

Construction a Walking Robot Using Theo Jansen Robot

Dr.Wadah Jasim¹, Duha Kareem², Esraa Ali³, Wurood Fadhil⁴

Head of Research's Department of Iraq University College & IUC, Basra, Iraq¹

Researcher of Iraq University College & IUC, Basra, Iraq²

Researcher of Iraq University College & IUC, Basra, Iraq³

Researcher of Iraq University College & IUC, Basra, Iraq⁴

ABSTRACT: This paper shows how to make handheld Theo Jansen robot that using legs based on Arduino hardware which connected with many components to provide the characteristics of the robot.

KEYWORDS: Ultra sonic sensor, Servo motor, LED, Bluetooth and Arduino.

I. INTRODUCTION

If there is one technological advancement that would certainly make living easy and convenient, robot would be the answer. Robots are human like machines capable of doing tasks they are programmed to do. They have shown significance in decreasing human work load especially in industries. Robots are mostly utilized in the manufacturing industry. The type of job that laborers encounter in this type of business is usually repetitive and monotonous. People who do the same thing for a long period of time tend to get bored and tired of what they are doing and might arrive in a position wherein he is unwillingly doing his job. The person who reached this point will not be as efficient and effective as when he first started working. Also, as human being, we get exhausted so the length of time that we can work is only limited. This is when the importance of robots is realized. They can be set to function for a long span of time producing the same quality product all throughout the production process. This resulted to an increase in the number of manufactured products and decrease in the production of defective goods. It is the industries that gained a lot of benefits out of robotics. The company productivity has risen which made businesses achieve more profits. Also, company loss has been reduced because flawed products are trimmed down to almost none. On the contrary, the emergence of industrial robots brought disadvantages on laborers. Since the former are truly effective machines, industries prefer utilizing them rather than employing humans. As a result, unemployment rate goes high. Many underprivileged people become poorer while company owners which are only a few get richer. The brain of robots where they receive set of instructions that make them perform tasks automatically is called artificial intelligence or AI. There have been stories showing that these machines have become intelligent enough to think and act independently and overthrow humanity. At present, this is nowhere near to happen since robots nowadays are not capable enough to do tasks without being controlled [1].

The Legged robots are a type of mobile robot which use mechanical limbs for movement. They are more versatile than wheeled robots and can traverse many different terrains, though these advantages require increased complexity and power consumption. Legged robots often imitate legged animals, such as humans or insects, in an example of biomimicry. Six-legged robots, or hexapods, are motivated by a desire for even greater stability than bipedal or quadrupedal robots. Their final designs often mimic the mechanics of insects, and their gaits may be categorized similarly. These include: Wave gait: the slowest gait, in which pairs of legs move in a "wave" from the back to the front. Tripod gait: a slightly faster step, in which three legs move at once. The remaining three legs provide a stable tripod for the robot [2].

Theo Jansen (born 1948) is a Dutch artist. In 1990, he began what he is known for today: building large mechanisms

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out of PVC that are able to move on their own, known only as Strandbeest Since 1990, Theo Jansen has been engaged in creating new forms of life: beach animals made from yellow plastic tubing. Skeletons made from these tubes are able to walk, deriving their nutrition from the wind. They evolved over many generations, becoming increasingly adept at surviving storms and water from the sea. Theo Jansen's ultimate wish is to release herds of these animals on the shore [3].

which has more memory and more peripherals than the ATmega328. The PCB is also larger, but it maintains form factor compatibility with the standard Arduino, adding three additional expansion connectors along the right side and extending the PCB by approximately an inch in length. The remainder of the circuit is essentially identical to the Arduino Uno [4].



Figure 1: Robotics.

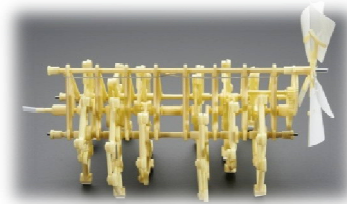


Figure 2: Theo Jansen robot.

II. HARDWARE

1- ARDUINO (MEGA 2560)

Arduino board designs use a variety of microprocessors and controllers. The boards are equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits. The boards feature serial communications interfaces, including Universal Serial Bus (USB) on some models, which are also used for loading programs from personal computers. The microcontrollers are typically programmed using a dialect of features from the programming languages C and C++. In addition to using traditional compiler toolchains, the Arduino project provides an integrated development environment (IDE) based on the Processing language project. The Arduino Mega 2560 is identical to its smaller sibling. It runs at the same speed of 16MHz, requires approximately the same amount of power, executes the same software, and uses the same development tools. The primary difference between the Uno and the Mega is the processor, the ATmega 2560.

