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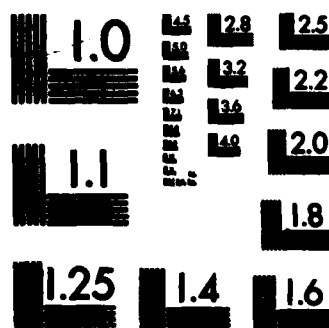
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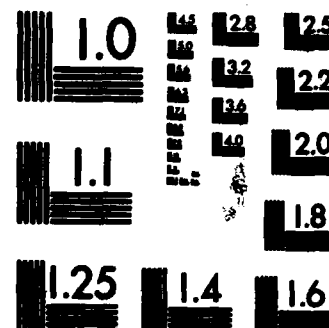
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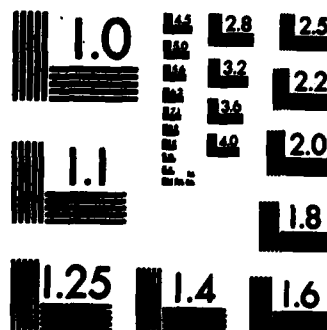
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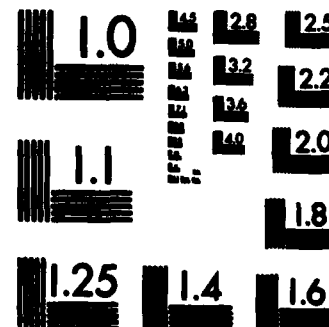
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FOREIGN TECHNOLOGY DIVISION



DEVELOPMENT OF REMOTE DATA TRANSMISSION SYSTEMS

by

Elzbieta Siwak-Szczepek



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The exhibits presented in this field at this time and at the present level of development of engineering thought, considering the quality of the designs, did not strive to attain the rank of some imaginary luxury, but of an object which is indispensable and irreplaceable in daily life. It follows that the representative substance of the exhibition was planned on two distinct levels:

1. part of the exhibited groups represented the achievements of particular branches of industry and the accompanying illustrations, drawings, etc. depicted their overall effect on the development of the national economy;

2. another part, on the other hand, constituted exhibits dedicated to the individual customer.

Each group of exhibits envisioned as part of the exhibition, planned with a great deal of dedication and resourcefulness, had still another essential merit from the standpoint of the purpose of the exhibition, namely, quality, originality of form, and suggestiveness of the content. The quality and rationality of the entire exhibition was decided by these factors since they represented a measure of the level of the exhibition in the eyes of the customer.

The interrelations between the above-mentioned substance levels within individual groups were completely arbitrary. They were left to the discretion of exhibitors, giving them an unlimited field to depict. In connection with the above, the exhibition character of individual groups was very diverse, while the thematic range of each exhibition was unmistakably determined by the character of the exhibits and the wealth of the content to be conveyed.

The diversity achieved in this manner influenced to a considerable degree the clarity of the purpose of the exhibition. Notwithstanding its vastness, it enticed the visitor to see it to the end. Without being tiresome, while at the same time forcing the visitor to think, especially in the practical part, touching directly on specific computer technology problems, it revealed essentials of the operation of computerized information and remote data transmission systems oriented to a particular range of practical applications.

It represented a great success of the organizers and exhibitors, since after visiting the exhibition, the visitor was impressed by it for a long time. It forced him to think and it suggested conclusions. Thus, it fulfilled its intended purpose.

Organizational Outline

The main organizer of the exhibition, which lasted from 31 May to 7 June 1979, was the Main Administration of the Association of Polish Electrical Engineers. In addition, considerable help was provided by the following ministries: Communications, Power Engineering and Atomic Energy, Machine Industry, and several associations and large industrial plants. The latter and plants and institutions subordinated to them were the main exhibitors in the exhibition, the guiding slogan of which was: Electrical Engineering-Economy-Society.

The slogan suggests unambiguously the range of problems in the exhibition and it also justifies the good sense of distinguishing the above-mentioned substance level. The objective implicit in the general assumptions was to emphasize and stress the role of the significance of such fields of science as electrical engineering and allied fields, and in many cases complementary fields (electronics) for the development of individual branches of the national economy, on one hand, and the effect of the above-mentioned fields of science on improved living standards in society, on the other.

