



Application of Flexible Industrial Park in the Scientific Technology Park of Sumgait State University of Azerbaijan

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Authors' contributions

This work was carried out in collaboration between all authors. Author EG organized research procedures and defined the basis direction of the paper. Author JM carried out scientific works by designing innovation projects and applied them in the technology park. Author GG wrote the protocol, and wrote the first draft of the manuscript and managed literature searches. Authors EG, JM, GG managed the analyses of the study and literature searches. All authors read and approved the final manuscript.

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ABSTRACT

As a result of analysis of international experience of technology park creation in the developed foreign countries it was proffered the structural scheme of the stages realization by creation of scientific - technology park at the Sumgait State University in Azerbaijan. There were chosen the base profiles of the scientific technology park at the Sumgait State University, proffered the new projects for their application in the park.

It was proffered the structural scheme of flexible industrial park at the scientific technology park for the new innovative projects output of different setting. For computing control of flexible industrial

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park of the scientific - technology park at the Sumgait State University, option of types of industrial robots, their sensor elements and controlling system was executed. On an example of the loading manipulator and its controlling elements it was proffered the automation scheme of the flexible manufacture module.

Keywords: Scientific - technology park; higher educational establishments; innovative projects; flexible industrial park; control system; sensor.

1. INTRODUCTION

At present for development of national economy and rising scientific-technical potential in Azerbaijan some important innovative works in many areas of industry and education execute. For realization of model of innovative development one of the priority area is technological parks which work in a complex with higher educational establishments, scientific research centers, manufacture systems and business incubators [1]. For definition of scientific-research directions, effective use of scientific potentials, application of new projects [2] at local and international markets, creation of technical parks [3] at higher educational establishments is actuality scientific problem.

The analysis of the technology parks, which are located in cities, showed that 59% of them (or 44% of all technoparks in the world) are in the small cities. In Europe this index is 71% of all cities technoparks (53% of all European technoparks). In Central Europe these indexes are yet higher, it is explaining by high closeness of urban population. In the Eastern Europe most of technoparks is located in the megalopolis. Technoparks and scientific parks is created mainly on a base or in close proximity of scientific and educational establishments. So, 48% of all technoparks of the world is located on territories of universities and research centers, like a variant is on earth place in their property.

As known, priority scientific directions for technology parks at the higher educational establishments are new information technology, computer aided design, electromechanical, chemical and physical sciences which provide theoretical and practical learning at laboratory conditions by means of the scientific methods and models. For effective realization of the innovative projects in technology park, choice of high qualified experts-engineers on the base of the open forums and independent expert groups is necessary. The expert groups executing different functions at first define economic efficiency, the second group defines scientific

direction, and the third group defines possibility of realization of the projects in the technology park [4].

From the before considered research data on conception of creation of technological park at higher educational establishments and their activity the aim of the article is certain. Thus, the purpose of the article is creation of scientific technology park at the higher educational establishments of Azerbaijan on the base of application of new information technology and systems, methods automation and control of technology process, non traditional electro-energetic scientific complexes, investigation and application of physical process, marketing systems [5].

2. BACKGROUND

2.1 Analyze and Definition of the Problem of Creation of Scientific - Technology Park at Higher Educational School in Azerbaijan

One of conditions of development of economics of different applied areas in Azerbaijan is application of the innovative technologies. Realization of conception of creation of technology park at higher educational school that provides introduction of new innovative technology, synthesis of education, science and technological process is actual scientific-economical problem for Azerbaijan. By means of the analyzing of the problem of creation of scientific technology park for higher educational schools in the foreign countries, option of a region and Sumgait State University like a basis of application scientific technology park at an higher educational school was justified [4]. There were defined profiles of scientific technology park and stages of working out the projects at scientific – research centers and a manufacture cell.

