

Information technology for promoting Instagram accounts

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Abstract

This paper presents the design and implementation of an advanced information technology system to optimise the promotion of Instagram accounts. The proposed system is structured to facilitate the interaction between two primary user groups: digital marketing specialists and clients seeking promotional services. A comprehensive analysis of existing technologies and market solutions was undertaken to ensure the system's alignment with contemporary functional and business requirements. The system's architecture was meticulously designed, leveraging cutting-edge web development technologies, including React for the front-end, Node.js and Express for the back-end, and MongoDB for data management. To enhance security and user experience, industry-standard tools such as JSON Web Tokens (JWT) for authentication and bcrypt for encryption were integrated. This paper discusses the methodological approaches employed during system development, focusing on the Agile model for iterative improvement and continuous testing. The results of extensive testing demonstrate that the system satisfies all predefined performance, usability, and security criteria. The solution offers substantial advantages, including enhanced scalability, ease of use, and a seamless user experience, making it a valuable contribution to social media marketing. This work underscores the significance of user-centred design in developing digital tools that cater to evolving market demands and contribute to the broader field of information systems engineering.

Keywords

Instagram account promotion, information technology, digital marketing platform, social media optimisation, web-based system, user engagement strategies, service marketplace, front-end and back-end development

1. Introduction

In today's rapidly evolving digital environment, social media platforms have emerged as pivotal channels for communication, information dissemination, and personal branding. With its visual-centric approach and robust engagement capabilities, Instagram has become a central tool for cultivating audiences and driving business growth. Both individuals and organisations leverage Instagram to expand their reach, foster meaningful connections, and enhance their digital presence in an increasingly competitive marketplace.

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This study investigates the strategies employed to promote Instagram accounts, a burgeoning area within contemporary digital marketing. While various approaches exist, including outsourcing to specialised agencies, leveraging automated tools, or engaging freelancers, each method presents distinct challenges, such as cost, audience targeting, and quality control. Identifying a suitable agency with the requisite expertise can be arduous. Automated services often fail to attract a genuinely engaged audience, and freelance platforms necessitate manual job posting and offer evaluation. Developing a comprehensive system is imperative to address these limitations and streamline the Instagram account promotion process.

The primary objective of this research is to create a system that mitigates the challenges associated with locating qualified professionals or companies to oversee Instagram promotions. Moreover, the system seeks to facilitate the acquisition of clients for novice service providers by enabling them to advertise their offerings. Ultimately, this system aims to bridge the gap between clients seeking to enhance their Instagram presence and service providers capable of effectively executing these tasks.

The object of this research is the promotion of Instagram accounts.

The subject of this research encompasses the tools and methodologies employed in designing and developing an information system dedicated to Instagram account promotion.

The practical significance of this research resides in its potential to empower users with an effective platform for promoting their Instagram accounts while simultaneously providing service providers with a streamlined avenue for acquiring clients. This system could significantly enhance the efficiency of account promotion and client-provider interactions within the social media landscape.

2. Related works

2.1. Methodological foundations of research

The ubiquitous presence of social media platforms in contemporary society is undeniable, with a continual surge in global user engagement observed daily. Originally conceived as communication tools, these platforms have since evolved into complex ecosystems developed by both individuals and organisations. Encompassing websites and mobile applications, social networks have become indispensable conduits for widespread communication and information dissemination. Many internet users now actively engage with social media platforms, underscoring their central role in modern digital interactions [1].

Among the most prominent social media networks, Facebook, Instagram, and Twitter are particularly notable, with Instagram emerging as a standout platform. As of July 2019, Instagram reported an impressive one billion active monthly users [2], reflecting its rapid growth and widespread appeal.

Mike Krieger and Kevin Systrom, who are from San Francisco, co-founded Instagram. Initially launched as a location-based app named Burbn, it underwent a transformative shift to focus on media sharing, culminating in its rebranding as Instagram. Launched in October 2010 on the Apple Store, the platform quickly gained traction, particularly among iPhone users. In 2012, Facebook acquired Instagram for a staggering one billion US dollars [3], marking a pivotal moment in its evolution. The same year, Instagram expanded to Android users, further amplifying its user base [4].

Since its inception, Instagram has continued to evolve, introducing a wide range of innovative features that cemented its position as a dominant social media platform. Users can create personalised profiles and share various types of content, including photos, videos, Stories (ephemeral content lasting 24 hours) [5], and IGTV (long-form videos ranging from 60 seconds to one hour) [6]. In addition to content sharing, Instagram promotes user interaction through comments and direct messaging.

For businesses aiming to enhance their online presence, Instagram offers business profiles that provide detailed analytics, helping companies gain real-time insights into audience engagement.

With its vast global reach and user-friendly interface, Instagram has become an indispensable tool for businesses seeking to expand their customer base and engage with specific demographics, enabling even small businesses to compete globally.

At the same time, there is a rising trend of individuals looking to expand their brands or Instagram accounts. The goal for many is to eventually monetise their presence or receive products from companies in exchange for promotional content. As their follower base grows, these users are approached by businesses or individuals seeking to advertise their products or services. Such advertising costs are typically determined by audience size, engagement metrics (likes and comments), and the number of views on Stories. Some companies may even offer products in exchange for promotion, a practice known as bartering [7].

There are various strategies for increasing an Instagram audience. One option is to post content regularly and hope for organic growth. However, this method requires significant time and effort without guaranteeing success, as it is uncertain whether potential customers or interested users will see the posts.

To effectively increase audience size and attract clients, one must optimise one's profile and launch advertising campaigns that engage the audience. An advertising campaign is a series of actions to promote a product or service [8]. However, not all Instagram users possess the necessary skills for this, as it requires expertise in marketing, copywriting (the ability to craft engaging content that attracts potential customers [5]), and audience management. For this reason, many individuals and businesses turn to specialised agencies that can leverage their experience to boost client and follower numbers.

Freelance platforms are frequently used to find such agencies or individual professionals. Freelancing, defined as remote work for a fee [9], allows users to post jobs and receive offers from potential service providers.

While this system may seem efficient, a significant challenge remains: how can professionals and companies attract clients? It highlights the need for a platform similar to freelance marketplaces but with the added functionality for service providers to create customised packages, allowing clients to select the services that best suit their needs.

2.2. Primary methods for popularising Instagram accounts

With the rapid rise in the popularity of social media, many social media users (including Instagram) are seeking ways to increase their account visibility to attract more clients [10-12]. Several effective methods can be used to grow an audience, including mass following, mass liking, giveaways, targeting, advertising on other platforms or through influencers, and publishing high-quality content.

Mass Following involves subscribing to numerous accounts with the expectation that those users will follow back, thereby expanding the follower base. This method is often automated using specialised services that perform the actions on behalf of the user, significantly enhancing efficiency. These services typically follow accounts based on predefined criteria, such as location or competitor audience. A similar technique is **mass liking**, where likes are automatically applied to selected user posts, again based on factors like competitor audience or location.

However, it's worth noting that these strategies have become less effective due to Instagram's restrictions on such activities. For instance, if the system detects high activity levels, such as excessive likes or follows, it may block the account. Additionally, users have become accustomed to receiving follows from businesses or unknown individuals, leading to a reduction in reciprocal follows, thus diminishing the overall effectiveness of these methods.

Giveaways involve offering followers a valuable prize or personal product [13]. The account owner sets conditions for participation, such as following the account, liking a post, leaving a comment, or mentioning the account in their posts or stories. While this method still works, it has become harder to attract participants, as increasingly expensive and popular prizes are required. Furthermore, a portion of the audience often unfollows after the giveaway ends.

Targeting is another highly effective method, enabling account owners to reach a more interested audience. Introducing business accounts on Instagram allows users to access detailed analytics, such as the number of page visits and audience reach over specific periods. **Audience reach** reflects how many users interact with the account, and targeted ads can boost these interactions by displaying ads to selected audiences.

The audience for targeted ads can be defined using a wide range of criteria, such as location, interests, age, gender, occupation, or even the brand and model of a user's device. This precise targeting ensures that ads are shown to users with a genuine interest in the profile or product, making targeting one of the most effective methods available.

When **advertising on other social media platforms**, selecting the right platform is critical to driving traffic to an Instagram account. Ad placement on thematic pages in different networks can be effective. However, it often requires significant time and effort, leading many users to rely on specialists or services that manage such placements.

Another powerful strategy is **influencer advertising**, where an account with a large following promotes your profile or product. This method can be particularly successful, as followers trust influencers they admire, often perceiving endorsed products or profiles as high-quality or exciting. However, identifying the right influencer and agreeing on favourable terms can be time-consuming.

In conclusion, while users can independently work on growing their Instagram audience, understanding how each method functions—and which are worth pursuing—is essential for success. Given the time and effort involved in executing these strategies, many users opt for the assistance of specialised services or experts to streamline the process.

2.3. Primary methods for operating promotion systems

Increasingly, to save time and effort in studying and implementing methods for promoting Instagram accounts, people are turning to specialists who, for a fee, can efficiently structure the process and achieve the desired results. Currently, there are several primary methods for organising promotion systems. These systems can be structured as freelance platforms, advertising platforms, or automation tools. Freelancing dates back to the 10th century when soldiers, having lost their kings or commanders in wars, offered their services to other rulers for payment. It is considered one of the earliest examples of freelancing [14].

Numerous freelance platforms enable professionals to work remotely without leaving their homes. However, this work mode is not suited to everyone, as it can be challenging to stay in the same environment for extended periods without face-to-face interaction. Nonetheless, the advantages of remote work include the opportunity to collaborate on projects from anywhere in the world. For example, a freelancer could be on a tropical island while working on a project for a client in Ukraine. This is why remote work is popular each year (see Fig. 1).

This chart illustrates the dynamic growth in the number of individuals engaged in remote work in various forms. Correspondingly, the number of freelancers in the labour market has also increased. Freelance platforms began their rapid development in the early 21st century, coinciding with the widespread adoption of the Internet. Today, almost everyone has access to the Internet, leading many individuals to seek employment opportunities through the World Wide Web, thereby contributing to the expansion of freelancing.

The first freelance platform emerged in 1999, and since then, the number of such platforms has surpassed one thousand, with some estimates suggesting that there are over 2,000 platforms currently in operation [14]. As the number of platforms has grown, so has competition among them. Platforms have introduced various features, premium services, and incentives to attract and retain users to differentiate themselves from competitors.

Currently, there is a lack of specialised freelance platforms that cater exclusively to Instagram-related tasks. Instead, general-purpose platforms are used to search for relevant professionals. It is worth noting that, on these platforms, clients can only post job listings. From there, freelancers can submit proposals to take on the project. No functionality allows freelancers to create profiles

featuring predefined services and pricing. Developing a platform tailored to this specific purpose could benefit newcomers seeking their initial clients.

Many of the existing platforms offer premium accounts that provide additional benefits. For instance, premium account holders are often afforded more visibility and more significant proposal allowances, while regular users may face restrictions or incur additional costs. When a premium user submits a proposal for a job, it appears at the top of the client's list, increasing the likelihood of being noticed. Furthermore, premium accounts also inspire greater trust among potential employers, leading to higher engagement rates.

