Robotic Frog

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Introduction

All jumping involves the application of force against a substrate, which in turn generates a reactive force that propels the jumper away from the substrate (Willoms, 2006; Armour et al., 2007). Any solid or liquid capable of producing an opposing force can serve as a substrate, including ground or water. Examples of the latter include dolphins performing traveling jumps, and Indian skitter frogs executing standing jumps from water (D.E. Koditschek. and M. Bühler, 1991; Willoms, 2006). There are several types of projects done before in amphibious robotics for imitate animal's locomotive mechanisms, behaviors in different environments, imitate their sounds (Saito et al., 1994; Willoms, 2006). In this project it is focused to imitate the mechanism of frog which use for their locomotion.

Methodology

To control the servo in 360 degrees, gears of the servo were modified because in normal conditions, they do not allow more than 180 degrees rotation. Then controlling circuit was prepared to give pulses to the servo for its rotation. Two NES 537 servo motors were used in this project. To modify the gear system, first the potentiometer was removed and a resister unit was added.

Figure1. Potentiometer and gear lock in servo motor

Then the mechanical construction of the robot body was carried out subsequently. Aluminium and plastics were used to make the robot body parts as these materials are lighter. Otherwise the torque of the servo motors will not be sufficient to give power to the arm. But when using aluminum there is a friction generated between aluminum parts requiring additional power to be used against that. To obviate such issues plastics were selected to make the robot body and aluminum nuts and bolts were used to connect the plastics parts.

After constructing the robot body, controlling circuit was connected. Controlling circuit was developed only to give pulses to the servo motors when input signal comes through limit switches.

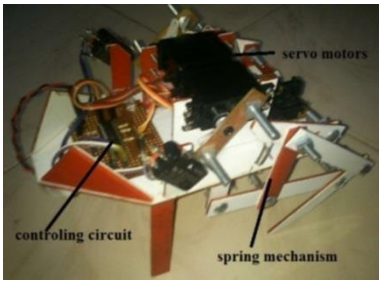

Figure 2. Main parts of the robot.

Results

By changing the pulse, approximate rotational angles were identified as follows.

Table 1. Rotational angle change according to the pulse width

Pulse width (ms)	Rotational angle (degrees)
0.5	30
1	55
1.5	80
2	105
2.5	135
3	180

After identifying required pulse width for 180 degrees rotation, the program was modified to work with the input signals of limit switches.

Conclusions

This project clearly showed that hybrid jumping and gliding locomotion is possible and an interesting option for miniature robotics. It demonstrated the jump of the robot and how the actual frogs use their legs to perform a jump. The results from my experiments suggested that jumping with rigid wings is a preferable option compared to using wing folding mechanism. The former increases the jump distance and reduces the impact energy that has to be absorbed by the robot structure on landing.

References

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