Fire Location Estimation with Temperature Sensor Arrays

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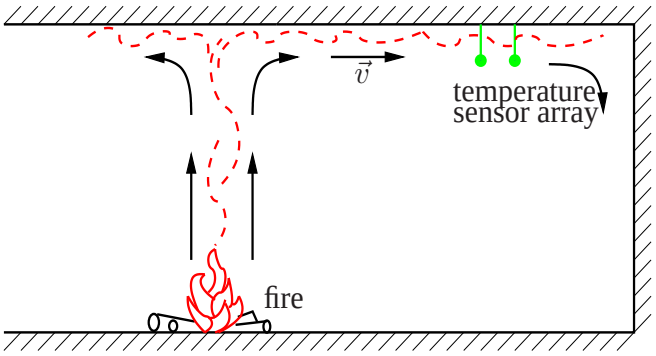
Motivation

- Large buildings: Fire fighters need to know the core of the fire.
- Is a temperature sensor array suitable to determine the location of a fire in a closed room?

Physical Simulation



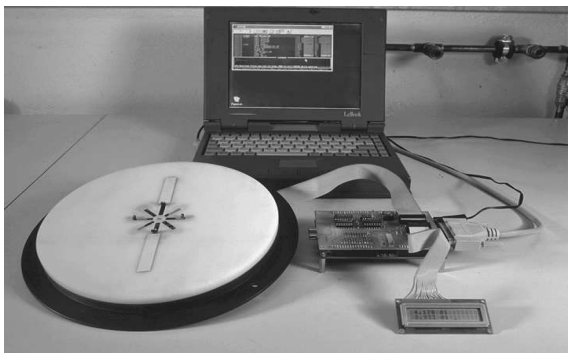
Fire in closed room (side view)

Temperature waves

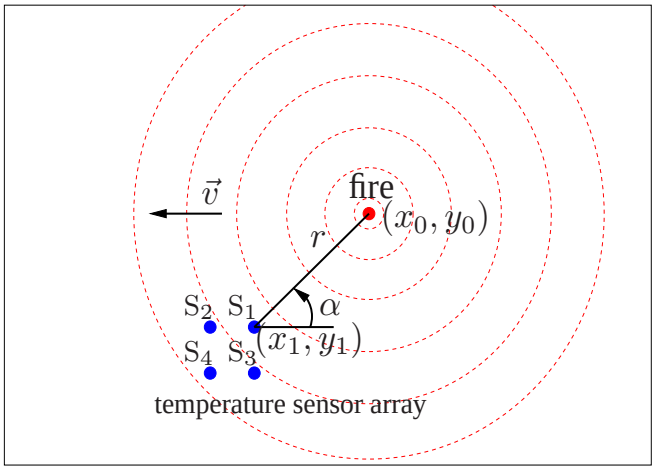
Fire is a turbulent process so that gas and corresponding temperature fluctuations occur. Under the assumption of a plane ceiling, approximately circular temperature waves are propagating at the ceiling. The expectation of the temperature field $T(x, y, t)$ on a circle is only a function $f(t)$ of time:

$$\mathrm{E}\left\{T(x,y,t)\right\}|_{(x-x_0)^2+(y-y_0)^2=c} = f(t).$$

Realized prototype

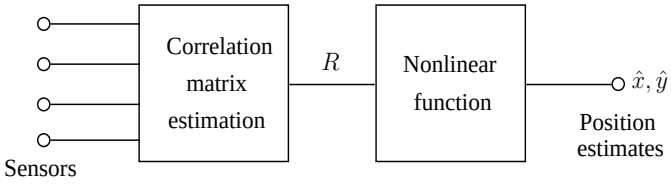


Detection of temperature waves with sensor arrays

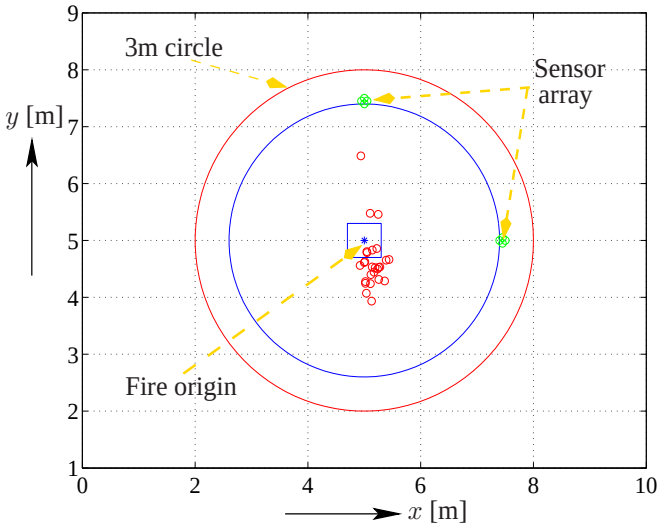


Circular temperature wave propagation (top view)

Signal Processing for fire location estimation



Experimental results



Simulation results

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