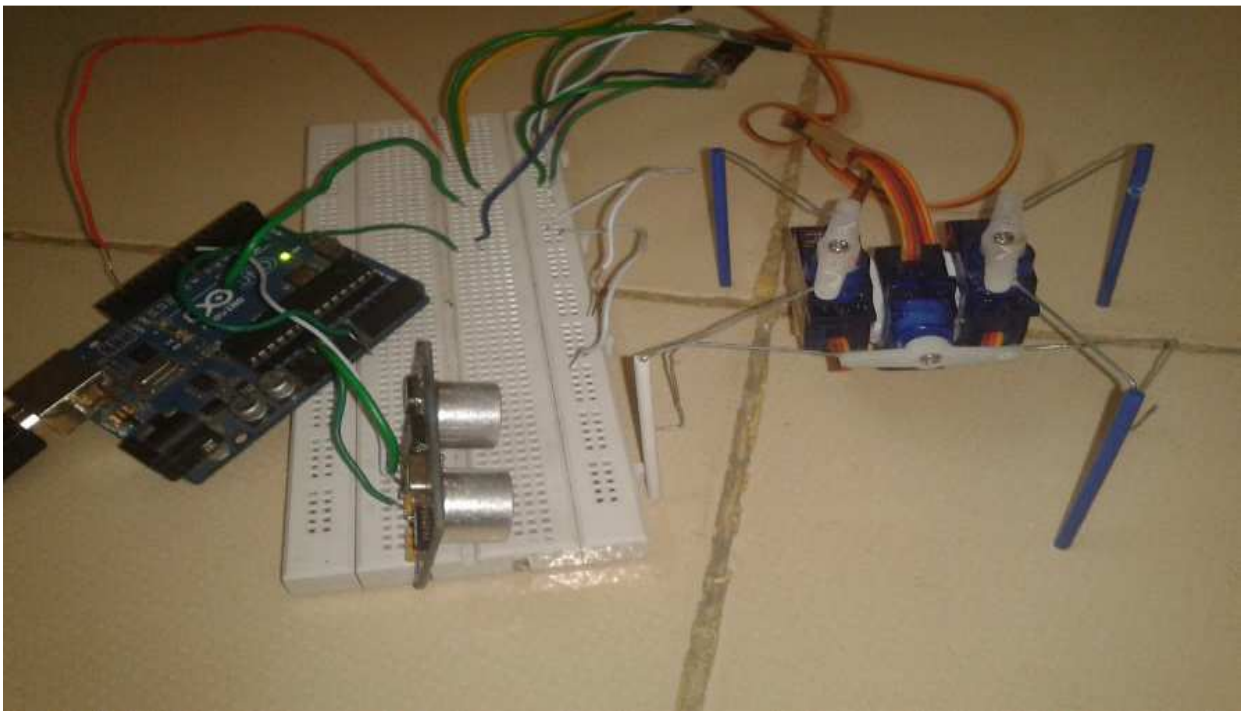
Department of Electronics and Electrical Engineering
Indian Institute of Technology Guwahati

Design Project poster

Title of the design project: HEXAPOD ROBOT

Project ID: #25



Name of the supervisor: Dr. Amit Sethi

Name of the coordinator: Dr. Srinivasan Krishnaswamy

Objective:-

The aim of the project is to build an autonomous Hexapod Robot, that includes electronics, software & mechanical components integrated together to work in coordination among themselves. But we have been focusing mainly on hardware implementation of the above design.

Available products on the market:-

- White Legged Spider Monkey Hexapod
  Cost (Rs 2800)
- Leo Servo Hexapod Robot
  Cost (Rs 3000)
- Pololu Hexapod Robot
  Cost (Rs 3500 (approx.))

Our improvisation over existing one:-

- We are using only 3 servos to move our hexapod robot instead of 6 or 18 servos which makes our design little bit complex but it is more efficient then terrestrial old versions.
- The cost of making of our hexapod robot is about Rs 1500, which is much less than those available in the market.
- It's simple, portable, easy to use & as far as possible is being made from household available cheap items.
- We have developed a type of moving surveillance system that starts the buzzer as soon as intruder (obstacle) is being detected.

Methodology Used:-

- We have attached one servo with the first and third legs of left side and similarly the second servos in right side. And the last i.e. third servo we have attached it in the middle of the two servo to control the movement of both legs of hexapod robot.

- **How to make this walking-robot:-**
  For forward & backward movement of the legs, first of all the third servo controlling the right middle leg movement will be activated that will lift the left side of the bot above the ground, which help in the movement of left parts of the legs (first & third legs) in forward (or backward) direction with the help of first servo. Then left middle leg comes to ground & will lift right side of the bot which in the similar way help to move the right part of the bot in forward or backward direction. And when this process is done repeatedly it helps in movement of the whole bot either in forward or backward direction.