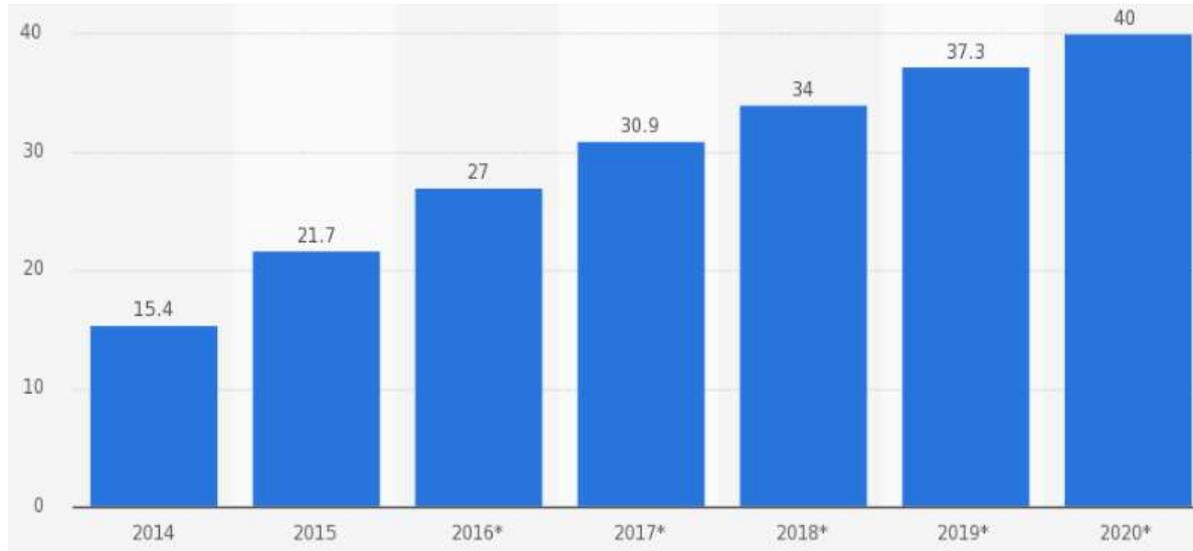


Figure 1: Number of Remote Workers in the USA

Freelancers, therefore, can choose a platform that aligns with their specific needs. Platforms that promise higher earnings tend to attract more professionals. However, such platforms may also charge clients more than expected, leading them to explore other alternatives. Striking a balance between these competing interests is vital for freelancers and clients. It is also worth mentioning that the intense competition among freelancers presents challenges for those attempting to enter the market. Newcomers often face difficulties demonstrating their ability to deliver high-quality work on time. As a result, many begin by accepting lower-paying projects to build a portfolio and gain experience.

As more companies adopt freelancing models, the number of users on these platforms is likely to grow, further driving the expansion of the freelance sector. Another operational model gaining traction is advertising platforms, which differ significantly from traditional freelance platforms.

Advertising exchanges arose to address the need for advertisers to promote products and services on social media, particularly Instagram. Initially, it was impossible for advertisers to directly place ads on Instagram, meaning they had to approach potential collaborators individually. On the other hand, influencers and bloggers could only passively await offers, creating a bottleneck in the advertising process.

These platforms enable users to select influencers from a pre-established list, facilitating the promotion of products or services on their accounts. Therefore, users seeking to monetise their influence register with the platform, while businesses looking to advertise can select bloggers according to specific criteria. Such platforms thus serve as intermediaries, simplifying the connection between advertisers and influencers. While placing advertisements directly on Instagram is possible, the platform has strict guidelines regarding which products and services are eligible for promotion. However, if an influencer posts the advertisement on their account, it is treated simply as a standard post, circumventing the moderation process. Most of these platforms charge a commission for

facilitating transactions between users. Premium accounts are also available, offering enhanced features as the platform specifies.

The market for advertising platforms is not particularly competitive, which can result in inconsistent service quality. Common issues include delayed payments, difficulties with withdrawing funds, and a lack of responsive customer support.

Automation systems, often employed by Instagram users for audience building, also play a significant role in the promotion landscape. These systems typically offer automated services such as mass following (massfollowing) and mass liking (massliking). These systems operate based on user registration, linking their Instagram accounts, and selecting desired actions (e.g., massfollowing or massliking). The process is executed according to predefined criteria, such as geographic location or the audience of a competitor's account, allowing users to attract targeted followers. These services generally operate on a subscription model, with varying levels of access based on the selected plan. Some platforms support multiple accounts across various social networks. However, one issue frequently encountered is suboptimal customer support. Users often report generic responses or lack of resolution to their problems. Moreover, users should remember that massfollowing and massliking are not guaranteed to increase followers substantially.

Recently, the relevance of automation systems has diminished due to the decreasing effectiveness of massfollowing and massliking as engagement strategies. Users increasingly opt for alternative methods, such as targeted advertising, to promote their accounts more effectively.

Instagram itself has taken steps to limit the use of automated services. The platform now encourages organic growth through high-quality content and paid advertisements. As a countermeasure, Instagram restricts the number of daily actions per account. Exceeding this threshold may lead to temporary suspensions or even account bans.

In summary, various promotional strategies are available for Instagram users, each with advantages and limitations. Users must carefully evaluate these methods, weighing the potential costs and benefits to avoid ineffective spending and account-related issues.

2.4. Analysis of established systems

As social media platforms, including Instagram, continue to evolve rapidly, there is an increasing demand for services that facilitate the connection between businesses and professionals seeking to enhance their visibility or attract new clientele.

Following a comprehensive analysis of various online resources, a curated list of popular platforms was compiled, each of which contributes, in some capacity, to address the challenges of client acquisition for specialists in account promotion. First, we examine a prominent representative from the traditional freelance marketplace, Upwork (Fig. 2a) [15].

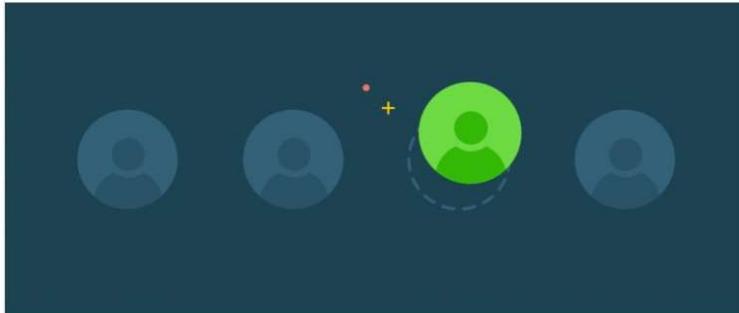
Upwork (Fig. 2a) is a platform that enables users to create job listings (Fig. 2b), where they can outline specific tasks, establish deadlines, and set a budget. Upon publishing the listing, specialists can submit proposals in the form of comments aimed at capturing the employer's interest. The employer selects the most compelling candidate from these proposals and initiates further collaboration. It is worth noting that the platform does not allow users to create proposals for their services. Another critical consideration is that Upwork imposes a commission fee when payments are transferred to the client. The commission rate ranges from 5% to 10% of the total payment, with a decreasing percentage applied to larger project sums [16]. This tiered approach incentivises higher-value projects, benefiting both the platform and users engaged in more substantial contracts.

Furthermore, Upwork has introduced a fee structure for contacting employers—called "Connects" on the platform. Users must pay a nominal fee to express interest in job postings. The cost of each Connect is set at fifteen cents [17], which can accumulate if users apply to multiple listings. Table 1 presents an overview of the key advantages and disadvantages associated with the Upwork service.

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Browse List freelance jobs

Sort:

Visual Graphic Designers for Real Estate Company Needed

Hourly - Posted 9 days ago

Less than 10 hrs/week
Hours needed

3 to 6 months
Duration

Looking to build a team of visual designers to assist with real estate clients' projects. They will be for realtors and agents who need strong visuals for a variety of projects including social media posts, flyers, logos, landing pages, brochures, stationery, etc. in order to drive sales, enhance branding and increase trust and confidence with their buyers.

Qualifications:
- Social media marketi...

- Flat Jobs
- Photographic Jobs
- Signage Jobs
- Social Media Post Jobs
- Blog Jobs
- Adobe Photoshop Jobs
- Business Card Jobs
- Animation Jobs
- Pinterest Jobs
- Report Jobs
- WhatsApp Jobs
- Resume Jobs
- Comparison Jobs
- Sticker Jobs
- Timeline Jobs
- Magazine Jobs
- Ad Banner Jobs

Figure 2: Upwork Homepage and Job Posting

Table 1
Advantages and Disadvantages of the Upwork Service

Advantages	Disadvantages
A vast array of job offers across diverse topics, including Instagram account promotion	There is a high entry barrier, making it challenging for beginners to secure their first order

Convenient job posting search
functionality with multiple filters
24/7 user support
Seamless withdrawal of funds

Commission fee of up to 20% for fund withdrawals

A charge of fifteen cents per Connect
Intense competition among freelancers, which often
leads to the misrepresentation of actual project
experience

An intuitive and user-friendly interface

Upon analysing this information, it is clear that beginners encounter significant barriers when engaging with this platform. The intense competition and the need to pay in advance for the ability to respond to job postings create a challenging environment for newcomers. In light of this competition, many users may resort to providing inaccurate or exaggerated information to capture the attention of potential employers, which can ultimately lead to the delivery of suboptimal results.

Specialised services such as Instaplus [14] are frequently utilised to promote Instagram accounts. This platform is dedicated to enhancing the visibility of personal profiles by automating various processes (Fig. 3). Among the critical services offered by Instaplus are mass liking (automatic liking of posts [18]), mass following (automatic following of other users [18]), automated commenting, and even automatic viewing of Stories. These tools streamline and expedite increasing engagement on Instagram, offering users a hands-off approach to account growth.

It is worth noting that practices such as mass following and Instagram do not endorse mass liking. Consequently, if suspiciously high activity levels are detected, the platform reserves the right to suspend or block the associated account. Despite this potential risk, services of this nature remain highly popular due to their ability to expand audience reach swiftly. However, it is essential to acknowledge that the audience generated through such methods is not targeted, with most users unlikely to exhibit genuine interest in the offered product or service.

Instaplus provides four subscription tiers (Fig. 7). The first option enables users to manage a single account for thirty days, while subsequent plans facilitate the simultaneous management of up to five accounts. The subscription periods vary, ranging from seven to sixty days, offering flexibility in engagement duration. Additionally, the service offers a five-day free trial for users to test its functionality. Table 2 presents the advantages and disadvantages of the Instaplus service.

