TELEOPERATED SYSTEM WITH ACCELEROMETERS FOR DISABILITY

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Abstract

This project involves the implementation of a teleoperated arm using an embedded platform based on a reconfigurable logic device (FPGA) configured and programmed in VHDL for Atmega 328p, using servomotors MG996R brand and a communication terminal with accelerometers, scheduled language C. the system is incompatible with teleoperated robotic autonomy (understood as the case where control and decision making are performed by the robot itself). That is why robots are teleoperated tasks perception of the environment, complex manipulation that are performed by humans and planning, ie, the operator acts in real time closed loop control high level. The evolved systems provide sensory feedback to the operator environment (strength, distance). In this manipulation we used an anthropomorphic arm with automatic controllers that replicate the movements of the operator.

Keywords: Teleoperated, FPGA, Servomotors

Introduction:

Our teleoperated robotic arm has 9 MG996R servo motors, whom rotate in degrees (angle), we can control the angle of rotation of the engine and make all the moves we would like to do with the teleoperated robotic arm. It also has accelerometers ADLX345 that serves to measure static acceleration (like gravity) in applications where we need to measure the inclination. But it also serves to measure dynamic acceleration (according to how we will move). Its high resolution provides information on changes of inclination of less than 1.0 °. We try do projects focused on improving the quality of life of disabled, which is why we realized that if the bionic prototype collect the functions of existing prosthesis but to lower price both in cost and maintenance could encourage that in our country many students and skilled dare to get involved in this branch of robotics, as many of today's designs are very expensive and foreign production, so purchasing on our state is almost exclusively for people with great economic solvency. Between advantages for construction was employed the use of recycled materials very low cost, such as printers engines, we can get aluminum structures doors and windows. So its cost target value is $150.00 U.S. (materials only) compared to other countries with a cost of $30,000 to $60,000 U.S, is very important to emphasize that our prototype has the same function, except that they have aluminum instead have a plastic or fiber.

I.

Teleoperator is a machine that enables a human operator to move about, sense and mechanically manipulate objects at a distance. Most generally any tool, which extends a person's mechanical action beyond her reach, is a teleoperator.

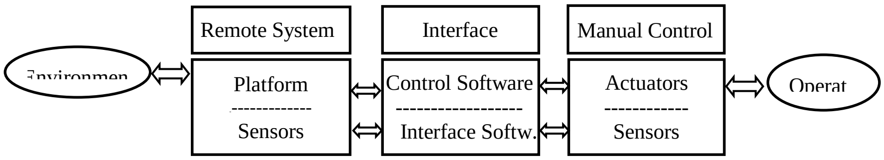

Figure N°01. Information flow in a teleoperation system

The main function of Teleoperator system is to help the operator to perform and carry out basic tasks that facilitate the development of their daily activities and overcoming the limitations of their disability. Within the last three decades, different teleoperation systems have been developed to allow human operators to execute tasks in remote or hazardous environments, in a variety of applications, our priority is in disabled and rehabilitation system. Teleoperation system tasks are distinguished by the continuous interaction between the human operators, teleoperator system and the environment. With the development of electronics devices and technology, the application of teleoperator becomes much wider and more indispensable than before. To efficiently control teleoperators, many different control approaches have been proposed. One particular need that still has not been effectively addressed seems to be dealing efficiently with significant time delays experienced by teleoperation systems since they can easily cause deterioration in system response as well as cause instability.

First we must consider that for our prototype, is necessary know the proportions with which work us, in this case the human arm, and the degrees of freedom that need our structure (shafts and joints) able to fully emulate the functions of the limb. For our prototype we think convenient to use aluminum for being a lightweight metal, its low cost and because our team is very easy to work with. Then according to the weight that each part of the arm, proceed to do the calculations of the forces necessary for the arm to move and can support the weight we want to support with ease and maneuverability for the operator, after obtaining design forces, supporting choose motors 50% over the design forces to avoid wear, fatigue and breakdowns.

Then choose the sensors, plates and other electronic components which need to operate the teleoperated robotic arm. We have to make a program which detects the pulses on the axes (x, y and z) space which is why we use a gyroscope, we detect that signal which doing some math calculations were spent in degrees (°) for to make the servo motor has the same degree that the gyroscope. Now with the plans and respective calculations proceed to the assembly, for it put us cut aluminum with the measured data and joined by bolts and nuts, adjust the servo motors which are not loose when turning. Then we make the respective wiring feeds the battery and signal integrated circuit which is in the plate.

Materials: Below we present the materials that we used for the proposed research platform: (03) Atmega 328P, (03) Accelerometers ADLX345, (20) meters of cables, (09) Servo Motors MG996R 7.2V, (05) Aluminum Iron 6m, (05) Batteries NI-MH 1.2V, balance 1 Charger Imax b6, (60) Stoboles, (03) resistors 10K, (03) capacitors 16MHz crystal, (01) fiber plate 10cm x10cm

