NUMERICALLY CONTROLLED MOULDING MACHINE

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ABSTRACT

Our work consists of developing a small moulding machine. The machine will be controlled by a PC via a serial port. It can be used for making PCBs (printed circuit boards) and small engraving works. Data from PC is "translated" to the "stepper's motor language" by a simple electronic circuit. The programming language used for writing the steering program is C++.

1. INTRODUCTION

We were always interested about the numerical control idea, automatic and engineer informatics. We decided to construct a numerical control machine. It requires streamlining many science branches:

- mechanics;
- electric;
- electronics;
- informatics;

2. MECHANICAL SOLUTIONS

Mechanical solutions contain:

- the implementation of axis;
- force carrying;

2.1. IMPLEMENTATION OF AXIS

The X axis (length) is implemented by the table move. Take a look on figure 1. The Y axis (width) is implemented by the spindle move on the machine gate's crossbeam (fig. 2). The Z axis (height) is implemented by the crossbeam move on gate's beams (fig. 3).

2.2. FORCE CARRY

For carrying forces we used screws and rails. We used slide bearing instead of roll bearing to decrease cost. The machine frame is build with steel. Drive screw has got triangular thread – this solution is enough for our project.
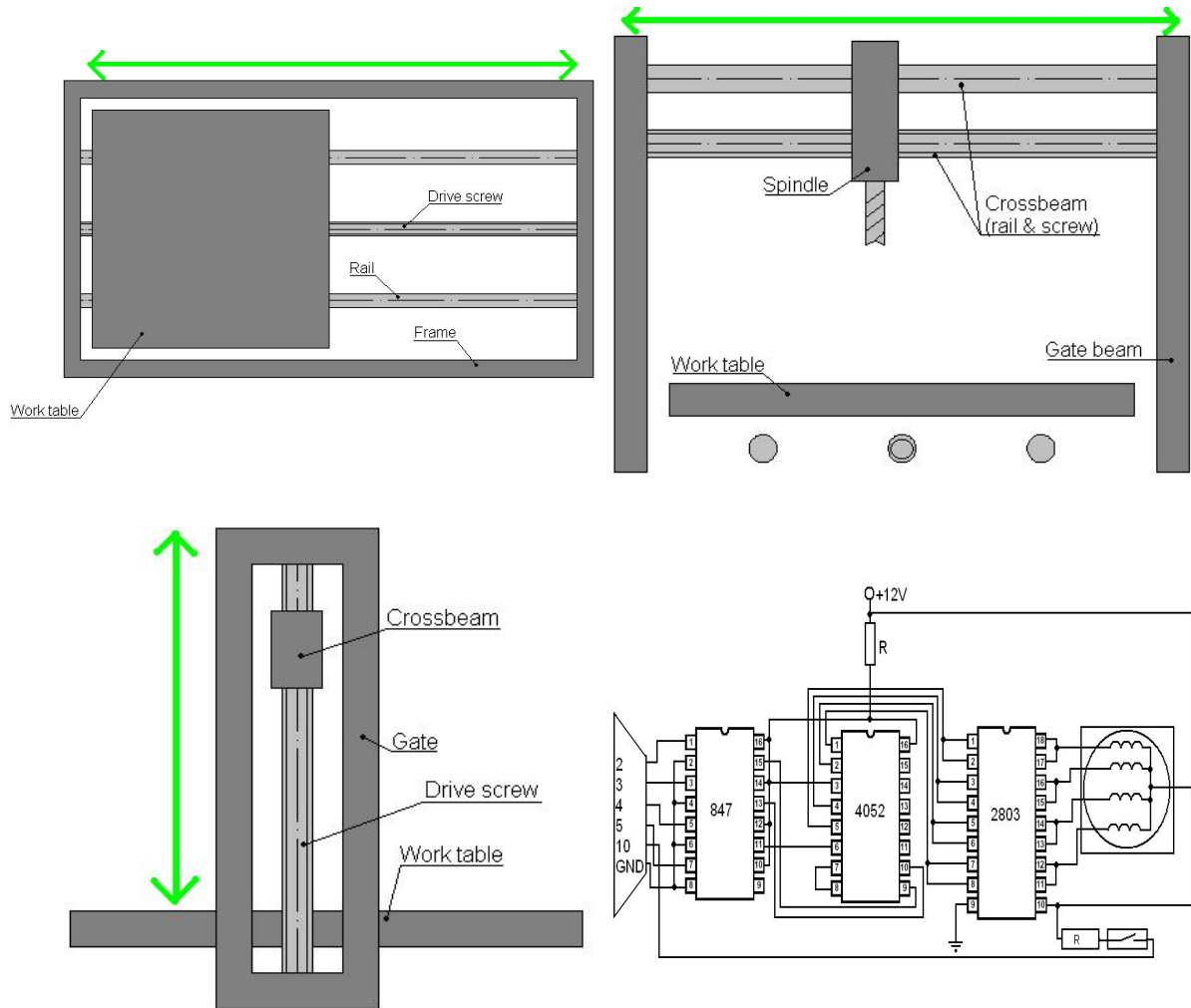

Figure 1: Axis realisation and electric circuit.

