Application of IT technology to Structural Engineering

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Structural engineering is a classical engineering field as a part of physics. Many researchers have a hard time to get research funds even if structural engineering is a very important for the safety of infrastructure. Somehow IT technology could be collaborated to the classical engineering field to survive. Image processing has been widely applied in many fields. It should be noticed that image processing technic could be incorporated in structural engineering for measurement of deformation of structure.

As a researcher for classical structural engineering, our research lab have been working on several topics in civil engineering research collaborated with image processing. The topics are as followings: 1) real time static displacement monitoring of structure during the lab test. The displacement data after image processing obtained from CCD camera pictures was compared with that of LVDT or laser displacement sensor. This system was used for the fire collapse test in which LVDT could not be used due to the fire heat; 2) As an application, a structural health monitoring system with waring sound at large deformation was also made; 3) Dynamic displacement of structure was also measured using image processing. There are still the limit for the general use and more improvement is required to be a more reliable system.

Another topics for civil engineering collaborating IT technology is tunnel scanning. The maintenance of infrastructure is a big issue for the safety of people. Tunnel is primary scanned by taking pictures while the camera on car is moving slowly to minimize the traffic obstacle during night. The basic data of tunnel monitoring is the crack patterns and crack width. KISC (Korea Infrastructure Safety Corporation) require the pictures with cracks width up to 0.1mm on concrete wall of tunnel, which is very difficult to take a picture while car moving. The basic idea taking picture is that camera is moving backward on linear mortar with the same speed of car to take clear pictures. Arduino or RaspberryPi could be used to control the linear mortar and camera. The moving speed of linear is controlled by the same speed ground speed of car. Output of speed of car is obtained by Ardunio board and used for the input of speed of linear mortar. The camera shutter is also controlled by Ardunio board at the same backward speed of car, which result in the stopped image.

There are so many application using basic IT technology and image processing. The original pictur e with cracks could be processed automatically to digital image with crack only, which could be as big data. The final warning or repair plan is made by AI judgement.