

**AUTOMATION OF BELT GRINDER FOR
ABRASIVE PROCESSING OF PARTS**
*LENTVEIDA SLĪPMAŠĪNAS DETAĻU
ABRAZĪVAI APSTRĀDEI AUTOMATIZĀCIJA*

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Abstract. This publication shows the lifting mechanism for the abrasive processing of belt grinding machine parts and its control automation. The Nextion display and Arduino Nano were used for this project. They will be used to control the lifting mechanism of the equipment and the frequency converter.

Keywords: belt grinder, Nextion, display, Arduino.

Introduction

The world is evolving very rapidly, with a growing demand for a variety of machines and devices that can make modern life easier and simpler and improve work skills. A belt sander for abrasive processing of parts is used for rounding sharp corners, grinding edges, as well as sharpening knives and chisels.

To make working with the device more convenient and functional, it is possible to automate it. A lifting mechanism with a Nextion display and an Arduino Nano are used for this purpose. The lifting mechanism will give the machine more functionality, more comfortable and better quality work.

Materials and methods

To solve the multifunctionality of the device, a lifting mechanism with manual control was designed.

From the beginning, the necessary bibliographic materials were studied to understand exactly how the given problem could be solved. After researching the bibliography, a kinematic scheme of the lifting mechanism was developed, in Figure 1[3]. It shows a linear motor that pushes the bar forward, pushes the lever, and raises the belt sander table to 90°. Pulling the bar back pulls the lever and the table lowers to its original position. Touch screens were then searched on various Internet resources.

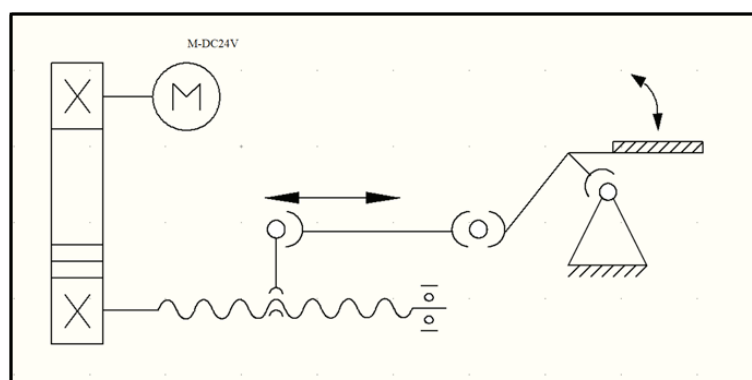


Fig. 1. Kinematic diagram of the lifting mechanism.

A 4.3-inch Nextion HMI SOLUTIN touch screen was used to automate the belt grinder, due to its low cost.

The materials, tools and software were selected for their low cost and ease of use, considering the type of project, being developed as a prototype to present a practical application of the studies, with the Nextion display, a mini USB cable was also used, a MicroSD used to upload the code to the display, the Nextion editor design software was used to create the screens, using features as described in the technical documentation.

But the machine control program was written in the Arduino program and the lifting mechanism was designed in the Solidwork program. In the Solidwork simulation program, the axle strength factor was tested to ensure that the appropriate material was selected. Axis testing is necessary as it will support the lifting table with the entire grinder. An 8 relay unit was used to control the machine, which will control the frequency converter, which drives the main grinder motor, and 2 relay unit will control the linear motor.

Results and discussion

The initial steps to using the Nextion display are very simple, you must first install the software to edit the Nextion Editor screens [1]. Later, a microUSB adapter was included with the Nextion device, as shown in Figure 2, and a TX / RX data cable for data adaptation and transmission is available in the same accessory kit. As well as connections for 5V power, red cable and ground wire for black cable.



Fig. 2. Nextion display devices with accessories, cables and microUSB connector.

The model used in the project has a 4.3 “display, which is enough to develop a solution. The Nextion device is chosen because it has the following advantages: easy design, low cost, touch screen function, reduced amount of programming code. During the process, the main thing is not to confuse the wires in places. Figure 3 shows how the Nextion display is connected to the Arduino Nano and the relay block model.