At scientific technology park of Sumgait State University the following projects must consider the innovative projects which were researched in [6,7]:

1. The program interface of intelligence computer aided system for Internet users;
 2. Development of the system for the safe vehicle lighting on the base of principle of polarization;
 3. The equipment for transformation to electrical energy from the mountain river;
 4. New version of compact equipment for water treatment;
 5. The piramidal camera providing save of nutritive products long period;
 6. Equipment for experimental researching causes of appearing Tsunami;
 7. Equipment of intelligence regulation of reactive power in electrical system;
 8. Development of microprocessor's control system for synchron motor with high power;
 9. New control system of working car motor with alternative energy;
 10. The Server system that provides data saving of files, sending electron mails, routing data, telephone connection in local network of scientific technology park.
- 2.3 Scientific research, constructor designing and testing the laboratory for physical investigation and application.
 3. Creation of a manufacture cell and its supporting with computer technology at scientific technology park;
 4. Application of corporative information system for the provide of planning, control of quality of innovative projects and theirs marketing, management at scientific technology park;
 5. Showing and presentation new projects, its technical, economical effective results on the exhibition of the innovative projects at technology park;
 6. Organization of buiznes incubator at scientific technology park of Sumgait State University.

For development of science and education areas in Azerbaijan till the high level of many Europa and Asian countries, decision of the problems by development of new information technology and systems, non traditional electro-energetic complexes, research and application of physical process and marketing at scientific technological park of Sumgait State University is demanded.

2.2 Planing Works at Creation of Scientific–Technology Park

It is planed the following works by realization of the stages for development of scientific–technology park at Sumgait State University (Fig. 1):

1. Learning and processing experience work of technology parks at higher education school in the foreign countries and application of them in Sumgait State University;
2. Creation of laboratory of experimental research, testing and application of new projects at scientific technology park:
 - 2.1 Scientific research, constructor designing and testing the laboratory for information technology;
 - 2.2 Scientific research, constructor designing and testing the laboratory for the innovative projects of electro-energetic complexes;

At creation and application of scientific technology park of Sumgait State University there were used applied methods of computer sciences and system analyze, intelligence control, polarization in automobile-building, application of alternative energy in control system of a car, innovative methods for working out scientific technology park considered by [8], [9].

The developed new innovative projects of information technology, electro-energetic complexes, research of physical process can be used at scientific technology park of Sumgait State University in Azerbaijan and also in the foreign companies. It allows to develop in complex science and education together, rise a status till international level and a status of Sumgait State University among Azerbaijan and foreign educational schools. Thus, the scientific technology park at Sumgait State University can exist research, makes different projects and executes marketing operations of new innovative projects in dependence on the chosen scientific profiles.

The first problem of creation of technology park at higher educational school in Azerbaijan is supporting its effective work, that is providing of economic earnings. For decision of that principle forming the design procedures of technology park is necessary to use [10]. In this connection, the stages for computing design of the scientific-technology park at Sumgait State University is offered:

1. On the first stage an informative analytic center by means of the international certificate is necessary to create. Financing this stage is realized by means of budget of the State and of the Manufacture of Innovative Technology.
2. On the second stage solution of two problems of creation of technology park are necessary to realize:
 - Stimulation of development of little manufacture business;
 - Searching a better innovative way for economical development.

On that stage at choosing a place of location of technology park its area must have beneficial geographical place and the developed transport infrastructure. In the limit of the chosen place there must be the central transporting road, an international aerodrome, line of railway. On the base of the above the considered demands the scheme of location of the important objects of infrastructure of the region near the technology park is determined. In dependence on the necessary terms the optimal scheme of the base objects of the infrastructure with manufacture enterprises, scientific-investigation institutes is chosen in a limit of the region of Sumgayit city on territory of the Sumgayit State University not far from the central magisterial, aerodrome, sea port and railway.

The scientific technology park is based at the Sumgayit State University, where for its effective functions of future project of technology park there are the laboratories of scientific-research for different technical specialty, the central computing network system, scientific - technical, engineering personal, infrastructure with conditions of learning and teaching.

