THE DESIGNING OF ELDERLY TRACKING SYSTEM USING INTELLIGENCE ELECTRONICS TRACKING SYSTEM VIA REAL-TIME 4G TECHNOLOGY

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ABSTRACT

The problems of the lack of care and abandonment for the elderly in Thailand are caused by the busy schedule or inconvenience of the offspring from daily workloads. As a result, they leave their parents or grandparents alone at home. Moreover, many working people need to work in countryside areas or overseas for many days or months. It is difficult for offspring to serve and take good care of them every day. The offspring have to agree and have a good understanding with their parents or grandparents that it is a time for their own family to be constructed so they cannot live together for the moment. However, in the future, if the parents get older and are unable to live by themselves, the offspring will eventually have to bring the parents in any way. While the offspring still cannot live with their father or mother, he/she have to find a way to look after the parents closely, for example, monitoring activities the parents do at home each day. Although the offspring are able to observe from CCTV cameras through a computer network to display on a mobile phone or notebook, some activities such as going out to do business outside the home cannot be monitored and cannot keep in touch with the elderly on the move and so on. In this project, the technology of the electronic tracking systems and the Internet of things via 4G telephone networks is developed. This is because it has advantages in speed and can receive more input signals than 3G. The results of the research are a model for production in the next production line to serve the aging society in Thailand.

Keyword: Elderly, Intelligent Electronics Tracking System, Internet of Thing, 4G Telephone System

1. INTRODUCTION

The number of elderly people in Thailand country is on par with many developed countries in Asia, such as South Korea and Japan since 2005. The National Statistical Office estimates that in 2016 the number of the elderly in Thailand will be 11.3 million out of the total population of 67.66 million, or accounted for 16.7% of the total population and will enter the aging society fully in 2022 and 2030. Thailand will have an increased proportion of the elderly population to 26.9% of the Thai population. Thus causing the future trend of the number of elderly people in Thailand to increase. The problem is no children to take care of because they have to leave the house to work daily. So he/she had to leave the elderly at home alone. This does not include the grandchildren who have to go to work in other provinces or abroad for several months or even years. This does not include the children who have to go to work in other provinces or abroad for months or even years. But he/she is always concerned with the elderly, but does not have the opportunity to serve them closely. In the past, he / she had to ask his/her neighbor to take care of the elderly or hire someone to take care of it and pay the person who comes to help it every month, which is very expensive. Where the wages of those who come to help take care of at least $699. Besides, he/she have to hire someone he/she trusted, which is hard to find today. Then the children will call back to the elderly who are getting older that they are unable to live on their own. Finally, he/she had to be brought in with the elderly in the end. But while he/she is still unable to live with an elderly person who is a father or mother. He/she has to find ways to closely monitor the elderly. For example what tasks do parents do at home each day in which he/she can observe you from a CCTV camera through a computer network to show to a mobile phone or notebook and go out to do errands where we will never know. Besides, he/she cannot contact the elderly, etc. Sometimes the elderly may be annoyed by the frequent phone calls of their children, which is more sincere in the elderly who want their children to be there to serve them more closely. But the lifestyle of each family is not the same, it is difficult for the children to be able to serve every day and night. He/she need to understand the elderly that it is only for a short time that they cannot serve. But in the future, if the elderly gets older, he/she will be able to take together. Therefore, the technology of intelligent electronic tracking system via the 4G phone network is the result of research that is the prototype for production in the next production line.

2. STRUCTURE OF ELECTRONICS TRACKING

2.1 The overall structure system

The overall structure of the elderly tracking system follows the design of the system in Figure 1, which will be based on the elderly tracking functionality by GPS, 4G

Manuscript received on December 22, 2020; revised on February 14, 2021, accepted on April 8, 2021.
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technology telephone networks, and mobile applications on Android and PC

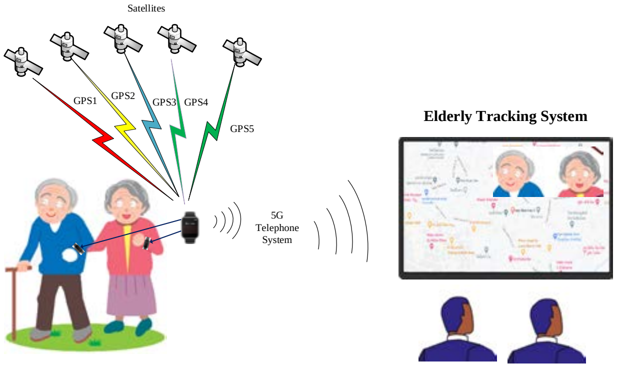


Figure 1. The structure of electronic tracking system for Elderly people.

