

Incremental, on-line topological map building with a mobile robot *

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Outline

- Hardware Architecture
- Mapping Software
 - Augmented topological maps
 - Behavioral organization
- Experimental Mapping Results
- Future directions

Augmented Topological Map

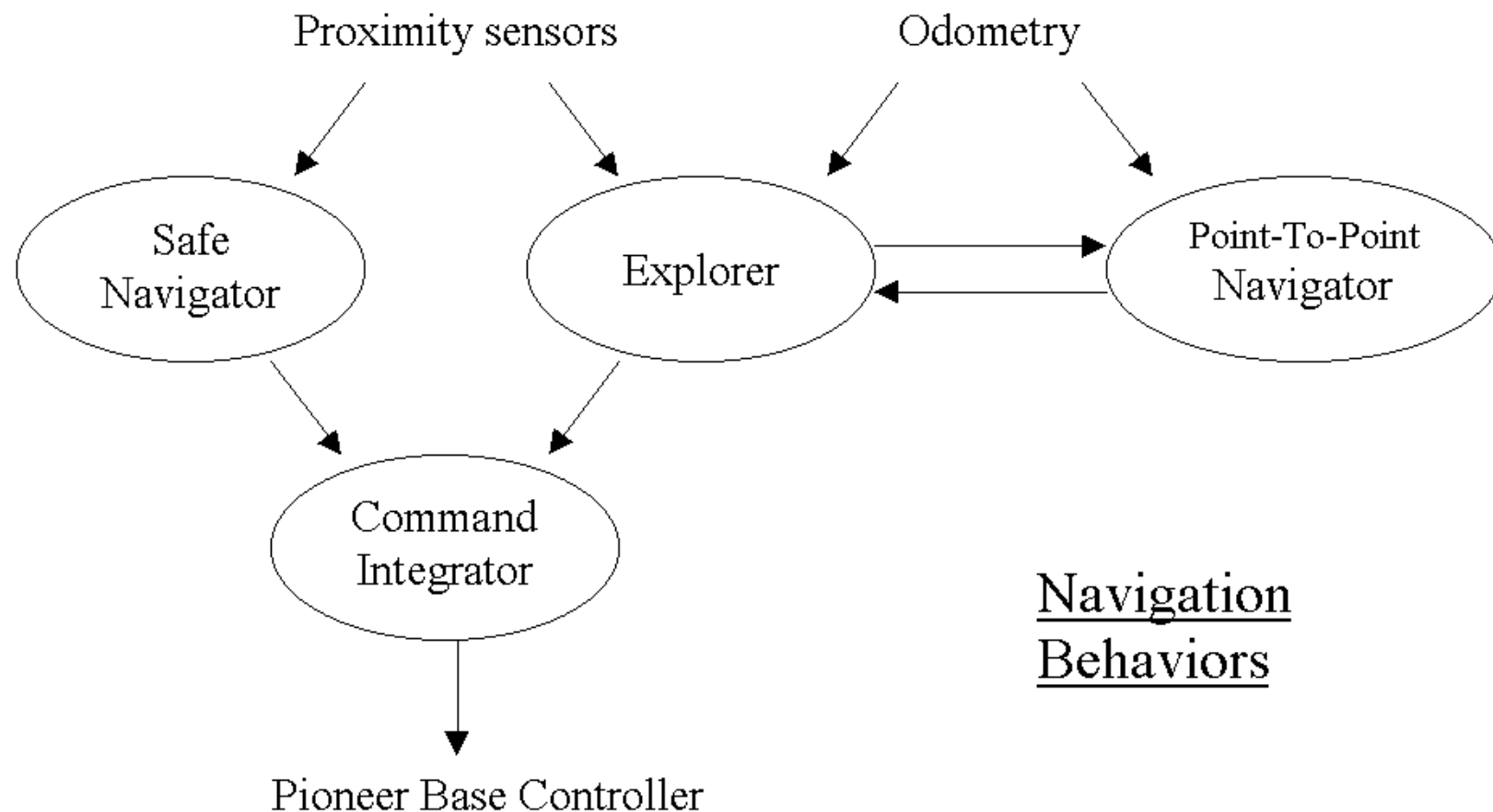
- Online, incremental construction of topological maps, augmented with metric information

```
struct node {  
    id, type, coordinates,  
    visited & detected counters,  
    arm data [4]}
```

```
struct arm {  
    heading, type, compass,  
    connected_to_node, distance}
```

