

Design and control of underwater robotic knifefish

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Design and Control of Underwater Robotic Knifefish

Introduction

Bio-mimetic robotic fish has become popular in recent years. A lot of researches have been conducted to study the perfect natural motions of fishes. In this project, design and control of robotic knifefish were studied.



Real Knifefish

Objectives

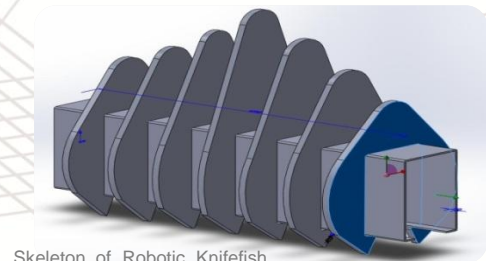
- Appearance design of the robotic knifefish
- Control strategy design for position sensing and obstacle avoidance
- Improvement in moving motion and the corresponding control strategy in turning

Results

- Streamline skeleton covered with mermaid costume fabric reduced the water resistance
- Ultrasonic Range Finder-XL-Maxsonar WR1 SEN-09496 was used to sense the position and underwater obstacle within a range of 0 to 765 cm.
- With TIMER and INTERRUPT in code, sine function was applied to control motions of six servo motors automatically.

Methodologies

- Streamline design to reduce the drag force
- Covering the skeleton with mermaid costume fabric to make it more vivid
- Application of sonar sensor to sense position and obstacle more accurately
- Application of image sensor to recognize the moving track and obstacle alternatively by identifying related color codes
- Applying sine function to adjust angular positions of six servo motors to control the motion of fins



Skeleton of Robotic Knifefish



Underwater Robotic Knifefish

Pulse type



Wave type



Pulse type V.S Wave type

Conclusion

Design and control of underwater robotic knifefish were studied in this project. Streamline skeleton was applied for the appearance design to reduce drag. Besides, sonar sensor was utilized to detect obstacle and to sense the position of knifefish. Additionally, sinusoidal function was used to control the motion of fins.

For the future study, more effort is needed to improve the control of turning motion and to apply image sensor successfully.

Reference

- Xiao Jianfang (2011), Design and Development of Smart Robotic Fish
http://thelife-animal.blogspot.sg/2012/05/knifefish-spiritblack.html#.UP7ezycp_uQ (Real Knifefish)
 What is an electric fish? http://people.virginia.edu/~mk3u/mk_lab/electric_fish_E.htm (Pulse type V.S Wave type)