The TX and RX cables are used to transfer data between the Nextion device and a controller, such as an Arduino. For this project, the TX and RX cables should not be used, as the Nextion device, this type of project is useful to eliminate the amount of processes performed directly in the controller, because as the Nextion device has a good storage and processing capacity, it is advisable to use the available resources, in a balanced way, avoiding overload in the processes [2][5].

After the necessary connections it is necessary to install the Nextion software, this should be the main tool for the development of the solution, the software already contains some examples of creation and use of the device, based on these models and available documentation was developed the example that was used during the development of this process.

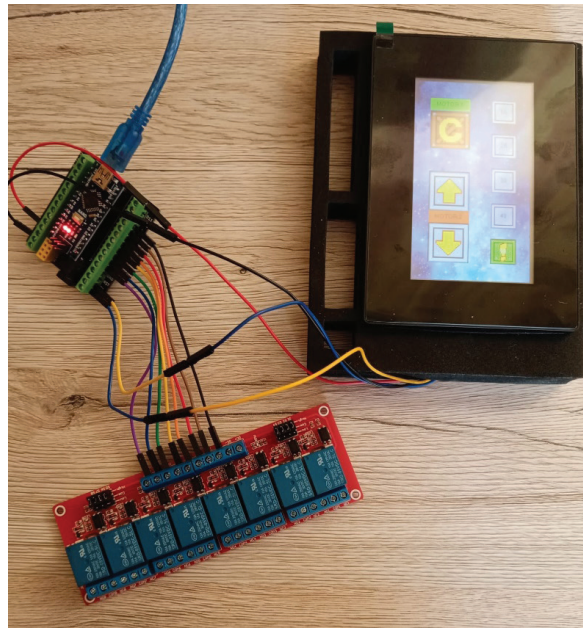


Fig.3. Connection between Arduino, Nextion and relays.

The SOLIDWORKS program was used to implement this project[4]. A 3D model of the lifting mechanism is shown in it, which is shown in Figure 4.

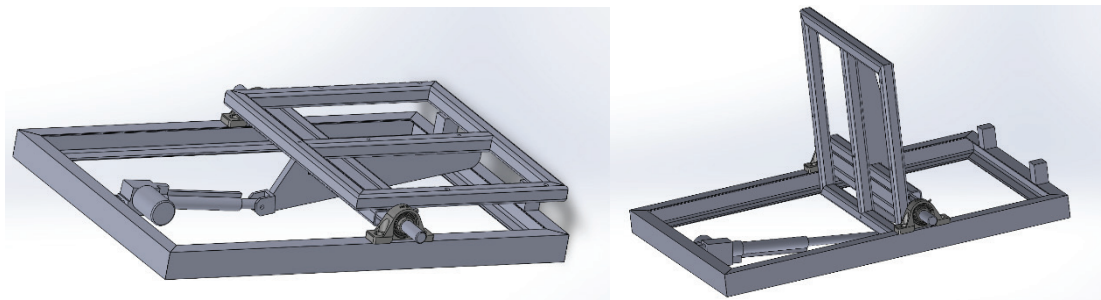


Fig.4. 3D model of the lifting mechanism.

An axle simulation was also performed, on which the platform of the lifting mechanism will be mounted and later a belt grinder will be screwed. Figure 5 shows the axle load. It shows that the maximum curvature is 0.038 mm. But Figure 6 shows the axle strength factor of 8.6. This is enough for this project, as there is also a small load reserve.