3. ELECTRICAL & ELECTRONICAL SOLUTIONS

To move axels we used 3 stepper motors. To propel the spindle we used a classic DC motor. A very important part is the electronic driver. It communicates with a PC by a LPT port. The circuit is based on integrated circuits: ULN2803 (8 Darlington tranzistors, which turn on/off power supply to motors), CD4052 (demultiplexer) and PC847 (4 transoptors, to seperate LPT from the driver). The driver can't do anything without a PC. We use feedback from a switch to set the zeropoint – it is required for precise item processing. The electric circuit of our driver (for one stepper motor and one feedback) is showed in figure 4.

4. INFORMATICAL SOLUTIONS

The programming language used for the application is C++. Stepper motors are controlled by a PC through a LPT port. Firstofall we built a class for communicating with the motors. We used two assembler functions [1] and a bit of C++ code to be able to make basic movements (forward and backward steps). Now that we had the bare controlling in a different class, we built another class for interpretting text files with instructrions on how to move the drill. So basically we have a translator which translates lines like: *go(120,8)* into the ammount of steps (for each motor) required for moving the platform in that position.
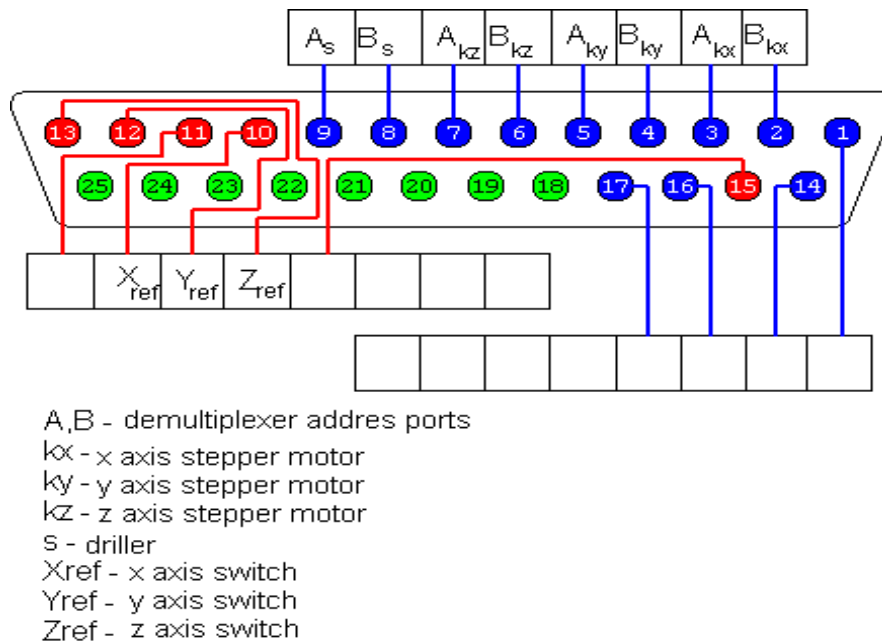

Figure 2:   LPT pins in our implementation.

5. CONCLUSIONS AND FUTURE WORK

After all of these steps, we have built a basic computer controlled driller, which uses a text file as the input, and converts the "human understandable" lines to computer code. The project gave us a chance to turn our theoretical wisdom into a practical one, and further understand what we've learned in our school. It helped also to learn how to work with a partner - dividing the tasks and sometimes discussing on how to solve a problem. One of us is a computer science student, the other one a mechatronic student, so we also learned a lot about the science branch our partner works in.

For the future of our project we will try to improve on both - the hardware and software level. To improve the hardware, we plan to add a microprocessor to make the driller self-sufficient. To improve the software, there would be a basic graphical tool added for drawing the things we want to drill.

REFERENCES

[1]   http://www.engr.uky.edu/~jel/misc/d481/info/SPP/

[2]   http://www.lvr.com/jansfaq.htm