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A Smart Footwear System for Healthcare and Fitness Application

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Abstract - *The human physique has an unsteady bio-medical formation attached to various joints even a normal issue in the lower joints harmfully affects the management of standing position. The projected system includes an observing circuit that is inbuilt and gives footstep count, weight count, walking speed, travel mapping, distance count, Pro-health tips. It is proposed with a load cell pressure sensor that will turn off the system to ignore unwanted usage of battery. This system includes a mobile application that describes overall bio-medical information. This system uses a real-time cloud server, geo-location, a microprocessor for real-time data assortment and a health monitoring mobile application.*

***Key Words*: Android, Cloud, Python, Raspberry Pi, User logs.**

1. INTRODUCTION

We have gone through various papers for the execution of this system. They have some disadvantages, some of them are recovered in our system. The system has been analyzed as per the requirements from healthcare and fitness. The people who cannot afford the expense, they prefer to stay at home, though, the lack of correct observing can head towards the shortage of a system of health control that could give necessary biomedical & also good health information to the caregiver and the user. This system is meant for insanity patients. Everyday human has some fitness issues or some medical problems and issues as per the survey. Our proposed work will change the life of every human. This system architecture is an adhesive methodology for variable health medicare & fitness observing method integrated shoe is introduced.

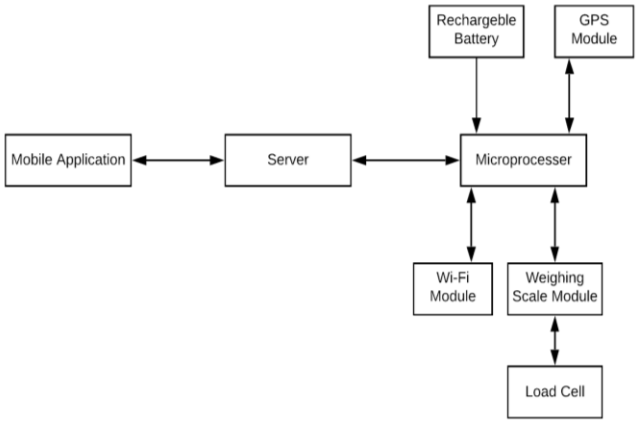

Fig -1: System Block Diagram [4]

Therefore, people use various health-related or fitness applications or devices. That system does not give an accurate result. Using our system, it is easy for the human to find their health-related all details with accuracy. We are using accelerometer and piezo sensors for step count and GPS sensors to recognize the human mapping region also we are using load cells to measure the heaviness of humans. There is also a utility through which the user can add their daily working schedule using our system application to manage their information. Users can register to our system through our android application by just following a few steps.

2. RELATED WORK

2.1 Step Count

We have used piezo sensors to count the steps user have stepped. There are four piezo sensors attached to the inner sole. If two of them are senses the pressure then it is said that the user has stepped a step. Like this approach, we are counting the steps of the user. Whenever a step is sensed a counter is increased and this is sent to the cloud server. Cloud server stores this information and this information is displayed on the mobile application.

Fig -2: Piezo Sensor

2.2 Length Travel

We have used piezo sensors to count the steps user have stepped. There are four piezo sensors attached to the inner sole. If two of them are senses the pressure then it is said that the user has stepped a step. Like this approach, we are counting the steps of the user. Whenever a step is sensed a counter is increased and this is sent to the cloud server. Cloud server stores this information and this information is displayed on the mobile application.

```
fun deg2rad(deg):

return deg * (math.pi / 100)

R = 6371

dLat = deg2rad (lat - vlat)
dLng = deg2rad (lng - vlng)

a = math.sin(dLat / 2) * math.sin( dLat / 2 ) + math.cos( deg2rad( vlat ) ) * m
ath.cos( deg2rad( lat ) ) * math.sin( dLng /2 ) * math.sin( dLng / 2 )

c = 2 * math.atan2(math.sqrt( a ), math.sqrt( 1 - a ) )

d = ( R * c ) * 1000
```

Where,
lat = Current latitude of vehicle
lng = Current longitude of vehicle
vlat = Latitude at the time of virtual lock
vlng = Longitude at the time of virtual lock
dlat = Distance between both latitude
dlng = Distance between both longitude
fun deg2rad(deg) = Converts the degree of latitude/longitude to radius

Fig -3: Distance Formula [5]

2.3 Weight Calculation

We are using a 50kg half-bridge load cell to calculate the weight of the user. These load cells are connected to an amplifier to amplify the voltage pulses. The amplifier is connected to Arduino nano which amplifies the load cell's voltage pulse and sends it to the microcontroller. The output of the amplifier is then calibrated to get the accurate weight of the user.

