



ELECTRONIC SIT UP EQUIPMENT

Patent Application Document

Technical Description

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Table Of Content

Title	Page
1.1 Functional Description	1
1.2 Profiling	3
1.3 Detection Algorithm	3
1.3.1 Body Lying Down Detection	4
1.3.2 Sit Up Detection	5

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Electronic Sit Up Equipment

1.1 Functional Description

The Electronic Sit-Up Equipment is designed to functions as test station – to electronically VERIFY and COUNT the number of valid sit-up performed by the user within 60 seconds (this time period can be user definable). As depicted in Fig 1.1, the machine is installed with various sets of infrared sensors arrays to detect the profile of user lying on his back. For detection of the sit-up position, an ultrasonic sensor is used to measure how far the user stretches his upper body towards touching his knee by his elbow. Fig 1.1B shows the user interface comprises of the LED matrix display. As part of an input device, a RFID¹ reader is installed on the platform (not shown).

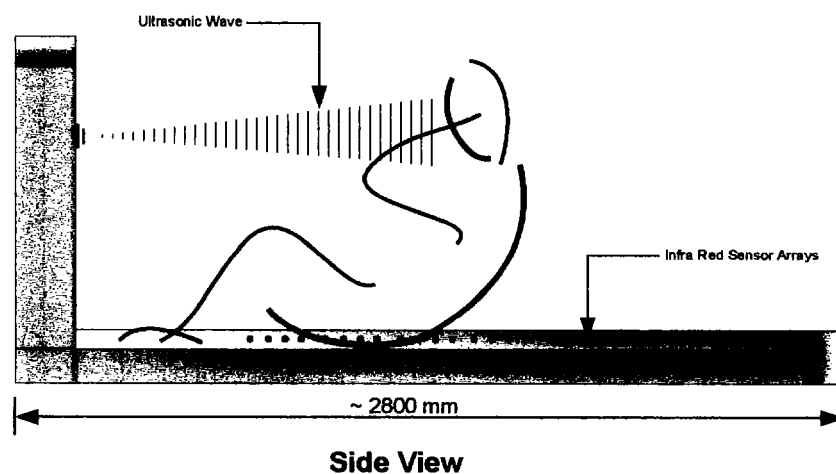


Fig 1.1A

¹. Radio Frequency Identification

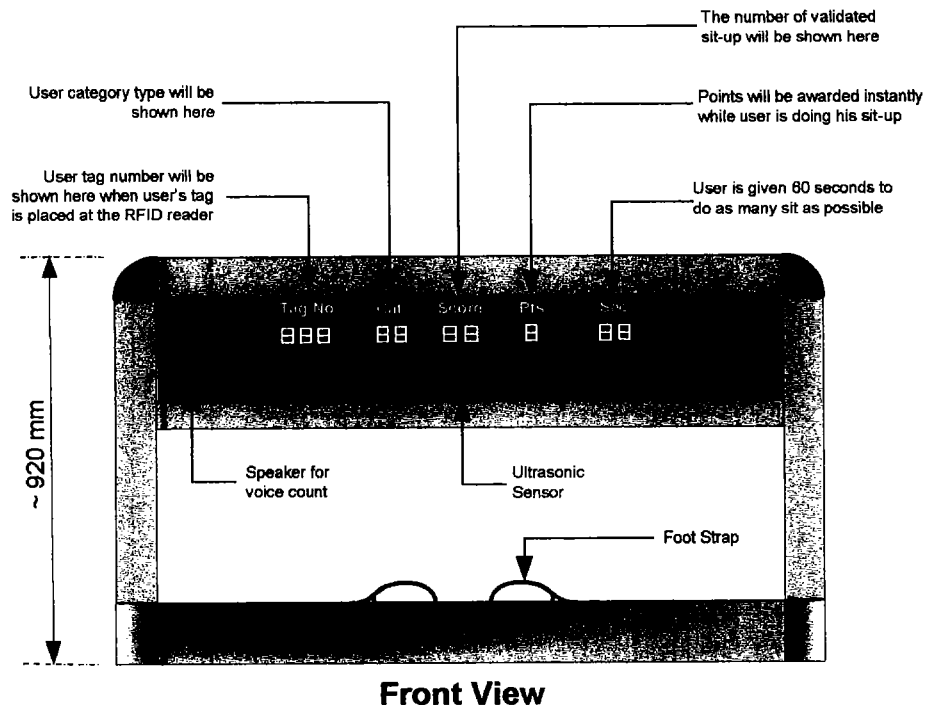


Fig 1.1B

To start using the equipment, the user is expected to scan his (pre-issued) RFID Tag at the RFID reader. The memory chip within the RFID tag contains his particulars including his tag number, category type (age group) and other relevant data. The system will read the data from the Tag and display his Tag number and other particulars. The user can then start doing his sit up at his own time, As soon as he started his first attempt, the preset 60 seconds timer will commence counting down.

The user must do as many sit-ups as possible within this 60 seconds time period (can be user definable). For each validated sit-up, the system will increment the Score by '1' digit count with a corresponding voice count. The score (number of valid sit-up done) and the corresponding points will be displayed at the LED screen for the user to view. At 50 seconds of count down, the system will signal an alert tone and subsequently this tone will repeat every second from 5 seconds to zero. The resulting score will be automatically written into the memory of the RFID Tag. The result may transmit to any server via wired or wireless LAN if desire.

