Three Protocols for Actor Selection in Wireless Sensor and Actor Networks

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ABSTRACT: *Wireless sensor and actor networks consist of heterogeneous sensor and actor that connect together by wireless media. In these networks sensors find the physical events and send them to sink or actor for suitable action. One of important goals in designing of these networks is send data from the best path with low energy and increase the network's life time. In this paper three protocols for actor selection is proposed. At first and second protocols, network is single hop and actor selection is done during it. But, in third protocol, one life time parameter is attached to every packet that it becomes to zero upon arrive to first actor, and actor selection is done.*

Keywords: Wireless Sensor and Actor Networks, Sensor, Actor, Protocol

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1. Introduction

Wireless sensor and actor networks consist of many heterogeneous nodes of sensor and actor [1]. Sensors have low cost and low communication power to send data. Role of actors are gathering and processing the receiving data from sensors and acting the best reaction [2]. Hence, actors enjoy of high processing power, big data transfer rate and long life time [3].

In wireless sensor and actor networks, the many number of sensor nodes are propagate in environment without any arrangement, and have very best collaboration for data gathering, but actors have not this congestion [4].

After the event detection in environment by sensors, sensors send it for actor. In other side, actors gather the events and process it, then return the best reaction to environment. Upon the data was detected, related actor do coordinate with other actors to make the best decision and reaction, that we called these process; Actor-Actor coordination [4].

For example, in operation of fire detection, sensors can do detection fire and place of it, then water pistol actors will activate to turn it off [5]. Also, there are sensors in building that can detect motion of annoying people (thief) and send suitable instruction for actors (camera) to take photograph of it [6, 7].

But, the important challenge in these networks is actor selection for event responding. This proposed method causes increasing performance in the Network.

In this paper, I focus on actor selection challenge and propose three protocols to solve this problem. In two first proposed protocols, sensors connected with actors without any interface media. But, in third protocol proposed a method that it can send out specific actor to anywhere of network.

2. Related Works

In [8] is shown that in wireless sensor and actor networks when the detect an event; there is not any primary actor that sensors send message to it. This uncertainty in actor selection is cause a big challenge.

In [9], the actor selection is first and important problem. Next problem is data sending and correct routing toward selected actor. When initial data is transferring via sensors, maybe this data collected by other actors or moved to front for establish correct transition. In additional, all of these actions must happen in real-time. In fact, routing protocols must to be able to execute with specific time period and bounded delay until data received by related actor on time.

3. Proposed Protocols

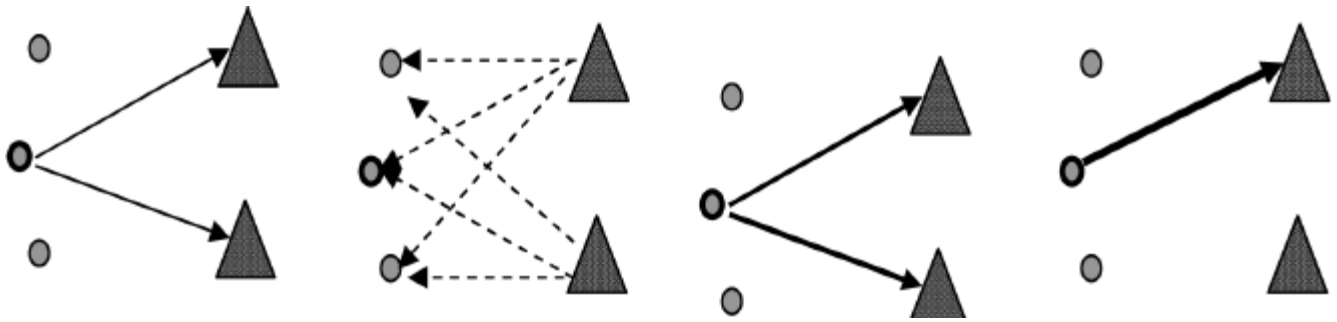
The important challenge in these networks is actor selection problem. So that, in these networks does not select any actors in initial.

Hence, upon to happen an event must selected suitable actor in shortest time. In this point, three protocols for actor selection have been proposed. In two first cases, actor was considered near of source sensor node; therefore the only challenge in two cases is suitable actor selection and no routing toward actor. But in third protocol in additional, there are not sensor near of actor, hence routing and transfer data to arrive the selected actor was added to this problem.

3.1 First proposed protocol

In this method the networks intended as a single-hop. In this point, there are three type messages in order to actor selection, such as Req, Ack and Data; also the actor and sensor nodes have a unique identifier.

In this way, when was detected an event by a sensor, sensor node broadcasted a Req message to all actors, immediately and attached its Id for detection of return address and wait for response (Ack) from actors. Active actors upon receive Req message from sensors will be broadcasting Ack message and attaching its Id to related sensor's Id for all sensors, every sensors is capable to receive this message, After that sensor was received the message, sensor was compared its Id with attached Id on packet, if no consistence, message will be deleted. But if is consistence, means that is same sensor which has sent Req message to actors. In this case, first Ack is accepted and the rest has not accepted, then related actor's Id will be extracted. After than it, sensor do send the event data with its Id and actor Id to all nodes immediately, then every actor do compare itself Id with packet's Id, If two Ids were consistence, actor is receiving the data and do the suitable reaction. This protocol is shown in Figure 1.



