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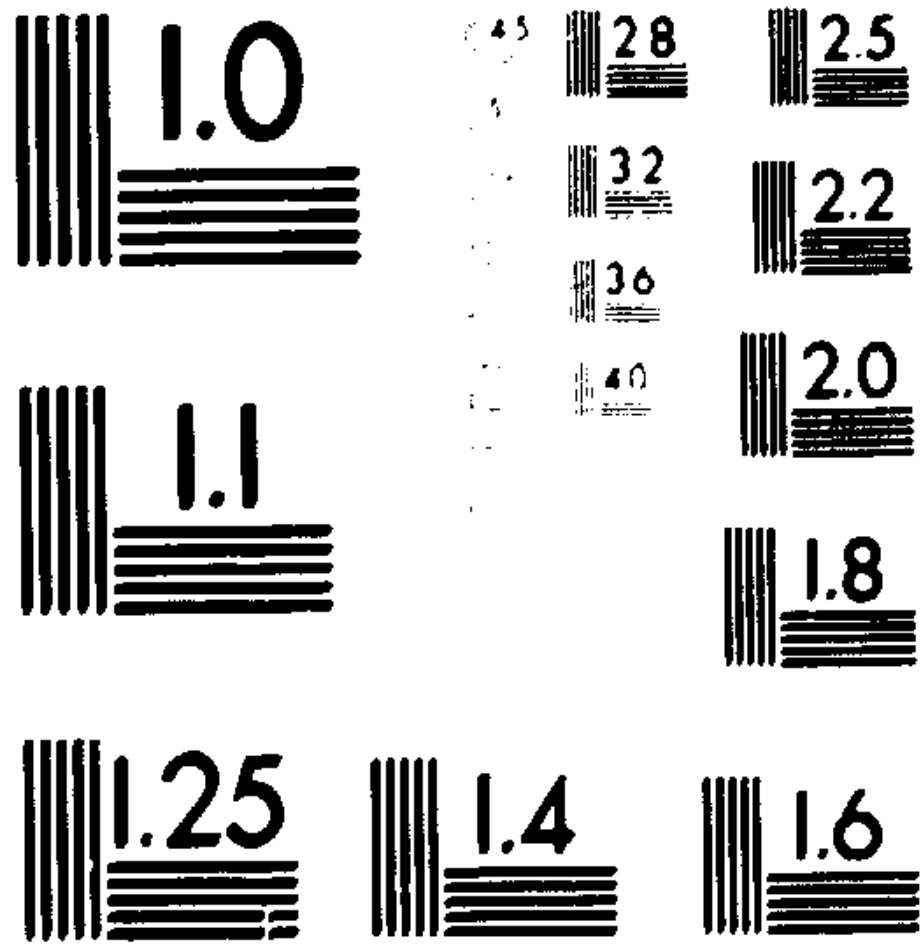

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ELECTRONIC INDUSTRIES RESEARCH
AND DEVELOPMENT CENTRE
PHASE II

DP/EGY/78/003

ARAB REPUBLIC OF EGYPT

Egypt.

Technical report: Microcomputer development and training laboratory *

Prepared for the Government of Egypt
by the United Nations Industrial Development Organization,
acting as executing agency for the United Nations Development Programme

Based on the work of Vladimir Hajek,
expert in the industrial application of microprocessors

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ABSTRACT

Report on the expert's activities from 13.1.1985 to 6.2.1985 at the Electronic Industries Research and Development Centre (EIRDC), Cairo, Egypt, project DP/EGY/78/003. The main objectives of the expert's assignment were:

- conception of the Microcomputer Development and Training Laboratory;
- conception of work in the existing laboratory and direction of its future development;
- training of the staff of the laboratory in the field of industrial application of microcomputers; and
- discussion and specification of the needs of Egyptian industry as compared with the possibilities of the laboratory.

These objectives were fully met during the expert's mission. The main conclusion is that the laboratory exists and is really doing its work. The main recommendation is that the staff needs permanent help in building up connections to the world trend in micro-computerization industrial instrumentation and control systems.

