Terms of Reference

Consulting an expert organization/ firm for the Development of National Platform for Integration and Dissemination of Air Quality Data for Sri Lanka. (A software system capable of integration, data acquisition, quality control, analysis and storage)

Introduction:

Central Environmental Authority responsible for monitoring and regulating air quality within Sri Lanka. We are seeking a qualified and experienced consultant to develop a comprehensive software & hardware solution that will amalgamate data from three air quality monitoring stations (Organizations) and other relevant sources. The software will be used to collect & store the data and do calculations & analysis to generate detailed & summarized reports to aid in environmental decision-making and policy formulation& public awareness.

Background:

Air quality monitoring is crucial in assessing the impact of various activities on the environment and public health. The existing air quality monitoring stations gather vast amounts of data, but the lack of a unified and efficient system hampers data analysis and reporting. There is a need to deploy a new software & hardware solution which will serve as a valuable tool to centralize, analyze, present, and disseminate the data in a user-friendly manner for informed decision-making while providing awareness for the public.

Objectives:

The primary objectives of the project are as follows:

a) Develop a software system capable of integration, collecting and aggregating data from three air quality monitoring stations and other relevant potential sources (data storage servers or units/ internet) Create an efficient - software systems capable of quality control analysis, storage module to process and interpret the collected data effectively.

b) Generate comprehensive and user-friendly reports and dashboard to disseminate data to aid policymakers, researchers, and the public in understanding air quality trends and issues.

Scope of Work:

The consultant will be responsible for:

a) Conducting a thorough analysis of the existing air quality monitoring stations and data sources to determine data format compatibility and integration requirements.

b) Prepare detailed software requirements specification document.

c) Designing and developing a robust open-source software platform that can amalgamate data from diverse sources in real-time or at specified intervals.

d) Prepare system architecture and software design document.

e) Identify and provide specifications for the hardware and utility software requirements to deploy the data gathering and analysis system.

f) Implementing advanced data analysis algorithms to quality control, identify data patterns, long/ short term trends, and potential environmental concerns related to air quality.

g) Creating an intuitive dashboard to visualize data and key performance indicators (KPIs) for easy interpretation (including geographical mapping of data locations).

h) Generating customizable reports with visualizations and summary findings.

i) Developing an interactive &mobile responsive web application for the public use.

j) Developing an Application Programming Interface (API) for distributing data based on access privileges and customized data parameters for external users.

k) Ensuring data security and compliance with relevant privacy regulations during data handling and transmission (including role-based access control for the system).

l) Provide APIs to feed customizable data parameters into the data system from new sources on availability.

m) Conduct system verification and validation with test reports.

n) Provide user training for each user access privilege level.

o) Provide system warranty & maintenance for a 3-year period.

Deliverables:

The consultant is expected to provide the following deliverables:

a) Detailed SRS, Hardware specification with infrastructure (software, hardware & other) requirements and Design documentation.

b) Developed and tested software platform with test reports.

c) An interactive website which is mobile responsive, and a mobile app.

d) Population of past records of data from all three organizational digital data resources with respective to the period of coverage.

e) Customizable APIs for distributing and gathering data.

f) User manual and training programs for software operation and maintenance.

g) Sample reports and visualizations highlighting the software's capabilities.

Timeline:

The consultant shall submit a detailed project timeline along with their proposal. The project is expected to be completed within 2 months of the date of contract signing.

The proposed project time limit, milestones and payment schedule are given below.

Deliverables	Expected delivery date (weeks following signature of contract)	Payment
Deliverable 1: Detailed Software Requirement Specification (SRS) Document and the Software Design Document (Including Architectural Design) acceptable to the Procurement Entity. Detailed Hardware / Utility Software and infrastructure requirements for the proposed system (Preferred to have within the first week) Cloud server details (vCPU, vRAM, Storage, Bandwidth, Backup Frequency, etc.)	2nd Week	10%
Deliverable 2: Migration of data of the CEA stations from SDF data resources or CSV text data files and completion of periodic data population and station data display module on the web application with User privileges and authentication module.	4th Week	20%
Deliverable 3: Population of data from other two data resources from	5th Week	15%

two institutions and completion of software module for periodic data acquisition from those stations established through the institutional APIs and Station wise data display on the web application.		
Deliverable 4: Creation of customizable APIs for periodic data feed into relevant parameters from other similar data sources. Creation of customizable APIs with privileges for data exports into other institutions. Completion of Mobile app with basic display functionalities.	6th Week	10%
Deliverable 5: Completion of Reporting and Visualization module for identified trend analysis (including long-term and short-term trends of parameters) (maximum up to 30 such dynamic reporting formats). Completion of Training manuals and user training for all necessary privileges including training on maintenance. Compilation and submission of test reports (Including test cases, suites, test data, etc.) for all above modules with demonstrations.	7th Week	10%
Deliverable 6: User Acceptance Report (UAT) to satisfy the acceptance compliance of the system. Deployment of the system and live run of the system Project completion Report with suggestions for further improvement	8th Week	10%
System Maintenance Disbursement based on the maintenance agreement	1st year 2nd year 3rd year	05% 10% 10%

Organization & Logistics

- The assignment will commence immediately upon contract signing.

