

## ***T-BOT AS AN EFFORT TO OVERCOME SPEECH DELAY IN CHILDREN***

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### **ABSTRACT**

*Speech is a developmental stage that begins in infancy. The speech stage must be considered as early as possible, because it can be used as a parameter or benchmark for the presence or absence of developmental disorders in children. Based on the results of the Observation and Research of Literature Studies conducted, speech delay or speech delay is a phenomenon that is often found in today's society, especially in the digital world as it is now. Based on the research obtained, parents (both father and mother) currently do not have quality time with their children because they are busy working and dominated by smartphones. Currently, there are many speech therapy practices, both opened independently by doctors and in hospitals. However, there are some parents who say that their children experience stress when they are brought to a therapy place because they feel threatened or afraid of the atmosphere in a therapy place that is foreign to them. There are studies that reveal that speech delay can also be done at home. The causes of speech delay are children who have too much screen time, are rarely invited to interact in two directions, and lack of stimulus from family or closest people. The purpose of making T-BOT or (Talking Robot) is as an effort to overcome and can be speech therapy for children from the age of 1.5 years by inputting various vocabulary, compound sentences consisting of 2 words, 3 words to 1 structured sentences. The existence of this T-BOT will be the first alternative for parents to help provide speech therapy for children at home and of course children do not feel pressured and feel more comfortable playing while practicing their speaking skills with the T-BOT. The output produced is in the form of a robot that provides information in the form of voice in Indonesian as the mother tongue of our country. The child's speech development will also be evaluated to see how effectively the T- BOT is working.*

**Keywords:** *Robot, Arduino Uno, Speech Delays, Prototypes, Speech Therapy*

### **1. Introduction**

Speech delay is one of the most common causes of developmental disorders in children (Neece et al., 2020). This is evidenced by the results of several studies conducted by Dewanti, et al in 2012 that in Jakarta, the main complaint of patients when checking their children is speech disorders by 46.8%. Meanwhile, in Surakarta there were 595 children who experienced speech delays during 2016 data obtained from Moeward Hospital in 2017. The presentation of these data shows the level of speech delay disorders in children in several cities in Indonesia shows inconsistent results can simply be ignored (Tohidast et al., 2020; Lipkin et al., 2020).

The causes of speech and language disorders in children can be seen from various factors, namely, Hearing loss, Speech muscle disorders, Limited cognitive abilities, Pervasive disorders and Lack of communication and interaction with parents and their environment (Snowling et al., 2020; Hyman et al., 2020). The strategies that can be carried out by parents with speech delays include, 1) training children to speak correctly, slowly and repeatedly, 2) When speaking, always pay attention to the grammar spoken, 3) always involve children in speaking in every situation by improving pronunciation. children who are still wrong, 4) Use of technological media that supports children's vocabulary and 5) Regular consultations with doctors and child psychologists to determine child development. One of the causes of speech delay in children today is that children are too often exposed to gadgets or gadgets (Akamoglu & Meadan, 2018). Based on the results of research conducted by Rae Fernandez and Hasti Lestari in 2019 that research with a sample

consisting of 51 children, 33 (62%) of whom are women. The mean age was 2 years 5 months (SD 0.6). It was found that 3 (5.8%) children experienced language delays, 10 (19.6%) children used devices more than 2 hours per day and 36 (70.5%) children used devices more than 2 days per week. There was a significant relationship between the intensity of using gadgets for more than 2 hours and language delay ( $p=0.034$ ) (Binns, et al., 2019).

Based on the description above, one of the speech therapy efforts that can support and help accelerate the recovery of speech delay in children is to design and build a T-BOT that is able to reduce the intensity of using gadgets in children and can replace the role of parents in suppressing and learning language in children. so that language skills in children who suffer from speech delay can be more effective. The resulting output is in the form of information in the form of voice in Indonesian as the mother tongue of our country. The way this robot works is by inputting various vocabularies, compound sentences consisting of 2 words, 3 words to 1 structured sentence, children's songs and children's stories. The child's speech development will also be evaluated from the first day of therapy to see how effectively the T-BOT works to serve as product testing.

Speech delays have a huge impact on a child's development at the next level. Children can feel inferior and insecure, have difficulty socializing with their peers, and have difficulty understanding and absorbing learning materials at school. The risks of developmental delay in speech are: 1) conceptual ability and educational achievement, this does not show a bad effect on children's educational and cognitive development because it does not depend on understanding and using language; 2) personal and social factors, speech delay causes negative risks to interpersonal relationships and the development of self-concept in children. Misunderstanding of others when communicating can cause low self-esteem in children.

