

The Design of Walker Appliances for Emergency Detection in Elders

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Abstract: *The design of walker appliances for emergency detection in elders aims to support elders and elderly care givers. The appliances consist of emergency function, automatic light function, heart rate monitoring function, walking distance monitoring function and lock function. The emergency function detects accidents with touch sensor modules, angle sensor modules, and emergency necklace. Besides, it alerts the sound signal and messages through Line Notify. The light function detects light intensity with LDR Photo resistor Sensor Module for illuminating and positioning walker in the darkness. The heart rate monitoring function measures pulse waves with heart rate sensor module. The walking distance monitoring function measures distances with accelerometer. These two functions show the health data through Line Notify. In addition, we also designed the high secured locking system which has simple usability. Our assessment results reveal high satisfaction from users, high accuracy of data collection and high efficiency of accessories.*

Keywords: Walking aids, Elders, Elderly people, walker, appliances, Elder care product, emergency, detection, age, caregiver, accident, SWOT, Arduino, IOT

1. Introduction

In the last four decades, Thailand's population structure has been changed rapidly. Thailand became an aging society. There are elderly people over numbered 8.4 million in 2018 with a dramatic increase in the proportion. (Thailand National Statistical Office, 2018). Most elderly people are losing physical ability and need more assisted from people around them. The study from the Bachelor of Science Program in Physical Therapy, Mahidol University said that walking aids is a vital part of elderly people because it may help to improve their mobility and regain independence.

Meanwhile, Independence activities would gain more risk of accidents in elder especially falling which is the second most found in elder's accidents (Bureau of Epidemiology, Thailand) and elderly people who ever fell are tended to lose the walking ability and falling again

To increase security and satisfaction for elderly people. This study gathers the way to solve these problems that are an accident alerting, Automatic light, Heart rate and Walking distance monitoring system which working on IoT system.

2. Methodology

Data Collection

We determined sample size of students and parents by Krejcie & Morgan principle. Our surveys gather information from a set of 343 people to provide insights of the elder care demands.

Materials

Arduino UNO R13, Ethernet Shield, LED Module, Buzzer, Touch sensor module, Angle sensor Arduino, LDR Photo resistor sensor module, Heartbeat Sensor Module, Accelerometer, Protoboard, Jumper, switch, button, Resister, Laser cutter, 3D Printer, Battery



Figure 1: Design of Walker Appliances

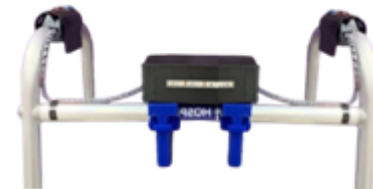


Figure 2: Walker Appliances prototype

SWOT Analysis Strengths

- Using Touch sensor module and Angle sensor module cooperation can improve in the accuracy of accidents detected
- User necklace consists of an Angle sensor module which working with Touch sensor module on a walker by Bluetooth system and an emergency button
- Users can check up the health record which is Heart rate and number of steps on Think Speakin anytime and anywhere

Weakness

- Using many accessories be the cause of unwieldy Walker Appliances
- Complex working system

Opportunities

This Walker Appliances would be wildly used because of its multi - function and this type of Walker Appliances are currently unpopular.

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Threats

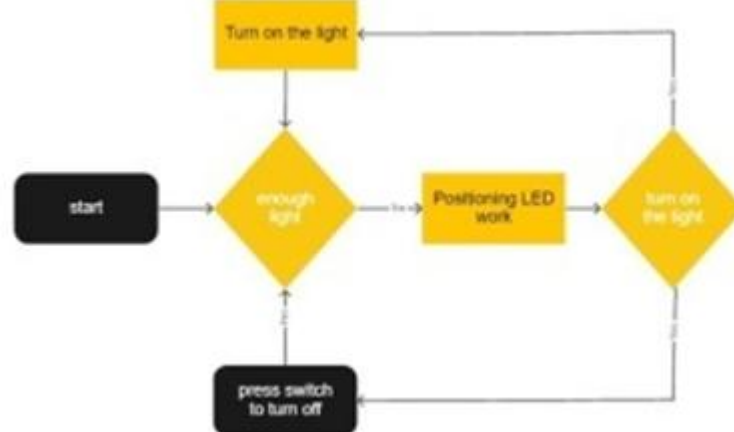
- Limited budget for this research
- Taking a lot of time to study about this complex working system.