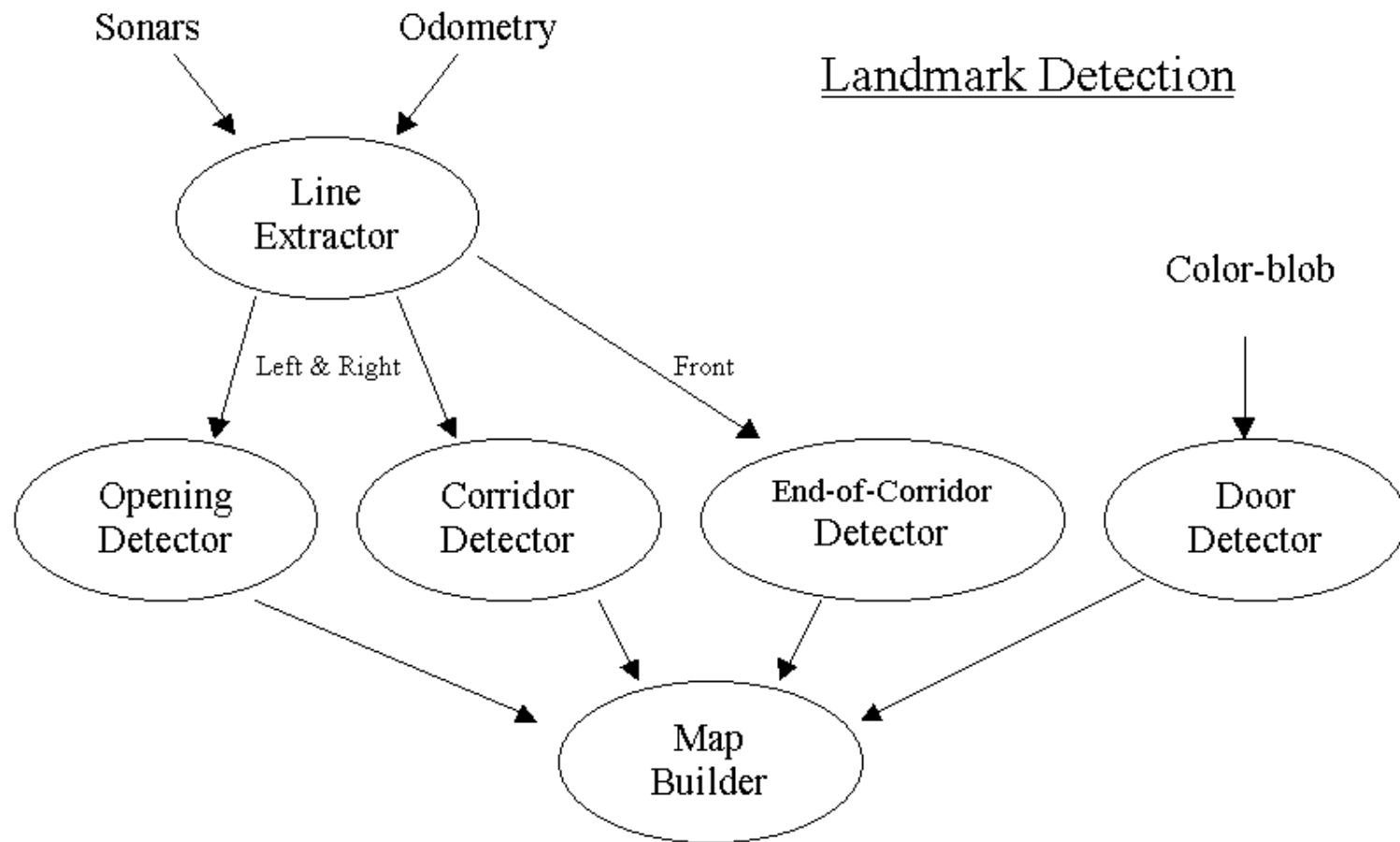
Exploration strategy

- Follow the corridor
- Go to unexplored ends of nodes



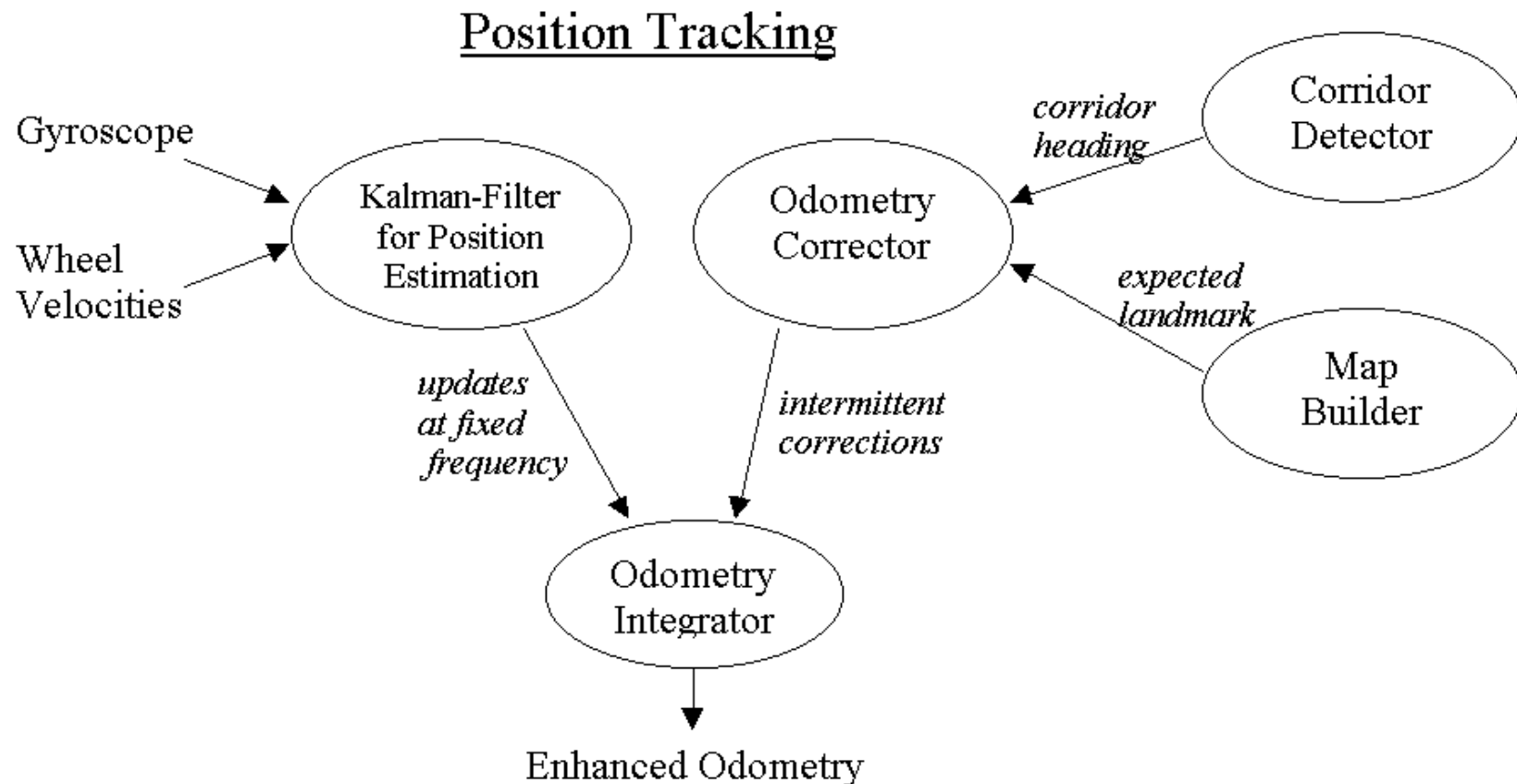
Feature detectors

Door / Corner / T-junction / End-of-corridor



Position Tracking and Relocalization

- Constraint: Orthogonal corridors
- Reuse of the map for topological matches



Experiments: Landmark detection rates

USC Salvatori Computer Center (2.6 kilometer)

Sensor	# landmarks	detected (%)	missed (%)	false alarm (%)
sonar	300	81	19	20
vision	180	92	8	3

Hospital Building, Fort Sam Houston (1 kilometer)

Sensor	# landmarks	detected (%)	missed (%)	false alarm (%)
sonar	230	75	25	23

Cooperative Mapping

- Topological map as a framework for scalable cooperative mapping
 - computationally cheap
- Encouraging results (San Antonio case)
 - two robots
 - real time

Future Directions

- Probability distributions for landmarks and links connecting them
- Integration of the Urban robot platform
- Multi-robot extension for cooperative mapping and exploration

