

6 Development and Modification of Curricula and Textbooks for 20 Schools

Following the decision of the MoNE to reduce the duration of education to 4 years, a new schedule of subjects is prepared by the pilot project schools and it is pending approval by MoNE. In this schedule, the general and vocational subjects will be as shown in the following table:

Subject/Sub Dept.	Factory Automation (IM)	Automated Production (IM)	Product Design (IE)	Network Servers (IE)
<i>Information Communication Technology</i>	x	x	x	x
<i>Industrial Mathematics</i>	x	x	x	x
<i>Circuit analysis and applications</i>	x	x	x	x
<i>Technical Drawing</i>	x	x	x	x
<i>Industrial Mathematics</i>	x	x	x	x
<i>Technical English</i>	x	x	x	x
<i>Industrial Management (sel.)</i>	x	x	x	x
Basic Industrial Applications	x	x	x	x
Automation Mechanics	x	x	x	x
Computer Control Techniques I	x	x	x	x
Sequential Control	x	x	x	x
Computer Networks	x	x	x	x
CAD	x	x	x	x
Computer Control Techniques II	x	x	x	x
Feedback Control	x	x	x	x
Factory Automation	x			
CNC	x	x		
FA Cell Control	x	x		
FA Robot Practices	x	x		
Microcontroller Applications	x	x	x	x
Basic Industrial Applications II (sel.)	x	x	x	x
Automated Production		x		
Mechatronics			x	x
Programmable Logical Devices			x	
Digital Signal Processing			x	
Industrial Product Design			x	
Network Servers and				x



Security				
Web Systems				X
Network Systems				X

Table 12. General and Vocational Curricular Subjects for Industrial Automation Departments

This schedule is prepared to provide a total of 54 hours (credits) of practice subjects. Total number of vocational subjects is 88 hours (credits). Common subjects for every sub department are:

- Information Technology
- Mathematics
- Circuit Analysis
- Technical Drawing
- Industrial Mathematics
- Technical English
- Industrial Management
- Selective subjects.

The curricula employed until now is almost adequate for the purpose. Some extra subjects in the light of the experience gathered during the pilot project, to cater for the developing demands of the industry shall also have to be included in the curricula, however. These subjects are Computer Programming Languages and Robotics Software. Then the curricula and class hours can be adapted to incorporate these new subjects.

Under the Pilot Project, 32 technical subjects were covered so far. JICA experts were engaged in writing the textbooks of these subjects and in technology transfer to the Turkish counterparts for about four years. From the experience of the interviewed teachers, school directors and foreign experts in the pilot project schools, it can also be said that existing textbooks need more sophistication, partly because some of the books were prepared within a tight schedule, and partly because of the adjustments necessary for better application practices (see Section 3).

Therefore these textbooks need to be rewritten. Existing textbooks of the pilot project should be taken as a basis for the new textbooks; but this time 4 years of pilot school practice results should be taken into consideration, to make a better coordination between the subjects. The time frame allocated to review and rewrite the textbooks is 24 months, according to the General Implementation Schedule. Theoretically, review and rewriting can be accomplished by the existing teachers, or can be undertaken via a technical collaboration scheme.

Rewriting of the textbooks is also necessitated by the ongoing SVET project. Under the SVET scheme (see Section 3), MoNE has decided that all textbooks in the vocational and technical high schools should be prepared in a modular fashion. This requires rewriting the textbooks of all subjects. For this purpose two coordinator teachers are appointed in every school under SVET scheme. The coordinators have received training on modular textbook preparation, and now all the concerned teachers shall come together to analyze and divide the textbooks into sections then engage in writing the modules. Since only existing teachers are trained on the subjects of Industrial Automation, only these teachers have the experience and knowledge to review and rewrite the books. On the other hand, these teachers shall also have to teach in the TTC; therefore an external assistance is going to be necessary (2.2.10.4).



Existing textbooks were prepared by 4 foreign experts within 4 years (176 man*months), but these experts were also involved in setting up laboratories and transferring technology to Turkish teachers. It is safe to assume that 75 % of the total was expended in textbook preparation, bringing the total to 132 man*months. Since existing material will be used as a starting point, 2 external experts working full time, working jointly with 3 pilot project teachers is sufficient to make the necessary revisions in 2 years (a total of 120 man*months).



7 General Implementation Schedule

Analysis of collected data indicates that:

- There is a demand in Turkey for the graduates of Industrial Automation departments, and this demand will continue in the future, surpassing the supply. The demand is not only from the industry, but from the service sector as well.
- The pilot project experience has proved successful, while providing valuable information based on the 4 years' practice
- The Schools within the expansion project are physically ready
- Laboratories need to be set up in 20 schools
- Textbooks for the students are inadequate, therefore a review and rewriting will be necessary
- Teachers need to be trained in a training facility with specific aspects. A curriculum and textbooks have to be prepared for the training facility
- The building of the training facility is being built by MoNE; will need to be furnished
- The training facility will need to have laboratories set up as well
- MoNE has started the tendering for the laboratory equipment for the schools.

Therefore implementation of the expansion project with TTC necessitates the synchronization of the following items (2.2.10.5):

- Procurement and installation of laboratory equipment in schools,
- Textbook revisions for schools,
- Preparation of curricula and the textbooks for TTC,
- Training the teachers in TTC,
- TTC building and furnishing,
- Procurement of laboratory equipment for TTC.

Scheduling of these items inline with the education program is displayed on the following pages.

The schools within the expansion project are grouped as shown on the Table 13. First group has already accepted students for the 2005-2006 academic year; and the second group will accept students for the 2006-2007 academic year.

First Implementation Group Schools	
Name	Province
Merkez ATL EML	Adana
İskitler ATL AML EML	Ankara
Merkez ATL AML EML TL	Antalya
Atatürk ATL AML EML	Eskişehir
Tarsus ATL AML EML	Mersin (İçel)
Pendik ATL AML EML	İstanbul
Merkez ATL EML	Van
M. Rüştü Uzel ATL AML EML	Gaziantep
Gebze ATL AML EML	Kocaeli
Adil Karaağaç ATL AML	Konya



Second Implementation Group Schools	
Name	Province
Gazi ATL AML EML TL	Afyon
Atatürk ATL AML EML	Erzurum
Merkez ATL AML EML	Kahramanmaraş
Hürriyet ATL EML	Kayseri
Merkez ATL AML EML	Şanlıurfa
Şehit Öğretmen Yusuf Batur ATL AML EML	Denizli
Çorlu M. Rüştü Uzel ATL AML EML	Tekirdağ
Merkez ATL AML EML	Ordu
Yunus Emre AML EML	Malatya
Ali Osman Sönmez ATL AML EML	Bursa