The symposia which accompanied the exhibition took place in the Main Administration building of the Chief Technical Organization in Warsaw on Czacki Street. The opening scientific sessions summarizing the observance of the 60th anniversary of the Association of Polish Electrical Engineers and the closing symposium on this anniversary had a particularly festive character.

The exhibition of achievements "Electrical Engineering-Economy-Society" took place in the KOSMOS Pavilion on the premises of the Center for Technical

Progress of the Chief Technical Organization in Warsaw on Bartycka Street, a pavilion which, because of its imposing size, made it possible to conduct an exhibition on such a large scale. A cycle of popularized science lectures describing fairly closely the designs presented at the exhibition or constituting a thematic complement of the exhibition took place at the permanent BUDOEXPO Building Industry Exhibition neighboring the KOSMOS Pavilion.

The deftly conceived territorial integration of exhibitions planned as part of the observance of the 60th anniversary promoted the maximum number of visitors in all planned festivities without limiting the scope of the exhibition.

The entire exhibition was comprised in six independent groups. Individual scenarios were directed toward realization of the following mottos:

1. problems in the development of Polish power engineering;
2. electrical engineering industry in the development of the national economy;
3. electronics in various spheres of life and the economy;
4. development of telecommunications to further socioeconomic progress;
5. electronics subassembly industry, the basis of the electronization process;
6. electrical engineering in consumer products.

Together, the above indicate the scope and thematic comprehensiveness of the exhibition.

In particular, the third and fourth group and to a certain degree also the fifth group, being allied and mutually complementing groups, presented an unusually interesting practical exposition as part of the exhibition, which concentrated on the presentation of computerized information and remote data transmission systems based on minicomputer equipment manufactured in the country

(Mera-300 series), focusing on possible realization of versions that are suitable in practice in various specialized applications in the communications sector.

The exhibits concentrated on a presentation of specific subsystems operating as part of the Basic Telex Computerized Information System (BIST).

A group of designers and digital hardware and software specialists is working on this problem under the direct supervision of the director of the above Center, dr. engr. Czeslaw Syc.

The exhibits demonstrated as part of the observance of the 60th anniversary were a logical, and at the same time, a very valuable (from the standpoint of further knowledge) continuation of the exhibits which accompanied the observance of Communications Day in October last year.

A certain part of the exhibits from allied groups constituted thematically a significant complement to the BIST system, since these elements decided the practical implementation possibilities. The latter included, among others, very interesting and spectacular telephone equipment and a great variety of telephone and telegraph cables and multiplex telegraphy equipment (Photo 2).

Essential genesis of BIST system

The basic condition which determined the development of the Basic Computerized Telex Information System in its prototype version was the concept of utilizing the existing countrywide telex network, which did not require any investment expenditures.

The latter fulfills the function of the basic and main (not the only one) information carrier in the system. Because of its comprehensive scope, the above-mentioned telex network guarantees the universality of computerized information systems designed on this base in time and space.

The latter is the most important element (ignoring deliberately, for the time being, a factor influencing the design of adaptive hardware equipment,

determining the equipment configuration, as well as the factor of skillful elaboration of the architecture of the system, which is subordinated to specific practical requirements) which earmarks the system for comprehensive applications in the field of optimal planning and operational management.

We are departing in this manner from the concept of traditional processing in the local mode to one requiring remote transmission of data over a distance edited in preliminary fashion in accordance with user requirements, prepared from the standpoint of format and content by the computer, which constitutes an essential part on which the developed system software is based.

A basic version of the equipment configuration on the basis of which practically any subsystem operating as part of the BIST system can be realized is shown in Photo 1.

The standard configuration comprises the following equipment:

1. MOMIK 8b/1000 minicomputer equipped with an internal (ferrite) memory capacity of 32,000 8-bit words;
2. two direct-access channels;
3. arithmetic unit channel;
4. multiplexer channel;
5. real-time clock;
6. set of control unit;
7. CT 1001 A paper tape reader;
8. DZM 180 mosaic printer;
9. 9425 disk memory;
10. PK 1 cassette memory;
11. modem equipped with contact according to CCITT V24 recommendations (creating a possibility of interacting with a large computer in the on-line mode);
12. line unit allowing minicomputer to operate interactively with telex network.