- The consultancy firm's team will consist of the following members: team leader (project manager), technical requirement analyst, database engineer, web, and mobile application developers/software engineers (3), software test lead, software security expert, system hardware engineer, and domain-specific data science expert or equivalent designations. The team's primary responsibility is to ensure effective communication and facilitate work with the CEA, relevant government agencies, stakeholders, and the advisory committee.

- The CEA (procuring entity) will assist in coordinating with stakeholders/agencies to provide necessary data access. However, the CEA will not provide any human resources, office space, office furniture, computer equipment, internet and telecommunication facilities, vehicles or transport services, or any other equipment or service required to fulfill the consultancy service.

- The company/firm and its consultants are responsible for covering their own travel, accommodation, and per diem expenses incurred while performing the service. The dates and venues for meetings will be determined in consultation with the CEA.

- The deliverables must be mutually satisfactory to both the CEA and the data source entities/organizations. It is recommended to submit some sub-deliverables before the given deadline to prevent unnecessary delays.

- The company/software firm must request CEA's participation in meetings or workshops at least 7 days in advance. The schedules for conducting workshops and meetings need to be agreed upon with the CEA.

Qualifications:

The ideal consultant should possess the following qualifications:

Consultancy Firm

The software consultancy firm shall at minimum demonstrate the following qualifications of the firm and team of experts to perform the required services.

Mandatory Requirements

- Scope of the consultancy firm as mentioned in the business registration/certificate of incorporation.
- Legal status and administrative setup.
- Minimum of 5 years of Proven experience in developing similar data management and analysis software.
- have a minimum of five completed project experience in software system development, implementation, and maintenance. Similar software development projects will be added qualification (Client reference should be submitted)
- Financial capacity and recent audited accounting reports of last consecutive three (03) years.

Other Requirements

- Expertise in open-source software environments and service-oriented architecture.
- Expertise in handling and integrating data from multiple sources (Experience working with air quality monitoring data, air quality model APIs, air sensor APIs, GIS tools, and other environmental databases is an added advantage).
- Proficiency in data analytics, visualization, and reporting tools / libraries.
- Understanding of environmental regulations and air quality standards.
- Experience in web apps and mobile app development.
- Excellent communication skills and the ability to collaborate with our team.

Team Leader (Project Manager)

- Master's degree or higher academic qualification in MIS, software engineering, or other relevant discipline obtained from a recognized university .
- Minimum five (5) years of working experience in project management/coordination or equivalent caliber.
- Minimum ten (10) years of working experience in software engineering discipline.
- Minimum five (05) years of experience in working with a diverse range of stakeholders including government and private sector agencies.
- Excellent capacity to conduct training for vast range of stakeholders in various sectors.
- Excellent capacity to communicate and conduct sectoral and plenary consultations with key decision-makers such as relevant ministries, and national and local government agencies, and key stakeholder in the private sector, NGOs, and the academia.

- Flexibility to address multiple tasks as required during the course of the assignments in the ToR.
- Experience in handling similar environmental / weather parameter related projects would be an added advantage.
- Fluency in English and preference will be given for proficiency in local languages.

Systems Analyst / Technical Requirement Analyst

- Master's degree or equal qualifications in computer science/engineering obtained from a recognized university .
- Minimum seven (7) years of experience in requirement analysis and software requirement documentation including system analysis and design.
- Minimum seven (07) years of experience in gap analysis and identification of functional and technical specifications.
- Minimum five (05) years of experience in working with a diverse range of stakeholders including government agencies or international agencies.
- Experience and knowledge about environmental science / weather data would be an added advantage.
- Good interpersonal skills.
- Fluency in English and local languages.

