YOUTH

Mechanical mastermind

Guo Tingting has been developing his passion for robotics and invention, and today his creations are helping preserve life, **Li Yingxue** reports.

While doctors and nurses were fighting to save lives on the front line of the COVID-19 battle in China's hardest-hit city, they had an unconventional ally. A robot was tasked with disinfecting one of the crisis-hit hospitals in Wuhan, capital of Central China's Hubei province, in February.

It was designed, built and donated by Guo Tingting's team who wanted to play their part and help the front-line medical staff in Wuhan. From drawing board to debugging the programs and running scenario applications, the team took about two weeks to finish developing the robot.

Guo, 30, is a doctoral student in harbor, coastal and offshore engineering at the College of Engineering, Ocean University of China, in Qingdao, East China's Shandong province.

He is also a robotics entrepreneur.

"Usually the equipment a robot carries is placed at the center of gravity of the mobility assembly so that movement is steady, but for disinfection, a mist sprayer must be placed on the front and the disinfectant carrier on the back," Guo says.

The sloshing of the disinfectant in the carrier when moving will severely disturb the stability of the robot's movement. After repeatedly testing and updating, Guo and his team finally solved the problem.

They received feedback about the disinfection robot and are continuing to develop new versions to make it more efficient and convenient.

From scientific research in the lab to turning his ideas into products, Guo always seeks to address life's problems and provide more convenience.

During his childhood in Qufu, Shandong province, Guo enjoyed taking apart home appliances, such as clocks and radios.

He would regularly make a mess of reassembling them, often finding some components left over, before finally managing to put them together again properly.

Nobody knew then that he would grow up to become an expert on machines, and after he enrolled into college, whenever he returned home during vacations, his neighbors would ask him to fix their electronics.

From top: The "firefighter" robots created by Guo Tingting and his team rehearse with the local fire brigade at an oil depot in Yantai, Shandong province, in 2019. Guo introduces a robot to the judges at a startup contest for college students in 2014. **Above left:** Guo displays a national youth technology innovation award. PHOTOS PROVIDED TO CHINA DAILY

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> **Guo Tingting,** 30, doctoral student, Ocean University of China

A career takes flight

Guo majored in electrical engineering and automation at Qingdao Agricultural University in 2010. He didn't have a clear direction until he took part in a water rocket competition in his freshman year at college. A water rocket is a ballistic model, typically made from plastic soda bottles, that uses water as its propellant.

The competition Guo entered scored the rockets based on the height they achieved and "hang time", or how long they stayed airborne.

Guo studied the previous results of the competition and noticed that under the rules a breakthrough in height would be difficult, so he turned his focus on the duration it stayed there.

He added a parachute to the top of his design to prolong the landing time. The next challenge was to decide when and how to open the parachute. After several trials, he put a small firecracker on the rocket which would open the parachute and blow away the nose cone at the same time.

Guo used a remote controller to ignite the firecracker. The battery to charge the remote-control equipment was taken from his phone.

With this level of diligence and application, it's perhaps no surprise that his water rocket won first prize and he also snagged the award for creativity.

In 2011, Guo discovered his passion in the laboratory, where he had access to more than enough tools and pieces of specialist equipment to realize his creative ideas.

Since then, that's where he has spent most of his time and the effort has brought him many awards, scholarships, published papers and patents, including a national youth technology innovation award in 2014.

Guo is observant, and most of his inventions are inspired by the needs of everyday life.

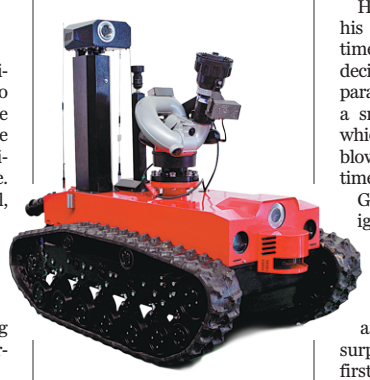
He visited farmland around Shouguang in Shandong province as his social practice during his winter vacation in 2012. He noticed that the farmers expended a lot effort manually opening and closing the ceiling coverings of their greenhouses.

So, upon returning to his beloved lab, he designed an automatic control system for the greenhouse coverings.

"The farmers can set the device to open the greenhouses' ceilings to soak up the sunshine and to close them when it rains," Guo says.

He developed an alarm system to detect pear scab: Sensors can detect the temperature and humidity of the air and soil and can predict if conditions are ripe for the disease to thrive and notify the farmers.

He also invented a robot that can spray pesticides, before refining the design to be more precise with its spray and have less of an effect on the surrounding soil.



A fire detection robot made by Guo and his team

Conveniently designed

"Whether invention or perfection, the importance is to make one item or one machine that offers greater convenience," he says.

