ANNALS of the ORADEA UNIVERSITY.
Fascicle of Management and Technological Engineering, Volume IX (XIX), 2010, NR3

PRODUCTION LINE CONSTRUCTION FOR EDUCATIONAL PURPOSES

HUSI Géza
Head of Department, Associate Professor
University of Debrecen, Faculty of Engineering, Department of Electrical Engineering and Mechatronics, husigeza@mfk.unideb.hu

Keywords: production line, educational, modular system

Abstract:The target of the work in one – also, let it be intensify the theoretical knowledge and at the time give a possible try of PLC the execution of a real engineering task in a real environment of work. The paper would like to demonstrate how this happened though. How the team worked together in the model's planning, implementation and testing My students **Tamás István Nagy, Kálmán Takács, Nándor Tarr** made the construction and programming**.**

We prepared the production line with brand of Fischertechnik's elements. The more capital units of the production line the followings: Press with a conveyor belt, conveyor belt with a welder machine, U-shaped manufacturer cell with a milling cutter and drill, and 3d-s robot faculties.
The control we solved it from Schneider Electric firm's Twido product family such as TWDLMDA20DTK type mark programmable logic controller.
We are planning the full redevelopment of one of the models. We would like to conrol the whole production line and also the robot arms with one piece of PLC with extension unit.
The result of our work was 2 production line models, which is suitable processing machines and ancillary robots doing its task onto timing, the tuning of theirs function, the education of the function and the programming.

1.INTRODUCTION

Together with my students (**Tamás István Nagy, Kálmán Takács and Nándor Tarr**) in the frame of TDK work as a more than one year's work result we built two production line models, which had been presented last year in the TDK conference's technical section. Fishertechnik served as models for the production line construction. The control was solved with the TWDLMDA 20DTK type PLC from the Shneider Electric Company. Students built the model and they were programming the robots. This article presents the building of the model.

2.FISCHERTECHNIK MODELS

Our project was prepared with the help of the Fischertechnik models. The company was founded in Germany, where it products its models for more than 40 years. Our goal was to design, to, install, and to program a production line which includes the following pressing, milling, drilling and welding.

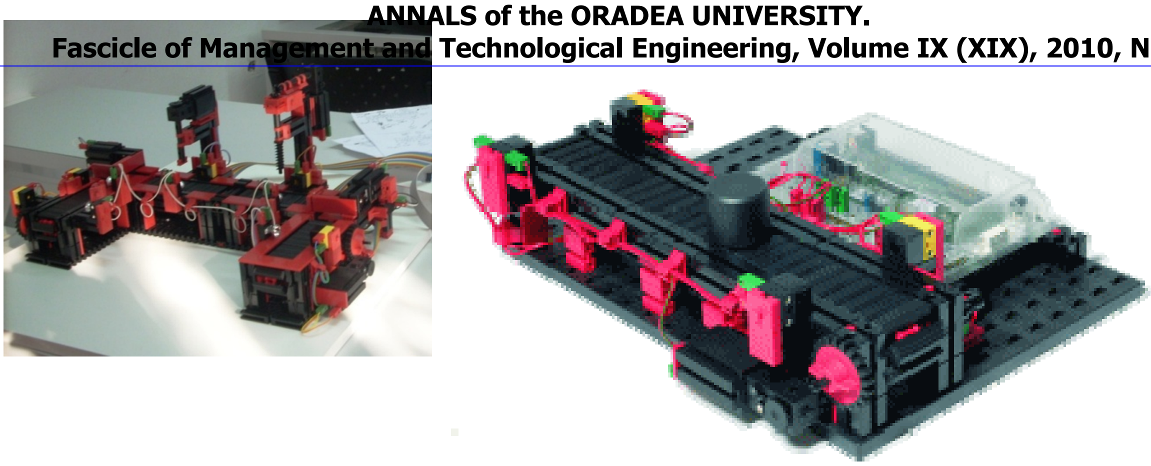

Fig. 1 Conveyor

In the two production model(linear and U-shaped) we used the following structures. This conveyor is powered by a 24V engine , in which we can find photo sensors. Such type of conveyor is used in several places. For ex: in manufacturing cell with drilling and milling machines or in the welding operation.

The conveyor is powered by a 24V engine which is equipped with a pressure machine with two “end” sensors and the conveyor is equipped with photo sensors.

