Automatic Varnishing System

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Abstract- **The project presents the simulation of a varnishing process, the hardware-software sistem being optimized to obtain an efficient time in the realization of the project. In an attempt to diversify the process, it is used fixed parts (conveyors, execution stages), as well as mobile parts(robotic arms). The purpose of this project beeing varnishing by immersion, drying and after transportation of the furniture pieces at the warehouse, everything to decrease the dead times of a big process.**

Keywords:arduino, conveyor, robotic arms, sensors, serial.

I. INTRODUCTION

The paper includes knowledge of electronics, informatics and mechanics, knowledge acquired in the last years of study. The aim of the paper was the minimizing, the automation and the efficiency of the varnishing process. I used a Arduino Due development board as master for control of the two robotic arms , and also two Arduino UNO boards as slave, ordered through a serial communication by the board presented previously, for the coordination of the process depending on the received data from the sensors. Monitoring the timings of the process but also displaying temperature and the liquid level in the vessel remain in the study, and will be implemented in the shortest of time. The aplication is structured in two parts: the psysical structure which is presented the steps that the system is was built and the software parts which contains the necesarly program to execute the entire process of varnishing.

II. PHYSICAL SYSTEM STRUCTURE

The project includes two parts hardware and four modules software. The assembly show in figure 1. has the dimensions 1200 x 1450cm , and consists in 7 engines with different functions (3 for the conveyors, 2 for furnace doors, 1 for the movement of the robotic arm, 1 fot the revolver type deposit). Manipulators formed each by 6 servo motors with 180 degrees powered by 5V, photodiodes sensors with phototransistor, a fluid pump replaced at the moment by a led to avoid parts wear during programming, two coolers, two light bulbs powered by 220V.

1. Represents the tape who pickup parts that will enter in the process of varnishing.
2. Shows the first process that the pieces go through, the process of application of a layer of painting oil.
3. Indicates the drying process of the painting oil previously applied to the parts, process necessary to the next step.
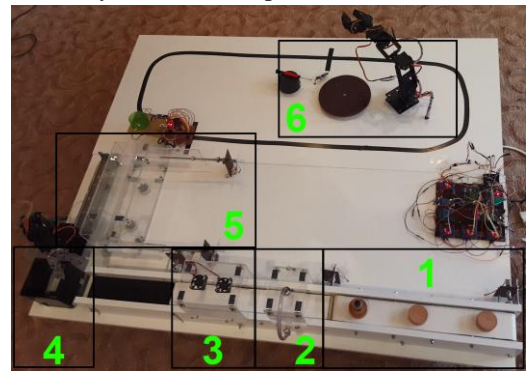

Figure 1. System ensemble

4. Varnishing by immersion,the key part of the process, the place where the furniture parts are subjected to the last contact with the liquid.
5. Shows the oven, who simulates the drying with the help of 2 bulbs, for the layer of varnish to be subjected to an accelerated and total uniform drying.
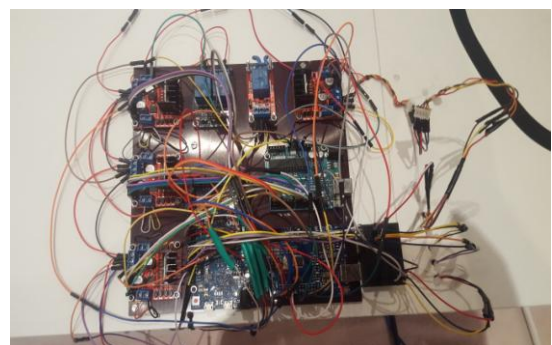6. The revolver type deposit who is storing the pieces at the end of all stages.

Figure 2. Supply scheme

The supply with energy is done from a source of 450W, that way the drivers for engines get 12V, the servo

engines get 5V, the photodiodes get 5V and the phototransistors get 3,3V.

III.   SOFTWARE STRUCTURE

The software assembly includes four distinct applications, presented in figure 3.

