SUPPORT VEST : AN ANALYSIS STUDY TO MONITOR FORCE AND MOTION FOR HUMAN POSTURE VIA IOT

Monessha a/p S.Suriakumar, Marriyati Morsi
Polytechnic Sultan Salahuddin Abdul Aziz Shah

ABSTRACT

Inaccurate posture is an issue that turns out to be progressively wide-spread in the present world. It can prompt short and long haul torment in the back and neck regions, and has additionally been connected to gloom. Current way of life encourages poor posture, particularly due to the expanding measure of time individuals spend sitting. A poor situated posture can likewise influence an individual's stance while standing and strolling. Muscle memory assumes an imperative job in this, as the body becomes acclimated to being inaccurately situated. Along these lines, to address ones posture and maintain a strategic distance from the previously mentioned dangers, a right sitting and standing position must be set up furthermore, prepared .Wearable innovation can be a way to accomplish this point by always estimating the wearer's body stance and giving input on right or wrong stance. This theory gives an account of issues of postures and how to measure it using sensors by using a support vest .It depends on the possibility that each human has a 'flexpoint', a point where the body twists when one sluggards. At the end of the day: it is unthinkable to have a poor posture and keep the front of the body straight This technical paper proposes an end-to-end system to help improve monitoring vest treatment by continuously observing the amount of force inside the vest. This device is very compatible to bring along anywhere since the device is attached on vest only. There is also an on /off button to connected it with Internet of Things (IOT)via WiFi connection to show the reading in Blynk Application in Handphone.

Keywords: Posture, Support Vest , Force , Internet of Things(IOT),Wireless Fidelity(WiFi).

1. INTRODUCTION

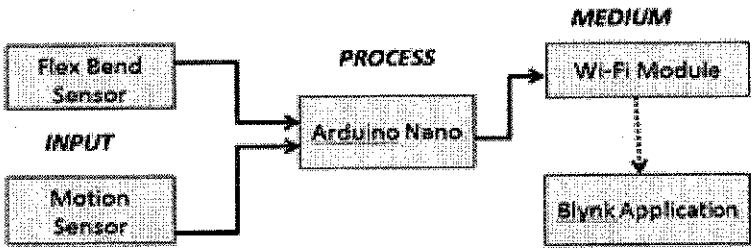
Bad postures happens because of daily habits, mental attitude and stress , muscle tension and muscle weakness. There are few methods that can be done as a treatment to prevent bad postures from happening such as exercise , chiropractic and yoga but it has the cons of commonly forgotten habits of repeating bad posture averagely everyday. The best solution of overcoming this issue is by wearing a support vest which is cheaper and with low risk. This project focuses on wearable sensors and technology use to monitor the right posture and helps to prevents the conditions from worsening . A support vest is invented with Force and Motion Sensors to identify the right posture angles . Activity such as walking , standing , sitting and running is done for variations proportions of force and motion data to be collected . This data will be implementing through a Blynk Application to identify different trends and patterns associated with the activities performed by the respondent. The problem that has been deduced from bad postures is mental and physiological effects which causes breathing problems , indigestion and disruption in blood flow. The objectives of the project are To improvise the condition of human from going into bad posture to good posture. To monitor the effectiveness of vest wear by correlating the forces and motion with a multi-modal sensor and to provide a healthy lifestyle. The scope of the project would be headed to the age group of (15-50) years old for both male and female. It is to identify is the supports vest would be comfortable to be worn by human. Sensors that monitors the force and motion will be embedded in the vest in order to build them in further. The analysis will be tabulated in graphical to review on the force and motion.

2. METHODOLOGY

The solution in this project study are using software and hardware. This chapter will explain about the whole research methodology process for this project. It consist about the project block diagrams, hardwares and softwares used and project illustration.

2.1 Block Diagram of the Support Vest

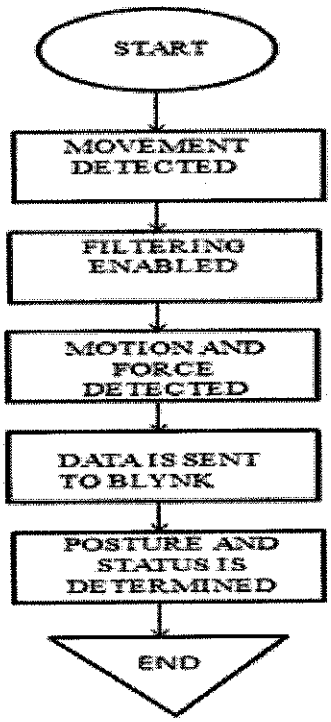
Fig. 1. Block diagram of Support Vest project which contains both software and hardware



There is several hardware components and circuit used in this project. For instance , a Motion Sensor is used to detect motion and Force Sensor for the exerted pressure acts upon the Support Vest. A Wifi-Module is used to transmit the raw data collected from the sensors to Blynk Application which shows the display.

