back to EnviroSensing Cluster main page

Contents

Planning Process

Throughout this document it is emphasized that the initial planning is extremely important, as well as the inclusion of expertise in many different areas, scientific and technical, in the early discussion and planning phase before a proposal is written. If all fields of expertise are not consulted/incorporated prior to making location, budget, deployment, and timeline decisions, critical interdependencies are likely to be overlooked (e.g. power requirements, topographic constraints, construction tools required, etc.).

Although, the discussion here is geared toward maintaining sensor networks over an extended period of time, planning is equally important for short term installations. Experience has shown that many short term installations have become long term even if that was not intended initially and many small installations have been expanded to cover more area or measure more parameters.

Clearly, sensor network deployments are driven by ambitious science questions. However, good planning can help anticipate limitations and prevent time issues from becoming the driving force. Focusing on the overarching imperatives of good design, proper placement, organized data flow, and a well trained and motivated team, will result in successful implementation and continued maintenance. Compromised installations diminish the impacts of the original study, can drain operating budgets unnecessarily, and inhibit leveraging of the science for future work and funding.

Implementation Feasibility

During the experiment or project design phase, defining the primary measurement objective is the first step to planning an observation site and platform. Answering these general questions is helpful before addressing specific technical issues:

- Where is the geographic area of interest?
- What are the measurements of interest?
- What is the desired accuracy and frequency of measurement?
- How critical are the sensor measurements? Can data gaps be tolerated? Is sensor redundancy necessary?
- What type of experimental manipulation is desired (if any)?
- What types of localized topography are likely to yield “representative” measurements at the time frequency of interest?
- What is the total funding amount for personnel, travel, tools/equipment, fees, and science instruments?
- What is the expected scope/lifetime of the deployment? Will it be expanded in the future? Consider scaling possibility (more sites, more sensors) even if it is not the immediate goal.
- Evaluate commercial turnkey installations vs. systems developed from commercial or open source components. Considerations: cost, skills, maintenance, longevity of the company providing the whole system or each component, functionality, interoperability, access to continued support.

Assembling the Team

Several very different areas of expertise are required to successfully plan, install, and maintain sensing systems. Some of these roles/skill sets can certainly be provided by a single individual or individuals.

Roles within a team establishing and maintaining an environmental sensor network:

- **Scientist** - determines the type of data and sampling frequency needed to answer the scientific questions within budget limitations.
- **Sensor system expert** - knows the types of sensors and platforms, their installation and programming needed to answer scientific questions. Is familiar with specific climate and terrain issues and QA/QC approaches in the field.
- **Field logistics expert** (for major site construction) - familiarity with transport, construction, weather, tools, and supplies for construction
- **Field construction and fabrication expert** - understands concrete, metal structure, tower design, fencing, underwater anchors, floating devices, load estimates
- **Field workers/assistants** - many people are needed for remote construction tasks, sensor wiring, initial site setup, cable management
- **Field technician** - familiar with maintenance tasks including minor repairs, maintaining a calibration schedule, other regular sensor maintenance tasks. Field technicians need to have a good understanding of the science application and the end user, they need to be comfortable with technology, and applying knowledge from one area to another, have creative problem solving and critical thinking skills and pay attention to detail. They should have basic electrical and mechanical knowledge (e.g., multimeter use, basic equipment installation, repair and programming). Depending on site conditions they also need to be certified in tower/rock/tree climbing, boat handling, SCUBA diving, respective safety training, and enjoy skiing, hiking, off-road driving etc. plus need to be skilled in GPS orienteering, navigation, and basic map making.
- **Communications/data transport expert / Licensed Commercial radio operator (ideal, but not required)** - needs to be familiar with moving digital data over wired or wireless networks from remote points to project servers and should have basic knowledge of radio communication (e.g., technician-level amateur radio license, basic antenna theory, IP networking)
- **Network administrator / System administrator** - is responsible for network architecture, redundancy of systems from data center to field sites, backup, data security
- **Software developer** - skills in preferred programming language
- **Data manager** - needs to be familiar with means of documenting procedures for maintaining communication between all roles involved, specifically, means for documenting field events and their ramification for the data quality. Needs to know approaches/software for managing high frequency streaming data, standard QA/QC routines for such data, approaches to documenting data provenance and data archiving (space requirements, backup, storage of different Q/C levels) and have database/software package programming/configuration expertise
- **Data technician** - needs to be thorough and reliable during tasks like ‘eye on’ quality control, manual data entry etc.

Overview of Chapters

The following chapters contained in this guide are structured to provide a general overview of the specific subject, an introduction to methods used, and a list of best practice recommendations based on the previous discussions. Case studies provide specific examples of implementations at certain sites.

- **Sensor Site and Platform Selection** considers environmental issues, site accessibility, system specifications, site layout, and common points of failure.
- **Data Acquisition and Transmission** is concerned with the acquisition of sensor data from the field, while ensuring the integrity of those data. Also, remote control of the system.
- **Sensor Management Tracking and Documentation** outlines the importance of communication between field and data management personnel as field events may alter the data streams and need to be documented.
- **Streaming Data Management Middleware** discusses software features for managing streaming sensor data.
- **Sensor Data Quality** discusses different ways sensor data may be compromised, how to automatically control for it in the data stream..
- **Sensor Data Archiving** introduces different approaches and repositories for archiving and publishing data sets of sensor data.