USING EEG ALPHA RHYTHM TO CONTROL A MOBILE ROBOT

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ABSTRACT

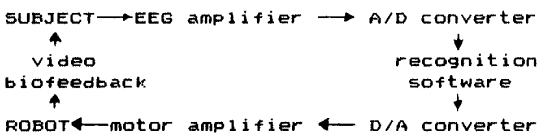
A report about some experiments in start/stop control of a microrobot movement using EEG alpha wave is given. The robot is a trajectory follower, and use an optical sensor to accomplish it. Experimental design allows the subject to start robot movement when closes his eyes, and stop the robot when eyes are open. The EEG alpha wave recognition software controls the movement of the mobile robot.

INTRODUCTION

Various approaches are wellknown toward the robotics, including artificial intelligence approach, flexible manufacturing system approach, among others. We take the biocybernetical approach, assuming biocybernetics as a science of entities, natural and artificial [1]. The communication between biological and artificial entities can be accomplished in several ways, including manual, spoken, and visual communication. We are here interested in direct bioelectric communication, using brain waves. Until now bioelectric control is mainly used from prostetic control in biomedical engineering and rehailitation, usualy from EMG sources [2].

METHODOLOGY UTILIZED

The experimental design is accomplished by the circuit



A differential biomedical amplifier is used to record the signal from the Pz site, with other electrode on right mastoide, and ground electrode placed at forehead. The signal is input in an IBM PC/XT computer by a A/D converter at 300 Hz sampling rate. The software which recognizes the alpha wave is written in Pascal. During the alpha wave presence, the system outputs a logic pulse at 5 volts through a D/A converter. The output signal is amplified on a transistor aplifier which drives the microrobot motor.

Figure 1 shows a typical experiment. The alpha wave is recognized by the recognition software, which recognizes also the EOG signals from eyes open and close movement. The robot control signal is shown on the upper part of the figure.

The microrobot we use is build up from an Elehoby kit. It is a line tracer microrobot, which has hardware built intelligence to follow a contrast black line on the floor.

The robot is placed at its initial place on a laboratory robot polygon which we use in our educational robots research program. Beginning the experiment, the subject closes the eyes which has a consequence that the robot starts to move along the drawn trajectory. Whenever the subject opens his eyes, the robot stops, and when the eyes are closed the robot proceeds the movement. In such a way subject manages to lead the robot from its start to a predefined stop position [3].

CONCLUSION

The biorobotics and brain waves bioelectric control has not been widely studied areas, although interest toward them was pointed out. This is one result of brain wave control of a robot and the experimental design is chosen to demonstrate a meaningful one. We believe that this type of control can be applied in tasks where control is performed using only the biosignals from the head region which is interesting for applications for handicapped, aircraft control, and space devices control among others.

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REFERENCES

[1] S. Bozinovski, "Geust editor's introduction" Automatika, 3-4: Special issue on biocybernetics, 1985

[2] L. Vodovnik, A. Stefanovska, S Rebersek, R. Janezic, N. Gros , "Some developments in functional and therapeutic electrical stimulation of neuromuscular system" Automatika, 3-4: Special issue on biocybernetics, 1985

[3] S. Bozinovski, L. Bozinovska, M. Sestakov, "Mobile robot control using alpha wave from the human brain" (In Serbocroat) Proc. Symp. JUREMA, Zagreb, 1988

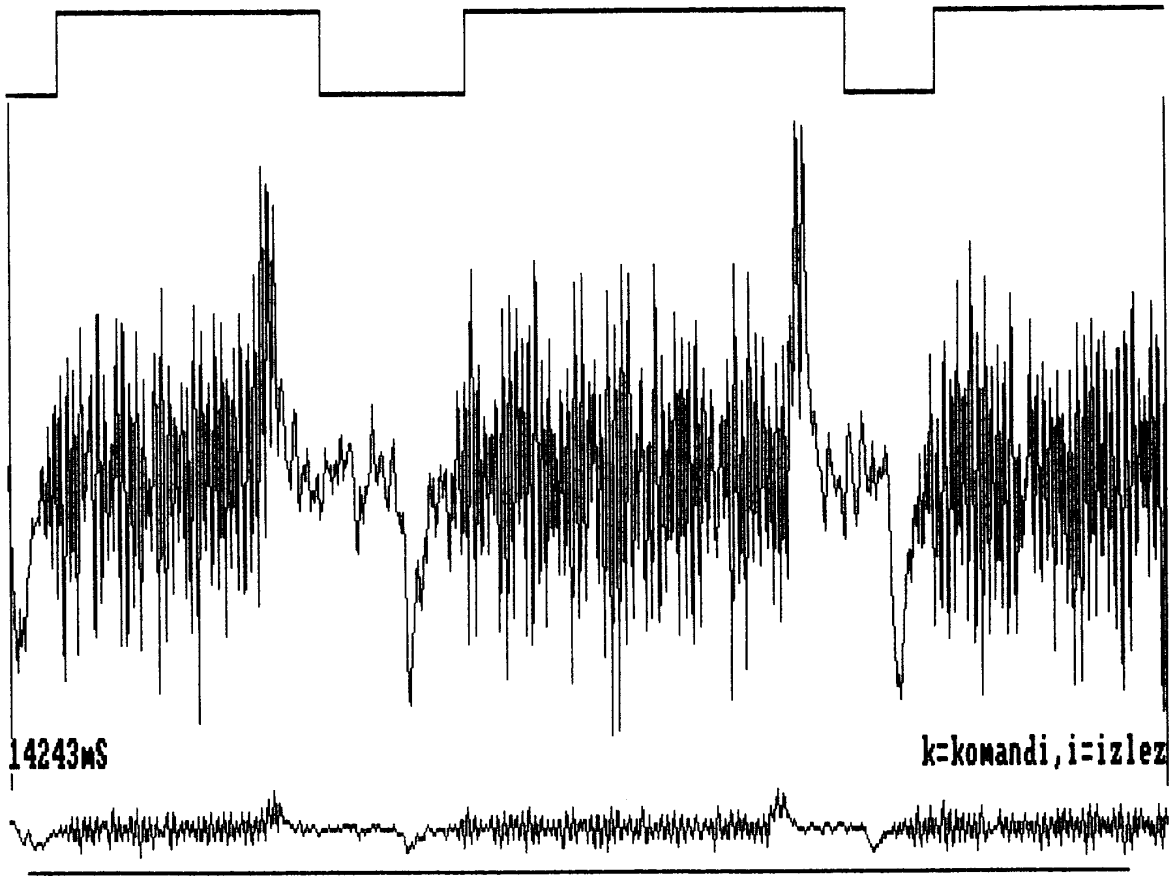

Figure 1. About 14 seconds control signal segment. The middle part of the figure shows the magnified EEG signal underlined on the lower part of the figure. For that segment, the produced robot start/stop control signal is shown on the upper part of the figure.