RESEARCH ON DESIGNING AND DEVELOPING AN EXPERIMENTAL MODEL OF A CONVEYOR ASSISTED BY A ROBOTIC ARM

SIMA Andreea Valeria, SAVU Tom and ENCIU Cornel-Cristian
Faculty: Industrial Engineering and Robotics, Specialization: Applied Iinformatics in Industrial Engineering, Year of study : IV, e-mail: andreea.sima14@yahoo.com

ABSTRACT: This work aims to develop and simulate an automatic conveyor assisted by a robotic arm. The realized system must be able to automatically identify and sort parts, by means of a video camera that will analyze the landmark while moving on the conveyor belt, and then transmitting to the robotic arm information about the part's conformity, so that it is stored in an area specified by the user. Information on the types of automatic conveyors available was briefly presented, as well as diagrams showing how they work and their main components.

KEYWORDS: conveyor, robotic arm, sorting

1. Introduction

The subject of the paper is the design and programming of a robotic system, i.e. the analysis of incomplete parts and their sorting.

The objectives are to present the working principle of the proposed product, the algorithm developed for the analysis of the parts and the elements that will be improved in a future research, based on the results obtained.

In order to develop the product and the software, Catia V5 R21, Onshape, Labview, Arduino and NI Vision image analysis software were used.

2. Current status

Sorting systems are needed at various intralogistics points, such as goods receiving, picking and shipping areas, etc. The level of global demand for technology has increased and the need for automated sorting can be a major advantage.

At present there is a lot of sorting equipment available and it is in continuous development, including the ones in the table below:

Table 1. Current status

Fig. 1. Interrol MX_H horizontal sorter [1]

Fig.2. MX-V vertical sorter [2]

3. Operating principle

3.1 System operating mode

The equipment consists of a conveyor, the main element, its role being to move the pallets on which the parts to be analysed are located, a feeder containing the parts to be analysed, and a robotic arm programmed to transport the parts according to the commands received from both the fixed video camera and the video camera on it.

Figure 3 shows the elements of the system developed.

