BIUNIBOT

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***Abstract*—In this paper we propose a mechanical-electronic system which resembles the human walk, this system is based on the use of SAM3X8E ATMEL microcontroller as the core and various sensors configured as elements of feedback for stability.**

I. INTRODUCTION

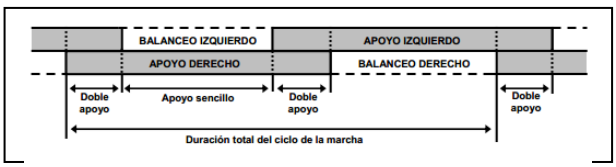
The human walking is a complex dynamic process involving interaction of nervous and muscle systems having as processor our brain that receives information through our sensory organs and decides motor actions needed to move to a target set, despite its complexity for our brain is just a routine process which is done unconsciously once learned in the early years of our lives.

The search of understanding not only the walk but also our other human biological processes respond to the growing need to replace the tedious tasks we do every day by more efficient mechatronic alternatives that could lead to a better development of technology, in this paper we propose one of these alternatives to emulate the human walk, this leads first to an analysis of the study of how we walk on stages, then the design of the mechanical system, the issue of competition, alternative solutions to finally implement it.

II. ANALYSIS OF HUMAN WALKING

Human walking are a number of rhythmical alternating movements of the limbs and trunk which determine a forward shift of center of gravity, this process starts when the foot contacts the floor and ends with the next contact of the same foot, to distance between these two steps is called full step.

The human walking cycle is divided into two main phases of the support and swinging, one leg is in support phase when contacted with the ground and swinging phase is when it is not. These two phases are alternating from one leg to another while walking, In a full step, simple support refers to the period when only one leg is in contact with the ground, double support occurs when both feet are in contact with the ground .



The support phase is divided into five different intervals such are:

- Contact with the heel: Moment when the heel touches the ground
- Planting Support: Contact the forefoot with the ground
- Middle Support: Time the greater trochanter is vertically aligned with the center of the foot, seen from the sagittal plane
- Heel Raise: instant the heel rises from the ground
- Foot Takeoff: time when the fingers are raised soil

Swinging phase comprises three ranges:

- Acceleration: It is characterized by the rapid acceleration of the end of the leg immediately after your fingers leave the ground
- Middle Swinging: The swing leg passes the stance leg like a pendulum
- Deceleration: The leg decelerates as it approaches the end of the interval

III. MECHANICAL STRUCTURE OF HUMANOID

The structure of the robot is based on single pieces articulated via servomotors, the structure is made such that when the robot is electrically powered, it remain straight in stable way, the material used for its construction is acrylic due to its light weight which helps to reduce power consumption, all the pieces have a thickness of 4mm, the approximate weight of the robot is 1.30 kg and has a height of 49 cm.

The robot is articulated via servomotors these pieces used for the limbs and torso, the finished model has 15 degrees of freedom.

IV. CONTROL STRATEGY OF STABILITY

Controlling the stability of the robot, is through IMU (Inertial Measurement Unit) which collects data from the acceleration and degrees of rotation of the robot's center of gravity activating the processes required for the robot to recover its initial state if it goes out the range allowed by example after falling by an external disturbance the robot make a set routine to get up, or to verify that his departure is straight, among other processes the IMU is directly controlled by the microprocessor by I2C protocol (Inter-Intgreted Circuit).

V. MICROPROCESSOR ATMEL SAM3X8E

The choice of this processor was its speed of 84Mhz, low power consumption when working with voltages of 3.3v, good availability of pin PWM for servo control in addition to their memory capacities.

VI. CONCLUSIONS

This paper describes an electronic mechanical model that resembles human walking is based on the bipedal gait study presented, the development of mechanical sequences necessary for the walk were made based on existing mathematical models [2] and by simulating walk in software, with the return results obtained open the possibility of new forms of modeling as well as the study of new forms of control.

REFERENCIAS

[1] Dr. Pedro Vera Luna, “Biomecanica de la marcha humana normal y patologica” Editorial IBV 1999

[2] Y. Zheng and J. Shen, “Gait synthesis for the SD-2 biped robot to climb sloped surface” Vol6, 1990, 86-96.