Doppler Radar Flash Flood Detector

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A Doppler Radar System is presented which is suitable for reporting sudden changes of streamflow. The system includes a Doppler radar transceiver and uses Digital Signal Processing to detect water velocity changes which are reported via radio or Internet of Things (IoT). The Doppler signature is compared with a theoretical model which is used to determine water velocity, turbulent flow, while rejecting animal movement. The theoretical signature is created by scanning a virtual river and determining the distance, azimuth and altitude angles to the radar transceiver. The Doppler frequency and the signal power are determined and this scanned data is combined to create the Doppler signature or spectrum of the flowing water. A normalized random number generator is used to simulate turbulence naturally found in water flow. A microprocessor samples the Doppler signal and performs a Fast Fourier Transform (FFT) which converts the time domain data to an audio frequency spectrum. The spectrum contains predictable background noise which is suppressed by subtracting background from the observed data which can then be used for signal analysis. The Doppler spectrum analysis includes detection of animal movement, velocity change and turbulence. An increase in surface water velocity will trigger an email or text message via IoT or radio. Real life radar signatures of flowing water were collected from streams of different flow rates. Additionally the signatures of vegetation and animal movement were collected. These signatures were analyzed and used to create the signature analysis algorithm. The system will be successful in giving early warning of flash floods by detecting sudden increases in water velocity, while rejecting false alarms created by animal movement.

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