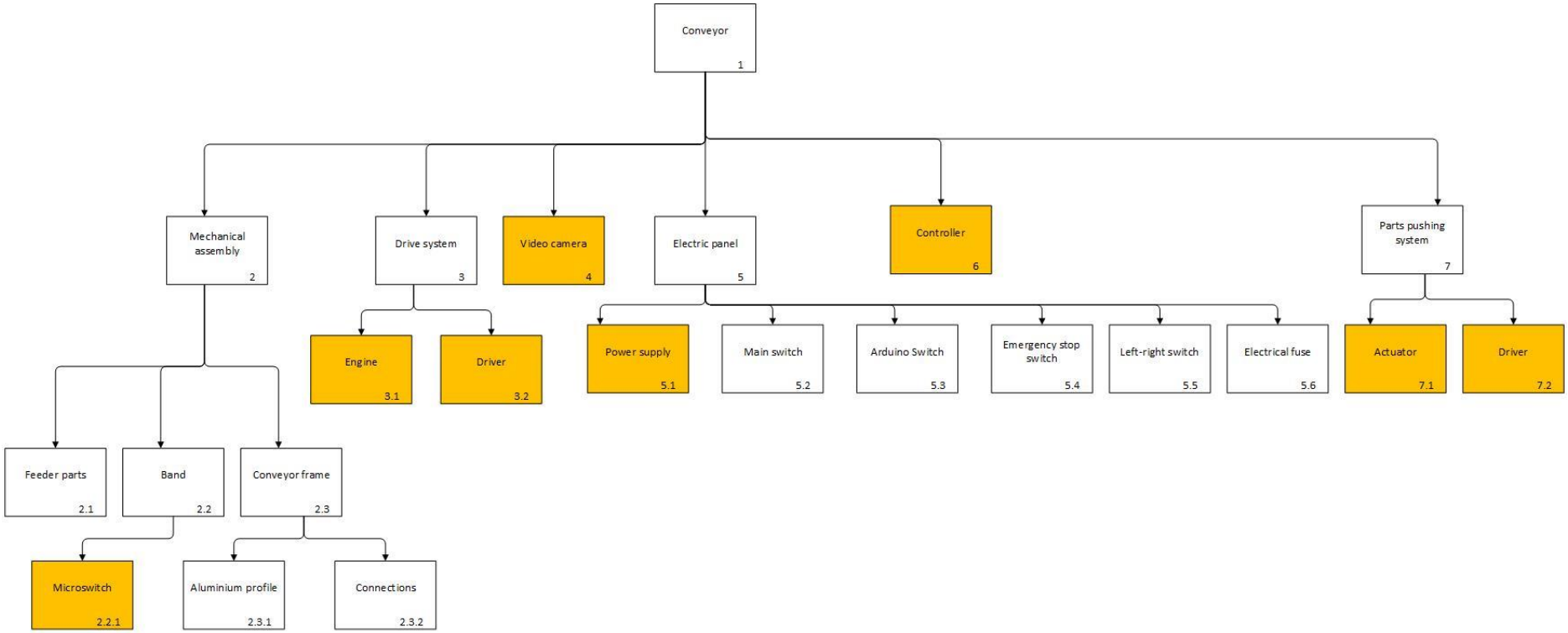

Fig. 3 Main elements of the system

The sequence of work steps is shown in Figure 4

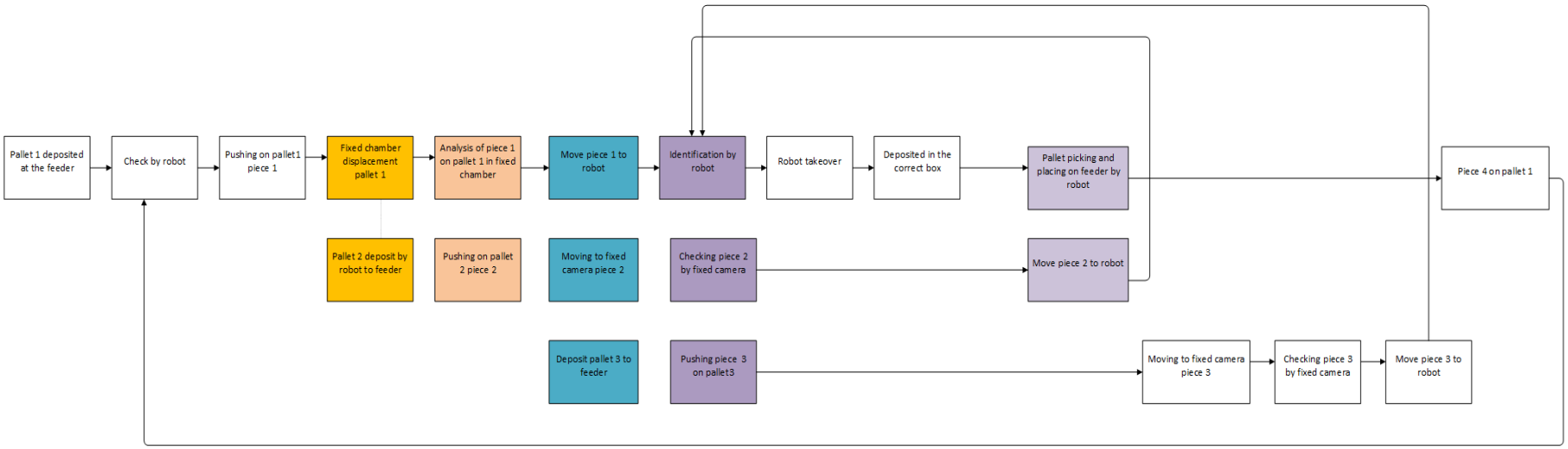

Fig. 4 Logic scheme system operation

The system will work by swapping three pallets to transport parts from the feeder to the robotic arm for sorting. There are 14 phases for a complete cycle, until the first moved pallet returns to its original position.

