Loughborough University

Community Slope SAFE

Landslide Early Warning System

Need

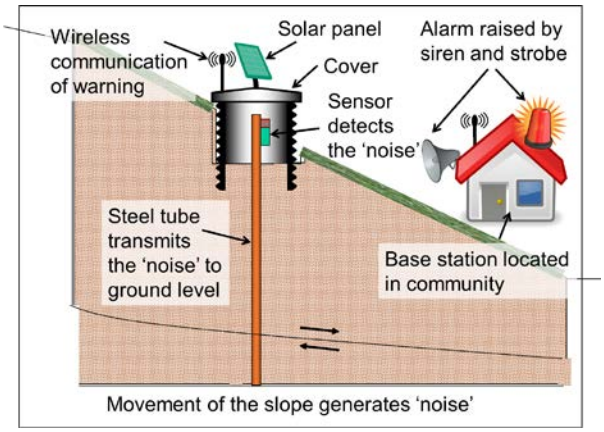
- Rainfall induced landslides have resulted in 30,000+ fatalities globally in the last 10 years
- Most of these fatalities occurred in Asia
- Early warning of these slope failures could have significantly reduced the humanitarian and economic losses
- The United Nations has called for development of early warning systems
- Existing instrumentation and monitoring techniques are prohibitively expensive
- There is an urgent need for a low-cost landslide early warning system operated by communities

What Slope SAFE can do

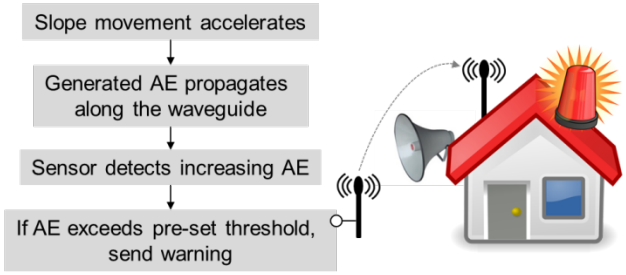
- It monitors slope displacement rates continuously
- It can detect acceleration of a slope (i.e. failure)
- It is able to inform the community that a slope failure is likely to occur
- The sensor is easy to install and is solar powered
- The sensor is located at ground level for ease of maintenance and reuse
- The system can be operated by the community
- Sensor costs are significantly lower than currently available systems

How it works

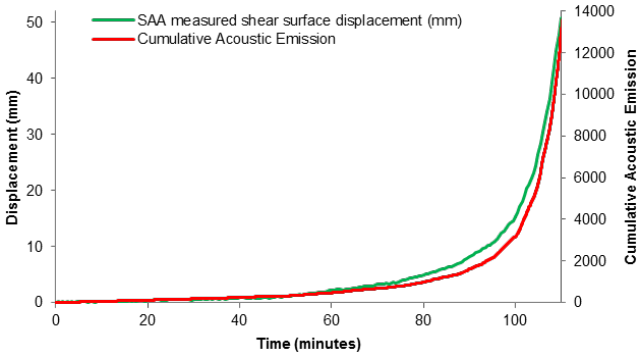
- When soil deforms it generates 'noise'
- The amount of 'noise' is proportional to the rate of slope movement (increasing noise means the slope displacements are accelerating)
- A steel tube is driven into the slope to transmit 'noise' from moving soil to the sensor attached to the tube at the surface and enclosed in a cover
- High frequency 'noise' called Acoustic Emission (AE) is measured and analysed and this removes background interference and stops false alarms
- AE is monitored continuously and if a pre-set threshold is exceeded a warning is transmitted to a base station located in the community
- Automatic health checks provide confidence the system is working
- The base station is used to trigger a siren and a strobe light to warn the community who can then put a pre-determined response plan into action



A waveguide installed through a slope with a sensor that communicates warnings to the community



Operation of the Slope SAFE monitoring system



Comparison of Slope SAFE system (red) with an expensive inclinometer alternative (green): Both are able to detect increasing rates of displacement

Further information can be obtained by contacting **Professor Neil Dixon**, Email: n.dixon@lboro.ac.uk