THE DESIGN AND IMPLEMENTATION OF A STORYTELLING AND INTERACTIVE ACCOMPANY ROBOT

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Abstract - Nowadays, with the increase of economic request, the families have fewer time to been together and share the precious family time. Some children have to be alone without the parent's accompany. In order to improve this issue, we design and implement a robot which could tell story to children to fulfill the gap of parent's accompany. The goals of this story telling robot include voice speech, automatic page turning, question answering and detecting if children still listening.

Keywords – Story Telling , Robots, Parenting

I. INTRODUCTION

In present time, there are a significant improvement of economic in our society. More consumptions lead to more workload. For the parents, the more work load means the fewer time to care their children. The static result of the time of Dual-Income couples dividing shares shows this fact clearly as follows[1].

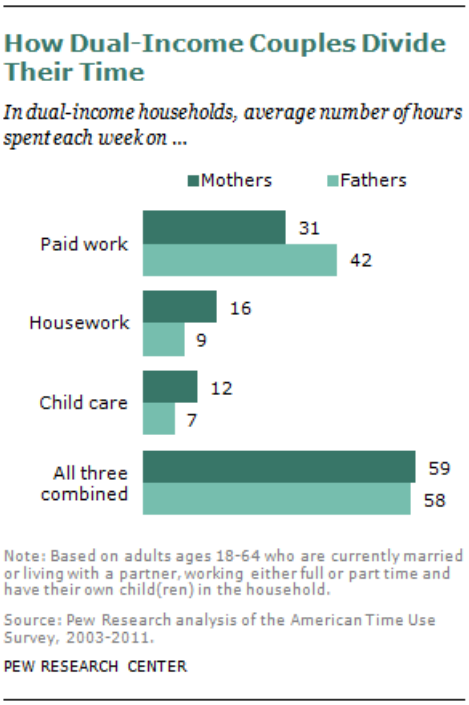


Fig. 1. Modern Parent time dividing

In Fig. 1, we observe that the parenting time only occupies 7% to 12% in a modern society. The observation shows that the children might not have enough caring from parents, and it might lead to the more society problems. In order to improve this problem, we decide to help parents who without enough parenting time with a story telling robot. This robot should have the ability of voice speech to tell story for children. Therefore the need of caring could be fulfilled partially. Due to there are usually multiple pages of children's books, thus this robot should have the ability to turn the pages automatically. Therefore the children could enjoy the story listening time.

Furthermore, when the children listen stories, they might have some questions. Such as the question likes "why the noses of elephants are that long?" At that time, the story telling robot should receive the question from children and find the answer as soon as possible for children with voice feedback.

It is worth noting that we should also detect the status of children listening. If the children are leave away, the robot will know that and stop storytelling to ensure the children could continue without break.

In order to reach these requirements of storytelling robot, the rest of the paper is organized as follows. The background and related work are presented in Section 2. The methodology and validation is detailed in Section 3. The experimental results are in Section 4. We then conclude our paper in Section 5.

II. RELATED WORKS

In the research field of storytelling robots, there are already a lot studies are proposed. For example, Mutlu proposed his work about modeling of a storytelling robots[2]. Plaisant also proposed his work for pediatric rehabilitation[3]. Shih studied of the using of Robots as a storytelling partner in the English classroom-Preliminary discussion[4]. These researches show the possibility of using storytelling robots in various scenarios.

Moreover, there are some surveys focus on the robot parenting, such as Chen's survey on storytelling with robots [5], and Gelin's storytelling humanoid robot[6]. Even in the field of psychotherapy, the storytelling robot also has its work[7].

Some storytelling robots are presented as a software, such as Sugimoto proposed the mobile mixed-reality environment for children's storytelling using a handheld projector and a robot[8]. The storytelling robots also work in the language learning field[9, 10]

III. THE METHODOLOGY VALIDATION

In order to build a storytelling robot for the children, the stories media is the first step. In this study, we use a magazine for children as the storytelling media, the whole robot design is shown as follows.



Fig. 3. The design of a storytelling robot

In order to reach the goal of a robust robot, this storytelling robot is built with multiple aluminum extrusions as the main frames. This frame could be adjusted freely to fit various height of children. With the correct adjustment, children could read the magazine comfortable and listening storytelling at the same time. The adjustable design is shown as follows.