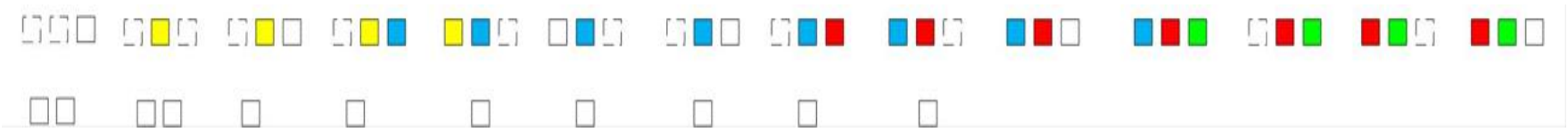

Fig 5. Overview of pallet movement

Yellow represents the first piece on the palette, blue piece number two, red piece number three and green piece number four. The conveyer moves the pallets from right to left. In order for there to be a correct way of working, certain conditions must be respected, the piece cannot be pushed onto pallet one if the robot has not checked the position of pallet one, it cannot move forward if position two of the fixed chamber is not free, the same being true for position two if position three is not free.

Figure 6 shows the connections between the elements for the correct functioning of the system

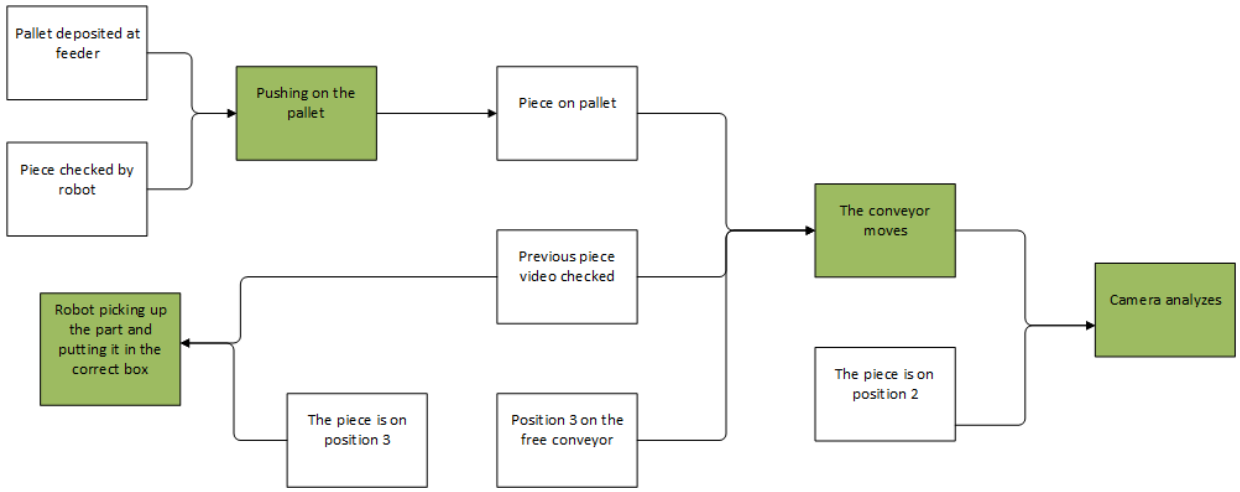

Fig 6. Elements required for the drive

3.2 The device designed

The main elements for the conveyor automation are shown in Figure 7.

