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Smart Low Power Motion Sensing Shoes Designed for Diabetic Patients through Wireless Technology

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ABSTRACT

Diabetic neuropathies are a group of nerve issue caused by diabetes. Individuals with diabetes can, after some time, create nerve harm all through the body. A few people with nerve harm have no indications. Others may have side effects, for example, torment, shivering, or deadness—loss of feeling—in the hands, arms, feet, and legs. Our project design is to develop minimal effort foot weight and foot development investigation and bloodstream stimulation system screens the foot pressure distribution to distinguish and analyse foot neuropathy.
Keywords: MEMS Accelerometer, Vibration Sensor, LPC1313 Microcontroller and Motor Driver.

INTRODUCTION

Nerve issues can happen in each organ system, including the stomach related tract, heart, and sex organs. Around 60 to 70 percent of individuals with diabetes have some neuropathy. Individuals with diabetes can create nerve issues whenever however hazard ascends with age and a longer span of diabetes. The most noteworthy rates of neuropathy are among individuals who have had diabetes for at least 25 years. Diabetic neuropathies additionally seem, by all accounts, to be more typical in individuals who have issues controlling their blood glucose, likewise called glucose, and those with elevated amounts of blood fat and circulatory strain and the individuals who are overweight. The blood vessels fixed within the specific part of the patient's body by releasing the restriction on blood flow and to monitor the condition which allows the air to enter the chamber [1]. Mononeuropathy includes harm to a particular nerve.

The nerve might be in the face, middle or leg. Mononeuropathy, likewise called central neuropathy, frequently goes ahead all of a sudden. It's most basic to more established grown-ups. In spite of the fact that mononeuropathy can cause extreme problems, it, for the most part, doesn't cause any long-haul issues. Manifestations typically reduce and vanish without anyone else over fourteen days or months. Foot issues, including wounds that don't mend, ulcers and even removal, are a typical intricacy of diabetic neuropathy. In any case, you can anticipate a significant number of these issues

by having a thorough foot exam at any rate once per year, having your specialist check your feet at every office visit and taking great care of your feet at home.

The consequence of microcurrent electrical prompt on the foot blood circulation and degree of soreness practised by diabetes patients were evaluated by a method of experimental and control group. The device is designed with footboard for a person with bed return and wheelchair comprising to stimulate the blood flow by oscillating movement by the gear driven by an electric motor [2-3]. The blood pressure raising reflex may be demonstrated in normal human subjects who takes its origin from the voluntary muscles and is concerned in the rise of the general blood pressure during muscular exercise [4].

The negative effects on peripheral circulation from the occupational high frequency in muscle blood volume with power Doppler sonography were examined. The manipulate of low-intensity laser irradiation was investigated for 50% of all nontraumatic amputations using infrared thermography on skin blood distribution in diabetic patients with diabetic microangiopathy of reduced microcirculation [5-6]. Gamma camera images showed radioactivity mechanism over the area of the body responsible for the pollution by particulates. Stimulant creation of excitatory chemoreflex afferents may supply to increase considerate activity to muscle movement in patients with OSA [7-8].

PROPOSED SYSTEM

The patient foot movement is monitor by using 3-axis MEMS Accelerometer as given away below in figure 1. If there is any changes means it will give an alarm to the patient and store the data in SD card at the same time it will display the pressure value in TFT display to take immediate steps at the time of injuries for healthy blood circulation as given in figure 2.

The shoe unit transfers the data wirelessly to the handheld device to vary the speed of the motor as a remedy of paining on the feet of the blood circulation at a particular injured area.

