Clustering in VANETS

- Advancement of vehicles and Ad-hoc network technology, the Vehicular Ad-hoc Network (VANET) has become an emerging field of study.
- Problems such as network scalability can be resolved by Clustering the vehicles together.
- In this project, we propose an autonomous multi-agent system of fixed-wing and quadcopter aircraft to identify, survey, and discover points of interest for closer-inspection. By design, the system will be flexible, scalable, and responsive to real-time data.

Problem Definition

Natural disasters such as hurricanes, earthquakes, and floods are significant dangers to civil developments. Collateral effects like loose soil cause additional damage such as building collapse or landslides. Indication of these events such as in soil texture or color come to notice only after the disaster. Such intricate data that spreads over isolated areas is partly obtained after days spent by rescue teams and after serious delay. If these affected areas are provided help in time, the level of damage can be significantly reduced.

Considering the shortcomings emphasized in the literature survey about the VANET technique, a more systematic architecture and flexible model is developed. The papers discussed in the literature survey emphasizes only about identifying the wildfires with the help of environmental conditions however ways of monitoring drones were not discussed which can cause serious issues like collision of drones with each other. To overcome this shortcoming, we discuss about a real-time monitoring system using POMDP and MDP techniques in this report.

Methodology

- The VANET is mostly interchangeable with the term Internet Vehicle System Communication (IVC), in spite of the fact that the main focus lies on instantaneous networking and less focus on infrastructure or cellular networks.
- VANETs communication types is classified into four different types: Infrastructure/infrastructure, Vehicle-to-vehicle communication (V2V), Vehicle-to-road infrastructure (V2I), and Vehicle-to-broadband cloud (V2B).
- Architecture such as a WSN could be helpful for deployment of sensors for events like detection of wildfire and its verification.
- The overall purpose of this paper is to present the idea of an effective way to detect fires using Ad-hoc wireless sensor networks and monitor the spreading of fire in various fields such as forest, agricultural lands.

Analysis and Results

Three metrics are taken into consideration at the time of communication between UAVs. These vital metrics are distance between the drones, velocity of drones and the direction of the drones. Measuring these fundamental metrics accurately is the prime motive that this project is based on.

- Creating a network of different nodes which moves with different velocity and in different directions is the initial step.
- The next step is to form clusters within close proximity so that neighboring clusters can communicate with each other.
- In the next step one node in every cluster is considered as a cluster head and others as cluster members.
- The clusters communicate with each other with the help of these cluster heads.
- The nodes are designed in a fashion such that there is a CH along with CMs. Each CM is connected to the CH. Based on direction, speed and sample size every CH is attached to multiple CMs in a similar way as the CMs are created.

The above figure shows different clusters depicted by dashed lines. The CH communicates with one another and are shown by the blue lines. But in Cluster based VANETS, every network cluster is managed by the CH and the supports inter node communication. The CH also controls mapping of every Cluster Member with help of inter cluster communication thus reducing the complexity. To maintain a record of communication happening in a network, each Cluster Head updates the routing table and member mapping with one another periodically.

The Cluster head forwards the updated information to the all the neighboring cluster members and hence every cluster member will have the updated information about the nodes. By sending a request to the cluster head, the CM is able to get the data about nodes of different clusters.

As the Cluster head has all the information about other clusters as well as about its own cluster the CH is now able to share information to its own cluster members as well as to other clusters. This is accomplished with the help of broadcast messages. If there is no new update in the received information, then the packet will be dropped. However, if new information is received the cluster head will store the data in its database and will forward unicast messages to the designated receiver node.

This complete process is accomplished in three hops.
- The cluster head has no information about a node
- A broadcast message is sent to all cluster heads in the network
- The table is updated by CH and a unicast message is sent to the respective node. By using “TDMA” process each communication is given different time slots.

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Key References


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