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"KHARKIV POLYTECHNIC INSTITUTE"

GUIDELINES

for the implementation of research works by students majoring in 122 "Computer Science"

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INTRODUCTION

A master's research paper is a completed independent and original work that contains a set of research results and scientific positions that the author defends publicly. Such a work must have internal unity, which testifies to the author's personal contribution and ability to conduct independent research, using theoretical knowledge and practical skills.

Violations of research ethics are unacceptable in research, including: falsification of scientific data, incorrect borrowing, violation of the rules of scientific citation, misappropriation of other people's scientific ideas, distortion of scientific facts and ideas of other researchers and the results of one's own research, use of unscientific and academically questionable sources of information, etc.

The content of the work may consist of the results of theoretical and experimental research, development of new technologies, methodological techniques and methods for solving scientific problems in the field of information technology, as well as their theoretical justification.

The research work should demonstrate the author's ability to conduct scientific research independently, using theoretical knowledge and practical skills, to see professional problems, to be able to formulate research tasks, select methods for solving them, plan, organize and conduct research, interpret its results and formulate conclusions.

These methodological recommendations define the general requirements for master's research, their approximate subject matter and structure, the rules of formatting and the procedure for preparing the work for defense.

1 REQUIREMENTS FOR WRITING A RESEARCH PAPER

The structure and content of the research work should be distinguished by the clarity of construction and logical sequence of presentation of the material. When completing the work, the student should pay attention to the accuracy of the wording, which excludes the possibility of subjective and inaccurate interpretation; the specificity of the results presented. The author is obliged to ensure the novelty of the material, its scientific value, completeness of coverage of the issues under consideration, correct citation of the material used and references to sources. In accordance with the existing scientific etiquette, the formulation of opinions in the work is carried out in the third person: "we believe", "in our opinion", etc.

The main stages of preparing and performing a research work are:

- selecting and approving a topic;
- drafting and approval of the research task;
- studying the research problem and reviewing the literature;
- conducting research;
- processing and presentation of research results;
- registration of research and development;
- defense of the research work before the Examination Commission (EC).

1.1 Choosing a research topic

The research topic should reflect the main idea, tasks and provisions to be investigated. The criterion for choosing a research topic is its relevance to current trends in the development of science and technology in a particular field of activity.

The title of the topic should be clear, concise and contain an unambiguous interpretation. The topic of the research work should contain no more than 15 words.

Research topics are considered and approved at a meeting of the department. Research topics are related to the topic of the master's thesis, which is approved by the order of the rector of the university.

1.2 Procedure for performing research work

A faculty member with a doctorate or PhD degree, academic rank of professor or

associate professor is appointed as the head of the research project.

With the active participation of the student, the research supervisor draws up the task (Appendix B) for the master's thesis, which is approved at a meeting of the department.

1.3 Components of research work

The NDR includes an explanatory note and a presentation (demonstration material) for presentation at the EC meeting.

The explanatory note is executed in the state language. The recommended volume of the main part of the explanatory note of the research work (Sections 1-2 and 3-4 of the master's thesis should be at least 30 pages of printed text (computer typing), which does not include the introduction, conclusions, list of references and appendices.

The explanatory memorandum must be clearly structured and comply with the requirements for formatting and include:

- cover sheet (see Appendix A);
- assignment for the master's research work (see Appendix B);
- abstract in Ukrainian and English (see Annex C);
- a list of symbols (if necessary) (see Annex D);
- content (see Appendix D);
- Introduction (2-3 pages);
- the main part, which includes, usually two sections consisting of paragraphs and subparagraphs;
- Conclusions;
- a list of information sources (see Appendix E);
- applications.

The title page is the first page of the research paper and contains the following information:

- Name of the ministry, educational institution, research institute, department;
- the topic of the research work;
- surname, name, patronymic of the author, course, group;
- name, initials of the supervisor, his/her academic title and academic degree,

position held;

– place and year of writing.

Page numbering on the title page is not required, but is included in the general numbering.

The research assignment is the second page of the qualification paper and contains the following information:

– information about the topic of the work;

– grounds for the work;

– the purpose and input data for the work;

– expected scientific results;

– requirements for work performance;

– stages of work performance;

– realization of results and efficiency;

– additional requirements.

The assignment is signed by the supervisor, master and approved by the head of the department (Appendix B).

The **abstract** should be written in Ukrainian and English, be 1 page in length, and contain a general description of the task, the work performed, and a description of the results obtained (Appendix C). The presentation of the material in the abstract should be concise and accurate. You should use syntactic constructions inherent in the language of business documents and avoid complex grammatical phrases. Standardized terminology should be used and little-known terms and symbols should be avoided.