2- SERVO MOTOR

A SERVO MOTOR (OR SERVO) IS A ROTARY ACTUATOR THAT ALLOWS FOR PRECISE CONTROL OF ANGULAR POSITION, VELOCITY AND ACCELERATION. SERVOS ARE FOUND IN MANY PLACES: FROM TOYS TO HOME ELECTRONICS TO CARS AND AIRPLANES. IF YOU HAVE A RADIO-CONTROLLED MODEL CAR, AIRPLANE, OR HELICOPTER, YOU ARE USING AT LEAST A FEW SERVOS. SERVOS ALSO APPEAR BEHIND THE SCENES IN DEVICES WE USE EVERY DAY. ELECTRONIC DEVICES SUCH AS DVD AND BLU-RAY DISC™ PLAYERS USE SERVOS TO EXTEND OR RETRACT THE DISC TRAYS THE SIMPLICITY OF A SERVO IS AMONG THE FEATURES THAT MAKE THEM SO RELIABLE. THE HEART OF A SERVO IS A SMALL DIRECT CURRENT (DC) MOTOR, SIMILAR TO WHAT YOU MIGHT FIND IN AN INEXPENSIVE TOY. THESE MOTORS RUN ON ELECTRICITY FROM A BATTERY AND SPIN AT HIGH RPM (ROTATIONS PER MINUTE) BUT PUT OUT VERY LOW TORQUE (A TWISTING FORCE USED TO DO WORK— YOU APPLY TORQUE WHEN YOU OPEN A JAR). AN ARRANGEMENT OF GEARS TAKES THE HIGH SPEED OF THE MOTOR AND SLOWS IT DOWN WHILE AT THE SAME TIME INCREASING THE TORQUE. (BASIC LAW OF PHYSICS: WORK = FORCE X DISTANCE.) A TINY ELECTRIC MOTOR DOES NOT HAVE MUCH TORQUE, BUT IT CAN SPIN REALLY. FAST (SMALL FORCE, BIG DISTANCE). The gear design inside the servo case converts the output to a much slower rotation speed but with more torque (big force, little distance). The amount of actual work is the same, just more useful. Gears in an inexpensive servo motor are generally made of plastic to keep it lighter and less costly. On a servo designed to provide more torque for heavier work, the gears are made of metal and are harder to damage [5].

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3- ULTRASONIC SENSOR

Ultrasonic sensors are based on measuring the properties of sound waves with frequency above the human audible range. They are based on three physical principles: time of flight, the Doppler effect, and the attenuation of sound waves. Ultrasonic sensors are non-intrusive in that they do not require physical contact with their target, and can detect certain clear or shiny targets otherwise obscured to some vision-based sensors. On the other hand, their measurements are very sensitive to temperature and to the angle of the target. Ultrasonic sensors “are based on the measurement of the properties of acoustic waves with frequencies above the human audible range,” often at roughly 40 kHz [1]. They typically operate by generating a high-frequency pulse of sound, and then receiving and evaluating the properties of the echo pulse. Three different properties of the received echo pulse may be evaluated, for different sensing purposes. They are: Time of flight (for sensing distance), Doppler shift (for sensing velocity), Amplitude attenuation (for sensing distance, directionality or attenuation coefficient) [6].

4- ZS-040 BLUETOOTH SERIAL BASE PLATE

Bluetooth is a wireless technology standard for exchanging data over short distances (using short-wavelength UHF radio waves in the ISM band from 2.4 to 2.485 GHz [7].

III.CONCLUSION

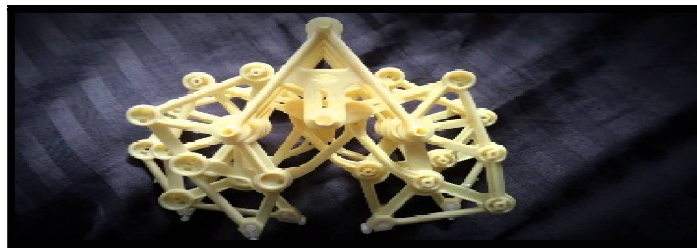


Figure 3: The legs of the robot

- Firstly, installing pieces properly and that gives real robot form with a note equilibrium of the robot.

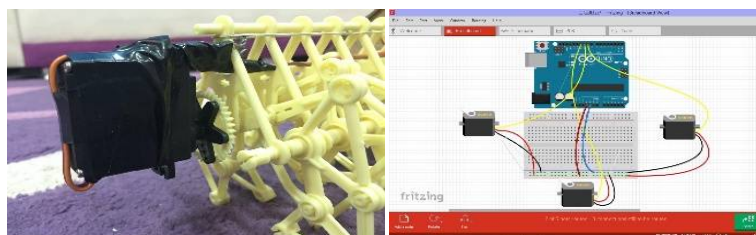


Figure 4: Servo motor.

