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Climbing Band

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Abstract - *The climbing band was designed and built with the use of technology, in this case home automation technology, our project is a prototype built on scale to reduce accessibility problems which represent barriers for those students and employees who work with some type of motor disability in the Technological University of Tlaxcala. Thus, these people can easily move from one floor to another, without suffering any accident. Find a place that is suitable for a person with disabilities is very difficult, thus the project tries to minimize the risk for people with physical disabilities because it is totally automatic, the person climbs the ramp and it will act on its own taking into account that it is a prototype.*

1. INTRODUCTION

The objective of this project is to design electric access ramps on scale in the Technological University of Tlaxcala. This scale project was postulated as a proposal within the technological university of Tlaxcala in order to avoid or reduce accidents with people with disabilities, but our availability in terms of time was not enough to do it physically.

For design this ramps, it is used home automation technology, so that people with physical limitations from one floor to another and to enable students and employees to access the service without encountering any type of architectural barriers in its path.

People with disabilities (physical) are the main affected by the accessibility barriers that exist in the physical environment because they prevent or hinder their mobility of students and employees affecting their social integration and the possibility of using themselves.

Said barriers can be an obstacle and come from the same disability that is physical functionality. Second, there are the architectural, urban planning, transport and telecommunications barriers that impact the interaction of the individual with the physical or social environment.

In this aspect, the application of assistive or support technologies play an important role, in this particular case with home automation, seeks to minimize accessibility barriers for those people with physical disabilities.

2. DEVELOPMENT

A climbing band or conveyor belt is for the transport of objects formed by two pulleys that move a continuous conveyor belt. The pulleys are moved by motors, making the conveyor belt rotate and thus be able to transport. In this aspect, the application of support or assistance technologies plays an important role, in this case home automation technology, which seeks to minimize the problems that they represent accessibility barriers for those living with disabilities and mitigate activity limitations and restrictions on social participation. Moving floor systems, which use oscillating plates to move the load; and roller conveyors, which use a series of moving rollers to transport boxes or pallets. But in this case they will be used to transport people with a motor disability, using home automation technology, to enable any type of user, especially people with physical limitations, to access the service without encountering any type of architectural barriers in their path.

2.1 RAMP MEASUREMENTS

The incline of the ramp is often determined by the space available. The lower the slope, the more distance the ramp will have to overcome the same height.

The incline that the ramp must have to be practical is established between 8% and 10% for cases of accessibility (wheelchairs and people with disabilities).

2.3 PROTOTYPE

A complete prototype was made to scale with metal, each part of the ramp being designed first in a CAD software for mechanical modeling all the moving parts,

The model is fully functional and from that fact we proceeded to solve minor design problems or improve it for the project on a larger scale. The point of making models before is to be able to glimpse the errors of movements, collisions between the pieces, if the mechanical systems project the forces as expected and if they work with something more practical and modifiable.

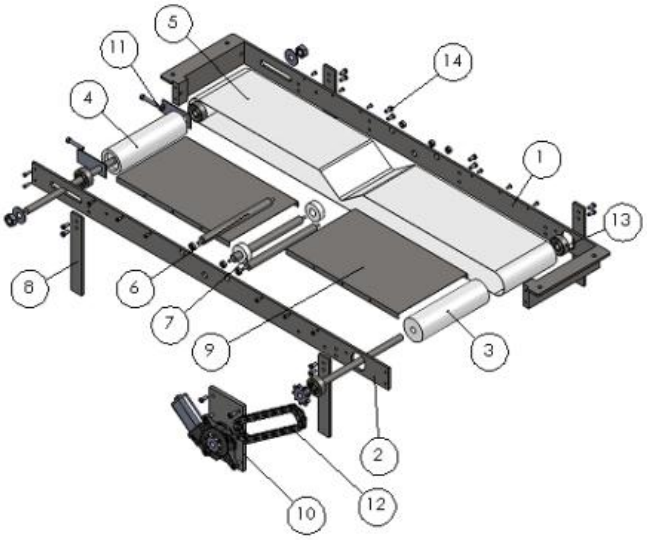

Fig-1 Parts of the conveyor belt.

