

**DEVICE FOR SPEECH-LIKE NOISE SYNTHESIS**

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**Abstract.** The feasibility study of using active means of speech information protection with flexible configuration based on wireless connection is justified. Speechlike noise generating device based on wireless connection for speech information protection is proposed. It is proposed to form two masking speech-like

signals, one with a power equal to the power of the information signal and generated without taking into account the statistical features of the language, the second with significantly greater power and generated taking into account the statistical features of the language, which will increase the resistance of the protection to methods of statistical analysis and signal power analysis. A speech information protection device body modeled in the SolidWorks environment is proposed for subsequent 3D printing. PLA plastic was used in the printing process; a photo of the assembled speech information protection device is presented below in the text of the article. Testing of the developed device was carried out using the Salute Speech neural network.

**Keywords:** synthesis of speechlike noise; acoustic masking; information security; speech information protection; speech-like noise; white noise; neural network; allophones; confidentiality; simulations.

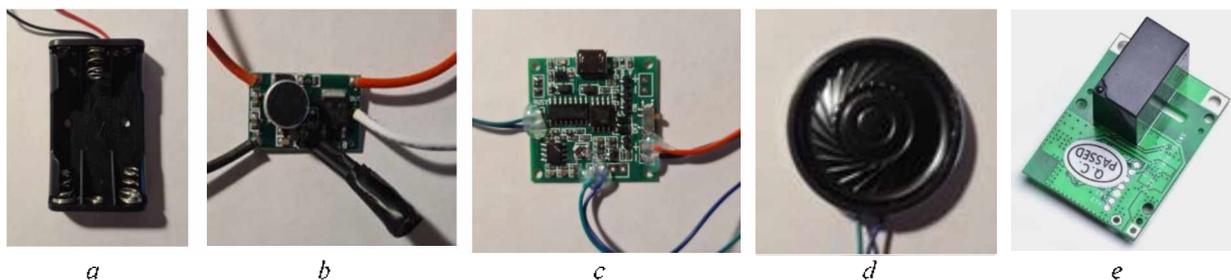
## Introduction

At present there is an obvious need to protect speech information from leakage through acoustic and vibrational channels, because there is a significant amount of confidential information is transmitted through the speech, as the most natural form of the communication. It seems more practical and mobile to use active acoustic masking, which reduces "links" between signal and noise at the border of the controlled zone by increasing the noise level [1, 2]. White noise, pink noise, and uncorrelated speech-like interference are widely used as masking signals [3].

However, the interference signals used in modern systems of active protection of speech information do not provide the required level of protection, since they can be provided with the help of modern software that is publicly available on the Internet. In that way there is a proposal to form a masking acoustic signal directly from the hidden signal, which cannot be compensated. The article proposes a device for the formation of speech-like noise, consisting of elements of hidden speech mixed with white noise.

## Construction of a device for generating speech-like noise

The following electronic components were selected to build the device: battery compartment, microphone unit, microprocessor unit, acoustic emitter, WiFi module (Fig. 1).



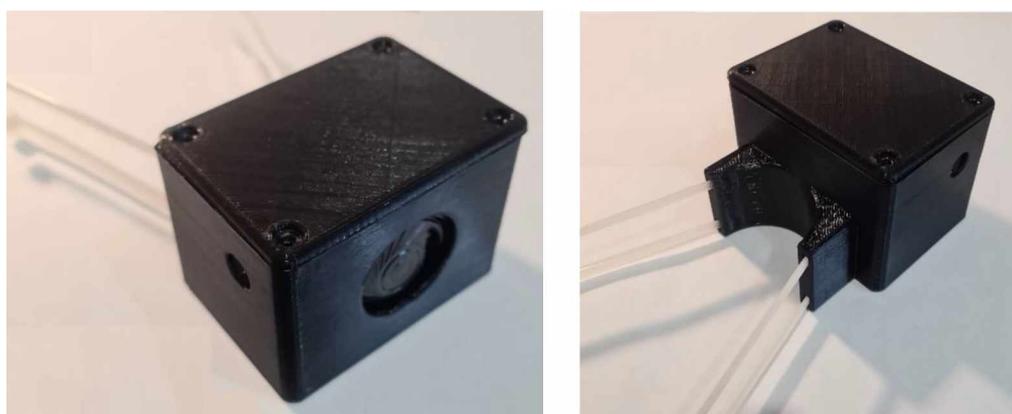
**Fig. 1.** Electronic components of a speech-like noise generation device. a – battery compartment, b – microphone unit, c – microprocessor module, d – acoustic emitter, e – WiFi module

The battery compartment (Fig. 1, a) provides power to all components of the device. The microphone node (Fig. 1, b) is designed to detect speech and record the voices of speakers in order to form a base of allophones and start the process of synthesizing a speech-like signal. The microprocessor module (Fig. 1, c) performs direct synthesis of speech-like signals, storage of the allophone database. The acoustic emitter (Fig. 1, d) reproduces the synthesized speech-like signal. The WiFi module (Fig. 1, e) allows remote control of the speech information protection device via a smartphone or tablet. Modeling of the body of the speech information protection device was performed in the SolidWorks environment, for the purpose of subsequent 3D printing. Printing was carried out on an AnetA 6 3D printer. The 3D model of the device body is shown in Fig. 2.



**Fig. 2.** 3D model of the housing of the speech information protection device

PLA plastic was used for printing a photo of the assembled speech information protection device is shown in Fig. 3.



**Fig. 3.** Speech information protection device

The proposed device for the formation of speech-like noise [4, 5] allows you to form a speech-like interference from the voice of the speaker a direct participant in a confidential conversation, which does not carry any semantic information, and according to its statistical features fully corresponds to Russian speech. Since the level of this interference significantly exceeds the level of the hidden information signal, it is proposed to form an additional speech-like signal also from the speech of this speaker, the level of which will be equal to the level of the hidden signal, but without taking into account the statistical patterns of the language. As a result of mixing an informative signal with an additional speech-like signal, a violation of statistical patterns will occur, as a result of which the mixed signal can be classified as not carrying a semantic load. At the same time, a more powerful speech-like signal corresponding to statistical patterns can be classified as semantic. The signals generated in this way are mixed with white noise in a ratio of 3–15 dB.

### Conclusion

A device for the formation of speech-like noise has been developed, implementing the proposed method for the formation of two speech-like interference of different levels directly from the hidden speech and their mixing with white noise. 3D modeling and 3D printing of the housing for the developed device has been carried out, allowing it to be mounted both on walls and pipes. The developed device was tested using the Salute Speech neural network. With a signal-to-noise ratio of 10 dB, the percentage of correctly recognized allophones was no more than 14 %. With a signal-to-noise ratio of 20 dB – 0 %. As a result, the high

efficiency of the generated interference was established in comparison with uncorrelated speech-like interference, as well as interference of the speech chorus type containing up to five voices.

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