2.2 System Flowchart

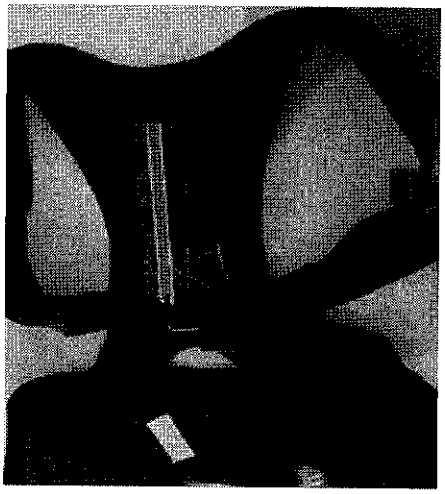
Fig. 2. Operation of Force and Motion Sensors.



The Fig. 2. shows a simplified flow chart of the normal operating mode. This helps to detect the posture. The diagram explains that the motion and force is detected and filtering was enabled , a specify activity detection such as walking is detected and the data was collected and sent to the Mobile Application (Blynk) .

2.3 Development of the device

Fig. 3. Above pictures shows where the sensors are embedded in Support Vest.



3. RESULTS AND DISCUSSIONS

Data collection is a key part to the achievement and exactness of this task. All information accumulation identifies with the information being gathered from the vest worn by the participants. . In this examination, I gathered information in test situations from Participant testing.

3.1 Participants Testing

Table 1

Participants	Awareness before Vest	Awareness after Vest	Increased Awareness while not wearing Vest
01	2 times / week	6 times / hour	Yes
02	3 times / day	1 time / hour	Yes
03	1 - 2 times / day	3 times / day	Yes
04	2 times / day	3 - 4 times / day	Yes

Explains the number of participants , the awareness before and after vest and whether did it increase awareness while not wearing the vest. These questions were asked to the participants on how they felt before and after wearing the vest.

Table 2 : Explains the observation and days of vest has been worn by the four participants

Participant	Occurrences of Poor Posture before Vest	Occurrences of Poor Posture after Vest	Days of wearing the vest
01	2	2	12
02	6	3	10
03	10	4	14
04	6	4	10

Table 3 : Minimum and Maximum Values.

STATUS	X	Y	Z	FLEX
WALKING	175.78-208.52	143.34-194.20	162.38-207.01	0.09-21.69
STANDING	203.52-256.16	179.96-233.6	175.01-277.04	0.09-6.659
RUNNING	191.70-212.47	155.52-197.86	174.45-245.98	0.09-12.19
SITTING	204.26-251.05	186.12-237.98	205.12-302.16	0.09-17.32

The table above shows the Minimum And Maximum Value Of 4 Participants Performing 4 Activities which is Walking , Standing Running and Sitting. The highest and lowest value of X-axis is taken to determine the status.

3.1.1 Motion Analysis

Fig. 5. Sitting X-axis

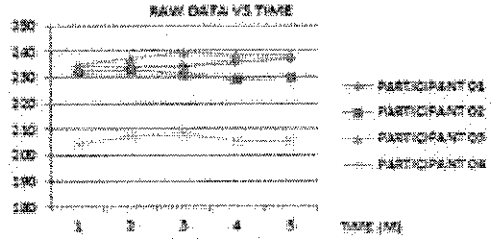


Fig. 6. Standing X-axis

Fig. 7. Walking X-axis

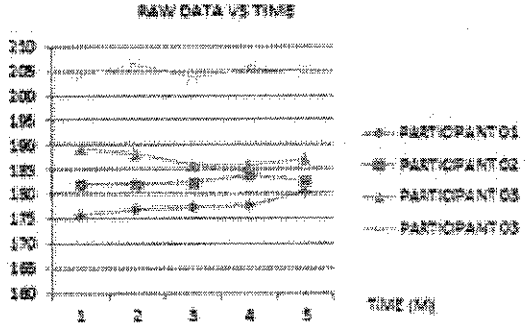
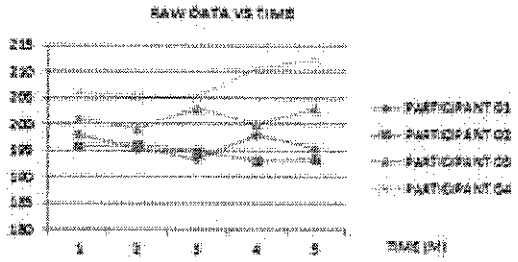


Fig. 8. Running X-axis



The above Figure 5, 6, 7 and 8 explains about the Sitting X-axis , Standing X-axis ,Walking X-axis and Running X-axis. This is known as Motion Analysis because it determines the status .The graphical view of the status shows in a same form where it all corresponds. Whereas for status determination x-axis has been taken into count to determine the status. The reason why x-axis is used to determine because the position of how sensors are mounted into the vest. Moreover there is only a minimal change in between Standing and Sitting status thus a Gyro sensor should be added in circuit.