- We are using proximity sensor circuitry that can detect the incoming obstacle at a given predefined distance & help our hexapod robot not to hit the upcoming obstacle.

- Our sensor is used at the front end of our hexapod robot that is connected with main controller circuitry board which receives data from surrounding obstacle & then sends commands out to the central leg servo via Arduino to coordinate the movement of the hexapod robot.

Circuit Diagram:-

The overall circuit part and component of hexapod robot diagram are given below**:-**

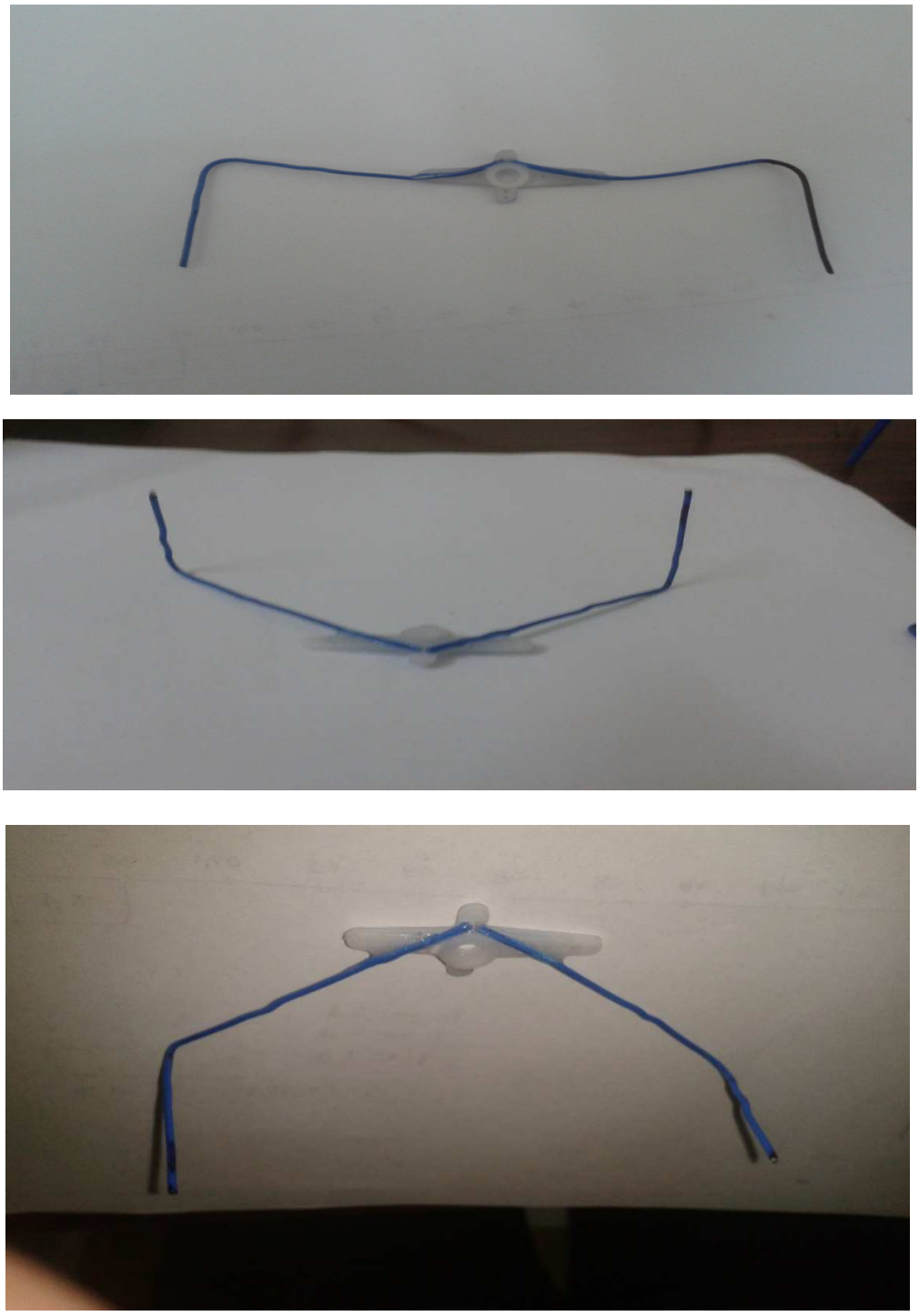
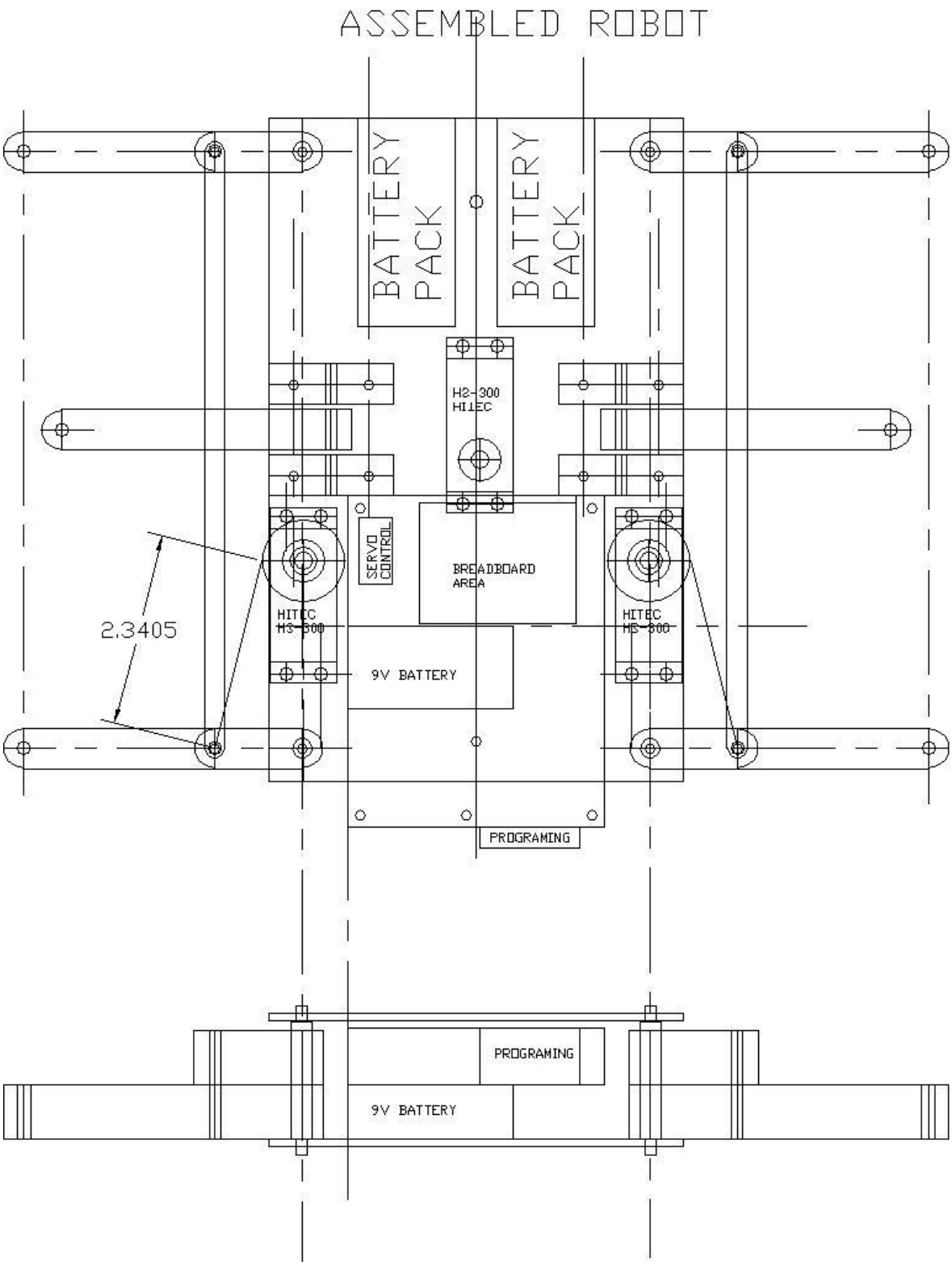
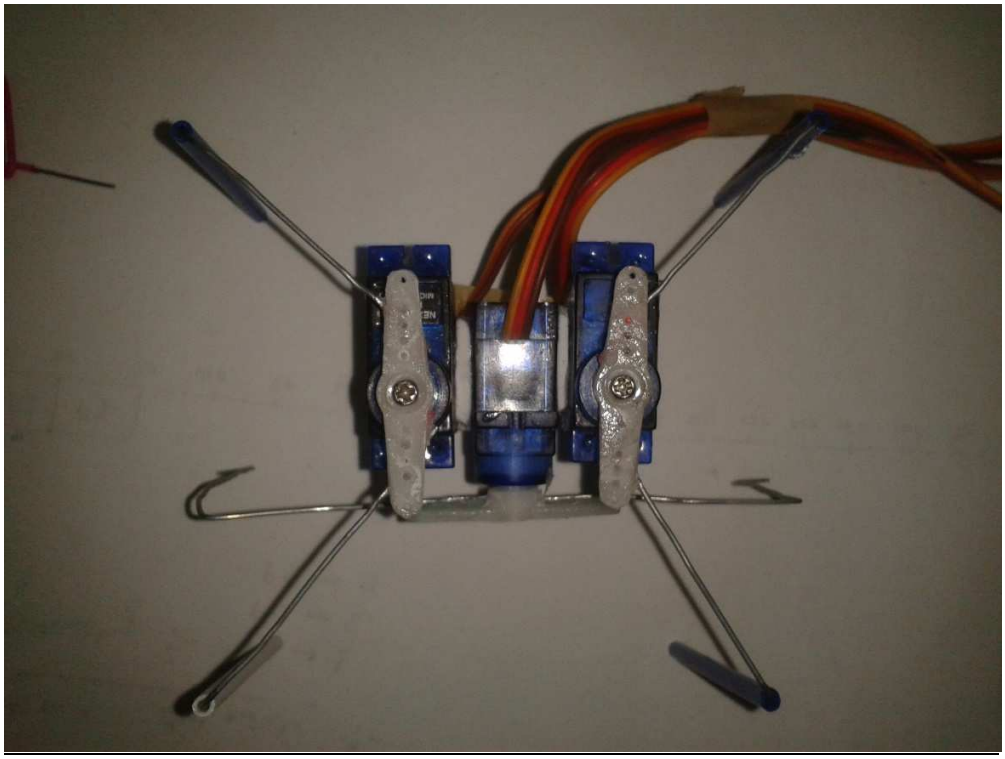