The practical process of working scientific-technology park at the Sumgayit State University is realized on the base of flexible industrial park (FIP) which connected with other scientific, education, learning, business and exhibition centers of technology park of the Sumgayit State University. The working projects which are worked out in the laboratory of scientific - investigation, after expert control of the projects, them transferring to the industrial parks (flexible industrial park) is executed, where are realized output productions of high quality. The teacher-professor contingents of the Sumgayit State University participate active at scientific - investigation works.

3. PROPOSED SCIENTIFIC TECHNOLOGY PARK

3.1 Option of Innovative Projects in the Scientific-Technological Park

In dependence on profiles of scientific-technological park at Sumgayit State University three scientific-research place were defined. In the scientific-research place-1 the universal complex of application of information technology, nano technology, control-measuring equipments and innovation projects in automation complex are planned. Also using nano technology in intelligence robot and electro technical complex, working out elements of automatic control in the oil industry are provided. In the scientific-research place-2 as priority directions oil processing, creation of electro energetic technology areas are planted. In the scientific-investigation place-3 by direction of protection of physical working out projects are planned.

On the base of the results which were got from the scientists of different area of scientific research in Sumgayit State University, there were solved the following problems:

- Taking into account international experience of creation of technology park the common scheme of scientific technology park at the Sumgayit State University is offered;
- The basis scientific directions at the structure of technology park are defined;
- For realization of the projects of the scientific-research places in the industrial park the scheme of flexible industrial park is chosen.

3.2 Option of the Scientific - Laboratories

For providing local network system and also conducting special investigation works in the scientific technology park of Sumgayit State University, creation of the new laboratories is demanded. In this connection, the suitable laboratory (with the necessary technical units, theirs types and characteristics) by the scientific directions are considered:

1. Laboratory of information technology and systems: 1.1. Personal computer – 5 pieces; 1.2. Notebook – 5 pieces; 1.3. HUB 16 port Rackmount – 1 pieces; 1.4. Cabel LAN UTKP Cat 5; 1.5. Optical cable 300

m; 1.6. Media Converter – 2 pieces; 1.7. Jack – 50 pieces; 1.8. Trank 50 mm; 1.9. Converter digital- analog – 1 pieces; 1.10. Converter analog- digital – 1 pieces; 1.11. Oscilloscope – 1 pieces; 1.12. Voltage

source 1.13. UPS; 1.14. Operation system; 1.15. Constructor-design program; 1.16. Office program; 1.17. Multimedia program; 1.18. Antivirus program.