The basic function of the elderly tracking system using intelligent electronic technology is to take care of the elderly or children who are present with the home area, or perhaps outside the house on a daily basis. It can also be used to make judgments by application computer programs to decide if the elderly travel to a place that has never been before. The system will give voice prompts to let the elderly know the environment of the place, then the bracelet developed from this research will be equipped with a global map locator and anomalies. Each incident, which is related to the standard behavior of the elderly being tracked, and the results of the real-time tracking will automatically transfer information to the offspring 24 hours a day, which, if necessary, may call for help and notify the family. In addition, the telephone system will automatically call the nearest police station at the last location if an emergency occurs with the recorded digital audio system.

2.2 The hardware designing

Hardware design consists of two main parts, as shown in Figure 2:

Part 1: The Elderly Section, which may be a bracelet or waist belt, consists of a GPS front-end receiver, 4G Module (4G Circuit Board) and intelligent controller board that controls the operation of the GPS receiver circuit and controls the 4G telephone circuit board. When the elderly wear this device, it will automatically work immediately, where the position of the elderly will be obtained from the control board, and feed GPS signal to 4G module for transmitting a streaming signal to the monitoring section of the family, which is a smartphone or PC Computer or LCD screen by the application software will receive the Latitude and Longitude from an elderly section. It was then processed in conjunction with Google Maps to show the location of the elderly on the map and make a report on the environment that the elderly are traveling or living with, such as the elderly vital signs report, the temperature and humidity of the elderly. Environment and if an accident occurs to the elderly, a cry for help will be sent to the nearest police station and sent to the monitoring section.

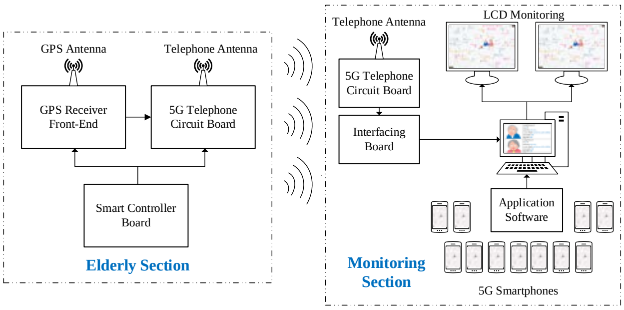


Figure 2. The block diagram of elderly and monitoring section.

Part 2: Monitoring Section including the relative section, consist of a 4G smartphone module, a PC or notebook, with a interfacing board as a GPS receiver and sent the signal from the belt/electronic bracelet of elderly. It is then feed to a PC via a serial communication port (USB Port) with an application software to process the signal so that it can be displayed on a computer screen and two 52-inch LCD screen monitors. This application controls the transmission of the signal to the mobile phone, monitoring results are in accordance with the software.

Figure 2. are the elderly section and monitoring section consists of a GPS module board which the internal circuit is as shown in the Block Diagram in Figure 3 with the details of the circuit as follows:-

2.2.1 Circuit detail

The system consists of a PC, a GPS front-end receiver that collects data from satellites, and a connection circuit to transmit data to the PC via a USB serial port.

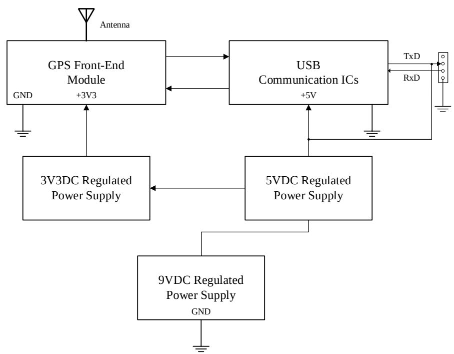


Figure 3. The block diagram of GPS receiver on PC.

Figure 3 is a block diagram of a serial connection circuit between the PC and the GPS module. All that is require/d is a serial cable, the special communication ICs, and a voltage power supply. This system requires a DC supply of 5 volts for special communication ICs and 3.3 volts for GPS front-end modules.

