3rd National Conference on Enhancement in Biomedical Engineering and Healthcare
Organised by Department of Biomedical Engineering,
Adhiyamaan College of Engineering, Hosur, Tamil Nadu, India

Amputation Prevention in Diabetic Patients Using Electronic Orthotics Shoe

C. Sathish Kumar[1], Aarthi M[2], Daisy Priya A[3], Lakshmi Priya S[4]

[1]Asistant Professor, Department of Biomedical Engineering, Adhiyamaan College of Engineering (Autonomous), Hosur, Tamil Nadu, India

[2,3,4] Student, Department of Biomedical Engineering, Adhiyamaan College of Engineering (Autonomous), Hosur, Tamil Nadu, India

ABSTRACT

Most difficult challenges facing the healthcare industry is Diabetes. It is a primary affliction of diabetic patients due to peripheral neuropathy that means "loss of sensation in the foot". So this leads to ulcer increases which in many cases lead to the action of surgically cutting off the foot. We have constituting a new stage in a changing situation to introduce a wireless electronic orthotics shoes that composed of less weighted embedded systems with flexible and non-invasive sensors which can be used by diabetic patients. Thus the resulted in the escalations of weightless embedded systems through the continuous breakthrough in transistor technology by the development in processor performance. Thus the advancement of our system is composed of wireless and implanted technology that make it possible for remote healthcare sectors and telemedicine systems. It insisting of an real- time monitoring and continuous discretely analyze of how a patient's behavior affects his/her physiological states and if supplement symptoms suffering from numbness and pain in foot. Our suggested system monitors feet motion, foot temperature and pressure distribution beneath the feet in real-time actions and also it classier the state of the patient. It also detects the conditions that had abilities that causes foot sores. Continuous feedback mechanism enables was enabled for a instance in case of any consequence behavior or condition a serving message wirelessly to the patient and the patient'scaretakers.

Keywords : Arduino, Wi-Fi (ESP 8266), Load cell, Database System

I. INTRODUCTION

As far as 25% of insulin impaired individuals will develop a foot sores during their lifespan and many of these patients finally must undergo the action of surgically cutting off a foot as a result of infection due to improper medical care foot sores. Any reduction in the rate of diabetic feet intricate would be significant to healthcare suppliers and more considerably, it improve the standard of life for many particulars. Diabetic individuals have difficulty with their feet mainly because of improper bloodflow, loss of sensation (diabetic neuropathy), reduced wound healing rate, and hardly fighting off infection caused by microbes. With diabetes, even a sores as tiny as a blister, e.g. due to a tight shoe, can cause considerable damage. In such individuals, the injuries heal to slow, because of improper blood flow. When a sore is not healing, it's a possibility for contaminations. The primary suggestion for preventing diabetic foot wounds are daily foot scrutiny, temperature monitoring, and pressure analysis by using this orthotic shoes. Educating patients to perform daily self inspectionsand properly care for their feet is not

costing a great deal and universally advised. An auspicious variant of this is daily assessments of feet temperature. Finding uplifted temperature in the foot is a significant early indicator of wound formations.

