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# The automation of the CNC milling machine

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***Abstract* — The paper solves the problem automation of the CNC milling machine. First will be described CNC device that will be automated and the changes you will need to make to the device. Next, the article describes the principle of the functionality of the entire automated system. At the end we will describe the 3D model of device. Functions of the individual hardware parts will be described separately.**

***Keywords* — automation, CNC milling machine, continuous production**

## I. INTRODUCTION

This project is an extension of the CNC milling machine. It is based on creating of automatic workpiece replacement. This extension provides more efficient work on the CNC milling machine. Which is desirable in modern industrial automation.

## II. CNC MILLING MACHINE

A CNC milling machine is a computer numerical controlled (CNC) milling machine, which of using rotary cutters to remove material from a workpieces. In our case the machine moves are carried out by stepped motors. The LinuxCNC software is used as a control system for a CNC milling machine, provides compilation of the G-code. This code contains motion instructions of the device. G-code can be generated using CAM software which is the expansion of CAD software used to model components. On xxx, you can see a CNC milling machine that will be expanded about automation.

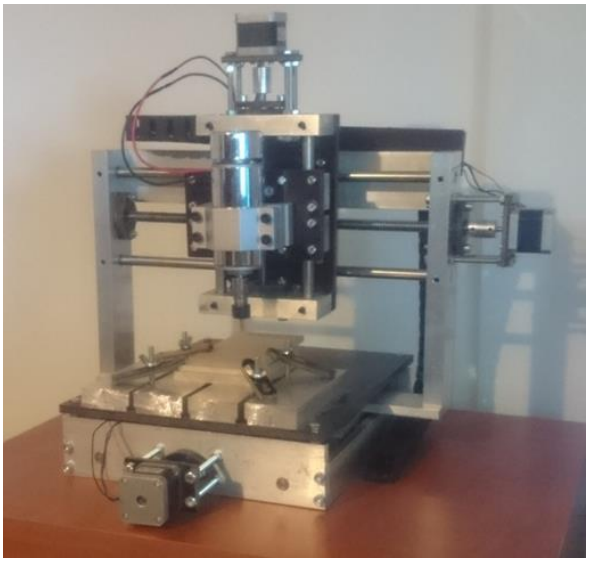

Fig. 1 CNC machine

## III. AUTOMATION OF PRODUCTION

Expansion of the milling machine will be make the production of our products more efficient. To introduce automated continuous production system, it is necessary to solve the following problems:

### *A. Storage and transport of the workpiece*

It is necessary to store the workpiece correctly, and then in the right time to present the workpiece to the place where the workpiece is to be fixed and machined using the CNC milling machine. And after machining it is necessary to remove it to free the space of the next workpiece.

### *B. Attaching Workpieces*

The gripping must be sufficiently strong to prevent the workpiece from slipping off, which would devalue the piece that would produce financial losses in the company. Furthermore, the clamping must be accurate to ensure the precision of the fabricated component with the associated production quality. Another dual factor in capture is the time of retention and repeatability of the process.

### *C. Machining the product*

The product will be produced by milling. This process is realized by our CNC milling machine, which will be expanded.

### *D. Assembly of the product*

Because the resulting product is a key ring with name of a web page of a department, you need to put on a circle for the assembled workpiece. And then the final product is produced, which is a turnkey pendant.

## IV. 3D MODEL OF AUTOMATION

The model needs to be expanded by a part of automated production. It consists of automatic workpiece changes and assembly of finished parts. In Fig. *2* you can see complete design of automation for continuous production.

