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Faculty of Computer Information System and Software Engineering

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9	Defense of qualifying paper		

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Keywords: telegram bot, recruiter, resume, position, vacancy, information system.

The paper analyzes recent research and publications, analyzes the current state of application of information systems for personnel support. Based on the data obtained, the relevance of the work being developed was substantiated.

The work includes an analysis of analogues of the developed system, modeling and design of the system.

As a result of the work, software was developed in the form of a telegram bot and a web page based on the example of an office management task, namely: searching for new candidates for an open role in the company, processing resumes, communicating with the candidate, and scheduling interviews based on the results of analyzing candidate resumes.

The practical significance of the work lies in the automation of the main business processes of recruiting tasks: collection, processing and storage of filtered information about a potential candidate and more convenient communication with the candidate for a particular position.

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INTRODUCTION

Technology actively influences all aspects of our lives. This has affected all spheres of social life, including business. The way people live, communicate, learn and think is transformed with the advent of innovations. All this, in one way or another, changes the view on lifestyle and quality of life. Current trends show that

What society expects an even greater impact of technology onprivate and business sectors, as a result - it is predicted that there will be an increase in opportunities for further business development. Thanks to technology, society has gained the opportunity to do the things that previously considered impossible. Thisled to a decrease in demand employees, but increased the efficiency of specialists.

Nowadays, any organization is interested in finding and retaining highly qualified personnel. That is why the process of hiring and selecting personnel for vacant positions is one of the most important issues and a key task in the human resources management system. Attracting potential candidates to the organization is one of the important functions of the organization's human resources management system, as it directly affects the future of the company and its image.

Business processes in the field of Human Resources are currently poorly automated in most companies. Unlike personnel administration, where everything is regulated by legislative acts and the Labor Code, the field of human resources management most often relies on improvisation and informal processes that have developed over time.

Automated Human resource management (HRM)The system will allow you to quickly find information about responsible persons and contact details, that is, interact with candidates or employees in real time.

The relevance of this work lies in automating the HR process, giving HR specialists enough time to work on important activities, such as interactive

employee services, career development and organizational design instead of wasting time on routine tasks.

Based on the analysis of analogue applications, the goal of the work was formed - to create an information system for collecting and processing information necessary for selecting a candidate for a vacant position, which, in turn, will make it easier for an HR specialist or recruiter to review information, schedule an interview for a particular position in the company, and communicate with a potential candidate.

To achieve the goal, it is necessary to solve a certain list of tasks:

- analyze the subject area of human resources management;

- to identify the main requirements of the information system being developed;

- choose design and development tools;
- design an information system;
- develop an information system;
- to test the information system.

1. ANALYSIS OF THE SUBJECT AREA

1.1. Research on the relevance of the problem

The search for a candidate for a vacant position is complicated by the use of numerous digital technologies. The latter, on the one hand, automate some business processes, and on the other hand, burden the HR specialist with additional tasks of viewing online boards.

In the modern infraspace of Ukraine, the problems of personnel selection are studied by creating strategies for the activities of recruiting companies, as a practical problem with the adaptation of technologies of models of activities of foreign agencies for personnel selection, and not as theoretical studies of the independent search for specialists by the enterprise itself [1].

In the course of the creation of the Ukrainian labor market, significant changes are taking place: if previously the problem was finding a job, today it is finding

"best" candidate [2]. Searching and analyzing resumes of the necessary specialists, initial selection and interviewing - all this takes a lot of time and, moreover, a lot of effort, which, with the wrong approach to personnel selection, may simply not achieve the desired results.

Automation of HR functions is the most difficult from a technological point of view, because in this case the automated system must work with parameters that are difficult to formalize or not formalized at all, some of which are directly related to psychology. In the "employee competency profile", in addition to the traditional parameters for accounting (education level, specialty, work experience), such indicators as adaptability, leadership qualities, ability to work in a team, openmindedness, "counting" which is simply impossible due to the subjective nature of their interpretation [3-4]. But with the rapid development of information technologies, this task becomes feasible for us. The need to facilitate the work of managers in finding the right specialists for a vacant position, collecting, storing, processing and analyzing a large amount of received data, and providing it to users in a convenient form poses the task of creating an appropriate information system.

Candidate tracking software offers a number of benefits and useful features throughout the hiring process.

Firstly, an information system to support the work of a recruitment specialist speeds up the entire recruitment cycle as a whole.

Secondly, the user, whether hired or not, will get an impressive experience with the automated candidate tracking system. A more efficient hiring and application process is the key to the success of any business.

These same candidates can say positive things about the company, which will help it take a strong position in the market [5].

Mostly, people apply for jobs blindly, without paying attention to the job requirements and their suitability for them. In such cases, HR feels a lot of frustration as they have to filter hundreds of applications and then filter out the ones that are relevant to the job applicants and then select the most suitable ones for the job.

Here you can see the third advantage - the information system allows you to avoid analyzing unnecessary job applications.

In addition, the information system being developed will simplify the development of an interview schedule for both the candidate for a vacant position and HR specialists [6-7].

The information system can send automatically generated emails to selected candidates that can inform them about the interview, thereby saving a lot of time and hassle for the HR department [8].

Thus, the development of an information system to support the work of a personnel specialist will reduce the time spent searching for

for the selection of candidates, will increase the quality of the results of this process, help improve the company's image, and strengthen its position in the market.

1.2. Analysis of similar products

Today, there are many programs on the market, one way or another related to personnel selection and employee management. Software solutions vary in functionality and structure.

Let's consider several options, analyze the advantages and disadvantages.

Workbright program

WorkBright offers complete remote connectivity for any organization. The application allows you to manage new hire documents and employee files from anywhere, as well as send automatic reminders throughout the onboarding process after the employee accepts your offer (Figure 1.1 - 1.2).



