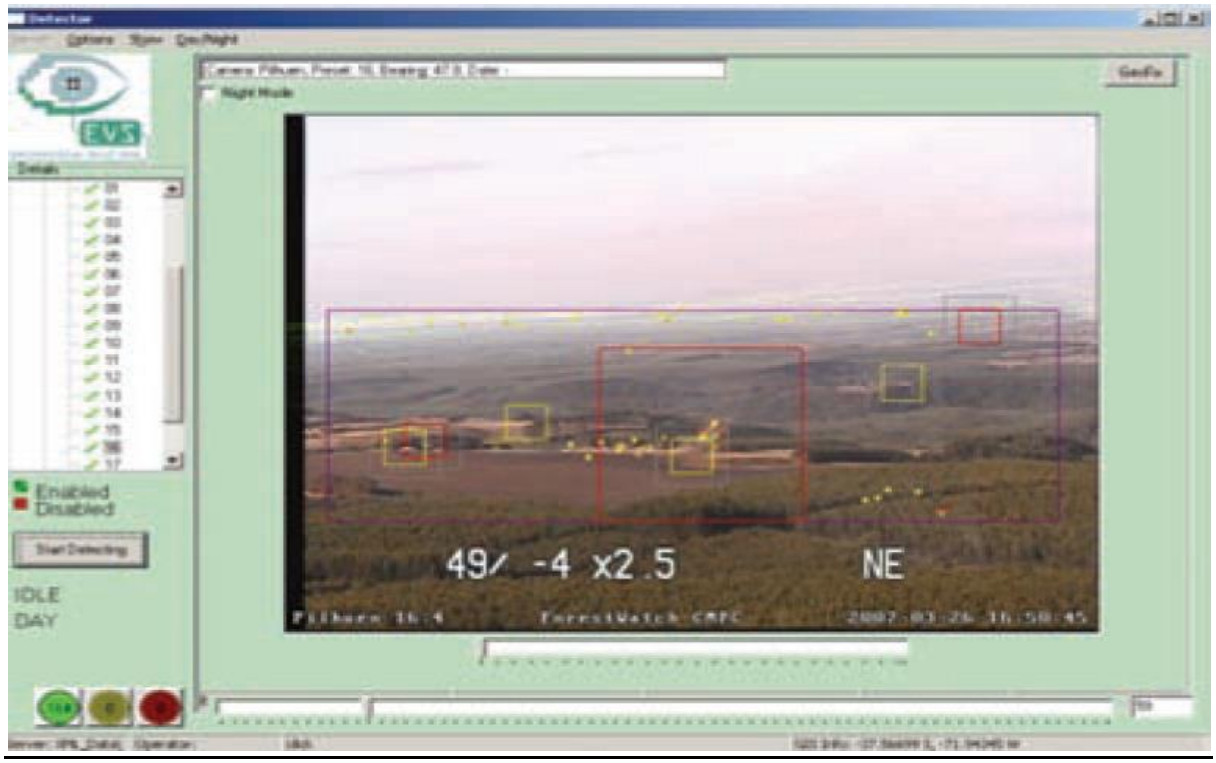
Project Design Phase-I
Solution Architecture

Date	19 September 2022
Team ID	PNT2022TMID44045
Project Name	Project – Emerging Method of Early Detection of forest fire
Maximum Marks	4 Marks