- Then, we creating the axis of robot that help the link to make they look similar to the one robot. In Modulating the servo Motors makes them were orbiting a full 360 degrees and then was linked to main axis.

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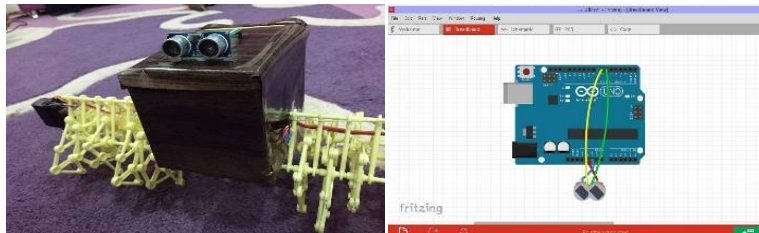


Figure 5: Ultrasonic sensor.

- After that, we connect the ultrasonic sensor to the servo motor and put it above the middle of the robot, the movement of servo motor let the sensor to scan in 180 degree.

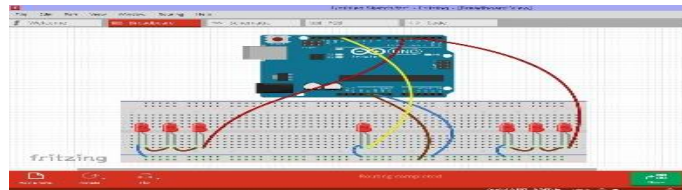


Figure 6: LEDs connection.

- Then, we connect the LEDs lighting on top of the robot, which operates as a warning in the event of a barrier.

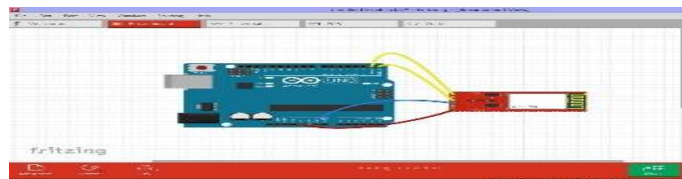


Figure 7: Bluetooth connection

- After that, we connect the Bluetooth to our workshop to be able to control the robot through the mobile app.



Figure 8: Wires connection.

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- Then, we connect the wires and complete the link of components with Arduino.



Figure 9: Arduino programming

- Finally, we make the Arduino programming form that accommodates orders emerging from it to Android, which allows him to move, and feel the barriers.

IV. ARDUINO CODE

```
#include < Servo .h >
#define echo Pin 7
#define trig Pin 6
Servo left, right, sensor;
int const f=0
int const b=180
int const leftLed =4
int const rightLed=5
int distance ,duration
void setup
pin Mode(trig Pin, OUTPUT)
pin Mode(echo Pin, INPUT)
left. Attach(9)
right. Attach(10)
sensor. Attach(11)
pin Mode(left Led, OUTPUT)
pin Mode(right Led ,OUTPUT)
Serial. Begin(9600)
digital Write(left Led, 0)
digital Write(right Led, 0)
pin Mode(13, OUTPUT)
digital Write(13, LOW)
void loop
distance=(duration/2)/29.1
Serial. printing(distance)
void forward
Serial. print In("Forward")

forward
sensor. Write(45)
delay(250)
Distance
if(distance <= 35)
turn Left
delay (250)
sensor. Write(100)
delay(250)
Distance()
if(distance<= 30)
backward()
delay(250)
sensor. Write(170)
delay(250)
Distance
if(distance<= 35)
turn Right
delay (250)
void Distance
digital Write(trig Pin, HIGH)
delay(200)
digital Write(trig Pin, LOW)
duration=pulse In(echo Pin, HIGH)
Serial. println("Turn Left")
left. Write(b)
right. Write(b)
```

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```
left. Write(f)
right. Write(b)
void backward
Serial.println("backward")
left. Write(b)
right. Write(f)
for(i=1;i<=10;i++){
digital Write(13, HIGH)
digital Write(left Led, HIGH)
digital Write(right Led, HIGH)
delay(100)
digital Write(13, LOW)
digital Write(left Led ,LOW)
digital Write(right Led, LOW)
delay(100)
turn Right
void turn Left

for(i=1;i<=8;i++)
digital Write(left Led, HIGH)
delay(100)
digital Write(left Led, LOW)
delay(100)
void turn Right(){
Serial.println("Turn Right")
left. Write(f)
right. Write(f)
for(i=1;i<=8;i++)
digital Write(right Led, HIGH)
delay(100)
digital Write(right Led, LOW)
delay(100)
```

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