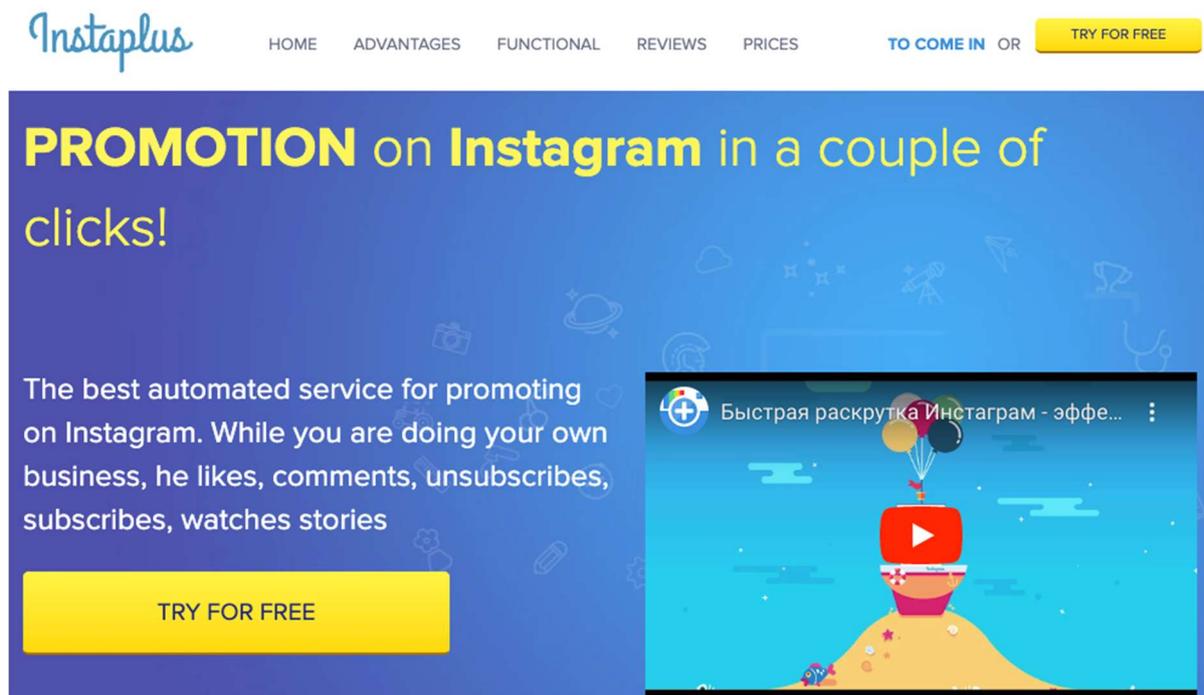


Figure 3: Instaplus Homepage

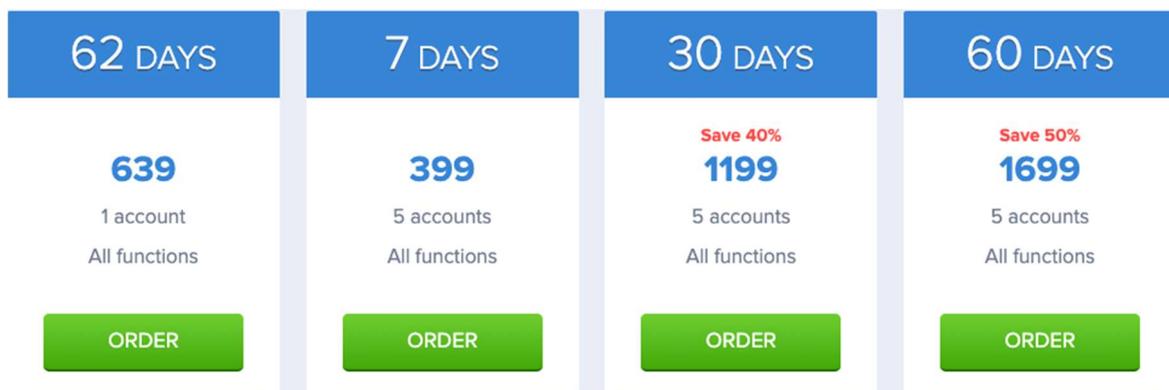


Figure 4: Types of Subscription Plans

Table 2

Advantages and Disadvantages of Instaplus Service

Advantages	Disadvantages
<ul style="list-style-type: none"> Five-day free trial period User-friendly interface 24/7 customer support 	<ul style="list-style-type: none"> Risk of Instagram account suspension Difficulty in managing tasks as they cannot be named Lack of analytics, making it challenging to assess the effectiveness of the service
<ul style="list-style-type: none"> Capability to manage up to five accounts simultaneously High speed of order execution 	

Analysis of the presented information suggests that this service rapidly increases the popularity of personal Instagram accounts. However, it is essential to note that such activities can result in the suspension of the account due to the high volume of actions performed in a short period. Therefore, for sustainable and risk-free promotion of Instagram profiles, it is advisable to rely on traditional methods, such as engaging with specialised companies or professionals.

Attention should also be drawn to the Ukrainian service **Freelance.ua** [19], which presents an alternative for effective account promotion. The homepage of the service is depicted in Fig. 5.

This platform enables users to create job postings where they can detail the requirements and set a price for the task. Freelance.ua offers the flexibility to work on either permanent positions or one-off projects. The platform features a wide variety of specialisations and many available jobs. The user interface is intuitive, making it easy to navigate the platform. Additionally, projects can be sorted by specialisation, streamlining the process for freelancers to find relevant jobs. Employers also can set a deadline by which their project will be visible to potential freelancers. An important feature of this service is its "safe transaction" option, which ensures that the platform holds the payment until the job is successfully completed. If the job is not completed as agreed, the payment is returned to the employer. However, it is worth noting that the platform charges a fee for this service, ranging from 15 to 30 UAH for projects with a budget of up to 300 UAH and between 8-10% for projects exceeding this amount [20].

A significant advantage of Freelance.ua is that it charges no commission on freelancer payments, though if the funds are refunded to the employer, a 3.25% fee is applied [20]. Additionally, users can purchase a Pro account, which allows unlimited applications to projects and increases the freelancer's rating by 25%. This Pro account also boosts the chances of being selected by employers, enhancing the freelancer's credibility [21].

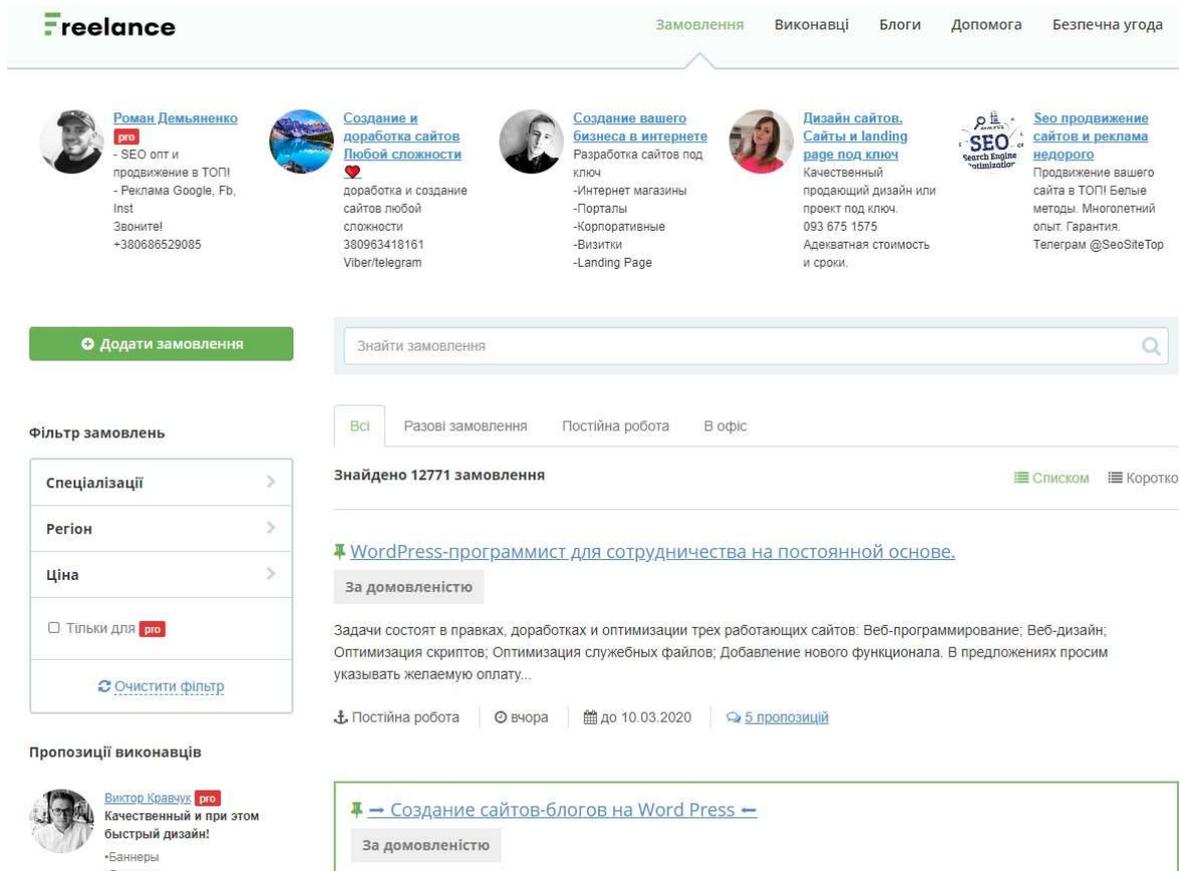


Figure 5: Homepage of the Freelance.ua Service

Table 3 provides an overview of the advantages and disadvantages of the Freelance.ua service.

Table 3
Advantages and disadvantages of Freelance.ua Service

Advantages	Disadvantages
User-friendly interface	Relatively high commission (8-9%) for large projects when using the "secure agreement."
Wide variety of specialisations and projects	Lack of a page with answers to frequently asked questions
No commission on fund withdrawals	The commission fee for refunding funds to the client exceeds three per cent.
Guaranteed payment for completed tasks	
Presence of freelancer ratings	

Analysis of the above data reveals several important conclusions: the service is oriented towards the Ukrainian market, which inherently resolves the language barrier between clients and service providers. Another significant advantage is the absence of commission fees during the withdrawal of funds, a feature particularly beneficial for beginners. The user interface is also highly intuitive and user-friendly, enhancing the overall user experience.

However, a notable drawback is the lack of a dedicated page addressing frequently asked questions. While this may be a technical oversight that could be rectified in the future, it remains a critical issue. This might not be as pressing for a smaller platform, but for a service of this scale, it is an essential feature to improve user satisfaction and facilitate smoother interactions.

3. Methods and means selection

3.1. Analysis of the Subject Area

System design entails the identification of the system's primary objectives, processes, and functions. Upon defining these foundational elements, the design process can be initiated. Critical quality attributes such as performance and efficiency must be considered for the second aspect of the system's development. To effectively achieve this, the following sub-objectives must be addressed [22-30]:

- **The establishment of a task hierarchy** outlines the critical tasks the system will address, defines the functions it will perform, and specifies the internal processes that will be executed within the system's framework.
- **Development of a context diagram** (DFD) serves as a tool to decompose system requirements into interconnected processes represented through data flows [31]. This diagram provides a high-level overview of the system's operations and interactions.
- **A relative importance hierarchy for criteria** for a detailed analysis of all requirements must be constructed, and a clear, logical hierarchy should be constructed to facilitate the accurate and effective implementation of the system.

The third critical aspect of successful system implementation is the actual realisation phase. For an effective implementation, meeting criteria such as user-friendliness and reliability is essential. The system must ensure uninterrupted operation and provide an intuitive user interface. To achieve these objectives, the following sub-goals must be addressed:

- **Selection of appropriate implementation tools.** A thorough evaluation of existing tools and technologies is necessary to identify the most suitable options to fulfil the system's requirements. These methods must be cutting-edge as technology evolves rapidly, becoming more robust, reliable, and secure.
- **Correct system implementation** using the selected technologies is paramount. The system must comply with all predefined criteria and deliver the intended functionalities effectively.
- **The final product testing and validation** is not the final step. Rigorous testing is required to identify potential errors or discrepancies, which must be rectified before final deployment.

From an automation perspective, systems can be categorised as informational-reference, informational-search, informational-management, decision support, and intelligent systems [32]:

- Informational reference systems are designed to perform arithmetic functions based on retrieved data.
- Informational-search systems focus on solving information retrieval tasks.
- Informational management systems are used to automate management functions.
- Decision support systems are interactive systems that aid decision-making processes by supporting various activities.
- Intelligent systems are built upon computational technologies that simulate problem-solving processes, imitating human-like intelligence.

Within the broader categories of decision support and intelligent systems, further distinctions can be made:

- Intelligent informational-search systems empower non-programming end-users to interact with databases using natural or near-natural language interfaces.

- Computational-logical systems allow non-programmers to solve complex problems in collaboration with electronic operations management (EOM) systems using various advanced techniques and tools.
- Expert systems facilitate the computerisation of various domains where mathematical models are either impossible or highly complex.

The Analytic Hierarchy Process (AHP) method has been chosen to analyse and select the appropriate information system type for promoting Instagram accounts. Four distinct system types have been considered as alternatives: Informational-reference system (A1), Informational-search system (A2), Informational-management system (A3), and Intelligent informational-search system (A4). To select the optimal system type, the following quality criteria have been established: Relevance (K1), Completeness of research (K2), Quality (K3), Performance (K4), Ease of use (K5), and Reliability (K6). The subsequent step involves constructing pairwise comparison matrices for both the quality criteria and the alternatives, allowing for calculating eigenvalues (EV) and vectors (VV). An established scale of relative importance priorities will be employed for the expert evaluation. This scale is presented in Table 4.