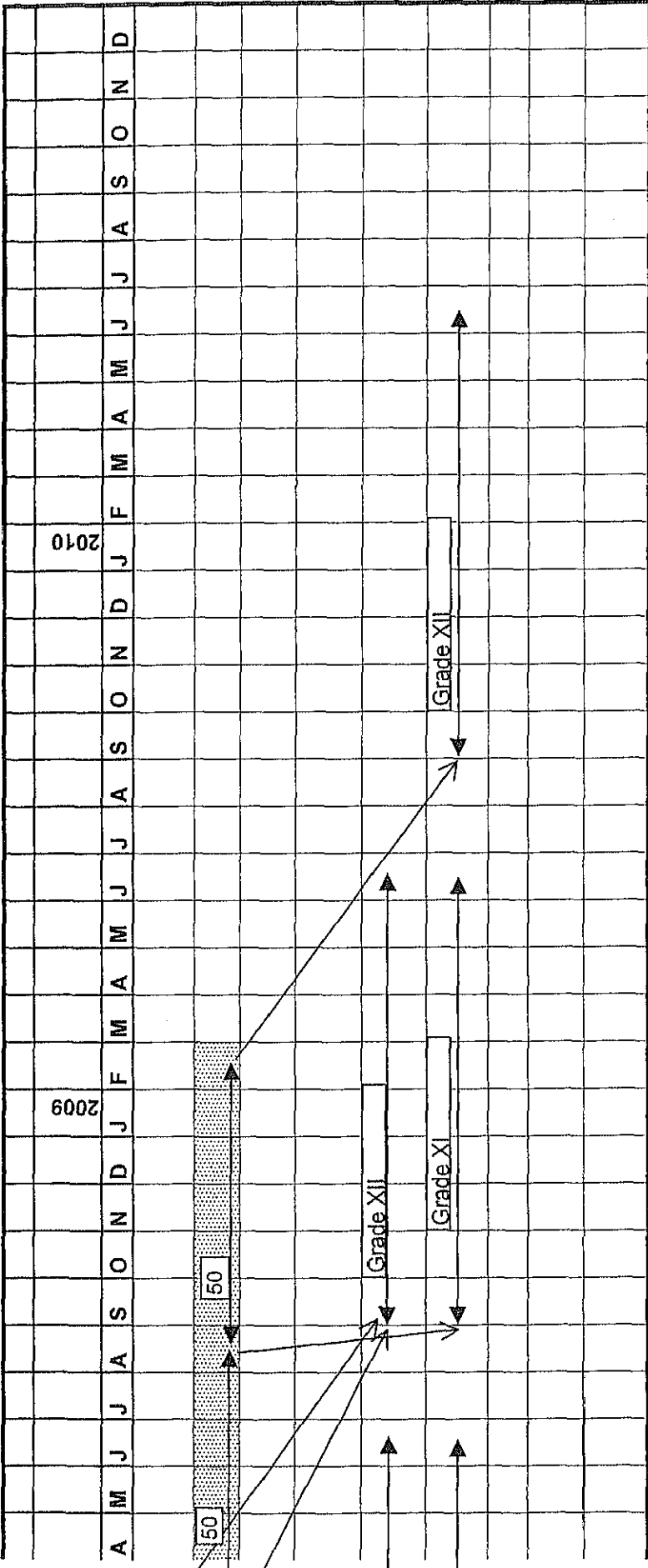
Table 13. First and Second Implementation Group Schools

While executing the schedule, it should be noted that the textbook revisions for schools and for TTC should start immediately.

Table 15. General Implementation Schedule

Year	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M
2006															
2007															
2008															
Month															
Textbook revision for schools															
Teacher training Curriculum&textbooks for TTC															
Purchase&install equipment at schools															
Education in first group of 10 schools															
Education in second group of 10 schools															
TTC Building															
TTC staff appointment															
Purchase&install equipment at TTC															

Note: The figures on the teacher training row indicate the number of trainees within the training group
 Note: Number of trainees can be adjusted according to needs



General Implementation Schedule (continued)



8 Financial Estimation

8.1 Cost Items

The cost items of the project are:

- Equipment for 20 schools
- Equipment for TTC
- Textbook expenses, including accommodation of foreign staff, review, preparation, translation, printing. Involves 2 foreign experts and 3 Turkish teachers for 2 years
- TTC curriculum and textbook preparation, including accommodation of foreign staff, preparation, translation, printing. Involves 5 foreign experts for 1 year.
- Contracted out services, including material requisitions, procurement, engineering for architectural design/layout, engineering for elevated floors, installation, test running and commissioning of equipment, supervision of engineering services, supervision of whole project
- Running costs for the implementation period
- TTC building and its furnishings.

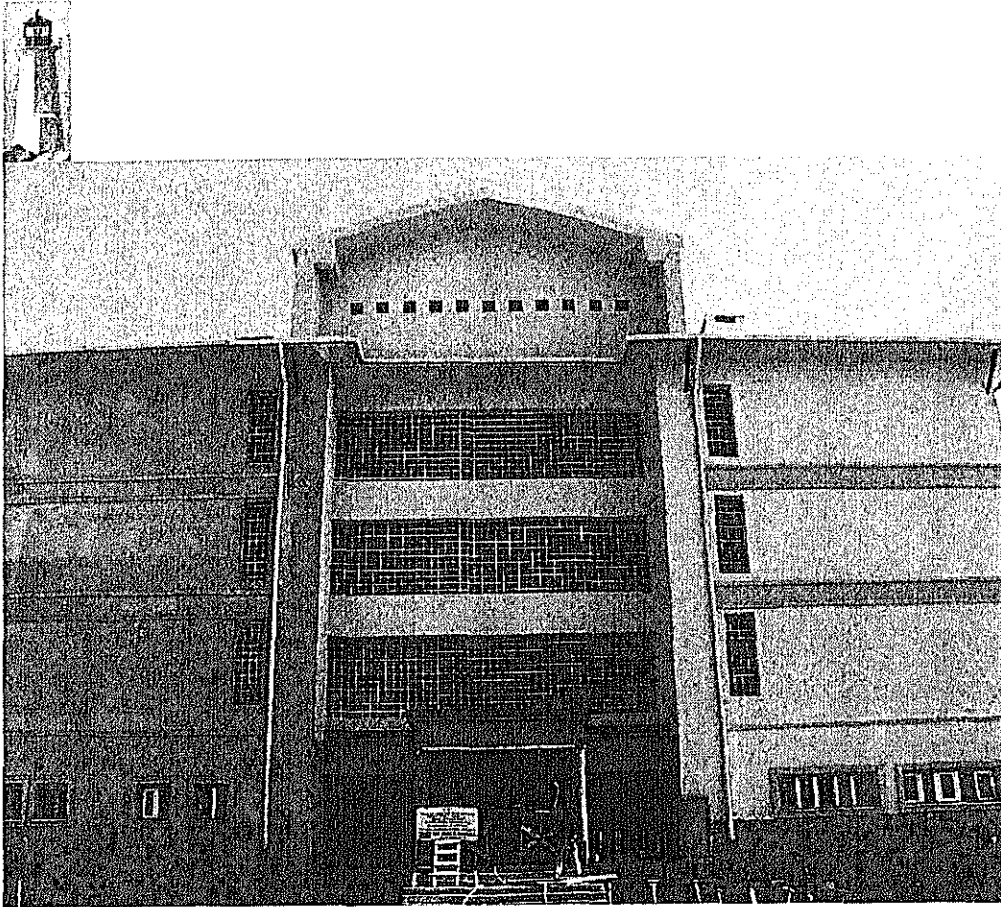
8.2 Cost Tables

Total cost for project implementation is:

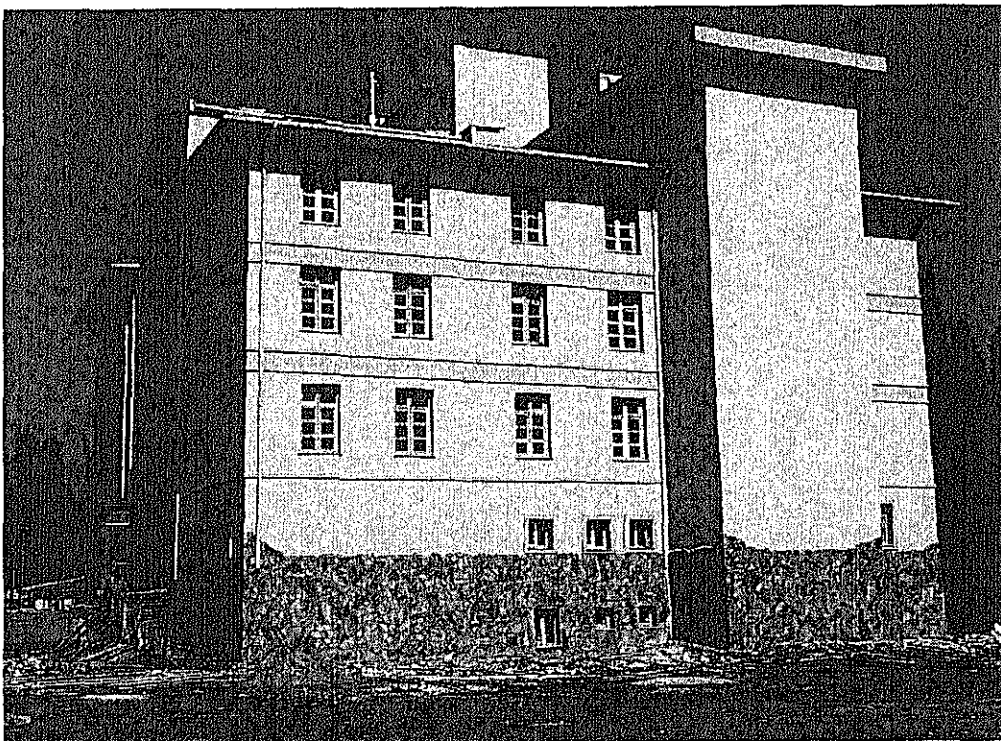
Item	Item cost, USD	Total, USD
Equipment for 20 schools		20,440,000
Equipment for TTC		500,000
Textbook development expenses for 20 schools		
foreign experts' accommodation & fees	400,000	
Turkish teachers' accommodation & fees	75,000	
translating and printing	225,000	700,000
Curriculum and textbook expenses for TTC		
foreign experts' accommodation and fees	500,000	
translating and printing	100,000	600,000
Contracted out services;		
requisitions and procurement	50,000	
architectural	10,000	
elevated floors, wiring & cabling	540,000	
installation, testing & commissioning	400,000	
supervision of engineering services	50,000	
supervision of whole project	100,000	1,150,000
TTC Building		990,000
TTC furnishings		100,000
Running costs for implementation period		1,000,000
Total		25,480,000

