OS2_01_02

Title: **HOME SOS SYSTEM FOR ELDERLY PEOPLE**

Field: Stem and innovation

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Abstract:

Currently, Thailand is entering an aging society with a population aged 60 years or more, more than 10 percent of the total population and it is likely to increase steadily. Causing health problems resulting from physical changes and aging. Which these people have a high chance of falling accidents. Therefore, there is a study to detect the fall characteristics of the elderly. To extend to prevent and ask for the help of the elderly when the accident from falling to reduce the rate of paralysis and death. This project was created to monitor the elderly when at home alone or during a fall accident that cannot rise or help themselves. Inside the device, there will be a notification system automatically returned to the administrator in the form of text and images. In this project, there is a process for detecting fall and system notifications made from Node MCU, Battery and Accelerometer sensors allow communication between devices using Cloud MQTT and use imaging equipment to be able to identify the location of the elderly in the event of a fall. There is also an improvement to be easy to use. By taking into account the environment of the elderly who live inside the house to be lightweight and encased in materials that are not harmful to users. From the test results will get the graph for falls of the elderly and the percentage of the accuracy of the device to detect the fall by collecting data. The data obtained from Accelerometer, which has the axis of the acceleration graphs from slope calculations. The data processing by computer with the method of measuring the maximum value of the graph and the slope of the data over time, which results from the graph, can detect the fall increase the accuracy of the device and automatically alert.

Keywords: falling patterns, notification system, Accelerometer, Node MCU

Introduction

Currently, Thailand is entering an aging society with a population aged 60 years or more, more than 10 percent of the total population and it is likely to increase steadily. Causing health problems resulting from physical changes and aging. Which these people have a high chance of falling accidents.

This work tries to create a fall alert system and collect data on falling methods using Accelerometer sensors. The equipment is created and tested by the system that we want to have two parts working, the first part being the user will have the following functions, when detecting a fall from a device next to the elderly notifications, it will be sent to the camera to allow the camera to take pictures of the falling room. Images, camera positions and alerts will be sent to the caregivers via the LINE mobile app. The second part, the system administrator is responsible for receiving user information to processes in order to find the source of the falling and the various kind of falling that occur from the elderly. The falling kind can be used to find conditions that will cause the device to collect data including to find equipment faults all the time.

Equipment

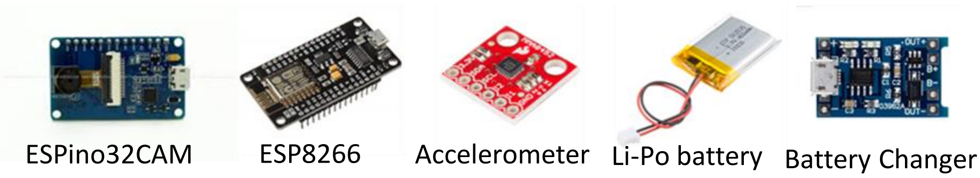



Figure 1: Devices for the elderly.

Methodology

The experiments were divided into 3 parts as follows,

Part 1: (Hardware) Study how to use the equipment and create equipment in the way that we want.

1.1. Study the information on the internet and buy the equipment you need.

1.2. Try using the purchased equipment to see if it can actually be used and with limitations and to be able to use it with the system.

1.3. Sensor to send data to Node MCU by connecting devices.

1.4. Connect the battery charger module to the battery and bring it to the Node MCU and sensor.

1.5. Measure the battery power consumption and the weight of the device made as in figure 1.

Part 2: (Software) Study how to write code and write code in order to use the created device.

2.1. Data transmission of the device via WiFi. We will bring two board Node MCU. One board emits signal. another board receives and gives the board receive signal, send sensor data to signal emitter board.

2.2. Create a program to store information using python. In the writing process, the data from the signal board is obtained and converted into numbers, the acceleration of each sensor axis will be calculated and the formula will be calculated to find the formula acceleration. As follows:

$$Aall = \sqrt{Ax^2 + Ay^2 + Az^2}$$

Ax is the acceleration in the X axis.

Ay is the acceleration in the Y axis.

Az is the acceleration in the Z axis.

When the total acceleration is stored, it is stored in notepad and displayed in real-time graph as in figure 2.

2.3. Notification sending to LINE in this step will be tested using LINE notify in issuing the API and using the board to send the information to the API and the web server for notification.