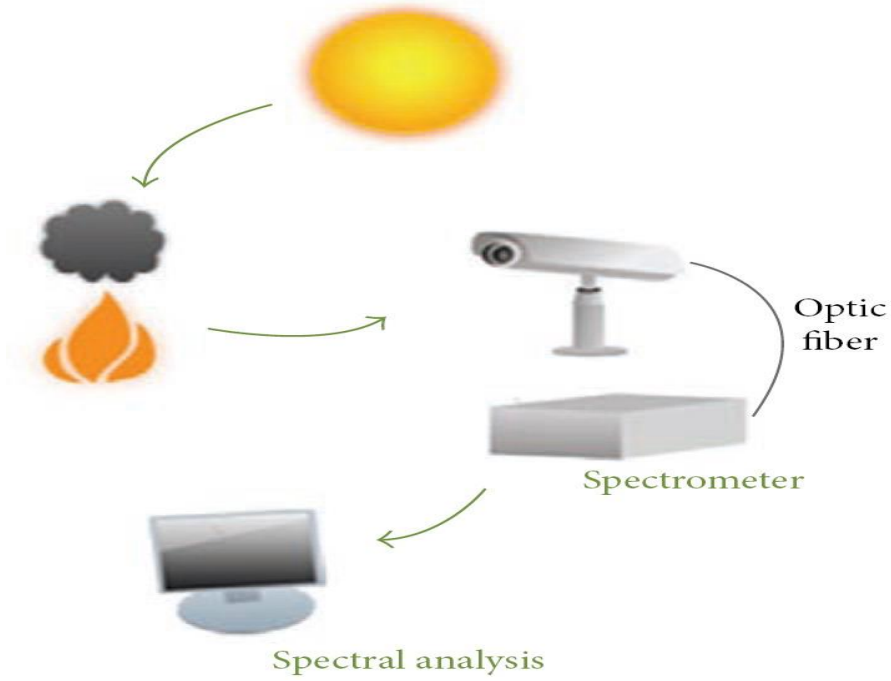
Forest Watch System:



Optical sensors produced by EYEfi, Australia, for forest fire detection consist of

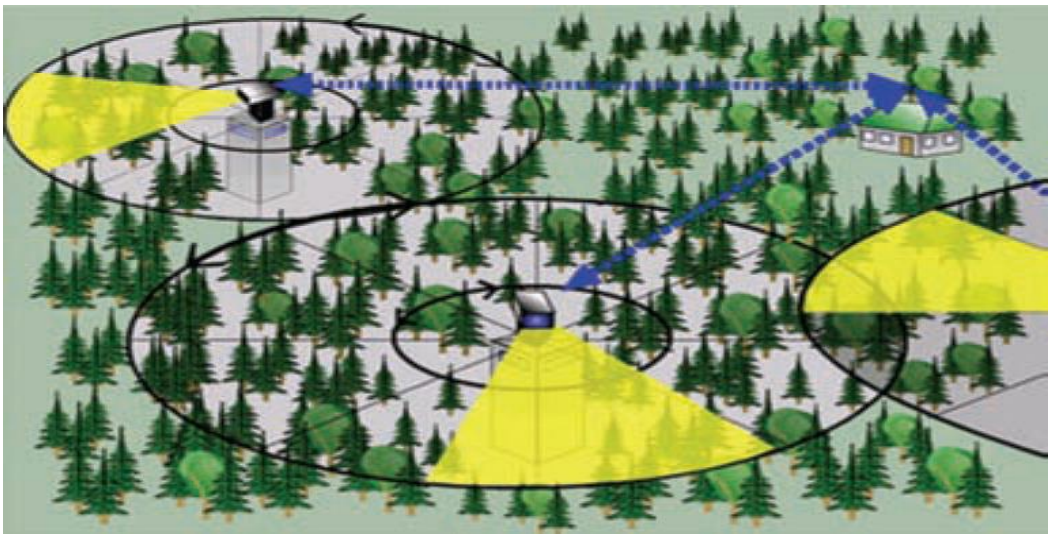
- camera (colour during the day and ultralow light gray scale at night),
- weather station,
- lightening detection sensor,
- communication unit (0.25 Mpbs),
- Power system.

Forest Fire Finder:



This optical system has totally different techniques and is a system based on intelligent analysis of the atmosphere instead of detecting the smoke or fire glow. Forest Fire Finder tracks the way the atmosphere absorbs the sun light, which depends on the chemical composition in the atmosphere. Different composition has different absorption behaviour, so Forest Fire Finder can recognise the organic smoke from burnt trees and the industrial smoke in range of 15 Km.

Fire Watch:

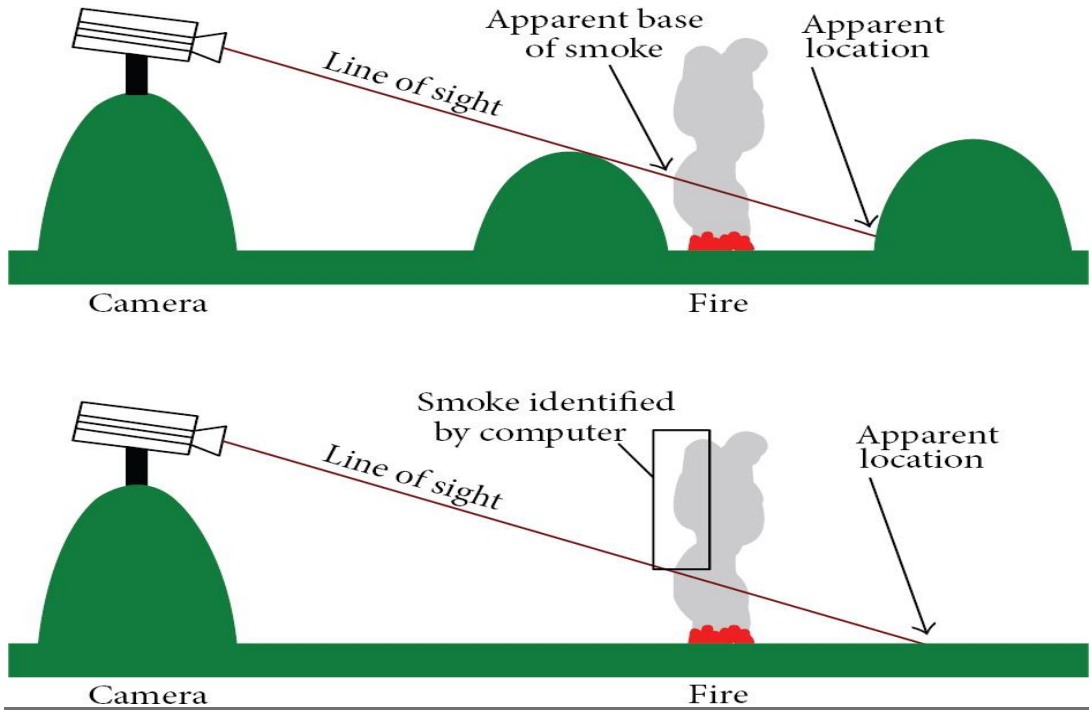


Forest Watch is an optical camera sensor system which provides a semiautomatic fire detection produced by EnviroVision Solutions, South Africa. A tower camera scans the area for smoke during day and fire glow during night. It can detect smoke in range of 16–20 Km and then report it over 0.25 Mpbs 3G.

Forest watch consists of

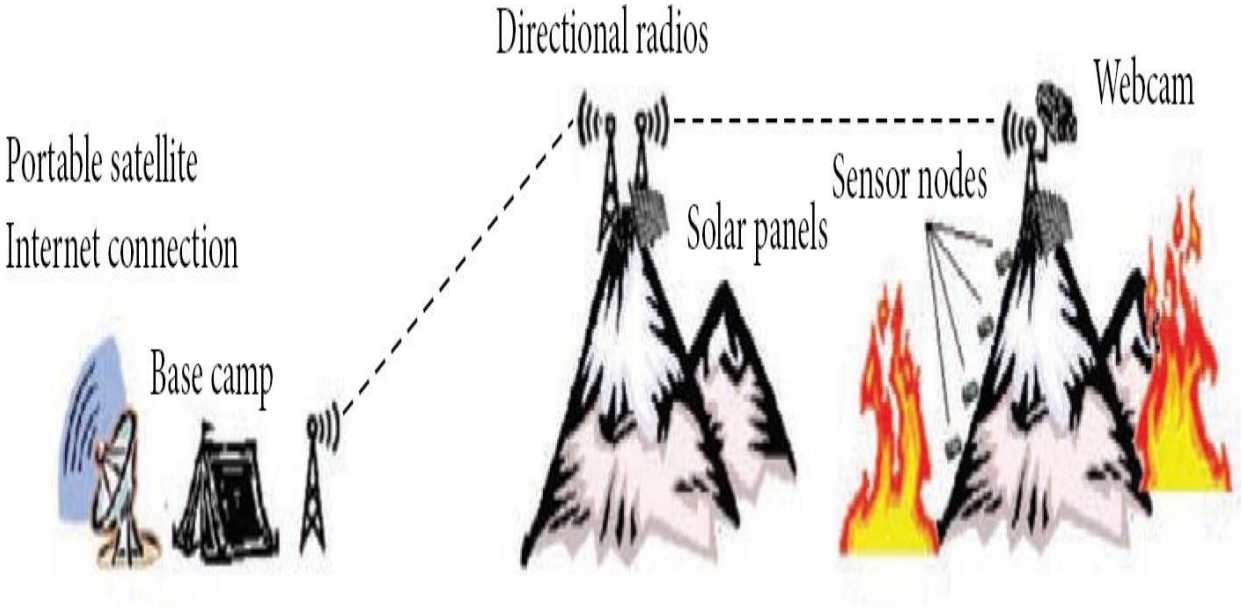
- a Pan tilt camera to allow a 360° rotation and +33 to −83 tilt from horizon, with 24x optical zoom,
- image sampling engine,
- communications system, such as 3G, microwave, or satellite,
- Forest Watch software to process the received data and produce sufficient evaluation for the operator to make the final decision.

