# Global Academy of Technology

**Department Of Electronics and Communication Engineering**

# Report On

# Open Day Project - 2019

## V Semester
## Academic Year: 2019-2020

## TITLE: QUADRAPOD SPIDER ROBOT

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# ABSTRACT:

- **SPIDER ROBOT --** As its name defines it, our robot is a basic representation of the spider movements but it will not perform exactly the same body moves since we are using only four legs instead of eight legs.

- Also known as **QUADRUPED ROBOT** since it is a four-legged walking robot which is a bionic replica of spider (Arachnid species) that uses their legs for movement and can perform some tasks either by human interaction or by its own.

# CONTENTS:

# INTRODUCTION:

- The main purpose of moving to legged robots is that they can handle irregular terrain with ease when compared with wheeled robots. It can be done by implementing **crawl gait** (pattern of movement) in which one leg will be in air and remaining three legs should be in contact with the ground while moving.

- The movement of each leg is related to the other legs in order to identify the robotic body position and also to control the body balance

- The crawl gait (which is also known as quadruped gait) can be converted into a program and embedded into microcontroller which instructs servo motor to move in desired positions.

- However, this makes legged robots more complicated, and less accessible to many makers. Also the making cost and the high expenses that a maker should spend in order to create a full body quadruped since it is based on servo motors or stepper motors and both are more expensive than DC motors that could be used in wheeled robots.
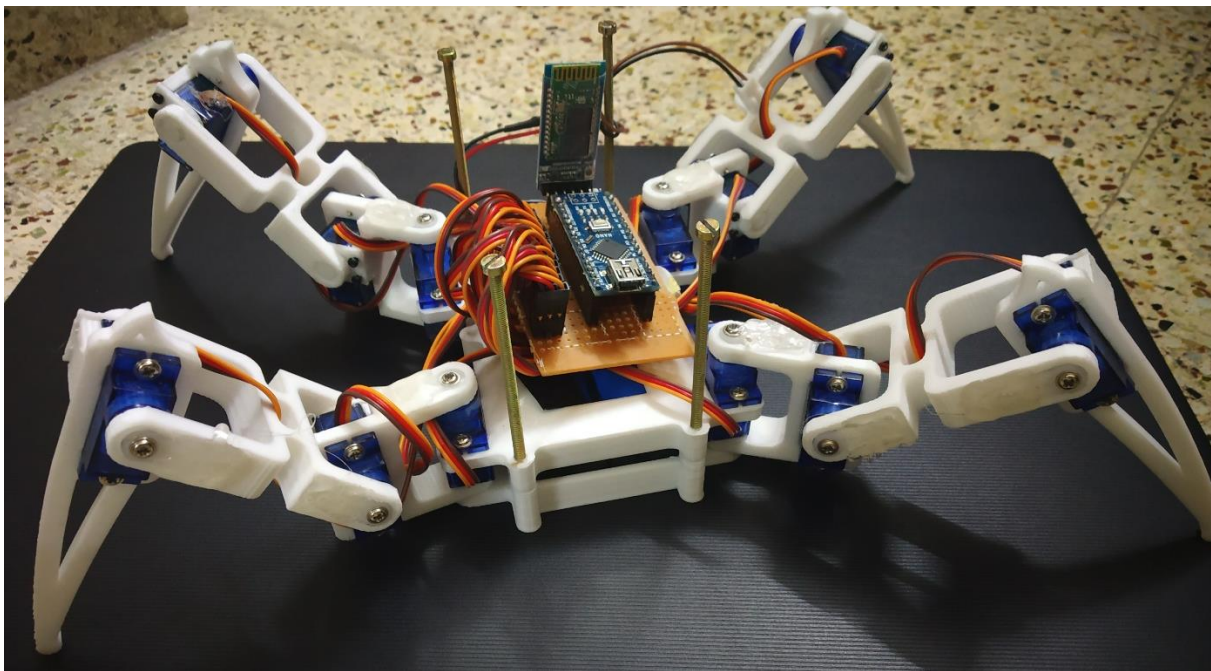
# LIST OF COMPONENTS REQUIRED:

- 12 X SG90 Servo motor

- 1 X Arduino Nano Microcontroller

- 1 X HC05 Bluetooth module

- Printed Circuit Board

- Heat Sink of size 3mm

- 2 X 1.6V lithium cell battery

- 1 X Cell Holder

- Jumper wires

- 1kg of Polylactic Acid Filament (PLA) for 3D printing of body

- 3-D design of spider robot

- 3D printer

- Screws and Drivers

- Soldering Gun

# PRINCIPLE OF OPERATION:

## Servo Motors Are the Main Actuators :_

- A Servo Motor as defined in wikipedia, is a rotary actuator or linear actuator that allows for precise control of angular or linear position, velocity and acceleration.

- It consists of a suitable motor coupled to a sensor for position feedback. It also requires a relatively sophisticated controller, often a dedicated module designed specifically for use with servomotors.

- Servomotors are not a specific class of motor although the term servomotor is often used to refer to a motor suitable for use in a closed-loop control system.

The positive pulse width is what determines the servo position :-

- A positive pulse width of around 0.5ms will cause the servo horn to deflect as much as it can to the left (generally around 45 to 90 degrees depending upon the servo used).
- A positive pulse width of around 2.5ms to 3.0ms will cause the servo to deflect to the right as far as it can.
- A pulse width of around 1.5ms will cause the servo to hold the neutral position at 0 degrees.

# 3D PRINTING :

- **3D printing**, or **additive manufacturing**, is the construction of a three-dimensional object from a CAD model or a digital 3D model.

- The term "3D printing" can refer to a variety of processes in which material is deposited, joined or solidified under computer control to create a three-dimensional object with material being added together typically layer by layer.

- CAD models can be saved in the stereolithography file format (STL)

- 3D printed models created with CAD result in relatively fewer errors than other methods. Errors in 3D printable models can be identified and corrected before printing

- The body of the quadruped is assembled with   3D body printer which consists of legs assembly by fitting servo motors to it, body assembly and finally all four legs are attached to the body of the quadruped
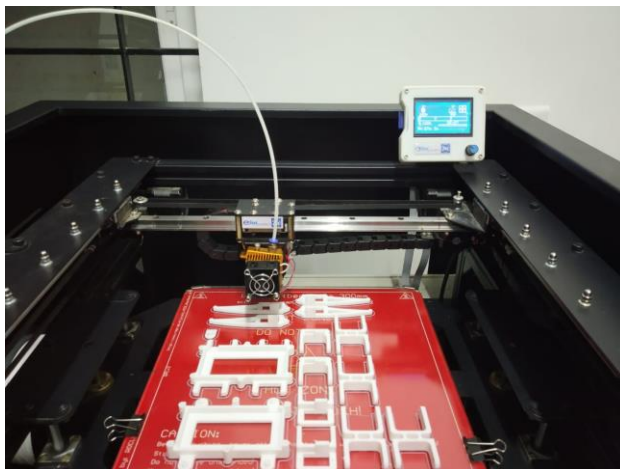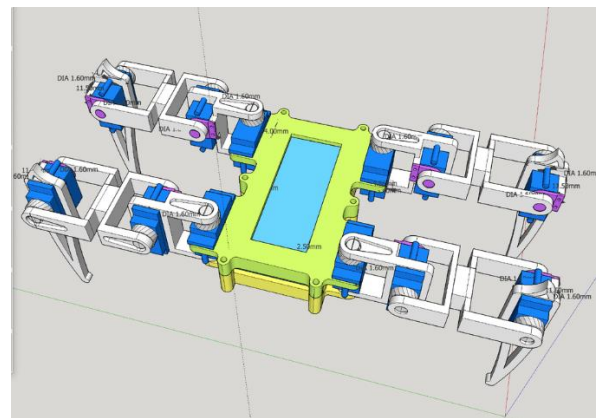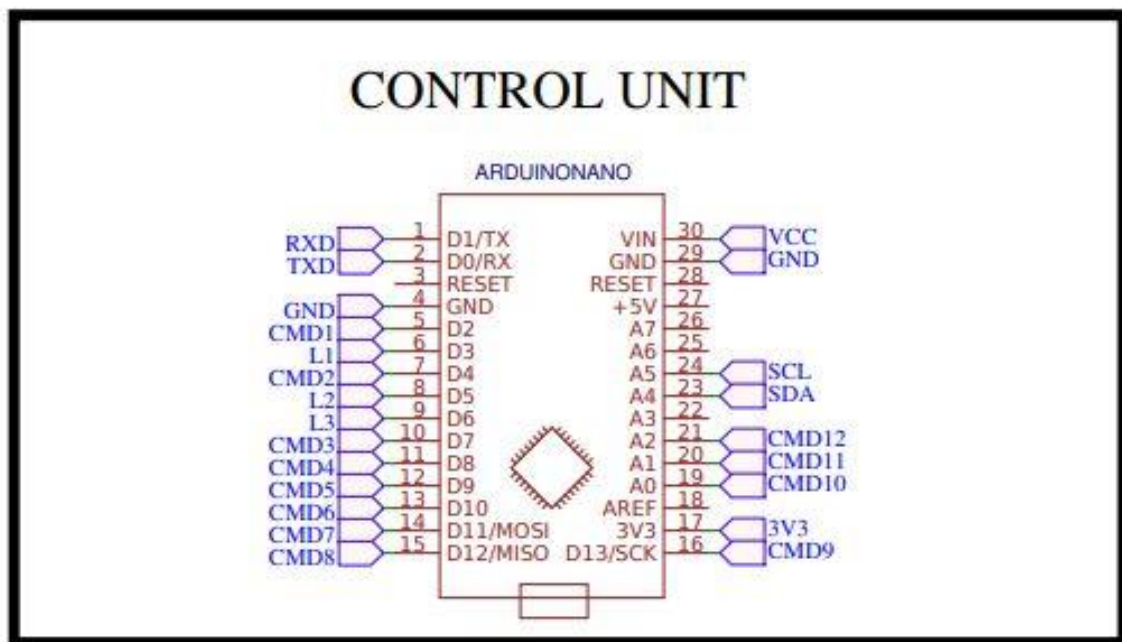
# CIRCUIT DIAGRAM:

1.  Servo Legs Connection :
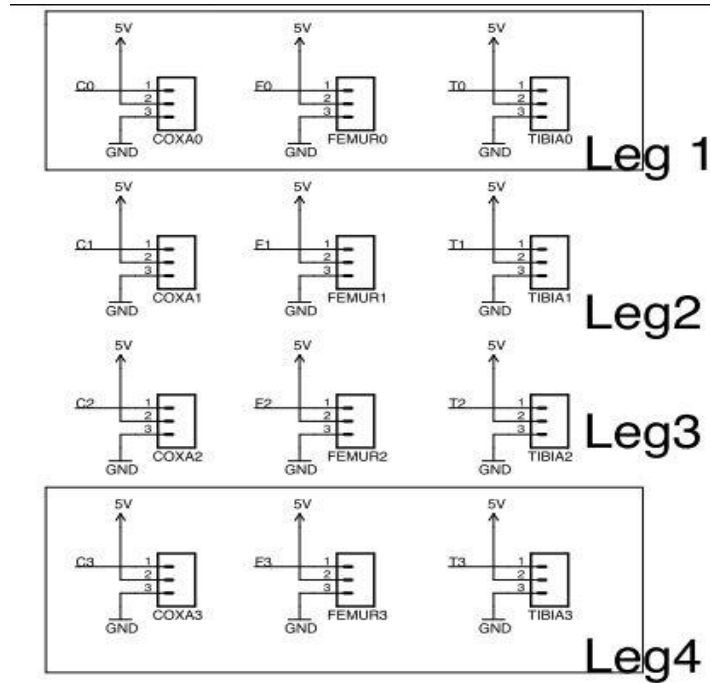


2.  Arduino Nano Connection :

# ASSEMBLY:

Tear down the parts from 3D Printer and check the objects printing quality, and using the sandpaper to polish the surface to make it looks good.

Put the battery between the upper body case and lower body case with 4 screws.

Install all of servos with legs parts, one leg comes with 3 servos and 4 screws and then connect all of legs to the body, and check all servos and joints are move smoothly.

