Implementation and Evaluation of a Reminder Registration Interface for Daily Life Objects

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Abstract. There are many tasks regarding objects that are conducted according to specific date and time in daily life. To avoid forgetting to handle a task, reminder applications are useful. However, these tools require some effort on the part of the user to verbalize her or his task, e.g., "Read the book taken out from the library," and input it to the system. To address this issue, we devised a model in which the user physically registers "the existence information of the task" to the object. This enables the user to notice the existence of a task related to the object and recall the content of the task every time he or she sees it. To realize this model, we propose a method for registering an object reminder by attaching clips to it. This makes it possible for the user to set the reminder only by attaching *clips* that have the specified duration information. Each clip has a full-color LED and displays the existence of task and deadline information associated to it. The evaluation result demonstrates that the proposed method yields better operability and acceptability for registering reminders than those of the conventional method.

Keywords: Reminder · Real environment oriented interface · Clip

1 Introduction

In daily life, there are objects connected to many tasks planned for specific dates and times. To ensure tasks are not forgotten, reminder applications are useful. However, existing reminder applications have problems. To use a reminder application, the user has to verbalize their task (e.g., "Read the book borrowed from the library") and input it into the system. If this is a business task, such as "send quotation data to customers today," the cost of verbalization and system inputting seems to be worthwhile. However, the cost outweighs the benefits for everyday tasks such as reading books. In this research, we will study future tasks related to such objects in daily life. To make the research subject clearer, we will organize where these tasks will be positioned among future tasks. Future tasks can be divided into *time-based* tasks and *event-based* tasks [1–3]. When a *time-based* task is detailed, it can be divided into a *by-time task* (a future task to be executed by a certain time) and an *on-time* task (a future task to be performed at a specific time). In this research, we focus on *by-time* tasks. Also, when an *event-based* task is refined, future tasks concerning objects, people, places, and situations can be classified as *object-based* tasks, *person-based* tasks, *location-based* tasks, and *situation-based*

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tasks. We focus on *object-based* tasks. Based on the above, this research focuses on future tasks that are *by-time* and *object-based* in daily life.

2 Research Goal

Future tasks are generally considered to consist of Step (1) formation of intention, Step (2) memorization of intention, Step (3) recall of intention, Step (4) execution of intention [3, 4]. A reminder aiming to memorize and notify of future tasks needs to support Steps 2 and 3, but considering the application to future tasks that are *by-time* and *object-based* tasks in daily life, some existing technologies have some problems.

As a first problem, in Step 2, the user needs to verbalize their task. Although [5] demonstrated an automatic notification time setting, they have not yet automated task content verbalization.

As a second problem, in Step 3, with existing technologies, it is necessary to constantly carry the electronic device to confirm the contents set via the reminder [6–9]. In a *by-time* task, it is likely that Step 3 will be performed several times before the deadline of the task. Therefore, for reminders used in daily life, it is desirable to be able to confirm task contents/deadlines without carrying devices.

As a third problem, there is the issue that the objects to which information can be related are limited. In the field of real environment-oriented interfaces, many methods of associating information with real world objects have been proposed. However, since it is based on the use of dedicated tools, it cannot be general purposed to various objects entering and leaving a daily living space. When setting a reminder related to various daily life objects, it is a burden to prepare dedicated tools for each object.

From the above, the case in which the user sets a reminder for the object-related daily life task deadline, we outline three research subject categories:

1. Reminders can be set without task verbalization
2. Task contents and deadlines can be confirmed without using an electronic terminal
3. The system is generalized to any daily life object

3 Proposal Method

To address the problems mentioned in Sect. 2, we decomposed the entire reminder system model. In the conventional model, it is necessary for the user to register the task contents in the system after verbalizing their task, which is burdensome for the user (see upper half of Fig. 1). For this reason, we hypothesized that, even if the system does not memorize task contents, the user can recall the task contents from their own memory if they view the related object in combination with the presence of an additional item that contains task information. Based on this hypothesis, we have devised a model in which the user physically registers the existing task and deadline information to the object (see lower half of Fig. 1). Consequently, each time the user sees an object, they can recognize that there is a task related to it, and can thus recall the task from their own memory. To realize this model, we propose a method for registering a reminder to an object by attaching clips to it. This allows the user to set the reminder by merely attaching clips containing the specified deadline information (see the upper half of Fig. 2). Each clip has a full-color LED indicating the existence of a task and the deadline information. Furthermore, by adding multiple clips, time addition can be performed (see the lower half of Fig. 2). For example, by attaching a clip with respective holding times of 1 d and 12 h to an object, it is possible to set a reminder with a deadline of one and a half days later.

