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Wireless Wearable Orthopedic Device for Posture Monitoring during Fracture Healing Period

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Abstract—The observance of any human physiological parameters throughout rehabilitation exercises needs noninvasive sensors for the patient. This paper describes a wireless wearable Criss-cross flex array sensors for posture monitoring during rehabilitation or reinforcement exercises. The subject posture is measured through a sensorized Criss-cross flex array sensors using an inductive sensor sewn directly on the fabric. The wireless wearable Criss-cross flex array sensors design specifications are the following: independence from the remote unit, easy to use, lightweight and comfort of wearing. This paper reports the abstract framework, the invented device description, and also the adopted experimental setup.

Keywords—Parameters, Rehabilitation, Noninvasive sensors, Wearable criss-cross sensors.

I.INTRODUCTION

A fracture is a broken bone. Doctors can use completely different ways to repair bone fractures counting on their location, type, and severity. Fractures is complete or partial. Some need surgery or metal plates, whereas others might solely want abrace. Improperly treated bone fractures may cause the formation of a blood clot in nearby blood vessels, infection from the injury, damage to the skin, tissues, or muscles around the fracture, swelling of a nearby joint thanks to trauma into the joint house. The healing method can depend upon the character and extent of the injury, the stability of fracture fixation, and biological processes, so a proper healing process is crucial. After repositioning the bone, doctors can generally immobilize the broken bone with a plaster or fibre glass forged. A forged can enable the bone to heal within the correct position. Doctors usually use casts to treat fractures within the leg, foot, arm, and wrist bones. When someone breaks a bone, they typically go through three stages of healing: The inflammatory phase, The repairing phase, Bone remodeling. Blood clots that type on the broken ends of bone area unit the beginning of the healing method. Over regarding 5 weeks, the body joins the two bone portions together with a combination of fibrous cells and cartilage. This temporary bone (callus) is'nt as sturdy as real bone. It will break simply till it's slowly replaced with real bone. For this reason the doctor may remove our cast or splint after a few weeks, but we still need to treat the bone with care. According to the Cleveland Clinic, the typical bone healing time is between six – eight weeks, though it will vary counting on the sort and website of the injury. There must be no movement during the fracture bone recovery period because it may leads to abnormal healing, loss of function or bone weaknesses . The concept of this module brings a new trend in orthopedic device which is used to regain the position of fractured bone. It requires a couple of days to seal up with the help of arm or waist belt which may cause some inconvenience to the patients injured part that leads to the dislocation of the injured bone, this may cause the patient to

change the dressing constantly. To avoid this type of situation we came up with this device which uses the simple concept of flex and vibro-tactile sensors.

II. RELATED WORK

This device avoids the patients inconvenience in bending or moving the fractured bone, the bone fixes to the curable position when it moves from the desired area through the vibrational force. The vibrational force stimulates from the flex and vibro tactile sensor keeps the subjected area to withstand in the area where it is located so that the blood and fluids passes comfortably to the injured surface at any distant and without distraction requires shorter recovery period.

2.1. HARDWARE REQUIREMENT

SL.NO	COMPONENTS NAME	Nos.
1	Pic microcontroller	1
2	Flex sensor	1
3	Vibrotactile sensor	1
4	Vibrotactile driver	1
5	Vibrotactile actuator	1
6	Power supply	1
7	IOT ESP8266	1
8	GSM Module	1

Table 1: Components list

2.1.1. PIC MICROCONTROLLER

The pic microcontroller are interfaces that suits comparatively with sensor designs ,in this we use pic 16f877a which has good operating voltage of 3.3v and it is cheaper and flexible in use in this module. This pic16f877a has large communication protocols and ADC devices and has peripheral features of timer calculations which suits for the vibration to free flow in the device and easy and takes the object to fixed position.