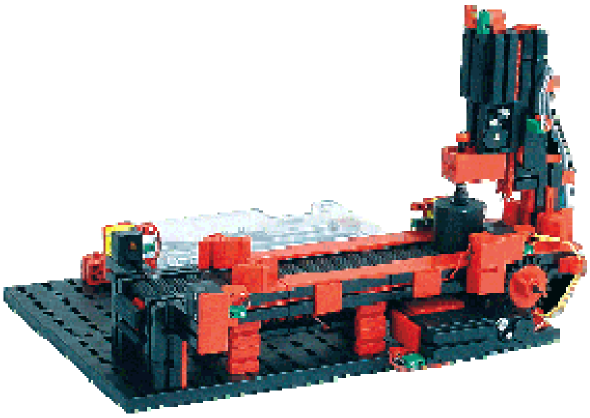

Fig. 2 Pressure machine

We can say that the manufacturing cell is more complicate, by structure, while are more engine, photo sensor and an end sensor and a motorized sliding structure, which can drill and mill.

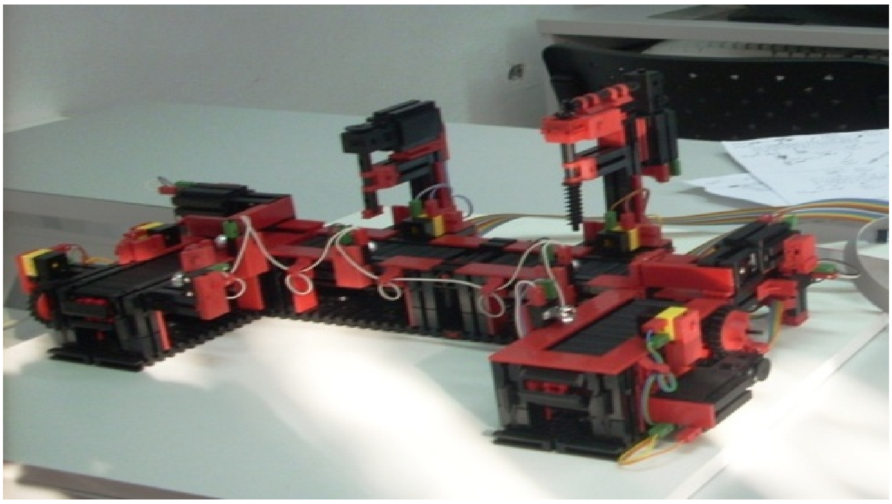

Fig. 3 Manufacturing cell

The arm can make, up,-down, back and front, right –left movements, in the end is a cather, with this it can catch the material and to transport to another conveyor.

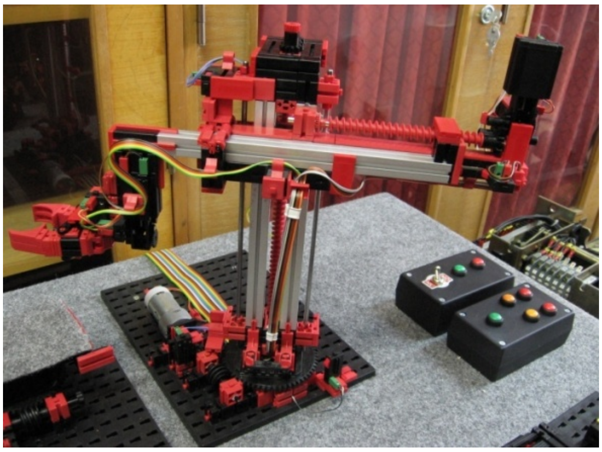

Fig. 4 2,5 D robot arm

The welding is powered by a 9 V engine, it can make two kinds of movements back and front .In the end the welding is simulated by a led. This structure had a rotary leg, but we cut out, because it wasn't necessary for us.