Table 15. Cost of Project

Among these items, TTC building is being undertaken on the account of MoNE. All other items require additional resource allocation, therefore necessary amount for the remaining part of the project is USD 24,490,000 (2.2.10.6).

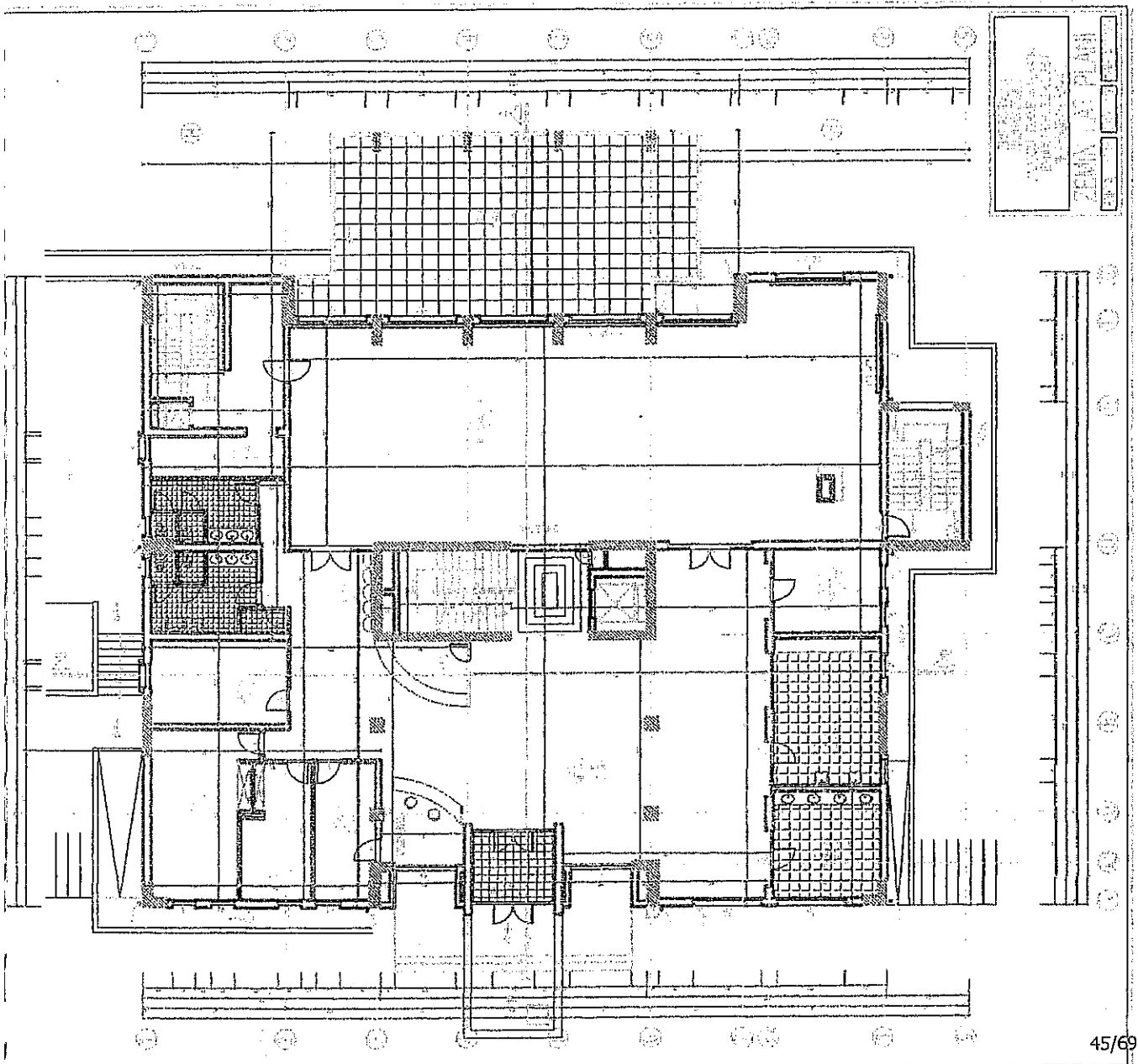


Picture 1. Teacher Training Center, Front View

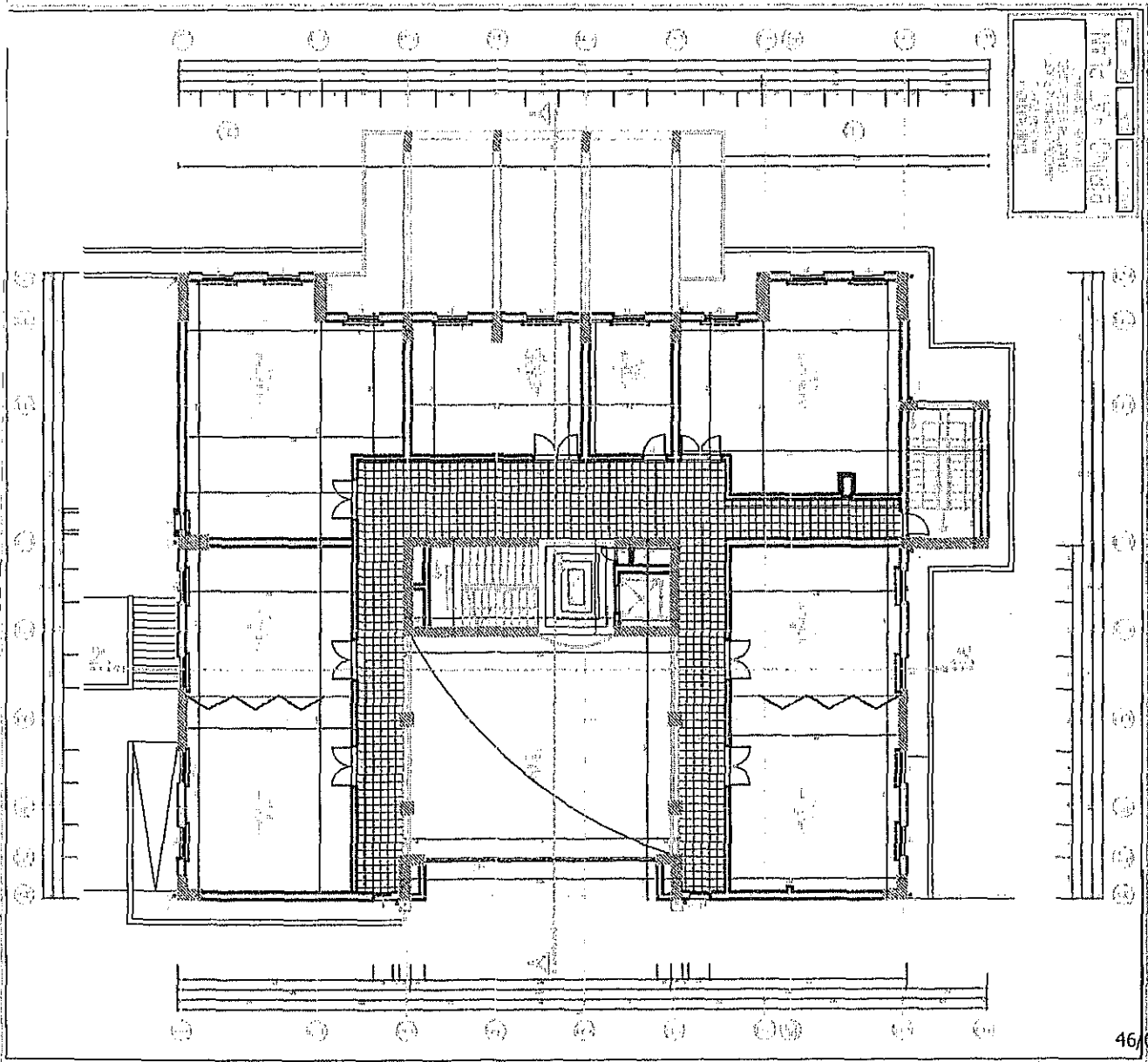


Picture 2. Teacher Training Center, Side View

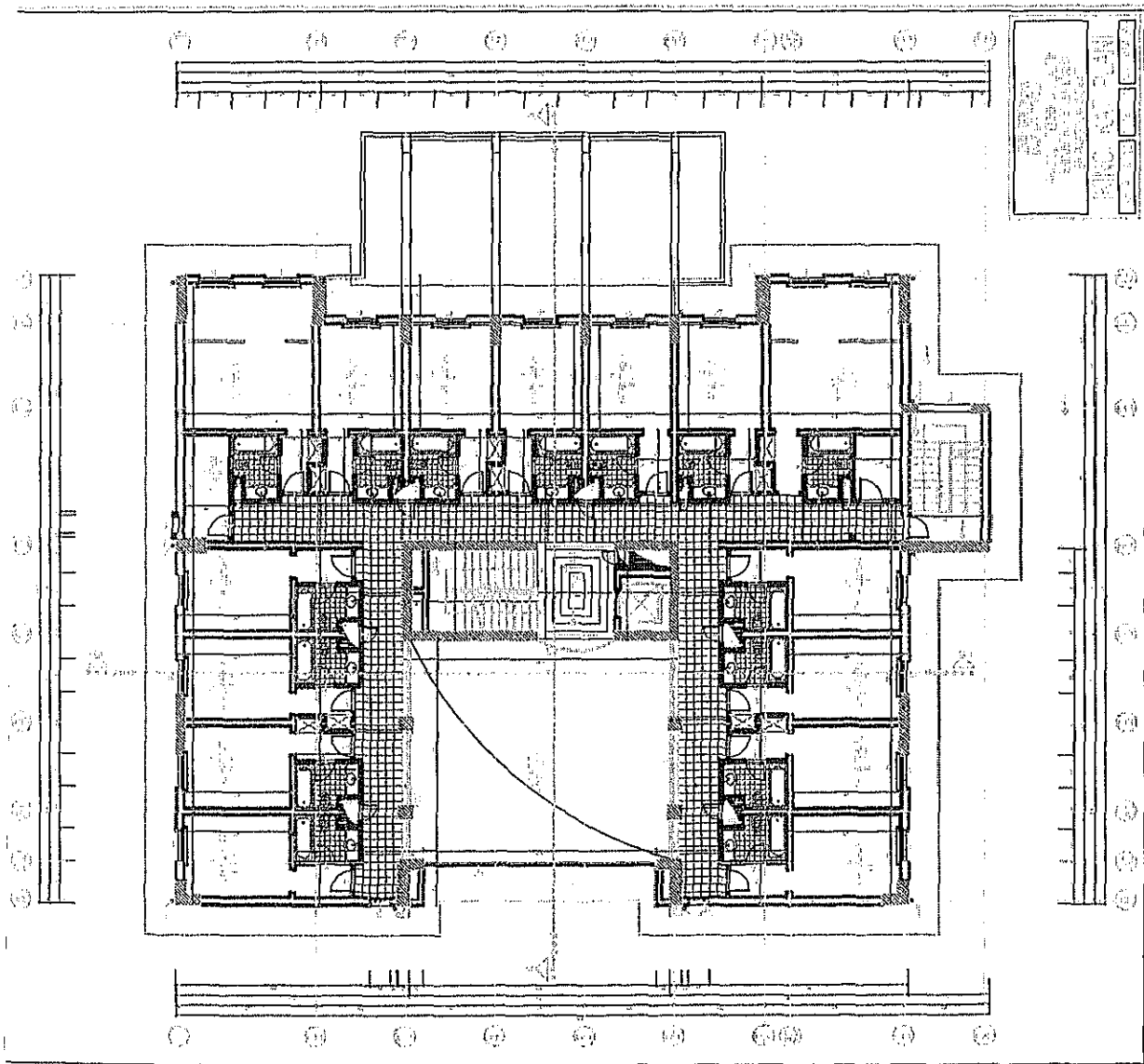
TTC Ground Floor Plan



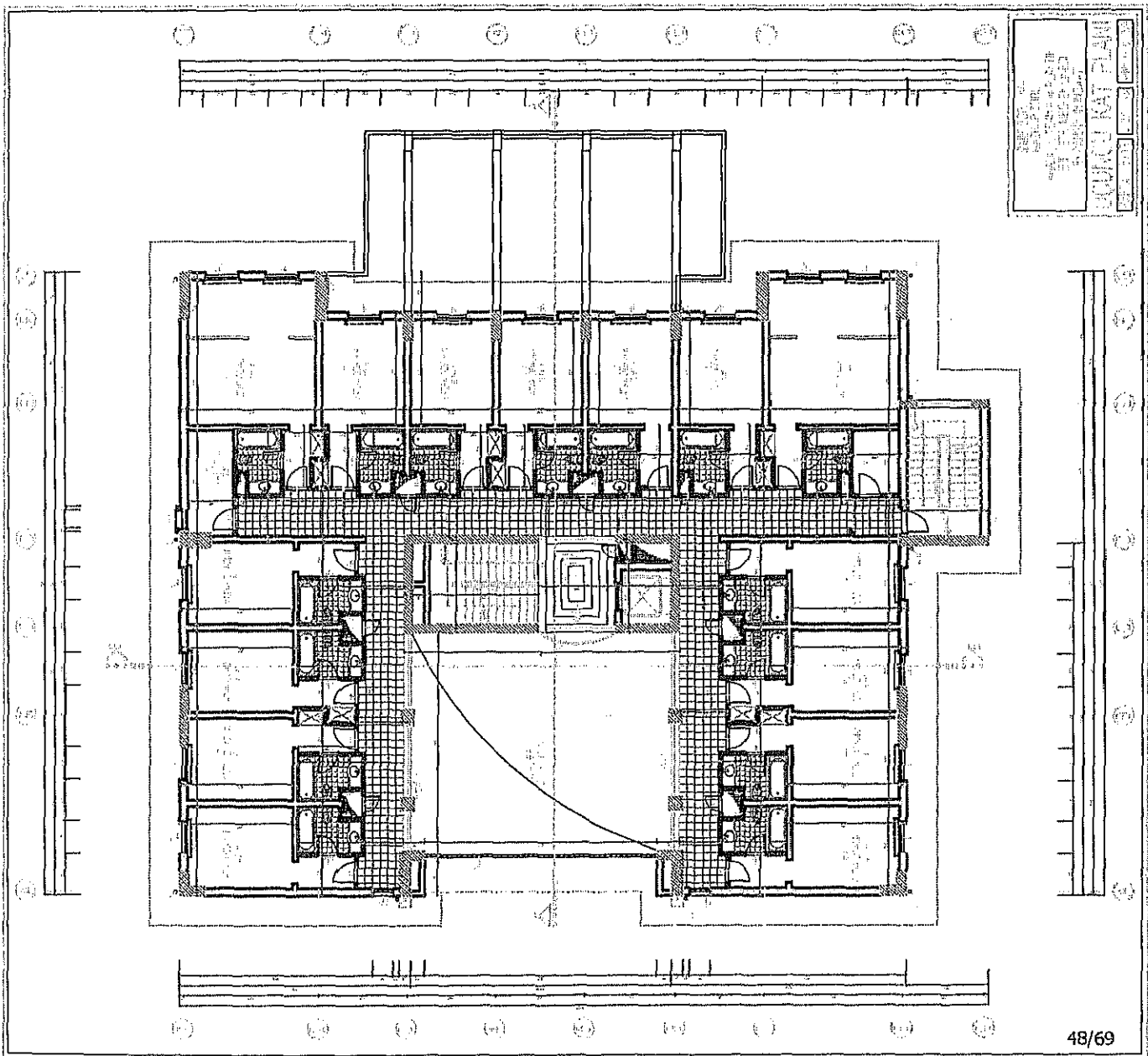
TTC 1st Floor Plan



TTC 2nd Floor Plan



TTC 3rd Floor Plan





9 Outline of Major Laboratory Equipment

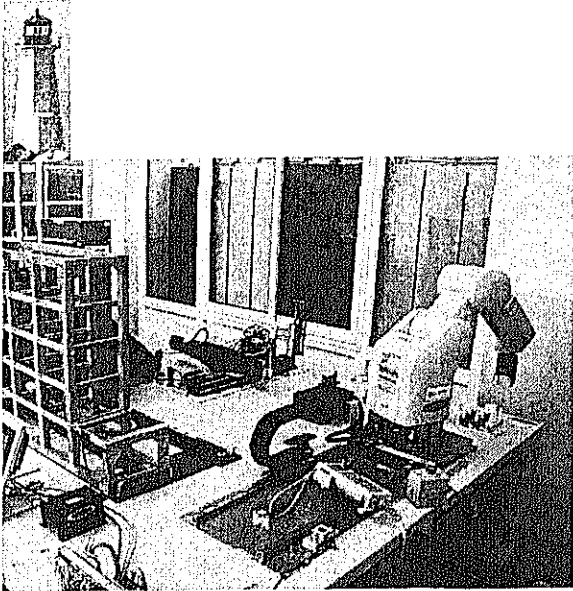
9.1 Purpose of Laboratories

In the Industrial Automation Department of a school, there are going to be 2 sub departments, namely Information Electronics (IE) and Information Machinery (IM), which are