DESIGN AND IMPLEMENTATION OF AN EXPERIMENTAL PATRUPED ROBOT MODEL

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ABSTRACT: The present project aims to highlight both mechanical and electronic and computer features of the design of an experimental model of a four-legged robot. On the other hand, the construction of a test bench can be a preview of the robot's operating cycle, as the operating principle is similar, both the robot and the test bench operate the robot's joints. with the help of hydraulic cylinders. An identical operating principle, in this case the hydraulic drive, also includes a set of similar components that aim to compose the hydraulic unit.

KEYWORDS: sensor , patruped foot , hydraulic system, acquisition data.

1. Introduction

The design of the test bench was necessary for the simulation and composition of the motion quadrature. precise hydraulic gear.

The monitoring and control system is composed of the following equipment:

- resistive angle sensor;
- pressure sensor;
- current sensor.

The test bench is made up of the following key components:

- acquisition and control board module;
- tilting system distributor mode;
- HAA foot cylinder.

In order to determine the necessary components and the mode of operation of the test bench, a general scheme of the mode of operation was made (Fig.1.1).

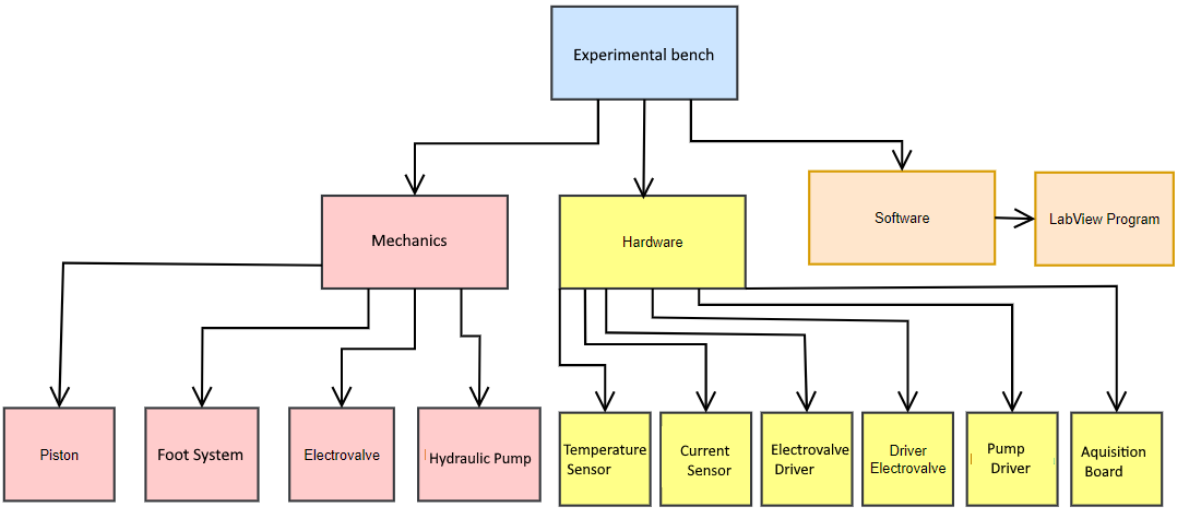

Fig. 1.1 General operating scheme

To establish the input and control parameters, the table below was made:

Table 1. Features pressure sensor

Measurable sizes	
Temperature	0-50 C
Intensity	0-20A
Pressure	0-100 bar
Tilt angle	0-200 grade
Sizes to control	
Pressure	0-100bar
Oil flow	0-20l/m

The control of the hydraulic fluid pulsation system is based on a constant feedback loop, made by the pressure sensor. when the pressure is higher than the required standard, the system will enter a fault state in which the hydraulic unit will be disconnected.

The test bench was made after the design of a preliminary connection electrical diagram, shown in Fig 1.2.

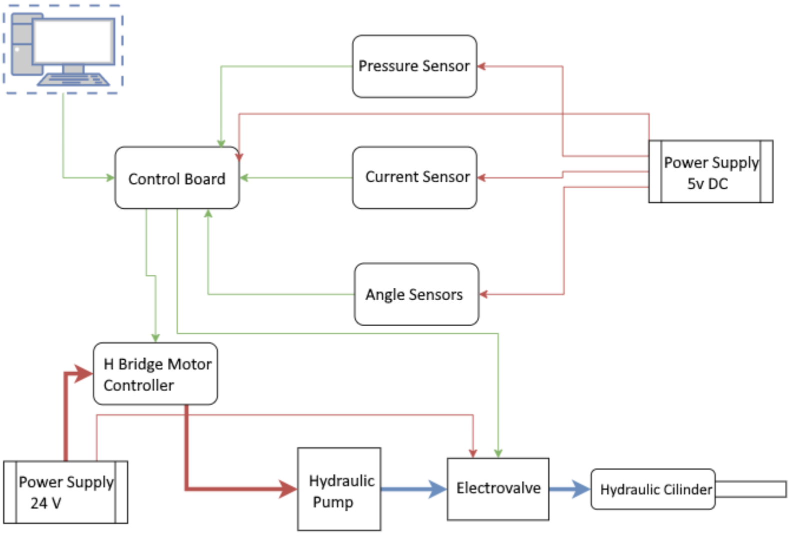

Fig.1.2. **Wiring diagram test bench**

Pressure sensor

The pressure sensor transmits a linear signal (Table 2) directly proportional to the degree of pressure load. It is powered by a maximum voltage of 24V DC.