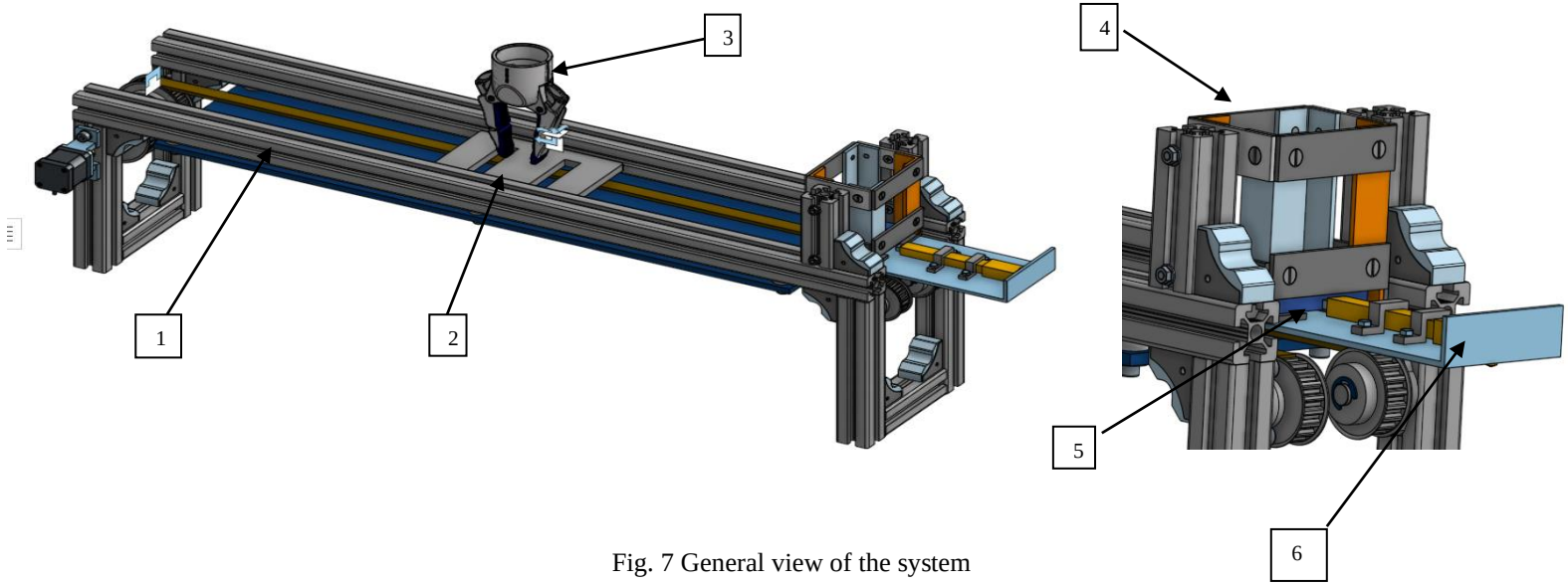

Fig. 7 General view of the system

1-Conveyor
2-Pallet
3-Robot arm of the Kinova Gen3 lite robot
4-Power supply
5-Piece
6-Actuator clamp support

The designed feeder has the following dimensions 105x84x124 mm, it will be made of 30x30x4 steel angle bars and 40x40x4 mm angle bars for the base part.

Two aluminium profiles, two joints and two spacers will be used to fasten the conveyor.

In this feeder there will be a batch of 10 pieces, some compliant, some not, with the size of 92x67x10 mm. In figure 7 is an example of a compliant part and in figure 8 an example of a non-compliant part

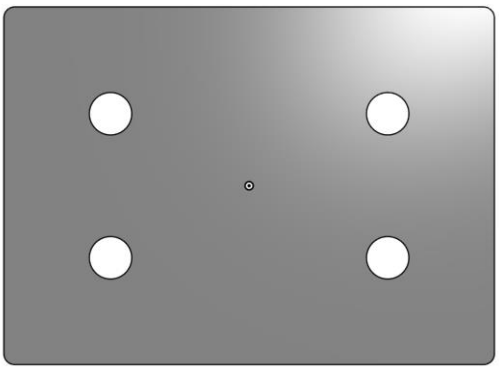

Fig 8 Conforming part

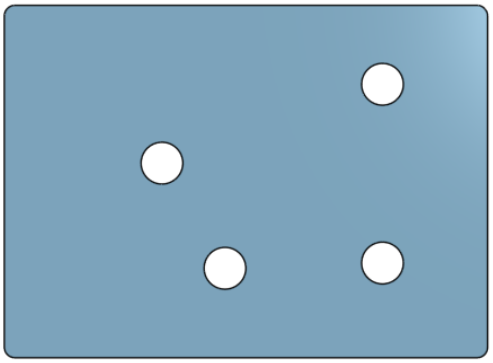

Fig 9 Non-conforming part

3.3 Electrical connection diagram

The actuation of the electrical elements shown in the diagram below was performed in Labview software using Labview-Arduino communication functions.

