

Figure 4: PFT Camera and Display Monitoring

- c. **Final Survey:** A comprehensive survey was conducted to assess the feasibility of camera installation, jointly undertaken by TERI, A-PAG, and a team from Lucknow Smart City Ltd. This final survey took place several months after the initial report to the LMC regarding vulnerable points.
2. **Progress of the pilot project:** This pilot project has shown remarkable progress, providing real-time data that has been instrumental in identifying and mitigating pollution hotspots. The high-resolution footage has enabled authorities to take prompt action against violators, enforce environmental regulations, and implement targeted measures to reduce emissions. Six issues were identified which includes road congestion, waste dumpsites, construction sites, C&D waste dumpsites, and open burning of waste have been identified and resolved.
- Continued investment in technology, data management, and community engagement will enhance the effectiveness of this pilot. By addressing current challenges and expanding the surveillance network, it can make significant strides in reducing air pollution and improving public health.

Glimpse of Resolved Issues

Before



After (Resolved)



Team members

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MONITORING & MANAGEMENT OF AIR POLLUTION HOTSPOTS THROUGH CAMERA SURVEILLANCE



1. Background

Recognizing the urgency of addressing of air pollution, India launched the National Clean Air Programme (NCAP) in 2019. This program paved the way for considerable research and collaboration to combat air pollution. Lucknow is one of 131 non-attainment cities identified under the NCAP. TERI conducted an emission inventory and source apportionment analysis in Lucknow district under Clean Air Project in India, identifying major sources of PM_{2.5} and

PM₁₀ concentration. Sources like trash burning, construction activities, industries, transport, and road dust re-suspension have been identified as major sources of PM_{2.5} and PM₁₀ concentration in Lucknow city. To manage particulate matter emissions from these sources, stricter monitoring of source activities is important. This pilot project aims to develop a real-time virtual source monitoring system leveraging integrated command and control centre of the city to combat air pollution.

2. Need of Project

Based on the stakeholder discussion, it has been identified that monitoring with PTZ cameras in key positions can help authorities track the local polluting activities at the hotspots. This early identification enables authorities to respond quickly, potentially preventing pollutant release into the atmosphere. The TERI team, in collaboration with A-PAG, identified thirty-two hotspot locations for the installation of cameras. Furthermore, continuous monitoring offers information about the frequency and duration of activities which aid in implementing target mitigation strategies.

3. Objectives of the Pilot

- » To accurately identify air polluting activities in specific hotspot locations.
- » Real time monitoring using visual data from PTZ cameras.
- » To develop an early warning system that alerts authorities and the public to potential air quality violating before they reach critical levels.
- » To inform the development of policies and regulations aimed at reducing air pollution based on empirical data gathered from the pilot project

4. Methodology

i. Identification of hotspots

Based on the emission inventory and source apportionment study, hotspot grids were

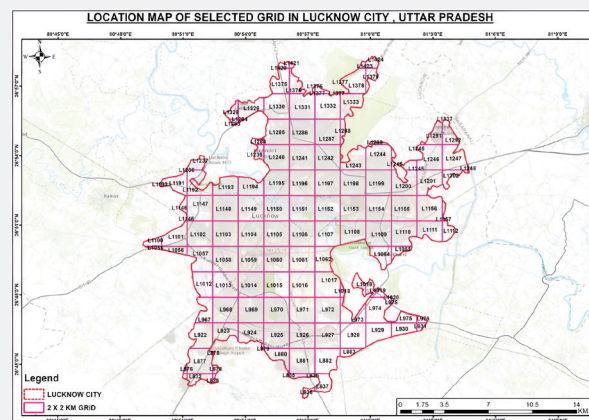


Figure 1: Grid representation in google explorer

identified where refuse burning, road dust and construction activities, came as the major emissions in Lucknow city. Identification of these hotspots assist in targeted action plan to mitigate air pollution. Thirty-two cameras have been installed across the city at hotspot locations to monitor air pollution violations by giving real-time data and will be instrumental in identifying and mitigating pollution at these hotspots.

Besides refuse burning and road dust, a few more hotspots such as industrial areas, waste dumpsites are also captured by cameras.

ii. Creation on Pollution Monitoring Unit

TERI in collaboration with Directorate of Environment Forest & Climate Change (DoEF&CC, U.P., Lucknow Municipal Corporation, and Lucknow Smart City Cell, have established a virtual monitoring system through PTZ cameras to combat air pollution from dispersed sources. The Pollution Monitoring (PMU), comprising TERI and A-PAG teams, established to execute the pilot project. Further, the team collaboratively prepared the Standard Operating Procedure (SOP) for operation and the reporting system following Solid Waste Management (SWM) guidelines to meet the Service Level Agreement (SLA). Additionally, the PMU developed the Air Quality Emergency Tool to address rising Air Quality Index (AQI) levels to facilitate alert generation and response through the emergency response team.