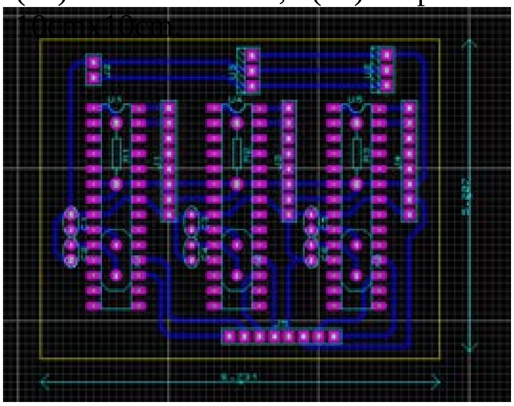

Figure N°02.CI board designed ISIS

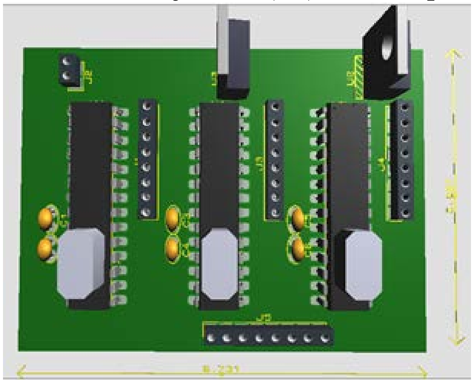

Figure N°03.CI board designed ARES

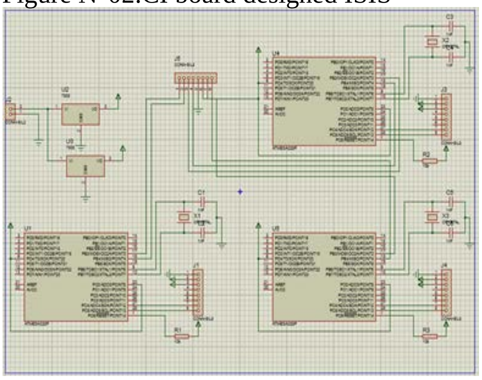

Figure N°04.CI board designed ISIS

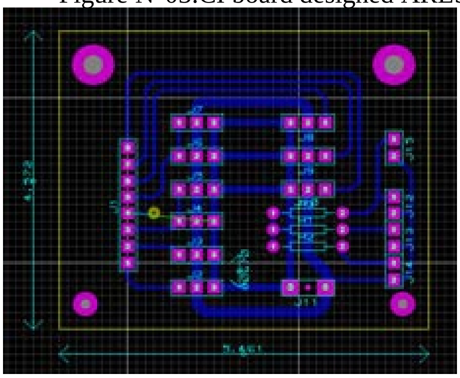

Figure N°05. CI 3D diagram ISIS (Connections)

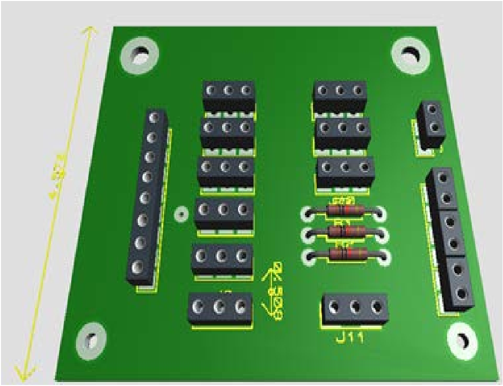

Figure N°06. CI 3D diagram ARES (Connections)

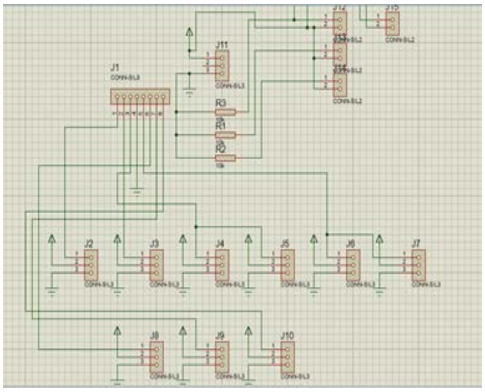

Figure N°07. Teleoperated (Schematic Capture)

Programming of Teleoperated

```
#include <Wire.h>
#include <ADXL345.h>
#include <Servo.h>
ADXL345 adxl;
Servo myservox;
Servo myservoy;
int pos = 0;
int valx;
int valy;
void setup()
{
adxl.powerOn();
myservox.attach(11);
myservoy.attach(12);
}
void loop(){
int x,y,z;
adxl.readAccel(&x, &y, &z);
valx = x;
valy = y;
valx = map(valx, -255, 255, 0, 179);
valy = map(valy, -255, 255, 179, 0);
myservox.write(valx);
myservoy.write(valy);
}
////////////////////////////////
#include <Wire.h>
#include <ADXL345.h>
#include <Servo.h>
ADXL345 adxl;
Servo myservox;
Servo myservoy;
int pos = 0;
int valx;
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void setup()
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valy = map(valy, -255, 255, 179, 0);
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}
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Servo myservox;
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void loop(){
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valx = x;
valy = y;
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valy = map(valy, -255, 255, 179, 0);
myservox.write(valx);
myservoy.write(valy);
}
```

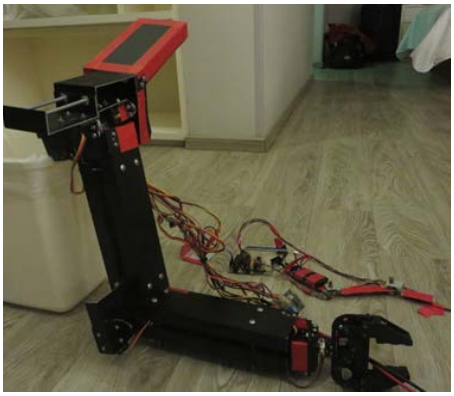

Figure N°08. Teleoperated System

Figure N°09. Teleoperated (Practicing)

Conclusion:

With this project, we help people: as elderly, disabled, hospitals, industries, schools, rehabilitation. Suitable for people who have lost an arm in an accident or illness, so our design must fulfill the same functions as a human arm. Can also serve as a rehabilitation team upper limbs, as it has a 3D workspace that allows freer movements excellent for functional therapy exercises in a virtual reality environment, therapy would aim at improving mobility severely weakened arm in patients with stroke, brain trauma skull and other neurological damage.

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