I. INTRODUCTION

Summary of expert's activities at EIRDC:

The expert arrived at Cairo on 12.1.1985 from Vienna. He started his work in EIRDC on 13.1.1985 according to the job description (see Annex 1) and the revised "Duties" (see Annex 2) and completed his work on 6.1.1985.

The working programme was often discussed with the Chairman of the EIRDC and National Project Director EGY/78/003, Dr. Eng. Roshdy El Hadidy, to find the most optimal way of using the expert's time in the Centre (see Annex 3).

Dr.Eng.El Hadidy was informed that according to the "Minutes of the Meeting", signed 10.7.1984 in Prague by Dr.Eng. El Hadidy and Dr.Jan Kroužek VTCTC project director, it is now possible from the Czechoslovak side in the frame of the UNIDO projects DP/CZE/80/001 and DP/CZE/82/006 to prepare agreements in training, exchange of experts, fellowships, joint training programmes, etc.

Several lectures were presented by the expert to the staff of the Microcomputer laboratory dealing with the topics from the job description (see Annex 4). For each of these lectures a short syllabus was prepared. Required survey " Microprocessor based systems for industrial instrumentation and control" was also prepared in full written form.

A "hands-on " training programme (see Annex 3 " Project example ") was prepared and realized for the staff of the laboratory consisting of a project to connect two diferrent microcomputers with a communication line. The training programme was worked as a real project (teams, documentation, responsibility, finding the best solution). The expert was in close contact with

the staff to discuss the problems and help with their work.

As a supplement, the expert was requested to solve a number of small technical problems (Annex 3), on some of which a short report was made.

II. RECOMMENDATIONS

Recommendations in detail are incorporated into the Body of report (chapter III.) . A conclusion of these recommendations and reasons are provided here.

There is a need to fulfill some missing parts in the laboratory equipment system - both software and hardware - to make effective work possible. Some steps had been already made; but it seems that the help of UNDP/UNIDO is inevitable in purchasing items listed in detail in chapter III, part B.

To continue improving /strengthening the basic staff of the microcomputer laboratory and follow-up action of developed countries in microcomputer applications, it is recomended to keep close, personal contact with the progress in this field in the world. To make possible fellowships, trainings, attendance of seminars, conferences, exhibitions consultancy and expert services, the support from UNDP/UNIDO is needed.

It is recommended to use the possibility of training in INORGA microcomputer laboratory (see chapter I) under the twinning agreement to be prepared with the Czechoclovak UNDP/UNIDO project DP/CZE/82/006. It is recommended for the staff to visit world known microcomputer exhibitions (Munich, Paris, Geneva, London) and make contacts with equipment and software suppliers. It will be useful to arrange visits to such exhibitions together with a short-term UNIDO expert. It is recommended to join the DECUS club (Digital Equipment Corporation - DEC - users club organisation) to obtain more information about development software (details were given by the expert to the staff of EIRDC).

It will be very useful and it will accelerate the progress of building up the microcomputer development and training laboratory (especially practical knowledge of the staff) to prepare and run rather small, not too difficult a project with real industrial application. Because the laboratory is in its stage

of development,it will not be able to implement such a project on a commercial basis and therefore it is recomended to do so with the UNDP/UNIDO support.

For these three main reasons,recommendation for the implementation of a UNDP/UNIDO project is made with aprox.total input 200 000 US$ (50 000 US$ equipment) for the duration of 2 - 3 years (starting as soon as possible) to provide the continuity of work. The objective can be also reached by more than one small-scale project (for example one for training, one for completion of the laboratory and one for an industrial application).

The state in the Microcomputer Development und Training Laboratory is very near to the stage, when it will be capable to give not only training to national specialists on the basic level but also to solve some main hardware and software problems for the Egyptian industry in the microcomputer application area, in particular maintenance, fault-finding and minor changes in the microcomputer systems delivered to Egypt as a part of industrial technology which is extremely important and cost-saving to the country.

