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ВАЖЛИВІ МОМЕНТИ І ПРОБЛЕМИ ВИКОРИСТАННЯ ПЛАНШЕТУ ДЛЯ ДІАГНОСТИКИ РОЗЛАДІВ РУХУ

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CRUCIAL ELEMENTS AND ISSUES WITH THE USE OF A TABLET IN DIAGNOSING MOVEMENT DISORDERS

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The use of a graphic tablet to detect essential tremor is a convenient and effective way to diagnose it. Using this method allows us to diagnose people not only in a specially equipped facility, such as a hospital but also to make this process mobile [1].

When using a graphics tablet for diagnosing tremors or any other medical condition, it's important to consider key tablet characteristics [2]:

- Pressure sensitivity: the ability to register even the slightest movements or pressure on the tablet surface is crucial for accurately capturing patient movements.
- Positioning accuracy: the graphics tablet should have high precision in determining the position of the pen or stylus on its surface to reliably record movements.
- Refresh rate: the faster the tablet can update motion data, the more accurate information it can provide for analysis.
- Resolution: high resolution allows for a more precise depiction of fine details and movements, which is important for diagnosis.

These features collectively enable the graphics tablet to be an effective tool for diagnosing tremors and other medical conditions, aiding medical professionals in obtaining objective data and tracking patients' conditions over time.

Graphics tablets may have limited accuracy or sensitivity, leading to insufficient detection or even omission of minor tremor amplitudes. The artificial environment in which testing is conducted can influence results; for example, stress, fatigue, or incorrect user positioning during tablet use may cause inaccuracies in tremor assessment. Tremor can vary for each individual and even for the same individual at different times. A graphics tablet may not provide a complete range of information to diagnose important tremor parameters [2] such as frequency, amplitude, movement characteristics, etc. A stylus is important as well, because it affects data input and accuracy, and its physical properties affect the feel in the hand, which also has a response when drawing and this should be taken into account during diagnosing.

To avoid partial or inaccurate results, it's important to use a graphics tablet as one of the diagnostic tools rather than the sole criterion. Combining it with other methods and clinical examination can ensure a more accurate diagnosis. As examples, we compare graphic

tablets *Wacom Bamboo* and *Huion Kamvas Pro*, used in this study. The key characteristics of both models (Table 1) are taken from the data declared by the manufacturers.

Table 1 – Graphics tablets specifications

Property	Wacom Bamboo	Huion Kamvas Pro
Display resolution (pixels)	- (no display)	1920x1080
Polling rate (Hz)	133	220
Working area	147 x 92	344.16 x 193.59

These characteristics are the most important for diagnosing movement disorders. The use of a tablet with a screen is a definite advantage for this task, as it simplifies the use of motion recording software, but it is not mandatory. If the screen is not present, one can place a paper template on the surface of the device to draw a line [3], in which case sufficient surface sensitivity is required register a pattern. Different movement disorders have their own characteristic frequency, so the appropriate rate value is essential to detect and distinguish them. Both tablets have acceptable frequency values (it is important to check the nominal value, not the highest value, as the device should provide a stable polling value).

Table 2 – The format of the acquired data

registered time	scheduled time	x	y	z (pressure)
0:0:0:937	0:0:0:937	80.1	-63.4	1

Experiments with these models revealed some problems:

- Unstable polling frequency, respectively, different time intervals between registered points, which should be considered when analyzing.
- When recording, in addition to the coordinates, the time when the point was drawn and when it was issued by the software is recorded (registered and scheduled time in Table 2). Sometimes these timestamps were repeated for different coordinates. Accordingly, it is necessary to clean up such data or interpolate it.
- Software is a layer between the tablet and the received data, so it can introduce a certain delay. If Java with a native driver is used, the lead to additional delay.

In general, the use of a graphic tablet with written software is an effective way to diagnose movement disorders, but it is important to understand the limitations imposed by the hardware and software components and the errors that may exist when recording movements.

References

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