

THE USE OF THE GESTURES SENSOR WITHIN A BIOMIMETIC STRUCTURE

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ABSTRACT: *In this paper it is presented a way to use an APDS-9960 gestures sensor. This sensor is capable of detecting certain simple gestures of the user, without direct contact with that. The sensor is connected to the Arduino development board that controls the Biomimetic Chimpanzee Alive. Moving the hand in front of the sensor, the chimpanzee’s head moves up and down, right and left.*

KEY WORDS: *gestures sensor, biomimetic structure, control architecture, emotional state*

1. INTRODUCTION

Facial expressions implemented on robotic systems are used in many areas such as telemedicine, education, robotics, etc. and plays a very important role in transmitting emotions. The biomimetic robots research community has considered the analysis and automatic recognition of facial expressions to be particularly useful in various areas such as human-computer interaction, entertainment, pain detection, social robots, lying detection, interactive video applications and monitoring behavior, etc.

2. THE DESCRIPTION OF THE COMPONENT ELEMENTS OF BIOMIMETIC STRUCTURE

As it is known, a biomimetic structure can reach certain emotional states (can be enumerated, for example, some of the expressive basic states: happiness, sadness, anger).

In order to obtain emotional states, it use the Wow Wee CHIMPAZEE ALIVE biomimetic structure [1], shown in Figure 1, where the arrangement of sensors are shown that can

influence the attainment of biomimetic expression states.

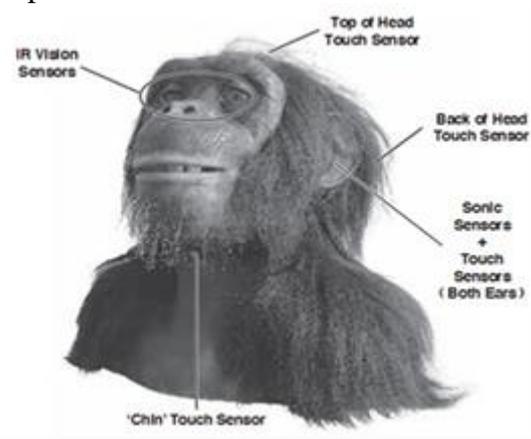


Figure 1. Chimpanzee Alive biomimetic structure

Obtaining expressive states is realised by controlling the DC motors that action the following elements of the structure:

- eyebrows movement;
- eyelids movement;
- mouths movement;
- left-right eyes movement;
- up-and-down eyes movement;
- left-right head movement;
- head-to-head movement;
- up-and-down nose movement.

For obtaining expressive states voice commands can be used or using a bluetooth with an automatic negative feedback system [2].

In this paper, it is desired to control the movement of the biomimetic structure by using the gesture sensor APDS-9960. This sensor detects the movement / passage of the hand (by two directions and four senses) at a certain distance of it.

The detection can be accomplished by transmitting information from the sensor to an ARDUINO development board. The ARDUINO plate further interprets the hand movement and gives commands to the biomimetic structure (towards motors of the structure) to achieve emotional states (Figure 2) [2].

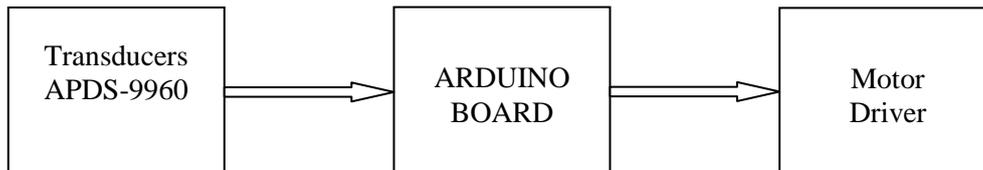


Figure 2. Transmitting information from the sensor to an ARDUINO development board [2]

Several emotional states have been obtained that do not use the change in basic parameters (s for eyebrow, p for eyelid, g for mouth) through which any emotional state can be expressed.

These states can express:

- the state of ecstasy / joy by the movement up of the head and a basic parameter (s or p or g);
- the state of sadness / melancholy by moving the head and eyes down;
- the state of fear / contemplation by moving the head and eyes left - right.

2.1. The description of the APDS-9960 gestures sensor.

The APDS-9960 sensor for distance and gestures (Figure 3) is able to detect certain simple gestures of the user without direct contact with it [3]. It uses a technology to detect the presence of objects from a distance of up to 20 cm as well as the direction and meaning of the object in the optimum range (12-17 cm) of the sensor action:

- left-right movement;
- right-left movement;
- up-down movement
- down-up movement.



Figure

Gestures sensor APDS-9960

3.

2.2. The description of the Arduino Mega board 2560

The connecting sensors to a development board with microcontroller requires the allocation of a large number of inputs out of which seven analog inputs for potentiometer. ARDUINO MEGA board, Figure 4, is a board which uses the ATmega2560 microcontroller and the ATmega16u2 microcontroller for USB connectivity [4]. ARDUINO MEGA is an ideal development board for applications that need multiple communication pins, analogs and PWMs. It has the following features:

- 54 digital input / output pins, aut of which 14 can be PWM
- 16 analog input pins
- recommended input voltage 7-12V

- 5V supply voltage
- frequency 16MHz.