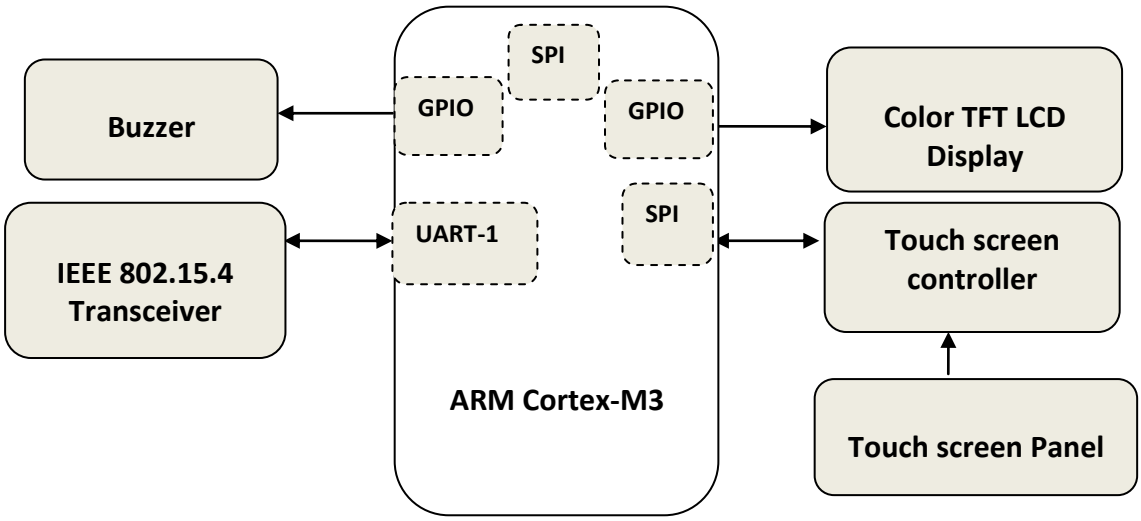
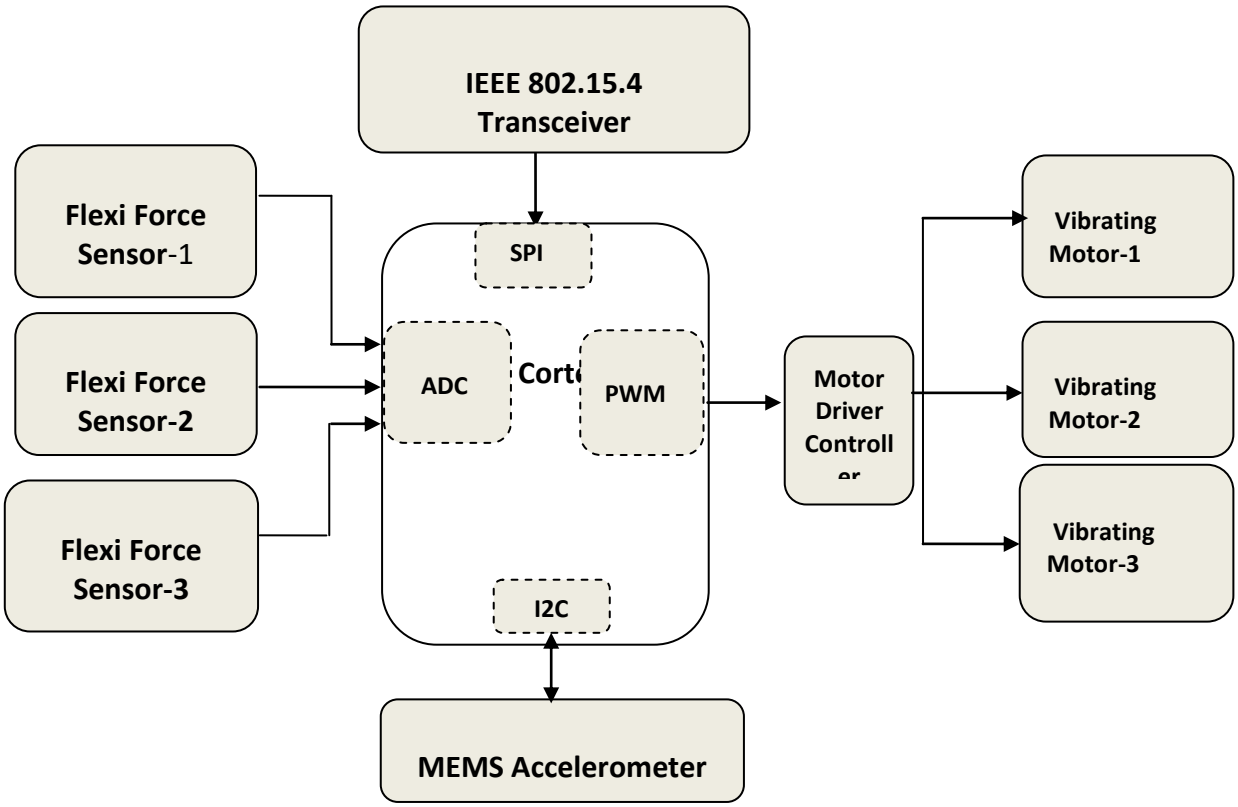


Figure 1. Block Diagram of Handheld Monitoring Unit



RESULT AND DISCUSSION

Initially Switch ON the smart footwear unit and next Switch ON the Handheld monitoring unit. After 5 seconds, IEEE 802.15.4 network will be formed. This is indicated by means of LED D4 on the footwear unit and LED D1 on the RF_DBV15 board. Both LEDs should be in ON state at this point of time. Immediately Cortex shoe image will be displayed on the TFT. Now touch the TFT once, a main menu will be displayed that has two options

- Data Logger
- Vibrating Motor

If you choose DATA LOGGER in it shows two options

- Start Record
- View Result

Press Start Record button on the TFT menu, foot pressure distribution image will be displayed initially the foot pressure sensor values (A, B, C) are shown as ZERO. The footwear unit contains 3 FSR sensors which are used to sense the foot pressure. If you give pressure the sensors value gradually increases the A, B, C digital value which is monitored as bar graph in handheld monitoring unit display.