The abstract should contain:

– information on the length of the document (explanatory note);

– the object of research;

– subject of research;

– the purpose of the research work;

– research methods;

– scientific novelty;

– a list of keywords.

Information on the volume of the document (explanatory note) contains

information on the total number of pages, number of illustrations, tables, appendices, number of sources according to the list of references (information is given, including data from appendices).

The object of research is a process or phenomenon that creates the problem situation studied by the author and exists independently of the researcher.

Example:

– The object of research is the process of quality assurance in the creation and production of high-tech products;

– The object of research is the processes of network interaction, characteristics of elements in the infrastructure of a wireless sensor network.

– The object of research is the process of receiving, transmitting and processing information in automated control systems of the gas transportation system.

The subject of research is a mathematical model of a problem or regularities of the functioning and development of an object, its qualities, properties, etc. The subject of research is contained within the object.

Example:

– The subject of the research is models and methods for creating and selecting cloud system architecture;

– The subject of the study is models, methods and information technology for quality assurance in the creation and production of high-tech products.

The purpose of the research work is to solve a set of applied problems in accordance with the generalized object of activity based on the application of a system of theoretical knowledge and practical skills acquired during the entire period of study.

Example:

– The aim of the work is to increase the availability of cloud services based on client-server and peer-to-peer distributed cloud architecture;

– The aim of the work is to improve the energy efficiency of using autonomous energy sources of modern portable computers and increase the duration of their autonomous operation;

– The goal of the work is to increase the efficiency of the e-commerce site as a commercial project, to increase the number of users, potential buyers, and to grow in the TOP according to all the rules of search engines.

Research methods. This section lists the scientific approaches that were used to achieve the goal set in the paper. The description of each method should be related to the content of the work, i.e., it should briefly but essentially describe what tasks were investigated using a particular method.

Example:

1 The research methods are based on the basic principles of system analysis, functional analysis, theory of multidimensional data models, and database theory. The methods of structural modeling, theoretical foundations of designing relational and multidimensional databases, theoretical foundations of building data warehouses, the basics of multidimensional and intelligent data analysis were used.

2 Research methods. Methods and tools of set theory were used to model data structures. The methods of probability theory and mathematical statistics were used to evaluate the time efficiency of data structures.

Scientific novelty is a scientific result that is evaluated according to the following criteria: first obtained, improved, further developed. The scientific novelty must indicate what the results allow for. Scientific novelty is written in the following sequence: first, improved, further developed.

Example:

The scientific novelty is that:

– For the first time, a method of providing access to the services of a distributed cloud system was obtained, which allows to increase the efficiency of response to a request with an increase in the number of users;

– For the first time, a model of autonomous operation of a portable computer for energy-saving planning was developed, which allows planning by solving an optimization problem;

– a mathematical model of network performance was improved, which allows for efficient management of network traffic regardless of the number of network elements;

– The information technology for managing the energy consumption of laptop computers was further developed in terms of creating models and methods for developing energy-saving software.

A keyword is a word or a stable phrase from the text of the abstract that carries a semantic load from the point of view of information search. The list of keywords should

reflect the main content of the paper out of context. The total number of keywords should be no less than five and no more than fifteen.

Key words are given in the nominative case, printed in a line, separated by commas.

Example:

Keywords: GENETIC PROGRAMMING, DIRECT CODING, INDIRECT CODING, CROSSING, MUTATION, GENETIC OPERATIONS.

The list of symbols **and abbreviations** contains explanations of special designations, symbols, little-known abbreviations, units of measurement, etc. used in the text of the report. This list should be drawn up on a separate sheet of the report in the form of a list, in which the symbols are given in alphabetical order on the left after the paragraph indent, and their full interpretation on the right. The Ukrainian alphabet symbols are given first, followed by the Latin and Greek alphabets.

An example of a list of symbols is provided in Annex D.

The content of the research work is determined by its topic and is reflected in the plan approved by the supervisor, placed after the title page.

The table of contents contains the titles of all sections, subsections, and paragraphs, if they have a title (introduction, main body, conclusions, list of references, and appendices) listed in sequence. The table of contents does not include assignments, abstracts, or a list of symbols and abbreviations.

The names of all structural parts of the report in the table of contents should be written in lowercase letters with the first capital letter, the names of sections, subsections and paragraphs should be written together with their serial numbers, and the names of appendices should be written together with the corresponding designations and titles.

The endings of element names are separated from page numbers by periods.

An example of the table of contents is provided in Appendix D.

The introduction of a research paper should contain information about the scientific problem to be solved and the current state of its research. On the basis of this information, the relevance of the chosen topic is substantiated, the scientific novelty and practical significance of the work are indicated.

The relevance of the topic is presented in the form of a critical analysis and directions for solving the problem, as well as a justification for the need for research.