Microcontroller is a microcomputer chip that is physically in the form of an IC (Integrated Circuit). Microcontrollers are usually used in systems that are small, inexpensive and do not require very complex calculations as in PC applications. Microcontrollers are found in equipment such as microwaves, keyboards, CD players, VCRs, Remote Controls, Robots, etc. The microcontroller contains the main parts, namely the CPU (Central Processing Unit), RAM (Random-Access Memory), ROM (Read-Only Memory) and I/O (Input/Output) ports. In addition to these main parts, there are several hardware devices that can be used for many purposes such as enumeration, serial communication, interrupting, etc. Certain microcontrollers even include ADC (Analog-To-Digital), USB Controller, CAN (Controller Area Network), etc (Sutabri et al., 2019; Raghunathan, 2021; Zhiqiang et al., 2021).

## 2. Research Methods

This research was conducted by building a prototype first and then implemented it to related parties. Prototype models can be used to connect customer misunderstandings about technical matters and clarify the specifications of the customer's desired requirements to application makers (Bjarnason et al., 2021). The steps of the prototype model are:

1. Researchers will collect the data needed in the process of making tools, and this stage is also the first step to find a problem formulation related to how to design a Robot (T-BOT) as an effort to overcome speech disorders in children (Mendoza et al., 2022).
2. Then a prototype program will be made to provide an overview to the customer. The prototypes that will be provided are as follow

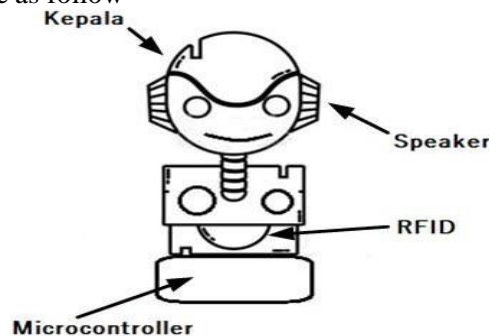


Fig 1. Robot Body Design

The following is an overview of the Layout Control Unit Talking Robot (T-BOT) that

will be made :

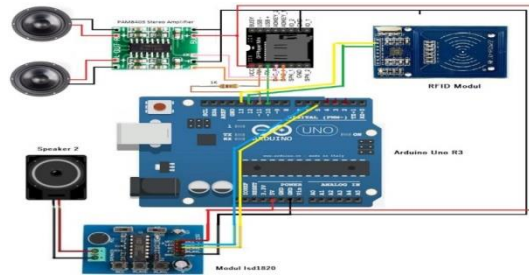


Fig 2. T-BOT Control Unit Layout Design

Information :

1. This speech therapy robot is only a medium that is able to display sounds to repeat vocabulary that will be introduced to objects (children), in addition to vocabulary recognition, this robot is also able to read short stories and interact using an RFID card.
2. Vocabulary is saved in .mp3 sound file format on SDCard card installed into Mp3 module.
3. Mp3 module functions to run sound files which are then displayed through speakers 1. Vocabulary collection depends on the number of files stored on the SD card memory in this Mp3 module.
4. Then to teach children to recognize new vocabulary, the Isd1820 module is available which functions to record new sounds or vocabulary with a maximum duration of voice recording for 10 seconds.
5. In this robot, an RFID sensor is also available, where the function of the RFID sensor is for the child's interaction with the robot. For example, to recognize color, each child shows a red RFID tag, the robot will say red, as well as other colors, especially basic colors.

In addition to color recognition through RFID tags, several examples of "story telling" or the robot's ability to read short stories are also available. The title of the story corresponds to the rfid tag chosen by the child.

#### 4. Results and Discussions

The initial stage in making this T-Boot is testing each module which consists of:

1. Testing the movement of the neck or head (position facing left, right, up and down)  
Testing the MP3 sound module. The MP3 has included the results of the sound recording.



Fig 3. Robot head manufacturing and testing process

2. Ultrasonic sensor testing
3. Testing the bluetooth module



Fig 4. Circuit Box

4. Test the system as a whole

The next stage that will be carried out is making the robot head body, testing the RFID Card and filling the circuit box. automatically when the ultrasonic sensor detects human distance, the servo will open the lid of the trash can.