Localisation error location:



This kind of technology only provides a line of sight vision, where high trees or the hills and mountains can block the vision; plus, it might be impossible to provide images for the point of ignition. Optical systems were designed to cover large areas with a minimum number of camera towers; each tower has to detect smoke in range of 15–80 Km, where it requires a long delay after the ignition to produce a watchable smoke cloud that can be detected by the camera. Weather condition and night vision reflect on the camera performance.

FireWX Net:

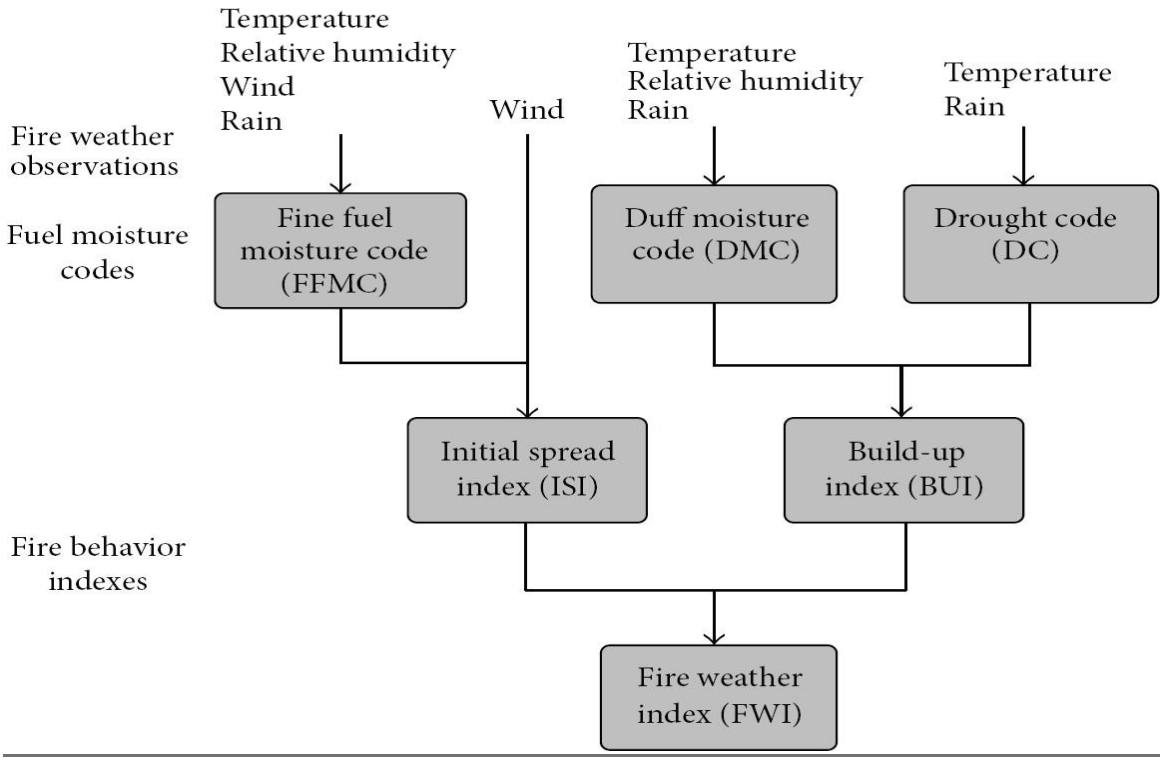


The moves were provided with GPS devices and tested on grassy areas, about ten/acre to sense temperature and humidity pressure and send this data back to the base station. The base station was connected to a MySQL database and clients for alarm monitoring. The problem with this system is that the distance between sensors is too far (approximately 1 km); in case of node failure, a connection between some sensors and the sink might be lost and that could leave a gap in the network coverage; plus, adding a GPS device to each sensor will make the network more expensive and reduce the network life time as a GPS will consume more power.