- Frame back (1)
- Frame front (2)
- Drive roller (3)
- Return roller (4)
- Conveyor belt (5)
- Medium rollers (6)
- Guide roller (7).
- Band Support Foot (8)
- Supporting structure (9)
- Engine Base (10)
- Screw tensioner (11)
- 520 Link Chain (12)
- Ball Bearing (13)

2.4 SUPPORT STRUCTURE

It must be firm as it supports the components of the conveyor belt and the users of the belt, the optimal material would be stainless steel, but due to its high cost and difficulty of finding the required thickness (5 mm) on the market national, this option has been ruled out; this is why the material designated for this structural component is AISI steel plate 1020 additionally and to avoid corrosion, it will be subjected to an electrostatic painting process.

Regarding the dimensions, a previous investigation has been carried out to find the ideal measurements of the conveyor belt and has taken into account the requirements of the facilities at the Technological University of Tlaxcala.

All the components of the system must be perfectly joined to the structure in such a way that the square and level of each one of them is always respected. The joints of the different parts or sections of the system must not present unevenness, respecting the horizontality of the whole assembly to avoid that the tape tends to go out of its way.

In the support structure, the two types of connection are used: the welded connection and the bolted connection. The welded joint is found in the parts that are needed for a solid, permanent and good-looking joint, this type of joint provides rigidity to the structure. The bolted joint is ideal for this design since, apart from being economical, it provides the desired didactic characteristic to facilitate the disassembly and cleaning of all the components of the conveyor belt.

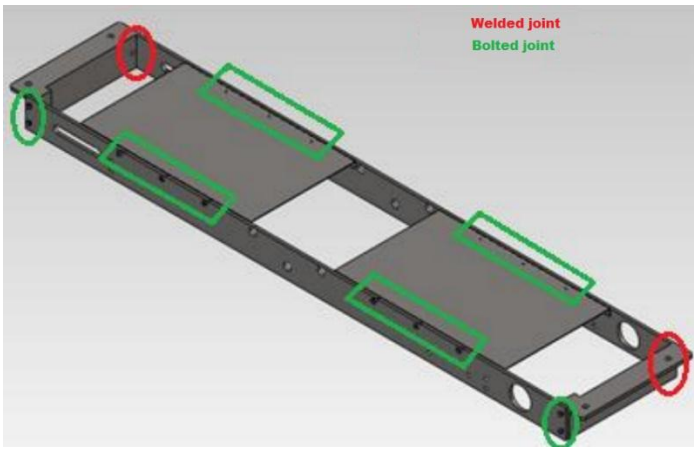

Fig-2 Support structure.

2.5 DRIVE AND RETURN DRUM

The operation performed by these drums is to function as pulleys, which will be located at the beginning and end of the conveyor belt. The adherence between the belt and the driving drum is responsible for transmitting the movement to the system. It must be taken into account that the greater the arc of embrace of the belt on the drum, the greater will be the force / power transmitted to the belt; This point is very important 59 in the calculation of the system as regards the definition of the power necessary for the movement.

The driving drum or pulley, depending on the arc of contact, as shown in Figure 3 can be classified into:

Simple pulley (Contact arc 180º)

Simple pulley with diverter roller (Arc of contact 210º to 230º) Tandem pulley (Arc of contact 350º to 480º)

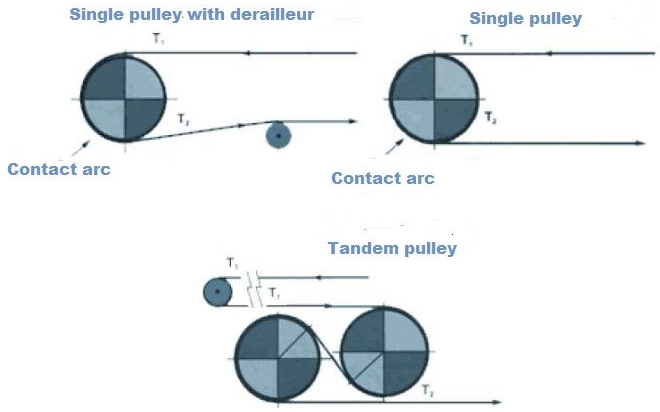

Fig-3 Types of arc of contact of the drum or driving pulley.

The case of a simple pulley is applied for both the driving and the return drum, that is, it has a 180 ° arc of contact.