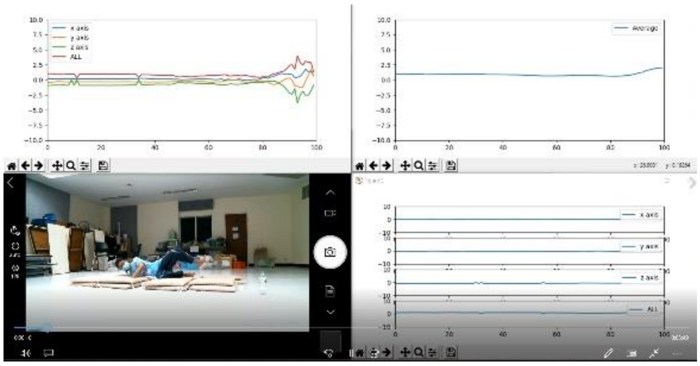


Figure 2: The program shows real-time graphs and videos.

2.4. MQTT connection, which is a system for communication between devices and devices that we do not use, which we will set in the code for devices attached to the elderly as publish, while the camera is subscribe to use to publish to send commands to subscribe when they occur The fall is to capture and use to send data to the server or the computer of the administrator to collect data. Which we use in the cloud services of SENSES Platform and MQTT cloud.

2.5. Using WiFi to determine the location of the elderly, we will use the device next to the elderly as a WiFi emitter and have the camera scanned. WiFi has the following functions, when the emitter comes close. It will be scanned when Come close until the signal WiFi is stronger. Due to the camera being enabled in that room. In which the radius of 7-8 meters is the WiFi strength specified

2.6. Notification when the battery is low. Let the Node MCU check the battery when it is lower than the specified to be alerted to LINE.

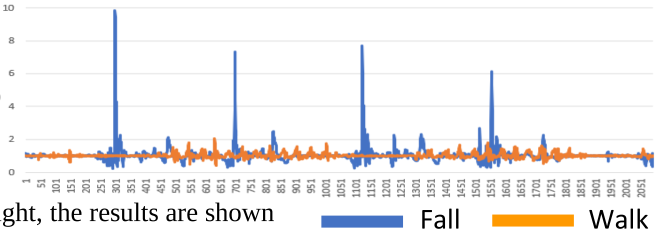
Part 3: (Test) Test the equipment. The equipment will be divided into 4 parts experiments as follows,

3.1. An experiment comparing the activities performed in daily life with falling, which will design the experiment as follows: activities that are expected of elderly people doing normal in the home such as sleeping, walking and sitting and design methods of falling for the elderly such as Falling forward, left, right and back to experiment using a program written with the device around the waist. The video clip was recorded during the experiment and the activity was done for 10 designed and falling activities, each time resting for 10 seconds, doing all the designed activities, taking the data to be processed into graphs and analyzed. This section performs experiments to find the difference between falling and different activities in daily life.

3.2. There will be an experiment similar to Part 1, but will be designed to fall in various ways such as stumbling, falling and slipping. Which will be divided into front, back, left and right in each method, the data is then processed into graphs and analyzed This section conducts experiments to find the differences between each fall position and wants to use it as a database for setting up the fall detector.

3.3. will use the original program to collect data but will design to find defects in the device by allowing people in the age 30-35 years and 16-17 Year, wear the equipment for 1 day in order to find the fall detection from activities occurring in 1 day. The detection data will be taken from sections 1 and 2. After 1 day, the data will be processed into Graph and analyze This section performs experiments to find equipment errors and determine the accuracy of the devices for detecting fall.

Graph 1: Comparison graph of the total acceleration of walking and falling.



Results

It was found from experiment. **In Part 1** It is found that the selected equipment matches the need to be used and from the measurement of the amount of energy the device uses with weight, the results are shown **In Part 2** The results of the application can be used well, but there are limitations in them such as Restrictions on sending messages to LINE limitation the frequency of data sending to the cloud but these limitations do not affect our devices.

The results of experiment 2.1 are in accordance with Figure 3

Data obtained from experiment 2.2 can be stored notepad.

It has characteristics experimental result 2.3.

Sending messages, pictures,and notification batteries into LINE.