Figure 1.1 – Home page of the Workbright information system

There are 21 pending submissions to review in	the inbox. View Inbox	
Company State (
Company Stats for Winter Season sea	ason	
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26		0

Figure 1.2 – Workbright Boards Page

WorkBright prices start at \$158 per month and increase based on company size, offering customized pricing to best meet your business needs.

"Resumemax" program

The main goal of the "Resumax" information system is data management and tracking information about the organization, professional experience and skills of employees (Fig. 1.3).

The application automates the recruitment of personnel in a corporation or recruitment agency that wants to improve communication between recruiters and department heads.

The information system "Resumax" provides the opportunity to fully record candidates and available vacancies. In addition, "Resumax" has the ability to notify the candidate and HR specialist about upcoming scheduled interviews.

This information system has an interface that is difficult for the average user to understand, as well as a high cost and lack of accompanying documentation.

E-StaffRecruiter Program

The main functions of this information system are automated job posting, resume search on professional portals. The program can be used as a

comprehensive program for a HR employee, and a universal tool for large recruitment agencies (Fig. 1.4).

	Control panel
We	elcome: Petr Gorbunkov
Ouick links All vacancies (3) All active vacancies (3) All my vacancies (3) My active vacancies (2) New vacancies (0) New candidates (0)	Import the candidate from the buffer Import the candidate from the file Add a vacancy Add kandNAVTA Edit my data Reports
Email and contacts * Received: (1) (New: 0) * Sent: (2) • Deleted: (0)	New contact
Current tasks	
Date 13-10-2004	Sort by field Date V

Figure 1.3 – Control panel of the information system "Resumax"

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Figure 1.4 – Information system job listing page

"E-StaffRecruiter"

Having reviewed the information system "E-StaffRecruiter", it should be noted that this system has a user-friendly interface, the database is stored on a personal computer, information about candidates is stored in the form of *.xml files. Data security is well developed.

However, this information system does not have the ability to exclude candidates processed in previous queries from the results of a new search.

After analyzing similar applications, a comparative characteristic of the analogues and the developed information system was developed for each criterion, which is presented in Table 1.1.

Criteria	«Workbright»	"Resumax"	"E-Staff	IS support for the
			Recruiter"	work of a
				specialist in
				working with
				staff
Resume screening system	-	-	-	+
Customer feedback	+	+	-	+
Working on vacancies	+	+	+	+
Reporting	-	+	-	-
Free	-	-	-	+
Comfortable and intuitively	+	-	+	+
clear interface and design				

Table 1.1. – Comparative characteristics of analogues of information systems

1.3. Research objective

Having determined the relevance and considered analogues of information systems, the goal of the diploma project was formulated, which is to create an information system to support the work of a personnel specialist. The main goal of this system is to automate the work of an HR specialist, which will reduce the time spent on searching for and selecting candidates, increase the quality of the results of this process, help improve the company's image, and strengthen its position in the market.

This information system will provide a number of advantages:

- quick search for candidates;
- saving time and increasing efficiency;
- optimization of costs and resources;
- clarity of information presentation.

2. PROBLEM STATEMENT AND RESEARCH METHODS

2.1. Problem statement

The main goal of the master's qualification work is to develop an information system to support the work of a personnel specialist to automate basic business processes, collect, process, and store filtered information about a potential candidate, and facilitate more convenient communication with a candidate for a particular position.

The created information system will have two integrated parts: a telegram bot and a web service. The information system should have a convenient and intuitive interface, allow the candidate to send a resume, receive the necessary information if the resume does not pass the necessary check by the built-in screening system, allow the HR specialist to view candidate resumes in a filtered form by available vacancies and maintain contact with a specific candidate using the integration of a telegram bot and a web service.

The following list of tasks was identified to achieve the project goal:

- analyze the subject area;
- analyze the created similar products;
- choose the means of project implementation;
- develop the structure of the information system;

- implement this system in the form of an integrated telegram bot and web service;

- develop the functionality of the information system;

- prepare supporting documentation.

Under development informational system should answer nextfunctional requirements:

- viewing information about vacancies;

- viewing resume information;

- the ability to download a resume file to a PC;
- the ability to process and filter resumes;
- customer feedback.

2.2. Choice of means of implementation

To develop the information system, modern trends and technologies in software design will be taken into account.

To begin, let's define the programming language for developing a human resources management information system. It is important to highlight the following evaluation criteria:

- cross-platform language that allows the developed system to work in different operating systems;

- ease and speed of learning;
- free or conditionally free;
- accessibility of literature;
- object-oriented;
- allows you to easily create parsers to collect information from files;
- reliability.

The most popular programming languages were considered, such as java, c++, c#, php, python, according tohttps://habr.com (Fig. 2.1) [9].

When it comes to building parsers, everyone thinks of PHP and Python, which are server-side languages. Although many applications still run on PHP, it is now much more profitable to use Python [10-11].

Python is a high-level language. It has no specific purpose, so it is suitable for solving any tasks, including writing parsers. Python's syntax is minimal, and the language supports OOP, functional, imperative, and other types of programming. This makes parsing in Python much more convenient.



Figure 2.1 - Programming language ranking 2021.

Python is considered more versatile than PHP. Its conciseness makes it a popular choice in areas such as:

- web application development using Django/Flask frameworks (BackEnd direction);

- system administration tasks;
- DevOps engineering (script writing);
- automated testing (Automation QA);
- working with large amounts of data,

- machine and deep learning, neural networks (Big Data, Data Science) [12].

PHP can be used for other purposes, but it is designed specifically for creating web pages, and that is what it does best. It is a complex programming language designed for creating complex web applications.