The servo of legs should match the pin number of main-board and leg direction, otherwise, the legs will get crazy.

Then, organize the wires of the servos to make it great looking.
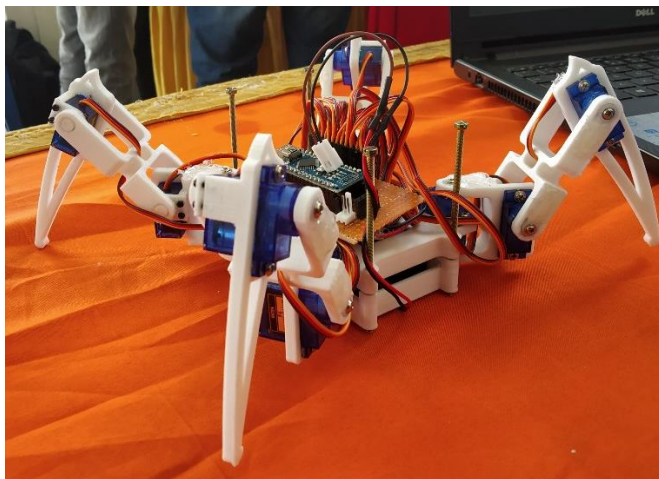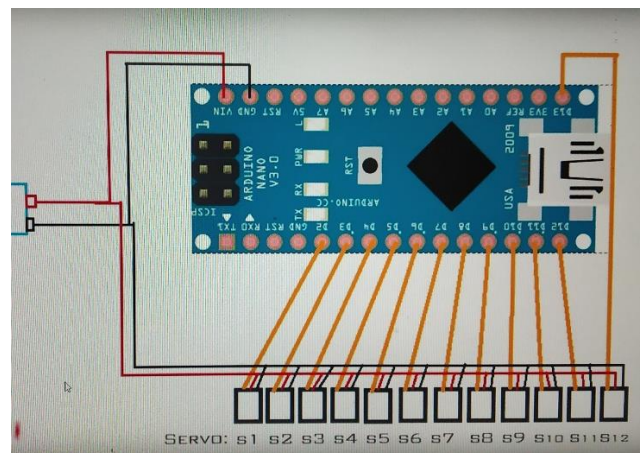
# CONTROLS AND MIT APP :

The Quadrapod is capable of :-

- Walking in any direction
- Turning around
- Sit down
- Dance
- Handshake
- Wave

MIT App Inventor is a web application integrated development environment originally provided by Google, and now maintained by the Massachusetts Institute of Technology (MIT).

It allows newcomers to computer programming to create application software(apps) for two operating systems (OS): Android, and iOS.

The android app created by us allows to connect the robot through Bluetooth and make forward movements with left , right turnings.
It can also perform certain Actions such as SIT , DANCE , HANDSHAKE , WAVE.
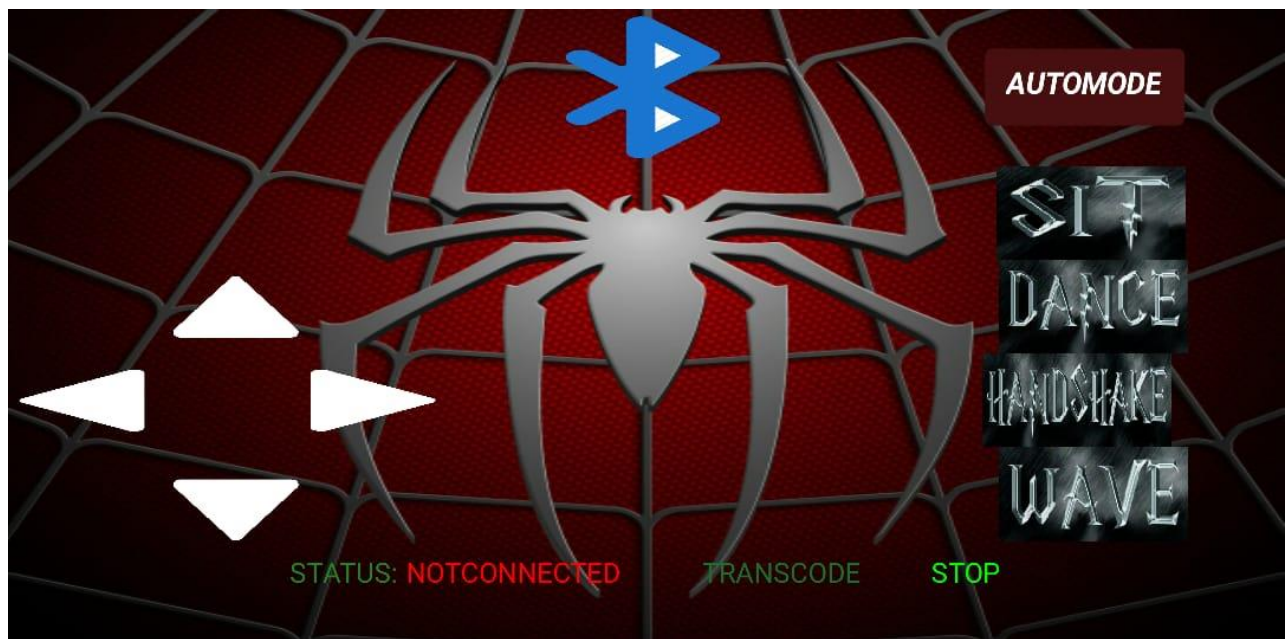
# ADVANTAGES:

- We find quadrupeds abundant in nature, because four legs allow for passive stability, or the ability to stay standing without actively adjusting position.

- The same is true of robots. A four-legged robot is cheaper and simpler than a robot with more legs, yet it can still achieve stability.

- Although they are complex to design, they have a greater edge over wheeled robots in terms of navigation on any kind of path or terrain.

# DISADVANTAGES:

- Quadrapod is less stable when compared to hexapod spider robot.

- Complex to design.

- Higher Cost then wheeled Robots.

# APPLICATIONS:

- Quadra pod spider robot is used in defense applications like if the Rovers are structed in the middle then the rover can be transformed into spider robot and can crawl.

- Exploring dangerous and / or rough areas for humans. For instance searching for survivors after a nuclear disaster, exploring war zones, inspecting unstable buildings after natural disasters such as an earthquake, tsunami or a volcanic eruption.

- Equipped with sensors and weapons, such a robot could be used in a crisis or war to avoid risking human lives in battle

- Defusing bombs such as land mines. Currently robots with tracks are used to do this but this robot spider would have the serious advantage in that it could be used in more impassable areas than the current robots.
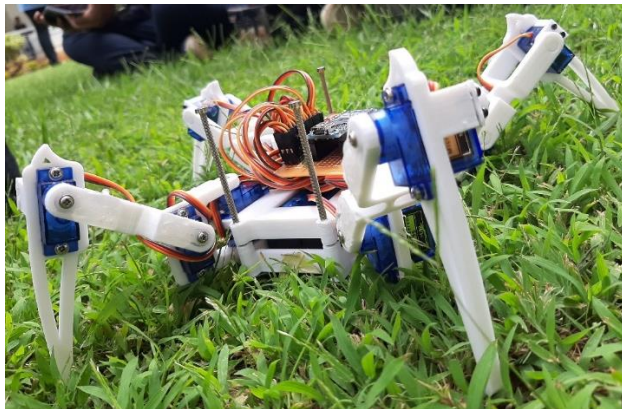
# CONCLUSION:

- This project has been developed considering the need for low cost.

- The equipment is compact, simple in design and can be used practically anywhere needs.

- Thus, a quadruped robot is designed in such a way that humans can interact with it using Mobile application to perform some tasks. The movement of servos is achieved by Inverse kinematics algorithm.

In further developments ,

- The Arduino Quadruped robot can be able to move on a guided path sensing the black line with its automatic obstacle avoiding feature makes it efficient to reach any destination as desired.

- Quadruped robot can be able to detect faces and transmit live camera feeds

# BIBLIOGRAPHY:

- Google chrome
- YouTube
- MIT app inventor tool.
- Wikipedia
- Arduino form