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Portal Mechanical Arm: a New Tool for Bridge Inspections

There is now an easy to use tool for bridge inspections! The Ministry of Transportation and Communication's Institute of Transportation (IOT) has collaborated with Tatung University to develop a portable and light-weight mechanical arm device for use in examining river-crossing bridges, allowing construction personnel to easily and safety inspect bridges that are prone to erosion from moisture and difficult to inspect in person.

Bridge safety is directly related to travel safety and requires regular maintenance to stay functional. There are nearly 30,000 bridges in Taiwan; during inspection, most maintenance personnel have to climb up and down bridge structures, which is not only dangerous but also time-consuming. While tall bridges and river crossing bridges can be inspected by the use of bridge inspection vehicles, scissor lifts or unmanned aerial vehicles, bridges that are located in low terrain areas or tidal rivers are often difficult to inspect, due to the reduced spacing between the surface of the water and bridge piers. Additionally, the depths and flow velocity of these regions are often difficult to determine, making it particularly challenging for personnel and equipment to safely access and inspect the bridges. The main bridge structures in these locations also are constantly exposed to moisture and air, further increasing the safety risks of inspections. Resolving these issues has become a challenge to bridge maintenance units and related personnel.

To help address these challenges, the IOT has worked with research teams from Tatung University in 2017 to design a portable and light-weight mechanical arm for use in difficult bridge inspections. Combining talents and expertise in mechanical engineering and design, the team has incorporated retractable arms, remote motors, active light source, smartphones and videogame joysticks into a device capable of remote extension and can be installed on the roof of most passenger cars or small vehicles. The device has been tested to stably extend to the bottom of the bridge and take pictures for real-time transmission, allowing bridge inspection crews to observe the conditions of the bottom on the bridge from a safe distance atop the bridge, cutting down on the time needed to climb down bridge piers or approach with boats and waterproof gears.

Aside from bridge inspections, the mechanical arm can also be used for inspecting the sub-grade of the retaining wall and safety status of the bottom of harbor structures,

as well as other potential applications. The IOT will continue to improve its scope of application, stability and operational efficiency, and to advance the design to better serve the MOTC in other types of transportation inspection.



Figure 1. Portable bridge inspection mechanical arm in closed position



Figure 2. Portable bridge inspection mechanical arm in used



Figure 3. Picture of the bottom of the bridge taken with the mechanical arm