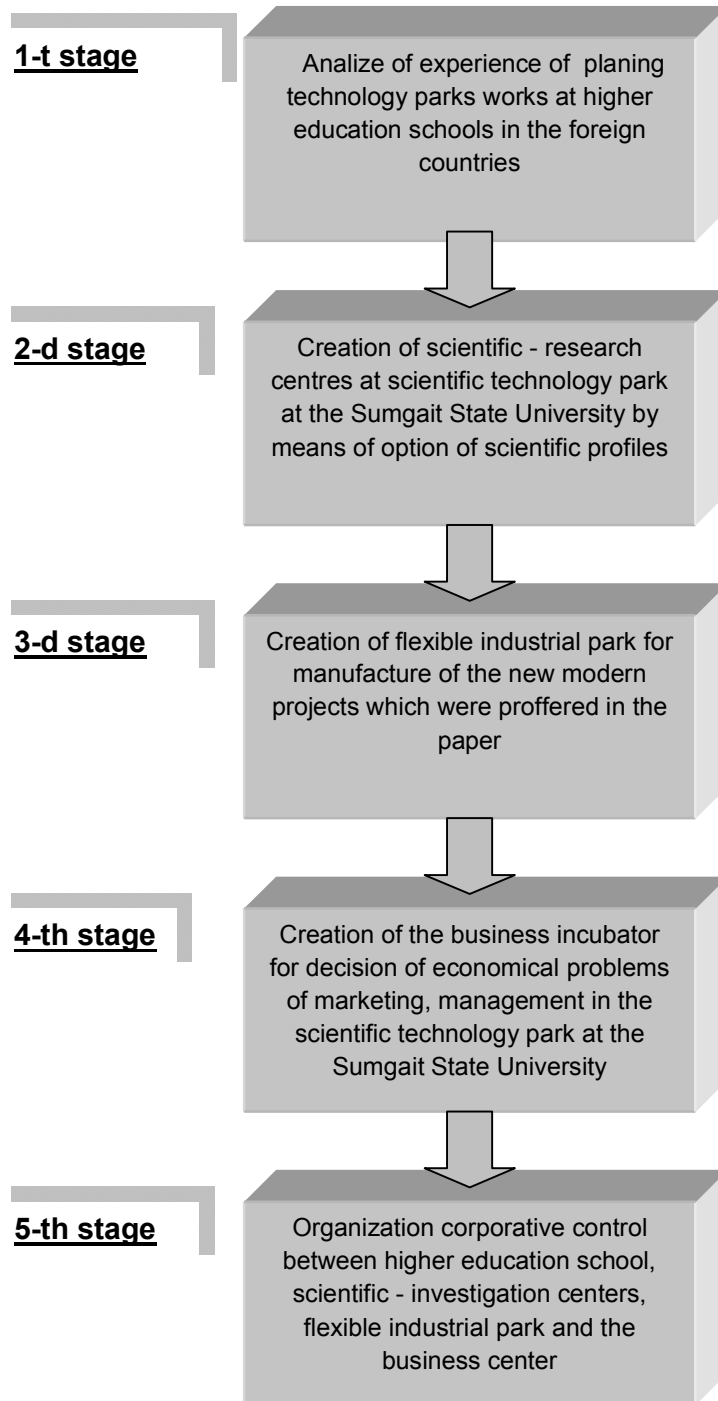


Fig. 1. The stages of planning design intelligence works for realization of the projects at scientific-technology park of Sumgait State University

The types, quantity and their parameters were chosen in dependence on architecture scheme and the sizes, specific of scientific functions in administrative, scientific and industrial centers of the scientific-technology park.

2. Laboratory of electro energetic complexes: Electrical appliances; 2.2. Static capacitor battery; 2.3. Contactor; 2.4. Sensor of reactive power; 2.5. Voltage sensor; 2.6. Drive; 2.7. Reducer.
3. Laboratory of physical research and application: 3.1 Car Lights; 3.2. Tourmaline crystals; 3.3. Front glass of the car; 3.4. Parktronic; 3.5. Illuminometer; 3.6. Oscilloscope; 3.7. Solar battery; 3.8. Generator; 3.9. Rheostat.
4. Flexible industrial park: 4.1. Screw-cutting machine with spindle seizure of 160-350 mm; 4.2. Vertical drilling machine; 4.3. Longitudinal boring machine; 4.4. Vertical boring machine; 4.5. Grinder; 4.6. Electric welding machine; 4.7. Milling-machine.

Process of option for every laboratory were provided in dependence on flexibility of technical systems and the chosen profiles of scientific – technology park.

3.3 Profiles of Flexible Industrial Park and Its Manufacture Modules Setting

All projects are researched and designed with computer systems in the scientific research centers and then as innovative projects applied in the flexible industrial park, which contents different profiles of robotic manufacture islands (Fig. 2): Flexible mechanical cell; flexible energetic cell, flexible car building cell; flexible chemical and ecology cell. On the base of the chosen equipments for manufacture cell its structure scheme is developed. Typical structure scheme is builded as some technological process with relocation of the modern technical equipments and standard sizes between them, communication system connect all elements of manufacture cell, control system with elements of measuring and positioning (Fig. 2).