(a) High risk regions (b) Force readings (lbs) from two different subjects

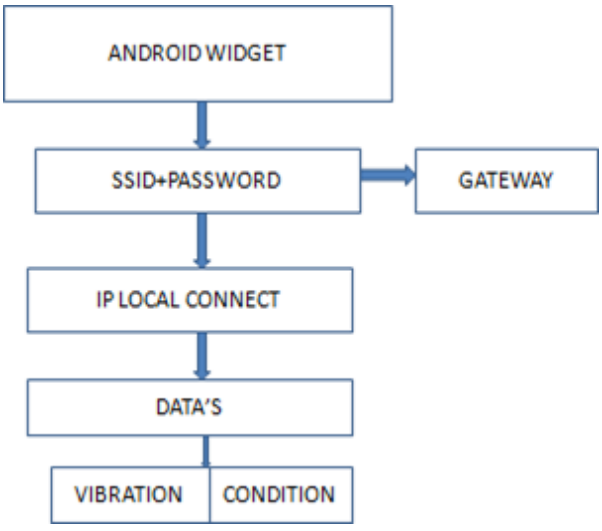
II. LITERATURESURVEY

[1] Mothiram K Patila, VasanthBhat M, Mahesh M. Bhati;, Parivalavan R, Narayanamurthy V. B. Andganesa New Methods And Parameters For Dynamic Foot Pressure analysis In Diabetic Neuropathy. Walking foot pressures are found to be affected by the weight of the person and their walking velocity. It is also found that both the magnitude and duration of the dynamic foot pressures are important in the formation of ulcer in neuropathic feet of diabetic patients. Therefore, foot pressure measurements are made on a long optical pedobarograph which could accommodate at least two steps. The foot pressure analysis is done using two new parameters: Normalized Peak Pressure,NPP and Pressure Contact Ratio, PCR, which take into consideration the weight of the person. Walking velocity and magnitude and duration of the peak foot pressure acting in ten areas of the foot .[2]Robert G. Frykberg, DPM, MPH,1 Thomas Zgonis Diabetic foot Disorder-A clinical Practice, The journal of Foot &Ankle surgery. Therefore, it is essential to detect the foot at risk of plantar ulceration, at an early stage of sensation loss, so as to prevent complications and amputation. It is found that the foot pressure parameters are functions of the material properties of foot sole soft tissue and also different levels of sensation loss. [3]C. Lebosse, B. Bayle, M. de MathelinIllkirch, P. Renaud LGeCo, Nonlinear Modeling of Low Cost Force Sensors, in Proc. of the IEEE International Conference on Robotics and Automation. The traditional orthotic insole by taking ink impression is not sufficient to correct the orthotic problems like misalignments and stability. Foot orthosis is used to alter foot biomechanics and associateddysfunction.[4] Sikyung Kim, Mohammad

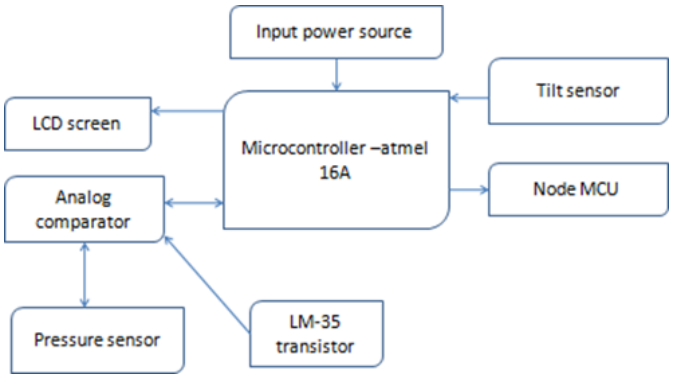
M. G. Mazumdc A Last Design with Uniform Foot Pressure Free Form Deformation, Planter foot pressure studies, in patients with diabetic neuropathy indicated relationship between excessive pressure and ulceration.

III. RESULTS AND DISCUSSION

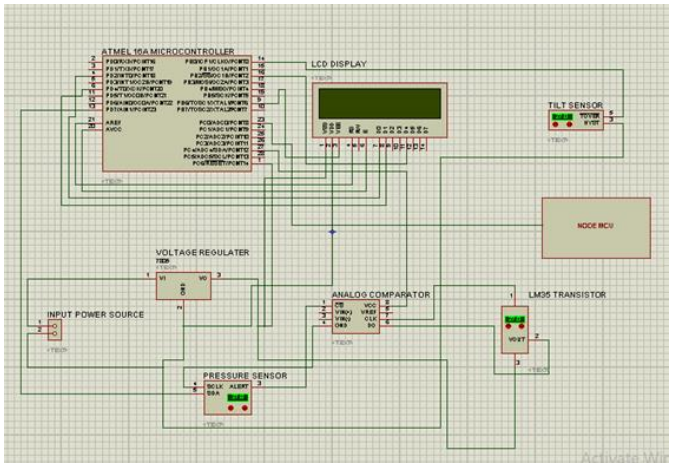
Android widget



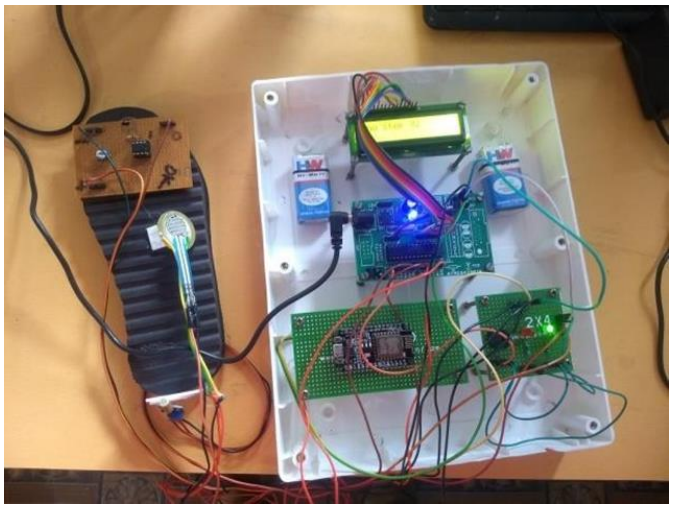
BLOCKDIAGRAM



CIRCUITDIAGRAM



DESCRIPTION



The Electronic Orthotics Shoe system is enforced with caliber, pervasive, diaphanous wireless implanting systems to establish the largest ramifications and probable for ratification. The upcoming segments evoked the hardware and software frameworks of the Electronic Orthotics Shoemodule.

