MaguRobot

Kinki University Technical College

Good morning ladies and gentlemen, we are from Kinki University Technical College, and on behalf of our team, I would like to introduce to you the person who made all things possible, the brain, of this project, Miss Ai Yamashita. Miss Yamashita is a fourth year electrical engineer. On my left is Mr. Hiroyuki Hashiji. He is also an electrical engineer, in the fifth grade. Mr. Hashiji made our spectacular powerpoint slides. I am Takahiko Takekabu, a first grade student.

Today, we would like to present to you our very own school's new robot invention, we call it the MaguRobot. It is a tuna-shaped robot that can move through water by remote control. The question is, of all the species living in the sea, why did our school choose tuna to be the model for the robot? The reason is that our parent university, Kindai, is breeding Blue Fin Tuna. That leads to another question: Why are we breeding tuna fish? Japanese people love tuna. We eat so much that we have needed to import tuna from other countries. This has led to a global decrease in tuna stocks. This decrease has led to increased fishing regulations and an increase in the price of tuna. That's why Kindai is breeding the Blue Fin: the future aim is to supply all the tuna we need.

Returning to the topic of the tuna robot, unfortunately, the MaguRobot is not yet complete, because some technical parts of the fish are not yet finished. So today, we will discuss the design plan and our reasons for joining the project.

There are three reasons why we are making the MaguRobot.

Firstly, our school wants to display the Blue Fin in the university's marine research site. But the Blue Fin won't live that long even if we have a huge aquarium. Tuna fish are quite different to other fish, because they can't move their gills to breathe, so they open their mouths while swimming so that the water will open their gills in order for them to breathe. The absolutely funniest thing is that they have to swim their whole lives with their mouths open until they are caught by fishermen. To prevent them from suffocating, they need a very big space and an enormous amount of sea water for them to swim. Therefore, our school thought of making a robot fish instead.

Secondly, the fastest underwater robot in Japan is a “dolphin”. It swims 1.5 meters per second. We want to beat not only the dolphin robot, but all the other swimming robots in the world. And we're doing the best we can to achieve that.

Finally, most of the scientists currently use submarines to search for existing creatures under the sea. Sometimes the seaweed accidently straps around the propeller; this prevents it from moving. Therefore, our college has developed the tuna using the tailfin to move through the water.

Mr. Hashiji will now explain the technical aspects of the fish.

The robot contains: the processor and three motors.

Three-year-old tuna weigh about 20kg. When the MaguRobot is constructed using only the essential parts, the weight is about 10kg. This weight is too light, so the robot cannot sink. Therefore, the robot's weight has been increased to about 15kg.

Now, I'm going to explain about the details of the processor. The MaguRobot's processor is put into a waterproof container in the middle of the fish. The main sections of the processor are one CPU, three sensors, and three different batteries. The CPU receives radio waves from a radio controller with a range of ten meters. There is a speed sensor in the stomach, and the other two sensors measure movement in the tail and the tail fin. Those sensors send the data to the CPU, which then controls the three motors, which in turn move the MaguRobot.

The MaguRobot has three moving parts; pectoral fins, tail, and tail fin. If the pectoral fins spread, the robot rises. If the pectoral fins close, the water resistance decreases, so the robot can accelerate.

Real tuna do not continually swim with their fins. They glide periodically to save energy. For example, in the slide, the consumption energy is 100% if the tail fin is always moving. When the tail stops moving, the fish continues to glide using its own momentum. As you can see in the slide, the fish sinks slightly. Eventually, the tail fin starts moving again and the pectoral fins help the fish to rise again. Mr. Takagi from Kindai University has demonstrated that the consumption energy can be lowered to about 88% using this gliding style.

Our college has succeeded in making our MaguRobot move straight at a speed of 1.5 metres per second. Our next challenge will be to find the right speed and timing for the tuna's gliding style.

Miss Yamashita will now talk about our roles in the project and possible future advantages of the MaguRobot.

After deciding to present about the MaguRobot, our group interviewed the teacher in charge of the project, visited the Kindai tuna farm and began helping the research team.

We arranged two thirty-minute interviews and recorded them with a digital voice recorder. After each interview, we listened to the answers for major ideas and for areas that we wanted to ask more questions about. Mr. Hashiji spoke about what we learned in his section.

At the Kindai tuna breeding farm, we learned the reasons for breeding the tuna that Mr. Takekabu explained in his section.

As you can see in the video, we joined the MaguRobot team. I helped the experiments to test the speed, resistance and buoyancy. Mr. Hashiji helped to adjust the angle of the tail. Mr. Takekabu helped with the 3D design.

We chose this topic because we were all inspired by the idea of a robot moving through the water. This MaguRobot is not finished yet, but working towards completing this helps us to dream about the future.

Mr. Takekabu mentioned that Tuna are unique because they constantly swim and Mr. Hashiji explained how the tuna avoid becoming tired through using a gliding style. The development of a MaguRobot that copies the tuna's gliding style could one day lead to more energy-efficient submarine vessels.

The global supply of food is decreasing in relation to world demand. The supply of land for crops and food-stock animals is limited and could even be decreasing due to the change to biofuel crops. The ocean is a good option. But fish breeding farms such as the one created by Kindai will only partly solve the problem. We also need to understand the migration patterns of open-water fish to avoid over-fishing.

We hope one day that our MaguRobot will go to sea, swim like real tuna and gather detailed migration information which can lead to controlled fishing in a way that does not decrease tuna stocks.