Guo also invented a "picking" robot to harvest tomatoes or strawberries. Two cameras on the robot serve as its eyes, helping the robot to "see" the fruit, while a chip inside the machine acts as the "brain".

When the cameras collect the image and transfer it to the "brain", the chip will analyze the image, calculate the location and initiate the picking procedure.

A mechanical arm equipped with a pair of scissors will extend toward the fruit and gently cut it from the branch.

Li Lin, a graduate student in the same lab with Guo at the Ocean University of China, has known him since 2014 when Guo was invited to give a speech as a university alumnus at the opening ceremony of her bachelor's study.

"I still remember his advice was: Go to the lab as soon as possible, which I did," Li recalls.

"Working in a lab offers access to cutting-edge technology and allows us to practice our operational and problem-solving abilities, as what we do in the lab has sometimes not been tried before."

Lin always sees Guo in the lab. "Whether weekdays or weekends, he is there without fail and he often arrives earlier than us," she says.

Guo founded a startup with two friends when he obtained his bachelor's degree. They were focusing on making laboratory equipment.

After spending about half a year developing his product, he found his ability to market it somewhat lacking. As a fresh graduate, a dearth of experience in managing a company swayed his decision to dissolve the business.

However, he never gave up on the idea of being an entrepreneur. In 2015, when he enrolled in the Ocean University of China for his master's study, an investor who learned about his "picking" robot offered him an opportunity to start a business again.

He said yes, on the condition that, this time, all of his focus, research and invention would be on the robot itself, while everyday management and marketing affairs would be delegated to others.

His current project is developing a robot that can work in high-risk environments.

"An invention in the college lab is more of an academic endeavor, while commercial design and development requires a mature product for the market," Guo says.

The latest fruit of Guo's labor is a "firefighter" robot that can enter the scene of a fire to investigate, put out the fire and carry trapped people out.

"The robot can endure a high-risk environment, such as being surrounded by flammable gas and it can climb stairs and slopes at gradients over 30 degrees," he says.

The robot has already been put through its paces by some fire brigades and Guo is currently updating the robot's functionality to detect fires at the scene of an emergency more comprehensively and extinguish the blaze more efficiently.

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Online video courses a boon for teachers

By **HE QI** in Shanghai
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Having proved to be a useful tool during the pandemic, online courses will continue to be provided to students in conjunction with on-campus education, the Shanghai Education Commission announced on Aug 31.

These courses have already been made available for the 2020 autumn semester for elementary and middle schools in Shanghai, which reopened on Sept 1.

Among those tasked with providing online courses is the Xuhui Institute of Education Shanghai, which will deliver senior middle school courses in Chinese and information technology along with elementary school courses in natural science this semester.

"The recording of the online lessons started when the pandemic broke out and it has continued until today. These online courses can act as a backup teaching resource during an epidemic and can also be used as supplement for regular teaching," says Li Hong, deputy director of Xuhui Institute of Education Shanghai, a teachers' vocational school in Xuhui district under the local education bureau.

"These courses are also a good resource for our teachers' professional development and can be used as a case study in teacher training and classroom teaching research," she adds.

More than 5,000 high-quality online video courses covering all basic subjects in schools were produced by the end of the spring semester, benefiting more than 1.4 million students from Grades 1 through 12.

According to Li, recording lessons for a course is not as simple as it seems. Each video, lasting only about 20 minutes, requires three teams of people and days to complete.

"The teaching team is responsible for ensuring the quality of the content, the technical team is responsible for recording, postproduction, delivery audit and uploading, and the logistics support team ensures the safety of each team and is responsible for epidemic prevention and control," she explains.

"For example, our senior middle school Chinese teaching team has selected 22 teachers this semester to be involved in the recording. A group of teaching researchers from the city and district levels are also involved in helping prepare, record, and check the lessons."

Li says that the institute recorded 566 lessons last semester, accounting for about one-tenth of the total in the city. This semester, they will record around 300 lessons.

"The biggest difference with the online course is that it lacks any interaction between teachers and students. Since teachers cannot see the students, they have to design different methods to achieve that interaction in the various disciplines," says Yuan Wenzheng, director of the Information Resource Center at Xuhui Institute of Education Shanghai.

"For example, our information technology course features three 'virtual students' who can answer questions during the class. These avatars will also accompany students throughout the entire learning process," Yuan adds.

The introduction of the online courses has not just benefited students, but also teachers, says Fan Biao, a researcher specializing in Chinese classes for the Shanghai Education Commission.

Jiang Li, a Chinese teacher from Shanghai No 3 Girls Middle School, has her lesson recorded by a colleague in a studio in Shanghai. GAO ERQIANG / CHINA DAILY

"Many teachers in other provinces said that such recording work promotes fairness in teaching because we can now share high-quality teaching resources. Video courses are indeed a great lesson preparation resource for teachers in many schools," says Fan.