3.1.2 Flex Analysis

Fig. 8. Flex value and Status.

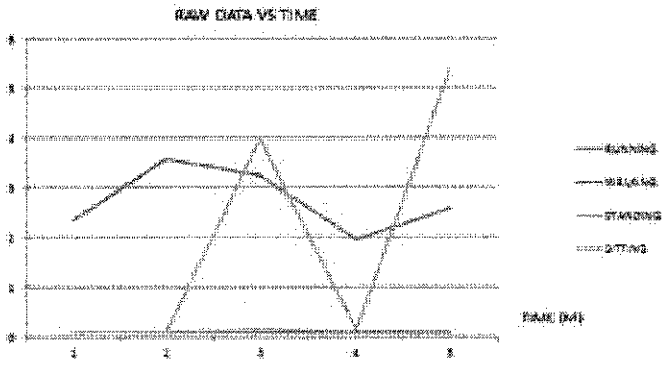
FLEX VALUE	STATUS
0.09-6.65	Very Good Posture
6.66-12.19	Good Posture
12.20-17.32	Satisfactory Posture
17.33-21.69	Poor Posture

The above figure shows the range of Flex Value that has been determined by using 4 Participants. It is understood the lower the value of Force exerted the better is the posture .Users can use this as a guide line to determine their posture effects .This will be a very promising results after a long term usage. The Support Vest can change your habits of maintain poor posture to good ones.

3.1.3 Good Posture Analysis.

Fig. 9. Shows a table of flex of Candidate A

RUNNING	WALKING	STANDING	SITTING
2.3395	0.09	0.09	0.09
3.58381	0.09	0.09	0.09
3.261429	0.09	0.14	3.998095
1.969048	0.09	0.09	0.14
2.591905	0.09	0.09	5.367143



From the observation the highest flex value that has been emitted by Candidate B is more than 20 (Raw Data). This observation is taken for 5 minutes duration. Comparing to the previous table flex has helped to identify between good and bad postures , for instance Candidate A has a better body postures and frame compared to the other participants .This is because the lower the value of flex the better is the body postures

4. CONCLUSIONS

In conclusion, this work set out to structure an answer for improve the wearer's act dependent on a novel methodology. The created plan indicates potential, be that as it may, leaves space for further enhancements. I accomplished a general exactness of movement acknowledgment of a 100%. Patients were told to wear the vest for 1 hours every day at first, bit by bit expanding to 5 hours per day. This was demonstrated by the examination, as consistence was seen to increment from the postures of the participant following a month.The vest is also portable and easy to use along and safe to use.

ACKNOWLEDGEMENT

I hereby complete my project and would like to offer my special thanks to my project supervisor Pn. Marriyati Morsin for her guidance and suggestions given to me during the planning and development of this project.

REFERENCES

[1] J. H. Riskind and C. C. Gotay, "Physical posture: Could it have regulatory or feedback effects on motivation and emotion?" Motivation and Emotion, vol. 6, no. 3, pp. 273–298, 1982.

[2] Bao, L. and Intille, S. S. (2004) „Activity Recognition from User-Annotated Acceleration Data Pervasive Computing", Pervasive Computing, 3001, pp. 1–17. doi: 10.1007/978-3-540-24646-6_1.

[3] Capela, N. A., Lemaire, E. D. and Baddour, N. (2015) „Improving classification of sit, stand, and lie in a smartphone human activity recognition system", in 2015 IEEE International Symposium on Medical Measurements and Applications, MeMeA 2015 - Proceedings, pp. 473–478. doi: 10.1109/MeMeA.2015.7145250.

[4] Ermes, M. et al. (2008) „Detection of daily activities and sports with wearable sensors in controlled and uncontrolled conditions", IEEE Transactions on Information Technology in Biomedicine, 12(1), pp. 20–26. doi: 10.1109/TITB.2007.899496.