The purpose and objectives of the study should be clearly stated and reflect the

subject matter of the study.

The object of research is the process or phenomenon that creates the problem situation selected for study (see page 8).

The subject matter of a research paper is a mathematical model of a problem or regularities of the functioning and development of an object, its qualities, properties, etc. The subject of research is contained within the object (p. 8).

The introduction describes the methods used to find solutions to the tasks set and the research conducted.

The introduction may contain information about the approbation of the results of the work: titles of articles, abstracts prepared on the basis of the work, speeches at scientific and practical conferences.

It is necessary to note the scientific novelty or practical significance of the work. The elements of scientific novelty should be generalized and contain the author's own conclusions and recommendations on the subject of the study.

Practical value should include the results of independently conducted research that can be implemented in production, activities of enterprises, institutions and organizations.

In the introduction, you can describe the structure of the paper, indicating the number of chapters and their brief descriptions.

The length of the introduction should be 2-3 pages and have the following structure:

- relevance of the topic;
- the purpose and objectives (or objectives) of the study;
- the object of research;
- subject of research;
- research methods;
- scientific novelty;
- practical significance;
- personal contribution of the author;
- structure and scope of the thesis;

The text of the introduction is not divided into paragraphs. The introduction does not include figures, tables, etc.

The main part of the explanatory note of the research work should contain the statement of the problem, a description of the developed mathematical model, justification

of the research methodology, a description of the applied algorithms for solving the problem, the results of computational experiments, comparative assessments of the developed algorithms with others known in the scientific literature, as well as a comprehensive analysis of the results and patterns obtained.

The main part of the research work consists of sections (theoretical and methodological, research and analytical, design and recommendation) and subsections, which should be interconnected, and the material should be presented consistently and logically, with a critical analysis of theoretical positions, statistics, information of various kinds, etc.

The first section of the main part discusses the theoretical and methodological aspects of the problem under study, an analytical review of the literature on the subject of scientific research, critically analyzes different views, provides their scientific classification, the main factors influencing the state and development of the object under study, etc. The theoretical justification, essence, significance, classification characteristics, history and development trends of the research subject, methodological approaches should have elements of polemicism, reveal the author's own position on the research subject, which creates the preconditions for conducting the author's own research in the next section.

To state and substantiate general theoretical conclusions and trends, it is advisable to use data published in relevant encyclopedias, monographs, reference books, foreign sources and publications. If the work is of a theoretical nature, it is advisable to formulate a mathematical model and review the mathematical methods used to solve the problem in the first section. In addition, you can provide examples of approaches to solving similar problems in the past, drawn from the literature.

If the work is of an applied nature, it is advisable to conduct a systematic analysis of the subject area and a detailed description of the system components in the first section.

In the second section, the student, using factual material and collected information, analyzes and reveals the content of the issues to be addressed. In this section, system connections and algorithms for solving local problems are designed. For this purpose, both the author's own research (conducted earlier in the qualification work, research papers, etc.) and ideas, methods and algorithms presented in textbooks, manuals, scientific articles and monographs are used.

If the work is theoretical, it is advisable to provide the latest scientific ideas in this field and examples of relevant calculations in this section.

If the work is of an applied nature (e.g., information and reference or control and training systems), it is advisable to provide a solution algorithm, a sufficient number of tables and diagrams illustrating the problems under study and the methodology for solving them.

The third section contains several interconnected subsections, which provide specific scientifically based proposals and innovative projects.

In this section of the thesis, it is necessary to highlight the essence of the author's original ideas and scientific developments. The third section should describe the developed program in detail and provide instructions for its use.

The fourth section is devoted to the evaluation and research of the approach proposed by the author. It is necessary to present the results of your own research, which illustrate the practical value of the author's methodology and allow you to compare it with other methods. It is advisable to illustrate the calculations with graphs and diagrams.

Each chapter ends with a summary of the conclusions regarding the results of scientific and applied research presented in it.

In the conclusions after the first section, it is necessary to formulate the main tasks to be solved in this paper.

The conclusions of the research and development work should contain the results of the research, the scientific and practical results obtained, and recommendations for their scientific and practical use. If there are any scientific developments, information about them should be indicated in the conclusions.

The formulation of conclusions should be based on the materials of the main part of the work in accordance with the tasks set. In this paragraph, the author analyzes his or her own contribution to the solution of the problem, formulates final conclusions, suggestions and recommendations for the practical use of the results obtained. The conclusions should answer the question: "What has been done in the work?" and "What has it done in comparison with other known results?". The conclusions should indicate the quantitative characteristics of the results obtained. Tables, figures, and formulas are not included in the conclusions.