Table 4
Priority Relative Importance Scale

Value	Quality Characteristic
1	Equal elements
2	Insignificant priority
3	Weak priority
4	Moderate priority
5	Significant priority
6	Substantial priority
7	Strong priority
8	Very strong priority
9	Absolute priority

In the next matrix (the criteria matrix), the relative importance of the criteria compared to others is shown.

$$A = \begin{matrix} K1 \\ K2 \\ K3 \\ K4 \\ K5 \\ K6 \end{matrix} \begin{pmatrix} 1 & 1/2 & 1/5 & 1/5 & 1/4 & 1/5 \\ 2 & 1 & 1/6 & 1/5 & 1/3 & 1/6 \\ 5 & 6 & 1 & 1/2 & 2 & 4 \\ 5 & 5 & 2 & 1 & 3 & 2 \\ 4 & 3 & 1/2 & 1/3 & 1 & 1/3 \\ 5 & 6 & 1/4 & 1/2 & 3 & 1 \end{pmatrix}$$

To calculate the eigenvalues, the following formula is used:

$$B\lambda = \sqrt[n]{\prod_{j=1}^n a_{ij}}$$

$B\lambda = (0.31; 0.38; 2.22; 2.58; 0.93; 1.49)$. To calculate the eigenvectors, the following formula is used:

$$BB = \frac{w_i}{\sum_{i=1}^n w_i}$$

$BB = (0.03; 0.04; 0.3; 0.28; 0.11; 0.18)$. At the next stage, it is necessary to construct the pairwise comparison matrices of the alternatives for each criterion relative to the primary goal. Criterion for "Relevance":

$$A = \begin{matrix} A1 \\ A2 \\ A3 \\ A4 \end{matrix} \begin{pmatrix} 1 & 1/3 & 2 & 1/3 \\ 3 & 1 & 3 & 2 \\ 1/2 & 1/3 & 1 & 1/2 \\ 3 & 1/2 & 2 & 1 \end{pmatrix}$$

$B\lambda = (0.68; 2.05; 0.53; 1.31)$ and $BB = (0.14; 0.44; 0.11; 0.28)$. Criterion for "Completeness of the study":

$$A = \begin{matrix} A1 \\ A2 \\ A3 \\ A4 \end{matrix} \begin{pmatrix} 1 & 1/4 & 3 & 1/3 \\ 4 & 1 & 2 & 3 \\ 1/3 & 1/2 & 1 & 1/3 \\ 3 & 1/3 & 3 & 1 \end{pmatrix}$$

B \checkmark = (0.7; 2.21; 0.63; 1.31) and BB = (0.14; 0.45; 0.12; 0.28). Criterion for "Quality":

$$A = \begin{matrix} A1 \\ A2 \\ A3 \\ A4 \end{matrix} \begin{pmatrix} 1 & 1/3 & 1/2 & 1/3 \\ 3 & 1 & 2 & 2 \\ 2 & 1/2 & 1 & 1/2 \\ 3 & 1/2 & 2 & 1 \end{pmatrix}$$

B \checkmark = (0.48; 2.34; 0.84; 1.31) and BB = (0.09; 0.47; 0.16; 0.26). Criterion for "Productivity":

$$A = \begin{matrix} A1 \\ A2 \\ A3 \\ A4 \end{matrix} \begin{pmatrix} 1 & 1/2 & 1/3 & 1/3 \\ 2 & 1 & 1/2 & 1/2 \\ 3 & 2 & 1 & 1/2 \\ 3 & 2 & 2 & 1 \end{pmatrix}$$

B \checkmark = (0.48; 1.00; 1.31; 1.86) and BB = (0.1; 0.21; 0.28; 0.4). Criterion for "Ease of Use":

$$A = \begin{matrix} A1 \\ A2 \\ A3 \\ A4 \end{matrix} \begin{pmatrix} 1 & 1/5 & 1/2 & 1/3 \\ 5 & 1 & 1/3 & 1/3 \\ 2 & 2 & 1 & 1/3 \\ 3 & 2 & 1/3 & 1 \end{pmatrix}$$

B \checkmark = (0.42; 1.49; 1.18; 1.18) and BB = (0.09; 0.34; 0.22; 0.27). Criterion for "Reliability":

$$A = \begin{matrix} A1 \\ A2 \\ A3 \\ A4 \end{matrix} \begin{pmatrix} 1 & 1/3 & 1/2 & 1/5 \\ 3 & 1 & 1/3 & 2 \\ 2 & 3 & 1 & 2 \\ 5 & 1/2 & 1/2 & 1 \end{pmatrix}$$

B \checkmark = (0.42; 1.18; 1.86; 1.05) and BB = (0.09; 0.26; 0.41; 0.23). Relative to the main objective:

$$A = \begin{matrix} A1 \\ A2 \\ A3 \\ A4 \end{matrix} \begin{pmatrix} 1 & 1/5 & 1/5 & 1/3 \\ 5 & 1 & 1/2 & 1/2 \\ 5 & 2 & 1 & 2 \\ 3 & 2 & 1/2 & 1 \end{pmatrix}$$

B \checkmark = (0.33; 1.05; 2.11; 1.31) and BB = (0.06; 0.21; 0.43; 0.27). The next step involves constructing the alternative comparison matrix. It is also necessary to determine the type of information system that will be used to promote Instagram accounts. The subsequent step is to present the alternative comparison matrix.

$$A = \begin{matrix} A1 \\ A2 \\ A3 \\ A4 \end{matrix} \begin{pmatrix} 0,14 & 0,14 & 0,09 & 0,1 & 0,09 & 0,09 \\ 0,44 & 0,45 & 0,47 & 0,21 & 0,34 & 0,26 \\ 0,11 & 0,12 & 0,16 & 0,28 & 0,27 & 0,41 \\ 0,28 & 0,28 & 0,26 & 0,4 & 0,27 & 0,23 \end{pmatrix}$$

Generalised priorities are (0.1; 0.36; 0.22; 0.28). As a result of the hierarchy analysis, the following priorities were obtained: 0.1 for the informational-reference system, 0.36 for the informational-search system, 0.22 for the informational-management system, and 0.28 for the intellectual informational-search system. The highest priority is given to the informational-search system.

3.2. Business process modeling

A context diagram has been used to model the business processes of the Instagram account promotion system. The diagram is shown in Figure 6. The diagram depicts the primary process "Promote Instagram Account" alongside two key entities: User and Administrator. The User initiates the process by submitting authorisation credentials to the system, verifying the information and returning either a positive or negative response. Following this, the User selects the account type, which can be either Client or Performer. The client can submit a query to search for the desired offer, after which search results are returned. The next step involves selecting an offer, wherein the User submits a request to the system, allowing them to choose a suitable offer. After this selection, the User provides Instagram account details, and the system delivers the outcome as a promoted account. The Performer is empowered to create a new offer, after which a confirmation request is sent. The User then receives a response, either positive or negative. Once the Client selects the service and

submits the account information, the Performer receives the account details and proceeds to fulfil the order. Upon completion, the Performer returns the promoted account.

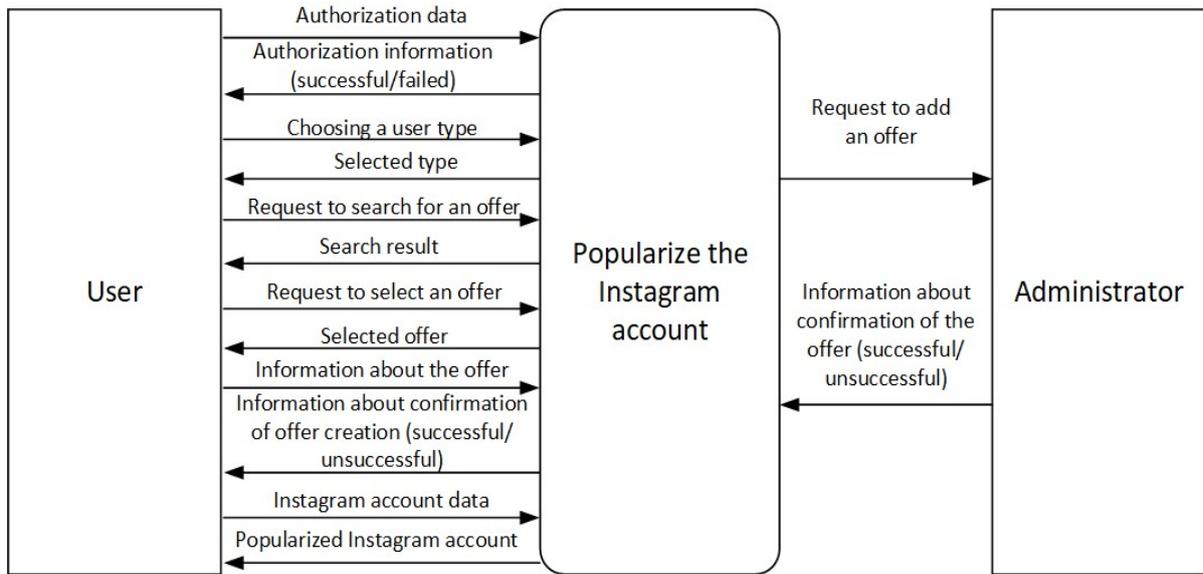


Figure 6: Context diagram

The next phase involves a detailed breakdown of the initial diagram (Figure 7).

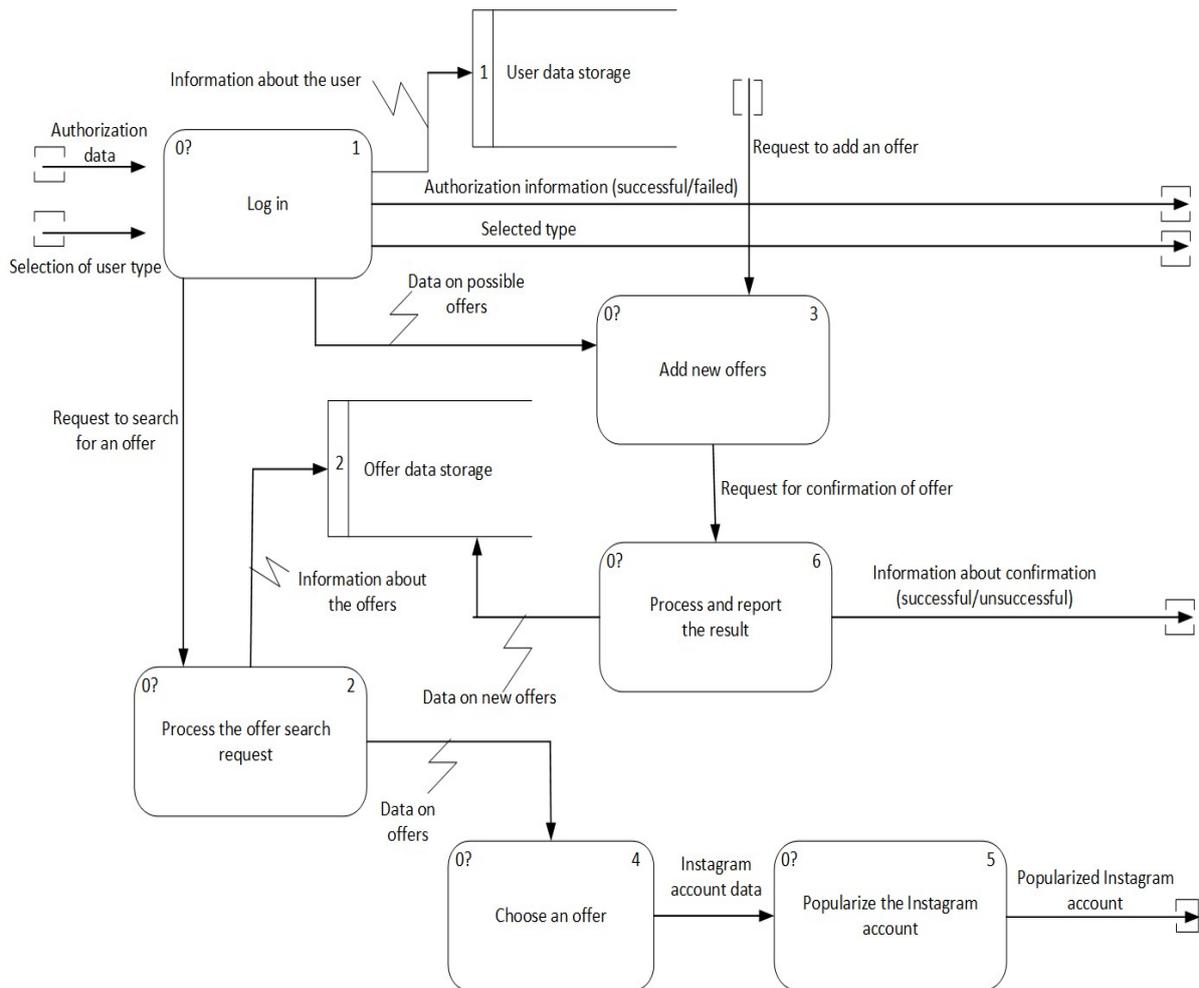


Figure 7: Detailed Data Flow Diagram (Level 1 Decomposition)