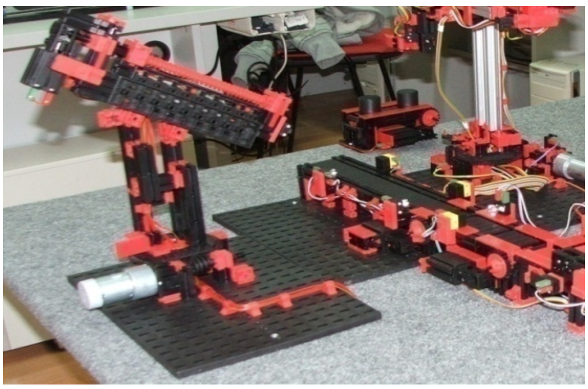

Fig. 5 The welding robot

3.TWIDO PLC

The Schneider Electric Company is one of the leading companies worldwide in the electrical industry. Their work covers energy management and electricity distribution, control techniques of the industrial processes and automation, installation systems and control, critical energy supply and cooling. We, in our project used the TWD LMDA 20DTK PLC and two diffusers TWD DDO 16TK and TWD DDI 16DK

4. PRODUCTION LINE OPERATIONS

We made two production line models, a linear and a U-shaped. The two structures differ somehow but the process elements and operating elements are the same.
In the case of U arrangement the production continuously is in the production line. in this model is a robot arm which puts the row material to the conveyor, after the last operation, in the end og the welding robot conveyor takes the final product. In chronological order the process are the following: pressure, milling, drilling, and welding. Once the robot arm took from the palette the raw material and placed to the conveyor the conveyor departs to the pressure machine. The pressure operation has two movements. After the pressure machine finished both, the conveyor turns, and a "turn" engine pushes through the product in a perpendicular direction, followed by the milling operation, which also consists of two milling operation.

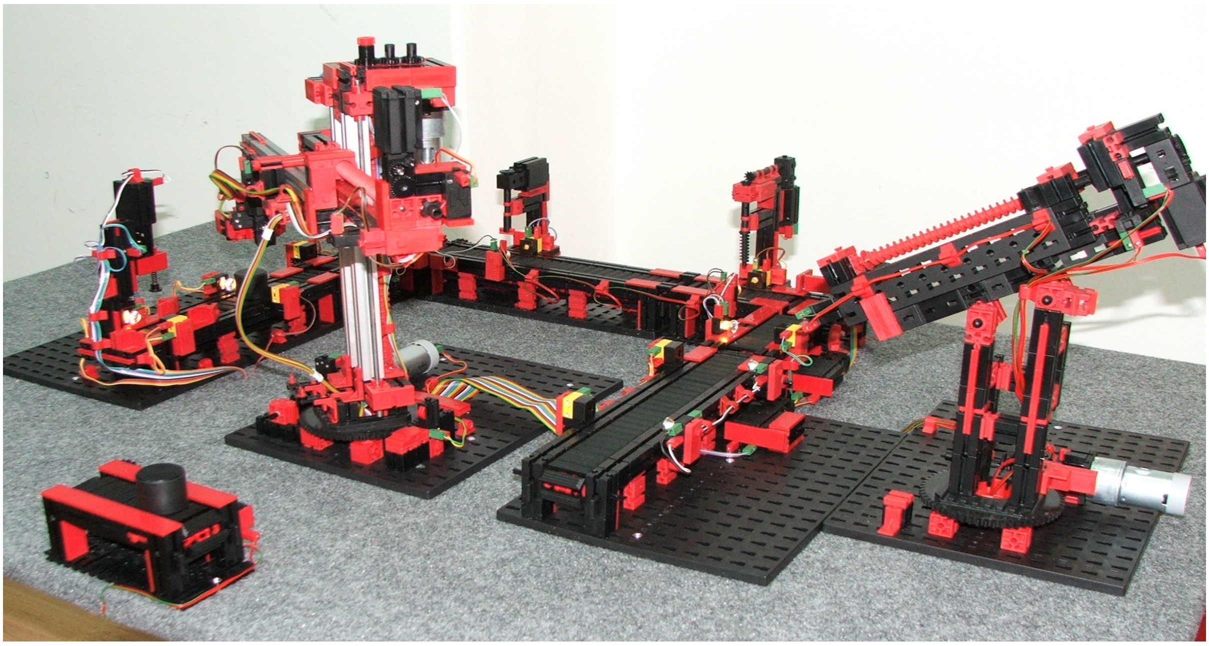

Fig. 6 U-shaped arrangement

In the end of the sub-process the conveyor delivers the product to the drilling unit, here takes place the drilling operation. Then, another "turn" engine pushes trough the product in a perpendicular direction, and follows the last operation, the welding. In the end of the production process, the robot arm catches the finished product and places to the pallet. The conveyor implemented in the model, is not present in the real production of the

pallet, this implementation only for the demonstration was important, towards that the production to be continuous and cyclical.
In the linear arrangement (Fig. 7) the conveyors are not coupled, the connection is solved by the robot arms. So, it largely differs, form the production of U arrangement, here it can be find two robot arms, not only one. In the beginning of the process, the first robot arm takes the raw material from the palette, and places in the pressure machine's conveyor.