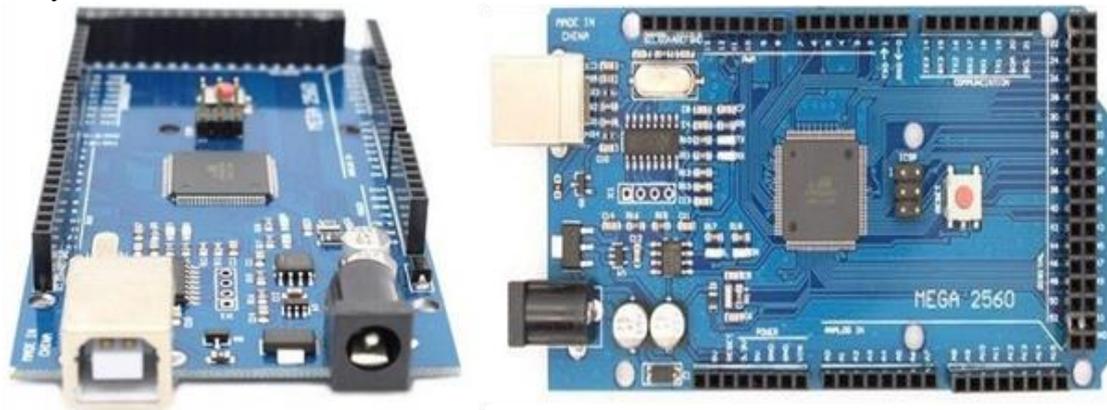


Figure 4. The ARDUINO MEGA board

3. THE CONTROL OF THE BIOMIMETIC STRUCTURE THROUGH THE GESTURES SENSOR

In the paper [5] is presented an experimental system based on Kinect and Arduino board in order to implementing reactivity of the biomimetic platform to the commands of gestures type by the user.

Figure 5 shows the transmission of information from the APDS-9960 gestures detection sensor to the Chimpanzee Alive biomimetic structure.

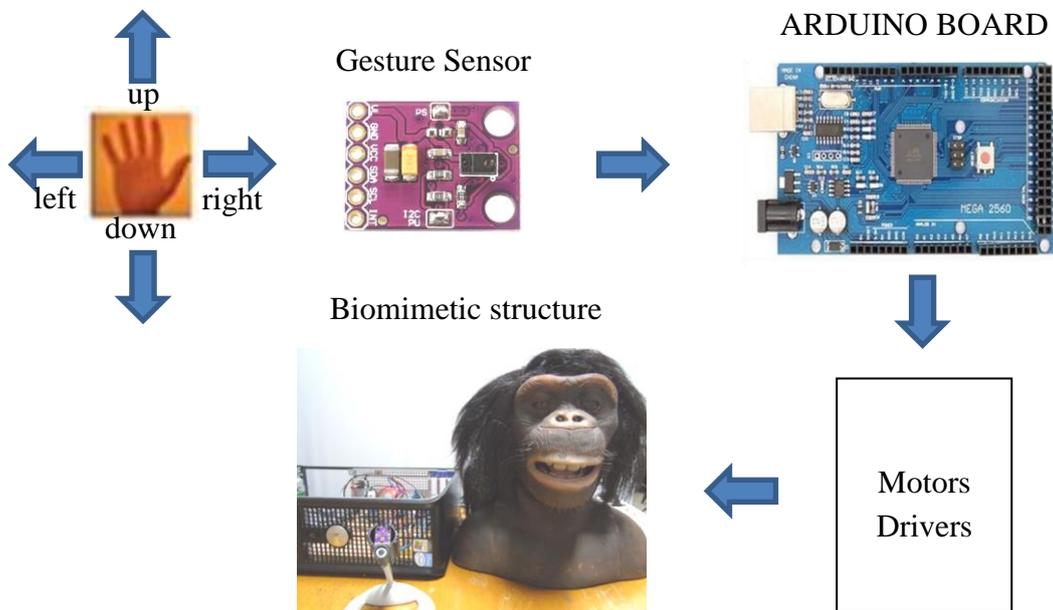


Figure 5. Transmitting information from the sensor to a biomimetic structure

Figure 6 shows the way the sensor is mounted on the support for optimal positioning and the detection of the hand motion in the four senses.



Figure 6. The position of the sensor

In Figure 7 are presented the four biomimetic expression states obtained from the hand movement in the four ways. These emotional states have been achieved by

significantly modifying a parameter (which can be called the primary parameter, namely, head movement) and by modifying another parameter within small limits (which can be called a secondary parameter, namely eye movement) so that:

- the state of ecstasy / joy can be achieved by moving the head up and the eyes down;
- the state of sadness / melancholy by moving the head and eyes down;
- the state of fear/ contemplation by the movement left - right of the head and eyes.



right



left



up



down

Figure 7. The expressive biomimetic states obtained by moving the hand in the four directions

4. CONCLUSIONS

This paper has highlighted the functionality of the gestures sensor within a biomimetic structure in order to achieve emotional states. Thus, the emotional states obtained with the biomimetic structure were differentiated by

sensing the hand movement up, down, left and right. In order to diversify the behaviour of the biomimetic structure for achieving the emotional states the change of basic parameters related to the movement of the eyebrows, eyelids and mouth were not taken into consideration. The emotional states

reached by the biomimetic structure were obtained by the movement of the head and eyes.

5. REFERENCES

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