[5] Weinstein, S. L. et al. (2013) „Effects of Bracing in Adolescents with Idiopathic Scoliosis", New England Journal of Medicine, 369(16), pp. 1512–1521.

[6] L. E. Dunne, P. Walsh, S. Hermann, B. Smyth, and B. Caulfield, "Wearable monitoring of seated spinal posture," Biomedical Circuits and Systems, IEEE Transactions on, vol. 2, no. 2, pp. 97–105, 2008.

[7] Q. Wang, W. Chen, A. Timmermans, C. Karachristos, J.-B. Martens, and P. Markopoulos, "Smart rehabilitation garment for posture monitoring, "in Engineering in Medicine and Biology Society (EMBC), 2015 37th Annual International Conference of the IEEE, IEEE, 2015, pp. 5736–5739

[8] W. Y. Wong and M. S. Wong, "Smart garment for trunk posture monitoring: A preliminary study," Scoliosis, vol. 3, no. 7, pp. 1–9, 2008.

[9] R. Tattersall and M. Walshaw, "Posture and cystic fibrosis.," Journal of the Royal Society of Medicine, vol. 96, no. Suppl 43, p. 18, 2003.

[10] A. P. Claus, J. A. Hides, G. L. Moseley, and P. W. Hodges, "Is ideal sitting posture real?: Measurement of spinal curves in four sitting postures," Manual Therapy, vol. 14, no. 4, pp. 404–408, 2009.

[11] Ribeiro Filho, J. D. P. et al. (2016) „MHARS: A mobile system for human activity recognition and inference of health situations in ambient assisted living", Journal of Applied Computing Research, 5(1). doi: 10.4013/jacr.2016.51.04.

[12] F. Gerr, M. Marcus, and C. Monteilh, "Epidemiology of musculoskeletal disorders among computer users: Lesson learned from the role of posture and keyboard use," Journal of Electromyography and Kinesiology, vol. 14, no. 1, pp. 25–31, 2004.

[13] J. Z. Canales, T. A. Cordás, J. T. Fiquer, A. F. Cavalcante, and R. A. Moreno, "Posture and body image in individuals with major depressive disorder: A controlled study," Revista Brasileira de Psiquiatria, vol. 32, no. 4, pp. 375–380, 2010.

[14] J. H. Riskind, "They stoop to conquer: Guiding and self-regulatory functions of physical posture after success and failure.," Journal of Personality and Social Psychology, vol. 47, no. 3, p. 479, 1984.

[15] P. Briñol, R. E. Petty, and B. Wagner, "Body posture effects on self- evaluation: A self-validation approach," European Journal of Social Psychology, vol. 39, no. 6, pp. 1053–1064, 2009.

[16] S. Baurley, "Interaction design in smart textiles clothing and applications," Wearable electronics and photonics, pp. 223–243, 2005.

[17] E. Beaudette, J. Hinestroza, L. Sanchez-Botero, H. Park, and S. Ash- down, "Innovative explorations in apparel design to create engineered outfits with lighting technologies," in Proceedings of the 2014 ACM International Symposium on Wearable Computers: Adjunct Program, ACM, 2014, pp. 15–19.

[18] M. Caon, Y. Yue, G. Andreoni, and E. Mugellini, "Atelier of smart garments and accessories," in Proceedings of the 2013 ACM conference on Pervasive and ubiquitous computing adjunct publication, ACM, 2013, pp. 379–384.

[19] K. O"Sullivan, P. O"Sullivan, L. O"Sullivan, and W. Dankaerts, "What do physiotherapists consider to be the best sitting spinal posture?" Manual Therapy, vol. 17, no. 5, pp. 432–437, 2012.

[20] B. D. Lowe, "Accuracy and validity of observational estimates of shoulder and elbow posture," Applied Ergonomics, vol. 35, no. 2, pp. 159–171, 2004.

[21] R. Asselin, G. Ortiz, J. Pui, A. Smailagic, and C. Kissling, "Implementation and evaluation of the personal wellness coach," in Distributed Computing Systems Workshops, 2005. 25th IEEE International Conference on, IEEE, 2005, pp. 529–535.

[22] C. Mattmann, O. Amft, H. Harms, G. Troster, and F. Clemens, "Recognizing upper body postures using textile strain sensors," in Wear- able Computers, 2007 11th IEEE International Symposium on, IEEE, 2007, pp. 29–36.

[23] D. De Rossi, F. Carpi, F. Lorussi, A. Mazzoldi, R. Paradiso, E. P. Scilingo, and A. Tognetti, "Electroactive fabrics and wearable biomonitoring de- vices," AUTEX Research Journal, vol. 3, no. 4, pp. 180–185, 2003.