Rapid Entire Body Postural Analysis Assessment Device
Sushmitha G\textsuperscript{1} Rakesh Kumar\textsuperscript{2} Harshitha Hm\textsuperscript{3} Arpitha V\textsuperscript{4} Dr. B. S Shylaja\textsuperscript{5}
\textsuperscript{1,2,3,4}Student \textsuperscript{5}Head of Dept.
Dr. Ambedkar Institute of Technology, Bangalore, India

Abstract—This project aims at providing a summary of one of the observational postural analysis in the ergonomic assessment tools. Rapid Entire Body Assessment (REBA) in terms of its development, applications, validity and limitations is convenient for postural assessment settings which includes health care job tasks and computer based jobs. The assessment of this Musculoskeletal Disorders which is work related involves the evaluation of risk which develops a range of disorders related to muscles, nerves and joints. It is also associated with occupational tasks which is primarily concerned with upper limb and lower back.

Key words: Ergonomic Assessment, REBA, Musculoskeletal Disorders

I. INTRODUCTION

The development of this project can be used in various circumstances and therefore it can be applied in multiple workplaces. The evaluation of the physical load is analysed by the body postural movement. The objective of this paper is to assess the postures of an individual by using REBA device who works continuously for hours.

Musculoskeletal disorders are caused by different risk factors resulting in individual, psychosocial and physical factors. These disorders are widely spread across developed and developing countries which is giving major problems in IT industry, with an increase in cost of salary, decline in productivity. There are many observational and instrument based techniques. The technique which is used here is the observational technique i.e. Rapid Entire Body Assessment.

![Fig. 1: Flow Chart of REBA](image)

II. BACKGROUND

The development of REBA is essential for evaluating the job activities in the analysis of body postures. The risk of this muscle and skeletal injury is interconnected with the readings or the values which are being recorded due to the changes in the position of the body. REBA provides a fast and convenient way to evaluate different working postures of the body.

REBA assessment evaluates the entire body for static and dynamic works. The main application of this device is in the IT Companies where people work for hours together in front of the system. This device will help them to get back to their normal position. In hospitals, paralyzed patients who are having a tough time with severe body pain, this device would make sure that the patients’ body movements are analyzed and proper instructions are given as to whether they are deviating from the normal position or not. This device comes in handy with minute wireless sensors. But since the wireless sensors are too expensive we have implemented wired sensors. This device can be implemented on the entire body i.e. Neck, spine, hand, knee, upper and lower limb. As far as our project is concerned, we have implemented on three different parts of the body i.e. Neck, hand and for knee movements.

III. SYSTEM DESCRIPTION

REBA is being proposed as a platform to analyse the body posture of an individual. This device is categorized into three different parts of the body i.e. Knee, hand and leg movement. If a person working since a long time tries to deviate from the normal position to another position, a message alert is displayed on the LCD screen of the device, and that message is sent to a registered mobile number on an android phone application through which the voice alert is also provided. The message is sent through a GSM where a sim is inserted in it. The data of all the commands or instructions including the login details are stored in the MySQL Front.

Since we have implemented on three different parts of the body i.e. Neck, hand and knee, for each movement a command is generated. One command for Neck (Spine) which alerts with a message “Keep your Neck straight”, the second command is for Hand (Wrist) which is alerts with a message “Move your Wrist and then for the knee which alerts with a message “Take a Walk” or “Walk Alert”. All these commands are displayed on the LCD screen and then to the mobile phone application which is also installed with a voice output.

![Fig. 2: Block diagram of REBA](image)

IV. HARDWARE REQUIREMENTS

A. Renesas Microcontroller Unit

R5F100LEA microcontroller from Renesas RL78 series which is a 16bit microcontroller that has been used to design a REBA device. Renesas Microcontroller has three units they are Power, Control and Communication units. The maximum power voltage is 12volt or less than that is constant. To make Microcontroller to process the data, we need to dump the code into Microcontroller using Renesas Flash Programmer. The RS232 cable or DB9 connector or USB-to-serial cable are used for communication.

