IMPROVING THE COOLING SYSTEM OF RACK BY REMOTE CONTROL OF AN AIR CIRCULATION*

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RACK contains a great amount of electronic devices so it is obvious that it will warm up during work. To prevent damage of hardware, a productive cooling system should be installed. Currently, there is a ventilation panel but an additional control of an air circulation is also necessary. This project had in view to create a mechanism which allows to lock the ventilation duct. The software was created in LabVIEW and has different options for average and authorised user. Additionally, elements of the mechanism were designed using 3D modelling in order to print them on 3D printer.

1. Introduction

Every machine warms up during its operation. This is the reason why cooling systems are designed. The quality of the cooling system affects the operation of the hardware. When the hardware contains multiple devices, its operation must be remote. Also the cooling system must be remote, it must react to every parameter change. In this project, the remote control is also needed because the entrance to the RACKs during their operation is forbidden.

2. Purpose and assumptions of the project

A purpose of the project is to improve the cooling system of RACK. Hitherto the cooling system contains ventilation panel mounted at the bottom of RACK. To better use this structure, the control over air circulation is needed. In order to achieve this, a mechanism which allows an easy opening and closing of air circulation inside a ventilation duct was created. The

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mechanism is controlled by myRIO from National Instruments and servo HS-311 Hitec. The software which dictates the movement of the motor was written in LabVIEW.

3. Hardware

The motor used in this project is servo HS-311 Hitec [1]. Position of the shaft is determined by signal on the input line. Until the signal is transmitted to servo, the shaft will retain its position. The angle of rotation depends on the duration of the pulse. The servo should get a pulse every 20 ms. This pulse of square wave signal is supposed to last for minimum 1 ms and no longer than 2 ms. The neutral position of each servo, which means the angle 90°, is determined by a pulse with a duration of about 1.5 ms. The servo is connected to MyRIO from National Instruments [2]. It is a control board which allows to develop applications written in LabVIEW.

4. Interface of the program

Figure 1 shows interface which contains three different panels. Run panel, Engineering panel and Authors. Run panel is designed to be used by an average user. It contains only one switch which allows to open and close the air circulation. Two diodes signalize which option has been selected. Engineering panel was created for authorised users. Here, the PWM channel and the frequency can be changed. Additionally, the user can see the duration of the pulse (time) and the duty cycle. At the bottom of this panel is Stop Button which allows the user to turn off the program. The last panel contains informations about authors of the project and logo of their faculty.

Fig. 1. Interface of the program.

5. Software

MyRIO demands LabVIEW so the software of the mechanism is written in this visual-programming language. To simplify the description of the block diagram, the code was divided into eleven constituent parts, all parts are shown in figure 2. First part is responsible for choosing the position of the shaft. The user can choose one of two options — open or close. The first one corresponds to angle $82°$ and second one to angle $-5°$ with respect to neutral position of servomotor. These values were selected empirically and it indicates that the shaft is a little rotated in its neutral position. The second part of code contains two diodes which signalize the option chosen by the user. Its work is based on if statement. In the third part, the value of an angle is calculated into time. The fourth element contains a field which allows the user to choose the frequency of signal. Default value is 50 Hz because it is the optimal value for the used servo. In the fifth part, the values of frequency and time are calculated into duty cycle which alongside time are displayed in the next part. The seventh element contains informations about authors of this project. The eighth one comprises Stop Button which finishes the main loop of the program. Last three parts are responsible for communication with MyRIO. In the part number nine the signal is generated based on values of frequency and duty cycle. The communication with MyRIO starts at part tenth. There, the user is able to choose the canal of communication and the output. The last part informs the user about any errors and resets MyRIO.
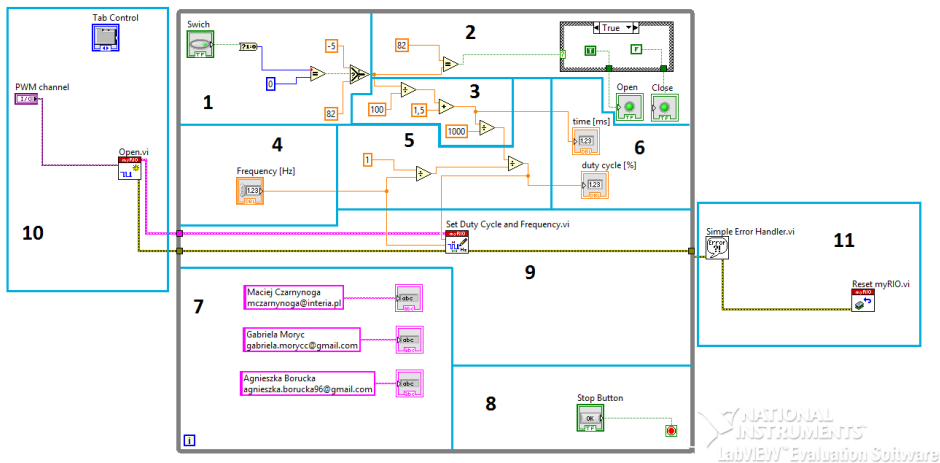

Fig. 2. The code of the program.

6. The assembly

The basic premise was that the servo was inside the ventilation duck due to the risk of damage to the mechanism. The whole project was designed in a way that the motor turns the lock directly, without help of additional arms. It was decided that the elements would be printed using a 3D printer. Models of the handles were done in an Autodesk Inventor Professional 2017 program. Eventually, there were two different models. In the second version, which is presented in Fig. 3, the servo is placed in an additional section so as not to reduce the cross section of the ventilation duct. In addition, the second project contains supportive parts which enable to print elements using hardware currently available in the institute. Finally, none of the projects were printed. The following figure illustrates the projects.
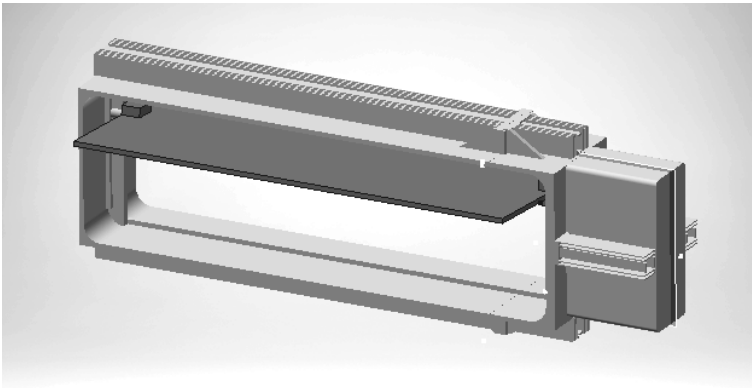

Fig. 3. Visualisation of project number 2.

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