Python has a huge number of open source libraries and documentation. Python has a library called Telebot, which allows a developer to easily create a chatbot in the Telegram messenger using ready-made classes and functions [13]. Since the main task of the information system being developed is to collect and process information necessary for the selection of candidates for a vacant position using a telegram bot, Python was chosen as the programming language. It was also decided in its favor because of its popularity among development professionals, there is a lot of available literature and video podcasts for it.

Study and it is one of the most sought-after in the labor market.

The Django framework was used as a framework for web development on Phython.

Django's architecture is similar to the "Model-View-Controller" (MVC) architecture. The controller of the classic MVC pattern roughly corresponds to the layer that Django calls the View, and the presentation logic of the View is implemented in Django by the Templates layer. Because of this, Django's layered architecture is often called "Model-Template-View" (MTV) [14].

Django supports PostgreSQL, MySQL, SQLite, and Oracle databases. Since the Python standard library already includes the sqlite3 module, the work in progress will use the SQLite database. In addition, SQLite is the easiest database to connect to using Python, as it does not require the installation of external modules. Moreover, the SQLite database does not require a server and is self-contained, i.e. it simply reads and writes data to a file [15-16].

Thus, the Python programming language, the SQLite database management system, and the PyCharm development environment were chosen to develop the information system [17].

3. INFORMATION SYSTEM DESIGN

3.1. Structural and functional modeling of the project

IDEF0 is a methodology for functional modeling and graphical description of processes. Thanks to the functional modeling methodology, the system to be developed can be seen as a set of interconnected functions (functional blocks). The construction of the IDEF0 model is presented to the developer initially from the idea of the system as a single whole - one functional block with interface arcs extending beyond the boundaries of the domain. Such a diagram with one functional block is called a context diagram and is designated by the identifier "A-0". [18].

Therefore, the process of designing a web system must begin with the development of an IDEF0 context diagram. The context diagram includes:

- Input resources used to perform a function.
- Output the results of the function execution.

- Management – the guiding influences that determine how and how much output to produce.

- Mechanisms – resources that perform work (e.g., employees, equipment, devices, etc.).

Figure 3.1 shows an IDEF0 diagram, and Figure 3.2 shows the decomposition of the diagram.



Figure 3.1 – Functional modeling of an information system in IDEF0



Figure 2.2 – Decomposition of an IDEF0 diagram

3.2. Use case diagram modeling

After developing the context diagrams, it is necessary to develop a use case diagram. A use case diagram is a diagram that describes which functionality of the software system being developed is available to each group of users. [19].

The following actors were identified for the information system under development:

- HR – has access to the functionality of the information system and can make changes to the content;

- Database – stores information;

- Candidate for the vacant position –has access to part of the functionality of the information system.

Next, use cases (processes that users can perform) for this information system were identified, namely:

- BB "Authorization" - BB allows the user to authorize in the system;

- BB "Adding new vacant positions" - BB allows the manager to add current vacant positions to the information system;

- BB "View all resumes" - BB allows the manager to view resumes sent by candidates;

- BB "View specific resume" - BB allows the manager to open a specific candidate's resume;

- BB "Feedback" - BB allows the manager to send messages to the candidate;

- BB "Send resume" - BB allows the candidate to send a resume to the selected vacant position.

The use case diagram is shown in Fig. 3.3.



Figure 3.3 – Use case diagram

3.3. Database model design

The information base of the system was implemented using the SQLite DBMS due to the small amount of data that will be stored in the site database. SQLite is a compact, embeddable relational database. The source code of the library has been transferred to the public domain.

The word "embedded" means that SQLite does not use a client-server architectural model. That is, the SQLite engine is not a separate running process with which the program interacts, but provides a library with which the program is linked and the engine becomes a part of the program. This approach reduces overhead, response time, and simplifies the program. [20-21].

The following entities were selected for the database:

- users stores information about users;
- candidates stores information about candidates;
- resumes stores information about resumes;
- vacancies- stores information about vacant positions;

Table 3.1 provides information about the attributes of the corresponding entities.

Entity name	Attribute name	Attribute type	Keys	Attribute
				description
1	2	3	4	5
users	user_id	INT	РК	Unique user ID
	username	VARCHAR(50)	-	User login
	email address	VARCHAR(50)	-	User's mail
	first name	VARCHAR(50)		User name
	last name	VARCHAR(50)		User's last name
	staff status	ENUM("true",		Availability of HR
		"false")		status
vacancies	vacancy	INT	РК	Unique job ID
	name	VARCHAR(50)		Job title
	description	VARCHAR(250)		Job description
	status	ENUM("Open",		Job status
		"Close")		
	timestamp	DATE()		Date added

Table 3.1. – Information about attributes and entities

Table 3.1 continued

1	2	3	4	5
	candidate	INT	РК	Unique candidate
				identifier
	name	INT		Candidate's name
	surname	VARCHAR(250)	-	Candidate's last
				name
	email address	VARCHAR(250)	-	Candidate's email
resumes	candidate	INT	FK1	Unique candidate
				identifier
	vacancy	INT	FK2	Unique job ID
	file	VARCHAR(250)	Ι	Resume file
	cover letter	VARCHAR(250)	-	Brief information
				about candidate
	extracted text	VARCHAR(250)	-	Basic information
				from resume file
skills	skill	INT	РК	Unique skill
				identifier
	candidate	INT	FK1	Unique candidate
				identifier
additional_info	id_info	INT	РК	Unique candidate
				identifier
	candidate	INT	FK1	Unique candidate
				identifier
	name	VARCHAR(50)		Information name
	value	VARCHAR(50)		The value of
				information
required_skills	required_skills	INT	РК	Unique required skill
				identifier
	vacancy	INT	FK2	Unique job ID
	value	VARCHAR(250)	-	The value of the
				required skills

Having identified the entities and attributes of the information system, an ER diagram was constructed, which is shown in Fig. 3.4.