It can be seen that the staff of EIRDC will grow up gradually on their own problems to high-level specialists in the industrial application of microcomputers. And even if they will leave EIRDC for other Egyptian firms, it will be good for the Egyptian industry as a whole to obtain specialists by such a circulation of staff in EIRDC as in a special training centre. There should be permanent support from the Egyptian Government to achieve the required level in the prevailing difficult conditions.

To accelerate the activity in the microcomputer application field,the following work should be carried out by EIRDC:

- prepare in detail the proposed UNDP/UNIDO project and follow its implementation;

- fulfill all recommendations, which are detailed in chapter III. "Body of report"; and
- use all other means, personal connections, twinning agreements, etc.,to give the staff of the microcomputer laboratory best possibilities to reach the required level of technical know- how.

III. BODY OF THE REPORT

A. EIRDC

The expert was coming for the first time to EIRDC and was comparing his new impressions and findings with reports of previous experts. After one month of observation, it can be stated that there has been a really considerable progress in all aspects. The thick-film laboratory is placed in a "clean room" */ (made under an Egyptian project by Egyptian firms) and is working (more than 1000 circuits were finished in January 1985). The laboratory has been working perfectly, even during the dust storm in Cairo.

The microcomputer laboratory is now in its forming period. The main parts of the equipment are delivered, well installed and working. The equipment is under good care of the staff. There is great effort to keep the laboratory, corridors and other rooms clean and not dusty, which is in the condition of Cairo really a difficult task to accomplish. It is not possible to make the whole building a "clean room". There is a good technical library with easy access on the same floor, which is well used by the staff. The expert took part in the closing ceremony of one of the courses of the EIRDC's training programme for engineers and technicians, and had the possibility to talk and discuss it with the students with positive evaluation.

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*/ "clean room" is a technical expression for a very special laboratory, where production and assembly of special technical devices is made under extra dust-free conditions.

All the EIRDC staff, whom the expert was in contact with in EIRDC during his one month stay, from the driver to the technical staff, were doing their job well and the overall working activity was ,on the average ,also good. There is one thing,which has to be mentioned with special importance. It is a unique method of joining together proffessions of an engineer repairing electronic instruments and other devices in all kinds of Egyptian industry, engineer developing new electronic devices and a lecturer teaching on ta training programme of EIRDC. Especially in the developing country it gives a really new quality - very close contact with the actual needs of the industry and very broad contact with the people working and using electronic equipment in the industry. This makes a very good base for the development of own devices, which meet the needs of industry and aremaintainable in the local conditions. The training can be done on the best level because the trainer knows very well the environment which the students are from. Repairing and maintenance is in a developing country usually a very difficult job and extremely important, too. No documentation, no spare parts, every system is from a different company, different country, lack of knowledge, no tools, no instruments. And yet the people in EIRDC are doing it.

The main conclusion is, that EIRDC is capable of achieving the set difficult targets (maybe sometimes with some delays) and that it is pushing the level of application of modern electronics in Egyptian industry remarkably forward.

B. Microcomputer design and development laboratory

Microcomputer assembly and checkout is as much electronic development as software, adequate laboratory equipment is as important as adequate software - compilers, assemblers, editors, simulators,etc.

A medium-sized laboratory, as EIRDC needs for the purposes of servicing Egyptian industry's requirements, should contain these items:

Microcomputer development system
Logic analyser
Oscilloscope
Hand tools
Small test instruments
Application /target/ microcomputers with I/O modules
Peripherals for application microcomputers
Commodity items
Manuals, catalogs, datasheets
Working space

There is one more thing, which is as important as a working, productive microcomputer laboratory. This is a skilled, well organised team of personnel.

Let us now take the above outlined items one by one, compare it with findings in the EIRDC microcomputer laboratory and give recommendations.

1. Microcomputer development system

Findings: There is available a microcomputer development system MICROPOWER / PASCAL - RT, produced by Digital Equipment Corporation (DEC), USA, which was delivered to EIRDC in December 1984. There are some minor problems with thedelivered software to be cleared with the supplier and also the ROM/EPROM programmer should be completed and working.

