Claims

1. A method of distributed acoustic sensing, the method including:

selecting an optical fibre cable installation having a path extending across a selected geographical area, the optical fibre cable installation including a bundle of optical fibres that form part of an established and dedicated fibre-optic communications network, the bundle of optical fibres including (1) a first subset of one or more optical fibres or channels associated with an optical fibre that provide a communication channel to carry communication traffic, and (2) a second subset of one or more optical fibres or channels associated with an optical fibre that are unused or unlit for communication;

repurposing the second subset of optical fibres or channels in the bundle of optical fibres for distributed acoustic sensing;

determining characteristics associated with at least part of the bundle of optical fibres in the selected optical fibre cable installation, including geospatially mapping between one or more positions along a length of the bundle of optical fibres and a corresponding one or more locations in the selected geographical area;

transmitting outgoing light through the second subset of optical fibres or channels;

receiving reflected light back scattered along the second subset of optical fibres or channels, the reflected light including fluctuations over time; and

based on the fluctuations and the determined characteristics, generating an alert signal representative of an acoustic event.

2. The method of claim 1, wherein the fibre-optic communications network is an established urban or metropolitan area network.

3. The method of claim 1, wherein the fibre-optic communications network is an enterprise network.

4. The method of claim 3, wherein the enterprise network includes a plurality of data centres interconnected by optical fibre installations.

5. The method of any of claims 1 to 4, wherein the geospatially mapping operation further comprises;

generating an acoustic calibration signal at or adjacent the one or more positions along the second subset of optical fibres or optical fibre associated with the second subset of channels,

determining and logging the geospatial locations of the positions in terms of geographic coordinates on the earth's surface,

detecting corresponding fluctuations at the one or more locations in the geographical area in received reflected light backscattered along the second subset of optical fibres or optical fibre associated with the second subset of channels, and

determining a path length of the second subset of optical fibres or optical fibre associated with the second subset of channels corresponding to the one or more geospatial locations.

6. The method of claim 5, where the geospatially mapping operation further comprises correlating the path length of the second subset of optical fibres or optical fibre associated with the second subset of channels with the geographic co-ordinates of the one or more locations to generate a look up table correlating the path length with geographic co-ordinates.

7. The method of any of claims 1 to 6, wherein generating the alert signal includes determining a location of an occurrence of an incident in the selected geographical area based on a corresponding fluctuation detected based on the mapping.

8. The method of any of claims 1 to 7, wherein the determining the characteristics includes acoustically calibrating the second subset of optical fibres or optical fibre associated with the second subset of channels to reduce impact of unwanted acoustic interference.

9. The method of claim 8, wherein the acoustically calibrating includes applying a spectral filter to the fluctuations to band-pass or band-reject the unwanted acoustic interference.

10. The method of claim 9, wherein the selected geographical area includes multiple zones corresponding to multiple sections of the second subset of optical fibres or optical fibre associated with the second subset of channels, and wherein the spectral filter applying step includes applying the spectral filter with band-pass or band-reject characteristics based on one of the multiple zones or corresponding sections.

11. The method of claim 9, wherein the spectral filter applying step includes applying the spectral filter with band-pass or band-reject characteristics based on at least one of the time of a day and the day of a week.

12. The method of any of claims 1 to 11, wherein determining the characteristics includes physically calibrating the second subset of optical fibres or optical fibre associated with the second subset of channels.

13. The method of any of claims 1 to 12, wherein the physically calibrating includes obtaining any one or more of the following properties of the second subset of optical fibres or optical fibre associated with the second subset of channels: core properties, attenuation properties, and trench properties.

14. The method of claim 13, wherein the core properties include at least one of a core diameter and a numerical aperture.

15. The method of claim 13, wherein the attenuation properties include at least one of a propagation loss, existing faults and spliced points.

16. The method of claim 13, wherein the trench properties include at least one of burial conditions and cable enclosure conditions.

17. The method of any of claims 1 to 16, wherein generating the alert signal includes classifying the alert signal into one or more classes of alerts based on acoustic signatures of the fluctuations.

18. The method of claim 17, wherein the selected geographical area includes multiple zones corresponding to multiple sections of the second subset of optical fibres, or optical fibre associated with the second subset of channels, each zone or corresponding section being associated with generation of one or more selected classes of alerts.

19. The method of claim 17, wherein the selected geographical area includes multiple zones corresponding to multiple sections of the second subset of optical fibres, or optical fibre associated with the second set of channels, each zone or corresponding section being associated with non-generation of one or more excluded classes of alerts.

20. The method of claim 18, wherein the one or more selected or excluded classes of alerts corresponding to each zone or section of the second subset of optical fibres, or optical fibre associated with the second set of channels are related to at least one of rail monitoring, road monitoring, and perimeter intrusion detection.

21. The method of any of claims 1 to 20, further comprising:
coupling a distributed acoustic sensing (DAS) unit to a plurality of fibre cable installations via an optical switch, wherein the optical fibre cable installation is selected from the plurality of fibre cable installations by the optical switch, and the alert signal is generated by the DAS unit based on the fluctuations and the determined characteristics.

22. The method of any of claims 1 to 21, wherein the second subset of optical fibres or second subset of channels associated with the optical fibre are repurposed to apply acoustic sensing to detect an acoustic event of excavation, drilling, digging, bore tunneling, traffic flow, train passing by or pedestrian flow near or within the selected geographical area.