ER diagram represents by yourself graphic representation entities and their relationships with each other.



Figure 3.4 – ER diagram

This diagram shows how entities are related to each other.in the information system:

candidates and resumes have a one-to-one relationship, one candidate can submit one resume, and one resume must refer to one candidate;

vacancies and resumes have a one-to-many relationship, one resume can relate to one vacancy, one vacancy can have many resumes; vacancies and required skills have a one-to-many relationship, one skill can relate to one vacancy, one vacancy can have many skills;

candidates and skills have a many-to-many relationship, one skill can apply to many candidates, one candidate must have at least one skill;

candidates and additional info have a "many-to-many" relationship, one item can refer to many candidates, one candidate must have at least one parameter.

3.4. Software application architecture

The "client-server" architecture and "file-server" architecture were considered as the basis for the architecture of the information system.

File server programs are dedicated computers on a network that are designed to store files. They are shared by users who can upload, download, modify, and delete files.

The main disadvantage of working with a file system is that data is stored in one place and processed in another. In fact, this means that data must be transferred over the network, which, in turn, leads to high network loads and, as a result, program performance decreases with an increase in the number of clients working simultaneously. The second disadvantage of such an architecture is that it cannot provide the necessary level of reliability and authenticity of information. Such an architecture does not support database integrity and does not have transaction management mechanisms, which makes it difficult to ensure logical consistency of information in the event of hardware and program failures. [22].

The main difference between client-server architecture and file-server architecture is the abstraction from the internal data representation (physical data schema).

Currently, client applications manipulate data at the logical scheme level. As a result, the use of client-server architecture supports the maximum level of storage reliability, relevance and reliability of programs designed for many users of IS with a centralized database, independent of the hardware of the database server, which support a graphical user interface on client stations connected by a local network. In addition, it allows you to connect different clients. Use the resources of one server often clients with different hardware platforms, operating systems, etc. [23].

Therefore, a client-server concept was chosen for this information system.

Model-view-controller (MVC) is a software architecture pattern that involves dividing a program into 3 loosely coupled components, each of which is responsible for its own area of activity. The main goal of using MVC is to separate data and business logic from visualization. This separation increases the possibility of reusing the program code. It also simplifies the maintenance of the program code: changes to the appearance, for example, do not affect the business logic, and changes to the business logic do not affect the visualization.

The MVC concept allows you to separate data, presentation, and user action handling into three separate components.

Moreover, the framework with which the information system is developed (Django) follows the MVC concept strictly enough to be called an "MVC framework". Here is a brief description of how M, V, and C are separated in the Django environment:

Model. This includes everything related to data - how to access it, how to test it, what its behavior and relationship to each other is.

View. Responsible for displaying information (visualization). The same data can be presented in different ways and in different formats.

Controller. Provides communication between the user and the system: controls user input and uses the model and views to implement the required response.

As a representation, the controller depends on the model. In turn, the model does not depend on the controller and the representation. Accordingly, the purpose of such a division is realized: it allows you to build a model independently of

visual representation, as well as create several different views for the same model. Figure 3.5 shows the MVC diagram.



Figure 3.5 – MVC model

The same structure will be characteristic of the structure of the information system being developed.

The client-server architecture of this information system can be described as follows.

The user enters the information system through a web browser. Then the user goes to his personal account, at that moment, the request is transmitted to the web server, the web server, in turn, transmits to the user the data that he can see on the web page. If the client wants to send a resume, and then send a message to the candidate, the data is validated on the client side and sent to the web server. The data is validated on the web server, if everything is correct - a request is made to the DBMS server, where a record about the candidate is made. The web server transmits to the user the data requested by the user from the DB: information about the candidate and his resume.

3.5. Database implementation

When creating and editing the database of the information system, Django administration is used. One of the strongest points of Django is its automatic administrator interface. It uses model metadata to provide a feature-rich, ready-touse interface for working with site content. SQLite is a lightweight and easy-toconfigure relational database management system. SQLite does not require a server, which is its biggest advantage. Unlike other DBMSs such as MySQL or PostgreSQL, a server is not required to run the database. Thus, we do not need to install [24].

SQLite databases are stored locally alongside files stored on disk, which greatly speeds up accessing and managing data in the database.

All SQLite transactions are ACID compliant.

The built-in sqlite3 module was used to create the SQLite database in Python. The sqlite3 module provides an API with which to create the database. It is compatible with the Python database API and does not require any external libraries.

The database of the developed system is called "cv-cheker". The physical implementation is presented in Fig. 3.6.

3.6. Software implementation

The information system to support the work of a personnel specialist consists of the following modules: Telegram bot; web page; database.

For implementation informational systems were used next technological tools:

Python (namely the Django library) – was used to implement the server part of the information system;

javaScript – used to implement interactive elements of the client side;



Figure 3.6 – Physical implementation of the information system database

html/css - used to implement static pages and templates.

The implementation of the information system can be divided into three stages.

The first stage includes the Telegram bot. The Telegram bot was implemented using the Telegram API and the server-side programming language Python [25].

The second stage includes the HR specialist admin panel. It was implemented using HTML/CSS and Java Script, which is why it has a simple and intuitive design.