Two (03) Software Engineers

- Bachelor's degree or equal qualifications in Computer science, Computer engineering, IT, or software engineering from a recognized university / institution .
- Minimum eight (07) years of experience in web and mobile based software development
- Experience and knowledge about environmental science / weather data would be an added advantage.
- Proven track record of proposed open-source software stack must be exhibited.
- Experience in REST or SOAP SOA API development
- Good interpersonal skills
- Fluency in English and local languages

Test Lead/Quality Assurance Engineer

- Bachelor's degree or equal qualifications in Computer science / Computer engineering / IT / Software Engineering from a recognized university

- Minimum six (06) years of experience in testing/quality assurance of web-based software development
- Experience and knowledge about environmental science / weather data would be an added advantage.
- Good interpersonal skills
- Fluency in English and local languages

Database specialist/Engineer

- Bachelor's degree or equal qualifications in Computer science, Computer engineering, IT Software Engineering from a recognized university
- Minimum six (06) years of experience in database engineering
- Proven track record of proposed open-source database technology, Microsoft SQL Compact Data repositories and unstructured data technologies must be exhibited.
- Certification in Data security aspects would be an added advantage.
- Good interpersonal skills
- Fluency in English and local languages

Security Specialist

- Bachelor's degree or equal qualifications in Computer science, Computer engineering, Cyber Security from a recognized university
- Specialized qualification / certification on cyber security / information security discipline
- Minimum five (05) years of work / project experiences on data / information security specialist
- Proven track record of security protocols and technologies
- Certification in secure programming would be an added advantage.
- Good interpersonal skills
- Fluency in English and local languages

Domain Specific Data Science Specialist

- Bachelor's degree or equal qualifications in Computer science, Computer engineering, Data Science from a recognized university
- Specialized qualification / certifications on Data science and Environmental Science
- Minimum five (05) years of work / project experiences on data science and applied data programming
- Proven track record of data science application development

- Certification in Environmental science would be an added advantage.

- Good interpersonal skills

- Fluency in English and local languages

- System hardware engineer Bachelor's degree or equal qualifications in Computer science, Computer engineering or IT from a recognized university

- Specialized qualification / certifications on Data Center Management and Computer Networks

- Minimum five (05) years of work / project experiences on IT infrastructure management

- Proven track record on IT infrastructure development

- Certification in data science would be an added advantage.

- Good interpersonal skills

- Fluency in English and local languages

Proposal Submission:

Interested consultants are requested to submit their proposals to the Central Environmental Authority no later than [Submission Deadline]. The proposal should include the following:

- Overview of the consultant's experience and qualifications with company profile

- Company registration details with proof.

- Financial stability of the company with proofs.

- Similar projects and customer details with cost of the project (must submitted with the project completion certificate)

- Detailed technical approach and methodology for software development.

- Qualifications of the proposed software development team with their CV's and track records relevant experience according to the requested team composition.

- Project timeline with milestones and deliverables.

- Proposed budget, including all costs associated with the project.

Selection Criteria:

The consultant will be selected based on the following criteria:

Evaluation of the company/firm and the proposal:

a) Experience and track record in similar projects.
b) Technical approach and methodology.

c) Efficiency & the use of tested & reputed pre-built components.
d) Creativity & innovativeness.
e) Cost-effectiveness of the proposal.
f) Availability to start the project within the desired timeline.

Evaluation of the Team and composition:

a) Educational and professional qualifications of team members suggested for each position.
b) Experience of the team member for the assigned task.

The Central Environmental Authority reserves the right to accept or reject any proposal received and is not bound to select the lowest-priced proposal.

For any inquiries or clarifications regarding this Request for Proposal (RFP), please contact Deputy Director, Air Resource Management and Monitoring unit of Central Environmental Authority through Mobile number: 0718163354 / Email: vernika@cea.lk or Environmental Officer through Mobile number: 0752556370 or Email: akila@cea.lk

We look forward to receiving your proposals and collaborating on this important initiative to improve air quality monitoring and analysis within Sri Lanka

Sincerely, Director General, Central Environmental Authority, Sri Lanka.

ADDITIONAL DETAILS

Data Sources

#	Equipment Type	Number of equipment
1	Ecotech (ACOEM) Ambient Air Quality Monitoring Stations	3
2	EE-AQM-210 Air Quality Monitors	3
3	NBRO Air Quality Database / Server *	1
4	TSI BlueSky PM2.5 Sensor	50
5	IQAir PM Sensors	10
6	Other / Generic **	x

* Multiple sensors are connected to a single database. Therefore, there are two options that can be used. A. Retrieving from the database. B. Retrieving from each sensor via internet.

** Typical air quality sensors are connected to the internet and they provide APIs or ways to get/post the data from their cloud. Almost all reputed air quality data management solutions that exists, supports integration of such sensor units. Therefore, connectivity for equipment # 4, 5 & 6 is expected to be almost identical.

Note:

Equipment # 1 is an integrated system that consists of multiple sensor units.

There, the data collection is possibly be done by multiple methods.