Photo 1. Standard configuration of Mera-300 minicomputer adapted to realization of any subsystem operating as part of the BIST system

Coupling the element of data transmission guaranteed by the telex network with the concept of a traditional computer system changes fundamentally the character of the system and classifies it in the group of computerized remote data transmission systems. This does not exclude the possibility of the system operating in the local mode; on the other hand, it creates the additional possibility of operating in the remote control mode.

The practical universality of this class of systems increases tremendously, entailing consequently exceedingly important changes in the design stage of hardware equipment interacting with the computer, which subsequently retains its leading role in the system (from the software standpoint).

From the standpoint of the telex network, a computer, a minicomputer, or any internal equipment of the following type: teleprinter, telephone, television set is classified as terminal equipment in the remote data transmission system.

With regard to a computer which has its own memory and a particular computational capability, we talk about a terminal station of the intelligent terminal type. The basis for intelligent terminals in the BIST system is

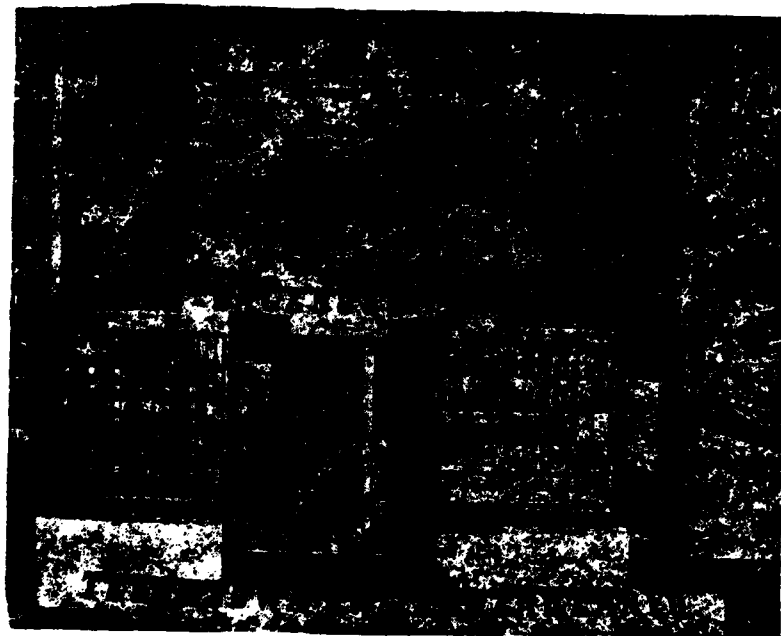


Photo 2. Multiplex telegraphy equipment TgTM

the telex network, the basic information carrier with its mandatory data transmission rules.

The effect of coupling the terminal with the network was achieved using a telegraph adapter.

The problem of interaction of the network with a particular type of terminal, on the other hand, reduces to the problem of modernizing contact and changing the architecture of the system. These elements are closely interrelated and they force the designer to make an alternative and optimal choice between the hardware design and software for the system. This creates simultaneously possibilities for expanding the range of applications and universality which are not mutually exclusive.

The first practical design of prototype subsystems integrated in the BIST system pertains to the realization of two fundamental functions imposed on intelligent terminals.

1. The first realized variant was oriented toward operation in the local mode and the terminal fulfilled in it the function of a DATATELEKS station. The software was oriented toward realization of elements collecting and converting data for a particular purpose, storing on an auxiliary memory carrier (disk type memory), retrieving, formatting data as per specified and elaborated control instructions, and as a final result, preparing input data for additional processing, for example, in a large computer (Photo 3).

2. The second version, on the other hand, while retaining the same data conversion principles used the telex network and the teleprinters connected to it for data transmission. The flow of information took place in both directions. Transmission was realized between the transmitting and receiving party and in the circular mode (Photo 3).

The above designs ensured, while gradually expanding the architecture of the system, that the following functions were performed by minicomputers used as terminal stations in the system:

1. intelligent terminals, playing an essential part while interacting with large computers;
2. independent specialized stations for automated preparation of data;
3. equipment for creating local data banks (scattered processing);
4. preprocessors for large digital computers;
5. data concentrators;
6. multiplexers.