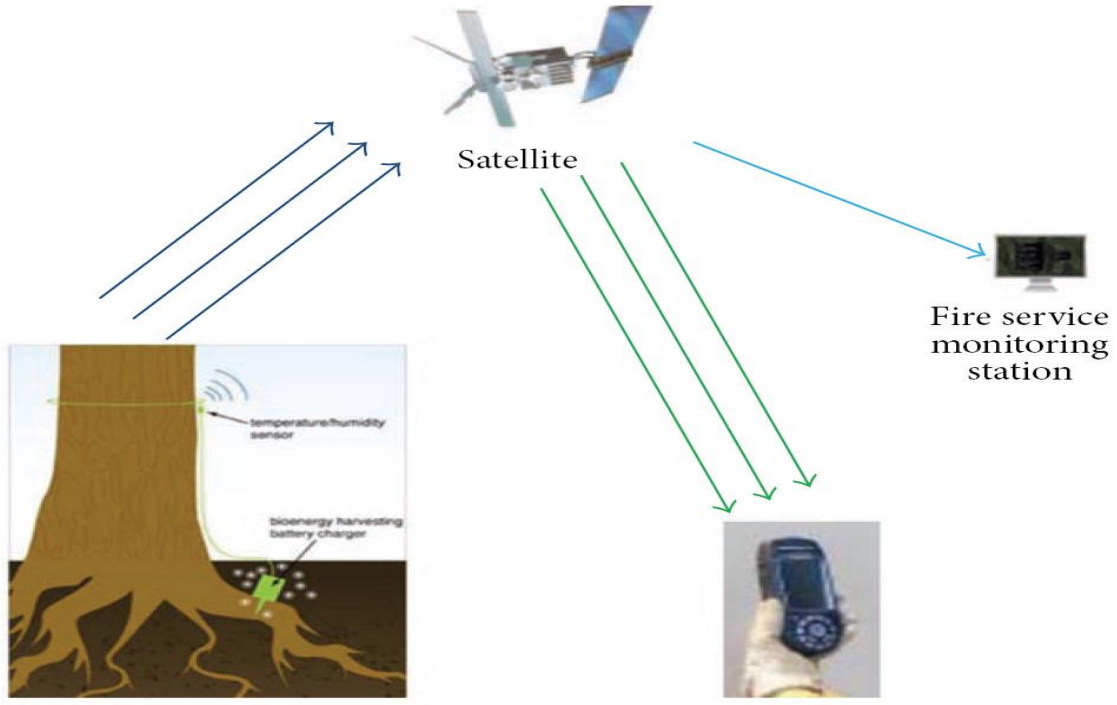
Aslan [5] proposed a good fire detection framework which consists of

- Sensor deployment scheme: represented in the distance between sensors, minimum collision, and minimum number of sensors deployed with full coverage.
- Network architecture: the cluster scheme used as network topology.
- Intracluster communication protocol: the communication between nodes and clusters divided into: initialisation phase, risk free phase, fire threat phase, and progressed fire phase. Nodes enter or change their phase according to danger rate calculation, which depends on NFDRS (National Fire Danger Rating System), temperature, and humidity ranges.
- Intercluster protocol: the main target for this protocol is the power balancing for cluster heads.

FWI system:



Pensylvania Project:



Fire Sense system:

(a) (b) (c)

This project builds on very complicated scientific models, algorithms, concepts, and comparisons, such as the following.

- Scene model: the fire and smoke, heat flux or emitted thermal (Planck's radiation formula), the fire flickering, the reflectance, absorption emission lines, and analysis of the atoms (e.g., potassium) and the molecules (water and carbon dioxide) are characteristics to be investigated.
- The background emits the thermal heat, the reflectance of sunlight, the clouds (clouds shadow) the buildings and the sky polarisation.
- The atmosphere has a number of gases (N_2, O_2, CO, CO_2, H_2O, etc.); each one has its own absorption and reflection behaviour. Water vapour concentration could vary as a result. Carbon dioxide is more uniformly distributed but its value is larger over industrial cities and vegetation fields than over oceans and deserts.