1. From each analyzer (Ecotech & MetOne analzers).
2. From the data logger (WinAQMS)
3. From the data client / report manager (Airodis)
4. Using their APIs.
5. From raw data text files (~CSV) stored in local hard drives.
6. From the SQL databasefile (SDF) of the data client.

Parameters

Air Pollutant Parameters

- $PM_{2.5}$
- PM_{10}
- O_3
- CO

- NO$_2$
- SO$_2$
- VOC
- CO$_2$
- Other

Meteorological Parameters
- Temperature
- Relative Humidity
- Atmospheric Pressure
- Solar Radiation
- Rain Gauge
- Wind Speed
- Wind Direction
- Other

Misc Parameters
- Timestamp
- Instrument Type / Nature of the instrument
- Instrument Model
- Instrument Statuses
- GIS coordinates
- City / District / Provinceetc.
- Other

Air Pollutant & Met Parameters (Displayed Parameters): Up to 40.

Other parameters which are hidden: About 90.

Total: About 130.

There could be more parameters depending on the equipment.

Parameter list varies from equipment to equipment.

Basic pollutants & basic met parameters are common for most equipment.

Data Storage

1. The collected data shall go through a quality control procedure considering the given criteria. (Ability to invalidate data, apply correction factors, and other basic quality control features)

2. Then the data shall be stored in a database.

3. Simple calculations shall be done to generate data points for appropriate time stamps where necessary. (5min, 15min, 1H, 8H, 24H etc).

4. Air Quality Index (AQI) can be calculated. (AQI-SL by default, and ability to calculate international other AQIs such as US-AQI. The calculation could be done either at initial stage and stored, or it could be done in later steps when the reports are being generated).

5. Processed data could be stored separately if it is convenient (To save time or processing power etc).

Report Generation

For Internal Users / Admins

1. A control panel or an interactive dashboard for report generation.

2. Using the appropriate data point values, further averages & simple calculations shall be able to be conducted.

3. Ability to categorize, filter, select, & sort appropriately.

4. Ability to output data tables & plots.

5. Ability to generalize values for the Country, Provinces & Districts.

6. Summaries and detailed air quality reports shall be able to be generated.

7. Availability and expandability of data analysis features (To be specified)

8. Integration into a GIS to enable to view a map of Sri Lanka with pin points of monitoring locations.

9. Integrating AI / machine learning components for data analysis &report generation would be advantageous (To be specified)

10. Ability to create manual & automated backups, that can be restored.

11. Ability to toggle the visibility of a station/sensor

12. Email & SMS alert system

For the Public

1. Parameter data& AQI data shall be published in the website in numerical & graphical forms in real-time manner.

2. Ability to filter data and view historical graphs.

3. Current AQI value shall be pinned in a map on the web.

4. Ability to display additional international AQI schemes as desired by the viewer.

5. Ability to select the city/location/equipment from the pin in the map, and from a list, and by searching, and view a short summery using recent historical data.

6. Ability to graphically compare two locations/equipment etc.

7. Website has to be mobile responsive.

8. A simple mobile app.

9. Ability to view the website & the app in Sinhala & Tamil languages.

Server & Hardware Requirements

1. The data shall be stored in a server and backups shall be set up.

2. The main server can be either local or in a cloud. (To be specified)

3. Locally set up servers shall keep automated periodical backups at a cloud. (To be specified)

4. 99% or higher uptime is expected.

5. The system shall be able to be scaled appropriately.

6. Bandwidth and processing power of the total platform shall meet the high usage when there is an air pollution episode.

7. Server & hardware requirement options shall be specified.

Other

1. The source code shall be provided, or specify the terms & conditions.
2. If subscription services are being used, specify the details.

Helpdesk support must be provided. Criteria sub-criteria, and point system for the evaluation of Technical Proposals are:

		Points
i. Specific experience of the company / firm relevant to the assignment:		[10]
ii. Methodology and Workplan		
	a. *Technical approach and methodology*	30
	b. *Workplan*	10
	c. *Organization and staffing*	05
	Total points for criterion (ii):	[45]
iii. Key professional staff qualifications and competence for the assignment:		
	a. *Team Leader (Project Manager)*	07
	b. *Technical Requirement analyst*	04
	c. *Database engineer*	04
	d. *Software engineer (Web / Mobile Appl developer) x 3*	09
	e. *Software Test Lead*	04
	f. *Software Security specialist/engineer*	04
	g. *Domain Specific Data Scientist*	04
	h. *System Hardware Engineering*	04
	Total points for criterion (iii):	[40]
iv. Transfer of knowledge (training) program:		
	a. *Training content, approach and methodology*	05
	Total points for criterion (iv):	[05]
Total points for the five criteria:		100

The minimum technical score (St) needed to pass is 70 Points.