2.1.2. FLEX SENSOR

This flex sensor usually measures the amount of bending position that object reflects in their working period (deflection) This flex sensor re fixes the bone to the original position when it is resembles that the fractured bone is moving from the desired part where it is fixed in criss cross method to locate the bone in the condition for shorter duration of recovery of bones fractures which is compatible.

2.1.3. VIBROTACTILE SENSOR

This sensor help relates to the ability of sensing vibration through touch. We use this sensor to identify the dislocates object that allocates from the desired area this sensor converts the signal (i.e., the object away from the area) to the actuator it takes the signal as force of an object and reflects the output by vibration.

2.1.4. VIBROTACTILE DRIVER

VibroTactile driver Stimulates a object at very wide range of sensations through pressure receptors in their skin and body. The vibro tactile stimulation connects the object and the area which dislocates from the part , does not causes any destruction to the skin nerves and blood. We use this vibro tactile sensor to re fix the fractured bone without distracting the other parts of the injured area which is safe and convenient.

2.1.5. VIBROTACTILE ACTUATOR

The vibrotactile actuator array acts on the threshold signal that the input is given to the particular surface. It percepts the threshold movement of posture of the injured area. It has the ability to change the exerted force and hence it distributes the signal eventually to all parts of the fractured parts. It capably measures the range of direction that the cramped part actually needs to evoke the new formation. It usually passes the signal directly to the skin considering the resistance and position of the injured area.

2.1.6. POWER SUPPLY

The E-batteries or a comfortable calcium detector sensor can be used for the running power which does not cause any systematic problem for device . it makes an integrated solution to provide concentration for the orthopedic implants.

2.1.7. IOT ESP8266

This IOT esp8622 helps in the external connection at times to record the bones spatial and physical activity by recording the internal activity of the fractured it collects data as like blood cramps in the fractured part or describing the increase or decrease of pain in the dislocated part. The collects rather information for the physician or surgeon comfort.

2.1.8. GSM MODULE

When the system is wireless wearable techniques then GSM module plays an important role as it takes the data from the external surface by IOT method. When surgeon or physician is non contact to the patient in emergency situation . The GSM module helps the connectivity between internal (patient) and external (physician) for the consulting purposes.

III.PROPOSED MODELLING

This device requires the simple working module as pic16f877a is interconnected to all sensors since it is wireless sensor it requires the GSM module to connect with the external surface. The system works on the concept with the vibrational force that acts from the vibro tactile driver. when the object dislocates or re direction from the place, this driver pushes the object and gives The indication to the flex sensor which is placed criss cross method .The indication connects the parallel interaction between the flex sensor and vibro tactile driver. The vibration range and the communication between the protocols are designed parallel in order to pass the signal from one part to another with distant range. The vibration forces produces a torque that makes the signal to contact with the tactile and flex sensors. The actuators helps in managing the contactable force between the driver and measuring array so does the object schedules in the position .The vibration spreads through the whole area conveniently via possibility and compatibility . This device is placed in a smooth e-textile designing fabric belt to reduce friction and coated with polymers for the flexibility and blood compatibility. The working of this device is simpler and digitally works for the patient

convenient. This device is used to all the orthopedic fractures which can be consulted with physician for better reusable working. The diagrammatic working is explained in this device which is easy in construction for the orthopedic product designers which is efficient in cost and time.