Next, the design of the drive drum and the return drum is done. The drive drum consists of two parts of the roller and the shaft that is embedded in the middle hollow part of it, as can be seen in Figure 4.

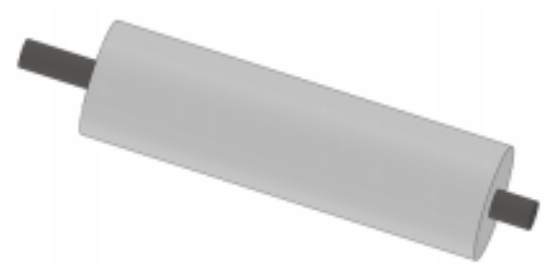

Fig-4 Driving drum.

2.6 RETURN DRUM.

The return drum is located at the end opposite the driving drum, its function is to allow the return of the belt once it has finished its journey in the bearing section. As shown in Figure 5, the drum consists of a shaft embedded in a bearing and in turn the bearing embedded in the roller; this from side to side.

Fig-5 Return drum.

2.7 PROGRAMMABLE LOGIC CONTROLLER.

For the control of the variables generated by the system, a robust device that has incorporated serial communication is needed to receive the information emitted by the XBEE modules. Based on the controlled parameters, a XINJE brand PLC (Figure 6) of the XCM-32T-E series was incorporated into the project.

Fig-6 PLC Xinje XCM-32T-E.

The characteristics of the selected PLC are shown below:

Technical characteristics:

- Programming Form: Instruction / Ladder 102
- AC power supply: 110 V
- Power supply: 24V DC
- Tickets: 22
- Departures: 16
- Brands: 8000
- Special Brands: 768
- Timers: 640
- Counters: 640
- Records: 8000
- Special Registers: 1024

PLC PROGRAMMING

Before starting with the programming of this equipment, a previous configuration will be carried out for the serial communication between the communication card and the PLC.

Free communication format.

To establish communication between the XBEE modules and the PLC, the free communication mode format was used, where common port two of the PLC is enabled to receive data.

To enable the free communication mode, select the Free Communication Config tab in the graphical environment of the program to access the data reception settings as specified in Figure 7.

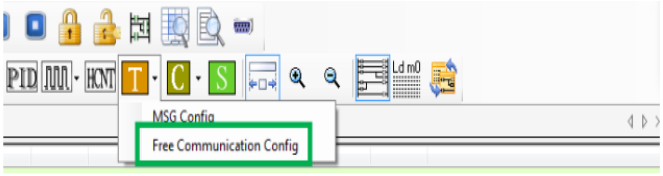

Fig-7 Access to free communication mode configuration.

To receive data, the reception mode is established by selecting Recv, choose the initial register where the data is stored, which for this program is register D0 and finally the communication port two of the PLC is established as indicated in Figure 8

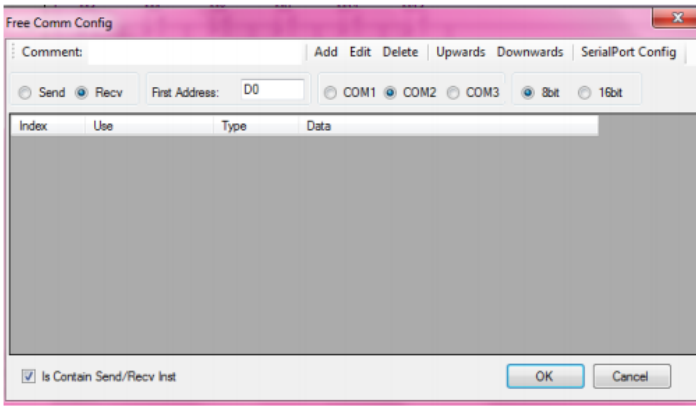

Fig-8 Configuration of data reception parameters.