The list of sources of information, according to the applicable standards, includes

sources referenced in the textas well as those used in the presentation of specific scientific provisions. The sources of information may include books, articles, dissertations, monographs, regulatory and technical documents, technical and economic standards, Internet information resources, etc. The list of references is presented in the original language in the order in which the source is mentioned in the master's thesis.

Appendices must contain supporting materials: tables, figures, results of intermediate calculations, program source code, illustrations, copies of documents, etc.

The appendices must be placed in the order in which they are referenced in the text of the master's thesis explanatory note. Appendices are numbered with capital letters of the Ukrainian alphabet in the upper right corner, for example, "Appendix A" except for the letters G, E, F, G, I, J, O, O, Ch, B .

Tables, figures and formulas in the appendices are numbered as follows:

– Tables - the entry is made above the table on the left side with a paragraph indentation of the text, for example, "Table A.1" - Table 1 of Appendix A;

– Figures - record in the center, under the figure "Figure - A.1";

– formulas - respectively "(A.1)".

2 REQUIREMENTS FOR THE EXPLANATORY NOTE

2.1 General provisions

The explanatory note of a research paper must meet the general requirements for research papers in accordance with state standards:

– DSTU 3008-2015 "Information and Documentation. Reports in the field of science and technology. Structure and rules of preparation";

– DSTU 1.5-2015 "National Standardization. Rules for the development, presentation and execution of national regulatory documents".

The text of the research paper should be drawn up on a computer in the Microsoft Word text editor, on A4 sheets (210x297 mm) with a line spacing of 1.5 pt.

The following page margins are set: 30 mm on the left, 15 on the right, and 20 mm at the top and bottom.

The font used for typing is Times New Roman, size - 14 pt. The font should be clear, the color should be black, and the text density should be the same.

Paragraphs in the text of the research paper should be clearly marked - 12.5 mm. No additional distance between paragraphs, except for the established line spacing, is set. It is not allowed to highlight text fragments in other fonts, colors, underlining, etc., except in specially indicated cases (section titles, subsections, code, footnotes).

The text of the main part of the master's thesis is divided into sections and subsections. Each section should start on a new page.

Titles of the structural parts of the master's : "ABSTRACT", TABLE OF CONTENTS", "LIST OF SYMBOLS AND ABBREVIATIONS", "INTRODUCTION", "CHAPTER", "CONCLUSIONS", "LIST OF REFERENCES", "APPENDIX" are printed in capital letters in the center of the page. Headings of structural parts should be bolded.

The distance between the heading of a section and a subsection or subsequent text is 1 free line. The distance between the heading of a subsection and the heading of a paragraph, between the heading of a subsection (paragraph, subparagraph) and the subsequent text should be the same as in the text. The distance between the preceding text and the headings of subsections, paragraphs, subparagraphs is regulated as follows:

– leave one free line between the previous text and the subsection heading;

– the distance between the preceding text and the heading of the paragraph

(subparagraph) should be the same as in the text.

The titles of subsections, paragraphs, subparagraphs are printed in lowercase letters with the first capital letter in bold and indented. Do not put a full stop at the end of the heading. If a heading consists of two or more sentences, they are separated by a period.

Pages, sections, subsections, paragraphs, subparagraphs of figures, tables are numbered in Arabic numerals without the "#" sign.

The pages should be numbered through and in Arabic numerals in the upper right corner of the page. The font size of the numbering is 14 pt.

The section heading is printed on a new line in the center, in capital letters, in bold. Each section starts on a new page. Sections are numbered throughout the document; no period is placed at the end of the number, for example, "1 ANALYSIS OF THE SUBJECT AREA OF THE INFORMATION SYSTEM PROJECT".

Subsections of the report are numbered within the same section. The subsection number consists of the section number and the subsection number, separated by a dot, for example, "1.1" or "2.1". No period is placed at the end of the subsection number. Accordingly, paragraphs are numbered within the subsection, for example, "1.1.1", "1.1.2" or "2.1.1", "2.1.2"; subparagraphs are numbered within paragraphs, for example, "1.1.1.1", "1.1.1.2".

The first page of the paper is the title page, which is included in the general page numbering. The pages are numbered starting with the "TASK" page and ending with the last page of the .

The table of contents should correspond to the work plan. On the page with the table of contents, opposite each component of the research work, page numbers are put, which indicate the beginning of the material.

The title page must bear the signature of the author and chapter supervisors, which certifies that the master's thesis is accepted for defense.

Before the defense, the master's student fully assembles the work in accordance with the structure and binds it together with published articles and conference abstracts in a hardcover.

2.2 Formatting mathematical formulas

When designing mathematical formulas, the following style should be followed: font

typeface - Times New Roman (Cyr) 14 pt, font - normal, indentation - 0.5 cm, equations - in the center, tabulation - on the right edge.