For the Arduino Due boards and the two Arduino Uno has been develoved in the programming environment IDE(fig.4) specific manufactuer a software module who: initiate the serial communication in the parameters 38400 symbols/second. Arduino Due represents the center of the assembly, this communicating serial with the two Arduino Due and with the both robotic arms, with the relay that allows the starting and stopping of the fans from the dry area, coordinated depending on the data received from the four connected sensors. The first Uno board synchronizes the movement of the three conveyors but also the movement of the manipulator in the oven depending on the data received from the central board(DUE). The next Uno board with the help of the two relays starts when is the case the pump for the applying of an layer of painting oil and the bulbs from the oven, also with the help from an driver L298N[4] orders the gear engine steper standing at the base of the revolver type deposit, with a movement of 1200 to the left, after each piece arrives in the warehouse. The number four aplication was used for the mobile robot, who incorporates the idea of follow liner, the received information is made by a sensor QTR-8RC Pololu[3], having in the conveyor cuvette an phototransistor and an photodioda, the engines being ordered by an driver TB6612FNG.

```
void Senzora(){

  if(digitalRead(Sa)==0 && flag==false)
  {
   Serial2.println("2");//oprire banda 1,banda 2 merge
   Serial2.println("3");//oprire banda 2
   Serial3.println("5");//pornire pompa
   delay(3000);
   digitalWrite(vent,LOW);//pornire ventilatoare
   Serial3.println("6");//oprire pompa
   Serial2.println("2");//pornire banda 2
   delay(1000);
   Serial2.println("3");
   delay(3000);
   Serial2.println("2");

   flag=true;
  }

}

void Senzorb(){

  if(digitalRead(Sb)==0)
  {
    Serial2.println("4");//pornire banda 4
    digitalWrite(vent,HIGH);//oprire ventilatoare
  }
}
```

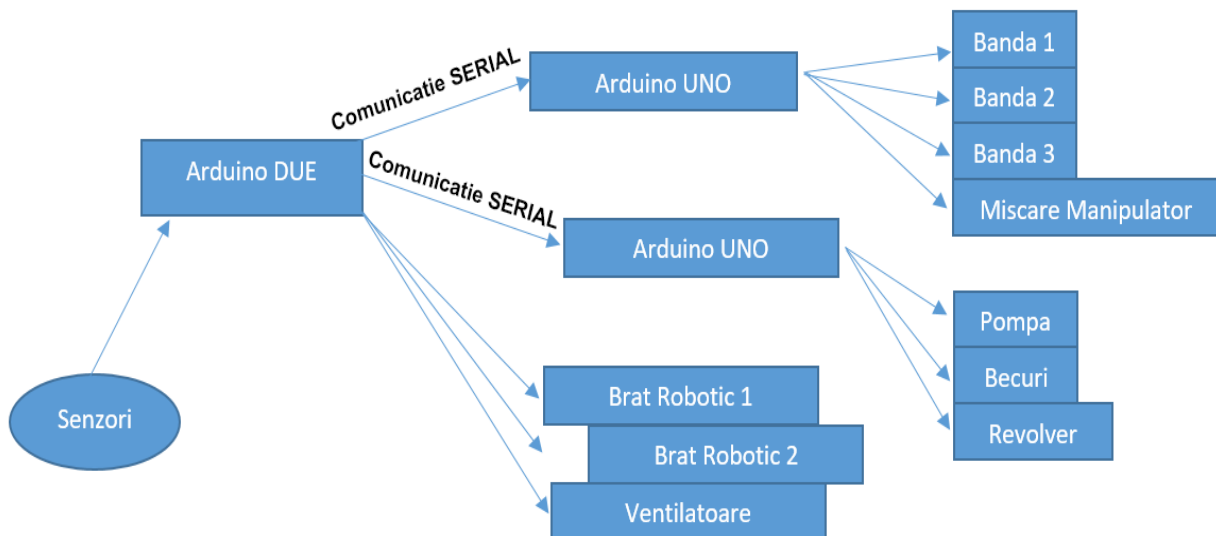Figure 4. Part of the code for the Arduino Due programming