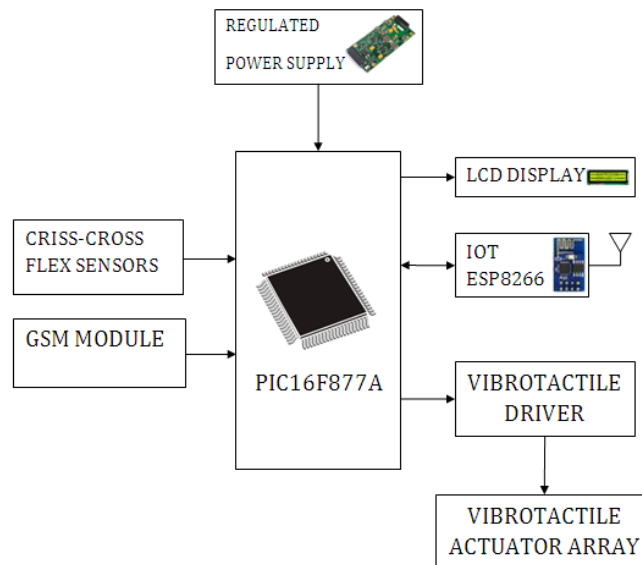


Figure 2: Architecture of Device

IV. RESULTS AND DISCUSSIONS

The identification of the bones compatibility, capacity and considering the period of recovery this project gives the innovation in the orthopedic project by using simple IOT devices which is useful for the orthopedic patients . The device is properly connected and works well on the bone segment. The patient feels comfort to wear this without affecting the other normal part of the body. It probably recovers the patients healing period in course of time.

V. CONCLUSION

This paper describes a wearable sensing and feedback system for postural monitoring. We performed usability and feasibility testing and demonstrated that the wearable system can be used to provide real-time feedback for Posture monitoring during broken bone recovery period. This device can maintain the position of the bone by using vibrotactile sensor and it helps for speedy recovery of broken bones. In general, the system is portable, configurable and effective for real-time human movement monitoring and thus may be well-suited for long term, home-based rehabilitation, and treatment.

VI. FUTURE WORK

The orthopedic gloves and socks with innovative and simple use for orthopedic patients fractures occurring in fingers which can be compact in nature and free to use . this device can be constructed more convenient and short for the future generation.

VII. REFERENCES

- [1] Peterka, Robert J., Conrad Wall Iii, and Erna Kentala. "Determining the effectiveness of a vibrotactile balance prosthesis."
- [2] Wall Iii, C., and Erna Kentala. "Control of sway using vibrotactile feedback of body tilt in patients with moderate and severe postural control deficits." *Journal of Vestibular Research* 15.5, 6 (2005): 313- 325.
- [3] Mišić Dragan, Zdravković Milan, Mitković Milorad, Vitković Nikola, Mitković Milan "Real-time monitoring of bone fracture recovery by using aware, sensing, smart and active orthopedic devices", IEEE ,IoT-2739-2017
- [4] Parvizi, J., Antoci, V. , Hickok, N., Shapiro, I. (2007). "Self protective smart orthopedic implants". *Expert Rev Med Devices*, 4(1), 55-64.
- [5] Patel S, Park H, Bonato P, Chan L, Rodgers M. "A review of wearable sensors and systems with application in rehabilitation" *Journal of Neuroengineering & Rehabilitation* 2012;9:21.
- [6] Kathleen H. Sienko ,Peter B. Shull "Configurable, wearable sensing and vibrotactile feedback system for real-time postural balance and gait training" *Journal of NeuroEngineering and Rehabilitation* (2017) 14:102
- [7] Joshy A., S. Senthil kumar. 2012. "A sensor network system for identifying landslide detection, monitoring and predicting of forewarning time" *International Journal of Electrical Engineering & Embedded Systems* 43-48.
- [8] PhilipH.Long:"Medical Devices in Orthopedic Applications" *Journal of IEEE*, ISSN:0912-6233, *Toxicologic Pathology*,36:85-91,2008
- [9] S Choi, KJ Kuchenbecker- "Vibrotactile display" proceedings of the IEEE,2013-ieeexplore.ieee.org
- [10] Y Zheng, JB Morrell " A vibrotactile feedback approach to posture guidance"- IEEE haptics symposium,2010-ieeexplore.ieee.org
- [11] Sreejan Alapati, Shivraj Yeole; "A Review on Applications of Flex Sensors" *International Journal of Emerging Technology and Advanced Engineering* ,ISSN 2250-2459, ISO 9001:2008 Certified Journal, Volume 7, Issue 7, July 2017

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