a. Send Req b. Return Ack c. Initial send to all d. Actor selection

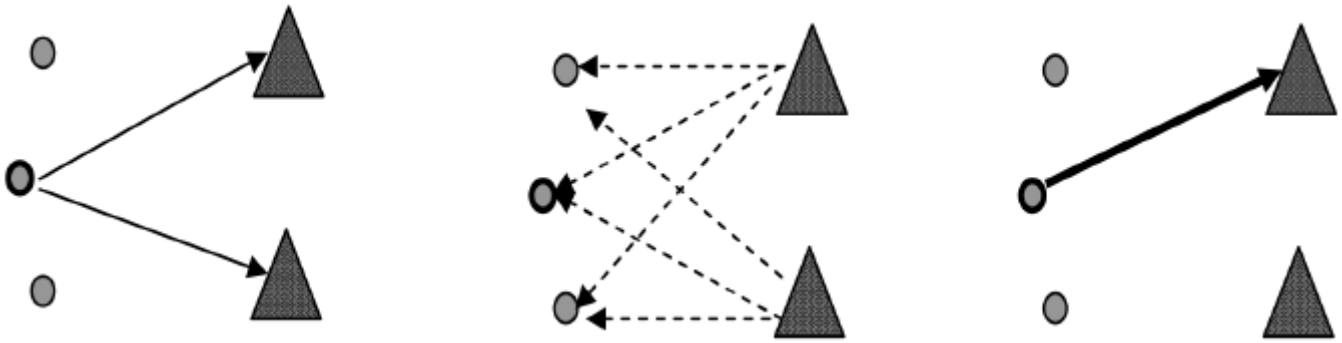
Figure 1. Actor selection according to protocol 1

Advantages of this method are that the failure of one actor will not cause problem in network's performance. In this way, selecting of near and best actor will be very fast. Trust percent is very high, since at every time all of actors will be called. Therefore least there are one of actors do show reaction to the event. this network is enjoy of high performance in real time cases, Also the all messages do sends via flooding method. Hence in these networks a few times have needed for path selection and data transferring.

But this method has some disadvantages, such as causing high traffic in network; also energy consuming is very high. Every actor must be having capability to event reaction potentially.

3.2 Second proposed protocol

This method is partly derived from previous method. In Figure 2 shown after that the sensor detected an event, its message with Id is broadcasting to all actors. The actor returned first Ack for source sensor which select as an active actor and after that sensor sends its data only to same actor in uncast form. In this way, traffic will be very low, but in other hand make decision was decreased for one level, and trusting of successful action will be low.



a. Send Req b. Return Ack d. Actor selection

Figure 2. Actor selection according to protocol 2

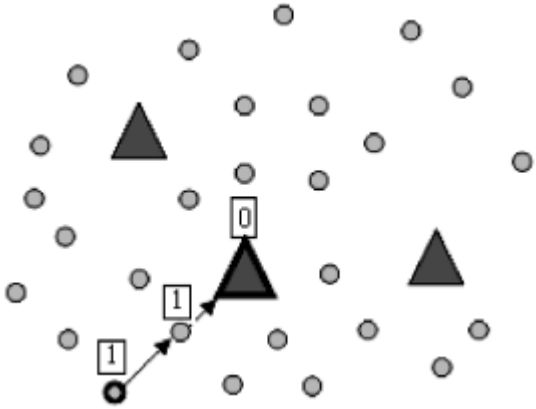


Figure 3. View of closest actor selection, depending on packet lifetime

3.3 Third proposed protocol (selecting special actor)

In this method, after that the sensor is detect the event; event was broadcasted for all actors. Also with every sending packet be will be send one life time parameter (TTL[1]). The first value of this parameter is one. In other side has been defined for actors that upon receiving packet, one unit will decrease of this parameter. Residence of packet is where that TTL become to zero, means that at this time the packet has not any capable for motion. Actor that cause this parameter become zero selected as active actor. In this point, every sensor must be capable to save Id of previous and next nodes. In order to was regulated and save of path from previous node to its and next node. In this case finally by combine of these partial paths will be set all paths from source to destination. After this process will be enabled relation in same path and since has established relation between sensor and actor. In this method, we have a few traffics and have not high trusting of network. Since only set one path and after that maybe selected actor will failed after first receiving, hence packet will be lose. Advantage of this method is that the changing and regulation of TTL can to select a special actor in everywhere of field. For example, if TTL= 3, two first actors cannot reaction for event, also third actor must be acted. In order to if network has an automated architecture, that it need which sensors enjoy of

[1] Time To Live

high processing power, and enough knowledge of actors and position them until after happen event was able to make decision that which actors must be selected to carry out that event. In this way sensor send firs event to sink, since sink capable to cover of total network and field, selected the suitable operating area and send to sensor that attached TTL on packet with which number. Figure 3, 4 shown steps of thirdproposed protocol.

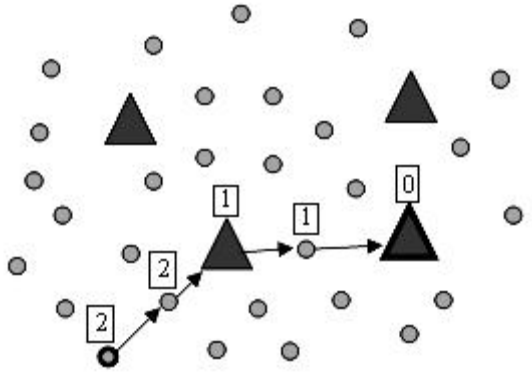


Figure 4. view of special actor selection, depending on packet lifetime

4. Conclusion

Although the wireless sensor and actor networks are extend of wireless networks, but there are some elements and properties that were caused many differences in these two networks. The important difference is existing another element called actor. The important challenge in these networks that in this paper focused on it are select of the best actor for suitable reaction. In this paper three types protocols has been proposed , that in two firs cases network on field has assumed limited. But in third protocol have not any limitation on field and area has assumed large, that there are several actor in it, and then special actor will be selected to reaction to event.

However, these protocols still cannot solved all of these network's problems such as actor failure during the operation, actor inability to function at work, limitation of network's energy, hence the next efforts must be focus on these problems.

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