further diversified as IE -> Network Servers and Product Design; IM -> Factory Automation and Automated Production. Under the curricula of these departments, there are 83 hours of vocational subjects, under the Anatolian Vocational High School Scheme. To provide the necessary practice areas for the subjects, 5 laboratories and a server room shall have to be provided in each school:

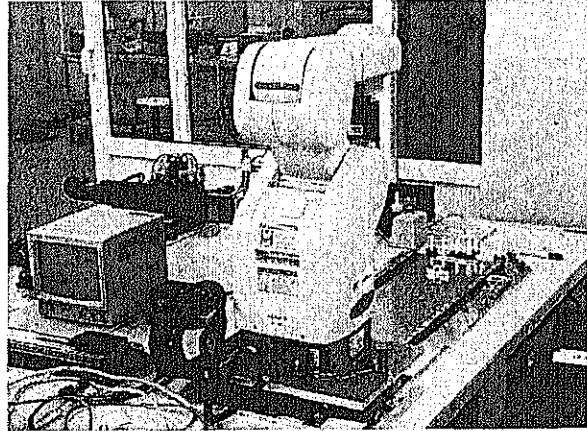
Laboratory	Practice subjects
Control and Factory Automation Lab	FA and Robot Technology (IE, IM) Sequential Control Technology (IE, IM) FA Control Cell Technology (IM) Automatic Production Technology (IM) CNC working (IM) Robot Software (Proposed)
Computer Lab I (Multimedia)	Basic Practices of Information Technology (IE, IM) CAD/CAM (IE, IM)
Computer Lab II (Programming)	Network Server & Security (IE) Network System (IE) Web System Technology (IE) Computer Control Technology (IE, IM) Computer Network (IE, IM) Programming Languages (Proposed)
