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CSSE News

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Pointing Toward the Future of Energy

Developing software that helps marine biologists monitor the ocean floor near off-shore wind farms is the subject of a project led by Computer Science Professor Lubomir Stanchev.

CSSE Department teams with Biological Sciences to help marine biologists study the impact of offshore wind farms

With a deadline set for California to eliminate carbon electricity, Cal Poly students and faculty are helping to expedite the process with computer software.

Last fall, former Gov. Jerry Brown signed a bill that mandates the state fully rely on carbon-free electricity by 2045, prompting many to look toward offshore wind production as the most feasible way to reach that goal. But, before any large-scale building initiative, studies have to be conducted to determine the potential environmental impact.

"With offshore wind farms, obviously there's some environmental regulation," said Computer Science Professor Lubomir Stanchev.

While 2045 might seem like a ways away, the state is expected to reach half its goal by 2030 — which is not as far off. Fortunately, California does have plenty of coastline. And ocean wind produces energy with no greenhouse gases.

Several wind farms have been proposed for California, but so far none have been built.

To generate energy from offshore wind would require turbines that would be attached to streams of cables connecting them to the electric grid on shore. As proposed, the California turbines, which look like windmills, would stand up to 360 feet high and could be located up to 40 miles from the coast.

Since it's not known how that equipment will impact marine life, the California Energy Commission sponsored a study awarded to Cal Poly, working in conjunction with the Monterey Bay Aquarium Research Institute.

"The permitting process for a project like this will involve a great deal of environmental analysis, including studies of how the massive anchors would impact marine species that live on the seafloor," said Benjamin Ruttenberg, associate professor of biological sciences and director for the Center for Coastal Marine Sciences. "At the moment, these analyses are expensive and time-consuming,

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Led by Computer Science Professor Lubomir Stanchev, left, a joint project with the Monterey Bay Aquarium Research Institute allows Cal Poly students to monitor marine life swimming by undersea cameras.

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so we are trying to develop tools to help generate that information faster and more efficiently."

Using underwater autonomous vehicle technology, aquarium researchers have gathered video of the sea floor featuring underwater species that would be found near the proposed turbines. That video was then shared with Cal Poly.

"We have about 50 hours of video," Stanchev said.

Working with computer science and marine biology students, Stanchev and Ruttenberg have created a software program that allows researchers and students to annotate the video.

Researchers are specifically focusing on 10 species, including sea urchins, starfish and crabs. The software will allow for greater efficiency and cost effectiveness of video data collection.

The software displays the initial videos with bounding rectangles around the subjects and allows for on-screen annotation.

Without such software, researchers would have to pour through hours of video, taking notes by hand and recording video times next to the notes.

"They wanted features for faster notation," Stanchev said. "So we tried to make it as user-friendly as possible."

Because the software is web-based, trained staff can annotate the video from anywhere, and researchers can easily share information. The computer stores the annotated imagery, providing a dataset to train artificial intelligence models, which will help train the computers to watch the videos and recognize the target species without humans. And, to ensure accuracy, the software will provide an efficient way for humans to review the work of both the computer and other humans, increasing the accuracy of the identification.

"Ultimately, we hope to be able to use the software on the ships, so we can generate data on abundance of key species in real-time directly from video," Ruttenberg said.

Stanchev expects the project, which began last spring, to conclude at the end of 2019.

The framework can be used for other applications. And this particular project, he said, could be helpful as a teaching tool for marine biologists.

"The data is proprietary, so we can't share the videos," he said. "But our hope is that maybe by the end of the project, we can make them public."

In the meantime, Ruttenberg said, the project represents an excellent opportunity for Cal Poly students.

"It's exciting to have marine biologists and computer scientists working together to solve real-world problems," he said. "It gives our students valuable experience working with peers with different backgrounds and skills, and it allows all of us to tackle challenges together that none of us could address alone." ■