Arduino Powered Quadrupedal Robot

Arshini Govindu
2020102009
IIIT Hyderabad

Aditya Nair
2020102022
IIIT Hyderabad

***Abstract*—A smaller version of a quadruped robot using servo motors. A robot with four legs that can perform walking gaits.**

I. Acknowledgement

We would like to express our extreme gratitude to our professors Syed Azeemuddin and Chiranjeevi Yarra, lab assistants and the teaching assistants who gave us this opportunity to work on such an interesting project. This helped us in gaining a lot of in-depth knowledge which we wouldn't have known otherwise and apply all that was taught in class into a practical working model. We would also like to thank our friends and every lab that helped us to complete this project on time.

II. Project Description

The quadrupedal robot is made using 12 servo motors. The main goal is to make a small but also robust system that can perform various asks like crawling and walking. The decision to make it smaller inevitably leads to relatively low-cost. This system can be used for more important purposes like navigation, obstacle avoidance.

III. Components

- Arduino Uno x1
- Servo Motors x12
- Arduino Sensor Shield x1
- 3D printed parts x22

IV. Working

The Arduino Uno is responsible for computing the motion paths of the various experiments. After all the digitally fabricated parts are assembled, the only thing left to do is connect the Arduino pins to the servo wires. Then coming to the code part, we have to program the initial position of each servo. After this, we need to program the servos in the form of motion paths. We can do this in two ways: using either forward kinematics or inverse kinematics. Here, we're using inverse kinematics. A sensor shield is also used to provide connections for servo motors by connecting servo ports to the sensor shield.

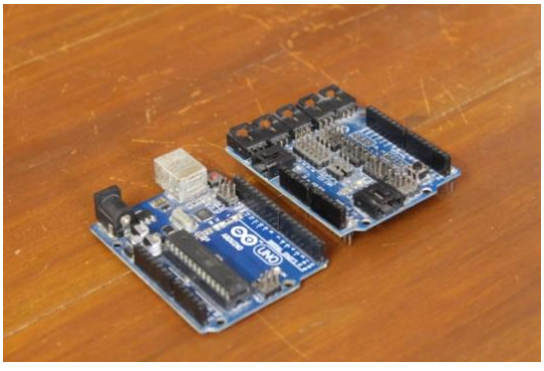
V. Construction

A. 3D Modelling

The first thing we do is build 3D models of all the parts that we require. We looked up measurements of the servo motors that we required, and according to that we used the 3D modelling software \textit{Autodesk Fusion 360} to make the 3D models. The material used was PLA, and the specifications used were 40% infill, 2 perimeters, 0.4mm nozzle diameter with a layer height of 0.1mm.

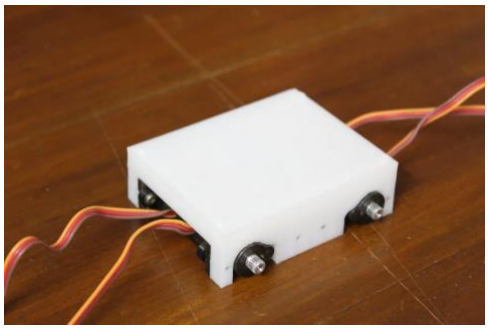
B. Arduino And Sensor Shield

An Arduino Uno was used in this project to compute motion paths of the gaits. It instructs the actuators to move to precise angles at specific speeds to create a smooth walking motion. It provides a bunch of I/O pins and provides a serial monitor although we don't require that here.



C. Assembling the parts

The links are made by pushing the servo horns into the slots. Then the servos motors are attached and screwed firmly. There are 2 servo motors in each leg. They are all assembled, and the Arduino Uno and the sensor shield are attached to the body. The sensor shield provides connections for servo motors.



VI. Code

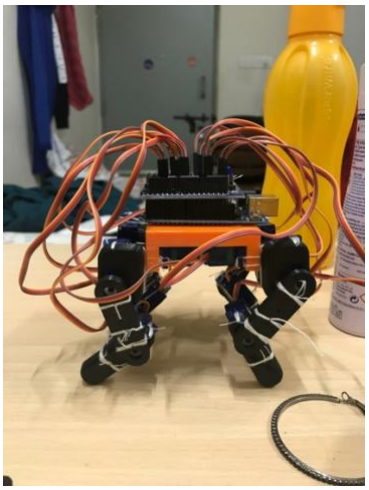
Firstly, the zero points of the code need to be setup, for these are the reference points from which we can code the complex movements. Once the wiring is done, you can program the paths.

VII. Applications

The quadruped on its own has not many uses but it can be programmed to perform various tasks like jumping and running. Some mounting points on it can be used to add sensors for measuring distance.

VIII. Final Result

We then assembled the parts using screws and threads and then ran the code so as to get a sort of crawling gait.



References

[1] Muhammed Arif Sen, Veli Bakircioglu, Mete Kalyoncu, "Inverse Kinematic Analysis Of A Quadruped Robot"

[2] Introduction to Arduino Sensor Shield