dog filter which adds a dog's ears and nose to the users face and whenever they open their mouth, the filter adds a dog's tongue with sound effects too. There are more filters like face-swapping filters and many more beauty filters. Another cool feature is that users can create their own filter with different texts, images and

characters. For example, to boost sales, Taco Bell launched the taco filter on Snapchat, and it cost them \$75,000 to keep the filter on Snapchat for 24 hours. This filter turned your face into a taco with

eyes and a mouth. Users adored it, and it got over 224 million views. It was a good investment from Taco Bell for the exposure it got (McCoy, 2020).

field1	field2	field3
Feature	Time needed	Cost
Self-destructing messaging	30-40 hours	\$1,500 - 2,000
Registration	Up to 125 hours	Up to \$6,250
Push notifications	40 hours	\$2,000
Adding friends (recognition algorithms and QR code recognition algorithms development)	From 2 hours (depending on complexity)	From \$100
Geolocation	32 hours	\$1,600
Uploading pictures and videos	76-320 hours	\$3,800 - 16,000
Video and photo customizing	68 hours	\$3,400
Audio and video calls	180-220 hours	\$9,000 - 11,000

(Alina A., 2021)

Summarizing everything in the table above, we can say that the approximate cost to make an app like Snapchat for one mobile platform will be around \$70,000 (Alina A., 2021)

As seen above, Snapchat makes use of many different technologies to ensure its app meets the requirements of the consumers in an effective and interactive manner. However, all of this is facilitated only through a strongly coded foundation. So, how does Snapchat code its app? The amount of time and hard work it takes to build an app like Snapchat is a lot. The time taken to code the application and its admin panel, coding all the features, adding all the technologies and designing the app would have taken well over 500-600 hours. Snapchat uses various types of coding languages such as Python, Objective-C and Swift for iOS, Ruby, Android-SDK, JavaScript, Coca Touch, and PHP. Snapchat also uses technology from the area of Computer Vision called image processing. It processes an image, and with the help of algorithms, adds layers with so-called masks (Alina A., 2021).

**What are the privacy implications of using Snapchat?**

Anything bearing on data communication

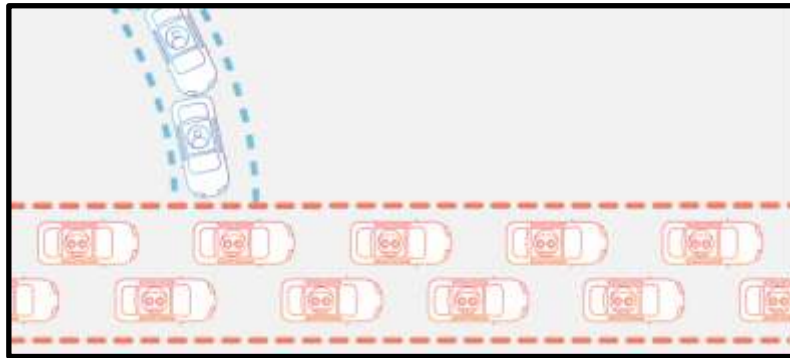
technology has a few privacy implications. In the case of an app like Snapchat, given its scope, reach and user base, it could be very dangerous if the data of the customers, may it be their actual memories or even their private data is accessed by someone who does not have authority to be viewing the same. When a person signs up for Snapchat, they're consenting to share their data with the company itself, however, as soon as this information is in the hands of another party, then privacy is simply breached. Privacy is described in a lot of ways but the most suitable definition for this would be that presented by Tavani which says: privacy is fundamentally about protection from intrusion and information gathering by others".

There can be a lot of privacy threats to Snapchat because of the manner in which their application is developed. Firstly, SQL is a standard language for accessing and manipulating databases. SQL stands for Structured Query Language. It can retrieve data from a database, insert, update or delete records, and also create a new database (W3schools.com, n.d.). SQLi or SQL injection is a web security vulnerability that allows an attacker to interfere with the queries that an application makes to its database. It allows an attacker to view data that they are not normally able to retrieve (PortSwigger, n.d.). In the case of Snapchat,

such data comprises the personal details, such as users Email Id, date of birth, phone numbers etc., that a person enters while signing up on the application. The main threat is the ability of the hacker to either modify or even delete this data.

Secondly, a distributed denial-of-service (DDoS) attack is a malicious attempt to disrupt the

normal traffic of a targeted server, service or network by overwhelming the target or its surrounding infrastructure with a flood of internet traffic. A DDoS attack is like an unexpected traffic jam clogging up the highway, preventing regular traffic from arriving at its destination (Cloudflare, n.d.).



(Cloudflare, n.d)

This can once again be harmful to Snapchat users and have many privacy breach implications.