Figure 3. The software structure of the application.
The logic scheme in the figure 5 highlights the structure of this program.
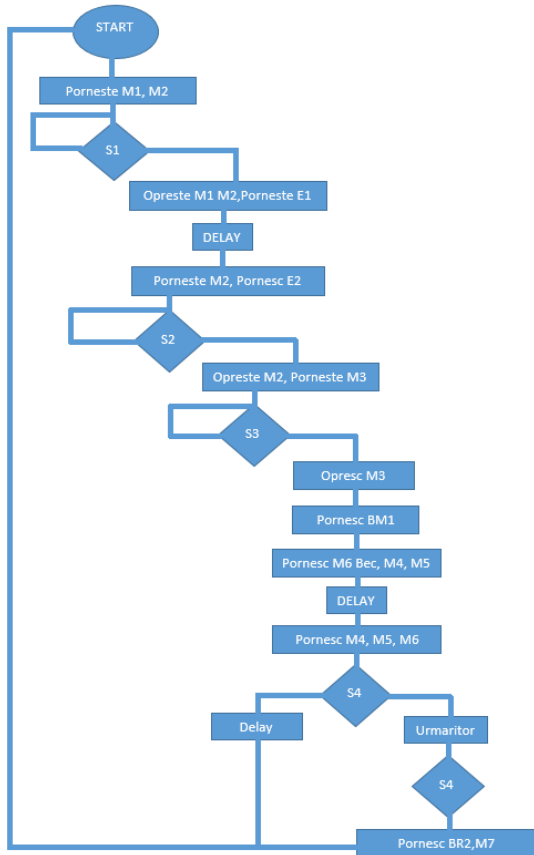
Figure 5. The logic gate scheme of the varnishing aplication

IV. HARDWARE STRUCTURE

The work is divided into 2 distinct parts, the fixed part consists of 3 conveyors, the first to supply the parts in the system of fabrication, the second transports the parts to the degreasing area or the appling of a layer of painting oil, process achieved by spraying, and the last conveyor for the lead of the parts by the first point of drying, process achieved through ventilation, conveyor belts for which was used 3 micro-engines with an reducing 298:1, a fluid pump (replaced for the moment by a led for the simulation stages of where spraying takes place).
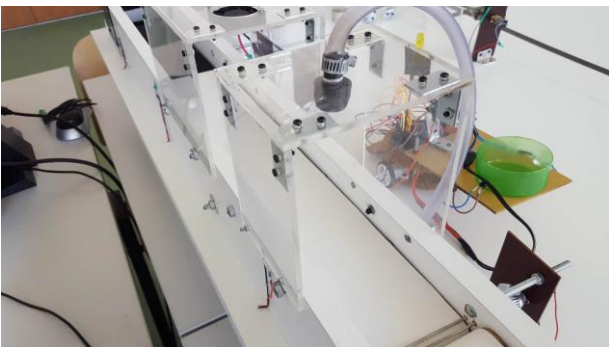

Figure 6. Spraying area

Two fans of 12V for drying the layer of painting oil the degresing previously applied, both the pump and the fans being ordered differently by relays, four sensors formed from phototransistors with photodiodes and comparator wavelenhths of 960nm, sensors apply in the process of transit of the workpiece from supply point to the pickup point for varnishing.
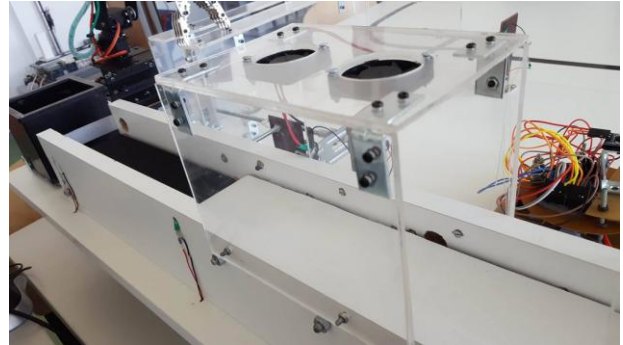

