

# BIO-HYBRID ROBOTS, THE KEY TO OUR PLANET'S FUTURE.

- Artificial control of animal locomotion provides us with answers to addressing longstanding challenges to control, actuation and requirements in power for soft robotics alone.
- This is a biohybrid robot that uses on board microelectronics to induce swimming in live jellyfish.
- Measurements demonstrate that propulsion can be substantially enhanced by driving body contractions at an optimal frequency range faster than natural behavior. Swimming speed can be enhanced nearly threefold, with only a twofold increase in metabolic expenditure of the animal and 10 mW of external power input to the microelectronics.
- It utilizes electrical signaling to enhance propulsion by increasing contractions at an optimal frequency range faster than natural behavior.
- Jellyfish are an model organism for underwater vehicles due to their low metabolic expenditure. The swimming speed can be enhanced nearly three fold while only increasing metabolic expenditure by a factor of two with a 10 mW of external power input to the electronic.
- The biohybrid robot uses 10 to 1000 times less external power per mass than an other aquatic robot reported in literature.
- This utilization allows us to go further than robotics alone by utilizing structure and muscles of the jellyfish for actuation.
- This also opens the door and allows us to further enable studies of live organism bio mechanics in robotic controlled experiments.
- This allows us to make many places more easily accessible, reach destinations never reached through machinery alone.

## HOW CAN IT HELP?

### WASTE

- The absurd amount of trash left on beaches or thrown into inland waterways will eventually end up in our ocean.
- These contain non-biodegradable waste such as plastics, which will break up into smaller particles and be mistaken for food by marine species.
- With islands of garbage the size of Texas already a reality in some areas of the oceans, new measures must be taken in order to eliminate and reverse these effects.
- These biohybrid robotics are equipped to help us identify and correct large sources of pollutants in our ocean. The robotics are equipped with a onboard netting system that catches large pollutants in the ocean and bundles them into packages to be easily identified and disposed.
- As our swarm of biohybrid Jellyfish robot migrates through the ocean, it will slowly accumulate floating non biodegradable waste. The sensors present will track energy expenditure and the rate of movement and once these factors reach threshold, the package will be released and float towards the oceans surface to be collected later. This aids in prevention and maintenance of our marine life.
- While these package size will be small, the quantity of packages will be abundant. Sensors detect non organic material and is non hazardous to marine life.

### POLLUTION

- Agriculture has a big effect on our ocean. Any fertilizers and pesticides used commercially in agriculture will eventually end up falling into the ocean.
- These products, if ingested by humans can cause major health issues. The same goes for our marine life.
- Almost all will causes damage to our marine ecosystem with some causing irreversible and fatal changes to species.
- The addition of special activated carbon filters have been incorporated to help aid the reverse of the pollution process caused by many fertilizers and pesticides used in agriculture.
- These special activated carbon base filters that remove larger containment particles. This filter is not 100% effective in removing pollutants but will aid in the overall state of the ocean.

### MONITOR

- These robots are also equipped to monitor numerous factors of our ocean.
- They will aid in monitoring aquatic life, weather changes, migration cycles, population, water content, and much more!
- It will allow us to have better control and management over fishing resources. Studies indicate that there has been a considerable reduction in the populations of some species of fish. This is partly due to over fishing but also a serious lack of fishing activity management or non-compliance with the rules.
- The over fishing of certain species with long life cycles at the top end of the food chain will cause irreversible changes in the ecosystem.
- This monitoring will help aid to prevent over exploitation of fishing resources allowing us to better respond to over fishing of species.

**THIS IS MAJOR STEP IN A CORRECT DIRECTION AS WE MOVE TOWARDS A FUTURE WHERE WE UTILIZE BIOHYBRID ROBOTICS AND PARTNER WITH ANIMALS IN ORDER TO REVERSE THE DAMAGES DONE TO OUR PLANET.**