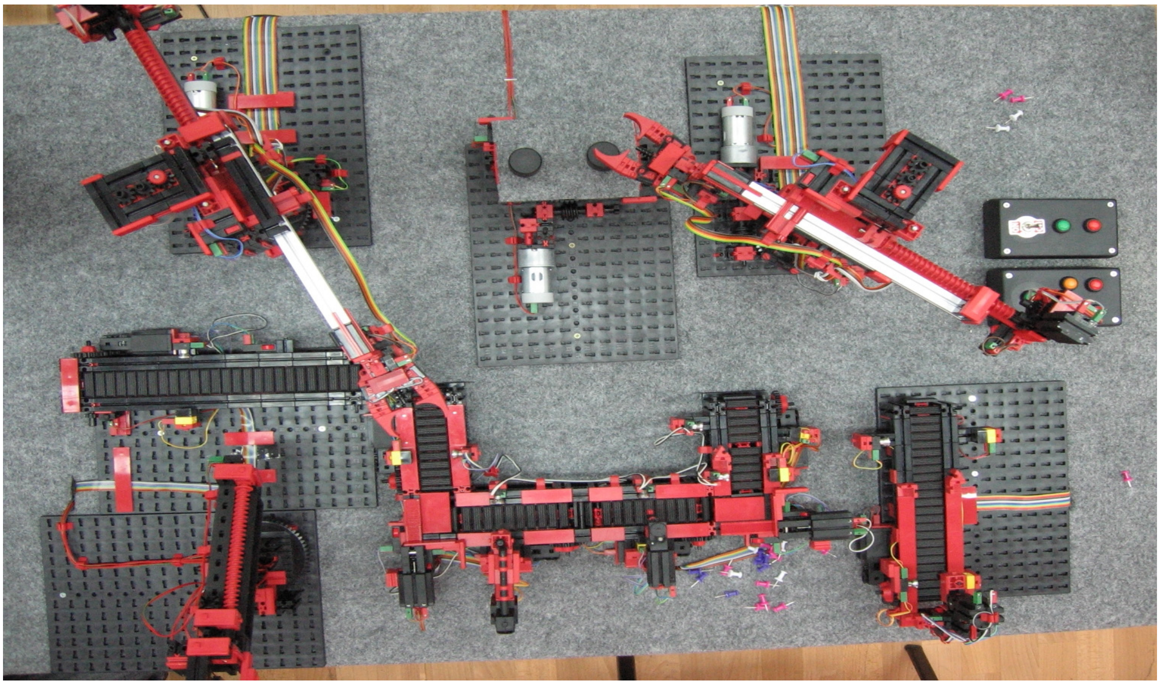

Fig. 7 Linear model in top view

The conveyor passes the product to the pressure machine. The pressing operation it also contains two operation elements, just like in the case of U-shaped model.
Then the conveyor took back the product to the first robot arm, which moves to a conveyor with have a miller and a manufacturing cell. Then the product is moved by the first conveyor of the manufacturing cell. In the next step a "turning" engine shifts perpendicular the product and thus reaches the milling operation. Here the milling machine makes the two staged milling process, followed by the drilling where also the conveyor transports. Before the final part-operation another "turning" engine pushes through the product perpendicular and arrives to the second robot arm, which puts to the welding robot's conveyor. Performs the welding, then in the end of the conveyor the second robot arm takes the product and puts to the pallet. In the case of this arrangement, because of the process continuity we build the pallet at the same way with the previous, only the mechanical implementation is different.

5. PROGRAMMING

The robot programming has three main parts, which are prerequisites for each other. The first part is the RESET. The second is the reset, after this the arm takes a given position. The third part is the program itself.
We created four controller inputs in the model. The first instruction is the RESET, which stops the currently running programme, so the robot immediately stops in the current position.