Electronics Lab	Electricity and Electronics (IE, IM) Mechatronics (IE, IM) Basic Industrial Practices (selective)(IE,IM) Feedback Control (IE, IM)
Microcomputer Lab	Microcomputer Technology (IE, IM) Programmable Logical Devices (PLD) (IE) Digital Signal Processing (IE) Industrial Prototype Design (IE)

Table 16. Laboratories and Corresponding Practice Subjects

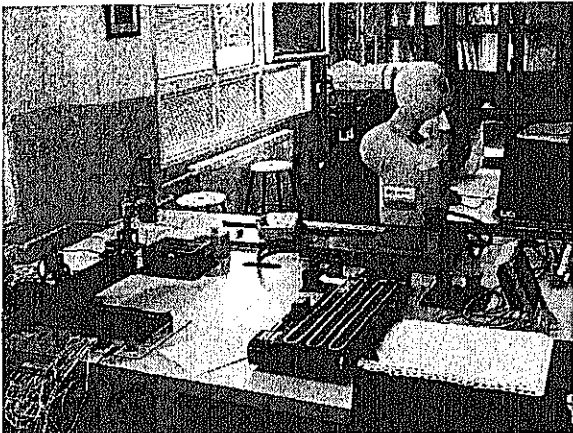
For the Teacher Training Center, requirements are already discussed in Section 5. The equipment list for TTC laboratories is under 9.2, *For the TTC*. Please refer to following pages for pictures of laboratories.



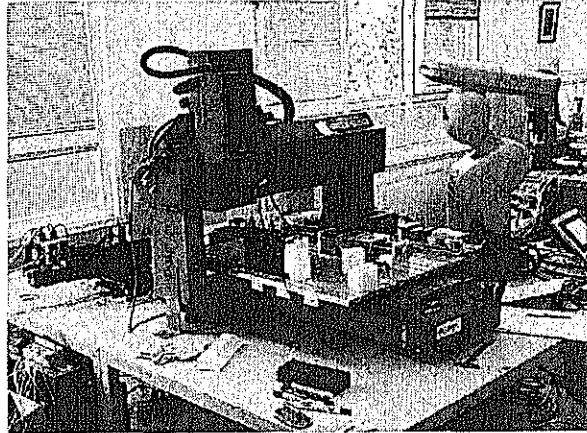
Picture 3. Warehouse Module, Control and FA Laboratory



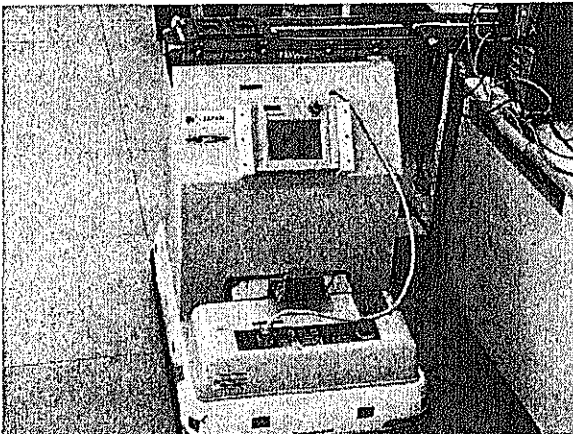
Picture 4. Testing Module, Control and FA Laboratory