Flexible mechanical cell provides manufacture of the following projects: New version of compact cleansing device; pyramidal chamber providing save of nutritive products long period.

Flexible energetical cell provides manufacture of the following projects: Equipment for transformation of electrical energy from waters of a mountain river; equipment of intelligence

regulation of reactive power in electrical system; microprocessor control system for synchron motor with high power.

Flexible car-building cell provides manufacture of the following projects: new control system of car working with alternative energy; the system for the safe vehicle lighting.

Flexible chemical and ecology cell provides manufacture of the following projects: Equipment for experimental researching causes of appearing Tsunami; automation of management of evacuation of population at an emergency; development of effective catalyst for the exhaust-gass of car; chart of automation in an apartment for the premature exposure of earthquake by means of ultrasonic signals.

For computing design of the projects of different industrial areas the program interface of intelligence computing aided system. The program interface is applied at flexible computing design of new projects for different islands of FIP (flexible industrial park). After receiving a project from scientific center an user process all data by means of the program interface of intelligence computing aided system and further it provides automatically making any output production in each flexible manufacture cell.

It is necessary to mark that, in the paper there are only the developed projects which included to the composes structure of flexible manufacture cells. Other new projects are worked out by scientists of different profiles in the scientific research centers and added into whole list of the project.

As see from the Fig. 2, the structural scheme of flexible industrial park contents of the basic equipments, robotic units which service the basic equipments and devices in the flexible manufacture cells of mechanical, energetic, chemical-ecology and physical setting.

Every flexible manufacture cell works an autonomy, because it produces individual productions of modern projects.

Informing connection of each flexible manufacture cell in the flexible industrial park with other parts of scientific park of Sumgait State University executes by means of the program interface in the corporative computer network.

Robotics modules are chosen in dependence on their setting in the flexible manufacture cells. For example, for working flexible mechanical cell

and car-building cell industrial robots of tooling, welding, cutting, bend and other setting are chosen.