Figure (Dimensions of leg's)

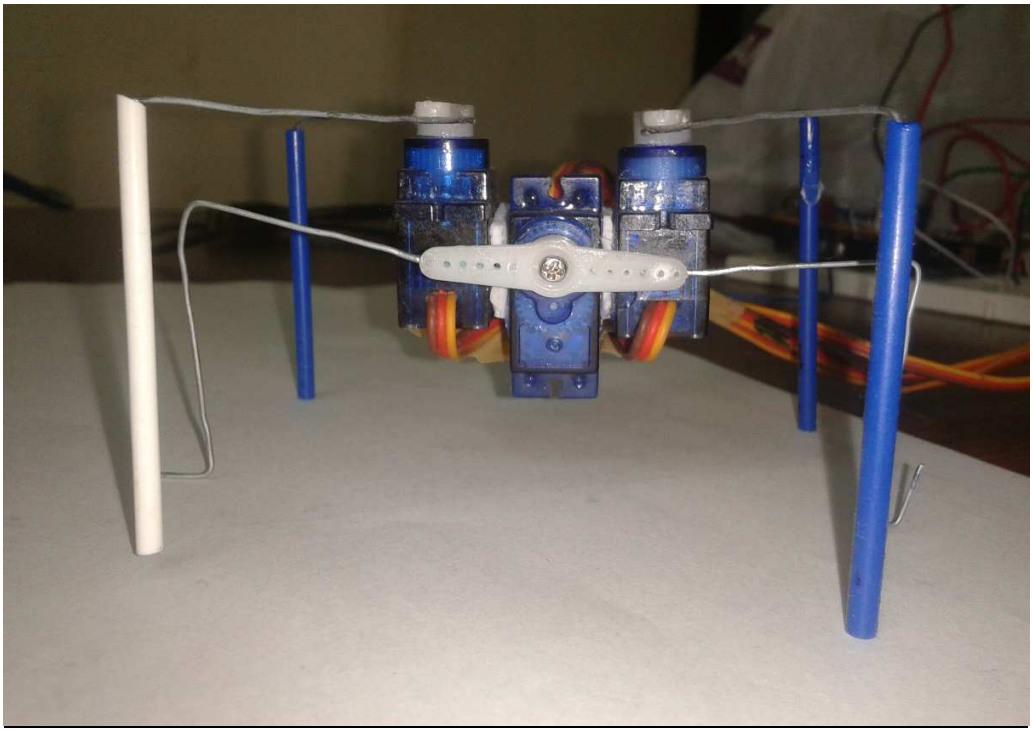
Overall front view of hexapod robot



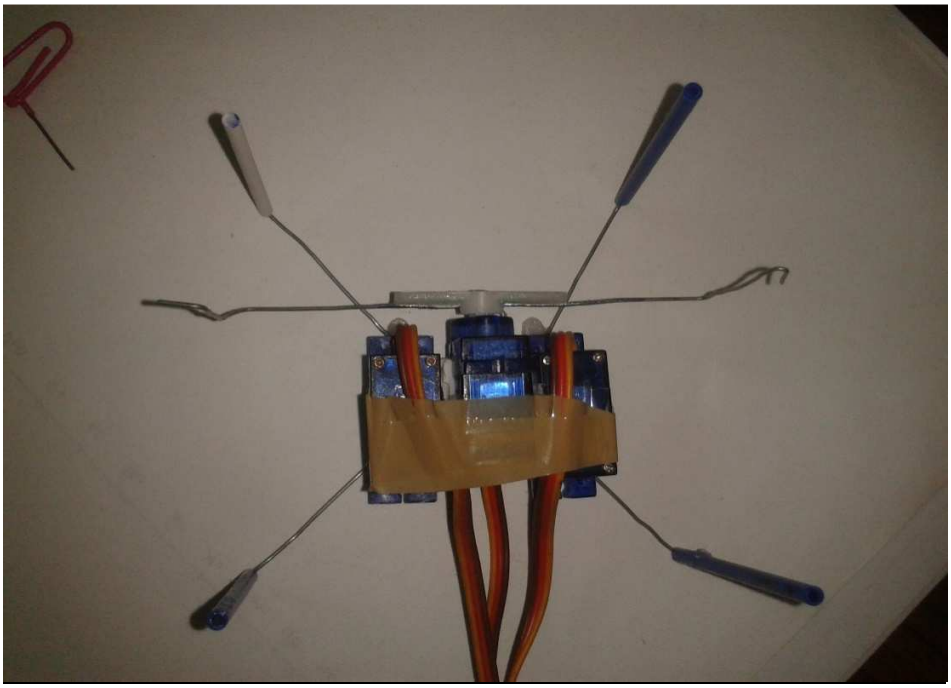
Top view of hexapod leg’s



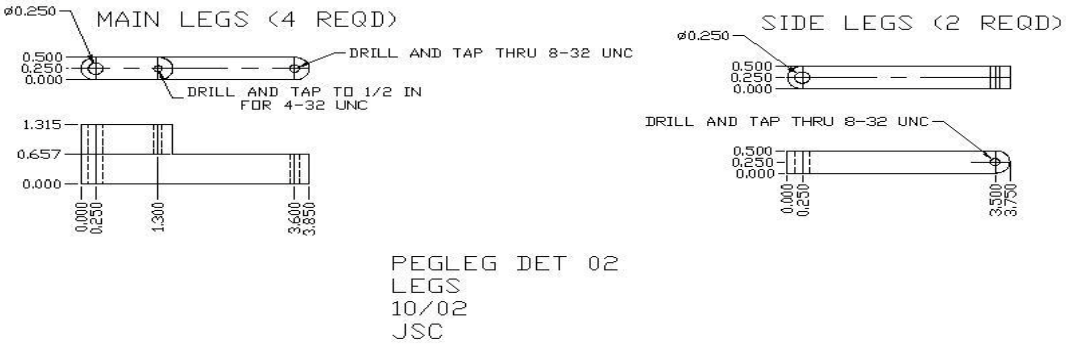
Front view of hexapod leg’s



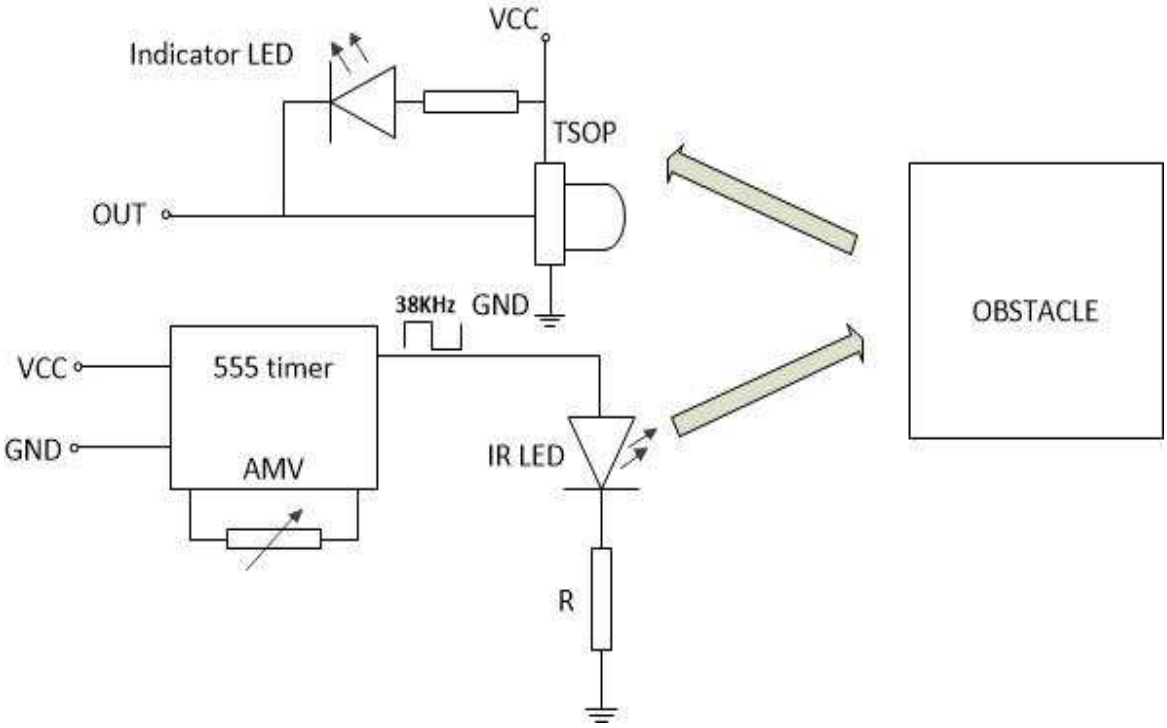
Bottom view of hexapod leg’s



Map of hexapod robot



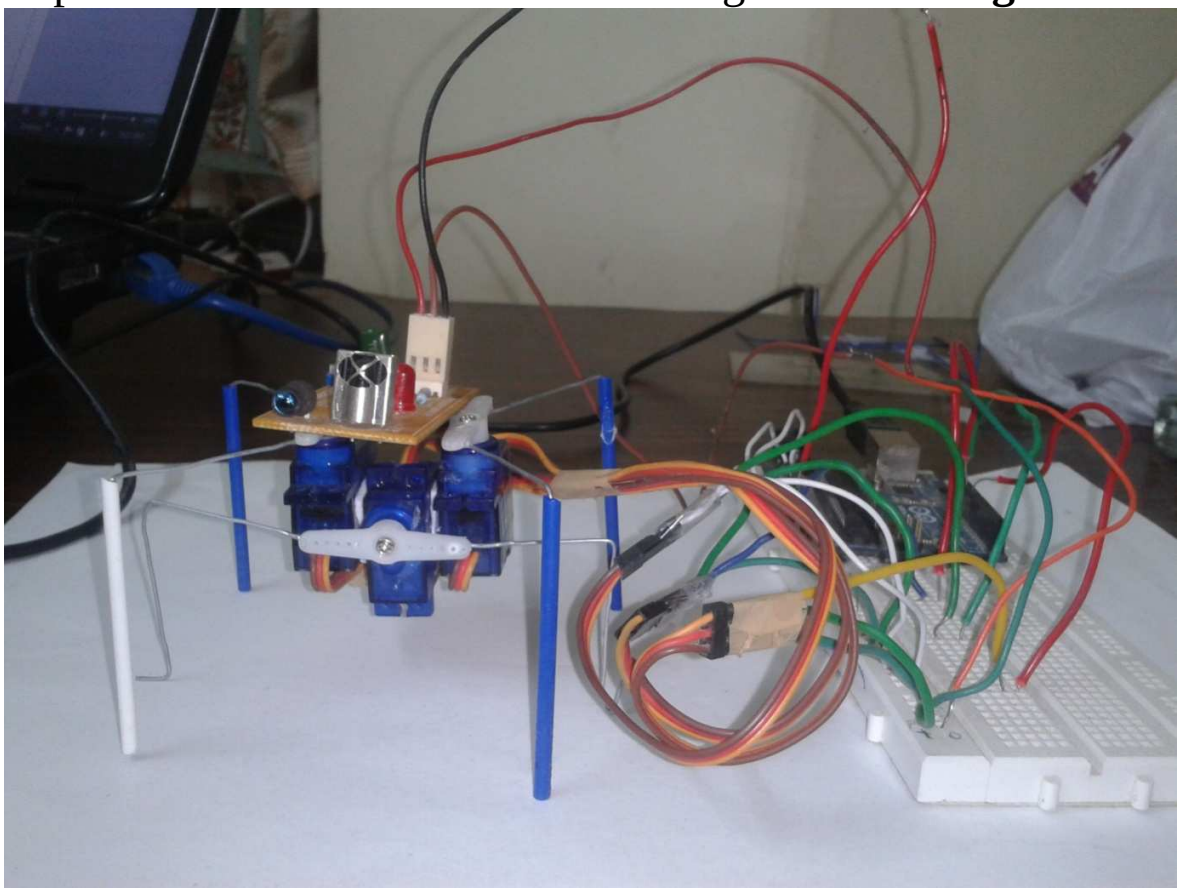
Circuit diagram of the sensor



- In this circuit diagram, it consist of 555 IC which is working in a stable multivibrator configuration. The output of 555 is given to the IR transmitter.
- The TSOP detects a frequency of 38 KHz. The output of TSOP goes low when it receives this frequency. Hence the output pin is normally high as IR LED is continuously transmitting, due to no obstacle, so nothing is reflected back to the TSOP. The indication LED is off.
- When an obstacle is encountered, the output of TSOP goes low, as the required frequency is reflected from the obstacle surface. This output is connected to the cathode of the LED, which then turns ON.
- The on-board LED indicator helps user to check status of the sensor without using any additional hardware.