Picture 5. Assembly Module, Control and FA Laboratory



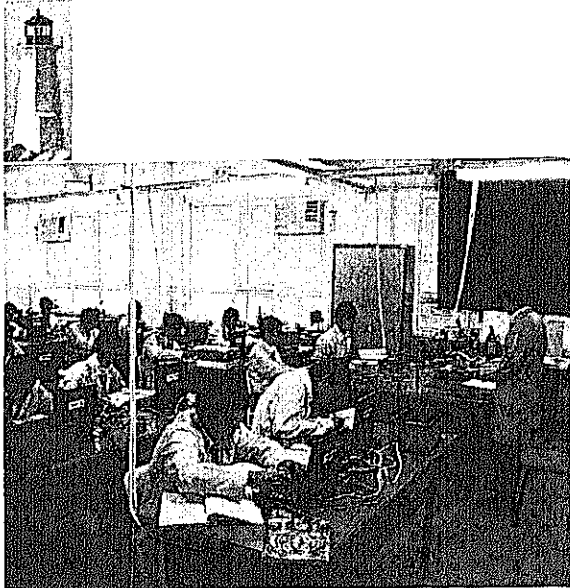
Picture 6. Processing Module, Control and FA Laboratory



Picture 7. Transport Robot, Control and FA Laboratory



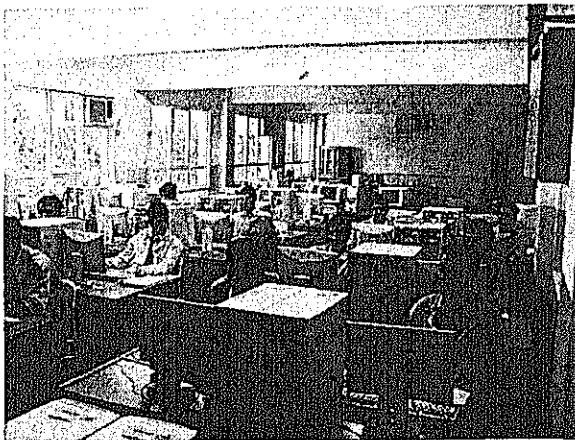
Picture 8. CNC coupled with BYNASS Test Set, Control and FA Laboratory



Picture 9. Microcomputer Laboratory



Picture 10. Computer (multimedia) Laboratory



Picture 11. Computer (programming) Laboratory



Picture 12. Electronics Laboratory

9.2 List of equipment

For the 20 schools

Control and Factory Automation Laboratory, 85 sq m

Purpose: For student practices in the areas of:

- Operation and control technology, like PLCs, motors and pneumatics
- CNCs and other controlled machines
- Factory automation process

Major Equipment

PC sets (35)

PLC practice units (10 sets)

Motor control practice units (10 sets)

Pneumatic control practice sets (10)

Factory Automation Process Modules, with robot arm and FA practice desks (3 sets)

Video projector

Electronic test gears

Electronic working kits (boards, accessories, wiring material, connectors)

Air compressor



Computer Laboratory I (multimedia), 85 sq m. with min. 7 m width

Purpose: Basic practice of computer operations and application programs

Major Equipment

PC sets (35)
Operating system and application software
Multimedia equipment (3 sets)
Computer peripherals (6 sets)
Video projector
Accessories and spare panel kits (10 sets)

Computer Laboratory II (programming), 85 sq m. with min 7 m width

Purpose: For student practices in the areas of:
Application practices of computer works like networking, servers, web page construction and programming

Major Equipment

PCs (35 sets)
Operating system and application software
Computer peripherals (35 sets)
Accessories and spare boards (10 sets)
Video projector

Microcomputer Laboratory, 85 sq m. with min 7 m width

Purpose: For student practices in the areas of:
Electronics and programming in computer control technology
Assembling a robot
Digital circuit assembling works
Table type machine tool operation

Major equipment

PC sets (35)
PLC units (10 sets)
PIC elements (10 sets)
Table type machine tools (3 sets)
Video projector
Electronic test gears (3 sets)
Electronic working kits, wiring material, connectors, boards, sensors, motors (10 sets)

Electronics Laboratory, 60 sq m + 40 sq m or 85 sq m.

Purpose: For student practices of basic electronic works such as:
Circuit design
Circuit assembly
Assembling
Measuring



Table type machine tool operation

Major Equipment

Electronic measuring equipment, such as:

Signal generator

Level meter

High impedance digital voltmeter

Digital counter

Oscilloscope, etc

(1 set per 30 students)

Video projector

PCB production facility

Table type machine tools (3 sets)

Electronic working kits such as tools, connectors, boards,

Wiring material and electronic parts (30 sets)

Server Room, 20 sq m

Purpose: To provide students with the basic knowledge of server construction and network supervision and control.

Major Equipment

Network servers

OS and application software

Computer peripherals

Accessories and spare boards

Test gear

Modems, hubs and routers.

For the TTC

TTC needs to have the following laboratories, Computer and Electronics Laboratory and Control and Robot Laboratory.

Computer and Electronics Laboratory

Purpose: To provide key technical practices to the teachers on:

Computers, networks, servers and programming,

Electronic control technology and mechatronics,

Design and assembly of electronic circuits and their measurement; such as filter circuits, amplifiers, oscillators, feedback circuits.

Major equipment

Electronic measuring equipment, such as:

Function generators (6)

Oscilloscopes (6)

Level Meters (6)

High impedance digital meters (6)

Frequency counters (6)



Parts and accessories (6 sets)
PLC and PIC practice sets (10)
Sensor kits (10)
PC sets (10)
Actuation kits (6)
Tools, electronic parts and spares (6 sets)

Control and Robot Laboratory

Purpose: To provide key technical practices on:

Robot control technology

Motor control

Actuator practice

Machine/CNC operation

Factory automation

Major equipment

FA robot and peripherals (3 sets)

Measuring devices such as oscilloscopes, digital meters (3 sets)

Electronic parts and accessories for FA (3 sets)

DC power supplies, tools and accessories (6 sets)

Electronic measuring equipment such as function generators, level meters, frequency counters (6 sets)

PC sets (35)

CNC machine

Electronic work sets (6).



10 Conclusions

As a result of the HR survey and interpretation of secondary data, it is safe to say that there is and will be a huge need for the Industrial Automation departments' graduates in Turkey.

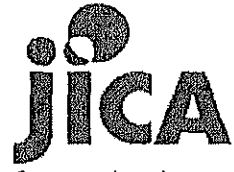
Within the given time limitations, the survey provided results only for 18 provinces and for companies under 150 employees, plus for three automotive companies. Therefore total HR demand for the next five years, even for this limited portion, is estimated to be 31,963 graduates, surpassing the supply of 20 schools, which will be 1,200 annually, for these provinces. The demand figure is well above the supply (3.5). On top of this, there will be an uncalculated demand for these graduates from the service sector as well. The results of the field study indicate that, even for the limited area surveyed, there will be no employment problems for the graduates of Industrial Automation departments. On the contrary, the industry is aware of the contribution this scheme and resulting human resources can provide to them and has already started to establish contacts to employ the pilot project graduates. The project will also encourage industrial investments because it will be dealing with a long term problem of finding qualified personnel to operate high level machinery and equipment, especially in developing areas. Therefore Turkish industries are going to benefit from this project in more ways than one.

The government policy is to support and to enhance the quality of vocational schools. This project is completely in line with the government policy. Therefore, the dissemination of Industrial Automation departments is justified and further investments in this educational sector are also expected.

To satisfy the curricular requirements of the 20 schools Industrial Automation departments, which are mainly determined by the existing pilot project experience, new laboratories shall be established, along with new textbooks for the teaching subjects. This will greatly contribute to the teaching and graduate quality of the vocational education schools.

To implement the project, the following shall be necessary:

- Setting up laboratories in the schools: 19 of 20 schools within the project have already allocated the required areas. 10 schools within the 1st implementation phase are physically ready. Necessary global equipment list to satisfy the curricular requirements for the laboratories is given under Section 8. MoNE has started tendering activities.
- Preparing textbooks for the schools: Textbooks need reviewing and rewriting. This should be undertaken via external technical assistance and should start immediately.
- Preparing a curriculum and subsequent textbooks for TTC: This is one of the most urgent issues and should be handled via external technical assistance.
- Training teachers for the schools in a Teacher Training Center: Necessary to implement the project. The General Implementation schedule must be followed.
- Equipping the Teacher Training Center laboratories and accommodation facilities: The building is going to be ready for in July 2006. For the first group of teachers in 2006, who are going to be trained on the subjects of Grade X, existing pilot project school facilities will be used. The laboratories should be ready by the beginning of 2007.
- Existing trained teachers are going to be utilized, apart from normal school teaching duties, for teaching in TTC and assisting foreign experts in rewriting of school textbooks.