To set formulas, use the Microsoft Equation 3.0 formula editor, setting the following parameters: uppercase, lowercase Greek letters and symbols - Symbol font, others - Times New Roman Cyr. Sizes: normal - 14 pt, large index - 8 pt, small index - 7 pt, large symbol - 18 pt, small symbol - 14 pt.

When using formulas, you must follow certain technical and spelling rules. You may write simple or auxiliary formulas inside the text. The main formulas are placed on a separate line.

To save space, several short formulas of the same type, separated from the text, can be presented in one line.

If an equation does not fit on a single line, it should be moved after the equal sign (=) or after the plus (+), minus (-), multiplication (x), and division (:) signs. Only those formulas that are referenced in the following text should be numbered; it is not recommended to number the rest.

Formulas are numbered within a section. The formula number is specified in Arabic numerals and consists of the section number and the sequential number of the formula in the section, separated by a period.

The number of the formula is indicated at the level of the formula in round brackets, in the last legal position, for example, (2.1) (the first formula of the second section). The number that does not fit on the line with the formula is transferred to the next line below the formula. The number of the formula when it is moved is placed at the level of the last line. If the formula is in a box, the number of such a formula is written on the outside of the box on the right side opposite the main line of the formula.

References to formulas are given by the serial number of the formula in parentheses, for example: "... in formula (2.1)". Explanations of the meanings of the symbols and numerical coefficients of the formula are given below it in the sequence in which they appear in the formula. The value of each symbol and numerical coefficient is written on a new line, starting with the word "where" without a paragraph and colon.

Each formula is separated from the text by a single line before and after the formula. If the formulas follow one another, the distance between them should be the same as in the text. If the formula is followed by an explanation that begins with the word "where," the

distance between the formula and the explanation and the explanation and the subsequent text should be the same as in the text.

Example:

$$\pi_k(v_i) = \sum_{j=1}^{m} \pi_j(x_i, v_j) \quad (2.1)$$

where $\pi_k(v_i)$- is the semantic significance for each set v_i

$\pi_j(x_i, v_j)$ -semantic significance of element x_i in context of set of elements v_j

2.3 Design of graphic materials

Graphic materials include charts, graphs, diagrams, bar charts, etc. These illustrative materials are labeled with the word "Figure" and numbered consecutively within the section. The number, title of the figure, or explanatory caption should be placed sequentially, separated by a period, for example: Figure 2.1 (the first figure of the second section), except for the figures presented in the appendices. The figure caption is placed in the center, under the figure, and no period is placed at the end. The figure and its caption should be placed on the same page. Figures should be placed immediately after the text where they are mentioned for the first time or on the next page.

All figures in the text of the master's thesis should be referenced either in brackets (Fig. 2.1) or by context, for example, "... as shown in Fig. 2.2". Vertical placement of figures in a clockwise direction is allowed. Figures larger than A4 are recommended to be placed in appendices.

Figures are separated from the main text at the top and bottom by a single blank line.

Example:

– illustration design:

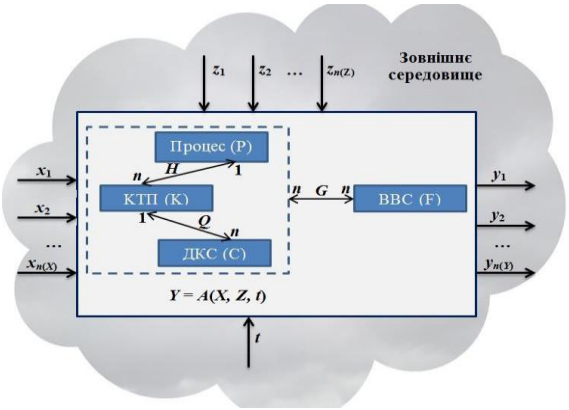

Figure 2.1 - Graphical representation of the mathematical model of diagnostics of the maintenance and SCADA operation

– design of the schedule:

Figure 2.2 - Graphs of the dynamics of changes in the number of states of the TOC control system

2.4 Designing tables

As a rule, digital material is organized in tables. The table should be placed immediately after the text in which it is mentioned for the first time or on the next page. When transferring a table to the next page, do not repeat the thematic heading, but write "Continuation of Table 1.1" and repeat the numbering on the next page, above the last part of the table - "End of Table 1.1".

All tables should be referenced in the text. The word "table" is abbreviated in the

text, for example: "...in Table 2.1". In repeated references to tables and illustrations, the word "see" is abbreviated, for example: "see Table 2.1".

Each table has a thematic heading above it, which is placed above the table on the left side of the text, indented. If there is no numerical or other data in a certain line of the table, put a dash in it. The numbers in the table cells should be placed so that the corresponding digits in the entire column are located one below the other.

