Biomimetic MEMS Sensor Array for Navigation and Water Detection

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GPS-Independent Navigation:

Skylight Information
Learn from Nature
(bees, ants, …)

Honeybees detect the skylight polarization with their compound eyes
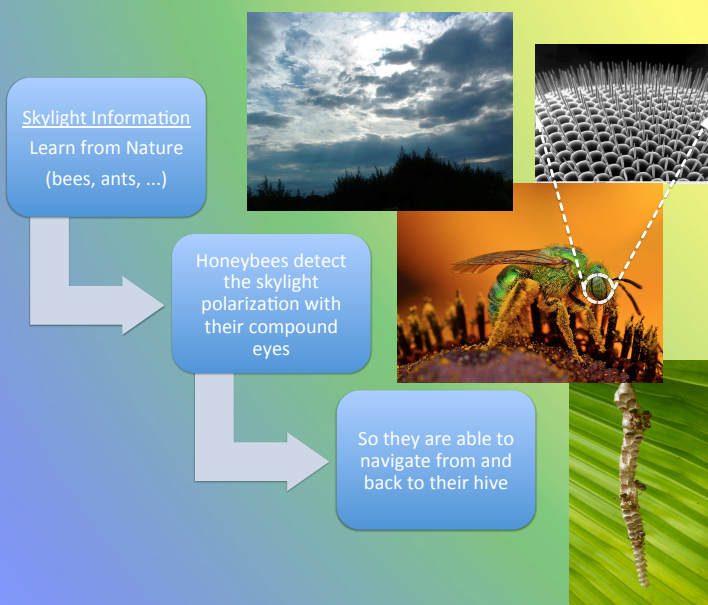
So they are able to navigate from and back to their hive

Honeybee Navigation:

- ❖ Honeybees memorize landmarks and gather information about the skylight polarization to navigate from and to their hive.
- ❖ The skylight polarization changes over the day and is visible even if the sun is hidden behind clouds.
- ❖ We can adapt this ability of the honeybee by using a

Bio-inspired polarized light-based MEMS navigation device

and applying the Rayleigh sky model.

MEMS Device Concept:

1. The MEMS-based sensor array is based on abstractions of biological functions such as the skylight navigation of honeybees (*Apis melifera*), which are able to see the skylight polarization. This ability is also used to detect humidity richer air masses near ground. We also investigate and transferred how elephants (*Loxodonta africana*) detect water.

2. To actually build our navigation device, we use light beam reactive MEMS; these can sense skylight polarization based on the Rayleigh sky model. The approach to detect water within our atmosphere with MEMS also builds up on the polarization effect and furthermore on the ability to detect underground rivers via characteristics of the emitted infrasound spectrum (as used by elephants when finding water).

Bioinspired Water Detection with MEMS:

Bees can detect humidity-richer air via the change in polarization.

Elephants can detect underground rivers within a range of 14.5 km and up to three meters deep.

These abilities combined and built in a MEMS-based system gives a perfect sensor for detection of water sources.