Despite the app's promise, the images and messages do not necessarily disappear forever. According to a complaint, a number of developers built applications that users could download to save pictures, videos and messages without user knowledge. 10 of these apps are available on the Google Play store. Recipients of the Snapchat messages could also use their devices' screenshot capabilities to capture an image of snap while it appeared on their screens, the FTC said. Snapchat claimed that if this happened, it would notify the sender immediately — but that wasn't true, any recipient with an Apple device with an operating system predating iOS 7 could save a screenshot without alerting the sender. Snapchat's privacy policy also claims that the app collects emails, phone numbers, and Facebook IDs to find friends for users to connect with. However, if an iOS user enters the phone number of another iOS user to find friends, Snapchat collects the names and phone numbers of all the contacts in their mobile device address books without notice or consent (Burnham, 2014). According to a report by Barbara Ortutay, a few hackers collected and published a database listing the usernames and phone numbers of approximately 4.6 million Snapchat users on a website called [Snapchatdb.info](http://Snapchatdb.info). The website has since been suspended. Snapchat was even warned a week prior to the attack by security experts. The group that published the warnings released two exploits on December 25 for two issues that

Snapchat failed to address even after they were initially alerted in August 2013 (MailGuard, n.d.).

Some tips on how one can protect their Snapchat account from data breaches are: changing passwords regularly and not reusing them. Reviewing the privacy settings and ensuring that content being shared on 'My story' is only with friends and not any random users. Carefully accepting friend requests. Avoid the use of third-party applications as these sources are usually less secure and users tend to learn this the hard way. For example, in a massive photo leak that occurred in 2014 more than 90,000 Snapchat photos were uploaded to a third-party website called [SnapSaved.com](http://SnapSaved.com). Many of these photos included explicit content and it's clear that the people involved did not intend for them to spread across the internet (pctechguide, n.d.).

## II. CONCLUSION

As we move further into a technology-driven world, it is increasingly important to understand the way in which we develop the technology we rely on. The main aim of this paper was to explain and highlight the importance of coding in the world of tech by understanding the fundamentals through exploring the science behind it. In addition to this, as consumers are using social media applications now more than ever, it is important to analyse apps like Snapchat and the technological integration behind their features as well as the privacy implications.

When looking at coding, it forms the basis of how we communicate with the computer and get

them to do what we want them to do. Knowledge of coding has many other benefits as well such as the ability to help a person boost their skills of logic and problem solving and building up confidence. That being said, coding can be quite complex and has many different languages which may be used for different purposes with the most common being Python, Java and C++. There may also be many challenges with learning to code as well as implementing it derived mainly from time and cost.

Since being founded in 2011, Snapchat, a popular social media application, has over 300 million daily active users worldwide. There are many features of the app, a few being the self-destructing snaps and the face filters, all requiring some sort of technological integration whether it be AR or basic software programming. All in all, once again as it is a very impressive app and aims to offer as many exceptional, unique features and services to the users as feasible, it has many implications with regards to the coding which is used to develop the app. Though there is no official information from the company about the codes and the programming languages used to write them, many researchers have managed to find some of the common languages that the company makes use of like Python, JavaScript and Swift, and also have estimated the cost of developing an application like this. However, the privacy implications include changing your password regularly, being sure of who you are adding as a friend in the app and reviewing the privacy settings carefully.

On the whole, coding is here to stay and the impact of technology on individuals and societies is only going to increase. Therefore, to be a well-informed citizen of today's world, knowledge about these various factors may be deemed essential.

## REFERENCES

- [1]. Alina A., 2021. How to Create an App Like Snapchat and How Much It Costs. [online] Cleveroad Inc. - Web and App development company. Available at: <<https://www.cleveroad.com/blog/how-much-does-it-cost-to-create-an-app-like-snapchat>>.
- [2]. Bromander, S., 2019. The 3 Types of Challenges in Learning to Code. [online] Medium. Available at: <<https://medium.com/furious-growth/the-3-type-of-challenges-in-learning-to-code-bffddb76255e>>.
- [3]. Burnham, K., 2014. 5 Ways Snapchat Violated Your Privacy, Security. [online] InformationWeek. Available at: <<https://www.informationweek.com/social/5-ways-snapchat-violated-your-privacy-security>>.
- [4]. Choose To Encrypt, 2020. Is Snapchat Privacy-Friendly? [Analysis]. [online] Choose To Encrypt. Available at: <<https://choosetoencrypt.com/privacy/is-snapchat-privacy-friendly/>>.
- [5]. Cloudflare, n.d. What is a DDoS attack?. [online] cloudflare. Available at: <<https://www.cloudflare.com/en-gb/learning/ddos/what-is-a-ddos-attack/>>.
- [6]. Costa, C., 2021. Top Programming Languages and Their Uses. [online] KDnuggets. Available at: <<https://www.kdnuggets.com/2021/05/top-programming-languages.html>>.
- [7]. Forbes, 2018. Why Is Coding So Important?. [online] Forbes. Available at: <<https://www.forbes.com/sites/quora/2018/08/16/why-is-coding-so-important/?sh=1b2befc72adc>>.
- [8]. Gallagher, B., 2013. TechCrunch is part of the Yahoo family of brands. [online] Techcrunch.com. Available at: <<https://techcrunch.com/2013/07/01/new-snapchat-docs/>>.
- [9]. Grasshopper, 2021. What is Coding? [online] Grasshopper. Available at: <<https://grasshopper.app/why-coding/>>.
- [10]. Hootsuite Academy, n.d. Introduction to Snapchat. [online] Hootsuite Academy. Available at: <<https://education.hootsuite.com/pages/introduction-to-snapcat>>.
- [11]. Johnson, D., 2021. What is coding? A brief guide to the facet of computer programming. [online] Business Insider. Available at: <<https://www.businessinsider.in/tech/how-to/what-is-coding-a-brief-guide-to-the-facet-of-computer-programming/articleshow/80595330.cms>>.
- [12]. KOKALITCHEVA, K., 2016. Here's a Secret Secondary Use for Snapchat. [online] Fortune. Available at: <<https://fortune.com/2016/05/13/snapchat-qr-code-reader/>>.
- [13]. Khare, S., 2021. Snapchat Brings 3D Bitmoji to Elevate Your Digital Avatar. [online] NDTV Gadgets 360. Available at: <<https://gadgets.ndtv.com/apps/news/snapchat-3d-bitmoji-launch-user-profiles-digital-avatars-new-body-functions-personal-friendship-2490788>>.