In this manner, modularly designed software creates the possibility of realizing practically any specialized subsystem with optionally precisely assumptions.

In the next design stage, which may be mandatory at central administration levels, the possibility is created for efficient processing, storage, and protection of a large volume of data which the system must handle without errors.

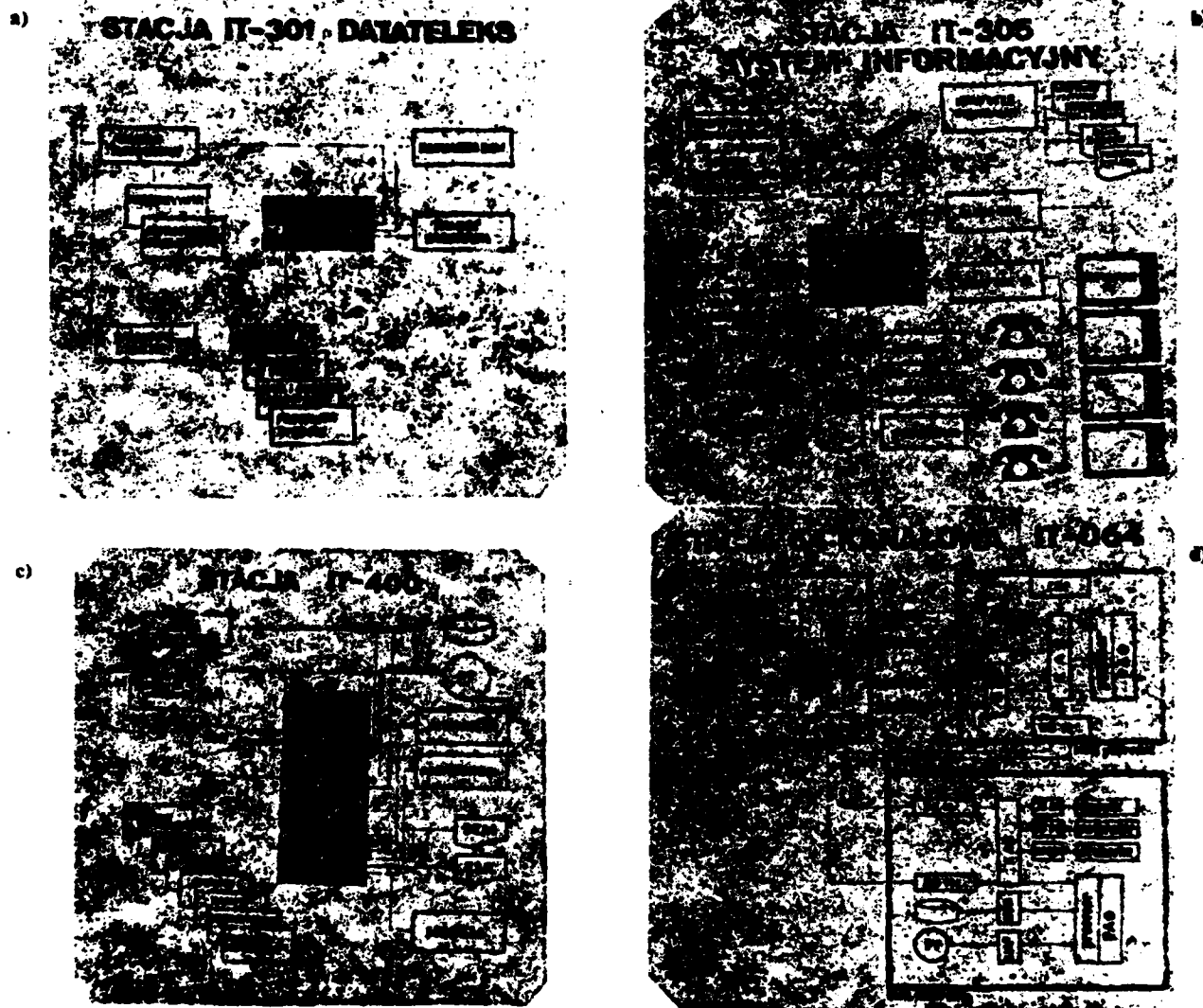


Photo 3. Functional diagram of subsystems operating as part of the BIST system, realized on the basis of various types of minicomputers (parts a, b, c, d illustrate the increase in functions realized by each subsystem and the increase in their scope along with the expanded configuration of the system)