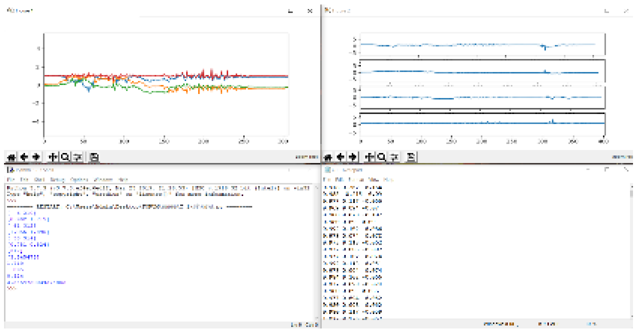
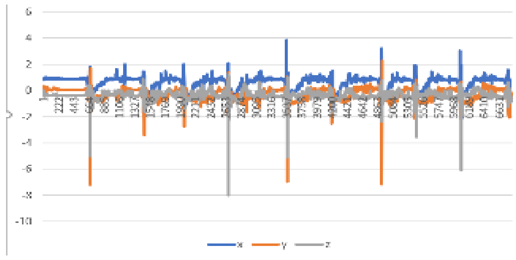


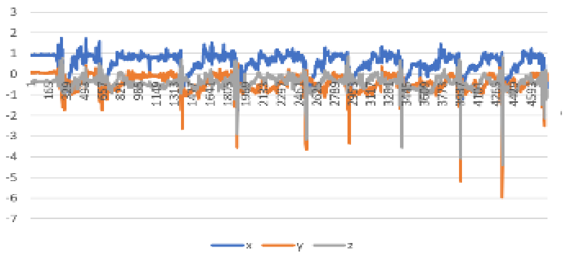
Figure 3: Data collection in graphs and notepad.

In Part 3 Recording Data from 3.1 This data is obtained from daily activities compared to the fall,which we will show the comparison in the graph 1 the results show that the graph between normal activities and falling has different graph heights.The record data from 3.2 is data obtained from falling in different positions. Will make to show as in Graph 2,3 the results show that there are differences in graph characteristics from falling in each position if compared with the intensity in each axis. Analyzing the experimental data 3.3 By taking the experimental result at 3.1,3.2, it will get the value that will be used to detect the fall and when testing it, the experiment 3.3 results show that the accelerator movement in each axis in 1 day of the tester.

Graph 2: graph of the falling on the left.



Graph 3: graph of the slipping on the left.



Graph 2,3: Comparison graph of the falling and the slipping on the left.

Analysis of experimental data 3.4 Based on the experimental results 3.1,3.2 and 3.3 to analyze the accuracy and error of the device, the device error has the following formula: $\%Error = Relative\ error\ x\ 100$

$$Relative\ error = \left|\frac{X\ all - X\ t}{X\ t}\right|$$

Xall is the total experimental value

Xt is the alert value when actual failure occurs

When the data is calculated according to the formula, the error value is equal to the $\frac{124-120}{120} \times 100 = 3.33\%$

Both experiments 3.1,3.2,3.3 and 3.4 The experimental results are recorded showing real-time graphs with video falling, as shown in Figure 2.

Conclusion

From the experimental results, it can be seen that doing activities in daily life, compared to falling, will have a big difference: changing the total acceleration per time, which is more valuable. 1-2 times or more Can be used to detect fall and the operation of the system can be used in daily life because of the convenience to users and it is safe for users as well as a total error of only 3.33% and there is a 0% fall error, which is very accurate in the notification time. There is an average of 6 seconds, which is detected every 300 Hz is enough frequency to detect the fall, the system also has to collect user data in order to be collected as a base. Data, increase accuracy of equipment and used to improve it to be able to work better. While trying to install the device on the waist

Acknowledgements

This project was supported by Science Classroom in University Affiliated School (SCiUS) and Fabrication Laboratory (Fab lab) under Chiang Mai University and Chiang Mai University Demonstration School. and Project to accept high school students to practice research skills under National Science and Technology Development Agency (NSTDA) The funding of SCiUS, Fab lab and NSTDA is provided by Ministry of Science and Technology, which is highly appreciated. I thank Assoc. Prof. Dr. Sakon Sansongsiri, Dr. Sittha Sukkasi, Dr. Arnan Sipitakiat, Mr. Theerawat bunfong and the team from MTEC and Fab lab CMU provided good knowledge and support, as well as providing ideas and comments that were helpful to me

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