The primary process outlined in the previous diagram consists of six subprocesses: Authenticate, Add New Offers, Process and Notify Results, Process Information Search Request, Select an Offer, Promote Instagram Account. The Authorize process is responsible for system authentication. As input, it receives authentication data and selects the user type. The output includes user information, authorisation status (successful/unsuccesful), selected type, information on possible offers, and a request for an offer search. The Add New Offers process receives as input possible offer data and a request to add an offer. The output is a confirmation request for the offer. It processes the data and sends a request to the administrator. The Process and Notify Result process receives the confirmation request for the offer as input. The output includes new offer data and confirmation information (successful/unsuccesful). The administrator receives the request, processes it, and then sends the result. The Process Offer Search Request process receives an offer search request as input. The output consists of offer information and offer data. This process searches for offers based on the request and then sends the results. The Select Offer process receives offer data input, with Instagram account data as the output. This process receives the offer search results, after which the user selects the required offer and submits the Instagram account.

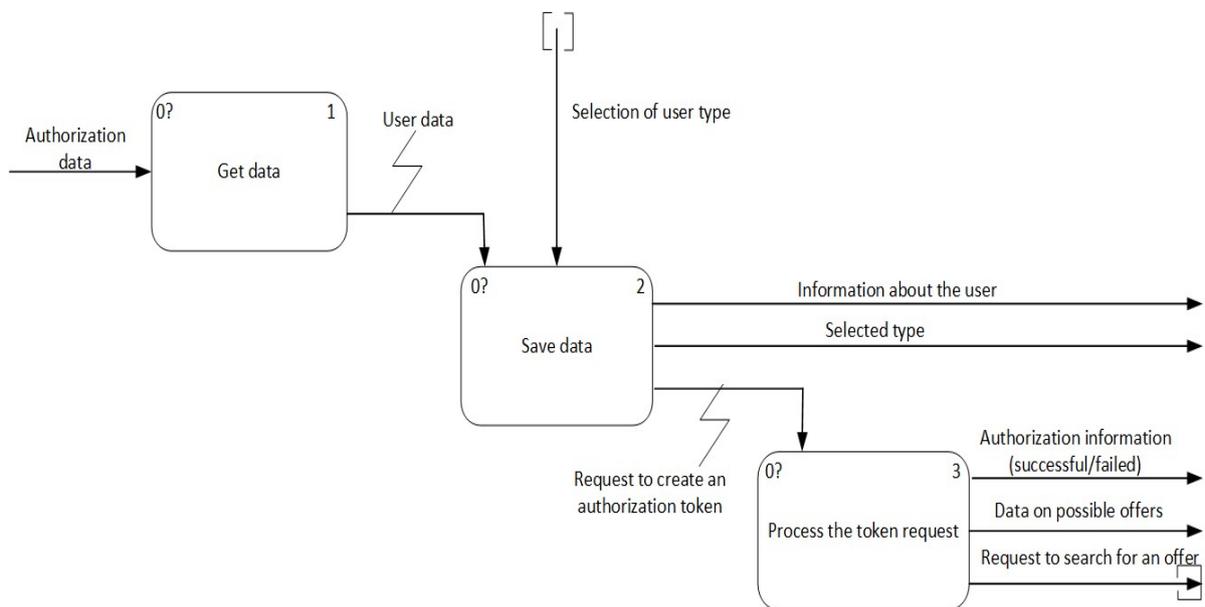


Figure 8: Detailed Data Flow Diagram for the "Authorize" Process

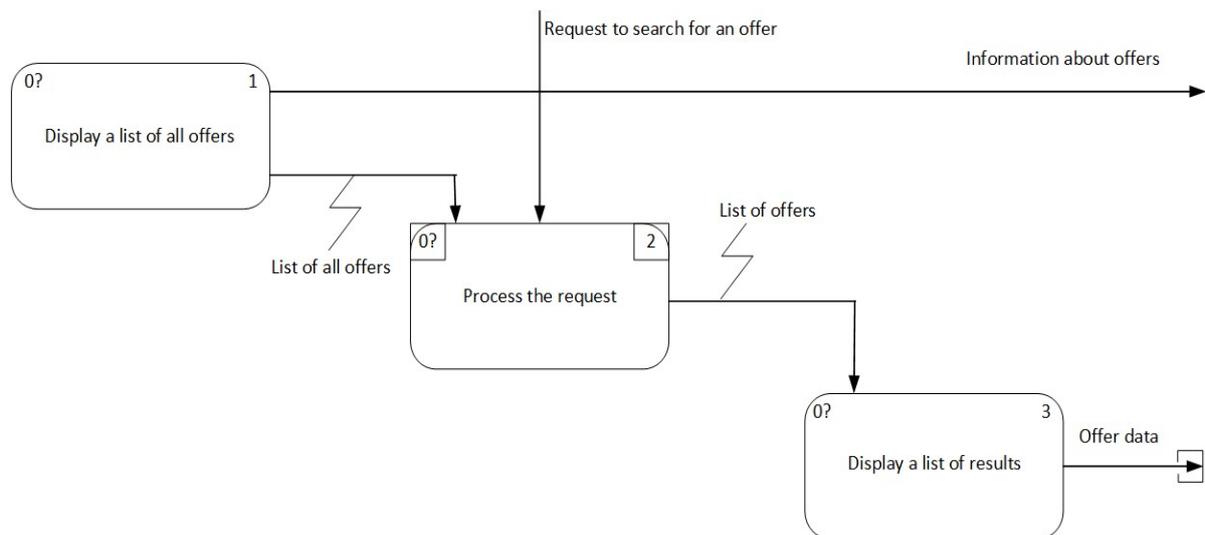


Figure 9: Detailed Data Flow Diagram for the "Process Information Search Request" Process

The Promote Instagram Account process receives the Instagram account data as input and outputs the promoted Instagram account. In this process, the performer receives the account data, promotes it, and sends the promoted account as a result. The next step is to detail these processes. Figure 8 shows the breakdown of the Authorize process.

During the authorisation process, the user enters their personal information. They then need to select an account type: client or performer. Depending on the chosen account type, the user will have different functionalities. The user's information is then sent to the data repository. Simultaneously, a request is formed, and a token is created, which will be used to verify that the user is authorised. After that, the request processing result is sent to the user. Depending on the account type, the user sends a request to search for an offer or creates a new one.

Figure 9 shows the breakdown of the Process Offer Search Request process.

The system generates a list of all available offers, after which the user performs a search for the desired offer using keywords. The formed results list is sent to the user and displayed on their screen.

3.3. Modelling of project requirements

Business Requirements:

- Increase the visibility of Instagram accounts for businesses and brands;
- Attract new followers and clients through the Instagram platform;
- Maintain activity and interaction with the audience on Instagram;
- Analyse and report on the results of account promotion.

User Requirements:

- Simple and intuitive interface for setting up account promotion;
- Ability to specify target audience and interests for attracting followers;
- Ability to schedule posts and automatically publish them on Instagram;
- Ability to view statistics and analyse the promotion results.

Functional Requirements:

- Automatic publication of content on Instagram according to the set schedule;
- Support for various types of content, such as photos, videos, and stories;
- Ability to apply filters and image processing before publication;
- Capability for interaction with followers, including liking, commenting, and replying to messages.

Non-Functional Requirements:

- High system speed and reliability;
- Ensuring the security of user data, including passwords and access to Instagram accounts;
- Support various devices and platforms, such as computers, smartphones, and tablets;
- Compatibility with the latest versions of the Instagram API and other web service.

3.4. Formation and justification of the task

Project Objective. The system's primary objective is to address the challenges of sourcing companies or specialists to fulfil specific orders. In addition, the system seeks to resolve the difficulty of acquiring new clients, particularly for novices, who will be responsible for posting ads offering their services. Ultimately, the system is designed to facilitate the promotion of Instagram accounts by seamlessly connecting clients with service providers.

Project Purpose. This project is tailored for freelancers in search of clients, as well as for clients seeking service providers with specific expertise.

Application Scope. The system can be leveraged by brands and businesses aiming to increase their audience reach and visibility. It is also suited for freelancers who wish to expand their client base.

Expected Benefits from Project Implementation. The anticipated benefits from implementing this project include empowering users to enhance the visibility and popularity of their Instagram accounts while providing service providers with a streamlined platform to connect with potential clients.

3.5. Selection and justification of technological tools for solving the problem

The Instagram account promotion system is best realised as a web application to ensure accessibility, versatility, and user-centric design. This approach guarantees the system is platform-agnostic, allowing seamless interaction from various devices with internet access. The next crucial decision in the development process involves selecting the appropriate technological stack and development environment.

For this system's front-end development, several frameworks and libraries can be considered. The most widely adopted and practical tools for constructing dynamic, responsive, and user-friendly web applications are Angular, Vue.js, and React.

Angular is a robust, open-source front-end framework designed to build dynamic and scalable web applications [33]. This framework extends HTML's functionality, allowing for the seamless rendering of dynamic content. Angular is highly regarded for its capacity to handle complex and enterprise-level applications easily. However, it presents a steeper learning curve due to its intricate structure and dependency management, which may pose challenges for novice developers.

Vue.js is a progressive JavaScript framework that facilitates the development of modern web applications [34]. It is lighter and more approachable than Angular, making it easier for developers to learn and implement effectively. Vue.js provides high performance, emphasising simplicity and modularity, making it ideal for smaller and medium-sized systems. Despite its rapid growth in popularity, Vue.js is less widely adopted than Angular and React in enterprise settings.

React is a JavaScript library designed for building user interfaces emphasising component reusability [35]. Its component-based architecture allows developers to build complex user interfaces incrementally, leveraging isolated components that manage their state. React is renowned for its flexibility, scalability, and efficiency in managing dynamic content and interactions. By the end of 2019, React had surpassed both Angular and Vue.js in terms of usage and popularity within the development community [36], as illustrated by the data presented in Figure 10. Among the options above, React was selected as the front-end technology for developing the Instagram promotion system. This choice is predicated on several factors. First, React's component-based architecture aligns well with the need for modularity and maintainability in developing complex, dynamic applications. Second, React's widespread adoption ensures a robust ecosystem of libraries, tools, and community support, which enhances productivity and long-term sustainability. Finally, React's flexibility allows for seamless integration with other technologies and frameworks, making it an ideal choice for constructing an advanced, scalable web application tailored to this project's requirements. In summary, React's balance of performance, modularity, and developer support makes it the most suitable choice for front-end development in this context. Among these three options, React was chosen, considering its frequent use in web application development and its ability to work with individual components and construct the required interface from them.

It is worth noting that React is a JavaScript library, which requires a sufficient level of proficiency in this programming language. JavaScript (JS) is a programming language that is compiled during execution. JavaScript is widely known as a scripting language for writing web pages and is also used in non-browser environments, such as Node.js and others [37]. Additionally, JS is an object-oriented and dynamic programming language. It enables interaction with the user on the client side, data exchange with the server, and the page's appearance modification.

