

## VEH'ICLE AUT'ONOMO FOR DETECIN 'ON AND RECOLLECTION' ON

Veh'culo aut'onomo with  
non-programmable circuits  
for detection,  
collection and counting of  
objects in environment  
simulated

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**Abstract** - This work presents the development of an autonomous electronic system capable of selectively identifying and collecting red-colored objects within a delimited environment, mimicking the basic operation of an ambulance in emergency situations. The project relies exclusively on non-programmable analysis and digital components, demonstrating the practical application of fundamental concepts such as monostable circuits, frequency-to-voltage conversion, and optional Filtering.

The methodology included three main stages: 1) Theoretical design structuring the motion subregion (controlled by an L293D H-bridge), color detection (using the TCS3200 sensor and LM339 comparator), and counting / display (with the BCD 7490 counter and 7448 decoder); 2) Proteus simulation validating circuit integration, including signal conditioning with the LM331; and 3) Physical implementation addressing challenges such as sensor reading facility.

The results demonstrated a partially functional system, although limitations included electromagnetic interference that caused a miss in function. The project achieved its objectives using basic electronics, fostering creative solutions such as NE555-based timing. This work serves as a foundation for future low-cost improvements.

The project did not achieve its main physical implementation objectives by using basic electronics, highlighting the importance of modular design and component optimization. Additionally, technical constraints (absence of microcontrollers) fostered creative solutions, such as using the NE555 for timing and the LM339 for signaling. This work serves as a foundation for future enhancement focused on robustness and precision while maintaining a low-cost, simplicity-driven approach.

THIS  
DRAFT

DEVELOPLLA A system  
electr'onico based on electronic and digital anal circuits  
to selectively identify and transport objects  
red within a delimited environment. The  
soluci'on implemented uses exclusively  
non-programmable components, demonstrating the  
application  
pr'actica de concepts como circuitos s'nchronos  
monostable para el operaci'on de diversos caracter'sticas  
del veh'culo [7] y converter de frequency  
a voltage for sensor application [5]. The system  
incorporates, adem'as, an 'optic sensor configured for  
miric 'fic recognition [3], together with  
protection of the circuit [4].  
The system simulates the b'asico operation of  
an ambulance in emergencies, where it must recognize  
'only red pimpons (representing people  
) among other colors. This development not only  
solves a specific problem by electr'onica  
b'asica, but also promotes the generation of  
new technological knowledge, promoting creativity and  
initiative in the field with restrictions on  
components.

Simulaci'on process

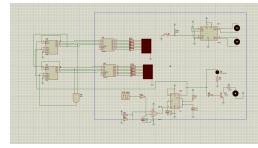


FIGURE 1: Complete Diagram in Proteus showing the three integrated subsystems.

The simulations were performed in three phases:

Engine Control  
The motion subsystem  
implements a b'asico control by:

- Main circuit:

- H L293D Bridge powered to 5V for two DC engines.

- Configuration of pins:

- \* IN1 = HIGH, IN2 = LOW (left engine forward)
- \* IN3 = HIGH, IN4 = LOW (engine right ahead)

- Direction mechanism:

- Bot'on that resembles a connected race end a ENABLE2.
- 10k- Pull-up resistance in ENABLE2
- When colliding: ENABLE2 = LOW (disable engine (right))

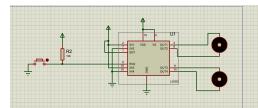


FIGURE 2: Full circuit outline with L293D, including protections and career end.  
The values are: R1 = 10k-, R2-R3 = 220-, C1 = 100nF, C2 = 100μF, D1-D4 = 1N4007.

## DEVELOPMENT

### Te'orico

The system consists of three interconnected odules implemented with non-programmable integration:

- aut'onomo movement:

- Engine control circuit with H bridge (L293D)
- L'ogica of turning of the veh'culo with a bot 'on that It looks like a career ending.

- Colour detection and patient collection:

- TCS3200 sensor with 'optic' filter for red
- LM339 comparator. [2]
- Voltage divider used to supply the Reference voltage.
- Unstable configuration of the NE555

- Counting and visualization:

- BCD 7490 counter with as'-ncrono reset.
- 7448 decoder for 7 segments display.
- L'ogica de reboot when reaching 23 pulses.

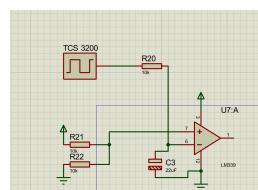


FIGURE  
3:  
Circuit

Color Detection 'on with TCS3200  
The system of detection implements the following flow of the following:

- Sensor configuration:

- Photodiodes with RGB filters (Red-Green-Blue) integrated
- Intensity-proportional output frequency red.

- Condition of the following:

- Frequency conversion -voltage with integrated LM331:

\* Circuit designed to convert the variable frequency from the sensor TCS3200 in a proportional analog voltage (Figure 4). This voltage is sent to the LM339 comparator for filtering and later the generation of a stable clock.

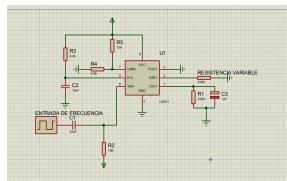


FIGURE 4: Circuit frequency converter - voltage based on LM331. Key components: RC network ( $R_3, R_4, C_2$ , 100k) and configuration reference ( $R_5, C_3$ ).