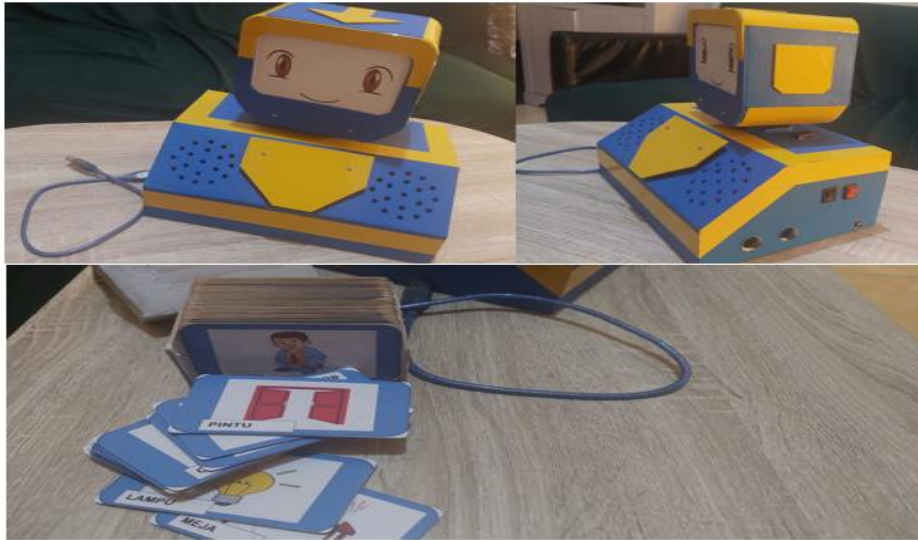


Fig 5. T-BOT with flash card

## 5. Conclusion

From the test results, it can be seen that the T-Boot Robot is able to provide stimulation to children who have speech delays if therapy using T-Boot is carried out routinely and continuously. The suggestion that can be given is that in the future T-Boot will be able to have a wider and wider vocabulary. T-Boot is able to interact as if interacting with humans.

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## References

- Akamoglu, Y., & Meadan, H. (2018). Parent-implemented language and communication interventions for children with developmental delays and disabilities: A scoping review. *Review Journal of Autism and Developmental Disorders*, 5(3), 294-309.
- Bjarnason, E., Lang, F., & Mjöberg, A. (2021, October). A model of software prototyping based on a systematic map. In *Proceedings of the 15th ACM/IEEE International Symposium on Empirical Software Engineering and Measurement (ESEM)* (pp. 1-11).
- Binns, A. V., Hutchinson, L. R., & Cardy, J. O. (2019). The speech-language pathologist's role in supporting the development of self-regulation: A review and tutorial. *Journal of Communication Disorders*, 78, 1-17.
- Hyman, S. L., Levy, S. E., Myers, S. M., Kuo, D. Z., Apkon, S., Davidson, L. F., ... & Bridgemohan, C. (2020). Identification, evaluation, and management of children with autism spectrum disorder. *Pediatrics*, 145(1).
- Fernandez, L., & Lestari, H. (2019). Hubungan Penggunaan Gawai dengan Kertelambatan Bahasa pada Anak. *Jurnal Sari Pediatri*, 21(4), 231-5.
- Lipkin, P. H., Macias, M. M., Norwood, K. W., Brei, T. J., Davidson, L. F., Davis, B. E., ... & Voigt, R. G. (2020). Promoting optimal development: identifying infants and young children with developmental disorders through developmental surveillance and screening. *Pediatrics*, 145(1).
- Mendoza, S., Sánchez-Adame, L. M., Urquiza-Yllescas, J. F., González-Beltrán, B. A., & Decouchant, D. (2022). A Model to Develop Chatbots for Assisting the Teaching and Learning Process. *Sensors*, 22(15), 5532.

- Neece, C., McIntyre, L. L., & Fenning, R. (2020). Examining the impact of COVID-19 in ethnically diverse families with young children with intellectual and developmental disabilities. *Journal of Intellectual Disability Research*, 64(10), 739-749.
- Raghunathan, K. R. (2021). History of Microcontrollers: First 50 Years. *IEEE Micro*, 41(6), 97-104.
- Snowling, M. J., Hayiou-Thomas, M. E., Nash, H. M., & Hulme, C. (2020). Dyslexia and developmental language disorder: Comorbid disorders with distinct effects on reading comprehension. *Journal of Child Psychology and Psychiatry*, 61(6), 672-680.
- Sutabri, T., Widodo, Y. B., Sibuea, S., Rajiani, I., & Hasan, Y. (2019). Tankmate Design for Settings Filter, Temperature, and Light on Aquascape. *Journal of Southwest Jiaotong University*, 54(5).
- Tohidast, S. A., Mansuri, B., Bagheri, R., & Azimi, H. (2020). Provision of speech-language pathology services for the treatment of speech and language disorders in children during the COVID-19 pandemic: Problems, concerns, and solutions. *International journal of pediatric otorhinolaryngology*, 138, 110262.
- Zhiqiang, W., Qingqing, Z., & Liang, X. (2021, January). Development of Grain Moisture Measurement Control System based on ATmega128. In *2021 2nd International Conference on Artificial Intelligence in Electronics Engineering* (pp. 89-91).