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AUTOMATED SYSTEM FOR THE COLLECTION, PROCESSING AND TRANSMISSION OF MEDICAL INFORMATION BY OBSERVING OF PATIENTS WITH AFFECTED LOWER LIMBS

Recently, new systems, methods, and protocols for rehabilitation after orthopedic surgical operations are increasing, driven by the growth of the elderly population and the necessity to be more effective, for example, reducing costs and improving the quality of these procedures. Therefore, there is growing interest in systems that are able to give quantitative parameters for monitoring and controlling rehabilitation after orthopedic surgeries. In fact, in order to expedite the rehabilitation period and avoid further and long-term damage to the affected limb, it is becoming important to constantly monitor the patient following his/her rehabilitation activities not only in the hospital but also outside.

It is widely recognized that excessive loading of the lower limb following certain types of surgery can disrupt the operated tissues and put the healing bones at risk of mal-union. The knowledge of the loads ensures that the patient loads their affected limb at the prescribed level. It is widely recognized that the improper use of crutches may lengthen the recovery period or even cause further damage. The therapist usually controls the correct use of the crutch using only a visual observing. Therefore, the perception of the loads on the patient's lower limbs, the angle of the crutch staging are usually subjected to considerable errors.

Mentioned above emphasizes the task significance. Therefore, in the proposed solution, we decided to measure the angles of inclination and force, that the patient loads on the crutch. This data are used as input for proposed Intelligent System for Recovery Support (ISRS). This system allows suggest some corrections for crutch usage. Besides, the crutch is easy to use and easy to install. The block diagram of the developed automated system for the collection, processing and transmission of medical information by observing of patients with affected lower limbs is shown on Figure 1.

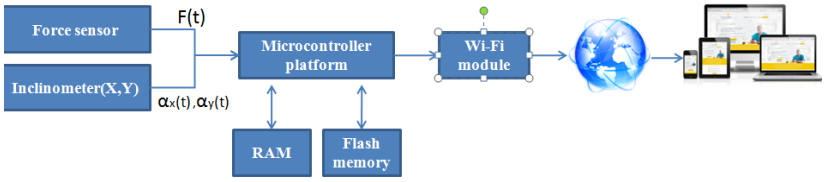

Figure 1. Block diagram of the developed automated system

Data from sensors are recording to the memory of the microcontroller platform and sends the information using the TCP/IP protocol to the web-server. For secure data transfer we use additional encryption protocols. On the web-server side the data are saving and only the patient and the therapist have an access to it. That allows remote analysis of the data and also allows crutch using corrections, we also complete the table, which is filled with the data from the force sensor and inclinometer. This data can be presented as graphs or load diagrams. For statistical processing will be used only the data, when the patient makes the load of at least 5 kilos on the crutch. The therapist can accept or reject this suggestions as well as add some corrections, before sending to the patient's account. The data from the sensors are sent to the web-server at fixed intervals during the day using the wireless mode. On the website, the therapist will be able to review the data of all his patients, be in touch with them via messages. The patient will be able to get a detailed analysis of the data as well as advice for the crutch using, will have feedback with the therapist using the messages.

For the force measurement the sensor should be precise, compact and has high rigidity and be suited for dynamic measurement tasks. The inclinometer should has compact design, high performance and good shock durability, to provide trouble-free measurements in moving hand held devices.

Taking into account all features of the proposed system the microcontroller platform should satisfy following requirements: it must has no less than 16 MB of flesh memory due to the data volume and 64 MB RAM. Microcontroller platform should be compact and has at least three analog inputs, micro-SD card slot, built-in ADC, Wi-Fi module, low power consumption in active mode. It should be easy to connect to any web-based resource.