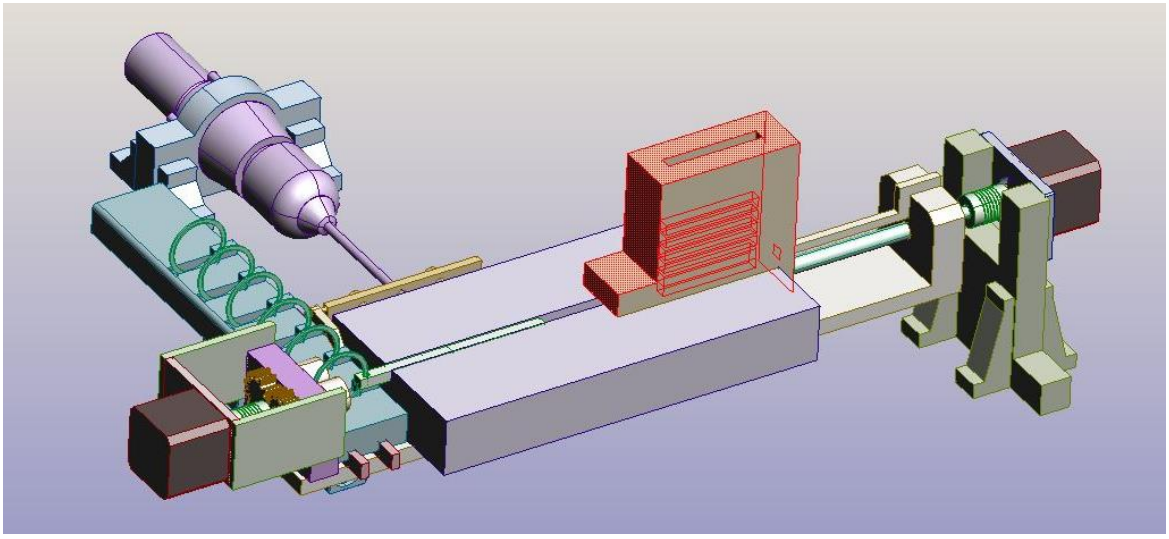

Fig. 2 3D model of extension

The workpieces needed to produce the products will be placed in the magazine. The capacity of the magazine is 10 pieces. The workpieces is inserted from the top into the magazine. In Fig. *2* we can see a magazine that is highlighted in red. The workpiece is pulled out of the magazine by a sliding part. The sliding part consist of a rail where the workpiece is moved to the clamping portion. The feed is realized by a linear support. The movement is ensured by a threaded rod that is rotated by a stepping motor. We designed an automatic jaw vice for the workpiece grip. The gripper is able to adjust the clamping moment. Opening and closing of the jaw is ensured by a DC motor. After inserting the workpiece into the jaw vice, the vice automatically grip the component. After the workpiece has been correctly fastened, the milling machine performs the milling operations required for to produce the component. When the milling process is completed, the jaw vice is opened and moved to the next part of the vice. In the second part of the vice, the components are assembled. The last part of the system is the assembly that

automatically completes our workpiece and key circle. It is stored in the bin of the key circles, the key circles are placed in this bin with the capacity 10 pieces. The vice moves the bin in the forward direction, allowing the use of the next component from the bin.

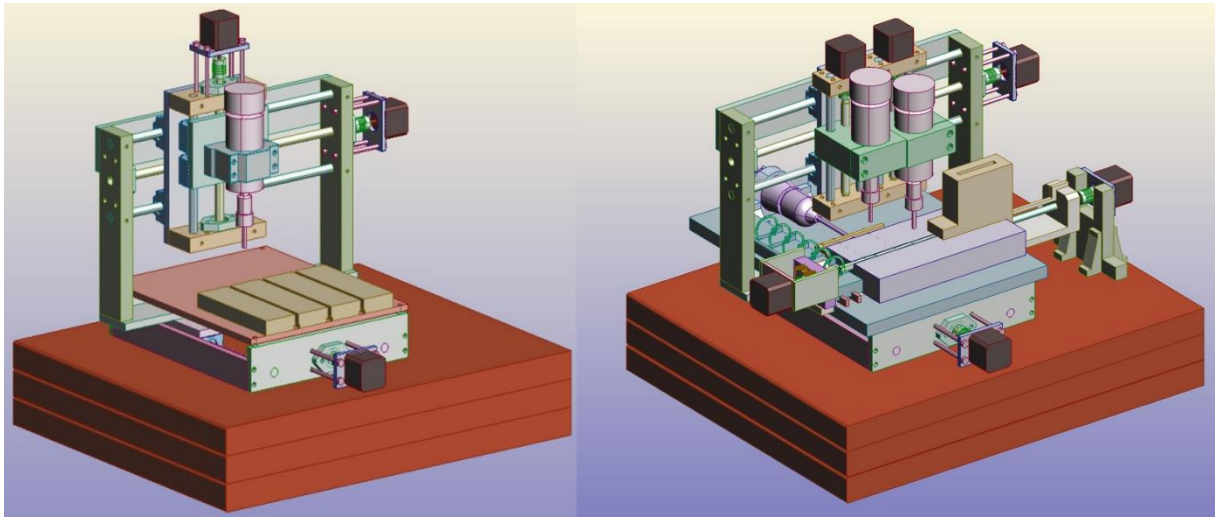

Fig. 3 Comparison of the CNC milling machine with the extended model

In Fig. 3 on right side we can see full model of automated CNC machine. The model must been expanded about next spindle because two milling tools are required to produce our components. One tool will be used to milling the inscription and the other is used to drill holes. Therefore it is necessary to adjust our milling machine and extended it to another milling head. The advantage of this solution is the ability to automatically produce more kinds of products.

## V. CONCLUSION

The paper show how solve automation of CNC machine. Correctly stated automation do our production more efficient. The solution will allow automated production of component, save time and sources required for production.

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