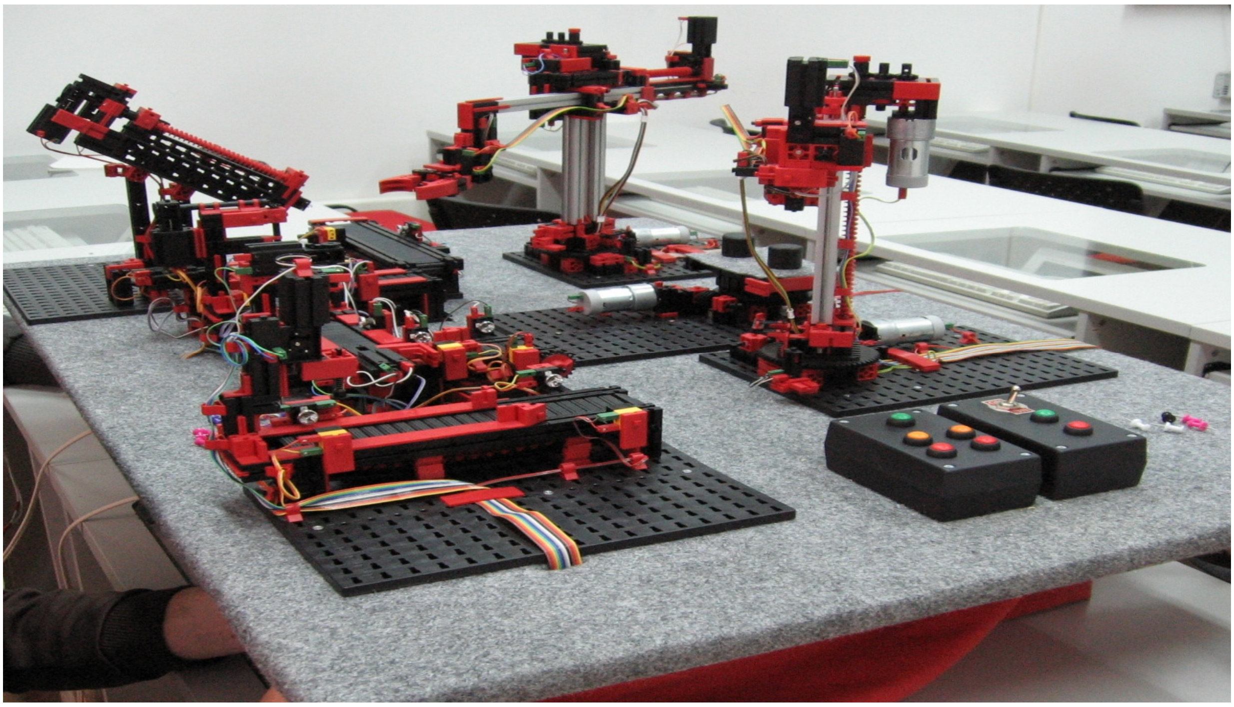

Fig.8: Linear model in side view

The second instruction is the original setting, which takes the arm in the correct position.
The third instruction is the start. To be able to make this instruction it could be wait that the arm to be in the original setting position after the RESET. When it is there we can give the instruction. When the instruction is given the production process starts. This instruction it should be given only once, because after the process begins, the programme can control in cycle the production line, so it is not necessary the hand-start; the automation do it.
The fourth instruction is the control from the conveyor, so it gets from the another PLC and so continuous the cycle.
The RESET and the original setting is programmed in the same in all three robot arms, except that when the original setting command is given the arms takes up different positions.

6. SUMMARY

Our models had a great success. We have participated in several events and we presented our production line for educational purpose. Our models were exhibited in more open days in the University of Debrecen, Faculty of Engineering, and in the “Magyar Regula” exhibition in 2009. Since then, students from the technical management section give us various ideas in order to develop the performance of the production line.

SPECIAL THANKS
I would like to thank for everybody, who helped in some way our work. For our Department's Professors: István Bartha and Gyula Darai. For students: Dénes Szabó, Péter Dávid, Gergő Gyöngyösi, Gergely Lakatos, Krisztina Piró, Sándor Szabó, György Kardkovács and László Veress.

BIBLIOGRAPHY:
[1] Hahn E., Harsányi G., Lepsényi I. és Mizsei J. (szerk: Harsányi, G.): Érzékelők és beavatkozók, BME Villamosmérnöki és Informatikai Kar, 1999.
[2] Szentiday K., Dávid L., Kovács A., Bársony I.: Mikroelektronikai Érzékelők, MK, 1993. Bp
[2] http://www.national.com/mpf/LM/LM335.html
[3] http://sine.ni.com/nips/cds/view/p/lang/en/nid/203462
[4] http://sine.ni.com/nips/cds/view/p/lang/en/nid/14128