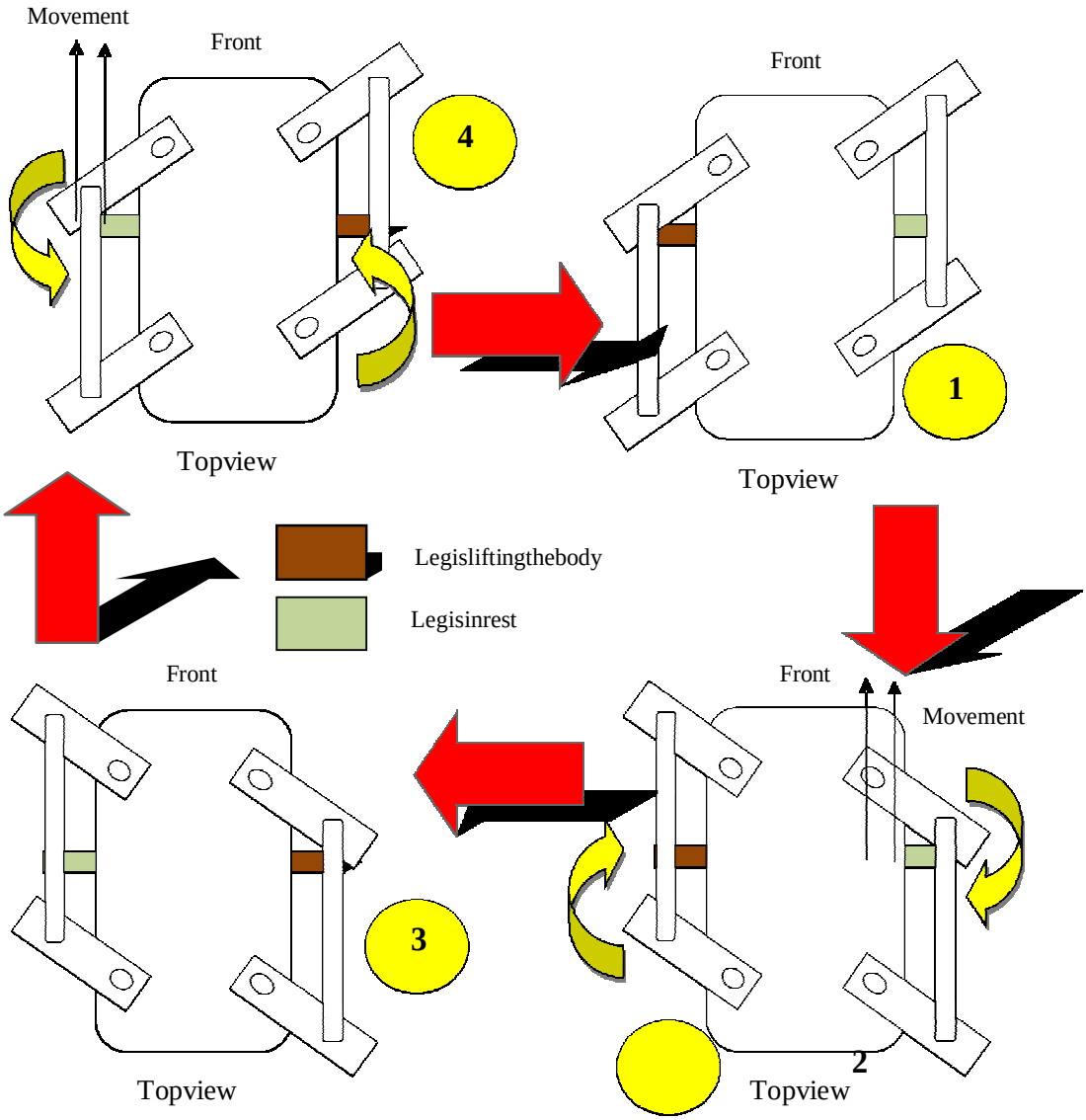
Hardware Implementation:-

The overall look of our hexapod robot with circuitry being implemented will look somewhat like given below **figure.**



Servo motor:-

- A servomotor is a rotary actuator that allows for precise control of angular position.
- A servo contains a normal DC motor. This motor is connected to a potentiometer (or a variable resistance) through gears. As the motor rotates, the potentiometer's resistance changes. So the circuit can measure exactly what direction the motor's shaft is pointing.
- When the shaft of the motor is at the desired position, power supply to the motor is stopped. If not, the motor is turned in the appropriate direction.
- the speed with which the motor turns is proportional to the difference between its actual position and desired position. So if the motor is near the desired position, it will turn slow.


Movement
Front
4
Front
1
Topview
Topview
Legisliftingthebody
Legisinrest
Front
Front
Movement
3
2
Topview
Topview

Results:-

- We are able to implement the movement of all the six legs with the help of servos in forward & backward directions in synchronism with coordination.