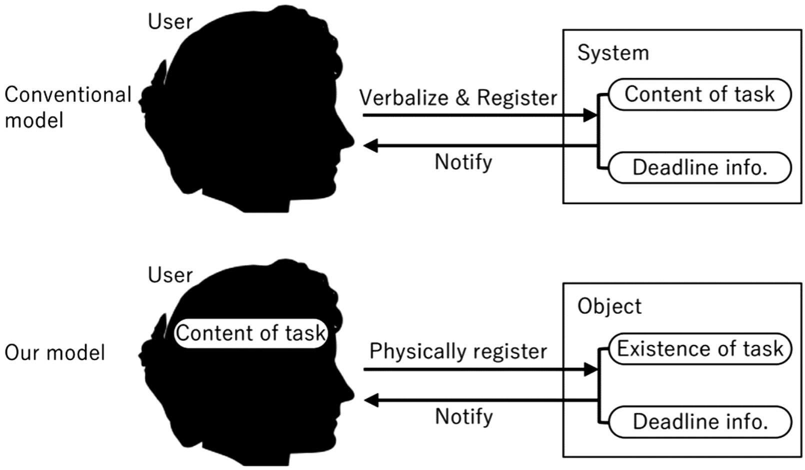

Fig. 1. The difference between the conventional model and our model.

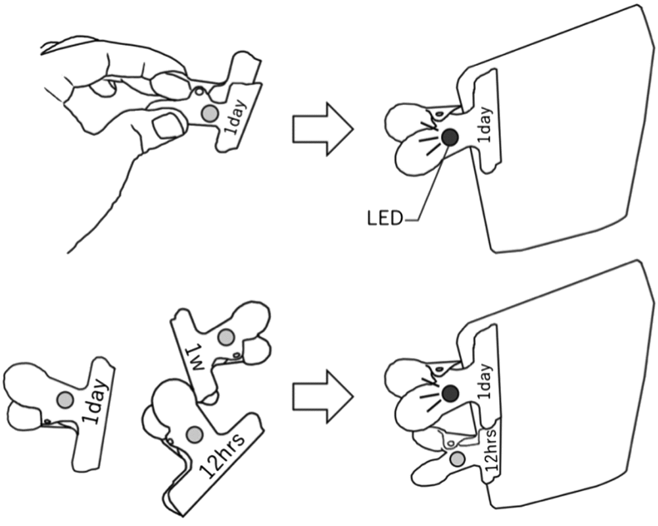

Fig. 2. Attached-clip reminder registration concept.

4 Implementation

The prototype system is comprised of multiple clip components and one clip control component. Each clip wirelessly communicates with the clip control component in real time using a WebSocket. Figure 3 shows the clip component in use; the LED and current sensor are attached. The LED color changes according to the time remaining until the deadline (Fig. 4). Gradation is implemented to incorporate a smooth-transitioning intermediate state for each color; the LED lights up before the deadline and flashes after the deadline. A color change of green, yellow, red refers to a traffic signal, which is familiar in everyday life. Figure 5 provides a sectional side view of the clip component showing the current sensor configuration. This mechanism enables the clip component to determine whether it has been attached to the object by detecting insulation. As previously mentioned, multiple clips can be attached to an object to add holding times (see lower part of Fig. 2).

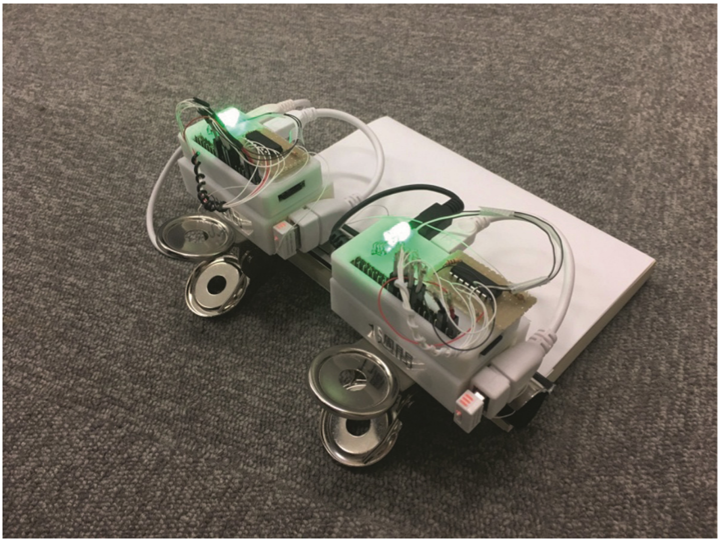

Fig. 3. Clip component implementation.

