Low-Cost and Easily Accessible Flash Flood Detection System

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Flash flooding is one of the deadliest weather events, taking over 5,000 lives each year. Traditional flash flood detection systems are often inadequate: they are expensive, require frequent maintenance, and are inaccessible in many areas and situations. Even modern systems have drawbacks that limit access to this life-saving technology. Another major issue with most existing systems is their lack of versatility. Flash flooding occurs in both wet areas, like rivers, and dry areas, like slot canyons, yet most detection systems only work in one environment. A low-cost, versatile, and accessible flash flood detection system could help solve this problem and save thousands of lives. When building the second iteration of my flash flood detection system, I first soldered and connected my ESP32s and Seeed Grove water sensors. I then programmed each microcontroller to detect whether the sensor read “Wet” or “Dry” and send this data over LoRa to a computer with a USB LoRa dongle every two seconds. A Python program converts the data to JSON so Node-RED can process it. Node-RED then compares the sensor readings and timestamps, and if multiple sensors detect “Wet” within a two-minute window, an alert is sent. Testing of the final prototype showed the design to be highly effective. It never produced an inaccurate alert. Alerts are only triggered when multiple sensors exceed the threshold, preventing hardware failures from causing false alarms. Once multiple sensors detect water, the alert is sent in under 8.5 seconds, much faster than existing systems. Because of its versatility, the system can monitor flood-prone rivers or help keep campers safe near slot canyons, giving it the potential to save lives.

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