Figure 7. Drying area by airing

The varnishing process is done by sinking into a full tank of varnish, once removed the piece from the tank is then placed in the oven, caught by the robotic arm that inserts the piece in an slot specially designed, oven that has the doors with side translational, once the doors ar closed it will open a relay connected to 220V that lights up the two bulbs, simulating this way the drying by heating.
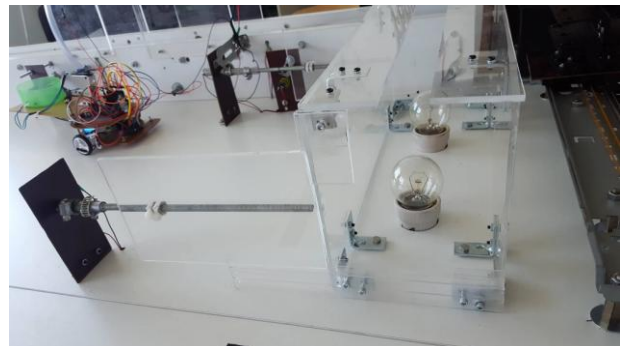

Figure 8. Oven-the drying by heating area

Once the piece is dryed the oven is opened, and the piece is placed on a follower of line robot, that has a cuvette for parts transportation equipped also with an phototransitor and an photodioda that sensed the workpiece presence. Reached the unloading point the robot presence is sensed by the sensors and is started a robotic arm that picks up the piece and deposits it in a "revolver" a warehouse with a capacity of three parts, having each time a spin of 1200 to the left, reason for wich i chose this name.
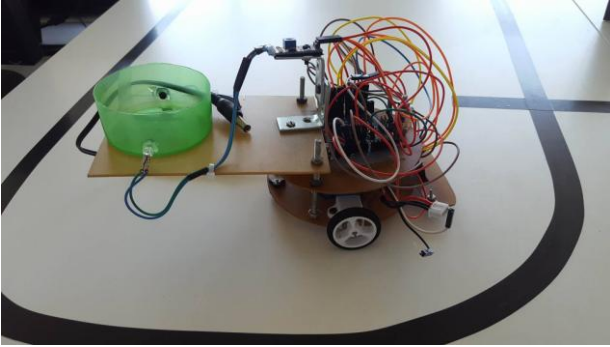
Figure 9. The mobile follower of line robot

A Arduino Due[1] development board for the coordination of the whole process and two Arduino Uno[2] for the order of the execution elements and the coordination of the whole ensemble with the help of information received from the sensors, a source computer of 450W, both mechanical arms each having 6 degrees of freedom, ordered with the help of 12 servo MG966R[5] with a range of mobility of 1800 on each degree of freedom, 4 engine draivers L298N, two micro engines with reduction 30:1 and an stepper.
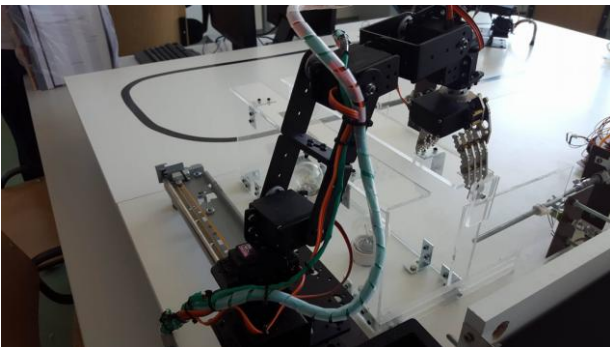

Figure 10. Mechanical robot arm with 6 degrees of freedom

V.   RESULTS AND CONCLUSIONS

Any thing easy in appearance, turns out to have its heavy points. The project is developing to make the implementation successful in the woodworkind industry. During the project i met many problems that necessitated a deepening of study in several different areas for example the senzors used for presence has light sensitivity and to remove the problem i put the senzor inside the edge of conveyor belt also another problem was the conveyor belt because it was homemade it does not have the accuracy needed and errors appeared in the process and for remove them i use slow speed in motors. In the future i want the reproduction at a larger scale of the project with minimum cost and the reducing of the process timings for his improvement. The main

advantage is the elimination of human from varnishing process because the process is toxic to the human body. A disadvantage in the current application is the execution time is a slow process because of the type of building application was homemade and doesn't have an industrial precision.

VI.   ACKNOWLEDGEMENTS

VII.   REFERENCES

[1]   Arduino DUE, AT91SAM3X8E, 84 MHz
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[2]   Robofun, Arduino Uno v3
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[3]   Pololu, sensors bar QTR-8RC
        http://robofun.ro/bara_senzori_linie_qtr8_rc
[4]   Dual Drivers L298N
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