The third stage is the admin panel, as it was done using the Django template. Admin panel The admin panel is designed to control the operation of the entire system. It is implemented as a web page, using which the user can add, change and delete data about candidates and vacant positions (Fig. 3.7).

jango administration			
te administration			
UTHENTICATION AND AUTHORIZATION			Recent actions
roups	+ Add	🥜 Change	Recent actions
sers	+ Add	🥜 Change	My actions
			X Illia Necheporenko Candidate
OT andidates	+ Add	Change	+ AWS S3 for Senior Python Engineer
equired_skillss	+ Add	🤌 Change	 microservices architecture for Senior Python Engineer
equirementss	+ Add	🥜 Change	Required_skills
esumes	+ Add	🤌 Change	 Amazon Timestream for Senior Python Engineer
killss	+ Add	🥜 Change	Diango for Senior Python Engineer
acancies	+ Add	🥜 Change	Required_skills
			 test documentation for Manual QA Engineer Required_skills
			+ Jira for Manual QA Engineer Required_skills
			+ Agile for Manual QA Engineer Required_skills
			+ XML for Manual QA Engineer Required_skills
			+ CSS for Manual QA Engineer

Figure 3.7 — Home screen of the admin panel.

Using the admin panel, an HR specialist has the ability to create, edit and delete current information about vacant positions (Figures 3.8 - 3.9).

÷	→ C (① 127.0.0.1:800)/admin/bot/va	cancy/add/	च्च 🖉 😾 😾 🖗 🗄
				WELCOME. ADMIN VIEW BITE / CHANGE PASSWORD / LOG OUT
Г		IZATION	A did concerns	
	Groups	+ Add	Add vacancy	
	Users	+ Add	Name:	
	807		Description:	
	Candidates	+ Add		
	Required_skillss	+ Add		
	Requirementss	+ Add		
	Resumes	+ Add		
	Skillss	+ Add		
	Vacancies	+ Add	Status:	Open V
«			Timestamp:	Bate: 2021-12-09 have Time: 113258 have Annual of server time.
				Seve and add another Seve and continue adding SAVE

Figure 3.8 — Screen for adding a new vacancy

Django administration									
Home - Bot - Vacancies									
AUTHENTICATION AND AU	JTHORIZATION	The vacancy "trainee/junior Full-stack developer" was added successfully.							
Groups	+ Add								
Users	+ Add	Select vacancy to change							
вот		Action: Go 0 of 4 selected							
Candidates	+ Add	VACANCY							
Required_skillss	+ Add	trainee/junior Full-stack developer							
Requirementss	+ Add	Senior PHP Engineer							
Resumes	+ Add	Senior Python Engineer							
Skillss	+ Add	Manual QA Engineer							
Vacancies	+ Add	4 vacancies							

Figure 3.9 — Vacant Positions View Screen

The HR specialist can also add the basic necessary skills, this is done so that the system can validate the submitted resumes for the presence of the necessary skills (Fig. 3.10).

Django admini	stration							
tome + Bot + Required_s	killss							
	ITHORIZATION	Colort required alvillo to obongo						
Groups	+ Add	Select required_skins to change						
Jsers	+ Add	Action: Go 0 of 10 selected						
		REQUIRED SKILLS						
ют		AWC \$2 for Saniar Buthan Engineer						
andidates	+ Add							
tequired_skillss	+ Add	microservices architecture for Senior Python Engineer						
Requirementss	+ Add	Amazon Timestream for Senior Python Engineer						
Resumes	+ Add	Django for Senior Python Engineer						
skillss	+ Add	test documentation for Manual QA Engineer						
/acancies	+ Add	Jira for Manual QA Engineer						
		Agile for Manual QA Engineer						
		XML for Manual QA Engineer						
		CSS for Manual QA Engineer						
		HTML for Manual QA Engineer						
		10 required abilities						

Figure 3.10 — Required Skills View Screen

All other tables are filled in automatically by the system after the candidate uses the Telegram bot.

When you start the program, the initial window shown in Figure 3.11 appears.



Figure 3.11 — Welcome page preview screen

By clicking on button "Run here" will open window authorization, shown in Figure 3.12.

AUTHORIZATION	
usemame	
password	
Login	

Figure 3.12 — User authorization screen

After authorization, the HR specialist is taken to the main page of the system, which allows:

- view the list of candidates who have sent their resumes to the company;

- view the resume of a specific candidate;
- filter the table by vacant position;
- review which necessary skills were matched with the candidate;
- send messages.

An HR specialist can view the list of candidates who have sent their resumes to the company (Fig. 3.13).

Also, the HR specialist is given the opportunity to send a newsletter to a specific candidate about the refusal of further cooperation with the company, or an

invitation to an interview and a proposal for further cooperation by clicking the Send Email button (Fig. 3.14).



Figure 3.13 — Candidate list view screen

日 5 년 1 후 · Invitation to Google Meet Test Task from [company name] - Message (HTML)		-		×						
Cut Times New • 11 • A A I II • III • A A I III • III • A A A I III • A A A I III • IIII • A A A I III • III • A A A I III • A A A I III • III • A A A I III • III • A A A III • III • A A A A				^						
The following recipient is outside your organization: necheporenko.illia@gmail.com										
To Incheporenko.file@unsil.com Send Cc	Image: Send Image: Cerrent content of the Sense Content of the									
Dear [], We invite you for an interview with []. We have scheduled the interview appointment for you on [day of week], [month] [day], [year] at [<u>time:time</u>] PM GMT+3. We have attached your interview appointment invite. We will contact you via Google Meet: <u>https://meet.google.com/</u> We look forward to a meeting with you]										

Figure 3.14 — Message sending screen

The system user can filter the table by a specific position by selecting the desired role in the field above the table (Fig. 3.15-3.16).