Fig. 4. LED color indicator of the remaining time. (Color figure online)

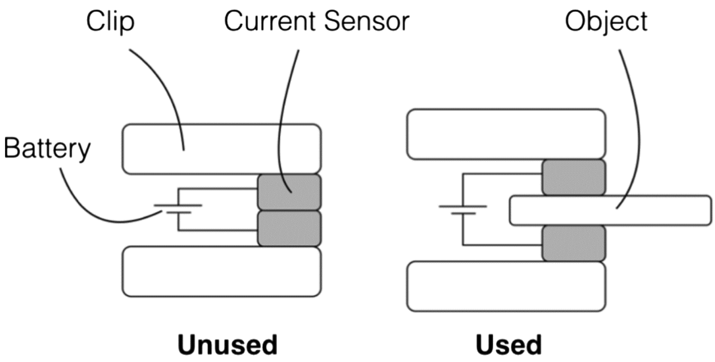

Fig. 5. Sectional side view of current sensor configuration for in-use detection.

5 Evaluation

5.1 The Evaluation Design

The intent of this research is to propose a new interface and model to provide reminders of tasks in daily life. To confirm the effectiveness of the proposed method, it is necessary to use the system and verify it in daily life. However, there are various external factors during everyday life, and the daily life of each subject is diverse. Therefore, to gradually and strictly proceed with the evaluation, we first verify the usability of the interface of the system itself (Sect. 5.2) and evaluate the practicality common to each subject during daily life (Sect. 5.3).

5.2 Evaluation 1

To verify the usability of the proposed method, we conducted an experiment comparing the smartphone reminder application with the time taken to set a reminder. The procedure of the experiment is as follows. The objects used in the experiment are books, a milk carton, and a potato chips packet.

Step 1: In the case of the proposed method, put an opaque box containing the clips in front of the subject. In case of the baseline method, have the reminder application launched on the subject's smartphone.
Step 2: The experimenter selects objects in random order and places them in front of the subjects and notifies the subjects of the deadline, for example, "the deadline is in xx weeks". In the case of the proposed method, the experimenter opens the box containing the clips immediately after notification.
Step 3: In the case of the proposed method, the subject selects the necessary clips from the box and attaches them to the object. In the case of the baseline method, subjects verbalize task themselves, and register the task names and deadlines in the reminder application.

Figure 6 shows the experimental results. The proposed method demanded less working time than the smartphone reminder applications for all objects. From here, it is thought that verbalizing the task contents and inputting text to the application has an influence on increasing the working time.

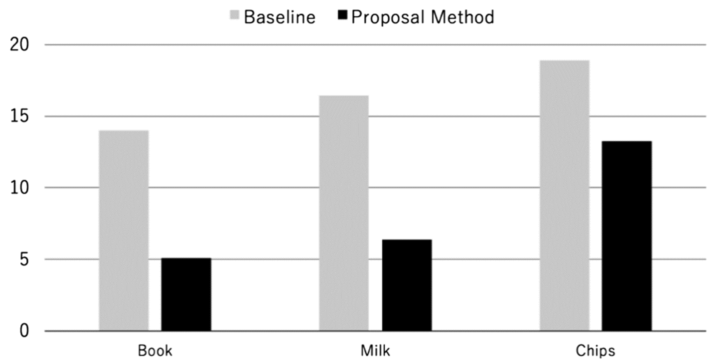

Fig. 6. The mean operation times in evaluation 1 (sec, N = 12).