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1.2 Profiling

The Sit Up equipment is programmed to validate and count when the following profiles are met:-

Valid Profile (Count)

1. Shoulder blade lies flat on the floor and followed by upper body curl up to touch his knee with his elbow (assuming both his palm are cupping his ear).

Invalid Profile (No count)

1. In-complete sit-up A. - Touch his knee with his elbow, but at lie down position, his back failed to touch the floor fully.
2. In-complete sit-up B. Though his back fully touches the floor, but failed to complete the sit up satisfactorily with his elbow touching his knee. (Assuming both his palm are still cupping his ear).

1.3 Detection Algorithm

The program expect the first few sit-up attempt by the user will meet the defined standard. Taking at least the first two ($2 + n$ where n is user definable) sit-ups as reference, the subsequent sit-ups are measured and validate against the standard of this reference. As depicted in diagram 1.3.1A, there are basically two type of sensor – one is the infrared sensor and the other is the ultrasonic sensor. The infrared sensors are arranged in arrays along the edge of the floor (platform). These infrared sensors arrays are programmed to detect and identify the lying back profiles. On the other hand, the ultrasonic sensors is installed at the front faces the user. It measures in real-time the distant towards the upper body movement. Each time the user curl up his body during his sit-up position, the measured distant will determine how far he stretches his upper body to touch his knee with his elbow (assumed user adopt palms-cupping-ear method).

1.3.1 Body-Lying-Down Detection

At the first lying down position, the detection algorithm measures the number of sensors being blocked by the body. Fig 1.3.1A shows an example of 17 sensors are being blocked. If n is defined as 1 (i.e $2 + 1$), then the AVERAGE number of first 3 lying-down blocked sensors will be used as the base reference for subsequent detection. For example: if the number of sensors being blocked at the first 3 attempt are: $B_1 = 17$, $B_2 = 16$ and $B_3 = 15$ then the Average = 16. Hence any subsequent attempt that is < 16 will equate a NO COUNT state.

