Fizyo-Robotiks

Abdülkadir Çakir

Isparta University of Applied Sciences, Faculty of Technology,

Department of Electrical and Electronics Engineering, Isparta, Turkey

ABSTRACT

In this study, a mechanism was designed and implemented to assist doctors or physiotherapists in the treatment process of injuries (dysfunction, impaired mobility, etc.) in the arms and legs as a result of accidents and traumas. Within the scope of the study, 17 stepper motors, stepper motor drivers, arduino uno and bluetooth modules were used. C and C++ languages were used as software language, and phone apk software was provided via mit app and inventor. With this study, the exercise movements foreseen by the physiotherapist for the damage to the arms and legs can be performed in 3 modes as slow, medium and fast, and can be stopped at any time. The project provides the opportunity to apply in 2 different ways for both arms and legs.

KEYWORDS: Physiotherapy and rehabilitation, speed control, exercise, robotic coding, software, phone control

1. INTRODUCTION

This study was carried out to support the treatment process of injuries in the arm and leg joints. There are some exercises that should be done against problems such as movement disorders in the arms and legs, non-moving joints, muscle disorders (Nashner, Shumway-Cook, & Marin, 1983; Schwartz et al., 2022). Physiotherapists do these in hospitals or private physiotherapy and rehabilitation clinics. However, this can sometimes cause problems in terms of transportation, sometimes cost and sometimes accessibility. This project, which provides the opportunity to do these exercises at home, will provide support in terms of cost and accessibility, as well as being able to do it by oneself without the need for a place or a person (Ditwiler, Swisher, & Hardwick, 2022).

This study consists of 4 parts. In the introduction, what has changed today with robotic developments and the importance of robots today are mentioned. In the second part, a literature review about robots was made. In the third part, where and in which areas robots are used in our daily life and the developments in robot technology from past to present are mentioned. In the fourth part of the study, the design and construction stages of the physio-robotics, which makes arm-leg exercises in the project realized, are mentioned.

2. RELATED WORK

Robotic systems have started to play an active role in the rehabilitation process, especially in the last 15 years. In this, the contribution of the project studies of the universities is very great.

Fizyoterabot has been developed for lower limb rehabilitation with 3 degrees of freedom. The system has been tested with real patients in a clinical setting, under the supervision of medical experts, by obtaining the necessary ethical approvals. Positive improvement was observed in all patients (Akdoğan, 2007).

Shoulder-arm robot (Armeo) is a robotic technology that can be used from the early stages of rehabilitation in patients who experience loss of shoulder and arm functions due to neurological or orthopedic reasons (Akdoğan, 2017).

3. FIZYO-ROBOTIKS

Necessary measurements were taken for the iron parts to be fixed to the arm in the robotic arm. Iron parts were cut according to the arm size and the body of the stepper motor used in the industry. The necessary

holes were made for the bandage to be used to attach the arm to the cut pieces of iron (Figure 1).

One of the iron pieces was fixed to the body of the stepper motor, corresponding to the upper part of the arm, which would remain stable. The second piece of iron, which will coincide with the lower part of the arm, is fixed to the shaft of the engine as it is the part to move.

The stages of the motor driver have been tried one by one and it has been decided that the most suitable and most powerful output stage is 1 Amper. The reason for choosing this stage is to keep the motor torque at the maximum level by drawing less current. By keeping the engine torque high, the load occurring in the elbow region of the arm is ensured to work in the best way desired on the shaft of the engine.

The application written for the phone works simultaneously with the microcontroller and sends a signal to the motor with the software written on it, and the desired movement in the arm is provided with the signals sent over the driver in the desired and adjustable modes.