Each table should be accompanied by a brief analysis or commentary. Tables should be separated from the main text by a single blank line at the top and bottom.

An example of a table design.

Table 2.1 - Table of parameters of the object-classification model for diagnosing the SCADA system operation

Model parameter	Description.	№ formulas
1	2	3
P	Process (a program module that runs on a system-forming node as part of SCADA system software)	2.1
P	The set of all processes (software of the agricultural SCADA system)	2.1
$n(P)$	Number of processes of the SCADA software	2.1

Continuation of Table 2.1

2	3	4
2^P	The set of all subsets of processes in the software Agricultural SCADA systems	2.12
P_z	Some arbitrary subset of processes in the Agricultural SCADA system software	2.12

K	Process control point (PCP)	2.2
K	Multiple process control points	2.2

3 PROCEDURE FOR PREPARING AND DEFENDING A RESEARCH PAPER

3.1 Preparing a research paper for defense

The research work is submitted to the supervisor for review within the time limits specified in the assignment for its implementation. The supervisor provides feedback on the research work, which determines: the relevance of the research; the effectiveness of the methodology used; the level of application of theoretical knowledge acquired in the course of training and preparation for research; the ability to independently solve scientific and practical problems; the ability to present material logically, consistently, reasonably and draw conclusions; the prospects of the proposed recommendations and conclusions; shortcomings of the work (if any).

3.2 Protection of research work

The defense of the master's thesis takes place in public at a meeting of the EC, the composition of which is approved in accordance with the established procedure. The student prepares a report and illustrative material for the presentation.

The following documents, executed in accordance with the requirements, are attached to the student's research and development defense:

- explanatory note;
- a presentation containing illustrations to the report;
- the R&D evaluation form (Appendix P);
- feedback from the research supervisor (Appendix K);

During the defense, the student:

- clearly presents the topic, goal and objectives of the research project;
- emphasizes its relevance and novelty;
- formulate the task statement;
- explains the essence of the methods used to solve the problem and justifies their choice;
- presents and explains the developed algorithm (method);
- justifies the use of software tools;
- defines the users of the software system, the level of access and functions of

the system provided to each user;

– describes the input and output information for each task implemented in the system;

– demonstrates and explains the key parts of the dialog between the software system and the user and the results of solving all the tasks;

– formulate conclusions about the work performed.

The student's report at the defense lasts up to 10 minutes. After the report, the student gives comprehensive answers to the questions of the EC, reasonably and persistently defends his or her point of view.

After the defense, the EC members discuss its results at a closed meeting and make a decision on the evaluation of each research paper defense.

3.3 Evaluation criteria for the master's thesis

The author of the research project must demonstrate the skills:

– present material in a logical and reasoned manner;

– correctly use statistical, mathematical and other methods;

– conduct their own research; have the skills of generalization

– formulate conclusions

– work with information sources;

– initiate and justify innovative approaches and directions for solving the problem under study.

The quality of its execution and design, the novelty and significance of the results obtained, the presentation of the master's thesis and the completeness of its answers to the questions are taken into account when evaluating the work.

LIST OF INFORMATION SOURCES

1 Requirements for the preparation of dissertations and dissertation abstracts // Bulletin of the Higher Attestation Commission of Ukraine. - 2011. - No. 9/10. - P. 2-10.

2 DSTU GOST 7.1:2006. System of standards for information, library and publishing. Bibliographic record. Bibliographic description. General requirements and rules for compilation (GOST 7.1-2003, IDT)". Effective as of July 01, 2007.

3 STVO-HPI-3.01-2021 SSONP. Text documents in the field of educational process. General requirements for implementation. Valid from 01.01.2022.

4 STVO-KHPI-2.01-2021 SSONP. Diploma projects and theses. General requirements for execution. Effective from 01.01.2022.

5 Methodical recommendations for writing, designing and presenting student research papers of students - members of the Small Academy of Sciences of Ukraine / G.G. Pivnyak, L.M. Korotenko, I.M. Udovyk, E.M. Holovnya - D.: SHEI "National Mining University", 2017. - 24 p.

6 Methodical recommendations for the implementation of qualification works of bachelors of the training direction 6.050101 "Computer Science and /, L.M. Korotenko, O.S. Shevtsova; National University of Dnipro Polytechnic - D : NTU "Dnipro Polytechnic", 2018. - 65 p.

7 Methodical recommendations for master's qualification work for students of specialty 122 "Computer Science" In: O.I. Artemenko, B.M. Gatz, V.G. Vershyhora, S.I. Osadchuk - Chernivtsi: 2022, Bukovinian University, 2022. - 46 p.

