Application of IoTs Based Multi-Level Air Quality Sensing for Advancing Environmental Monitoring in Pingtung County

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Abstract : Pingtung County is located in the southernmost region of Taiwan. During the winter season, pollutants due to insufficient dispersion caused by the downwash of the northeast monsoon lead to the poor air quality of the County. Through the implementation of various control methods, including the application of permits of air pollution, fee collection of air pollution, control oil fume of catering sectors, smoke detection of diesel vehicles, regular inspection of locomotives, and subsidies for low-polluting vehicles. Moreover, to further mitigate the air pollution, additional alternative controlling strategies are also carried out, such as construction site control, prohibition of open-air agricultural waste burning, improvement of river dust, and strengthening of road cleaning operations. The combined efforts have significantly reduced air pollutants in the County. However, in order to effectively and promptly monitor the ambient air quality, the County has subsequently deployed micro-sensors, with a total of 400 IoTs (Internet of Things) micro-sensors for PM2.5 and VOC detection and 3 air quality monitoring stations of the Environmental Protection Agency (EPA), covering 33 townships of the County. The covered area has more than 1,300 listed factories and 5 major industrial parks; thus forming an Internet of Things (IoTs) based multi-level air quality monitoring system. The results demonstrate that the IoTs multi-level air quality sensors combined with other strategies such as "sand and gravel dredging area technology monitoring", "banning open burning", "intelligent management of construction sites", "real-time notification of activation response", "nighthawk early bird plan with micro-sensors", "unmanned aircraft (UAV) combined with land and air to monitor abnormal emissions", and "animal husbandry odour detection service" etc. The satisfaction improvement rate of air control, through a 2021 public survey, reached a high percentage of 81%, an increase of 46% as compared to 2018. For the air pollution complaints for the whole year of 2021, the total number was 4213 in contrast to 7088 in 2020, a reduction rate reached almost 41%. Because of the spatial-temporal features of the air quality monitoring IoTs system by the application of microsensors, the system does assist and strengthen the effectiveness of the existing air quality monitoring network of the EPA and can provide real-time control of the air quality. Therefore, the hot spots and potential pollution locations can be timely determined for law enforcement. Hence, remarkable results were obtained for the two years. That is, both reduction of public complaints and better air quality are successfully achieved through the implementation of the present IoTs system for real-time air quality monitoring throughout Pingtung County.