This development system is a very good base to prepare application programs and test them specially for the Digital Equipment Corporation (DEC) hardware microcomputers (LSI - 11/2, LSI - 11/23 and SBC 11/21) (see annex 5).

The development system can also work like a small " mini " computer with the RT -11 operating system for other purposes in the EIRDC.

Recommendations:

Because the EIRDC laboratory will not be dedicated to DEC microcomputers only (to service the needs of the Egyptian industries ,the laboratory must be capable of working in general with all main types of microprocessors and microcomputers), it is recommended to expand the possibilities of the laboratory to work with other types of microcomputers. The most simple way how to do it is to provide special cross-software, which will run under the RT 11 operating system and will be capable of programming the EPROMs. Terms of reference and sources for such a software were given by the expert to the EIRDC. (Two Software referral catalogues and TESLA ELTOS software catalogue.) It will be useful to make first a preselection and

then contact possible vendors for more information about their software products. In the package must be editing facilities, compilers, linker, debugger, simulator and a way to link to the EPROM programmer. There exists also the possibility to contact the DECUS society and obtain the above software for memory media and reproduction cost only.

It will be very important for the Laboratory to obtain in the future (let us say in one or two years) a microcomputer development system, which will service all needs in a wide variety of 8 bit microprocessors and microcomputers and also be capable of working with the 16 bit processors. Such a device must be very carefully chosen (recommendation is not to buy a product from a computer firm, but another from an instrumentation firm - these products are more universal, and this is what HIRDC needs), because it must fit from earliest types 8 bit microcomputers for maintenance up to most modern 16 bit microprocessors. Universal development system with an "in circuit emulator" is absolutely needed for the development of HIRDC's own special purpose microcomputers (controllers, personal computers).

2. Logic analyser, Oscilloscope

Findings: Both instruments are in EIRDC in a very good quality

Recommendations:

It is necessary to repair in the suppliers factory some not properly working functions of the oscilloscope (memory). For the logic analyser it will be useful to purchase special personality probes for different types of microprocessor (to work with a universal probe is very complicated, it needs high qualified attendance and very easy a damage can occur).

3. Hand tools

item	seen in the laboratory	recommendation
soldering irons	simple type, not good for professional work	with temperature control is needed for proper work (specially for repairs)
wrapping tools	simple type, not good for professional work	a set of hand operated with interchangeble heads
unsolder tools	simple type, good for field repairs, not good for complicated work	Vacuum unsoldering kit is needed for repairs
screw drivers, pliers etc.	good	no action necessary

4. Small test instruments

item	seen in the laboratory	recommendation
bredboards	good	no action necessary
power supplies	good	dtto
logic aids /probes clips,pulser,..../	good	dtto
digital multimeter	good	dtto
extender cards	none	to be purchased; needed for the development system and for the target computers, too.

5. Application /target/ microcomputers

Findings: There is nothing like this in the laboratory. Training microcomputers can not be used for this purpose.

Recommendations:

For applications and for serious work in the laboratory it is necessary to have a kit, from which an application microcomputer will be assembled. The kit must contain housing with power supplies and a set of modules (cards) as processor,RAM memory, ROM (EPROM) memory, peripheral modules, digital I/O modules,analog I/O modules,etc. There are several types of such module systems and they differ with the card size, bus structure, connectors, microprocessor family, and others. To

choose the best for EIRDC is a question of the future policy of the Centre, situation on the Egyptian semiconductor market, contacts to perspective suppliers, service, etc. Detailed recommendations in this area should be the subject of a detailed study - this being out of range of the expert's one month work with the EIRDC.

6. Peripherals for application microcomputers

Findings: There is nothing like this in the laboratory.

Recommendations:

Two types of peripherals are needed: for the laboratory use and for the industrial applications. For the laboratory (for the first period) it will be enough to have a CRT terminal, cassette tape memory drive, simple printer, teletype. For the industrial installation some special devices will be required which can be specified when the application will be more known. It will be useful for both laboratory and application, to have some simple keyboards and single line alphanumeric displays.