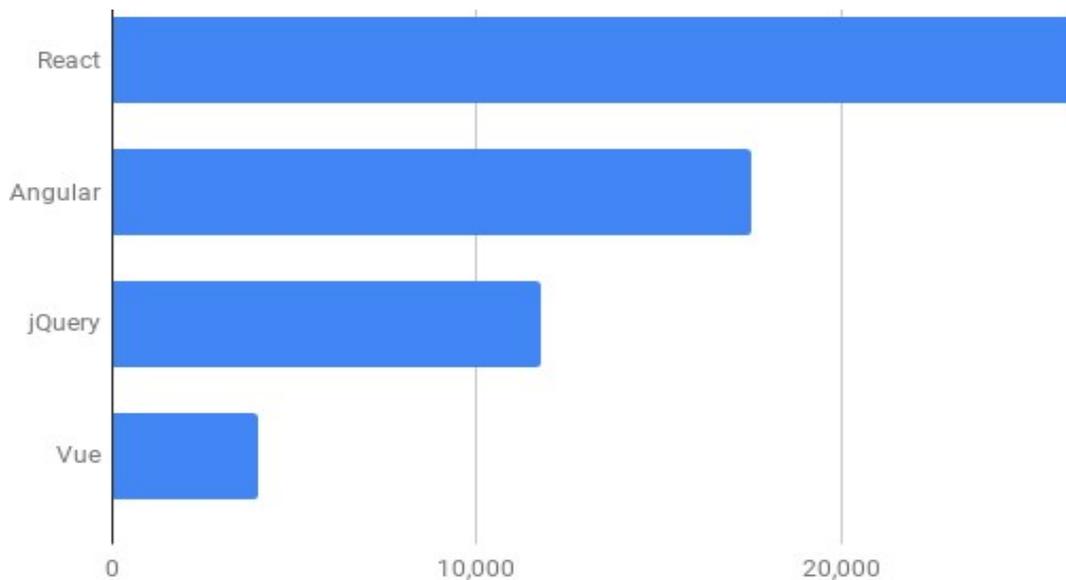


Figure 10: Number of Open Vacancies

HTML (Hypertext Markup Language) is the language used for creating web pages and for their visual presentation [38]. HTML is the foundation of every web page on the Internet. It describes the structure of the web page and the semantics of the web document content. The page's content is marked up using tags that represent HTML elements.

CSS (Cascading Style Sheets) is a stylesheet language used to describe how elements should appear on the user's screen [39]. There are currently three versions: CSS1, CSS2.1, and CSS3. CSS1 is now considered outdated, CSS2.1 is recommended, but CSS3 is the most commonly used version in developing new applications due to its wide range of capabilities.

Axios is an HTTP client for browsers and Node.js [40]. It is used for communication between the front-end and back-end. Using this client, data can be transmitted and received from the server. It also includes automatic transformation for JSON data. Axios reduces the need to write large amounts of boilerplate code, making the code more understandable. Additionally, Axios allows tracking the process of material uploads to the server.

Bootstrap is an open-source toolkit that enables development using HTML, CSS, and JavaScript [41]. Essentially, Bootstrap allows HTML to be styled using pre-made templates. It significantly simplifies and accelerates the development of web pages. The latest version of Bootstrap, Bootstrap 4, greatly extends its capabilities.

Body parser is middleware that allows access to data in a request's body. Accordingly, it enables the retrieval of data from the server-side of the application.

AOS (Animate on Scroll) is a simple library for implementing animations on web pages [42]. It enables creating effects where elements appear as the page is scrolled.

JSX is a syntax extension for JavaScript [43]. JSX creates React elements. This syntax is recommended when working with React.js. JSX allows for the combination of page layout and logic into one file, making web development easier. It enables the page to be divided into individual blocks – components. React itself does not require the use of JSX, but most developers prefer this syntax.

Font Awesome is a set of fonts and icons used on web pages. It was originally created for use with Bootstrap, and later this set was added to BootstrapCDN. Font Awesome is designed to be used with embedded elements, typically within the `<i>` tag.

For the server-side development of the web application, Node.js proves to be an excellent choice. Node.js is an open-source JavaScript runtime environment [44] that has gained widespread popularity in software development. It enables developers to write server-side code using JavaScript, utilising the V8 engine, which Google initially developed. One of the key features of Node.js is its asynchronous execution model, which ensures efficient handling of parallel requests. In essence, Node.js shares similarities with frameworks such as Ruby Event Machine, Python Twisted, and Perl

AnyEvent. It is important to note that the event-driven processing loop in Node.js operates behind the scenes, abstracting away much of the complexity from the developer.

Express is a highly flexible and minimalist framework designed specifically for Node.js applications [45]. It offers a comprehensive set of features for building robust web applications. Although Express remains relatively minimalistic, the developer ecosystem around it has flourished, resulting in an abundance of middleware packages catering to a wide variety of use cases. However, it is worth mentioning that the vast array of available packages can make it challenging to choose the most suitable one for a given task. Furthermore, Express does not enforce a strict structure for application architecture, offering developers the freedom to design their applications as they see fit. Express's continued popularity ensures ongoing community support and development, facilitating the integration of new features and improvements.

MongoDB, a distributed, document-based database, is designed to handle modern applications and cloud technologies with exceptional efficiency [46]. It stores data in a flexible, JSON-like format, offering high scalability and flexibility. MongoDB eliminates the need for predefined schema structures, allowing for dynamic and unstructured data storage. The database is optimised for handling large binary objects and provides robust indexing and dynamic querying support, making it ideal for complex data sets and real-time applications.

JSON Web Token (JWT) is a widely adopted open standard that facilitates the creation of access tokens in JSON format [47]. These tokens are often used for secure user authentication in client-server applications. JWT tokens are generated on the server side, signed with a secret key, and then sent to the client, who uses the token to authenticate their identity when making subsequent requests.

Bcrypt is a popular library used for password hashing and encryption [48]. It provides a secure mechanism for generating cryptographic keys used to store sensitive information, such as passwords. Bcrypt employs salt to defend against dictionary and brute-force attacks, enhancing security by ensuring that identical passwords are not stored similarly. Each password is hashed with a unique salt, further obfuscating the data. Bcrypt utilises the Blowfish cipher, known for its robust encryption and secure key preparation process, setting it apart from other hashing algorithms.

Multer is an efficient middleware for handling file uploads within Node.js applications [49]. It is particularly suited for processing multipart/form-data requests, which are typically used for file uploads. Multer parses the incoming request, appending the uploaded file or files as objects to the request object, making it easy for developers to process uploaded content. It is worth noting that Multer does not handle any other data types apart from file uploads, keeping its scope focused on this critical functionality.

Path is a core Node.js module that provides a powerful set of utilities for working with file and directory paths [50]. Developers can leverage Path to determine the appropriate storage paths for files uploaded via forms, ensuring seamless and reliable file handling throughout the application.

Visual Studio Code (VS Code) was chosen as the application's integrated development environment (IDE). VS Code offers a comprehensive set of features that streamline the development workflow. It includes built-in terminals for executing applications and installing necessary libraries and packages. Its syntax highlighting capabilities enhance readability and code comprehension, while intelligent auto-completion based on variables, functions, and imported modules boost productivity. One of the standout features of VS Code is its real-time error detection, which flags issues as code is written, eliminating the need to run the program to identify errors and significantly accelerating the debugging process.

Furthermore, VS Code boasts a rich ecosystem of extensions, enabling developers to customise and optimise their workflow according to specific programming languages and frameworks. A key advantage of VS Code is its seamless integration with Microsoft Azure, empowering developers to easily deploy applications built with React, Angular, Node, Vue, and other frameworks [50]. This integration offers a powerful platform for cloud-based development, allowing for scalable and high-performance web applications.

4. Experiments, results and discussion

4.1. Description of the developed software

4.1.1. General information about the application

The "InstaLation" website is designed to promote Instagram accounts by connecting field specialists with clients seeking account promotion services. The application is implemented using the JavaScript library React and the Express framework for server-side operations. MongoDB is the database to store essential data for the application's functionality.

4.1.2. Database structure

For this website, MongoDB serves as the underlying database. It consists of the following collections: employers, seekers, jobs, tokens, companies, and accounts.

The Employers table contains data about users who act as specialists. It includes the following fields: `_id`, `username`, `email`, `password`, `role`, `createdAt`, `updatedAt`.

The Seekers table stores information about users who act as individuals needing account promotion. This table contains `_id`, `username`, `email`, `password`, `dateofbirth`, `role`, `image`, `jobs`, `createdAt`, `updatedAt`. The `jobs` field is an array of objects that holds the `_id` of the offers selected by the user.

The Companies table stores information about the user-created company profile that provides services. It includes the following fields: `_id`, `address`, `phone`, `website`, `description`, `image`, `user_id`, `createdAt`, `updatedAt`. The `user_id` field links this table with the Employers table.

The Jobs table contains information about job offers created by users. It includes the following fields: `title`, `description`, `category`, `experience`, `salary`, `status`, `user_id`, `company_name`, `isDeleted`, `createdAt`, `updatedAt`. The `user_id` field links this table with the Employers table, and the `company_name` field links to the Companies table.

The Tokens table contains the fields `_id`, `token`, `createdAt`, `updatedAt`. It stores the user's token when they log out of the system. Later, when checking whether the user is authorised, the user's token is compared with the token in this table to prevent unauthorised users from accessing certain site pages.

The Accounts table contains data about Instagram accounts added by the client. It includes the following fields: `_id`, `accountname`, `password`, `user_id`, `createdAt`, `updatedAt`.

It is important to note that the fields `_id`, `createdAt`, `updatedAt` are created automatically in all tables.

The structure of the database is shown in Figure 11.

4.1.3. Database structure

This software product encompasses two primary categories of users: service providers and service recipients, with an additional role designated for the administrator.

A service provider may register to access detailed information about their company. Upon completing this step, they create listings for each service they offer, specifying key details such as their experience, the anticipated compensation for successful completion, and other relevant criteria. Service providers are also afforded the ability to review and deactivate their listings if necessary. Furthermore, the system displays a list of users who have selected a particular service.

A user seeking to promote their Instagram account must first undergo registration. Once registered, they can supplement or update their profile as needed. They are also allowed to browse through all available service listings and perform searches to identify the most relevant options. The user can add their Instagram account, which they wish to promote and review a list of the services to which they have subscribed.