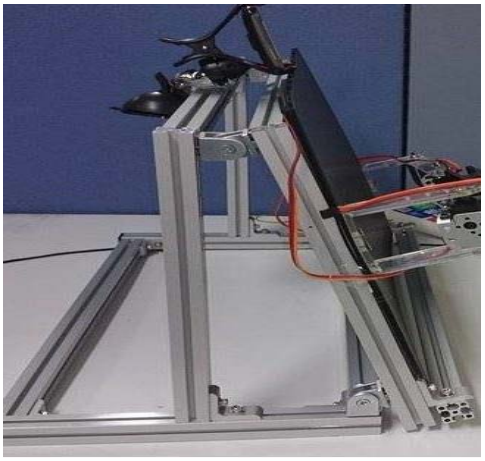


Fig. 4. The design of adjustable frames

The configuration of this storytelling robot is shown as follows. The microcontroller is STM TM32F103C8T6. The MCU is connected to servo control and motor control. Moreover, the ultrasound senor is also connected to MUC to provide the information of children location, and then the robot could determine that if children is still there to listen story.

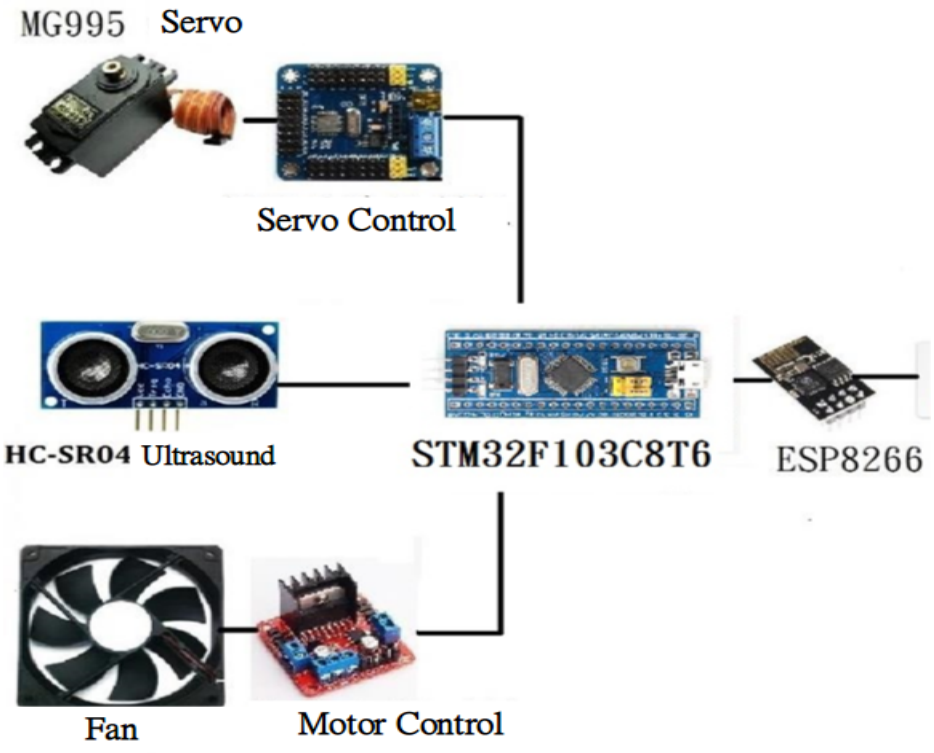


Fig. 5. The Configure of the robot system

The whole system design is shown as follows.

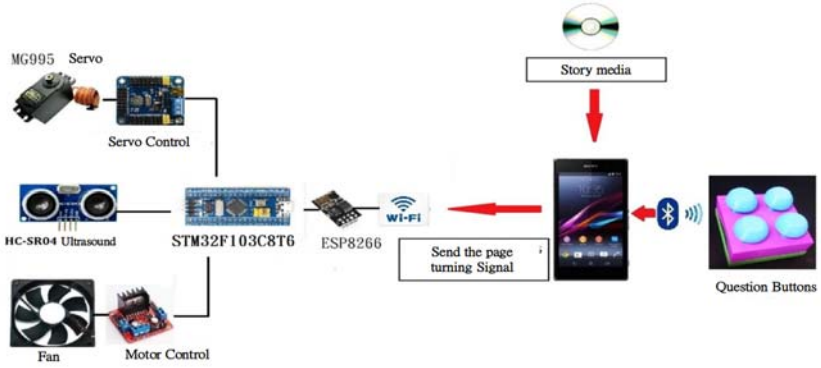


Fig. 7. The storytelling robot system design

On the other hand, we use a smartphone as the media player to play the story media. In order let children ask questions, we also design a question button. When children press this button, the storytelling will be paused. And the question of children will be convert to string with the technology of speech recognition. The question string will be searched to find the appropriate answer for children.