Fig -4: Load Cell

2.4 Calories Burned

To calculate how many calories user had burned for a particular activity is calculated using the following formula:

Calories burn formula:

Calories_burned/hour=MET weight_of_the_user_in_kg*

Where,

MET = Metabolic Equivalent
weight_in_kg = Weight of the user in Kg.

The MET value used in any activity varies as per the activity.

2.5 Walking Speed

We have used our Ublox neo-6M GPS sensor to calculate the walking speed. We are calculating the walking speed as per the change in the speed of the location of the user. Our device will monitor the change in the geolocation of the user very deeply. GPS module will send the geo-location to the device apart from the usual timespan given to all the sensors of the inner sole.

2.6 Foot Pressure Point

To recognize the pressure point of the foot, we are using piezo sensors. When the piezo sensor will get pressure on it, it will generate voltage pulses. Arduino nano senses these pulses and sends the pressure point to the raspberry pi. Then this data is sent to the server. By taking the mean of this data foot pressure point is calculated.

3. SYSTEM OVERVIEW

Our system can calculate all the features explained above. By using our system user will be able to keep track of his fitness and can monitor his activities very closely. The user will also get the health tips on our mobile application as per the history of his activities and all the information gathered during the performance of his activities. The smart inner sole system is wearable and reasonable technique that indicates the present problems in walking inspection. The smart inner sole system has an inbuilt movement-sensing part in the shoe's inner sole. Using the intellectual inspection rule all-important human gait options are fetched from the device knowledge. Thus, the smart inner sole system observes all kinds of actions independently without troubling the subject's standard life [2].

3.1 Hardware Architecture

The smart inner sole system includes a price-effective sensor inner sole and software-application package on smartphones and computers pair for storing the visualization and the data. The inner sole includes "an array of sensors, an ultra-low power micro control unit (MCU) and Bluetooth low energy (BLE) wireless transmission module, a channel multiplexer (MUX), a battery, and a micro-Universal Serial Bus (USB) connection module". The software-application package gives real-time and visualization directed response. The smart inner sole system may be a wearable & reasonable technique that indicates the present problems in

walk inspection. The good inner sole system has inbuilt movement-sensing parts in the shoe inner sole. Using the intellectual inspection rule, all-important gait options of humans are fetched from the device knowledge. Thus, the smart inner sole system observes all kinds of actions independently without troubling the standard life of the subject.

The information saved inside the SD card will usually observe health behavior which makes it easier for effective & understanding intercession choices to raise independence of personal. The smart inner sole can calculate "step counts, step pace, swing time, and center of pressure (COP) shifting velocity", that may be a more intimate balance status of the walk and real possible risk of fall [3].

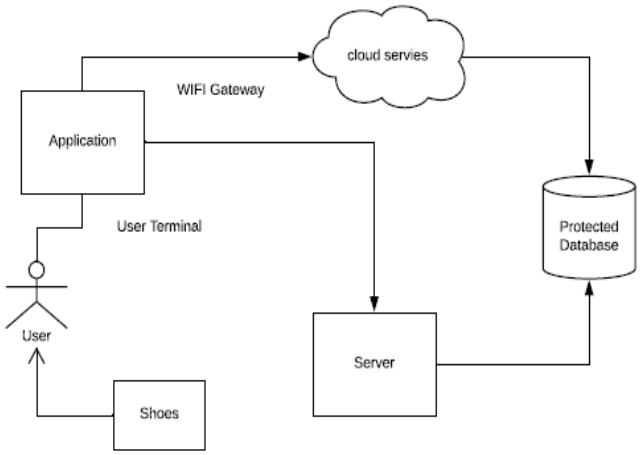

Fig -5: System Architecture [4]

4. CONCLUSION

Using a Smart shoe, allow securing human health and providing Fitness Tips for Good human health. As an application of it, we can implement the same basic concept in Fitness, which requires more fit and healthy for humans. With this system, it becomes easier to track a human while walking and count the steps of human with the tracking system and all show in one android application which will detect you and it also displays human weight, it measured the weight on human's height, age. This system is working on a mobile-based application and also hardware base shoes which having load cell and sensor.

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