7. Commodity items

In the laboratory there should be enough floppy diskettes, EPROM chips, connectors, flat cables, switches, etc.

8. Manuals, catalogs, datasheets

Findings: There is a very good library, with books, magazines and catalogs, all of these being frequently used. The service in the library is very good.

Recommendations:

Update every year component catalogs and data sheets from the well-known suppliers and keep the old ones in the library for future use when repairing old devices.

9. Working space (lay-out)

Findings: The laboratory is placed in a room which is good and suitable for both the staff and the equipment.

Recommendations:

It will be very useful to install in the laboratory earthed power supplies (third wire to be earthed). It must be done according to the Egyptian prevailing regulations, but common earth is recommended for a number of instruments used in the laboratory to prevent damage by electrostatic shocks. It is absolutely necessary when work with MOS circuits is carried out. It is recomended not to use electronic equipment with moving parts (printers, disk drivers) during sand storms in Cairo. They should be kept under plastic cover until the room is properly cleaned.

10. Laboratory Staff

Findings: The staff consists of well qualified people with good know - how. They like their work and are enthusiastic. However, the staff have no experience in the application of microcomputers and no experience in team work on computer application projects.

Recommendations:

One way how to improve the situation is to give the staff possibility to gain the required experience by fellowhips of the individuals of the EIRDC in laboratories working on industrial applications abroad. The other way is to make a possibility for an expert with experience in the microcomputer industrial applications and with experience in team leading to work in EIRDC with the staff for a longer time.

It is very important, now and in the future, to have permanent and close, personal contact to the world activity in this field. The world progress is very fast and this is the only way how to follow it. This contact can be also improved by participation in international seminars, exhibitions, etc.

Some observations to the internal organisation of the laboratory are in recommendations which are attached to this chapter.

C. Recommendations for the future policy of EIRDC in the microcomputer area

The expert's opinion is that it would be most useful for the country if the microcomputer laboratory would be oriented in the beginning on application software. The software/hardware cost-ratio for industrial systems is in the best case 4 : 1, usually 8 : 1 or more, and the trend is more expensive software and cheaper hardware. From the economical viewpoint it is more useful to save the bigger part of the price of the system, and use in the beginning period some proven, reliable factory-made hardware. And all the more, for the development of good application software you must know very well the place of installation and the conditions under which the system will be working. The experience with microcomputer industrial systems will constitute a very good base to create an industrial microcomputer hardware specially for Egyptian conditions, which can be interesting for other developing countries as well.

To start at once with all problems put together will be very difficult, and is certainly not the quickest way of reaching the required level (own hardware, own system design, own application software). As far as training purposes of the Centre are concerned, the way through the application software will be also more useful.

The microcomputer hardware, to start with the own microcomputer development activity, will be - as proposed - a personal computer rather than an industrial controller.

To make a conclusion on this topic, the following work steps seem to be the best for fast progress:

1. to build up the laboratory (both personnel and equipment);
2. to implement a simple application;

3. to develop and prepare, for production, an Egyptian personal or training computer; and

4. to develop an industrial hardware (controller).

It is possible, of course, to implement some of these tasks in parallel and/or overlapping as appropriate.

D. Recommendations for the internal organization of work in the microcomputer laboratory

The equipment which is already in the laboratory and the other one which is expected to be delivered must be studied and understood; aims which are to be reached require a number of problems to be solved. Therefore the problems must be divided among the staff to go through faster, and there must be a system how to achieve continuity of progress for longer a time. The leakage of best people from the laboratory team to the private industry in Egypt seems not to be as high as it was in the past, but it will be useful to find a method, which will minimize the loss to the laboratory when an individual leaves.

