23rd ABCM International Congress of Mechanical Engineering
December 6-11, 2015, Rio de Janeiro, RJ, Brazil

VEHICLE COLLISION K&S-I: WITH MICROCONTROLLED PLATFORM AND SYSTEM BOARDED

José Edleuson de Souza
André Araújo Kuhn Pereira
Laboratory of Energetic Efficiency and Environmental (LABEFEA), Polytechnic School, Federal University of Bahia, Salvador, Bahia, Brazil
e-mail: souza_edleuson@hotmail.com; andre_kuhn@hotmail.com
Marcos Danilo Monteiro
Center of Mechanical Engineering (NMC), Federal University of Sergipe, São Cristóvão, Sergipe, Brazil
e-mail: daniloautomacao2010@hotmail.com
Duilio Almeida Norberto da Silva
Technological Training Centre at Industrial Automation (CTAI), Polytechnic School, Federal University of Bahia, Salvador, Bahia, Brazil
e-mail: duilioalmeida@hotmail.com

Abstract. *The use of technologies aimed at optimizing industrial processes are welcome in a society that works in search of immediate results. Robotics is a branch that portrays this well, since the beginning of the Scientific-Technical Revolution in the second half of the twentieth century exponentially companies invest in technological innovation in this segment in order to reduce labor costs, increase production and profits in the market. This work aimed to develop a didactic robot microcontroller with autonomy in mobility and control, K&S-I. Its movement is accomplished by means of servo-controlled by a microcontroller open platform Arduino. Encountering obstacles, the car has two keys in its front (normally open) placed in parallel so as to cover the front beam of the vehicle in the event of an imminent collision. With the shock, this (the key) sends a signal to the microcontroller to proceed as the project schedule. The system in question is kept running through batteries shipped.*

Keywords: *Robotics, microcontroller, servomechanism*

1. INTRODUCTION

In recent decades is very noticeable direct and indirect effects of technology in the life of the contemporary human being, either by simple leisure activities, at work or in numerous other circumstances she is present. Robotics is a field that can serve as a reference in this regard to the numerous benefits brought to man, from its inception after the advent of Technical and Scientific Revolution in the mid-twentieth century.

The robotic era is also known as the information age. This project had as its main purpose the construction of an autonomic car prototype, driven by impending collisions, powered by batteries and an embedded system. As Bolton (2010) "An embedded system is a microprocessor based system designed to control a range of functions and is not designed to be programmed by the user in the same way that occurs with a computer." Table 1 presents the basic characteristics of the vehicle K&S-I:

Table 1. Main features of Vehicle K&S-I

Vehicle structure	Balsa Wood
Servomotors	3,0 – 7,2V
Microcontroller	ATmega328 / Atmel
Power	4 batteries de 1,5V e 1 de 9V
Software	C/C++
Electronic Circuit Board	Protection circuit

Muir (1988) features a mobile robot as: "A robot capable of movement on a surface only through the agency of the sets of wheels mounted on the robot and in contact with the surface."

The project summary is based on the development of a low-cost prototype and didactic applicability, with the fundamental principles the use of resources and materials easily accessible. Thus, it is used as microcontrolled platform Arduino, ATmega328 model, AVR family.

Otherwise, the present study was organized with the following topics, plus the introduction: Section 2 shows the part of development. In section 3 addressed on the results, in section 4 conclusion, in sequence thanks and references.

2. DEVELOPMENT

2.1 Mechanical accessories

The part concerning mechanical prototyping vehicle is in the subsections below.

2.1.1 Chassis

The chassis is the main vehicle structure as it is the basis for setting all other vehicle equipment.

The chassis design was developed in specific software in order to optimize the time in their development. The software used was Auto CAD 2014 includes tools that allow for the construction of mechanical parts in two or three dimensions. According Norton (2004) "original CAD systems a generation ago were essentially drawing tools that allow the creation of multiple view computer generated drawings similar to those made centuries manually on the drawing board."