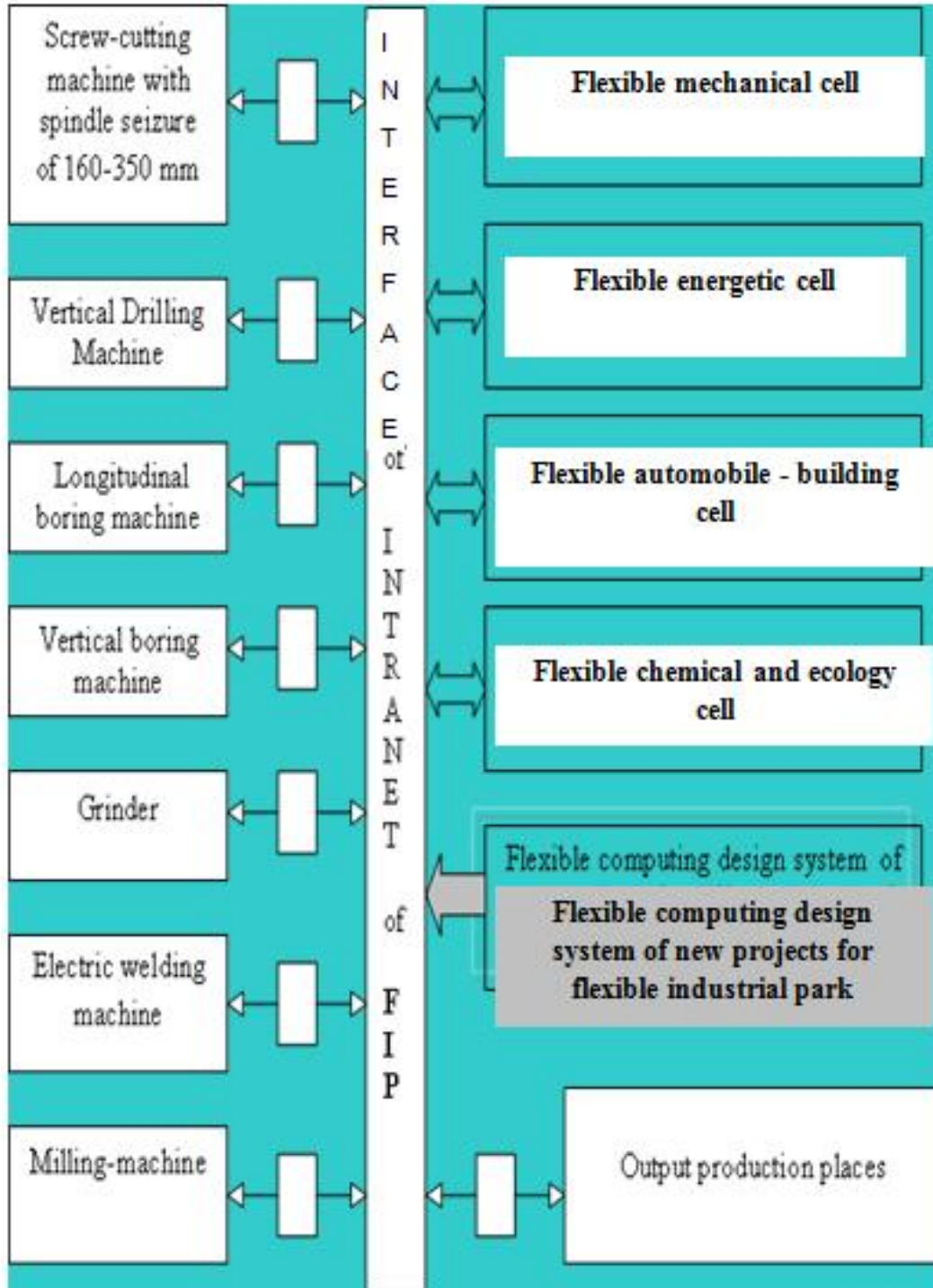


Fig. 2. Scheme of robotization of the flexible industrial park with using special technical units of manufacture of machining, metallurgy, energetic and chemical productions

