

Lessons Learned on Future Application of Tepmachcha sensor units



TEPMACHA in Sangker District, Battambang province.

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- Despite the resilient nature of the Tepmachcha sensor units, the harsh conditions that they experience in the field can cause faults. Previously, PIN would have to travel back to the sensor site to fix any problem that may arise, which could involve days of fieldwork and in some cases the issue required a simple solution (e.g. moving it to a location with better sunlight, removing obstructions, etc.). **In January 2020, PIN's DM team refined the sensor installation SOP, incorporating a detailed checklist to reduce the likelihood of easily preventable problems from occurring after they had left the site. Additionally, PIN now request the attendance of the PCDM, to ensure that they are fully aware of the sensor location, as well as requesting that they designate a local focal point. This has been extremely effective in reducing the number of maintenance trips, as the focal point can send photos to help PIN identify the issue. Furthermore, PIN created a simple sensor maintenance form, with a series of questions to support the PCDM in order to troubleshoot the issue.**
- Damage and theft have also proven to be a prominent issue, as local people often believe that they can sell the sensors parts to make money. Despite the use of complex locks to increase the security of the sensors, attempts are still made to steal the parts using heavy duty equipment. **The best way to prevent the problem is to encourage participation from the local authorities (Commune & Village Chiefs) when installing the sensors, as well as educating the community to increase awareness and understanding of the value that the sensor provides to local people.**
- The river warning levels are currently determined through discussions with local disaster management authorities. In urban areas these are often well defined and accurate. However, in rural locations they are mostly based on local knowledge and experience of historical events, which can sometimes lead to unreliable warning thresholds. **In these cases it would be better to use scientific methods to determine these river levels, such as consulting or creating a Digital Elevation Model, possibly through the use of drone RTK GNSS technology.**
- In March 2020, PIN Cambodia experienced a problem that was causing newly built sensors to fail to send recorded data, despite having seemingly identical parts to previously functional units. After a long troubleshooting process, it was established that the problem was caused by a firmware change inside the new generation one of the sensor parts. This required PIN Cambodia to sign a contract with a local electronics company (ArrowDot) who were able to reprogramme the sensors and overcome the problem. This solution led to PINs desire for ArrowDot to be more heavily involved in the sensors for EWS1294, initially through technical support and now as the producer of the units. **The involvement of a local service provider will ensure greater sustainability of the system, especially after PIN has completed the full handover to the government.**



SENSOR MAINTAINING in Kamrieng District, Battambang province.

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- Previously the sensors were programmed to send data at 15-minutes intervals and to go into a 'sleep state' in between data sharing phases. This was initially to ensure that the batteries sustained enough power to continually operate. Unfortunately, during the reprogramming to solve the problem in March 2020, the software engineers were unable to reprogram them at these set intervals and instead the data is now being sent roughly every 3 minutes. In the long-term this is unsustainable, as the system is now recording and storing 5 times as much data as it was before, overloading the online storage system and slowing down the data visualisation on the dashboard. This has led to our Senior IT Consultant having to eliminate vast amounts of data on multiple occasions, as a quick fix. Additionally, during periods of limited sunlight the battery life of the sensors is now reduced, as they are 'active' for a longer period of time. PIN plans to fix this problem, following the migration of the EWS1294 server to the local service provider (ArrowDot), as they will have more control over the internal programming after this change. **Hence, if a similar sensor model is to be adopted, it would be recommended to minimise (within reason) how regularly data is recorded and shared, whilst considering the implications on battery life during times of reduced sunlight.**
- Occasionally the sensors record unusual fluctuating measurements, despite regular river conditions and the unit appearing to still be fixed in the originally installed position. After closer inspection, this discrepancy between the measured and observed data can often be attributed to the formation of a spider web inside the sonar sensor part of the unit. In the short term, this can be fixed by carefully removing the spider web, however PIN Cambodia are currently in discussion with the local sensor service provider to establish a long-term solution, possibly by coating the sonar part with a protective lubricant. **Disruptions like this have demonstrated the need for focal points who are located close to each sensor. This enables minor issues to be solved quickly, without having to send a team to maintain them or replace each unit.**
- The sensors require internet connectivity and generally Cambodia has good internet coverage, however this is not the case in some rural locations. **Hence, PIN's DM team always check the strength of the cell signal using a phone with the same sim-card provider at the provisional installation site.**
- In December 2020, around half of the active sensors turned inactive within a few days. After a long troubleshooting process, PIN established that this was due to an internet usage limit placed on the sim-card inside the sensors. **This problem was mitigated by contacting the telecommunications company and removing the usage limit across all sim-cards. Note that this issue was caused due to the increase in the rate of data sharing during the previously mentioned reprogramming of the sensors, further demonstrating the need to carefully consider the data sharing interval.**
- The EWS1294 sonar sensors have a range of 10m. Hence, the warning levels need to fall well within that range, to ensure that there is enough time to identify the increasing river water level. This was not the case for a previously installed sensor in Ratanakiri, where the unit had been installed in the middle of a high bridge. **The sensor was eventually moved towards one side of the bridge where it could instead record the increasing water levels on the sloped riverbank.**
- Despite strong efforts to reduce the likelihood of faults, the EWS1294 sensor network still experiences numerous sensors turning inactive, which can sometimes take weeks to repair due to PIN's limited fieldwork availability and long travel times. **PIN Cambodia, therefore, aims to train NCDM and then the PCDMs on how to fully replace the failing sensor units with new devices. The ideal scenario would be for spare sensors to be on standby at each of the PCDM buildings (in each province) and for them to replace the faulty units as soon as they identify that they have gone offline without any support from PIN. This will require considerable capacity building and TOTs to NCDM.**