Subsequently, the Add tab must be accessed to establish the M8226 mark, which is the one that enables the reception of free communication data and configure the extension of the 22-byte frame since this is the largest frame that is arriving from the XBEE modules ; as shown in Figure 9,

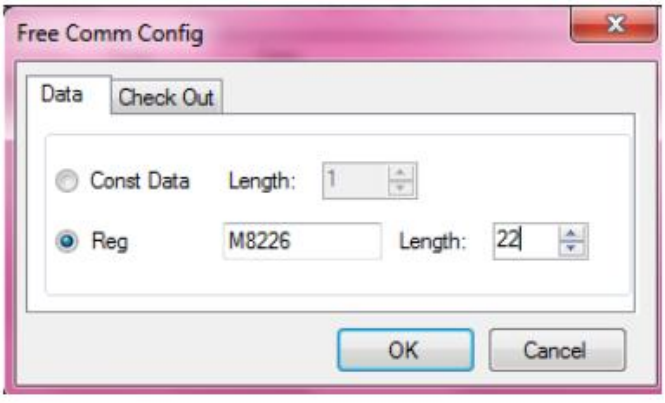

Fig-9 Special Mark Placement and weft length.

Once these parameters have been configured, the communication parameters of port two of the PLC must be changed with a speed of 9600 BPS (Figure 10), similar to those of the XBEE module to establish communication between the two devices.

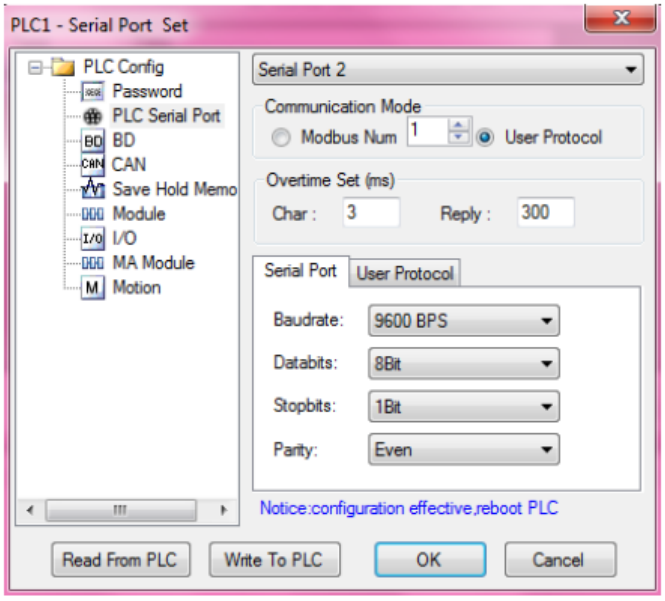

Fig10 Speed selection on serial port 2.

2.8 OPERATION OF THE RAMP

The basic operation of the ramp is based on the movement through rails, always maintaining solidity and stability thanks to the band system, its operation is similar to a mechanical scissor jack, two bars joined by a central point that when opening or closing, help the ramp in their respective ramp or stair states.

The slide along the rail is achieved by a slot in the structural pipe through which one end of the lift is inserted and is attached to bearings that not only function to make the route even and stable, but also as a lock between the elevation and rail.

2.9 TESTING THE MOVEMENT OF THE CONVEYOR BELT

When performing the direction of rotation tests, it can be observed that the positions mentioned are fully met in the design and implementation stage remembering the options of this parameter:

- engine off
- motor counterclockwise
- motor clockwise.

As for the speed of the conveyor belt, it is programmed in such a way that this parameter varies between 0 and 255, performing a PWM control. 141 the respective tests are carried out and it is determined that it acquires safe movement with a parameter between 70 and 255, for safety the values should not be set below 70 because although it is true with these values the band moves, but the motor makes a much greater effort and you could suffer some damage.

3. CONCLUSION

Finally, with the tests it was demonstrated that the project fulfills its function, which is to move autonomously and safely for people with disabilities, concluding that the materials and dimensions are correct, with respect to the analytically developed calculations.

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BIOGRAPHIES.

Jose Luis Hernandez Corona candidate for a PhD from the autonomous university of Tlaxcala, research professor in the area of industrial maintenance, desirable profile before the PROMEP, responsible for the CA of industrial maintenance at the Technological University of Tlaxcala.

Jonny Carmona Reyes graduated from the Technological Institute of Apizaco in 2010 with a bachelor´s degree in Electronic Engineering, specialty in automation and instrumentation. He worked as an electronic engineer in MIF company, developing electronic projects for the steel industry from 2010 to 2015. Since to 2013, he has been working as a teacher in the Technological University of Tlaxcala in the industrial maintenance career.

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