Table 2. Features pressure sensor

Technical data	**Values**
Measuring range	0-200 bar
Output voltage	0,5 – 4,5 V
Working temperature	-40~+120°
Master	+ 5v red, GND-black, Green - signal
Protection class	IP67
Environment of use	Gas,Mineral Oil
Clamping thread	1/8" NPT
Accuracy	+-0.5%
Response time	<1ms

MAX6675 Temperature Sensor

Fig.1.3. Temperature sensor MAX 6675

The technical characteristics of the temperature sensor are provided in table 3:

Table 3. Features Max6675

Supply voltage:	3V - 5V
Operating current:	50mA
Measured temperature:	2C - 1024C, with a resolution of 0.25C;
ADC resolution	12 biți
Differential input	high impedance
Thermocouple type	K
Communication	SPI
Other	Thermocouple disconnected connection detection
Dimensions:	15 x 25 mm.

This model of temperature sensor (Fig.1.3) can measure high temperatures with a very low resolution, providing high accuracy. The communication mode of the Max6675 module is via the SPI interface, so it can be easily integrated into AVR systems.

Current sensor:

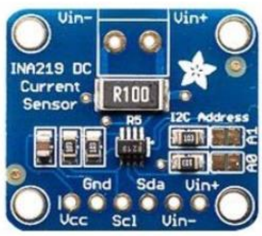

Fig. 1.4 **Intensity sensor**

With the help of this module (Fig 1.4) which has the integrated component l INA219-B, current and voltage measurements can be performed with a high resolution up to the threshold set by the manufacturer. (Table 4). The measured values are transmitted to the microprocessor via the bus. I2C.

Table 4. Voltage Sensor Features

Technical specifications:	
Rezistence	0.1ohm 1% 2W
Maxime voltage	26V DC
Maxim current:	3.2A, with a resolution of ± 0.8mA
Dimensions[mm]:	25.5 x 22.3
Adresses I2C	0x40, 0x41, 0x44, 0x45, selectable by jumpers

Hall 360 Angular Sensor

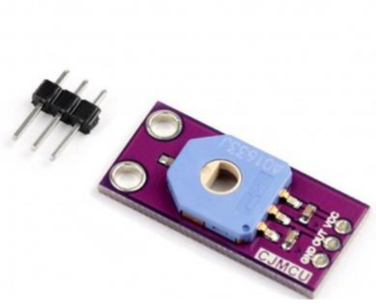

Fig 1.5. Angle sensor Hall 360

The module with angle sensor (Fig.1.5) has as principle the reading of the internal resistance of the potentiometer. Unlike a classic potentiometer, this module can transmit information over a 360-degree measurement range.

The sensor indicates the position according to the degree of rotation of the potentiometer directly proportional to the change of the internal resistance of the potentiometer. (Table 5).

Tabel 5. Angular sensor Features

Mechanical rotation	continuous (has no travel limit)
Electric rotation	after a 333 degree rotation, the value will restart from 0 degrees
Electrical resistance:	10k ohm
Output:	Analog

Pump drive

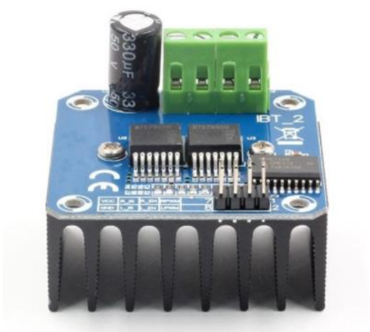

Fig 1.6 H bridge driver hydraulic

Specifications:

Table 6 Tehnical data H Bridge Driver

Technical data	
Processor	BTS7960
Input frequency	maxim 25KHz
Applications	hobby
Maximum current supported	43 A
Size	4 * 5 * 1.2 cm
Weight	65g.

The test stand was designed in Fusion 360 CAD software. In this project, parts such as the hydraulic pump, the piston, the pressure sensor and its adapter, the solenoid valve and its flow subsystem were modeled as illustrated in Fig.1.7. After modeling the parts, an assembly of the test bench was made to establish the areas where the parts will be mounted.