The best way how to go through a big amount of work is to divide it into smaller, well defined, problem areas. For each problem area there must be a responsible person, who will give results of his work to other members of the laboratory team. He will answer their questions and will help them with all questions concerning his problem area of work. It will be very useful to second these responsibilities to junior members of the staff. In such case, when one senior member of the staff leaves, it will be a loss to the laboratory, but it will be not a tragedy and it will be not necessary to start from the beginning. There will remain the spreaded knowledge among other members of the staff, there will remain the young assistant and there will remain all written reports about the particular problem area . Written reports are also very important to go successfuly through a big piece of work, and if they are on a good level, they help also very much in situations when one leaves the team. For good health of the team it is very good, when everybody of the team receives a piece of work and a piece of

responsibility, everybody feels that he is important to the team. The more skilled members must receive higher or more difficult responsibilities, the beginners adequate responsibilities.

In terms of the problem area, such parts of responsibilities are to be understood as for example:

Hardware of the microcomputer development system
Programming EPROMs
Operating system RT 11
PASCAL compiler
MACROASSEMBLER compiler
Cross techniquee for M 6800
Cross technique for I 8085
and so on

With such an organization of work in the laboratory, the leader can act more like a manager and he can easily let grow his staff members into specialists.

In such a computer laboratory it is also necessary to have the following (and probably in future other) responsibilities:

hardware - keeper :	responsible for hardware of computers; knows what hardware is in laboratory, what is outside; knows where are cables, spare parts, calls for maintenance, etc. (It can be more persons for separate parts in future.)
software - keeper :	responsible for software and media; keeps the software (original, first copy, users diskettes), produces copies, distributes new magnetic media, etc.

manual - keeper : responsible for computer manuals (software and hardware) which cannot be in the library permanently; makes copies, etc.

It should be noticed that in a microcomputer laboratory like in EIRDC, these responsibilities are not a full-time job, but only an extension of other normal duties.

Summarizing the above recommendations, they can be condensed:

split the work and write documentation.

Annex 1

UNITED NATIONS

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

UNIDO

Project in the Arab Republic of Egypt

JOB DESCRIPTION

DP/EGY/78/003/11-05/31.9.C

Post title Expert in the Industrial Application of Microprocessors

Duration One month

Date required As soon as possible

Duty station Cairo

Purpose of project To assist the Egyptian General Organization for Technical Electrical and Electronic Industries and its electronic companies in the development, improvement and expansion of the electronics industry.

Duties The expert will be attached to the Electronic Industries Research and Development Centre (EIRDC) and will specifically be expected to:

1) Assist the EIRDC in stengthening the Microcomputer Development and Training Laboratory to enable it to provide assistance to the electronic industry in the use of microcomputers for production control and processing systems;

2) Train the staff of the Centre in the field of industrial application of microprocessors (process control, real time signal processing, etc.);

3) Provide technical and general guidance in the following areas:

   (a) Introduction of the trend of microprocessors

   (b) CPU, memory and J/C interfaces (single and multi chips), instruction system, microprogramme control

   (c) Microprocessor programming

   (d) Description on microprocessors Zilog 80

   (e) Microcomputer system

..../..

4) Assist the staff of the Centre in training national specialists from industrial enterprises on the subject.

The expert will also be expected to prepare a final report, setting out the findings of the mission and recommendations to the Government on further action which might be taken.

Qualifications: B.Sc., PH.D., or equivalent, with extensive experience and knowledge in microprocessor development and in the field of industrial application of microprocessors; experience in such areas as process control, real time signal processing, etc.

Language: English (Arabic an asset)

Background Information: During the last few years the Centre was engaged to assist the different Egyptian industries (such as textile, electrical, metallurgical, mining, petrochemical, food and chemical industries) in the fields of industrial electronics, control and instrumentations.

Confronting the growing demand of the Egyptian industries to use in their plants new electronic equipment and systems based on microprocessor and microcomputer technology, to improve the productivity and the quality, EIRDC is establishing and accelerating the development and implementation in those fields. It is also strengthening the engineering and technical qualifications in the field of microprocessor and microcomputer hardware and software development work.

