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Additional Topics - Mobile 2000

The Active Bat is an ultrasonic tag, which forms part of an indoor location system. Describe the operation of this location system in terms of:

The basic method used to locate Active Bats	[6 marks]
Synchronization of Active Bats and the fixed ultrasonic receivers	[6 marks]
System resource allocation to Active Bats that are moving	[4 marks]
Methods of obtaining orientation information for tagged objects	[4 marks]

Active Bat transmits ultrasonic pulse. Receivers in the ceiling pick up transmissions. Reflections are filtered out. Three or more receptions of ultrasonic pulse can be used to locate Active Bat by measuring the time of travel to each receiver and doing the appropriate geometric calculation. Only one Active Bat transmits at a time and transmissions are spaced out so pulse/reflections completely decay between transmissions.

Each Active Bat and each ceiling receiver have a radio receiver. A radio transmitter sends a signal, which triggers one Active Bat transmission and resets the counters in all ceiling receivers. Speed of radio signal is much grater than ultrasonic pulse hence time of flight to a number of ceiling receivers can be measured with enough precision.

Because each Active Bat can be triggered independently those that are moving can be triggered more frequently. There is a time-out so the location of those Active Bats that have apparently been inactive can still be monitored. As a radio cell is quite small there is a need for Active Bats to hand-over from one radio cell to another if they move out of range.

If two Active Bats are attached to a rigid object the orientation of that object can be determined. If a person wears the Active Bat on their chest the area behind is shadowed and if there are enough receivers in the room an approximate orientation calculation can be made.