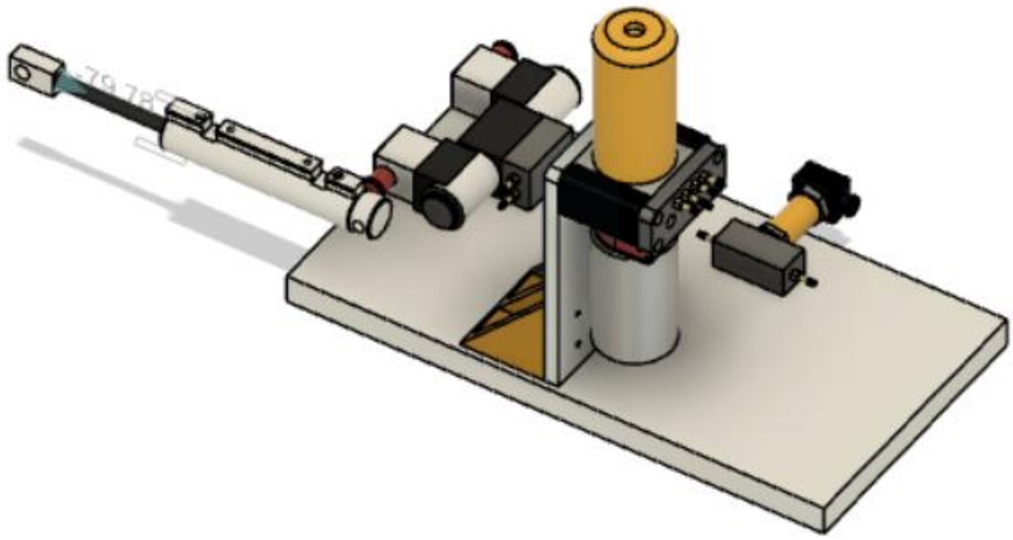

Fig 1.7. Test bench assembly

2. The current stage

The current stage of the test bench is 60% complete. At the moment, the stand is able to execute orders on a single hydraulic cylinder. Even if from an electronic and computer point of view the test bench is able to execute the movement of 2 hydraulic cylinders, from a mechanical point of view the order cannot be realized because an increased flow rate is required for the synchronous use of the 2 cylinders.

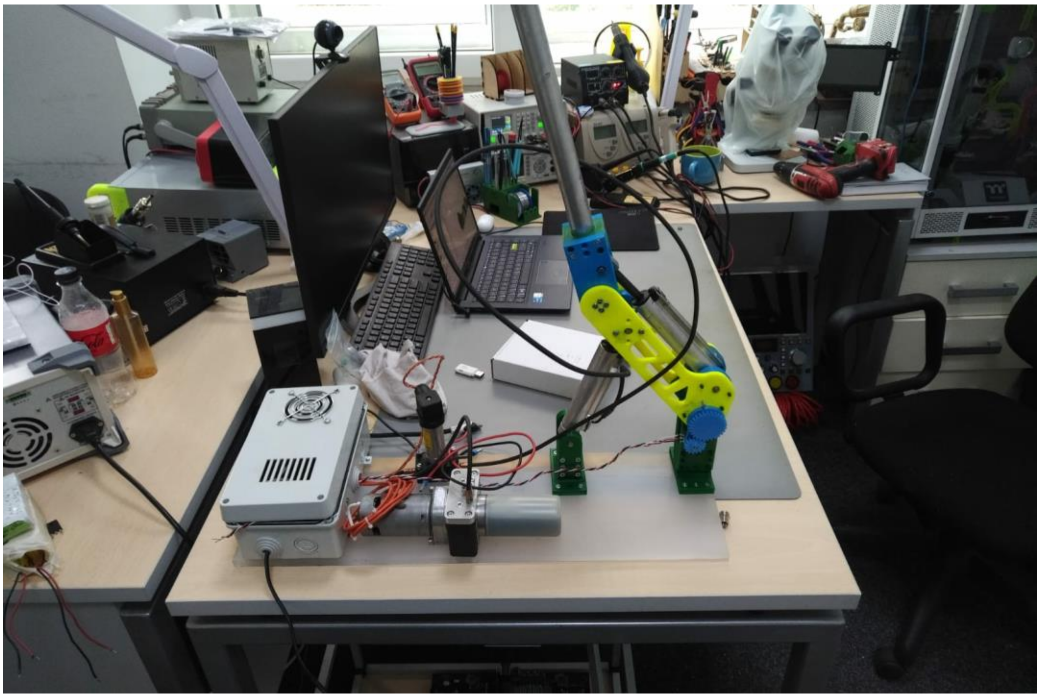

Fig 2.1. Current status of the test bench

3. Conclusions

The experimental test bench pattern has been found to be essential in the study of step algorithms. For future research on the bench, we will intervene by ensuring the flow necessary to control both hydraulic cylinders, mounting tensiometric marks for their force control and the use of linear displacement sensors.

The primary purpose of the experimental test bench is to simulate the ways of walking a leg. By performing the test bench, experimental models of stepping algorithms were tested and designed.

The only vulnerability of the test bench is the leakage of hydraulic fluid in the area of the fittings. This phenomenon is due to the non-use of standardized fittings, but their realization in diy mode.

4. References

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