Annex 2

Revised "Duties" / Working Programme

The expert will be attached to the Electronic Industries Research and Development Centre (EIRDC) and will specifically be expected to:

1. Assist the EIRDC in strengthening the Microcomputer Development and Training Laboratory to enable it to provide assistance to the electronic industry in the use of microcomputers for production control and processing systems;
2. Train the staff of the Centre in the field of industrial application of microprocessors and microcomputers (process control, real time signal processing, enviromental conditions, electrical interference, plant interfacing, man-machine interface, cabling, etc.).
3. Train the staff of the Centre in the field of using a microcomputer laboratory (operating organisation, working methods, testing methods, etc.).
4. Provide technical and general guidance in the following areas:
   a) Introduction of the trend of microprocessors and microcomputers from the point of view of an industrial system designer;
   b) microcomputer programming;
   c) microcomputer systems; and
   d) system, software and hardware documentation.

5. Assist the EIRDC in searching the optimal aim and way in future microcomputer applications with reference to the needs of the Egyptian industry and possibilies of the Microcomputer Development and Training Laboratory.

6. Assist the staff of the Centre in training national specialists from industrial enterprises on the subject.

The expert will also be expected to prepare a final report, setting out the findings of the mission and recommendations to the Government on further action which might be taken.

Annex 3

Itinerary

9.1.1985		Prague-Vienna by train.
10.-11.1.85		Briefing at UNIDO Vienna headquarters
12.1.		Vienna - Cairo by air.
13.1.	a.	Briefing at UNDP/UNIDO office in Cairo.
	b.	Handing the letter from Mr.A.A.Vassiliev, Director of Division of Industrial Operations, UNIDO, to Mr.T.Sabry.
	c.	Meeting with Dr.Eng.El Hadidy, introduction to the staff, discusions about EIRDC and its plans and needs.
14.1.	a.	Familiarization with the equipment in the microprocessor laboratory.
	b.	Discusion about contents of lectures for the staff.
15.1.	a.	Lecture given "Programme development for microprocessors and microcomputers ".
	b.	Demonstration using the PHILIPS PM 3540 16 channel logic scope in microprocessor fault-finding.
16.1.	a.	Work - plan for next days prepared with Dr El Hadidy.
	b.	Demonstration the PM 3540 with signal generator.
	c.	Preparing the computer - computer connection as training project example.
17.1.	a.	Start of the "Project example ", explanantion of the job prepared for two teams.

	b.	Studying manuals of the MICRO POWER PASCAL RT microcomputer development system.
	c.	Attendance of a closing ceremony of a EIRDC course, discussion with the students from Egyptian industry.
18.1.85		Weekend.
19.1.		Preparation of materials for lectures.
20.1.	a.	Two teams appointed by Dr. El Hadidy for the "Project example ". Work in two teams started.
	b.	Fault-finding in the HP 85 personal computer. A note for file with the conclusions was made.
	c.	The SKEMA - GRAF system was studied from manuals for finding the way to speed up testing of produced masks for printed circuits.
21.1.	a.	Lecture given "Microprocessors, microcomputers ".
	b.	Work on the "Project example " continued (definition of the communication, I/O ports), first programmes written.
	c.	An inspection to the SKEMA GRAF was made. First part of the note for file (Memorandum) was written.
22.1.	a.	A detailed summary of the required survey (lecture) " Microprocessor-based systems for industrial instrumentation and control " was given to Dr.El Hadidy.
	b.	Work on the "Project example " continued.First version of the communication protocol was defined, first programmes were tested.
	c.	Lecture given "Microcomputer systems programming ".
23.1.	a.	Lecture given "Microcomputers in industrial control systems ".
	b.	Visit to the EIRDC library.
	c.	Work on the "Project example "continued.
	d.	Preparation for the study "Personal and Industrial computers" .

24.1. a. Discusion with Dr.El Hadidy on personal and industrial computers in EIRDC plans.
-documentation from lectures and
-information about findings on the SKEMA -GRAF were given.

b. Work on the "Project example " continued. Discussion about searching for the best solution for connection was terminated.
A flowchart of two working possibilities was explained and discussed in detail, and both teams prepared own flowcharts. Both flowcharts were tested simultaneously with a "non computer" simulation test.

c. Lecture given " Man - machine communication " .