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B. Liquid Crystal Display (LCD)

LCD (Liquid Crystal Display) is a thin, flat display device made up of any number of color or monochrome pixels arrayed in front of a light source or reflector. Liquid crystal layer is inserted between two electrodes. It is used as a user interface. It has 14 pins, out of which 3 pins are controlling pins and 2 others are Vcc and Ground. Port 7 of microcontroller is used for LCD. It is used to display the changes in output voltages of accelerometer and any event occurring. It can take 16 characters which will be displayed in two lines and rest of them are truncated.

C. Global System for Mobile Communication (GSM)

GSM (Global System for Mobile Communication) is developed as a digital system using TDMA (Time Division Multiple Access) technology. GSM model can accept any GSM network operator SIM (Subscriber Identity Module). By this we receive the message from the REBA device and is sent to the mobile phone application. GSM is the most popular standard for mobile phones in the world. The GSM standard has been of greater advantage to both clients and also to network engineers. GSM networks operate on different carrier frequencies which ranges with most of the 2G GSM networks operating between 900 MHz and 1800 MHz bands.
MySQL is the open source relational SQL database management

C. Java

Java being high-level programming language is portable across operating systems. Reliability and accessibility are its advantages. It converts source code into byte code. Java is a class-based, structured programming following the multiple paradigm. Java language is secure and it is robust.

D. Cube Suite+

Integrated Development Environment Cube Suite offers the ultimate in simplicity, usability and security for the repetitive editing, building and debugging that typifies software development.

E. Renesas Flash Programmer

Renesas Flash Programmer is software that erases, writes, and verifies program on the target system or program adapter on which a Renesas Electronics single-chip microcontroller with on-chip flash memory is mounted. Writing is controlled by the host machine and Graphical User Interface (GUI) specific to writing.

VI. IMPLEMENTATION

Implementation include registration page, user or login page. Initially we insert the sim in the GSM sim slot and check if the sim is activated by the message being displayed on the LCD. Soon after the GSM is activated, the initial readings are displayed on the LCD display. The normal postural readings that are recorded initially are displayed (180 190 160 0-30). Now the sensors are fixed on the neck, wrist and the knee with proper positions respectively. The first reading on the display is for the neck, second is for wrist, third is for knee and the last reading is a count for the knee (initially we have 30 counts), after it crosses 30, it will prompt a message “Take a Walk”. If there is a deviation from the normal position of the neck i.e <180, message is displayed on the LCD as well as a voice output is generated through the android device.

If there is a deviation from the normal position of the wrist i.e <190, message is displayed on the LCD as well as a voice output is generated through the android device.

If there is a deviation from the normal position of the leg i.e <160 and count >30, message is displayed on the LCD as well as a voice output is generated through the android device.

All these messages that are sent via GSM to the mobile phone application with user details are stored in MySQL Front (Web Services). We can create as many users as possible. Here, we are making use of one registered number, because the registered number in the code is dumped to the microcontroller using the software Renesas Flash Programmer via DB9 connector.

VII. SNAPSHOT

Fig. 14: Snapshots of circuit

A. REBA

Fig. 15: REBA
B. Initial Display

![Initial Display Image]

Fig. 16: Initial Display

C. Registration Page

![Registration Page Image]

Fig. 17: Registration page

D. Main Screen

![Main Screen Image]

Fig. 18: Login Page

VIII. CONCLUSION AND FUTURE ENHANCEMENT

Today we have implemented our device REBA working for people in IT industries, factories, hospitals, warehouses, and laboratories. In this project, we have developed a device which helps people to overcome their health related issues. As a future enhancement, we are making use of the same project being implemented for the wireless sensors replacing wired sensors. This device is likely to boost the country’s economy in the future days. These type of wireless sensors enable a larger group of people to work comfortably without any health hazards even in complex environment continuously. This device could also be a boon in reducing the risk factors leading to musculoskeletal disorders resulting in a healthier workplace.

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