Equipment is protected from errors above all by protection devices and software protection involves:

1. software programs for all possible communication versions between the central and local data banks;

2. software programs of methods available in the system for creating a replacing of local data banks;

3. creation of the possibility of integrating local data banks in a single central bank;

4. protection from access to data banks (to unauthorized persons);

5. taking into account the specifics of distributed processing;

6. depending on the need, creating the possibility of replacing and checking data in an on-line mode;

7. specialized software of a group of protections which will allow error-free resumption of the operation of the system in the event of an unforeseen breakdown;

8. development of software programs for creating archive copies of data banks (central and local data banks).

In summary, all characteristics of the BIST system discussed so far create the possibility of realizing in practice any specialized system.

Specialized designs

The groups of systems demonstrated at the exhibition pertained to the realization of the following tasks:

1. preliminary preparation and collection of data on a Mera-301 minicomputer base. The latter is a typical station for preparation of data;

2. realization of a circular, with a demonstration of preparation and dispatching of reports in a particular format and strictly specified content. The subsystem realizing this task operates using as a base the Mera-306 minicomputer;

3. relay of telegrams as one of the first and practical operational systems in many postal-telecommunication offices. The latter guarantees a correct and error-free processing of telegrams. It operates on a Mera-306 minicomputer base;

4. collection and accumulation of specialized data for the communications sector (INTERWAG system). This subsystem operates on a Mera-306 minicomputer base;

5. furnishing information to management by means of a minicomputer information computer system operating on a Mera-305 minicomputer base. This subsystem is characterized by such terminal equipment as television sets, telephones, and numerical keyboards (MKC-300 module).

The following subsystems were used as part of this system:

1. RESERVATIONS--check of reserved numbers of savings books or number of identity cards;
2. PARCELS--information about parcel tariffs in foreign traffic;
3. INFORMATION--information about current services provided by the Polish Post, Telegraph, and Telephone Office.

The above-mentioned keyboards playing the part of terminal equipment in the system make possible remote communication with the system, i.e., input and output of information. Transmission takes place sequentially by means of a two-way transmission line. Special control instructions ensure setting of the keyboard to the appropriate operational mode. The buffer register is the intermediate element in the transmission of information. Interaction of the keyboard with the minicomputer is asynchronous in an alternating mode.

Because of this, the program used by the operator must take into account certain delays. The transmission rate is 9600 bits/s. The information is

transmitted in the form of 10-bit characters, of which 7 bits are information carrying bits and the remaining bits are the start bit, the stop bit, and the parity bit. The single-character bit rate is about 1.1 ms.

The multiplex telegraphy equipment (TgFM) mentioned above, which is used in the system, makes it possible to increase the number of channels for the transmitted information without the necessity of installing additional telegraph cables. The latter are adapted to telegraphy at a rate of 50, 100, and 200 baud and utilize the frequency multiplication principle, which necessitates the operation of each channel on a different carrier frequency. Multiplex telegraphy equipment creates the following possibilities:

1. simultaneous two-way transmission of 24 telegraph messages over a single four-wire telephone circuit;
2. simultaneous two-way transmission of 10 telegraph messages over a single two-wire telephone circuit;
3. simultaneous two-way transmission of telegraph messages in two directions over a single four-wire telephone circuit.

The equipment can also interact with slow data transmission devices.

Future prospects

On a basis of the presented design, setting up in any arbitrary manner the configuration of equipment, adapting the appropriate hardware, modifying and utilizing appropriate elements of available software, the possibility is created for realizing any specialized system.

Thus, real possibilities exist for utilizing the Basic Computerized Telex Information System with small investment expenditures for materials management, management of stores, distribution of materials in transportation, agriculture,

and also for reservation purposes (railroads, airlines). The fact that this can be realized on generally available minicomputer equipment manufactured in the country is another point in favor of this concept.

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