25.1. Weekend .

26.1. Preparation for lectures .

27.1. a. Work on the "Project example " continued . Programmes of both teams were tested and worked separately, prepared for testing with signal simulators.

b. First half of lecture "Connection to the plant (Industrial I/O) " was given.

c. First version of the "Body of the report " was written .

d. On the faulty HP 85 personal computer the possibly faulty cfruits were localised.

28.1. a. Discusion with Dr.El Hadidy to the first version of the "Body of the report " and recommendations.

b. The required survey "Microprocessor-based systems for industrial instrumentation and control " was finished .

29.1. a. A visit to UNDP/UNIDO office in Cairo was made to arrange the trip to Vienna.

	b.	Work on the "Project example " continued. Cabling for microcomputer connection was made and prepared for testing .
30.1.	a.	Second half of the lecture "Connection to the plant (Industrial I/O) " was given.
	b.	The faulty module from the DEC printer LA 36 was discussed.
	c.	Lecture given "Working with floppy - disks (diskettes) " .
	d.	Work on the "Project example " continued. The cabling revision was made and the cabling was tested. The connection of computers was made.
	e.	Work on Tektronix logic analyser started to instale the universal module instead of the I 8080 personality module .
31.1.		Work on the "Project example " continued with troubles. Several versions of programmes were written and tested .
1.2.		Weekend .
2.2.		Preparing and writing of report.
3.2.	a.	Lecture given "Building up an industrial micro-computerised system "
	b.	The use of DEC´s "Software referral catalogue " was described to the staff .
	c.	The PB 11 AY PROM-EPROM programmer was studied.
	d.	The DEC R x 02 floppy disc drive was studied for compatibility reasons .
4.2.	a.	Work on the "Project example " continued.The connection was made and was successful in one direction communication .
	b.	Discusion with Dr. Hammalawy from Cairo University about microcomputer applications in Egypt .

	c.	Lecture given "Structured programming " .
5.2.	a.	Work on the "Project example " continued. Noise problems on the M 6800 system occurred.
	b.	Discussion with Dr El Hadidy on draft of some parts of the report .
	c.	Lecture given "Documentation for industrial systems " .
6.2.	a.	Final excursion in the EIRDC laboratories was made.
	b.	Closing ceremony in the Microcomputer laboratory.
	c.	The Tektronix logic analyser probe was changed from the I 8080 configuration to the universal mode .
7.2.		Cairo - Vienna by air .
8.2.		Debriefing at UNIDO Vienna headquarters.
9.2.		Vienna - Prague by air.

Annex 4

List of lectures

1. Programme development for microprocessors and microcomputers
2. Microprocessors, microcomputers
3. Microcomputer systems programming
4. Microcomputers in industrial control systems
5. Connection to the plant (Industrial I/O) (two parts)
6. Man - machine communication
7. Working with floppy - disks (diskettes)
8. Building up an industrial microcomputerised system
9. Structured programming (structured solving problems)
10. Documentation for industrial systems (programme documentation, system documentation, users' documentation, maitenance documentation).

Required survey:

Microprocessor based systems for industrial instrumentation and control (14 p).

Annex 5

Microcomputer development system MICROPOWER/PASCAL - RT

Producer: Digital Equipment Corporation (DEC), USA

This development system is based on the LSI -11/23 microcomputer working under the RT 11, version 5.0 operating system and have special software for development microcomputer systems based on these three types of microcomputers:

LS I - 11/2, LSI - 11/23 and SBC 11/21 . The source program is written in a version of PASCAL or MACROASSEMBLER and the modular operating system for the target in also build up in the host. The connection between the host and target computer is made by a serial link.

The configuration in EIRDC laboratory:

CPU	LSI - 11/23
Memory	128 kB
Diskette	RX 02 (Two drives, double or single density, single side)
Terminal	VT 100
Printer	LA /20
Operační system	RT 11, ver. 5.0
PROM programmer	PB 11 (for EPROMS 2708, 2716, 2732 and others)