Figure 3.15 — List of available vacant roles

All vaca	ncies	v)			Applicar	nt inform	ation				
Show Name	Surname	Vacancy	Cover letter	English	Work experience	Type of employment	Importance	Technical skills	Required skills	Email	File	Decline
illia	necheporenko	Manual QA Engineer	test	B1	0-1 year	full-time	ability to work from office	test	Django Amazon Timestream microservices architecture AWS S3	necheporenko.illia@gmail.com	Open	Send Email
nastya	markova	Manual QA	test	B1	0-1 year	part time	ability to work from	test			Open	Send Email

Figure 3.16 — Filtered table by vacant role "Manual QA Engineer"

The system compares the skills required for the vacancy selected by the candidate with the skills described by the candidate in the resume, and displays in the table in green those skills that the candidate has that match the required skills, and in red those skills that the candidate does not have (Fig. 3.17).

By clicking the "Open" button, the system opens the candidate's resume PDF file in the adjacent window (Fig. 3.18).

					A	Applicant	informati	on				
All vacancie	s	•										
Show												
Name	Surname	Vacancy	Cover letter	English	Work experience	Type of employment	Importance	Technical skills	Required skills	Email	File	Decline
illia	necheporenko	Manual QA Engineer	test	B1	0-1 year	full-time	ability to work from office	test	 Django Amazon Timestream microservices architecture AWS \$3 	necheporenko illia@gmail.com	Open	Send Email
illia	necheporenko	Senior Python Engineer	test	B1	0-1 year	full-time	ability to work from office	test	Django Amazon Timestream microservices architecture AWS S3	necheporenko.illia@gmail.com	Open	Send Email
Anastasiia	Markova	Manual QA Engineer	test	A2	0-1 year	part time	ability to work from office	It's a perfect company for me. I think the company has a lot of	HTML CSS XML Agile Jira test documentation	markovan97@gmall.com	Open	Send Email

Figure 3.17 — Candidate skills that matched the required skills for the job and those that did not match



Figure 3.18 — Resume of the candidate

Next, let's look at the work of the Telegram bot from the candidate's side.

At the beginning of working with the bot, the candidate clicks the Start button and begins working with the bot. First of all, the bot prompts the candidate to enter their first and last name (Fig. 3.19).



Figure 3.19 — Getting started with the bot

After the user clicks the Confirm button, the user must complete a short survey that looks the same for all candidates (Fig. 3.21).



Figure 3.20 — Description of the selected vacancy sent by the bot

19:36		
<0	cv-checker бот	0
Please, cho	ose level of your English s	skills 19:25
	A1	
	A2	
	B1	
	B2	
Please, cho	ose your work experience	. 19:25
	0-1 year	
	2-3 years	
	3-6 years	
	6+years	
Please, cho prefer.	ose type of employment	you 19:25
	full-time	
	part time	
What's mos	at important to you? 19:25	
abilit	y to work remotely	\checkmark

Figure 3.21 — Poll screen.

Next, the bot offers the candidate to choose the vacancy he needs, after the user selects the vacancy he is interested in, the bot sends a description of the selected vacancy (Fig. 3.20).

After the user has read the description of the selected vacancy, he can choose a new vacancy if he made a mistake and the one he chose earlier does not suit him, or continue working with the selected vacancy.

After the candidate has completed the survey, the system stores the responses sent by the candidate in the database and then displays them in a table.

Next, the candidate is invited to send their resume. The system has several stages of checking the resume for validity.

If a candidate sends a resume with a different first and last name than the one specified at the beginning of working with the bot, then the bot notifies the user about this (Fig. 3.22).



Figure 3.22 — Screen with a message about an incorrect first and last name

If a candidate sends a resume with an incorrect email address, the bot also notifies the user (Fig. 3.23).



Figure 3.23 — Screen with a message about an incorrect email address

If system not finds none errors in resume candidate, it sends the following message to the candidate (Figure 3.24).



Figure 3.24 — Screen with a message about successful submission of resume.

The system also checks whether the submitted resume already exists in the system and sends a message to the user (Fig. 3.25).

19:43		ıII ? ■)
<0	cv-checker ^{бот}	<u> </u>
		test 19:25 🗸
Send your F	Resume as pdf file. 19:25	
	CV_Anastasiia_N rrect name asu	Markova(inco urname).pdf 19:25 🗸
Thanks. You contact you	ur Resume is saved. We w after check 19:	/ill :25
		/start 19:43 //
Enter your r	hame and surname 19:43	
Resume for	Anastasiia Mar this name already existin	rkova 19:43 // g 19:43

Figure 3.25 — Screen with a message that a resume with that name already exists exists in the database

Previously, HR specialists entered data from resumes into the candidate's card manually. Filling in the fields took a lot of time. We wanted to automate this process.

The main goal of the information system was to develop a parser for resume files.

To achieve the goal, the pdfminer library, which works with PDF, was used.

This work used regular expression parsing of resume files using a third-party library, pdfminer [26].

After candidates upload their resumes in PDF format to the HR system, the libraries will convert these files to plain text. The processor extracts data from the text using regular expressions, places them in the appropriate fields of the candidate card, and writes them to the database (Fig. 3.26).



Figure 3.26 — Screen with parsed candidate resume in database

4 SAFETY OF LIFE, BASIC LABOR PROTECTION

4.1. Effects of electromagnetic radiation on the human body

A large body of literature exists on the response of tissues to electromagnetic fields, primarily in the extremely-low-frequency (ELF) and microwave-frequency ranges. In general, the reported effects of radiofrequency (RF) radiation on tissue and organ systems have been attributed to thermal interactions, although the existence of nonthermal effects at low field intensities is still a subject of active investigation. This chapter summarizes reported RF effects on major physiological systems and provides estimates of the threshold specific absorption rates (SARs) required to produce such effects. Organ and tissue responses to ELF fields and attempts to characterize field thresholds are also summarized. The relevance of these findings to the possible association of health effects with exposure to RF fields from GWEN antennas is assessed.