Footwear unit contains MEMS Accelerometer sensor monitor the user foot movement condition. Now shake the MEMS sensor slightly to show that the user has hit an object as shown in figure 3. Immediately the unit senses this abnormal foot movement and raises the buzzer sound to alert that user. This part of the demo will work only in recording mode.

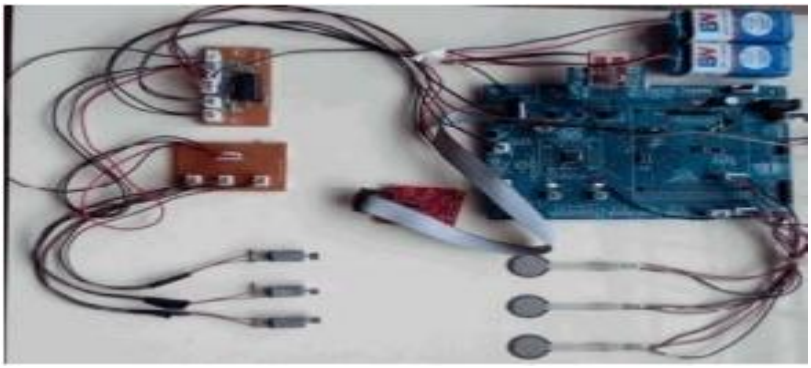


Figure 3. ARM LPC1313 Controller interfacing with MEMS Accelerometer

Press the back button on the left bottom to end this recording mode. Now the screen shows two options, Start Record and View Result.

Now press View Result button on TFT Menu. Again it shows two options.

- Listing
- Bar graph

Choose listing mode, it shows the result of recording mode displayed in a list format. Touch the screen once to get back to the previous menu. Now press bar graph button, it shows the average value and maximum value of 3 FSR sensors, each sensor results are displayed on the bar graph. Once again touch the TFT it shows two options such as start record and view result, use back arrow to come back to the main menu as shown in figure 4.

Now choose the vibrating motor option, it displays three input bars A, B, C representing the three vibrating motors on the unit. Touch the input bar to activate the corresponding vibrating motor. The vibrating motor speed can also be adjusted using the position of touch on the input bar which is indicated graphically. Touching the left end of the bar represents minimum speed and the right end of the bar represents the maximum speed.

Figure 4. Foot pressure monitor in TFT

CONCLUSION

This project developed for treatment and anticipation of Diabetic Neuropathy which is a crucial therapeutic issue. This device is designed to make this product as portable with low cost. In this project the system consist of sensor unit to analyse the foot pressure and immediate prevention is given by actuators fitted in the shoe unit. By this way with low cost patient can use this system even at home and store the sensor data for future reference using low power ARM Cortex-M3 architecture hardware for high performance.

REFERENCES

1. Linman, E.K. and Weinshenker, E., Procter and Gamble Co, 1988. *Method and apparatus for augmenting blood circulation*. U.S. Patent 4,738,249.
2. Park, R.J., Son, H., Kim, K., Kim, S. and Oh, T., 2011. The effect of microcurrent electrical stimulation on the foot blood circulation and pain of diabetic neuropathy. *Journal of Physical Therapy Science*, *23*(3), pp.515-518.
3. William, G., 1968. *Apparatus for the stimulation of blood circulation in the feet and legs*. U.S. Patent 3,370,584.
4. Alam, M. and Smirk, F.H., 1938. Observations in man on a pulse-accelerating reflex from the voluntary muscles of the legs. *The Journal of physiology*, *92*(2), pp.167-177.
5. Kerschan-Schindl, K., Grampp, S., Henk, C., Resch, H., Preisinger, E., Fialka-Moser, V. and Imhof, H., 2001. Whole-body vibration exercise leads to alterations in muscle blood volume. *Clinical physiology and functional imaging*, *21*(3), pp.377-382.
6. Schindl, A., Schindl, M., Schön, H., Knobler, R., Havelec, L. and Schindl, L., 1998. Low-intensity laser irradiation improves skin circulation in patients with diabetic microangiopathy. *Diabetes care*, *21*(4), pp.580-584.
7. Nemmar, A., Hoet, P.M., Vanquickenborne, B., Dinsdale, D., Thomeer, M., Hoylaerts, M.F., Vanbilloen, H., Mortelmans, L. and Nemery, B., 2002. Passage of inhaled particles into the blood circulation in humans. *Circulation*, *105*(4), pp.411-414.
8. Narkiewicz, K., Van De Borne, P.J., Montano, N., Dyken, M.E., Phillips, B.G. and Somers, V.K., 1998. Contribution of tonic chemoreflex activation to sympathetic activity and blood pressure in patients with obstructive sleep apnea. *Circulation*, *97*(10), pp.943-945.