- LM331 key configuration [1]:

\* Frequency input: Connected to the pin corresponding to LM331 to travel through a  $C_1 = 10\text{nF}$  coupling capacitor.  
\* Output: Frequency-proportional voltage ( $V_{out-end}$ ) goes to LM339 to filter noise.

- Voltage Divisor: Used to generate a  $V_{ref}$  for a precise detection.

Lógica de comparación  
The comparator circuit LM339 implements:

- Adjustable threshold:

- $V_{high} = 3.25\text{V}$ ,  $V_{low} = 2.95\text{V}$

- 555 activity:

- Trigger in LOW (single-stable configuration)

## Integration on Global

- Synchronization between 555 pulse and activation of the engine of the patient's inlet.

Next to the alarm and the counter.

- Coupling with the chassis containing the circuit in charge of the vehicle movement.

## Estrés tests

- Exposición to false positives (non-red objects with similar reflectivity)

## RESULTS AND DISCUSSION

Fotografias of Project F'sico

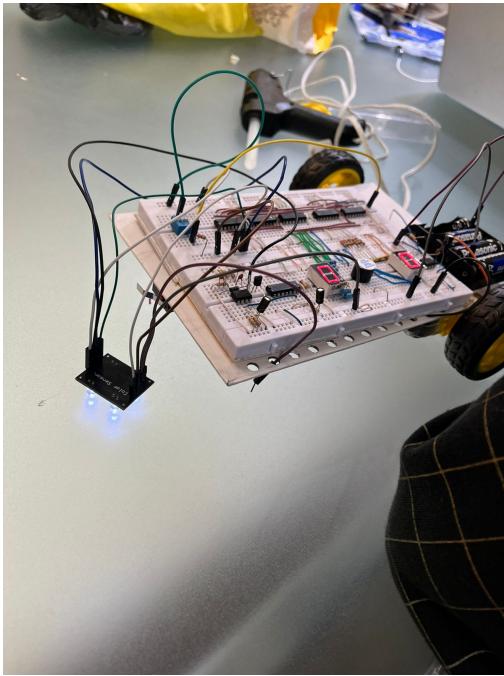


FIGURE 5: General view of the prototype with the system mounted on the veh'culo chassis.

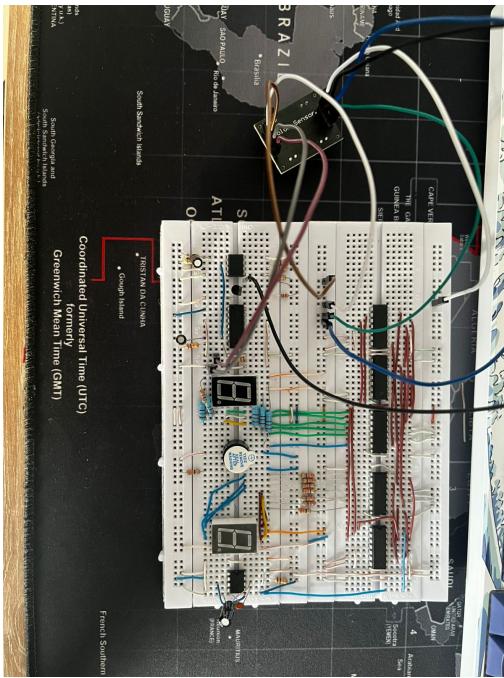


FIGURE 6: Detail of the clock circuit, the displays, The alarm, LM339 and LM331.

TABLE 1: Cálculo of the single-stable pulse time with NE555

Formula		
Variables		
Outcome		$T = 1.1 \times R \times C$
		$T = 1.1 \text{ s}$

TABLE 2: Cálculo of the voltage divider for comparator

Formula		
Values		
Vref	R1	
Vref	=	Vref = 3.1V
= VCC		

TABLE 5: Unsolved problems and possible solutions

Unsolved problem	Possible Solution Proposal
<ul style="list-style-type: none"> <li>— Calibrate the comparator LM339 with a range of voltage slightly m'as low to increase the detection of tonalities</li> <li>— Red</li> <li>— A nadir un sensor de lnea Infrared for correction of path or increase the speed of scanning of the Island the circuit with a housing met 'alica (cage) of Faraday) or add capacitors of</li> </ul>	<ul style="list-style-type: none"> <li>Add a RC filter for reduce high frequencies transmitted by the sensor, leaving</li> </ul>

TABLE  
3:  
Configuration

Couple of ameters		
Configuration		
Color filter		
Red (S2 = LOW, S3 = (LOW))		
Exit		
Frequency proportional to		

### Problems Detected and Solutions Implemented

TABLE 4: Problems and solutions during implementation

Problem detected		
Change to motor-reducers capable of moving		
The ambulance.		
Unstable reading of the color sensor		
	Be	
	a	
	the	
	LM331	
	to stabilize the	
	by	

■ REFERENCES

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He's a student of  
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Very facil!!,"Jefetronic: Electrónica and M'as, 2017.