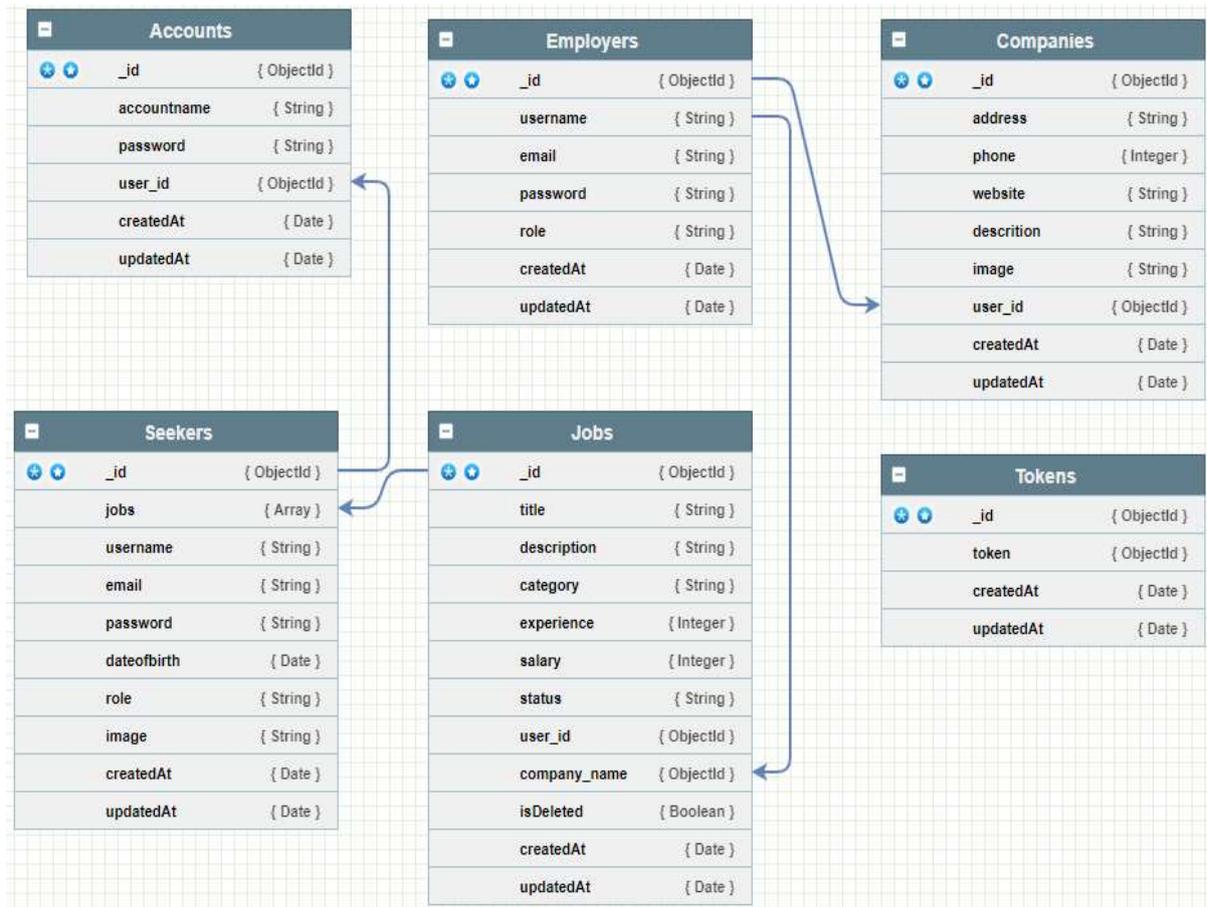


Figure 11: Database structure

The administrator assumes a supervisory role, ensuring all listings adhere to appropriate content standards. Should any listings contain unsuitable information, the administrator can deactivate them, preventing them from appearing in search results and rendering them inaccessible to users.

4.1.4. Description of the website's logical structure

The website's structure is a web, enabling navigation between pages through various pathways. The website features a main page with the core content, a header and a footer. Through the header, users can access the login or registration pages. Once authenticated, users, depending on their role, can use the header to navigate to the page to create listings or view their profile. On all main pages, except the homepage, users are provided with a left-hand menu that allows them to quickly access the relevant pages.

4.1.5. Technical requirements for implemented technologies

To ensure the proper functioning of the website, the following software is required:

- Internet Explorer 10+;
- Firefox 21+;
- Chrome 23+;
- Safari 6+;
- Opera 15+;
- Android Browser 4.4+.

4.1.6. Hosting and Deployment

For complete website functionality, hosting space must be purchased. The hosting environment should have Node.js and the npm package manager installed. Additionally, a connection to the database is required to perform basic operations with the necessary data. Upon completing these steps, the website will be accessible to all users.

4.1.7. Input and Output Data

The system receives the following input data:

- Personal information of users;
- Instagram account data;
- Service details.

The system outputs the following Instagram account information.

4.2. Analysis of the Control Example

The outcomes of its implementation are presented below to substantiate the system's functionality. Figure 12 shows a segment of the homepage. Positioned at the top is the footer, featuring two links: *for customer*—registration for clients, and *performer*—registration for service providers. The "login" button redirects users to the login page, irrespective of their role.

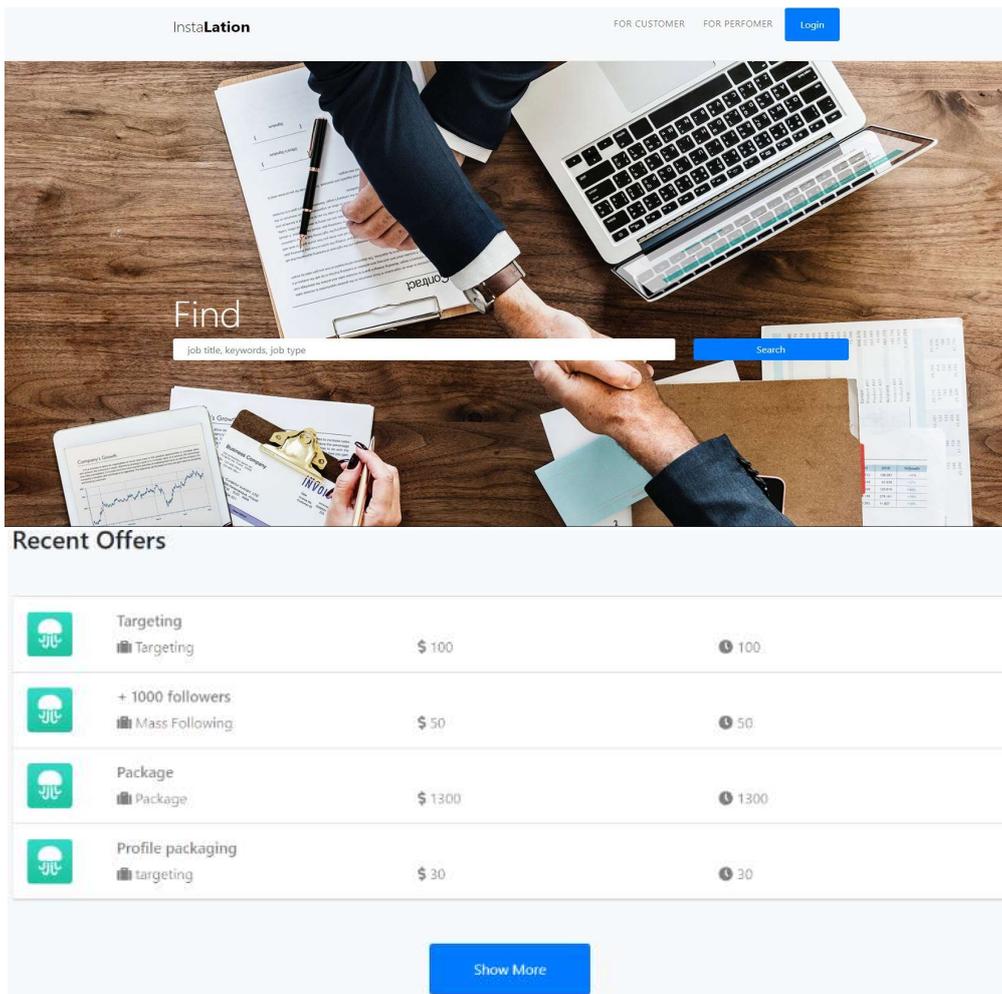


Figure 12: Fragment of the Homepage

The image shows three distinct web forms for user registration and login. Each form is topped with a red padlock icon, indicating a security requirement. The first form, 'Sign up As Customer', includes fields for 'User Name *', 'Email Address *', 'Date Of Birthd' (with a calendar icon), and 'Password *'. The second form, 'Sign Up As Performer', includes fields for 'User Name *', 'Email Address *', and 'Password *'. The third form, 'Sign in', includes fields for 'User Name *' and 'Password *'. Each registration form has a blue 'SIGN UP' button and a link for 'Already have an account? Sign in'. The login form has a blue 'SIGN IN' button and links for 'Don't have an account? Sign Up As Customer' and 'Sign Up As Performer'.

Figure 13: Registration forms a) for the Customer, b) for the Performer and c) Login Form

The image displays two header sections for a website named 'InstaLation'. The top section features the 'InstaLation' logo on the left and two buttons on the right: a blue 'My Profile' button and a red 'Logout' button. The bottom section also features the 'InstaLation' logo on the left and two buttons on the right: a blue 'Create an Offer' button and a red 'Logout' button.

Figure 14: Header for a) the Customer and b) the Performer

The image shows a 'Profile Management Page' for 'INSTALATION'. On the left is a dark sidebar with menu items: '+ Create Offer', 'i Company Info/Update', 'My Offers', '? Who Applied', and 'LOGOUT'. The main content area is divided into two sections. The top section, 'Update Your Company Information', contains form fields for 'Address' (with 'Lviv' entered), 'Phone' (with '095758485' entered), 'Website' (with 'www.tets.com' entered), and a 'Description' text area (with 'The best company' entered). An 'Update' button is at the bottom. The bottom section, 'Update logo', shows a green logo with a white figure, a file selection button labeled 'Выберите файл' (Choose file) and 'Файл не выбран' (File not selected), and an 'Update' button. Below this is an 'About your company' section listing details: Name: empl, Address: Lviv, Phone: 095758485, Website: Website, and Company page: View.

Figure 15: Profile Management Page

The "Find" field allows users to search for offers by title. The "Recent offers" section lists the four most recent proposals. Users are directed to a page with more detailed information by selecting an offer. Clicking on "Show more" redirects to a comprehensive page listing all available offers. Figure 13 presents the registration forms for both clients and performers.

After entering all the required data and clicking the Sign Up button, a new record is created in the data storage, where the information is saved. Figure 13c shows the login form. After entering the credentials, the data is sent to the server, which is verified against existing records in the data storage. Upon successful verification, the user is assigned a token, which allows them to pass authentication when accessing certain pages. If the user is not yet registered, they can click Sign Up As Customer or Sign Up As Performer to register in the system. After a successful login, the header changes for both types of users. For the customer (Figure 14a), navigating to the profile page and logging out

becomes available. For the performer (Figure 14b), the option to create an offer and log out appears. After logging in, the performer can add and edit information (Figure 15) about their company, as they will fulfil orders under the company's name. The information that can be updated includes the address, phone number, website, and detailed personal information. Additionally, the company logo can be updated. If no logo is provided, a default logo is displayed.

Upon clicking Create an offer, a page with a form for creating a new offer is displayed (Figure 16a). On this page, all necessary data for the offer is entered: title, description, category, years of experience, and expected salary. The data is then saved to the database. Upon clicking My Offers, a list of created offers will appear (Figure 16b). Detailed information can be viewed by clicking Read. To remove an offer from the database, click the Delete button. If an offer needs to be deactivated (i.e., to prevent it from appearing in search results for clients), click the live label, which will change to "draft". To reactivate it, simply click on "draft" again.

The image shows two parts of a web application interface. Part (a) is the 'Create An Offer' form, which includes input fields for Title, Description, Category (with a dropdown menu showing 'Package (all methods)'), Year of experience, and Salary, along with a Submit button. Part (b) is the 'Your Offers' listing page, which displays a table of offers with columns for Title, Category, Salary, and status (live/draft), along with Read and Delete buttons for each offer.

Title	Category	Salary	Status	Actions
+ 1000 followers	Mass Following	50	live	Read, Delete
Package	Package	1300	draft	Read, Delete
Profile packaging	targeting	30	live	Read, Delete

Figure 16: a) Offer Creation Page and b) Created Offers Viewing Page

To view the list of users who want a particular service to be performed, click on "Who Applied" (Fig. 17a). When clicking on a service, a list of clients who need the service performed will open. The email for direct contact is also provided, along with the service status. Clicking on the status changes it to "Done," indicating that the service has been completed. A similar status is displayed for the client. Upon logging in as a client, the user can edit and view their profile information (Fig. 17b). They can also change their profile picture.

Upon clicking All Offers, users gain access to a comprehensive list of all created offers (Fig. 18) and can conduct a search for specific services (Fig. 19). By selecting a service users can navigate to the information page (Fig. 20) and place a request for its execution.

Upon selecting the "Accounts" option from the menu, a form is displayed where users can input the details of the account to be promoted (Fig. 21a). Additionally, users can review the list of previously added accounts and remove any account by selecting the "Delete" button.

