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## An Imaging Capable, Low Cost IoT Node for River Flood Phenomena

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Among all natural disasters, river floods are becoming increasingly frequent. They present high risk and their impact can be fairly destructive and of strong economic, health, and social importance. Key tools to avoid their catastrophic results are the Early Warning Systems (EWS). An EWS usually monitors various physical quantities through a specific hardware, and produce data which after certain processing can detect and estimate the level of the risk.

In the current work we present the concept, the design, the application, and some preliminary data regarding a low cost imaging node, part of an EWS aimed for river floods. This EWS consists of various sensing nodes which are mainly equipped with water presence detectors, water level meters, water temperature sensors, along with the necessary networking capability. The novelty of this new node design is that it utilizes a VGA resolution camera which captures still images of a view of interest. The latter can be for example an implementation prone to defects in case of flood, such as a river basin level road crossing, or a bridge. The images can also provide constant monitoring of the river basin state, i.e. to detect the presence of any unwanted objects (waste or other natural & artificial bring materials). Through image processing the images can even provide some coarse data, i.e. water level measurements by utilizing vertical stripped rods within the field of view of the camera.

The ability to have a camera usually counteracts the IoT characteristics of an electronic device. Nevertheless, in this design the IoT character of the node was not constrained. The nodes have extended power autonomy (several months via Li-Ion battery, optionally solar rechargeable), present a small size, each node is network independent using GSM and LoRaWAN technology. The data usage is minimized by uploading only 2 QVGA images per day in normal operation (can be increased to a maximum of 48 VGA images per day, if required). In case of risk detection the node also supports the actuation of a local warning sign.