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Wearable IMU Sensor for Monitoring Hand Motion Disorder in Parkinson's Patients (Poster)

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***Abstract*—The number of Parkinson's patients is continuously increasing, and the importance of the diagnosis is growing. Parkinson's disease typically involves hand motion disorder. However, the present diagnostic method is still in the qualitative judgment of the doctor. In this study, we developed a diagnostic score and a wearable IMU sensor that can be used as a quantitative measure and a effective monitoring for the diagnosis of Parkinson 's hand motion disorder.**

Keywords—Parkinson, Hand Motion Disorder, Wearable IMU sensor, Diagnostic Score

I. INTRODUCTION

The number of Parkinson's patients is expected to increase in the international community. A typical symptom of Parkinson's disease is hand motion disorder. Currently, a diagnostic method requires a doctor to perform a specific operation on a patient, and evaluates it visually. This method has slightly different results depending on the subjective opinion of the doctor and the time of evaluation. In addition, there is a disadvantage that it is difficult to monitor the progress of disease rehabilitation. Thus, there is a need for quantitative diagnostic methods and equipment that can effectively monitor hand motion disorder. The purpose of this study is to develop a diagnostic score for quantifying hand motion disorder using IMU sensor and to fabricate a wearable IMU sensor using it. [1]

II. METHOD

In this study, we used three representative methods of assessing hand motion among the Unified Parkinson's Disease Rating Scale widely used in the medical field. When the patient repeats three motions(Finger taps, Hand movements, Rapid alternating movements of hands) for a certain period of time, the magnitude, velocity, rate of change, and coefficient of variation are analyzed. First, a wearable IMU sensor for diagnosing Parkinson's disease was self-fabricated. The equipment is attached to the wrist by a MCU module (nrf52832, Nordic semiconductor, Oslo, Norway) which includes operation and transmission parts. Two pairs of IMU cables (MPU6050, TDK invensense, San Jose, California) extend from the module and are attached to the thumb and index finger. Through the IMU sensor attached to the thumb and index finger, the signal from the patient's motion is measured and transmitted to the computer or mobile phone using Bluetooth. Next, the diagnostic score was developed using the signals measured by the sensor. We analyzed in the time and frequency domain and extracted the indexes that can express motions through various signal processing such as digital filter, zero crossing, period integral, curve fitting, Fourier transform and median frequency analysis. The diagnostic score was finally developed through the weighted combination of the indexes extracted in the above procedure, and it was confirmed that there is a clear correlation between the diagnostic score and the doctor's visual evaluation.

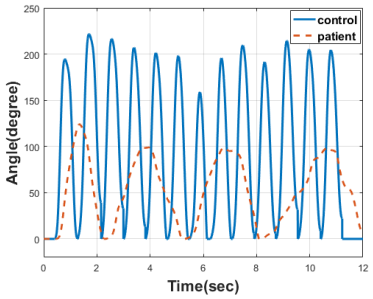

Fig. 1. Comparison of hand movement angle between patient and control group

III. CONCLUSION

In this study, we developed a wearable IMU sensor suitable for the diagnosis of Parkinson's hand motion disorder and a diagnostic score that can represent the motion quantitatively. As a result, it was confirmed that the diagnostic score could be developed which distinguishes the patient from the healthy person and has similar results as the doctor's visual evaluation. In the future, clinical tests will be continued to increase the reliability statistically. We will create assessment programs for computer and mobile phone. It is expected that the system will be able to diagnose Parkinson's hand motion disorder as an objective value and to monitor the degree of disease rehabilitation effectively.

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