Processes

Work flow of emergency function



Work flow of automatic light function



Workflow of heart rate and walking distance monitoring function



Assessment Emergency function

We measured sound volume in decibels with Science Journal application which use sensors in smart phone for detection.

Automatic light function

We compared our LED modules efficiency with the industrial standard and created the survey to get the insights. The result of survey was collected from 33user.

Heart rate monitoring function

We compared the accuracy of our appliances with the medical heart rate monitor. We analyzed the percentage of appliances accuracy by 3 sets of experiment.

Walking distance monitoring function

We calculated the accuracy of our appliances with the real distances. We also collected data from 3sets of experiment.

Lock function

We created the survey about satisfaction of movement in lock function. All of information was collect from 33 people who test this function.

Meanwhile, Independence activities would gain more risk of accidents in elder especially falling which is the second most found in elder’s accidents (Bureau of Epidemiology, Thailand) and elderly people who ever fell are tended to lose the walking ability and falling again

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study gathers the way to solve these problems that are an accident alerting, Automatic light, Heart rate and Walking distance monitoring system which working on IOT system.

3. Results

Assessment result of emergency function

From the model assessment, we use the online application to measure sound volume in decibels (dB). The sound assessment has been divided into 2 parts - open space and enclosed space. In the enclosed space, the longest distance for a sound signal is 12 meters. Its volume average is 71 dB. In the open space, the longest distance for a sound signal is 6meters. Its volume average is 66.67dB.

Assessment result of automatic light function

Our material selection is based on industrial efficiency. The LED module emits 150 lumens of luminous flux, i. e. luminous flux between 120 - 150 lumens which is acceptable to use in darkness. In addition, the automatic light function has got high satisfaction from users. As shown in the result of automatic light function satisfaction (Fig.3), this function has got \bar{x} = 4.52 from 5.00.

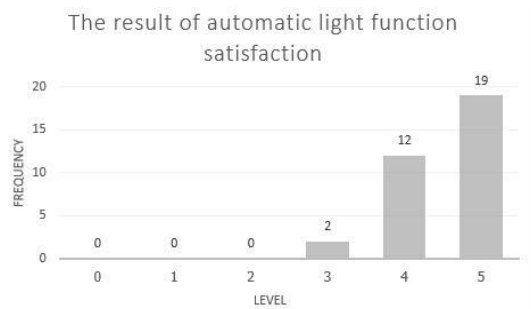


Figure 3: The result of automatic light function satisfaction

Assessment result of heart rate monitoring function

In the table below, we found that the accuracy of this function is 85.67%.

Assessment result of walking distance monitoring function

In the table below, we found that the accuracy of this function is 81.33%.

Assessment result of lock function

We have done our assessment in 33 people of a sample group. The lock function has got high satisfaction from users. As shown in the result of lock function satisfaction (Fig.4), this function has got $\bar{x} = 4.33$ from 5.00.

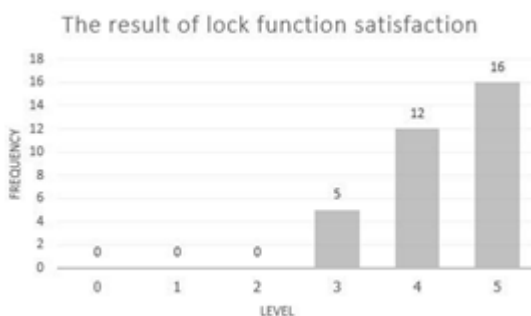


Figure 4: The result of lock function satisfaction

4. Discussion

As we observed by questionnaire about walker satisfaction from the sample group, those are 343 grade 10 students and parents. According to the feedback show that walker users need an emergency function that can detect an accident, automatic light function, Health recording, and relocatable lock function.

Strength of this study was every Walker Appliances designing using the SWOT analysis and it was created in form of 3D before we created a functional prototype. The assessment results were agreeable with an objective which is:

- 1) The Walker Appliances emergency alarm is up to standard which is 65 – 120 dB, in the enclosed space, the longest distance for a sound signal is 12meters and 6 meters in the open space. Moreover, this Walker Appliances can notify by Line application.
- 2) The Walker Appliances automatic light function is up to standard which is 20 – 150 lumens and got high

satisfaction from users that is 4.52 from 5.00.

- 3) The Walker Appliances heart rate monitoring function was 85.67% accuracy.
- 4) The Walker Appliances walking distance monitoring function was 81.33% accuracy.
- 5) The Walker Appliances relocatable lock function got high satisfaction from users that is 4.33 from 5.00

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