2.3 Application Software Designing

Application software for GPS front-end module. The basic functionality of this system is based on decoding a protocol called "NMEA (Nation Maritime Electronics Association) protocol". It is an association that focuses on the study and development of electronic devices for device connection and collaboration where they when connected and work together, must be able to understand each other or communicate in the same language. The standard for communicating data between such devices is called NMEA Standard, which specifies electrical connections and data formats as shown in Figure 4.

Figure 4. The signal data information from a GPS receiver.

This front-end GPS module uses NMEA-0 1 8 3 , a subset of the NMEA protocol, consisting of a string of ASCII characters and a defined format. These messages are transmitted continuously by the GPS module to the connected devices which are standard as follows: -

NMEA Standard, like other language protocols, has been developed from NMEA-0 1 8 0 , NMEA-0 1 8 2 to NMEA-0183, where usage of NMEA-0180 and NMEA-0182 is limited and will focus on communication between Loran C with autopilot. Therefore, it has been developed to be able to be used more widely. It spans marine electronics into NMEA-0183, uses ASCII characters and serial communications to transmit data from one device to one or more receivers.

NMEA-0183 standard, in this standard, the characters used are ASCII text, which it can be printed (including carriage return and line feed). NMEA-0183 transmits data at a 4,800 baud rate. Data is sent as a sentence, as in Figure 5.

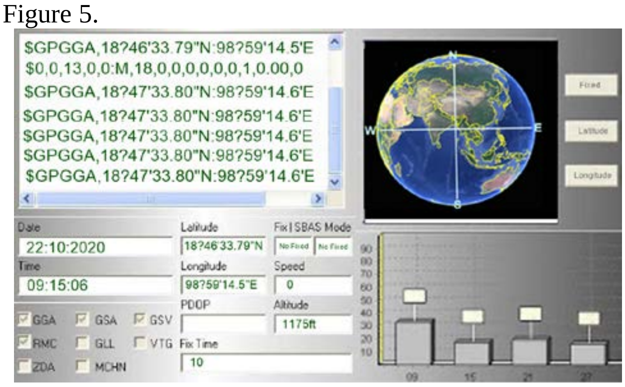


Figure 5. Display GPS information.

Figure 5 is shown an important protocol of a GPS device, it is contained in NMEA, which is the standard GPS protocol, but internally there can be many other protocols, the main active protocols are as follows.

GGA - a format that shows that GPS data is sufficient to display coordinates in three dimensions (3D) in which up to four or more satellites transmitting data to the receiver is known as fixed data.

Example of GPS data

$GPGGA,123519,4807.038,N,01131.000,E,1,08,0.9,545.4,M,46.9,M,,*47

Meaning:

GGA-Global Positioning System Fix Data

22102020-Fix data at 9:15:06 UTC 18.7755958, North equator Latitude 18º46’33.79” 01131.000, East equator Longitude 98.987435E or 98º59’14.5”

GSA-Detailed format of fixed information, number of active satellites including the DOP (dilution of precision) tolerance, a small number is a beast value with high accuracy.

Example of GPS data

$GPGSA,A,3,19,28,14,18,27,22,31,39,,,,,1.7,1.0,1.3*35

Meaning:

GSA-Satellite status

A–is the mode of the fixed data status, A-automatic, M = manual.

3-is a number indicating the fixed location consisting of values:

1 = None fixed data

2 = two-dimensional fixed data

3 = 3D fixed data

Numeric number of 19,28,14,18,27,22,31,39-is the receiving satellite number. In this case, 8 satellites are received, followed by 4 free commas, which the GPS can receive up to 12.

GSV - Detailed format for each GPS satellite, such as elevation, azimuth, and SNR (Signal to Noise Ratio) which is comparable to signal strength or SNR ranges from 0 to 99, which is larger. Good value at some point, the GPS may be able to receive all 12 full signals, the transmission of the message will be excessive if it must be displayed on a single line all 12 satellites will receive a total of 3 sentences.