- [14]. Learning Potential, 2020. What is coding?. [online] Learning Potential. Available at: <<https://www.learningpotential.gov.au/articles/what-is-coding>>.
- [15]. Lee, N., 2021. Engadget is part of the Yahoo family of brands. [online] Engadget.com. Available at: <<https://www.engadget.com/snapchat-earnings-210932638.html>>.
- [16]. Liew, Z., 2021. Overcoming 7 main problems of learning to code for people who don't have a developer job. [online] Zellwk.com. Available at: <<https://zellwk.com/blog/7-challenges-of-learning-code/>>.
- [17]. MailGuard, n.d. Snapchat - Security Breach Affects Millions of Users. [online] Mailguard.com.au. Available at: <<https://www.mailguard.com.au/blog/snapchat-security-breach-affects-millions-of-users/>>.
- [18]. Masunaga, S., 2017. What happened to ousted Snapchat founder Reggie Brown? No, really, we don't know. [online] Sun Sentinel. Available at: <<https://www.sun-sentinel.com/business/la-fi-live-updates-snap-ipo-what-happened-to-ousted-snapchat-1488401913-htlmstory.html>>.
- [19]. McCoy, J., 2020. 25 Surprising Facts You Didn't Know About Snapchat. [online] Search Engine Journal. Available at: <<https://www.searchenginejournal.com/snapchat-facts/335017/>>.
- [20]. Moyers, S., n.d. Common Web Design Languages, What They Do and Why You Need Them. [online] Spinxdigital.com. Available at: <<https://www.spinxdigital.com/blog/common-web-design-languages-what-they-do-and-why-you-need-them/>>.
- [21]. PortSwigger, n.d. What is SQL Injection? Tutorial & Examples [online] Portswigger.net. Available at: <<https://portswigger.net/web-security/sql-injection>>.
- [22]. Shahzeb, F., 2017. The 9 Most Common Problems New Programmers Face. [online] Simpleprogrammer.com. Available at: <<https://simpleprogrammer.com/9-common-problems-new-programmers-face/>>.
- [23]. Snapchat, n.d. Snapchat Support. [online] Support.snapchat.com. Available at: <<https://support.snapchat.com/en-US/a/friend-emojis>>.
- [24]. Spaces, 2020. What is Coding and Why is it so Important?. [online] Spaces. Available at: <<https://www.spacesworks.com/the-importance-of-coding/>>.
- [25]. Statista, 2021. Snapchat: daily active users worldwide. [online] Statista. Available at: <<https://www.statista.com/statistics/545967/snapchat-app-dau/>>.
- [26]. TechTarget, 2017. What are Snapchat World Lenses? - Definition from WhatIs.com. [online] WhatIs.com. Available at: <<https://whatis.techtarget.com/definition/Snapchat-World-Lenses>>.
- [27]. Tillman, M., 2021. What is Snapchat, how does it work, and what's the point?. [online] Pocket-lint. Available at: <<https://www.pocket-lint.com/apps/news/snapchat/131313-what-is-snapchat-how-does-it-work-and-what-is-it-used-for/>>.
- [28]. W3schools.com, n.d. SQL Introduction. [online] W3schools.com. Available at: <[https://www.w3schools.com/sql/sql\\_intro.asp](https://www.w3schools.com/sql/sql_intro.asp)>.
- [29]. ptechguide, n.d. Tips to Protect your Snapchat Account from a Data Breach [online] ptechguide.com. Available at: <<https://www.pctechguide.com/articles/tips-to-protect-your-snapchat-account-from-a-data-breach>>.