map center point setter sets value of the map’s center in the map layer manager when the map is magnified/reduced and when the area of the map in interest is shifted. The zoom ratio configurator sets the zoom ratio in the map layer manager when the map is magnified/reduced. The full extender is used when the magnified/reduced/shifted map is drawn again to the entire area. The overall diagram of map controller is shown in Figure 7.

![Figure 7. Map Controller Architecture](image)

5) **Node Manager**

In Figure 8, we show the detailed structure of node manager. Node configurator saves the information on sensing range, communication range, supersonic wave range, degree of connectivity, and the number of sensors to be deployed. The saved values are applied in batch when sensors are created by node generator. The supersonic wave range is used to determine the location of obstacle in the target field where the sensor status is unknown. The node generator creates and manages the given number of sensors.