Example of GPS data

$GPGSV,2,1,08,01,40,083,46,02,17,308,41,12,07,344,39,14,22,228,45*75

Meaning:

GSV - View of satellites

2 - Number of text sentences (In this place can accept 8 satellites, therefore, use only 2 lines)

1 - Sentences 1 of 2

08 - The number of satellites that can receive signals

01 - GPS satellite number

40 - Altitude in degrees

083 - Azimuth Corner (North 0, East 90, South 180, and West 270)
46 - SNR - signal strength a high value is a good value.
02,17,308,41 - number 2 satellite with elevation, azimuth, and SNR data.
12,07,344,39 - Number 12 satellites with elevation, azimuth, and SNR data.
14,22,228,45 - number 14 satellites with elevation, azimuth, and SNR data.
* 75 - checksum value, preceded by *
RMC - The GPS format detailed for velocity, coordinate, time, and direction.

Example of GPS data

$GPRMC,123519,A,4807.038,N,01131.000,E,022.4,084.4,230394,003.1,W*6A

Meaning:

RMC - Recommended minimum sentence C
123519 - Data fixed at 12:35:19 UTC.
A - State, A = In use or V = except
18463379N - 18 degrees latitude 46” over
985914.5E - longitude value 98 degrees 59’ East direction.
022.4 - Ground speed in a knot (nautical miles/hour).
084.4 - direction angle relative to surreal
221020 - Date - 22 October 2020
003.1, W - angle difference between the true and magnetic north
* 6A - checksum value preceded by *

These messages are GGA, GGL, GSA, GSV, RMC, VTG, and ZDA. Here we don't need to know about them all. We only need a GGA text string showing time, position, and static information for this application. This string has a format such as:

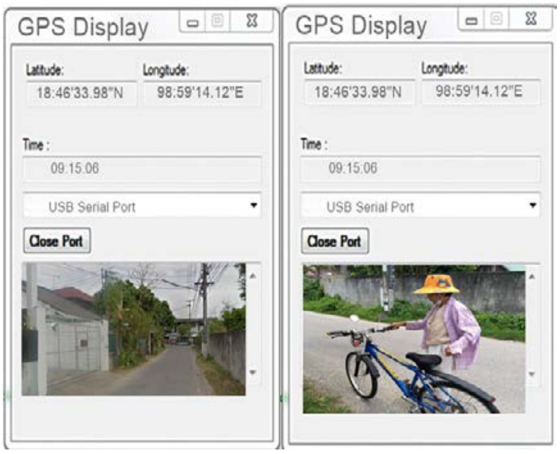
$GPGGA, 002153.000, 3342.6618, N, 11751.3858, W, 1.2, 27.0, M, -34.2, M,, 0000*5E

Each field, separated by a comma (,) represents specific information. We have only used these five fields for the purpose of displaying time, latitude/longitude direction, and direction which are the second, third, fifth, fourth, and sixth fields respectively. When the GPS receives the exact location of the latitude and longitude on the earth's surface from real-time satellites then we can view the position from a standard map. When the GPS sends the value to the Monitoring Section, we can write the code for our web services. The software for converting the position from satellite data will use a high-level programming language such as .net framework 3.5 or higher that will be able to run on PC computers. This code will be written in C #.net and compiled on the .net platform on Microsoft Visual Studio 2020. The program output is shown in Figure 6.

Figure 6. The GPS display on PC’s screen.

Procedures of the program

1. Open the executable file (.exe) created after compiling the C# code. The "GPS Display" window will appear on the screen as shown in Figure 6.
2. Select the COM PORT by clicking the arrow.
3. Select the COM PORT that we have connected to the GPS module from the menu by scrolling down.
4. If all goes well, we can get latitude/longitude information on our PC screen. If no data has yet arrived, turn the circuit off and on again, wait a few minutes, and repeat the steps above.
5. The output will display on the PC’s screen as shown in Figure 7 (a) and (b)



(a) (b)

Figure 7. The output display on the PC’s screen

Program C#

Code to receive latitude/longitude from GPS receiver using C language written is shown the following:

/*

```
*GPS based location tracker by Assoc.Prof.Dr.Suranan Noimanee, 11/10/2020
*/
        using System ;
        using System.Collections.Generic ;
        using System.ComponebtModel ;
        using System.Data ;
        using System.Drawing ;
        using System.Ling ;
        using System.Text ;
        using System.Windows.Forms ;

namespace GPS
  {
        public partial class Form1 : Form
  {
        private SerialPort port ;
        private string data ;
        private string[ ] parts ;
        // a flag used to halt reception of data while //processing is being done
        int x = 0 ;
        public Form1 ( )
  {
        initializeComponent ( ) ;
// get all the available serial ports string [ ] ports = SerialPort.
GetPortNames ( ) ;
        foreach (string p in ports)
  {
        comboBox1.Items.Add(p) ;
  }
        comboBoa=x1.Test = "Select the Serial Port" ;
        port = new SerialPort ( ) ;
        port.DataReceived += port_DataReceived ;
  }
private void port_ DataReceived (object sender, SerialData-ReceivedEventArgs e)
  {
        Data = port.ReadLine ( ) ;
// fine the required string containing // "$GPGGA"
        If (x== 0 && data.IndextOf ("$GPGGA") ! = -1)
  {
This.Invoke (newEventHandler (display_Data))
  }
  }
private void display_Data (object sender, EventArgs e
  {
        x = 1
// splitting all the parameter separated by ',' ;
// hours and minutes int h, m ;
// latitude and longitude double lat. lon;
// retreiving integer hours and minutes from // the received data string with
// proper conversion for INDIAN STANDARD TIME (UTC+7)
        m = Convert.
        ToInt32 (parts[1]).Substring (2, 2)+30;
        h = Convert.
        ToInt32 (parts[1]).Substring (0, 2)+7;
// rounding up latitude and longitude values to 4 places of decimal
        lat = Math.Round (lat, 4)
        lon = Math.Round (lon, 4)
// retreiving double values of latitude and longitude from the received data // string with proper conversion from ddmm.mmm to proper degree
        lat = Convert.ToDouble(parts[2].Substring(0, 2)) + convert.ToDouble
        (parts[2].Substring(2))/60) ;
        Lon = Convert. ToDouble(parts[4].Substring(0, 3)) +convert.ToDouble
        (parts[2].Substring(3))/60) ;
// minute adjustment
        if (m > 59)
  {
        m -= 60 ;
        h += 1 ;
  }
// hour adjustment
        if (h > 23)
  {
        h -= 24 ;
  }
// displaying TST (Thailand Standard Time) on the Time textbox
textBox2.Text = h.ToString ( ) + " + m.ToString( ) +" : "+parts[1].String(4, 2) ;"
// displaying latitude and longitude along with their proper directions in //their respective textboxes
        textBox_Lat.Text = lat.ToString ( ) + parts[3] ;
        textBox_Long.Text = lon.ToString ( ) + parts[5] ;
        x = 0;
      }
Private void comboBox1_SelectionChangeCommitted(object sender,EventArgs e)
  {
        if (port.IsOpen)
        port.Close( ) ;
// setting basic port parameter
        port.PortName = comboBox1.SelectedItem.ToString ( ) ;
        port.BoardRate = 19200 ;
        port.Parity = Parity.None ;
        port.StopBits = StopBits.
One ;
        Port.ReadTimeout = 5000 ;
        try
  {
        port.Open ( ) ;
    }
        cash
    {
        messageBox.Show("Sorry, Serial Port" + port.PortMame+ "can't be opened!!", "Serial", MessageBoxButons.OK, MessageBoxIcon.Warning) ;
        comboBox1.Text = "Select a Serial port!" ;
  }
        port.Close();
```

```
            comboBox1.Text = “Select the Serial Port”;
    }
            Private void textBox1_TextChanged(object
sender, EventArgs e)
                        {
                    }
                }
            }
        }
```

3. RESULT

The results were that a prototype of an elderly tracking system using intelligence electronics tracking system via real-time 4G technology design by my researcher teams using a special C# program which is the standard size to feed to a bracelet or waist belt that can use every location. In this work, we take from the basic hardware and use a special application program to implement them. Our design according to the intelligence model at the two states between special application and small hardware in figure 8, this work is running to solve using the GPS and obtains the result through the post-processing: the location deformation figure of the Thailand place is shown in Figure 6 and 7.

4. CONCLUSION

This paper has designed a new elderly tracking system for his/her family and then a comprehensive has been conducted using special software on this bracelet or waist belt. The results of the work have shown that this design found that the reliability and stability of elderly tracking system requirements, verifying the rationality of this structured design. The way of using special software to conduct an analysis and check for designing work is simple, practical, high efficient, highly shorting the production cycle and reducing the research and development costs. This method is worthy of further extension.

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