In this system, an administrator acts as a moderator, ensuring no irrelevant information is present in the created offers. Figure 21b shows the page where all created offers are displayed. The administrator can view the details by clicking the "Read" button and modify the status of an offer, thus deciding whether it will be available to clients. If the administrator clicks the "Delete" button, the offer is moved to the Trash page (Figure 21c), making it inaccessible to clients and performers. By clicking "Restore," the offer becomes available again.

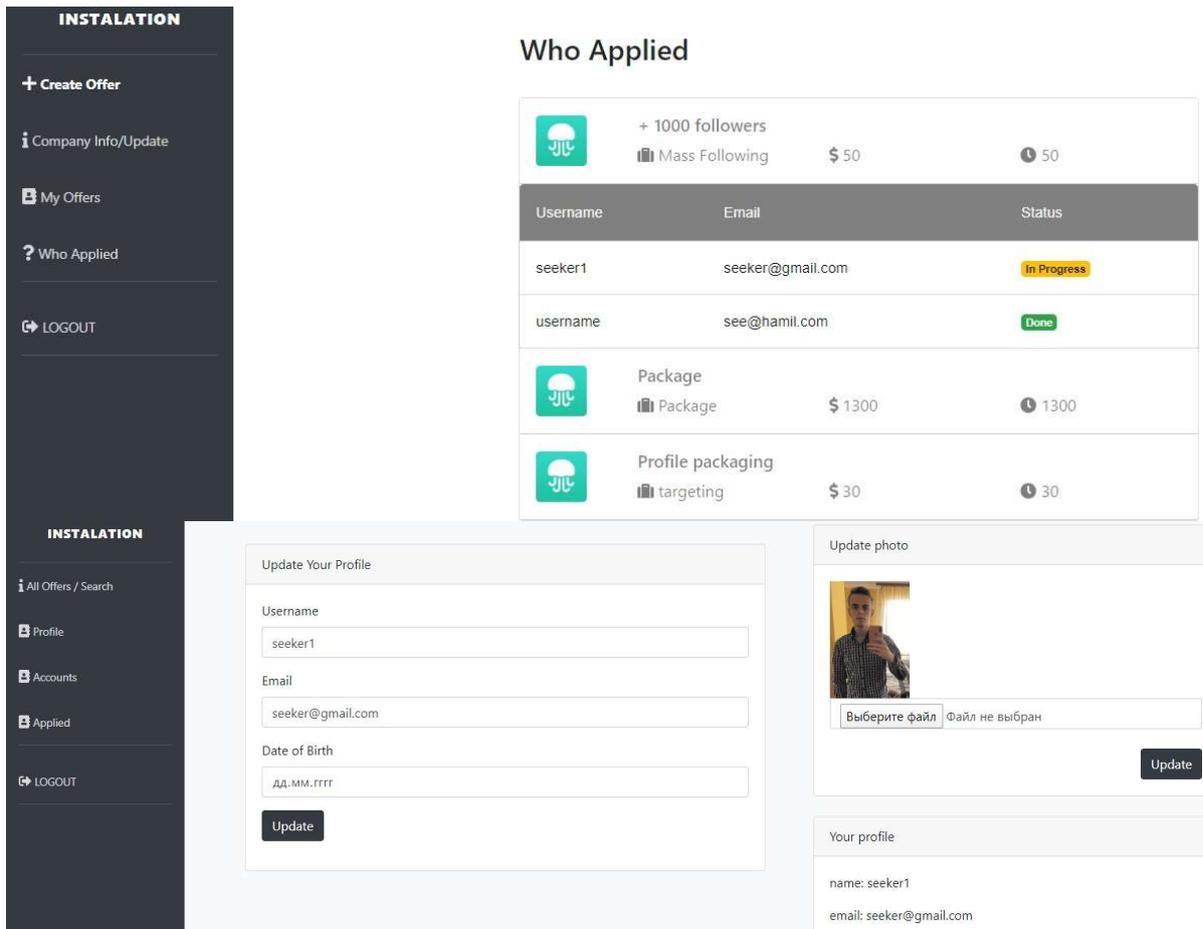


Figure 17: Page for Viewing Services to Be Performed and Client Profile Edit Page

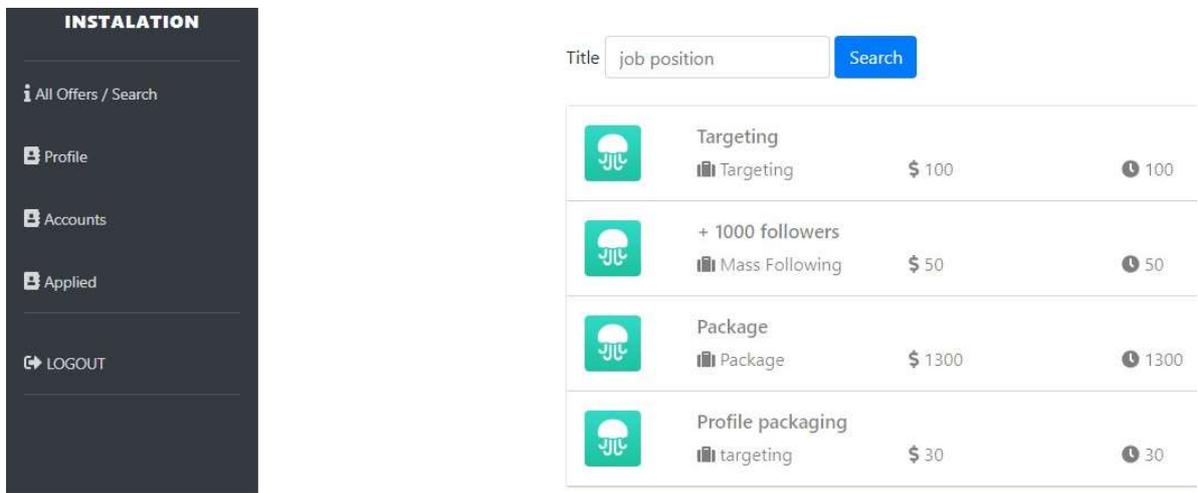


Figure 18: Service search page

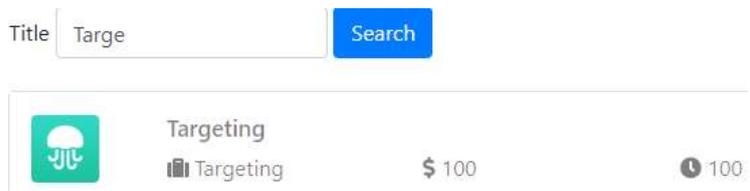


Figure 19: Service search

Targeting

Description

We can make the best targeting strategy

Experience

5

Experience

Targeting

Salary

100

Short Info

Company name: AdsLive

Address: Lviv

Website <https://trello.com>

Phone: 0983657472

Applied

Figure 20: Service information

The screenshot shows the 'Add Account' form and a table of service offers. The form has fields for 'Account username*' (paradise321) and 'Password*', with an 'ADD' button. Below the form is a table with columns 'Username' and 'Action', showing 'paradise123' with a 'DELETE' button. The main table, titled 'All Offers', has columns 'Position', 'Company', 'Status', 'View', and 'Action'. It contains three rows: 'Targeting' (AdsLive, live, Read, Delete), 'Package' (empl, draft, Read, Delete), and 'targeting' (empl, live, Read, Delete). A second table below shows 'Mass Following' (empl, live, Read, Resore).

Username	Action
paradise123	DELETE

Position	Company	Status	View	Action
Targeting	AdsLive	live	Read	Delete
Package	empl	draft	Read	Delete
targeting	empl	live	Read	Delete

Position	Company	Status	View	Action
Mass Following	empl	live	Read	Resore

Figure 21: Page of a) Added accounts, b) Service List Viewing and c) Deleted Services Viewing

4.3. Project testing

The developed project fully complies with all established requirements. The specified technological, environmental, and development tool standards have been met. Furthermore, the project adheres to industry best practices and relevant standards. Both functional and business requirements have been successfully fulfilled. The tools developed within the project are proficient in executing all designated tasks. The performer is empowered to connect with clients, while the client can promote their Instagram account effectively.

4.4. Deployment (implementation) of the project

A comprehensive guide has been created for this project.

Introduction. This website is designed to promote Instagram accounts by engaging two distinct user groups: promotion specialists and individuals in need of such services. The platform also helps beginners and small businesses find clients, as they will be the ones creating ads showcasing available services.

General Information about the Software. The software product is named "InstaLation," and it is implemented as a web-based platform. For front-end development, the following technologies were used React, HTML, CSS, Bootstrap, JSX, Axios, AOS, and Font Awesome. Node.js, Express, Jsonwebtoken, Mongoose, Bcrypt, Body-Parser, Multer, and Path were employed for back-end development. The application is compatible with all major browsers across all platforms.

Problem-Solving Capabilities. "InstaLation" addresses two core objectives: promoting Instagram accounts and enabling specialists and companies to attract clients. The performer can create a list of services related to Instagram account promotion, thereby attracting potential clients. The client can select the desired promotional service from the available options. Ultimately, the client receives a promoted Instagram account.

- The application features include:
- User authentication (registration and login),
- User type selection,
- Profile editing,
- The ability to create, deactivate, and delete service offers,
- The option to search for services via keyword search.

Description of Key Characteristics and Features. This software product, when deployed on hosting, operates 24/7. It is essential to note that the service will be inaccessible if an issue arises with the hosting. Continuous internet connectivity is required to use the service, and network problems may result in unstable app performance. Additionally, the application does not support older browser versions that do not comply with the ECMAScript 5 specification.

Functional Limitations and Usage Restrictions. To ensure proper functionality, a browser that supports ECMAScript 5 is required. A stable internet connection is also essential for the application's operation. Peripheral input and data display devices are necessary to interact with the web application. Key software requirements include having Windows 7+, iOS 7+, or Android 4.1+ operating systems.

5. Conclusions

The project successfully developed and implemented an information system designed to enhance the popularity of Instagram accounts. A comprehensive review of literature sources was undertaken, followed by a detailed system analysis, selection of appropriate technical tools, system implementation, and a thorough economic justification for the system's feasibility.

In the initial stage, a detailed examination of existing literature was conducted to deepen the understanding of the problem. Furthermore, an analysis of existing software solutions was performed, identifying the strengths and limitations of each approach.

Based on this analysis, a selection of services to enhance the popularity of Instagram accounts was developed. Key advantages and disadvantages of these services were identified. The findings lead to the conclusion that developing an information system for promoting Instagram accounts is both a viable and pertinent undertaking. This system addresses the challenge companies or account promotion specialists face in creating service offerings. As a result, it empowers individuals seeking to expand their account's audience by allowing them to select the most suitable company or specialist.

In the second stage, the Instagram account promotion information system was designed. Using a hierarchical method, the system type was determined. A context diagram illustrating the system's interactions was created, and a process decomposition was carried out. A comprehensive list of business, user, functional, and non-functional requirements was compiled.

In the third stage, a rigorous analysis of the necessary technical tools for implementing the system as a web-based platform was conducted. The following tools were selected: for front-end development—React, HTML, CSS, Bootstrap, JSX, Axios, AOS, Font Awesome; and for back-end development—Node.js, Express, Jsonwebtoken, Mongoose, Bcrypt, Body-parser, Multer, Path. Visual Studio Code was chosen as the primary code editor.

The software product was meticulously described by established standards during the fourth stage. Detailed information was provided regarding the general characteristics of the software product, its functional purpose, database structure, logical architecture, technical components, invocation and loading procedures, and input and output data. A control example was analysed, demonstrating that the software product is fully operational and meets the objectives outlined in the initial project requirements.

Finally, in the fifth stage, comprehensive testing of the project was conducted, followed by the creating a detailed user manual. The manual outlines the key features of the software, its system requirements, and functional limitations. This documentation ensures that users can effectively operate the system and understand its functionalities.

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