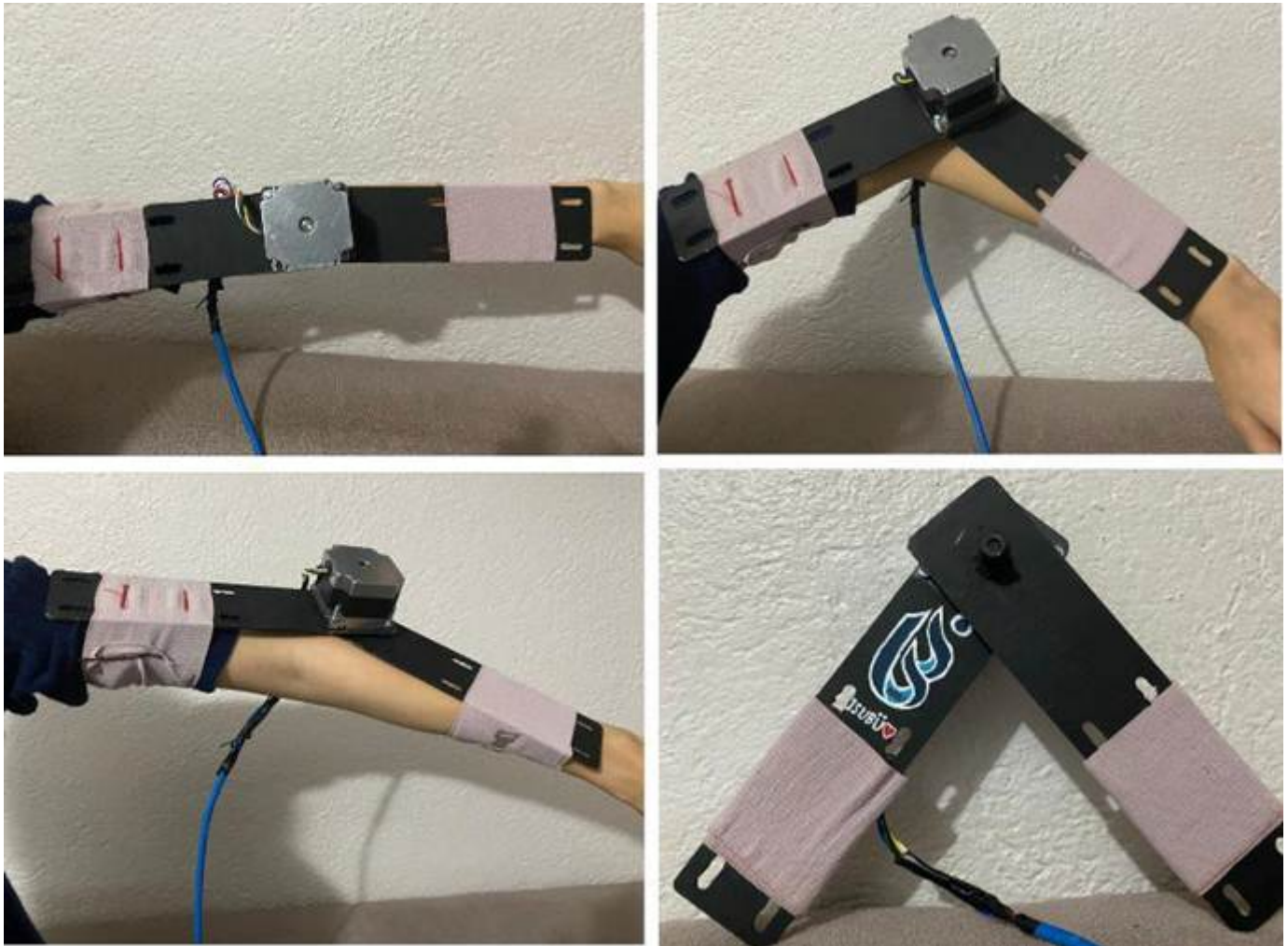Bluetooth Module, wireless communication between the phone and the system is provided.

Figure 1 Single, double and triple combinations of faults

It was made to constantly check if there is data coming from bluetooth. If there is an incoming data, it is assigned to the variable named IncomingData. In the Android program, these commands are numbered from 1 to 5.
1 = Slow to the right
2= Slow to the left
3= Fast to the right
4= Fast to the left
5= Automode

➢ If "1" is assigned to the variable named IncomingData, the stepper motor slowly turns to the right at a certain angle.
➢ If "2" is assigned to the variable named IncomingData, the stepper motor slowly turns to the left at a certain angle.
➢ If "3" is assigned to the variable named IncomingData, the stepper motor moves towards the right side rapidly.

➢ If "4" is assigned to the variable named IncomingData, the stepper motor turns to the left side quickly and at a certain angle.

➢ If "5" is assigned to the variable named IncomingData, it enters automode. That is, at a certain angle, it turns right and then left.

4. CONCLUSIONS

With this study, a robot was designed to contribute to the field of physiotherapy and rehabilitation (Figure 2). At the end of the project, a robot that can be controlled with an application installed on the phone was created for arm and leg exercises. C and C++ languages and Arduino ide library were used as software language (Figure 3).

Figure 2. Fizyo-Robotiks

Figure 3: Application Interface

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