

Knee monitoring device based on optical sensor embedded in mechanical compartment assembly

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ABSTRACT

Development of various health monitoring devices for health monitoring applications such as spine monitoring, respiration rate, heart rate, as well as upper and lower limb motion detections are at increasing rate. The use of optical fiber-based devices provides significant contribution in this area due to their advantages such as immunity to electromagnetic interference, lightweight and possibly small sensor setup. However, the application of intensity-based optical fiber sensor for human joint motion detections resulted in limited detection angle, where most sensor are not able to detect more than 90 deg. angle. To improve this limitation, we propose an optical sensor approach with mechanical-assisted components assembly that translates angular movement to linear movement. The light detection on the photodiode array at different pixels is analyzed to represent the angle movement of the knee. Based on our study, the proposed device can be applied to detect angle between 0–160° with an accuracy of 0.08°. The obtained results make it possible to apply this technique as knee monitoring device.

KEYWORDS

Linear array photodiode; Knee joint assessment device; Optic fiber; Biomechanics; Mechatronic system; Knee joint rehabilitation

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