Table 1. Priority wise grid for MSW and road dust from grid action plan

Priority Grids for MSW	Priority Grids for Road Dust
L1105	L876
L1149	L881
L1154	L925
L1155	L926
L1198	L1286
L1241	L1328

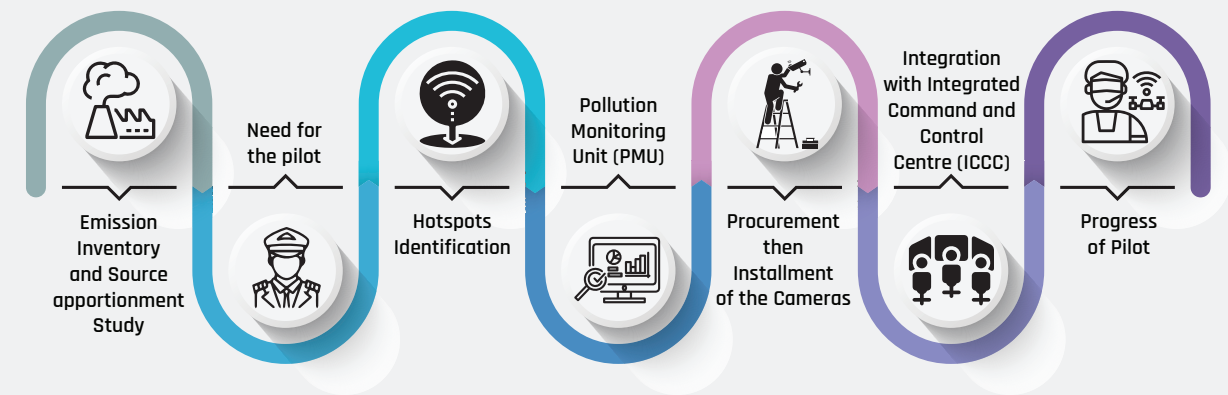
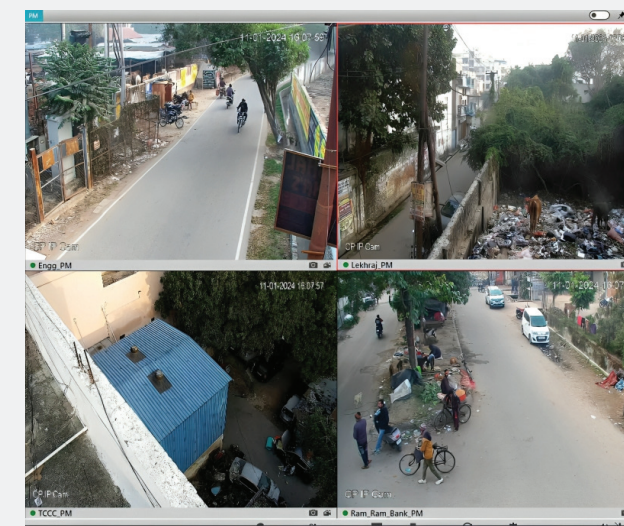


Figure 2: Pilot Methodology

5. Implementation Process

1. **Preliminary Survey:** A comprehensive initial survey identified 32 sites, encompassing garbage vulnerable points, waste dumpsites, industrial areas, areas with road dust issues, and chronic burning sites. Identified garbage-vulnerable points often become municipal solid waste (MSW) burning hotspots.



Identified Area	Number of cameras
Industrial Area	10
In garbage dump and burning site	14
Landfill Area	4
Transfer Station & MRF site	3
Site suggested by AMC	1
Total	32

Figure 3: Identified locations for camera

- a. **Camera Procurement:** TERI procured 16 cameras under the CAP India project, and A-PAG procured an additional 16 cameras of similar specification and focal range of approximately 150 meters.
- b. **Installation Tender:** During the stakeholder consultation, the Lucknow Municipal Corporation (LMC) committed to installing cameras using funds from the NCAP. This initiative aims to fortify vulnerable points in the city. The Request for Proposal was assisted by LMC to Lucknow Smart City Limited for the camera installation.