Eleven teachers are required for school teaching, four in TTC and three for textbooks. These teachers are to be allocated on a rotational basis to make efficient use of time.

Total cost of the project is USD 25,480,000. USD 990,000 of this amount has already been allocated under MoNE budget for TTC building construction; therefore USD 24,490,000 is required for completion.

Implementation of this project will address a long-term deficiency in the Turkish vocational education system. A modern and highly technological style shall be adapted in vocational education, resulting in high quality mid-level labor force, as indicated by the industry representatives who have met the students during summer practice periods. The project will also help to increase employability of the young. Contribution to the national economy is very important; as the qualified human resources are deemed to be the most important factor for competitiveness in the international arena, especially when Turkey is on the borderline for EU accession.



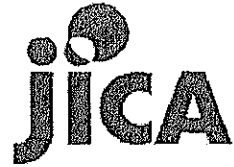
11 Planning and Recommendations

- Detailed design, procurement and installation can be handled by a single company, but there are drawbacks; a company specializing in all aspects of this specified field can be difficult to find, considering the spread of schools on the country.
- Detailed design can also be handled within a technical collaboration scheme.
- Physical situation of 2nd phase implementation schools might need to be reassessed to find out if there will be any bottlenecks in the infrastructure for the 2007-2008 academic period.
- Tender preparation can be handled in-house or by the assistance of an external (foreign) source.
- TTC curriculum and program preparation can be handled by means of an external (foreign) assistance scheme.
- Textbook preparation for schools can be handled by means of an external (foreign) assistance scheme.
- Textbook writing is heavily dependent on the type and brands of laboratory equipment, therefore selection of equipment has the priority.
- Sponsorship is important for keeping industry relations alive; some lectures such as Industrial Management should be provided by industry representatives.
- During the implementation, establishment of the Industrial Automation Department in the schools should be advertised and its contents should be discussed with the industry. This is also important to be able to receive students with high capacity, scoring higher points. The success of the education is highly dependent on the selection of students.
- Financial sources for the implementation are
 - o Foreign government loan(s)
 - o A technical collaboration scheme
 - o Own resources (2.2.10.8).



12 References

- (1) State Institute of Statistics. "Household Labor Force Survey". September 2005.
- (2) Metal Goods Manufacturers Syndicate (MESS), 2004. "Qualified Manpower needs of MESS Members", Survey.
- (3) Official Gazette, No. 25831(rep. ed. 2), "Mid Range Program 2006-2008", 31.05.2005.
- (4) Small and Medium Industry Development Organization (KOSGEB), "Field Survey", October 2005.



13 Appendices

- Appendix 1 MESS Training Project Summary
- Appendix 2 Survey Form for Company
- Appendix 3 Survey Form for Chamber of Industry
- Appendix 4 Questionnaire for School and Chamber of Industry Interview

MESS İŞKUR Training Project

This project is an integral part of the MESS' "New Horizons in Employability Project", jointly with Turkish –German Chamber of Industry and Commerce. The main project was initiated in 2003 and was found eligible for a European Union fund support of € 190,000.

Objective: To increase the employability and productivity of MESS member companies' workforce.

Start Date: 25.12.2004

End Date: 25.12.2005

Duration: 12 months

Budget: € 211,592.

Activities are handled by a project team of 9 and with 11 local technical training personnel, giving competency and vocational development training.

To date;

- textbooks are prepared and printed
- 209 persons received competency training
- 200 persons received vocational training
- project team and steering committee paid a technical visit to Berlin and Cologne.

Details of Trainings:

Competency Trainings:

Target staff: Blue collar workers in MESS member companies

Trainers: MESS Foundation for Education (MEV) trainers

Place: MEV Technology Training Centers in Gebze (İstanbul), Bursa

Timeframe: May-June-July

Subjects:

- Health and Safety at work (1 day/8 hours)
- Emergency (1 day/8 hours)
- Human Relations and Efficient Communication (1 day/8 hours)
- Efficiency and Quality (1 day/8 hours)
- Information Technologies (1 day/8 hours)

Training materials: Textbooks, CDs.

Vocational Trainings:

Target staff: Blue collar workers in MESS member companies

Trainers: MESS Foundation for Education (MEV) trainers

Place: MEV Technology Training Centers in Gebze (İstanbul), Bursa, Çerkezköy/Tekirdağ.

Timeframe: Sept-Oct-Nov-Dec

Subjects:

- Welding (120 hours)
- Industrial Automation (120 hours)
- Electrics – electronics (120 hours)
- CNC operation (120 hours)

Training materials: Textbooks, special simulation programs, prototype workstations.

Questionnaire for School and Chamber of Industry Interview

1. Name of School: Province:

Name(s) of contact(s):

a. Does the school have enough information on the dissemination project?	
b. Is the physical area adequate for implementation of Industrial Automation? (*)	
c. What are the relations of the school with the industry?	
d. Has there been any contacts with the industry concerning this project, in the context of Survey or else?	
e. Can the school's help be obtained to get in touch with the Chamber of Industry and get the Survey forms filled?	
f. What are the factors affecting the graduates' career after school, university or working directly? What is the situation for this school's graduates?	
g. What can be said for the above, in the case of Industrial Automation Department graduates?	

This form can be appended with additional pages when necessary. Please refer to the original question on the appended page(s) like 1c, 2d. School and Chamber of Industry Interview - Questionnaire Form 2005

2. Chamber of Industry:

Name(s) of contact(s):

a. To what extent are they informed of the Project?	
b. Do they have an idea on the contributions of this project to the industry?	
c. What can be said on the future career and employability of these graduates?	
d. Is it possible to provide long-term summer practice training to the students (6-8 weeks every period)? What are their opinions?	
e. Explanation of Survey Form for Chambers of Industry; is it possible to fill the form?	
f. Can they forward the Survey Form for Companies to their members (no need to give us the addresses)?	

(*)

- Control and FA Lab, 160 m2, can be divided into two sections
- Microprocessor Lab, 80+20 m2
- Computer Lab I, 90 m2
- Computer Lab II, 90 m2
- Server Room, 20 m2
- Electronics Lab, 60+40 m2

Notes:

- 1b: Has MoNE sent any kind of information on the subject?
- 2b: Information from School or any other source?
- 2d: Students start summer practice from Grade X, 60 students in each Grade
- 2e: It is very important that the Survey form be filled now. If this is not possible, arrangements should be made that it is filled and sent to endotetek@gmail.com within 2 days.
- 2f: It is preferable to have the forms forwarded by the Chamber on the grounds of secrecy, speed and efficiency.

Interview by:
 Date: / /200

This form can be appended with additional pages when necessary. Please refer to the original question on the appended page(s) like 1c, 2d. School and Chamber of Industry Interview - Questionnaire Form 2005

Dear Mr/Ms

A joint project between Turkish Government, Ministry of National Education and JICA, representing Japanese government for technical assistance projects, on the subject of establishment of Industrial Automation Technologies Departments in vocational high schools has been organized and is under way. A Protocol was signed on 12 October 2000 between the two governments and the project is initiated in 2001. At the present, two pilot project schools, İzmir Mazhar Zorlu Anatolian Technical High School and Konya Adil Karaağaç Anatolian Technical High School are proceeding with this education. Competence levels of the students who were sent to industrial companies for summer practice training are appraised highly by the companies. It was declared that the graduates of these departments would readily be employed in the industry.

At the present, it is considered to disseminate the industrial automation technologies departments to 20 more nationwide schools and the feasibility study is being carried out by ourselves, as *Denizfeneri Consulting Services*. A part of this study is aimed to assess the demand for this graduate profile. This survey form contains questions to assess the demand for graduates, of which competency levels are listed below, within your Company. Results of this survey shall be used in making decisions to supply of necessary human resources and relevant planning.