Electrical components:
1-Power supply 12V, 2A;
2-Nema 17 motor-used for rotating the conveyor belt;
3-Driver A4088- used for motor control;
4-Actuator-used for pushing parts;
5-Driver L298N- used for actuator control;
6-Roller microswitch-used to interrupt the belt drive motor when a blade has reached position three;
7-Arduino Uno- used for loading programs that will control the electrical components;

The drivers and the Arduino Uno board will be clamped on a board, the actuator on the designed bracket clamped to the power supply, and the rest of the elements will be mounted on the conveyor.

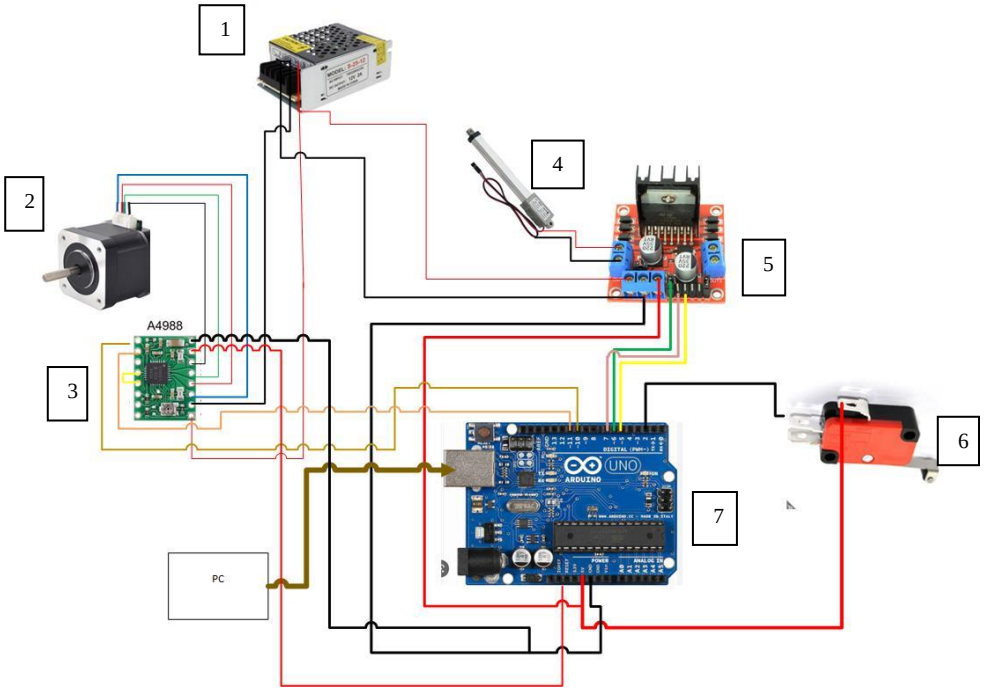

Fig 10. Electrical components

4.Conclusions

Future research for the realisation of the automatic transport system assisted by the robotic arm are:

-Design of the fixed video camera mount;
-Producing image analysis for the pi esa;
-Establishing the sequence of actuation of electrical elements;
-Programming the robotic arm for transporting pallets and parts;

5.Bibliography

[1]***, https://www.interroll.com/products/unit-handling/sorter/mx-h-horizontal-crossbelt-sorter/ (accesat la data de 16.03.2023)

[2]***, https://www.interroll.com/products/unit-handling/sorter/mx-v-vertical-crossbelt-sorter/ (accesat la date de 16.03.2023)