Nervous System

The effects of radiation on nervous tissues have been a subject of active investigation since changes in animal behavior and nerve electrical properties were first reported in the Soviet Union during the 1950s and 1960s.1 RF radiation is reported to affect isolated nerve preparations, the central nervous system, brain chemistry and histology, and the blood-brain barrier.

In studies with in vitro nerve preparations, changes have been observed in the firing rates of Aplysia neurons and in the refractory period of isolated frog

sciatic nerves exposed to 2.45-GHz microwaves at SAR values exceeding 5 W/kg.2,3,4 Those effects were very likely associated with heating of the nerve

preparations, in that much higher SAR values have not been found to produce

changes in the electrical properties of isolated nerves when the temperature was controlled.5, 6 Studies on isolated heart preparations have provided evidence of bradycardia as a result of exposure to RF radiation at nonthermal power densities,7 although some of the reported effects might have been artifacts caused by currents induced in the recording electrodes or by nonphysiological conditions in the bathing medium.8,9,10 Several groups of investigators have reported that nonthermal levels of RF fields can alter Ca2+ binding to the surfaces of nerve cells in isolated brain hemispheres and neuroblastoma cells cultured in vitro (reviewed by the World Health Organization11 and in Chapters 3 and 7 of this report). That phenomenon, however, is observed only when the RF field is amplitude-modulated at extremely low frequencies, the maximum effect occurs at a modulation frequency of 16 Hz. A similar effect has recently been reported in isolated frog hearts.12 The importance of changes in Ca2+ binding on the functional properties of nerve cells has not been established, and there is no clear evidence that the reported effect of low-intensity, amplitude-modulated RF fields poses a substantial health risk.

Results of in vivo studies of both pulsed and continuous-wave (CW) RF fields on brain electrical activity have indicated that transient effects can occur at SAR values exceeding 1 W/kg.13,14 Evidence has been presented that cholinergic activity of brain tissue is influenced by RF fields at SAR values as low as 0.45 W/kg.15 Exposure to nonthermal RF radiation has been reported to influence the electroencephalograms (EEGs) of cats when the field was amplitude-modulated at frequencies less than 25 Hz, which is the range of naturally occurring EEG frequencies.16 The rate of Ca2+ exchange from cat brain tissue in vivo was observed to change in response to similar irradiation conditions.17 Comparable effects on Ca2+ binding were not observed in rat cerebral tissue exposed to RF radiation,18 although the fields used were pulsed at EEG frequencies, rather than amplitude-modulated. As noted above, the physiological significance of small shifts in Ca2+ binding at nerve cell surfaces is unclear.

A wide variety of changes in brain chemistry and structure have been reported after exposure of animals to high-intensity RF fields.19 The changes include decreased concentrations of epinephrine, norepinephrine, dopamine, and 5hydroxytryptamine; changes in axonal structure; a decreased number of Purkinje cells; and structural alterations in the hypothalamic region. Those effects have generally been associated with RF intensities that produced substantial local heating in the brain.

Extensive studies have been carried out to detect possible effects of RF radiation on the integrity of the blood-brain barrier.20,21 Although several reports have suggested that nonthermal RF radiation can influence the permeability of the blood-brain barrier, most of the experimental findings indicate that such effects result from local heating in the head in response to SAR values in excess of 2 W/kg. Changes in cerebral blood flow rate, rather than direct changes in permeability to tracer molecules, might also be incorrectly interpreted as changes in the properties of the blood-brain barrier.

Effects of pulsed and sinusoidal ELF fields on the electrical activity of the nervous system have also been studied extensively.22,23 In general, only highintensity sinusoidal electric fields or rapidly pulsed magnetic fields induce sufficient current density in tissue (around 0.1-1.0 A/m2 or higher) to alter neuronal excitability and synaptic transmission or to produce neuromuscular stimulation. Somewhat lower thresholds have been observed for the induction of visual phosphenes (discussed in the next section) and for influencing the electrical activity of Aplysia pacemaker neurons when the frequency of the applied field matched the endogenous neuronal firing rate.24 Those effects, however, have been observed only with ELF frequencies and would not be expected to occur at the higher frequencies associated with GWEN transmitters. Recent studies with human volunteers exposed to 60-Hz electric and magn.

Electromagnetic radiation can be classified into two types: ionizing radiation and non-ionizing radiation, based on the capability of a single photon with more than 10 eV energy to ionize oxygen or break chemical bonds. Ultraviolet and higher frequencies, such as X-rays or gamma rays are ionizing, and these pose their own special hazards: see radiation and radiation poisoning. By far the most common health hazard of radiation is sunburn, which causes over one million new skin cancers annually.

4.2 Types of hazards

Electrical hazards

Very strong radiation can induce current capable of delivering an electric shock to persons or animals.[citation needed] It can also overload and destroy electrical equipment. The induction of currents by oscillating magnetic fields is also the way in which solar storms disrupt the operation of electrical and electronic systems, causing damage to and even the explosion of power distribution transformers, blackouts (as occurred in 1989), and interference with electromagnetic signals (e.g. radio, TV, and telephone signals).

Fire hazards

Extremely high power electromagnetic radiation can cause electric currents strong enough to create sparks (electrical arcs) when an induced voltage exceeds the breakdown voltage of the surrounding medium (e.g. air at 3.0 MV/m). These sparks can then ignite flammable materials or gases, possibly leading to an explosion.