In the Mid Range Program (2006-2008) of the Turkish State Planning Organization, there are several clauses intended for increasing the importance of technology in education and increasing the level of cooperation between industry and educational institutions. In the program, under the sub section "Development of Human Resources and Increasing Employability", for increasing the quality of education, strengthening the relations between education and employers and increasing employability are the key factors for a highly competent economy and sustainable development. Therefore in this framework;

- In the Vocational education, transition actions toward a modular and flexible structure shall be accelerated to educate the human resources needed by the market.
- To educate the human resources needed by the business world, mechanisms shall be implemented to strengthen the cooperation between educational institutions and workforce market.
- A cooperation and division of labor shall be established between Vocational Education colleges and Vocational high schools based on program integrity. Provisions shall be made to give applied training in cooperation with industry.

Additionally, under the sub section "Developing Competitive Powers of Companies" it is intended to bring the companies to a level with highly technological and qualified workforce, flexible and competitive on the international markets. In this context;

- Physical and informational infrastructure of the companies shall be developed; networking between companies shall be supported.
- Effective use of technology and innovativeness shall be supported, especially for small and medium sized companies.
- Activities intended to increase the qualifications of employees shall be supported.

Employability Survey for Industrial Automation Departments Expansion Project - December 2005 - Companies Denizfeneri

Reply to: endototek@gmail.com

- Under the "Education" subsection;
- Use of Information technologies in education will be more effective and widespread.

As observed in the abovementioned phrases, the government is following a policy to increase the cooperation and reciprocity between education and industry. Education system is being developed, as the industry is getting better acquainted with the vocational education process.

Before starting to answer the questions, it is recommended you take a few minutes to review the sections on Industrial Automation technology and the departments to be established.

Industrial Automation technology education is one of the typical business trends of the present business world to provide better, more effective, dependable efficiency. Being successful in the career is dependent on the person's training, employing various methods and mechanisms. Therefore it is expected that the graduates of industrial automation will find employment in various sectors of the industry, based on the flexible and multi faceted education they received.

The Department of Industrial Automation Technologies has two sub departments, Information Machinery and Information Electronics. This is the only department in Turkey, where electronics, mechanics, production technology, measurement and control technology, mechatronics, robotics, computers, automation systems, communication and network technology is taught. Beneficiaries of this system are teachers who will receive direct technology transfer, students who will receive a quality education and industry, who will satisfy its demand for qualified human resources.

As mentioned above, there are two sub departments, which determine the qualifications of graduates. These are Machinery and Electronics. In the Annex 1 you will find a list of the qualifications of the graduates. In the Annex 2 you can see an overview of the curricular subjects. We believe that these lists will provide a better view to assess the need for these graduates.

It is required to fill out the questionnaire in Annex 3, considering the qualifications of the graduates, and the general requirements of your Company.

Please fill and return this form electronically, to endototek@gmail.com via e-mail.

We would like to thank you in advance for your efforts.

Cem DÖZ, Project Team Leader
Denizfeneri Consulting Services
December 2005

Employability Survey for Industrial Automation Departments Expansion Project - December 2005 - Companies Denizfeneri

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Annex 2

List of Curricular Subjects

Information Electronics	Information Machinery
Information Technology (Computers, multimedia, office etc)	Information Technology (Computers, multimedia, office etc)
Mathematics	Mathematics
Basic Practice of Industrial Works (selective)	Basic Practice of Industrial Works (selective)
Technical Drawing	Technical Drawing
Industrial Machinery	Industrial Machinery
Computer Control Technology I	Computer Control Technology I
Electricity and Electronics	Electricity and Electronics
Microcomputer Technology	Sequential Control Technology
CAD/CAM	CAD/CAM
Industrial Mathematics I & II	Industrial Mathematics I & II
Computer Network	Computer Network
Computer Control Technology II	Computer Control Technology II
Industrial Management	Industrial Management
Mechatronics	Robot Technology
Feedback Control	Feedback Control
Technical English	Technical English
Sequential Control Technology	Microcomputer Technology
Project Study	Project Study
- Web System Technology	- Automated Production
- Network, Servers, Security	- Factory Automation Cell Control
- Network Systems	- Technology
	- CNC

Annex 1

Graduate Profile for Industrial Automation Technologies Departments

Electronics Sub Department	Mechanics Sub Department
CAD/CAM designer	CAD/CAM designer
Computer/network specialist	Computer/network specialist
Microcontroller designer	Microcontroller designer
Computerized control expert	Computerized control expert
PLC control expert	PLC control expert
Industrial product designer (prototypes)	Industry type Robot designer
Electrician	Electrician
Electronics expert	Electronics expert
Automation expert	Automation expert
Instrument worker	Instrument worker
Mill/lathe operator, basic level	CNC operator
Digital signal processing	Automated production planner

Annex 3

In which geographical sector are you located?

Marmara	<input type="checkbox"/>	Black Sea	<input type="checkbox"/>	Aegean	<input type="checkbox"/>	Mid Anatolia	<input type="checkbox"/>
East Anatolia	<input type="checkbox"/>	Southeast Anatolia	<input type="checkbox"/>	Mediterranean	<input type="checkbox"/>		

Please state the province you are located in and your Chamber.

Province:

(Chamber:

In which industrial sector are you operating?

State the total number of employees in your company:

000

1) Suppose that there are **no** employees in your company. How many of the graduates with the qualifications explained above, would you need to fill the required positions **now**? Please write the number of needed personnel, and the Job position they would be placed in, across the relevant qualification.

Qualification	Number	Position
CAD/CAM designer		
Computer / Network specialist		
Microcontroller designer		
Computerized control specialist		
PLC control specialist		
Industrial product designer (prototype)		
Electrician		
Electronics expert		
Automation expert		
Instrument specialist		
Mill & Lathe operator, basic level		
Digital signal processing		
Robot designer		
CNC operator		
Planner for automated production		
Other		

2) Similarly in this section, please write the number of graduates you think your company will need in the next five years, considering the expansion and investment plans of the company. Keep the present number of employees in mind.

Qualification	Number	Position
CAD/CAM designer		
Computer / Network specialist		
Microcontroller designer		
Computerized control specialist		
PLC control specialist		
Industrial product designer (prototype)		
Electrician		
Electronics expert		
Automation expert		
Instrument specialist		
Mill & Lathe operator, basic level		
Digital signal processing		
Robot designer		
CNC operator		
Planner for automated production		
Other		

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Automation expert	Automation expert
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Mill/lathe operator, basic level	CNC operator
Digital signal processing	Automated production planner

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- Web System Technology	- Automated Production
- Network, Servers, Security	- Factory Automation Cell Control
- Network Systems	- Technology
	- CNC

Annex 3

How many companies are there within your organization?

Please state the number of companies according to their sizes

Number of Small size companies	Number of Medium size companies	Number of Big size companies
.....

1) In your opinion, what is the number of graduates, with the qualifications explained above, that might be needed in each group of companies? Please suppose that there are no employees in the company to undertake the specified work. State the average number of workers that would be needed in the respective fields in the companies, in a broad sense.

Qualification / Job	Demand		
	Small size companies	Medium size companies	Big size companies
CAD/CAM designer			
Computer / Network specialist			
Microcontroller designer			
Computerized control specialist			
PLC control specialist			
Industrial product designer (prototype)			
Electrician			
Electronics expert			
Automation expert			
Instrument specialist			
Mill & Lathe operator, basic level			
Digital signal processing			
Robot designer			
CNC operator			
Planner for automated production			
Other			

2) What can you say for the demand over the next five years for these graduates? Please state the numbers relevant to the sizes of companies. Populate the table considering the expected growth of industries in each size category, using the present demand figures as a guide.

Qualification / Job	Demand		
	Small size companies	Medium size companies	Big size companies
CAD/CAM designer			
Computer / Network specialist			
Microcontroller designer			
Computerized control specialist			
PLC control specialist			
Industrial product designer (prototype)			
Electrician			
Electronics expert			
Automation expert			
Instrument specialist			
Mill & Lathe operator, basic level			
Digital signal processing			
Robot designer			
CNC operator			
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Other			

