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Application of Internet of Things in Real-Time Urban Flood Risk Management

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Today, IoT devices are becoming integral to the real-time management of flooding through the implementation of flood early warning systems [1]. With the assistance of advancements in remote sensing, the expanding band board of the internet, and satellite technology, numerous local sensors, such as ultrasonic water level detectors, flowmeters, wind speed and direction meters, and soil moisture sensors, have been introduced to provide essential real-time data for flood early warning systems [2]. Importantly, the application of IoT in urban flood risk management extends beyond the establishment of early warning systems, encompassing a comprehensive stakeholder engagement throughout all stages and applicable to a wide range of scenarios [3].

Although this concept is currently undergoing testing worldwide, there is still a notable gap in the existence of a comprehensive framework that classifies and explains the roles of all sensors [4]. This research aims to fill that gap. The identification of five pivotal stages in flood risk management - prevention, mitigation, preparedness, response, and recovery - emphasizes the comprehensive nature of the challenge. In the prevention stage, IoT sensors are strategically deployed to monitor meteorological conditions and hydraulics information, providing real-time data essential for predicting potential flooding. Integrating IoT into infrastructure, such as smart dams or levees, enables continuous monitoring and adjustment to prevent breaches or overflows. In the mitigation stage, IoT-controlled devices, like smart pumps or floodgates, can be autonomously activated based on real-time data, aiding in managing water levels and mitigating flood impacts. Furthermore, IoT devices, by collecting data on evolving conditions, enable predictive analytics for assessing potential flood risks. This empowers authorities to proactively devise and implement mitigation measures.

In the preparedness phase, sensors trigger automated alerts and notifications to authorities and the affected population, facilitating timely evacuation and preparedness measures. During the response stage, IoT facilitates real-time monitoring of flood events, empowering emergency responders to make informed decisions and allocate resources judiciously. Concurrently, IoT supports communication during emergencies, ensuring seamless connectivity among response

teams, affected individuals, and pertinent authorities for coordinated efforts. In the recovery phase of flood risk management, IoT sensors prove invaluable in assessing the extent of damage in affected areas, providing indispensable data for recovery planning. Moreover, IoT applications, such as monitoring air and water quality, contribute to ensuring a safe environment during the recovery period.

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