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

Borda Munevar Samuel
University of the Sabana

Sanchez Sotelo Daniel
University of the Sabana

Infant Vega Jeronimo
University of the Sabana

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 operación 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.

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.

Simulaci 'on process

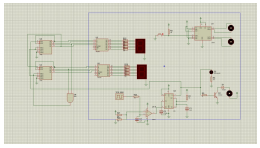

FIGURE 1: Complete Diagram in Proteus showing the three integrated subsystems.

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)

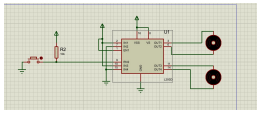

FIGURE 2: Full circuit outline with
L293D, including protections and career end.
The values are: R1 = 10k·, R2-R3 = 220·, C1 = 100nF,
C2 = 100µF, D1-D4 = 1N4007.

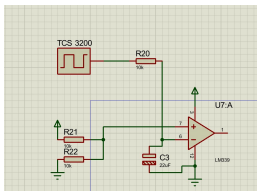

FIGURE
3:
Circuit

Color Detection 'on with TCS3200
The system of
detecci 'on 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 anal 'ogic voltage (Figure 4). This voltage is env'·a to the LM339 comparator for filtering and later the generation of a stable clock.

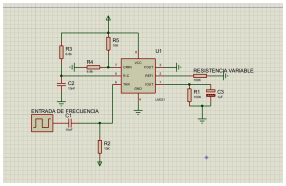

FIGURE 4: Circuit frequency converter - voltage based on LM331. Key components: RC network (R3, R4, C2), (100k) and configuration reference (R5, C3).

- LM331 key configuration [1]:

* Frequency input: Connected to the pin the corresponding LM331 to trav 'is of a C1 = 10nF coupling capacitor.
* Output: Frequency-proportional voltage (Vout-end) goes to LM339 to filter noise.

· Voltage Divisor: Used to generate a Vref for a precise detection.

L'ogica de comparac' on
The comparator circuit
LM339 implements:

· Adjustable threshold:

- Vhigh = 3.25V, Vlow = 2.95V

· 555 activity:

- Trigger in LOW (single-stable configuration)

Integration on Global

· Synchronization between 555 pulse and activation 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 veh'·culo movement.

Estr'es tests

· Exposici'on to false positives (non-red objects with similar reflectivity)

RESULTS AND DISCUSI 'ON

Fotograf·as of Project F'·sico

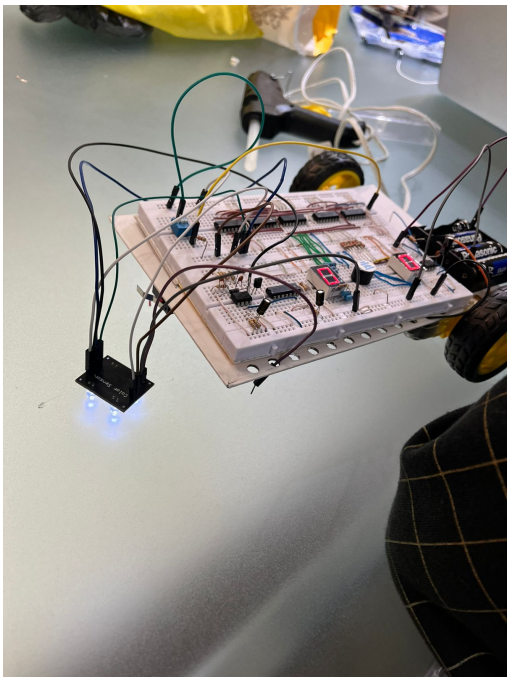

FIGURE 5: General view of the prototype with the system mounted on the veh'·culo chassis.

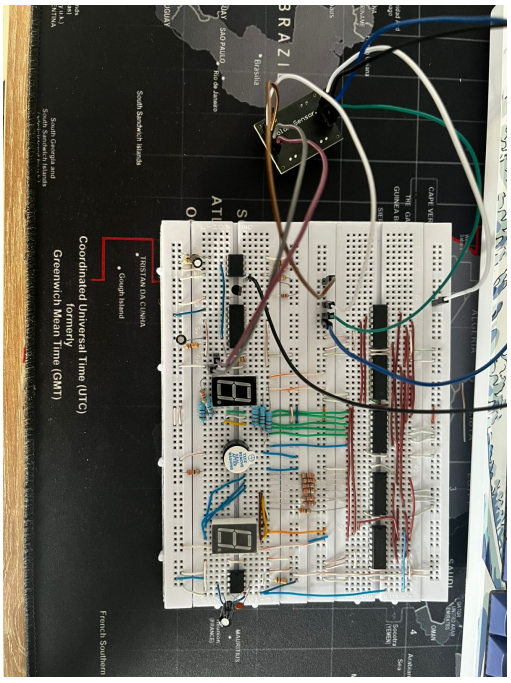

FIGURE 6: Detail of the clock circuit, the displays, The alarm, LM339 and LM331.

TABLE 1: C'alculo of the single-stable pulse time with NE555

F'ormula	Variables	Outcome
T = 1.1 × R × C		T = 1.1 s

TABLE 2: C'alculo of the voltage divider for comparator

F'ormula	Values	
Vref = VCC · R1 /	Vref	Vref = 3.1V

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

TABLE 5: Unsolved problems and possible solutions

Unsolved problem	Possible Soluci'on Proposal
Calibrate the comparator LM339 with a range of voltage slightly m 'as low to increase the detection of tonalities Red	
A nadir un sensor de l'·nea Infrared for correction of path or increase the speed of sampling of the	
Islar the circuit with a housing met 'alica (cage) of Faraday) or add capacitors of	Add a RC filter for reduce high frequencies transmitted by the sensor, leaving

REFERENCES

Very f'acil!!, "Jfetronic: Electr'onica and M'as, 2017.

Borda Munevar Samuel He is a undergraduate student of engineer '·a inform' atica, presents interests to demonstrate their knowledge in class. Contact it at samuelbomu @ unisabana.edu.co

Jeronimo Infante Vega
He's a student of
undergraduate
of
Engineering
Computer
of

Sanchez Sotelo Daniel
He's a student of
undergraduate
of
Engineering
Computer
of