The material acquired for making the chassis was the balsa wood (because it is lightweight). Figure 1 shows the chassis:

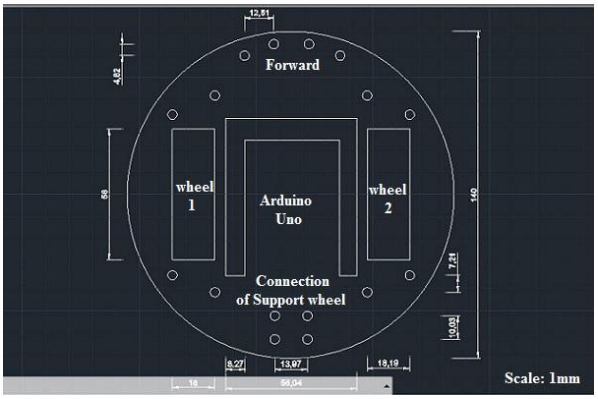


Figure 1. Chassis design

In [Fig. 1] you can see a prominent place in the center, is this place where the microcontroller is inserted.

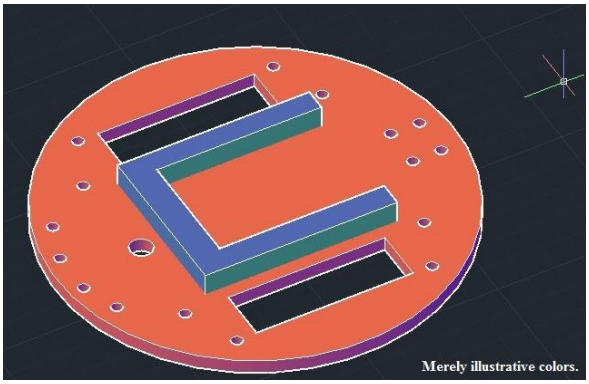


Figure 2. Chassis in phase of finish

2.1.2 Wheels of the vehicle

The vehicle has two wheels on the sides responsible for its movement, and its control is achieved by servo motors coupled to each of its.

Description:

For vehicle wheel choice was necessary to consider some specifications such as the size of it, as this influence on their speed, torque and positioning. It was then decided by the wheel which is found in the common roll printer inkjet.


Figures 3 and 4. Conformation and placement of the bracket

It was necessary realize the conformation through a heated screwdriver to simmer [see Fig. 3], and then allocate the support that would fix the motor shaft [see Fig. 4]. In sequence with the use of a clip (used to attach documents), heated at low heat by means of pliers, are punched so as to cross (in the shape of a U) asymmetrically wheel of the vehicle, securing the support wheel.

2.1.3 Support rear

The support wheel attached to a pin on its axis serves as the basis of the vehicle direction changes. See the figure of support below:

Figure 5. Base of support rear

2.2 Electromechanical devices

This part is divided into two subsections, referring to the servo and retractable switch.

2.2.1 Servomechanisms

Tower of the servomotors are fed Pro 9g model by a set of four AA batteries of 1.5 V, and the minimum voltage necessary for optimal operation of them is approximately 4.8V. In designing McRoberts (2011) "A servomechanism is an engine with a feedback system, which helps to control motor position. Servomotors typically rotate 180 degrees, although you can also get continuous rotation servos, or even modify a servo pattern for this purpose. ". Knowing this, it was made changes in the characteristics of motors respective targeting this effect, as seen in the figure below:

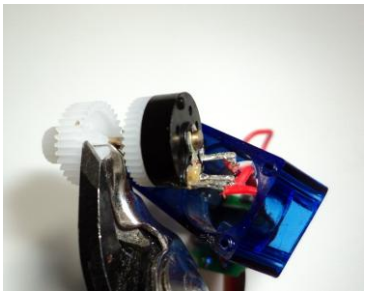
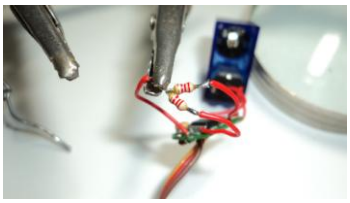