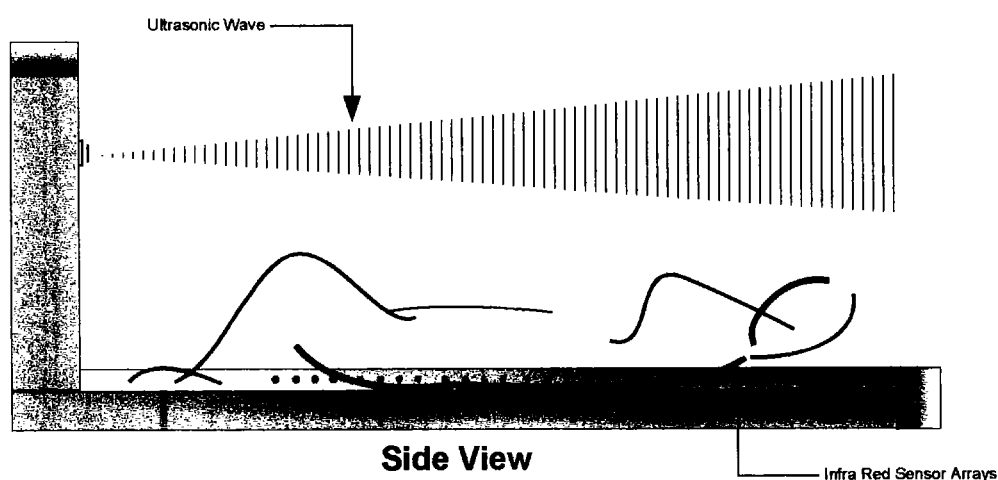


Fig 1.3.1A

1.3.2 Sit Up Detection

The ultrasonic sensor continuously measures the distant between the sensors position and the user's head. Fig 1.3.2A shows an example of sit up position where the ultrasonic sensor takes the distant measurement. If n is defined as 1 (i.e $2 + 1$), then the AVERAGE distant of first 3 sit-ups position will be used as the base reference for subsequent detection. For example: if the distant measured (in mm) at the first 3 attempts are: $D_1 = 1530$, $D_2 = 1590$ and $D_3 = 1610$ then the Average = 1576. Hence any subsequent attempt where the distant $D > 1576$ will equate a NO COUNT state.

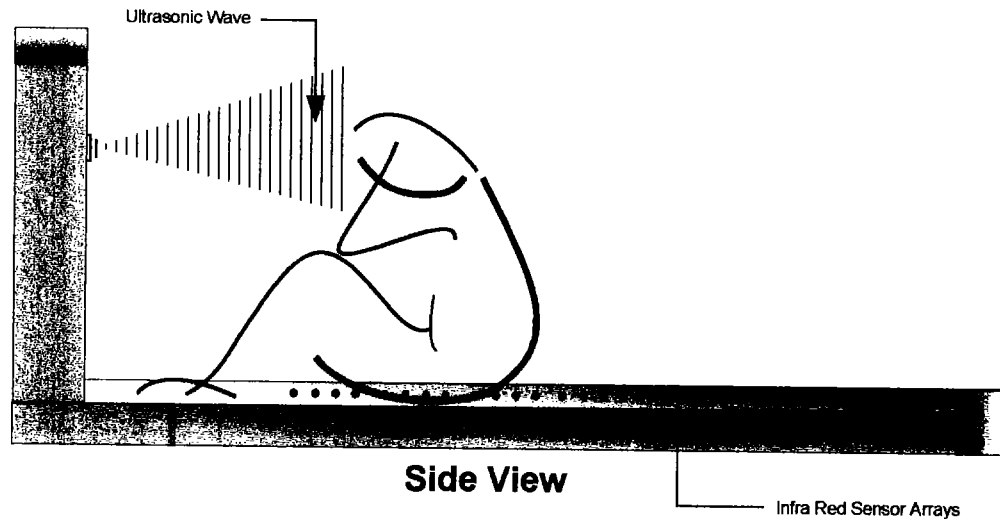


Fig 1.3.2A

A validated sit-up comprises of a successful attempt on the lying-down position followed by the sit-up position consecutively. In the above example, if the lying-down position blocked at least 16 sensors and followed by the sit-up position reaching at least 1576 mm = the detection algorithm will equate a COUNT.

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