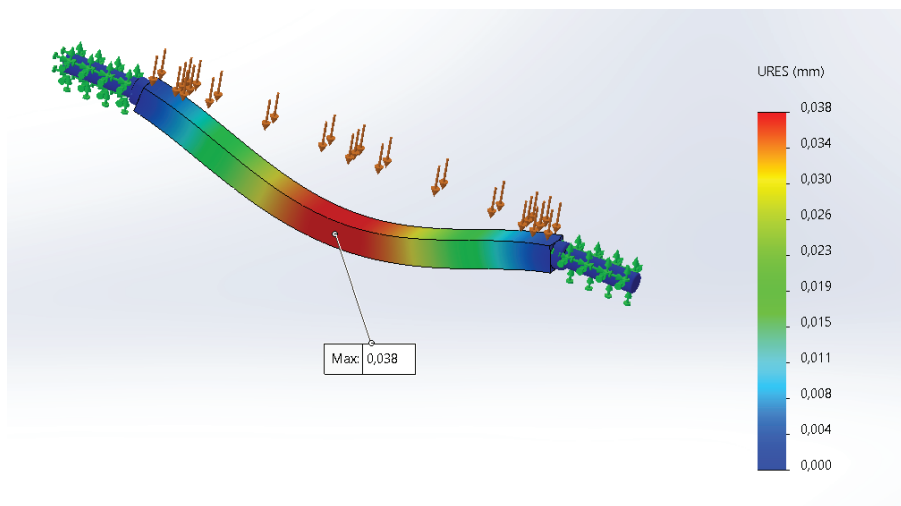


Fig.5. Axle load test.

Model name: Part1 kvadrāt stienis
Study name: Static 1(-Default-)
Plot type: Factor of Safety Factor of Safety1
Criterion: Automatic
Factor of safety distribution: Min FOS = 8.6

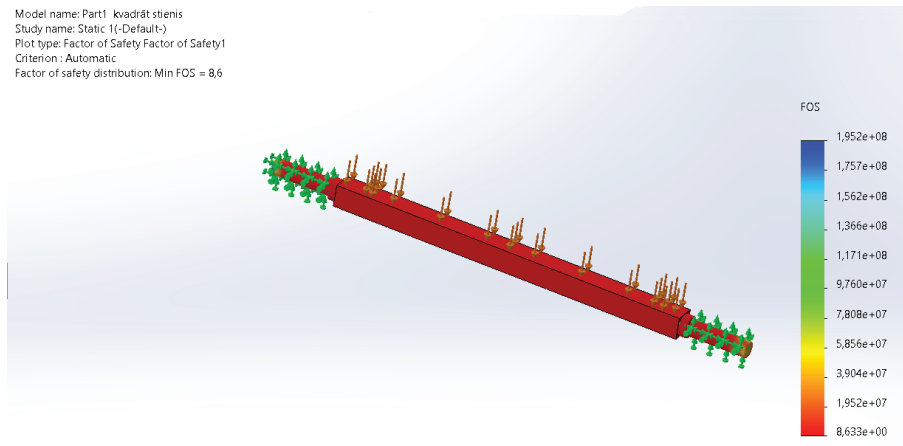


Fig.6. Factor of safety distribution.

Figures 7 and 8 show the end result of a 3D belt grinder and its lifting mechanism.

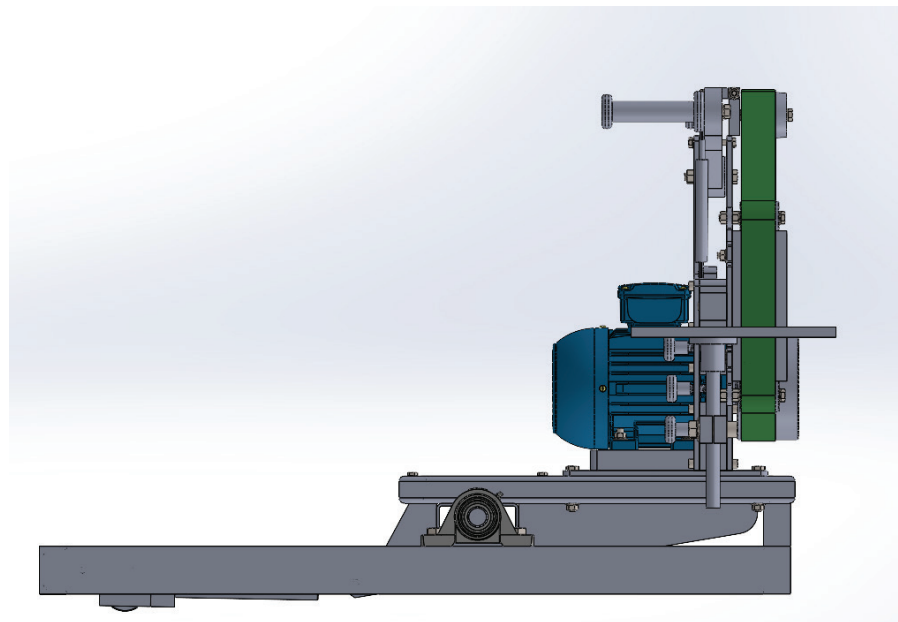


Fig.7. Belt grinder for lifting mechanism.

