Hanyang University
Introduction to Intelligent Robot Control

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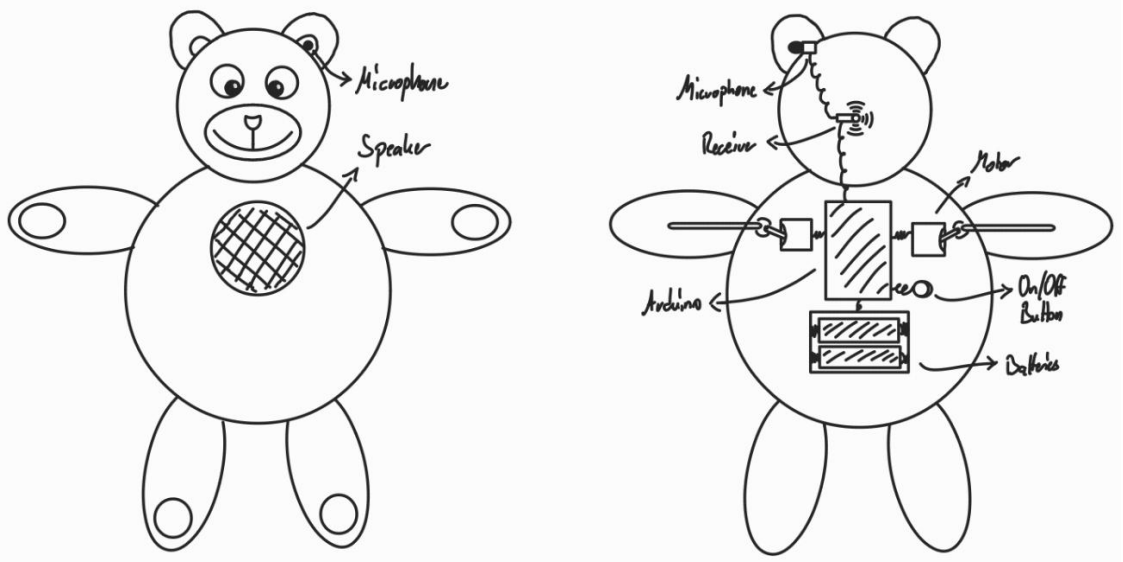
Prototype Design & Evaluation Plan

I. Sketch 1

A. Drawings/Sketches



For this design we will use a teddy bear in which we will hide the electronics. So that it can still be used for its original purpose, namely as a cuddly toy, we will do without screens and a large number of buttons and instead use a remote control and simple voice commands to operate the alarm clock inside the teddy bear.
There should only be one on/off switch so that the user can turn off the alarm clock. For all other functionalities the remote control or voice commands will be used. The commands will include only simple words, such as 'off/stop' (turns off the alarm), 'snooze' (snoozes the alarm), 'time' (gives the current time) and 'alarm' (gives the time and date of the alarm).
The prototype will interact with the user in the form of short sentences or a movement of its arms.

B. Needed Components

1. 1x Teddy bear
2. 1x Box (to store the electronic in the bear)
3. 1x Microphone
4. 1x Receiver
5. 1x Remote
6. 1x Speaker
7. 2x Motors

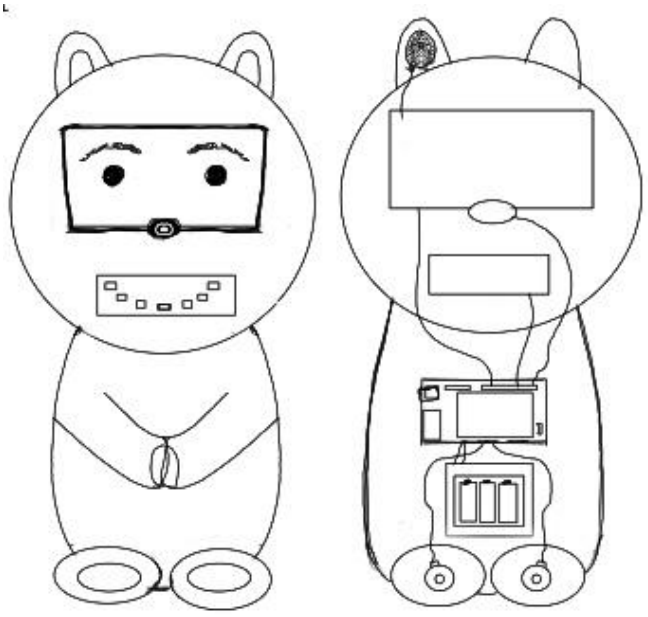
8. 1x Arduino
9. Cables
10. 1x Battery case
11. 1x Button (for on/off functionality)
12. 1x RTC
13. Rods (for stabilization and to move the arms of the bear)