- We have implemented the circuitry for the sensors so that hexapod robot can detect obstacles within certain defined range.

- We have developed a type of moving surveillance system that starts the buzzer as soon as intruder (obstacle) is being detected

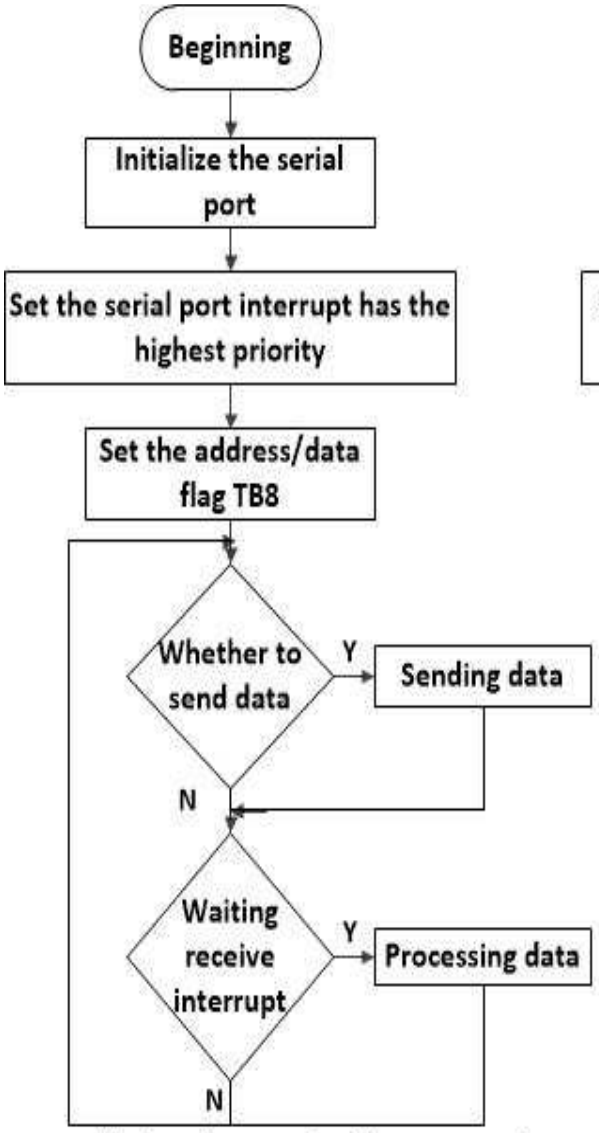
Conclusion:-

- The experimental results show that our design can achieve 6 legged robots to walk forward & backward & have a reliable performance. Through the experiment we can see its excellent performance in obstacle handling capacity.

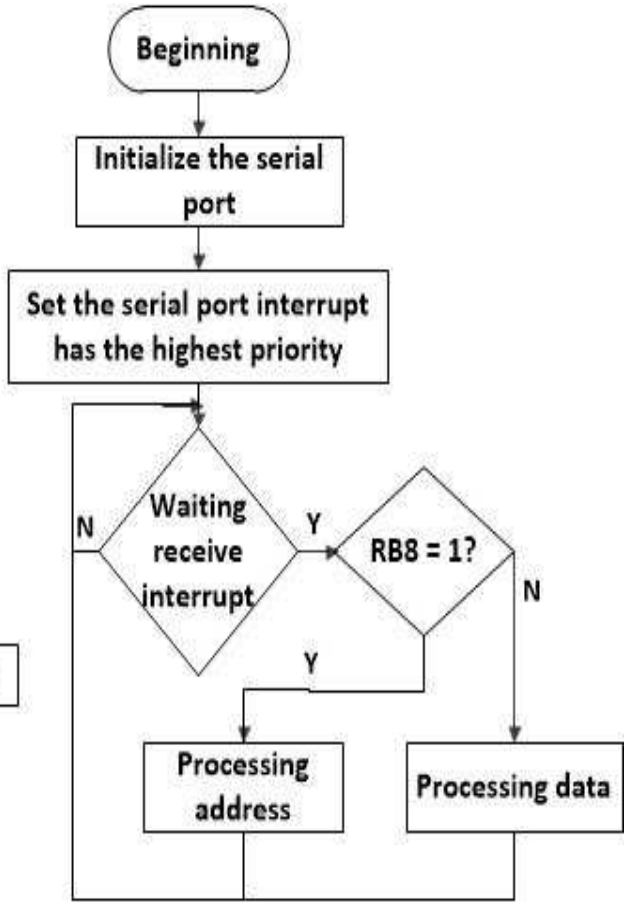
- Practical implementation circuitry or any theoretical concept is much complex than its theoretical overview.

- We can reuse each and every broken component for something more relevant in the project.

Control flow of microcontroller and its exchange of data with servo motor



Main microcontroller processing flow



Microcontroller that control the motor processing flow