8 Methodical recommendations for the implementation of qualification works of bachelors of **the** training direction 6.050103 "Software Engineering" / O.S. Shevtsova, I.M. Udovyk, L.M. Korotenko; National University of Dnipro Polytechnic - Dnipro: NTU "Dnipro Polytechnic", 2018. - 65 p.

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higher education of full-time and part-time forms of education / O.P. Ostapchuk, T.P. Tsvetkova - Rivne: NUHPG, 2018. - 28 p.

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14 SIS NSU NMZ - 05. Regulatory and methodological support of the educational process. 2005 - 08 - 05. - D. : NSU, 2005. - 139 p.

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APPENDIX A

An example of the title page of a paper

MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE

NATIONAL TECHNICAL UNIVERSITY
"KHARKIV POLYTECHNIC INSTITUTE"

Institute (Faculty) of Computer Science and Software Engineering
Department of Software Engineering and Intelligent Control Technologies
122 Computer science
Educational Computer science and intelligent systems

RESEARCH AND DEVELOPMENT WORK

second (master's) level of higher education

On the topic Research, design and development of software components for the system of classification of objects in traffic

Performed by a 6th year student of the group KN-H423 .
_____ Anton SHPYPUNOV
(signature, surname and initials)

Head of _____ Oleksandr Shmatko
(signature, surname and initials)

National scale
Number of points_____ ECTS score
Commission members _____
(signature, surname and initials)

_____
(signature, surname and initials)

_____
(signature, surname and initials)

Kharkiv 2024

APPENDIX B

An example of a research assignment

MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE

NATIONAL TECHNICAL UNIVERSITY
"KHARKIV POLYTECHNIC INSTITUTE"

Institute (Faculty) of Computer Science and Software Engineering
Department of Software Engineering and Intelligent Control Technologies
122 Computer science
Educational program Computer science and intelligent systems

TASKS

for research and development work

On the topic Research, design and development of software components for the system of classification of objects in traffic

Summary of the work:

1 Abstract part. General characteristics of modern problems and aspects of the software development process.

2 Theoretical part. Review of similar software, choice of a method for solving the problem.

3 Practical part. Designing a software solution.

4 Experimental part. Development and research of a software solution.

Date of issue of the task: 03.09.2024 Defense date: 11/26/2024

Head of the course work: Alexander Shmatko

APPENDIX B

An example of an abstract

ABSTRACT

Explanatory note to the research work: 86 pages, 36 figures, 2 tables, 4 appendices, 63 sources.

Keywords: VEHICLE IDENTIFICATION. ARTIFICIAL INTELLIGENCE, MACHINE LEARNING. TRAFFIC ANALYSIS

Object of study: automobile traffic recorded by a camera from a dashboard camera installed on a vehicle. **Subject of research:** methods of artificial intelligence, neural networks and models from combinations of neural networks used to identify physical objects, in particular vehicles that can be uniquely identified by license plate, and neural networks and methods that can be used to determine the text of the license plate as accurately as possible. **The purpose of the research work: to** improve the accuracy of vehicle recognition and identification by license plate by designing and developing software components for a traffic analysis system using machine learning algorithms.

Research methods. To solve the tasks, the following methods were used: data analysis, pattern recognition theory from the field of computational intelligence, fuzzy set theory, object-oriented analysis and design. **The scientific novelty of** the research results is determined by the fact that the pattern recognition model for classifying vehicles in a video stream has been improved, which has improved the accuracy of vehicle recognition and identification using license plates.

ABSTRACT

Explanatory Note to the Research Work: 86 pages, 36 figures, 2 tables, 4 appendices, 63 references.

Keywords: VEHICLE IDENTIFICATION, ARTIFICIAL INTELLIGENCE, MACHINE LEARNING, TRAFFIC ANALYSIS.

Object of the Research: Automotive traffic recorded using a video camera mounted on a vehicle's dashboard camera. **Subject of the Research:** Artificial intelligence methods, neural networks, and models combining neural networks used for identifying physical objects, particularly vehicles that can be uniquely identified via license plates, as well as neural networks and techniques that can enhance the accuracy of license plate text recognition. **Objective of the Research Work:** To improve the accuracy of vehicle recognition and identification via license plates by designing and developing software components for a traffic analysis system utilizing machine learning algorithms.

Research Methods: The tasks were addressed using methods of data analysis, pattern recognition theory from the field of computational intelligence, fuzzy set theory, and object-oriented analysis and design. **Scientific Novelty:** The scientific novelty of the research outcomes lies in the enhancement of a pattern recognition model for classifying vehicles in video streams, which has led to improved accuracy in the recognition and identification of vehicles via license plates.