C. Weekly work plan

Week	Todo
9 (27/10 - 03/11)	Implement clock functionality
10 (03/11 - 10/11)	Implement alarm functionality (setting via remote)
11 (10/11 - 17/11)	Implement movement
11 (13/11 - 17/11)	Implement batteries and on/off functionality
12 (17/11 - 24/11)	Implement language/commands
13 (24/11 - 01/12)	Testing the prototype
14 (01/12 - 08/12)	Evaluation with users
15 (08/12 - 15/12)	Analyzing the data

II. Sketch 2

A. Drawings/Sketches



Also for this design we will use a teddy bear. Unlike the first design, however, we will integrate two screens that can be used to control the prototype and the alarm clock, respectively. To make this possible, one of the two screens will be a touchscreen. The other one will be a simple LCD. The touchscreen will replace the eyes and the LCD will replace the mouth of the bear.
With the help of the screens and a speaker, the prototype will be able to express emotions. Here we had thought that the bear would be happy if the user gets up at the desired time, and unhappy if the user snoozes the alarm.
As with the first design, motors are again integrated into the bear, but this time to cause vibrations.

B. Needed Components

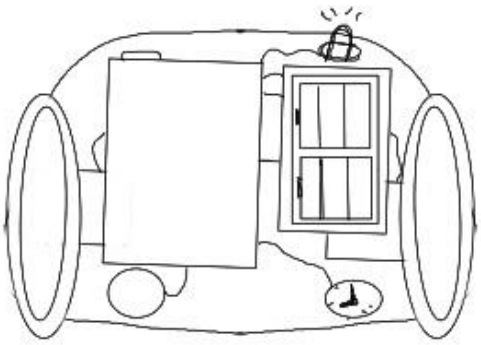
1. 1x Teddy bear
2. 1x Box (to store the electronic in the bear)
3. 1x Microphone
4. 1x Touch screen (for the eyes)
5. 1x LCD (for the mouth)
6. 1x Speaker
7. 1-2 Vibration motors
8. 1x Arduino
9. Cables
10. 1x Battery case
11. 1x Button (for on/off functionality)
12. 1x RTC

C. Weekly work plan

Week	Todo
9 (27/10 - 03/11)	Implement clock functionality
10 (03/11 - 10/11)	Implement alarm functionality (on/off via remote)
11 (10/11 - 13/11)	Implement monitor and touchscreen
11 (13/11 - 15/11)	Implement movement
11 (14/11 -17/11)	Implement language/commands
12 (17/11 -20/12)	Testing the correct function of each part.
12 (20/11 -24/12)	Build the design
13 (24/11 - 01/12)	Testing the prototype
14 (01/12 - 08/12)	Evaluation with users
15 (08/12 - 15/12)	Analyzing the data

III. Sketch 3

A. Drawings/Sketches



This design focuses more on waking up the user through a physical task, more precisely movement by tracking the prototype. When the alarm sounds, the robot starts moving, in the case of the prototype, following a line. The user must then follow it if he wants to stop the alarm or snooze it.
The interaction between the prototype and the user will be done via a 4*4 keypad,
This prototype also offers the possibility to show emotions via the integrated OLED or its speakers. Furthermore, it will use a regularly flashing LED to make it easier for the user to determine his position.

B. Needed Components

1. 1x Big box (to store all the electronic components)
2. 1x OLED
3. 1x Microphone
4. 1x LED
5. 2x Big wheels, 2x small wheels (for stabilization)
6. 1x Speaker
7. 2x Digilent IR Range Sensor
8. 1x SparkFun Dual H-Bridge motor drivers L298
9. 2x DC motors
10. 1x Arduino
11. Cables
12. 1x Battery case
13. 1x 4*4 Keypad
14. 1x Button (on/off functionality)
15. 1x RTC

