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To support short distance navigation especially during blinding dust storms [Habe86,Loev86] or foggy athmospheric conditions [Brig77,Mart86] and to continuously measure surface parameters essential for rover safety [Chic89] or sampling preanalysis, we propose a two joint extendable stick with a multi-sensor head and a feathering of contact wires.

The cane detects size and position of obstacles in or near the rovers path [Fren86], empty or dust filled holes (quicksand), sandy surfaces not fitted to bear the weight of the rover or keep it from sliding, and measures inclination.

The cane's tip holds active and passive sensors for measuring surface hardness, grain size and weight, shear resistance, temperatures, thermal and electrical resistance, evtl. dielectric constant and magnetic susceptibility too.

Optional strap-ons support analysis of composition by laser or high-voltage spark spectroscopy, and other rover bound instruments using hoses and fiber optics.

The cane is fixed to the rover in a universal joint with a constant length arm segment about .8 m long. A second cardanic joint directs the 5 retractable (car antenna-like) segments with the sensor head. This allows moving the cane head with the broad feather of contact wires in a cycloidal fashion, covering a maximum of space at minimum energy (few stops/starts).

Each segment has a (passive) joint at the end to allow high angle bending. Segments are extended by flushes of high-pressure mars-air (30 mb nominal, 100 mb to clean the inside from dust) and internal wires (controlling extension), and are retracted by these wires (2/segment, carrying power and data). Not fully extended into the endjoints, the cane is stiff enough to bear up to 200 gr strap-on tools on its tip. The segment surfaces are painted with calibrated color/distance patterns as markings for the cameras [Patt77].

All segment joints contain microprocessors to measure the bending of the segment (DMS strips) and the angle to the next segment to determine the tip position to within few mm. Bendangle changes (and accelerometer readings) are input to a surface shear resistance model.

The head joint additionally allows rotating the head by wire or external forces (orientation of surfaces or contact of feather wires with ground or obstacles).

The quadratic sensor head has on two surfaces sets of simple stiff wires with endswitches (ground contact, rough obstacle positions), direct contact switcharrays on the other two (raw grain size, more precise position), thermal sensors on two edges (one in contact, one in air) and inside, and analogue circuits to apply selectable voltages to one or more edges (electrical conductivity can be measured with the rover moving).

The heads inside is thermally isolated on three sides, with a known thermal conductivity on the forth. The power regulator is used as controlled heat source (check water and other volatiles in sands by heating till evaporation).

The head contains a triaxial accelerometer (surface hardness, shear resistance), and a controlled air outlet (to detect weight of dust particles from onset of flight under wind pressure, or simply to clean a surface, or heat sand with hot air).

Also under consideration are: a coil on one side to measure magnetic and/or electromagnetic properties (dielectric constant, magnetic susceptibility),

fiber optic guiding light to a photometer and/or spectrometer (a switchable lens as used in medical fiber cameras allows several foci),

lighting fiber supplies white light (or known spectral distribution)

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or laser emission (tunable) to objects.

Small strap-on tools kept dust protected at the roversides could improve sampling strategies. The cane head would then provide 2 contacts to supply power and communication lines.

Some tools under consideration are: a HV tesla transformer with grounding strip. Set at different distances from the surface, sparks with several kilovolts amplitude ionize the air and surface material. The spectral signatures can identify rock and sand material or volatiles and at least qualify them as samples.

A rotating brush exposes deeper layers and transports even sticky "loess" into or out of a shovel.

A small drill gets probes of the interior of not too hard rocks.

Other probes could apply chemicals to the surfaces and record reaction products.

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