5.3 Evaluation 2

To evaluate the practicality of our system, we have tested the hypothesis in Sect. 3 via a two-week experiment involving ten subjects. The procedure of the experiment is as follows. As the experimental site, we selected our laboratory which is a daily living space where all the subjects spend most of their school days. In addition, we prepared six types of objects, two books (a comic, a novel), two types of snacks (chips, jelly), and two documents (a report, a questionnaire). Steps 2 and 3 were carried out twice, about once a week, after Step 1.

Step 1: Set reminders on objects using the proposed method. At that time, the subject tells the experimenter the task.
Step 2: Give the subject a voice recorder and have the subjects clean the laboratory for 5 min.
Step 3: When a subject notices that another subject set a reminder, the subject records the recalled task and remaining deadline in the voice recorder.

In performing the steps above, the experimenter calculates the task content recall rate and the recall time of the remaining time limit. The task content recall rate is calculated by comparing the tasks set by the subject with the tasks recorded when the subject recalled, and by discussing how accurately they are recalled. The recall error of the remaining time limit compares the actual remaining time limit with the remaining time limit remembered by the subject and calculates the error.

The results of the experiment are shown below. Figure 7 shows the percentage of people noticing the object that set the reminder. The horizontal axis shows the elapsed time from Step 1, and the vertical axis represents the percentage (%) noticed.

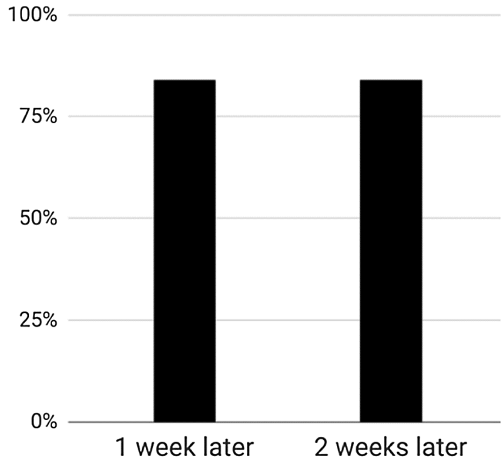

Fig. 7. The mean percentage of objects noticed in evaluation 2 (%, N = 10).

Figure 8 shows the rate of task content recall when the object that set the reminder is noticed. The horizontal axis shows the elapsed time from Step 1, and the vertical axis represents the percentage (%) correctly recalled. Both one week and two weeks later, the user could remember the tasks he himself performed with an accuracy of 100%. Therefore, if a user can notice the object that set the reminder, the hypothesis is that a task recalled from a user's memory is considered correct.

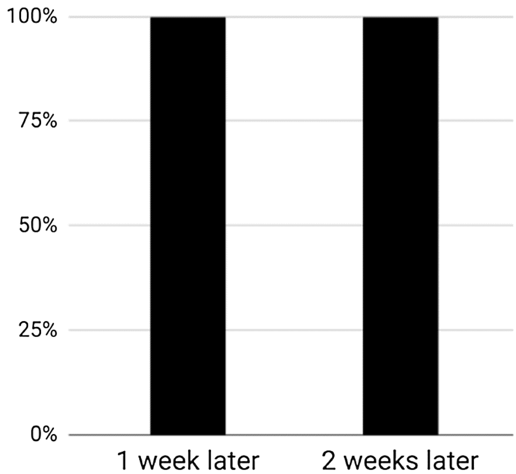

Fig. 8. The mean percentage of recalled task contents in evaluation 2 (%, N = 10).

In addition, regarding the recalling error of the remaining time limit, the error was 13.3% after 1 week and 5.5% after 2 weeks. The percentage of expirations noticed was 85.7% after 1 week and 87.7% after 2 weeks. As compared with the time after 1 week and after 2 weeks, the accuracy of both the recall of the remaining time limit and the recall of the expiration has improved. It is thought that this is because the subjects once recalled their tasks and deadlines, so that the deadline was established more in memory.

6 Conclusion

In this research, we devised a model in which the user physically registers "the existence information of a task" directly in the object. To realize this model, we proposed a method for registering the reminders associated to object by attaching clips to it, and constructed a prototype system combining clips and LEDs. In the experiments, we confirmed the effectiveness of the proposed system on interface usability and practicality in daily life. In the future, we plan to apply the objects to be applied. Given that the current system determines whether clips are attached to an object by the current sensor, if the object is a conductive object, it cannot be determined whether the clips are attached to the object. This problem can be solved by a method such as attaching a mechanical opening or closing sensor to the clips.

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