A. Hardware framework: The high-level system architecture of Electronic Orthoticsshoe.

The main module of our establishmentincludes:

- ✓ Sensors for keep track of pressure dispensations, movement and step\walk inspections
- ✓ Med Node: implanting components for data acquisition, signal determinations and wireless dissemination
- ✓ On-Body Terminal which is idiosyncratic convenient gadgets for retention of retrievable data, categorization and depiction as well as providing assessments
- ✓ Central server which gathers patients' antiquity and several details for further examinations.

B. Softwareframework:

The software framework in our module subsists of two main constituents. First part is the imbedded software, which is managing on the processing unit implanted interior in the shoe. The second part is the software, which is getting effectuate on a personal device such as cell phone or PDA. The software running on the embedded processor is responsible for data acquisition, some preliminary data and signal processing, and transferring collected data to the empirical device. Software functioning on empirical device is responsible for supplemental computational and storage meticulous tasks such as data computing and signal processing in ancillary to the user enabling, then it lay out the collected ammunitions from various sensors and also the pressure's extremity under the patient's foot in the confirmed time during which a activity occurs.

IV. CONCLUSION

The experimental study of foot pressure parameter for various class of diabetic patients and the mean value for both normal and abnormal foot pressure values are compared. The lag points are taken for pressure measurement; there will be an Increase in pressure if there is possibility for getting foot ulcer in a particular area .So any variation in Foot pressure which indicates of early detection of foot ulcer. This is very helpful to the Physician for The detection of foot ulcer in earlier stage and also reduces foot amputationpossibilities.

V. REFERENCES

[1]. American Diabetes Association,http://www.diabetes.org.

[2]. N. Singh, D. Armstrong, and B. Lipsky, “Preventing foot ulcers in patients with diabetes,” JAMA: the journal of the American Medical Association, vol. 293, no. 2, pp.217–228.

[3]. R. Macfarlane and W. Jeffcoate, “Factors contributing to the presentation of diabetic foot ulcers,” Diabetic medicine, vol. 14, no. 10, pp. 867– 870.

[4]. A. Veves, H. Murray, M. Young, and A. Boulton, “The risk of foot k8ulceration in diabetic patients with high foot pressure prospective study,” Diabetologia, vol. 35, no. 7, pp.660–663.

[5]. D. Lott, M. Hastings, P. Commean, K. Smith, and M. Mueller, “Effect of footwear and orthotic devices on stress reduction and soft tissue strain of the neuropathic foot,” Clinical biomechanics, vol. 22, no. 3, pp. 352– 359, 2017.

[6]. C. Lebosse, B. Bayle, M. de MathelinIlIkirch, P. Renaud LGeCo, INSA-Strasbour, Nonlinear Modeling of Low Cost Force Sensors, in Proc. of the IEEE International Conference on Robotics and Automation.

[7]. Sikyung Kim, Mohammad M. G. Mazumdc, A Last Design with Uniform Foot Pressure Free FormDeformation, in IEEE, pp.88-93.

[8]. Mothiram K Patila, VasanthBhat, Mahesh M. Bhati, ParivalavanR'Narayanamurthy V. B. and Ganesan V .New Methods and Parameters for Dynamic Foot Pressure Analysis in Diabetic Neuropathy, in Proc. of the IEEE If/h International Conference, pp.1826-1829,

[9]. DV Rai,LMAggarwal,RajBahadur,Plantar Pressure Changes in normal And Pathological Foot during bipedal standing,Indian Journal Of Orthopaedics,vol 40,pp 119-122.

Cite this article as :

C. Sathish Kumar, Aarthi M, Daisy Priya A, Lakshmi Priya S, "Amputation Prevention in Diabetic Patients Using Electronic Orthotics Shoe", International Journal of Scientific Research in Science and Technology (IJSRST), Online ISSN : 2395-602X, Print ISSN : 2395-6011, Volume 5 Issue 5, pp. 78-81, March-April 2020.

Journal URL : http://ijsrst.com/EBHBM001