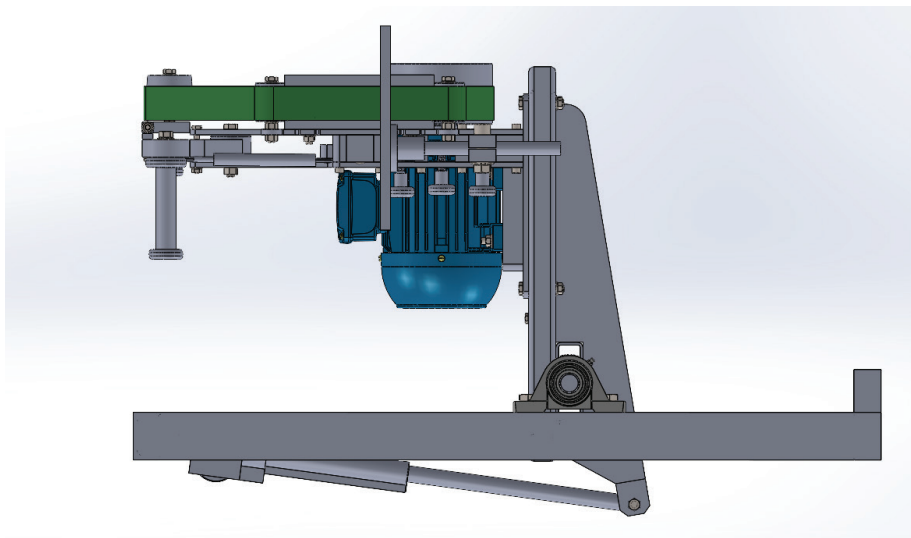


Fig.8. Belt grinder in tilted position.

A case diagram was also created for this project, in Figure 9. In which the control sequence can be seen, the operator uses only the Nextion display, while the technician can change the Arduino code and the design and software of the Nextion touch screen.

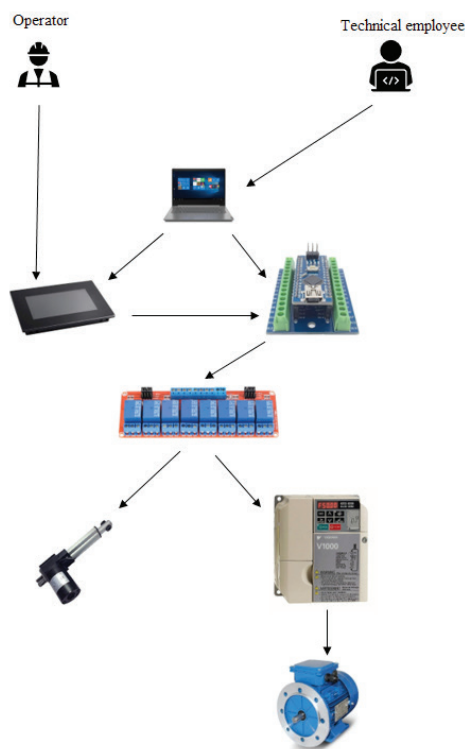


Fig.9. Case diagram.

Conclusion

In conclusion, the Nextion touch screen with Arduino can create a little automation for simple devices because the consumables are cheap and available. The Nextion device, allowing the creation of a solution quickly and simply, also allowing the use of other sensors and devices connected to the same controller, this is a great advantage compared to other types of displays available on the market.

The lifting mechanism of the belt sander is very simple. The axle is mounted on bearings that are attached to the frame body, and the lever is mounted on the axle to move the axle.

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