[Response letter]
Dear Reviewer 1
Subject: Submission of revised paper
Manuscript ID: sensors-408336

We thank the referee for fruitful comments and suggestions. We were pleased to know that our manuscript was rated as potentially acceptable for publication in the special issue, subject to adequate revision and response to the comments raised by reviewer 1.

As you notice, we have revised the manuscript by modifying the almost all sections. Accordingly, we have uploaded a copy of the original manuscript marked with main changes made during the revision process.

Our responses to the referee's comments are as follows:

(1) The novelty and advantages of the proposed approach should be better detailed: GA is a well-known technique widely used for solving scheduling problems; the reference section must be improved accordingly.

We revised our contribution of this paper in Introduction and Section 3(Related work). Also, we add description about GA in Section 3.

We think our main contribution of this paper is to propose a data traffic control scheme for polling based communications and verify its performance from viewpoints of end-to-end communication success probability and balanced slot utilization. We adopt a GA as a heuristic to derive an optimal schedule. GA is one of probabilistic search algorithms and optimization techniques based on the mechanisms of natural selection and evolution.
(2) What are advantages of the proposed solution with respect to other approaches, e.g. as simulated annealing?

Although other heuristic algorithms such as simulated annealing, PSO (particle swarm optimization), or even machine learning can also be adopted, we consider a GA-based algorithm in this paper, which could achieve a reasonable and feasible schedule with practically short computation time on an off-the-self computer.

We added this in Section 3. In addition, we changed the title of Section 6:
- 1st draft: GA based data collection algorithm
- Revised draft: GA-based slot assignment algorithm

(3) Provide some additional comments about Figure 3; does it refer to the centralized controller?

We revised Figure 3 and its caption, and added a sentence “A center node has the data traffic control function in order to manage all polling traffic.”

(4) Section 4 is not so easy to read; I suggest to insert a table resuming all the terms and provide a clear description of each one; the proposed examples, shown in the figures 4-5 should be better detailed; what is tajg in (2)? what is Ti? What is the node identification number? (a unique id?)

In Section 4, we provided terminologies at first. We inserted a new table (Table 1) to summarize terminologies and notations. Then, we presented an outline of how our data traffic control scheme for periodic data collection works using Figure 4 and Figure 5.
(5) Figure 6 is never referenced.

At first, we added the label such as “Section 6.1” of each process in Figure 6. Then, we refereed Figure 6 when we describe the specific process in Section 6.

(6) How is computed the “pass quality” introduced in Section 6?

In Section 6.1.2, we newly added the following sentences:

“The number of retries depends on a path quality (end-to-end PER) between a node and a central node. A central node gets the path quality from a network manager in IWSN, because a network manager perceives network conditions.”

We think that our scheduler can get network information (condition) from a network manager of IWSN because IWSNs such as ISA100.11a or WirelessHART are controlled by a centralized device (network manager).

(7) The simulation engine must be better detailed: how is the routing protocol implemented? Do the authors consider a multi-hop network?

We described our simulation engine in Section 7.1. (Simulation settings) and also explained how to create route from nodes to a central node. We assume that our scheme can work in standard IWSNs. Standard IWSN such as ISA100.11a support multi-hop network. Therefore, we also consider a multi-hop network.
(8) The PER is fixed, but Table 1 and 2 reports a range 0-20%; what is the actual value? How many simulation runs do the authors consider?

In our simulations, we determined PER of a path quality at random for every node. As shown in Table 3, we set the range of PER to 0 - 20% (e.g., PER of node 1 is 2% and PER of node 2 is 14%). Although the link PER dynamically changes in reality, we assume it is stable and constant in this paper.

(9) What about the effect of initial random selection? Do the authors verify the impact on the GA algorithm?

In Section 6.1., we added the following sentences:

“We think that the random selection provides a search diversity. Our simulation experiment showed that it did not have a big impact on the performance.”

(10) What is the fitness value in Section 7.2?

The fitness value is calculated by Equation (13). We have already described our fitness function and fitness values in Section 5 and in Section 6. Since it is easy for readers to understand the value, we described what is the fitness and how it is calculated, in Section 7.2 again.

(11) What is the slot information plotted in Figure 11?

We are sorry for the mistake in previous manuscript. That was erroneous description. We revised labels of y-axis of Figure 11, 14, 16.
(12) How is the success probability computed (is it the pass quality as well)?

We calculate success probability by Equation (1). Therefore, we added the following sentence in Section 7.1:

“The E2E communication success provability is calculated by the left-side hand of Equation (1).”

In addition, we added that path quality is as well as End-to-end PER in Section 6.1.2 (Initialization).

(13) How do the authors choose the 3s duration of each slot?

In Section 4, we explained how we decide the value as follows:

“We consider bandwidth of downward traffic to define polling cycle $\Delta t_s$. For example, an our preliminary experiment showed downward traffic for SmartMesh IP that is based on the 6LoWPAN and IEEE802.15.4e standards is assigned every about 2 seconds by the default setting. $\Delta t_s$ should be longer than the frequency for pre-assigned downlink traffic of IWSN protocols. In this paper, we set $\Delta t_s$ to 3s for simulation setting.”

(14) Why the data collection cycles scale linearly with the number of nodes in the IWSN?

Our proposal should determin the length of QF that depend on the number of nodes in an IWSN. Therefore, we describerd it in Section 8.2. as follows:

“At the same time, we expand polling cycles because our proposal data traffic
control scheme is like a TDMA manner. To be more precise, we enlarged the length of a QF 10 times because the length of a QF is $\Delta T_{QF} = \Delta t_s \times N_{all}$ as described in Section 4. Accordingly, we also enlarged the length of a SF 10 times. Simulation conditions are described in Table 4.”

(15) Please, use “s” instead of “sec” (according to the SI standard unit of measurement).

We corrected the mistake.

We hope the revised version is suitable for publication and look forward to hearing from you in due course.

Sincerely,
Yuichi Igarashi
Hitachi, Ltd.