APPENDIX D

An example of a list of symbols

LIST OF SYMBOLS AND ABBREVIATIONS

DATABASE - database;

GA - genetic algorithm;

GIS - geographic information system;

GISPR - a geographic information system for decision-making support;

MNC - least squares method;

SPPR - decision support system;

HTTP - Hypertext Transfer Protocol,
used to exchange information between clients and web servers;

IDE – (Integrated Development Environment is an integrated development environment that combines tools for writing, testing, and debugging code;
- Unified Modeling Language.

APPENDIX D

Example of a table of contents

TABLE OF CONTENTS

APPENDIX E

Creating a list of information sources

Bibliographic descriptions of information sources are made in the form in which they are presented in the source (on the title page, back of the title page, or other elements of the document containing the original or similar information), taking into account the requirements of DSTU GOST 7.1.

The abbreviations of words in the bibliographic description should correspond to: in Ukrainian - DSTU 3582, in foreign European languages - DSTU 7093.

In general, a bibliographic description of an information source (IS) can be presented as follows [3]:

Main title: information related to the title/responsibility information. - Information about the publication. - Area of specific information. - Place of publication: Name of publisher, year of publication. - Issue number (for serial publications). - Physical characterization area.

The elements of bibliographic description and punctuation are drawn up in accordance with DSTU GOST 7.1, taking into account the simplifications defined in DSTU 8302, in particular:

– the title should contain information about one, two or three authors, and the names of these authors should not be repeated in the information about responsibility (with a slash);

– if necessary, you can specify more than three names of authors in the title;

– instead of the dot and dash (";-") sign that separates the zones of a bibliographic reference, it is recommended to use the full stop sign (punctuation marks should be unified within the same document);

– information not taken from the title page of the document may not be enclosed in square brackets;

– it is allowed not to indicate the general designation of the material after the title ("Text", "Electronic resource", "Maps", "Notes", etc.);

– the name of the publisher may not be indicated in the source data;

– in the information about the physical characteristics of the document, you can specify either the total volume (for example: 285 p.) or the page number where the reference object is located (for example: P; 19);

– information about the series and the International Standard Number (ISBN, ISMN, ISSN) may be omitted.

Some examples of bibliographic references in a list:

1 Methodical instructions for the implementation of the economic feasibility study of the project for the development of software for the bachelor's degree thesis / V. Moskalenko, O. Shmatko, N. Fonta - Kharkiv: NTU "KhPI", 2022. - 35 p.

2 STVO-HPI-3.01-2021 SSONP. Text documents in the field of educational process. General requirements for implementation. Valid from 01.01.2022.

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APPENDIX G

Feedback from the supervisor

MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE

NATIONAL TECHNICAL UNIVERSITY
"KHARKIV POLYTECHNIC INSTITUTE"

Institute of Institute of Computer Science and Information Technology

Department of Software Engineering and Intelligent Control Technologies
122 Computer science

Educational Computer science and intelligent systems

REVIEW

for a research work of the second (master's) level of higher education on the topic "_____"

студента(ки) групи_____
(last name, first name'me, patronymic)

The author of the research paper must receive a written review from the department's supervisor. It is recommended to print the review of the supervisor of the research work in the following form:

- relevance of the topic;
- the degree of scientific and practical significance of the work;
- the level of student's preparation for professional duties;
- the degree of independence in the course of completing the thesis;
- the novelty of the issues raised and the originality of their solution;
- degree of mastery of research methods;
- completeness and quality of the topic development;
- logical, consistent, reasoned, literary literacy of the material presentation;
- the possibility of practical application of the qualification work and its individual parts;
- conclusion on the possibility of admitting the research work to defense in the examination committee.

Head of Research and Development _____
(first and last name)

APPENDIX K

Research work evaluation form

RESEARCH WORK EVALUATION FORM

Студент _____

(last name, first name, patronymic)

Evaluation criterion	Points.	Member points EC
Compliance with the requirements for a master's degree work:	**60 points**	
Structural and logical organization of the work, relevance and novelty	5	
Design of the work (diagrams, tables, formulas, codes, figures, literature) in accordance with the requirements of the standard	5	
Section 1 (level of theoretical research)	10	
Section 2 (depth and quality of practical research)	15	
Section 3 (level of program implementation, developments and proposals)	15	
Section 4 (depth and quality of the experimental study)	10	
Conclusions.		
Protection of work:	**30 points**	
Quality of the report (clarity, logic in presentation of the material)	10	
The quality of answers to the questions (mastery of material)	10	
Quality of visual materials (presentations)	10	
Manager's assessment	**5 points**	
Participation and prizes in competitions, availability of scientific publications	**5 points**	
Total (maximum number):	**100 points**	

Educational edition

Guidelines
for the implementation of research work
by students majoring in 122 "Computer Science"

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