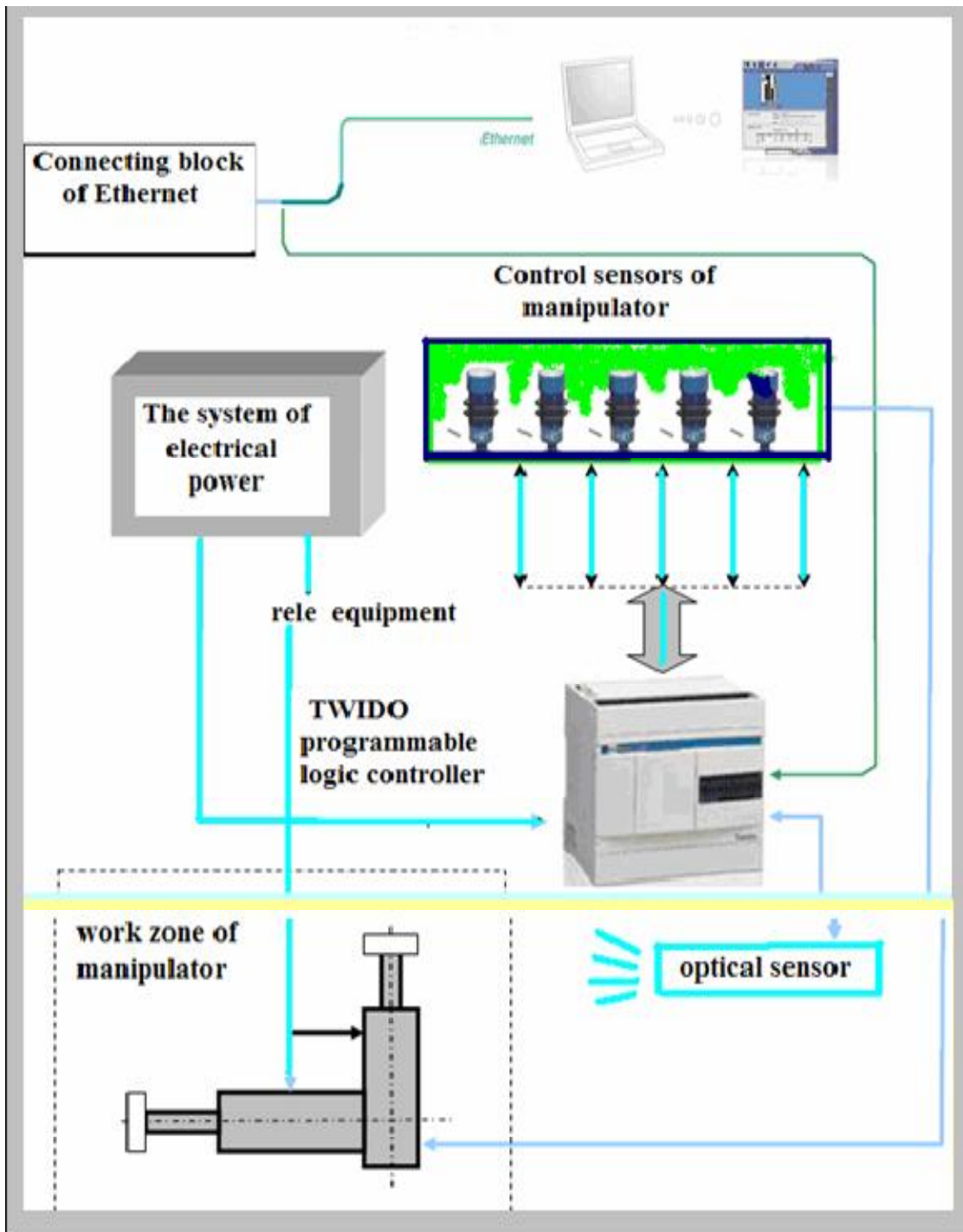


Fig. 3. Automation scheme of the flexible mechanical cell

System of control flexible industrial park builds as hierarchical structure on principals of flexibility (Fig. 3, above), with transformation of equipments from one type of production to other one. On the first hierarchical level of the control

system of each flexible manufacture cell there is programmable logic controller given by [11] which process and control of information as signals at fixing relocation of hand of industrial robot, its gripper, mechanical parts of equipment.

On second level of the control system of each flexible manufacture cell there are sensors in industrial robots, equipment, the transporting conveyers and special technical units of stove and other active elements.

Connection between first and second hierarchical level of the control system of each flexible manufacture cell is provided after receiving controlling information from the optical sensor of the work zone of manipulator, control sensors of manipulator, the system of electrical power devices. For effective control of the flexible manufacture cell the criteriums of choosing TWIDO controllers are defined:

1. Simplicity and comfortable of using equipment is placed compact into the one body, where there are 10 compact blocks;
2. Flexibility is provided by analog modules.
3. Effectivity of control of the system is supported by transferring data with high speed.

4. CONCLUSION

By means of the conducted scientific research in the article there were got the following results:

1. By introduction in a result of investigation of the presence status of technology parks in many the developed countries it was defined the base problem for decision of creation flexible industrial park in dependence on profiles directions;
2. By means of analyze and definition of the problem it was planed the works by realization of the stages for development of scientific–technology park at Sumgait State University at higher educational school in Azerbaijan;
3. In dependence on profiles of scientific–technological park at Sumgait State University there were done option procedures of the scientific – laboratories for investigation and development of new innovative projects;
4. By the profiles the structure of flexible industrial park is proffered and its manufacture modules setting are defined;
5. On an example of a loading manipulator, optical sensors and other elements of the system of controlling, the composes

scheme of flexible manufacture cell is proffered.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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