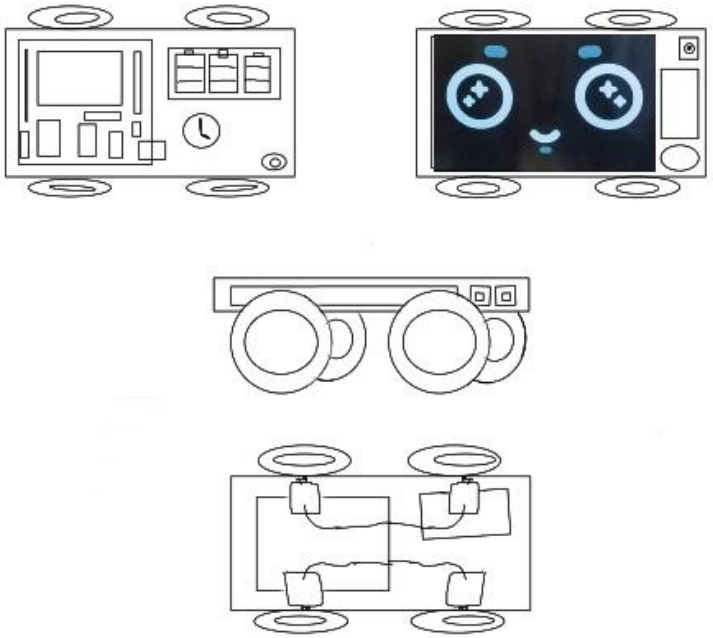
C. Weekly work plan

Week	Todo
9 (27/10 - 03/11)	Implement clock functionality
10 (03/11 - 10/11)	Implement alarm functionality
11 (10/11 - 13/11)	Implement movement

11 (13/11 - 15/11)	Implement OLED
11 (14/11 -17/11)	Implement language/commands
12 (17/11 -20/12)	Testing the correct function of each part.
12 (20/11 -24/12)	Build the design
13 (24/11 - 01/12)	Testing the prototype
14 (01/12 - 08/12)	Evaluation with users
15 (08/12 - 15/12)	Analyzing the data

IV. Sketch 4

A. Drawings/Sketches



This design is very similar to the third design, but has the crucial difference that instead of a 4*4 keypad, the user can interact with the prototype via a touchscreen.
Otherwise, the goal behind this design will be the same as the previous design: to wake up the user with the help of physical tasks. In this sense, the robot will again be able to move through space or follow a line.
In addition, the user-robot interaction will be facilitated by emotions, which the robot can show via the screens, and a speaker.

B. Needed Components

1. 1x Big box (rectangular and thin, to store all the electronic components)
2. 1x OLED
3. 1x Touchscreen

4. 1x Microphone
5. 1x LED
6. 4x Wheels
7. 1x Speaker
8. 2x Digilent IR Range Sensor
9. 1x SparkFun Dual H-Bridge motor drivers L298
10. 2x DC motors
11. 1x Arduino
12. Cables
13. 1x Battery case
14. 1x Button (on/off)
15. 1x RTC

C. Weekly work plan

Week	Todo
9 (27/10 - 03/11)	Implement clock
10 (03/11 - 10/11)	Implement Alarm functionality
11 (10/11 - 13/11)	Implement touch screen and OLED
11 (13/11 - 15/11)	Implement movements
11 (14/11 -17/11)	Implement language/commands
12 (17/11 -20/12)	Testing the correct function of each part.
12 (20/11 -24/12)	Build the design
13 (24/11 - 01/12)	Testing the prototype
14 (01/12 - 08/12)	Evaluation with users
15 (08/12 - 15/12)	Analyzing the data

V. Detailed final evaluation plan

The final evaluation plan is based on direct metrics which will be collected directly from the robot and interviews.
The directly collected data will provide insights into the effectiveness of the prototype without being biased by the subjective feelings of the users.
A total of two interviews will be conducted per respondent. One before the tests and a second one after the tests. This makes it possible to record and analyze both the user's initial impression and his later experiences.

Direct data: How effective is the alarm clock robot?

- How many users wake up with the first alarm?

- How often do they snooze it?
- What interaction method is used more frequently? Which is used less?

Evaluation with users: How effective is the robot perceived by a user?

1. Before user-prototype-interaction: in an interview, the user will describe its expectations of the prototype.
    a. Overall expectations: What are his/her overall expectations?
    b. Effectiveness: Will the robot help him/her wake up?
    c. Quality: Will the robot make waking up more enjoyable?
    d. Interaction: Does he/she like the design of the robot? How does he/she expect the interaction with the robot to be?
2. After user-prototype-interaction: in an Interview, the user will share its actual experiences with the robot.
    a. Bottom line: What are his/her overall experiences?
    b. Effectiveness: Did the robot help him/her to wake up?
    c. Quality: Did the robot make waking up more enjoyable?
    d. Interaction: How did the user perceive the interaction with the robot? What was easy, what difficult? Which interaction method did he/she prefer?
    e. Comparison: How would the robot fare against other wake up measures in his/her opinion?
    f. Opinion: What would he/she change about the robot, if he/she could?