Figure 6. Remotion the lock gear (FerPinheiro page in WordPress, 2014)

First of all, it was necessary attention to see how all the pieces were connected, so that at the end of the replacement process was carried out correctly. The mechanical modification is summed up in two stages after opening the servomotor. In [Fig. 6] you can view a lock that is willing asymmetric gear, limiting this to turn more than 180 degrees, after its removal was accomplished the first step. In the picture below you can see the last step of mechanical change:

Figure 8 - Withdrawal latch potentiometer (FerPinheiro page in WordPress, 2014)

The second and final mechanical change was made in the potentiometer. After his withdrawal we could see a lock in "U" shaped, cut it carefully this latch as [Fig. 7] and the shaft started to rotate freely. The figures below show the electronic modification:



Figures 8 e 9. Electronic changes (FerPinheiro page in WordPress, 2014)

It was essential to note the wiring configuration before starting adjustments. The wire located in the center of the potentiometer had to be in the common point of the 10k resistors. After the welding of the resistors, a tape was used to isolate them and thus reposition all parts of the manner in which it originally were.

2.2.2 Retractile switch

Touch sensors (or contact) are usually employed in Automated Guided Vehicle - AVGS and mobile robots to provide a last resort collision statement with obstructions around the robot.

The use of retractile switch or micro switch was due to its characteristic front of the prototype needs. By having contact with an object it is triggered after that a pulse is sent to the microcontroller circuit. Note in the following figure:

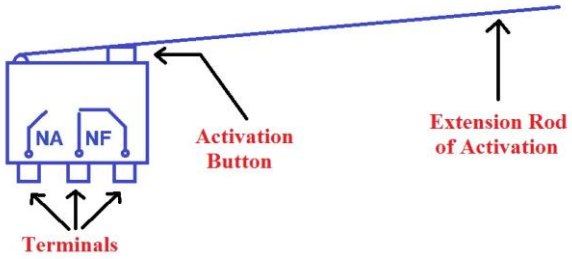


Figure 10. Scheme of retractile switch

This type of device has features allows it to control a direct way solenoids or even direct current motors.

2.3 Arduino Platform

The Arduino Uno is a board based on the ATmega328 microcontrolled. It has 14 digital inputs / outputs (six of which can be used as PWM outputs), 6 analog inputs, a 16 MHz crystal oscillator, a USB connection, a power connector, ICSP connector and a reset button.

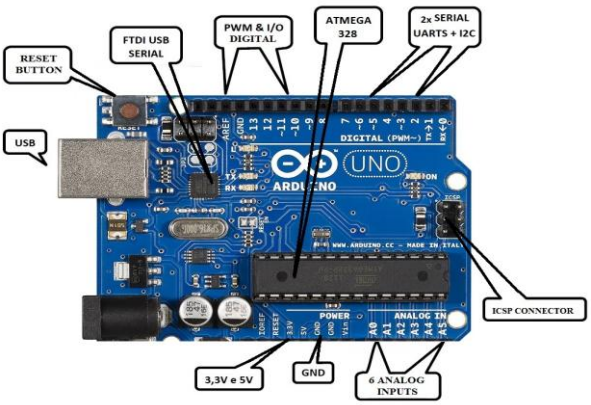


Figure 11. Arduino Uno platform

2.4 Electronic Circuit

The manufacture of the printed circuit board is performed by software called CADSOFT EAGLE, version 6.3.0 for student CADSOFT available on the website. Its development was mainly intended to establish and protect the circuit from external problems that compromise the optimal operation of the vehicle collision K&S-I. See the figure below:

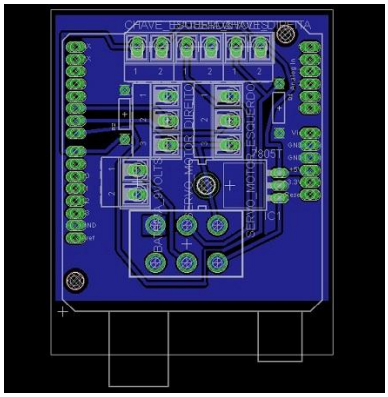


Figure 12. Electronic circuit boarded

The electronic circuit board has a switch On/Off serving to drive the vehicle or turn it off. It also has a voltage regulator, the IC 7805 which is responsible for stabilizing the output voltage at 5V. Thus, it is possible to protect the microcontroller being damaged by possible variations in voltage or input current.

2.5 System Architecture

Autonomy in operating a robot becomes possible when there is a power source that feeds the electronic circuit, through the ability of this (source) to store the energy required for the operation of itself. Therefore, we used in this work a 9V battery responsible for powering the Arduino and 4 AA batteries 1.5V each, responsible for feeding the servo. The figure below shows all the wiring diagram:

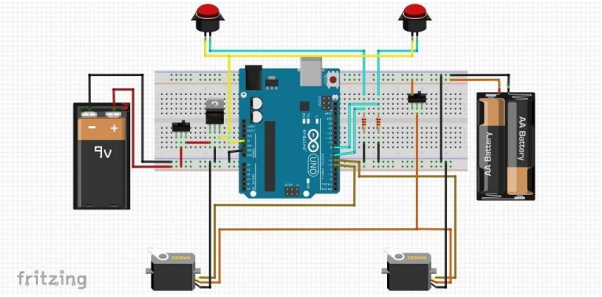


Figure 13. Electric system architecture

The figure up shows all electronic components used in this project, such as: the microcontroller Arduino one, two resistors 10kΩ, a voltage regulator 7805 (5V), an On/Off switch, two servo motors in addition to the batteries that power the circuit. It is also possible to observe the two micro switches in the top of the [Fig. 13] already connected to electric wires, which will by 10kΩ resistors before connecting to the microcontroller.

The demonstrative layout of the electrical diagram was prepared using a mount software of electrical circuits prototypes, Fritzing. According Fritzing (2013) "this application is an electronic automation software design for designers, artists or anyone who has an interest in computing and prototyping".

3. RESULTS

The system works as follows, encountering with obstacles, the vehicle has at its front two switches NO (Normally Open) placed in parallel so as to cover the front radius of the robot in the event of an imminent collision. When there is the shock, the micro switch will send a signal to the microcontroller according a brief narrative description of the prototype programming.

After we having set both the inputs and outputs according to the Arduino own syntax, opened up the configuration block, the values obtained (individually) in the tests of the servomotors were then placed. In sequence were enabled resistors of the circuit board, having known that the input and output pins have already been defined and associated, in this way the block can be closed. In the loop block the first procedure performed was command of enable the servomotors could move. Afterwards, is done the reading of the collision switch - if the left switch is pressed, to reverse the car for about 2 seconds (optional time), turn right and go ahead - if the right switch is pressed, to reverse the car for about 2 seconds, turn left and go ahead. The word "pressed" refers to the direction of vehicle collision.

4. CONCLUSION

The K&S-I vehicle was designed for educational purposes and may be used by teachers in order to encourage to students beginners in the area to use their ideas and put them into practice, using how the referential model the prototype described in this paper. There are future projects, in which sensors will be inserted in order to perform control remotely. Moreover, new devices will be coupled to its structure, in order to enable the vehicle work on irregular surfaces.

5. ACKNOWLEDGEMENTS

The researchers were supported by Federal University of Bahia and Federal University of Sergipe (facilities, infrastructure and financial support).

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7. RESPONSIBILITY NOTICE

The authors are the only responsible for the printed material included in this paper.