This can be a particular hazard in the vicinity of explosives or pyrotechnics, since an electrical overload might ignite them. This risk is commonly referred to as Hazards of Electromagnetic Radiation to Ordnance (HERO) by the United States Navy (USN). United States Military Standard 464A (MIL-STD-464A) mandates

assessment of HERO in a system, but USN document OD 30393 provides design principles and practices for controlling electromagnetic hazards to ordnance.

On the other hand, the risk related to fueling is known as Hazards of Electromagnetic Radiation to Fuel (HERF). NAVSEA OP 3565 Vol. 1 could be used to evaluate HERF, which states a maximum power density of 0.09 W/m^2 for frequencies under 225 MHz (i.e. 4.2 meters for a 40 W emitter)/

Biological hazards

The best understood biological effect of electromagnetic fields is to cause dielectric heating. For example, touching or standing around an antenna while a high-power transmitter is in operation can cause severe burns. These are exactly the kind of burns that would be caused inside a microwave oven.[citation needed]

This heating effect varies with the power and the frequency of the electromagnetic energy, as well as the distance to the source. A measure of the heating effect is the specific absorption rate or SAR, which has units of watts per kilogram (W/kg). The IEEE and many national governments have established safety limits for exposure to various frequencies of electromagnetic energy based on SAR, mainly based on ICNIRP Guidelines, which guard against thermal damage.

There are publications which support the existence of complex biological and neurological effects of weaker non-thermal electromagnetic fields, including weak ELF magnetic fields and modulated RF and microwave fields. Fundamental mechanisms of the interaction between biological material and electromagnetic fields at non-thermal levels are not fully understood.

Lighting.

Fluorescent lights.

Fluorescent light bulbs and tubes internally produce ultraviolet light. Normally this is converted to visible light by the phosphor film inside a protective coating. When the film is cracked by mishandling or faulty manufacturing then UV may escape at levels that could cause sunburn or even skin cancer.

LED lights.

High CRI LED lighting.

Blue light, emitting at wavelengths of 400–500 nanometers, suppresses the production of melatonin produced by the pineal gland. The effect is disruption of a human being's biological clock resulting in poor sleeping and rest periods.

EMR effects on the human body by frequency

Warning sign next to a transmitter with high field strengths

While the most acute exposures to harmful levels of electromagnetic radiation are immediately realized as burns, the health effects due to chronic or occupational exposure may not manifest effects for months or years.[citation needed]

Extremely-low frequency

High-power extremely-low-frequency RF with electric field levels in the low kV/m range are known to induce perceivable currents within the human body that create an annoying tingling sensation. These currents will typically flow to ground through a body contact surface such as the feet, or arc to ground where the body is well insulated.

Shortwave

Shortwave (1.6 to 30 MHz) diathermy heating of human tissue only heats tissues that are good electrical conductors, such as blood vessels and muscle.

Adipose tissue (fat) receives little heating by induction fields because an electrical current is not actually going through the tissues.

4.3 Road Transport Safety

The basic strategy of a Safe System approach is to ensure that in the event of a crash, the impact energies remain below the threshold likely to produce either death or serious injury. This threshold will vary from crash scenario to crash scenario, depending upon the level of protection offered to the road users involved. For example, the chances of survival for an unprotected pedestrian hit by a vehicle diminish rapidly at speeds greater than 30 km/h, whereas for a properly restrained motor vehicle occupant the critical impact speed is 50 km/h (for side impact crashes) and 70 km/h (for head-on crashes).

As sustainable solutions for all classes of road have not been identified, particularly low-traffic rural and remote roads, a hierarchy of control should be applied, similar to classifications used to improve occupational safety and health. At the highest level is sustainable prevention of serious injury and death crashes, with sustainable requiring all key result areas to be considered. At the second level is real time risk reduction, which involves providing users at severe risk with a specific warning to enable them to take mitigating action. The third level is about reducing the crash risk which involves applying the road design standards and guidelines (such as from AASHTO), improving driver behavior and enforcement.

4.4 Conclusions

A serious workplace injury or death changes lives forever for families, friends, communities, and coworkers too. Human loss and suffering is immeasurable. Occupational injuries and illnesses can provoke major crises for the families in which they occur. In addition to major financial burdens, they can impose substantial time demands on uninjured family members. Today, when many families are operating with very little free time, family resources may be stretched to the breaking point. Every person who leaves for work in the morning should expect to return home at night in good health. Can you imagine the knock on the door to tell you your loved one will never be returning home? Or the phone call to say he's in the hospital and may never walk again? Ensuring that husbands return to their wives, wives to their husbands, parents to their children, and friends to their friends that is the most important reason to create a safe and healthy work environment. But it isn't the only reason.

CONCLUSIONS

During the development of the master's thesis, all the main aspects of information flows that operate in the field of personnel management were investigated and analyzed. Also, an analysis of the subject area was conducted based on the literary sources indicated in the work, the relevance of the information system that was being developed was determined. Based on the data obtained, a decision was made to develop an information system, due to the high relevance of the selected topic today in the form of a telegram bot and a web page.

The developed information system satisfies all the functional requirements described in the task.: viewing information about vacancies; viewing resume information; the ability to download a resume file to a PC; the ability to process and filter resumes; customer feedback.

In addition, an analysis of existing solutions that are similar in functional requirements to the information system being developed was conducted. After that, an analysis of existing tools and technologies was conducted and the choice of the most optimal solution was justified.

To write the information system, modern tools were used: the Python programming language, the Django web framework. SQLit was chosen as the database in this service, which allowed us to significantly shorten the development process and create a flexible and convenient HR information system that allows the manager to reduce the time spent on data processing and entering primary information.

As a result of the work, software was developed in the form of a telegram bot and a web page based on the example of an office management task, namely: searching for new candidates for an open role in the company, processing resumes, communication with candidate, planning interview on basis results analysis candidates' resumes.

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