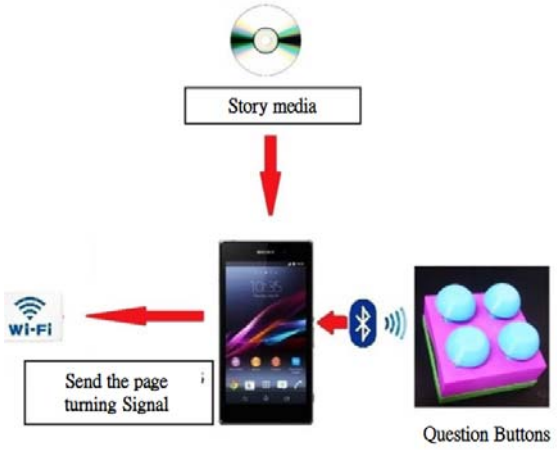


Fig. 8. The media player and question buttons

IV. THE EXPERIMENTAL RESULT

With the use of adjustable design, the robot could fit various height of children, the experimental results show the feature is very adaptable as follows.

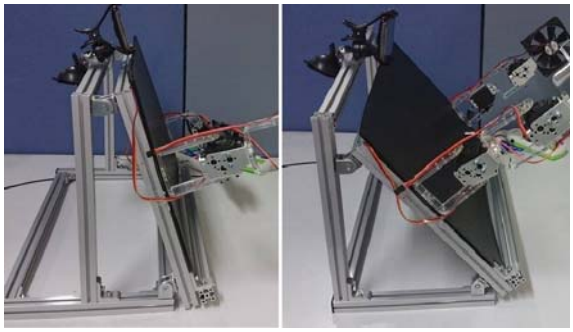


Fig. 9. The adjustable design experiments

With the design of robot arms, the MG-995 servos are used as the joints of arms as follows. The page turning functions are combined with two arms. The first one suck up book pages with the fan, and then another arm turns the page over. The relative design is shown as follows.

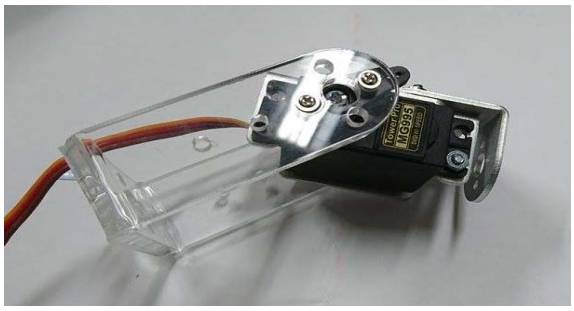


Fig. 10. The MG-995 servo

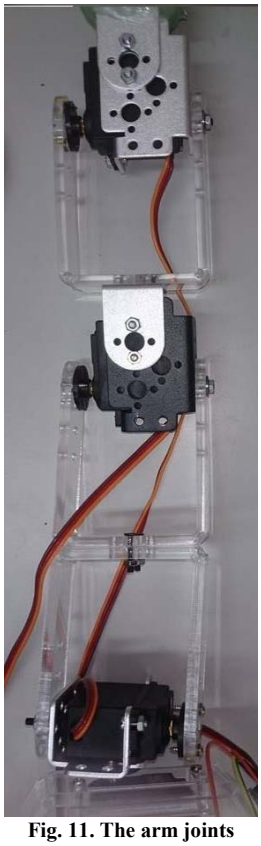


Fig. 11. The arm joints



Fig. 12. The arm with the fan

It is worth noting that the effect of question button is welcome to children. The design of question button is created with 3D modeling technology and 3D printing as follows.

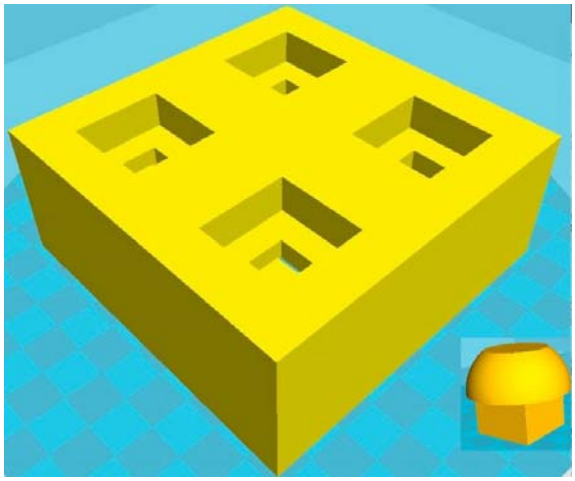


Fig. 13. The question button 3D design



Fig. 14. The question button 3D printing

CONCLUSION

In this study, the storytelling robot is proposed. With the support of MCU and android applications, a robot control system is developed to test. The experimental result shows that the storytelling robot could be adjusted to fit the various children, and the feedback of question button is very useful. Thus this proposed robot is actually a good helper in parenting.

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