Intelligent car housekeeper design based on brain waves

Xinguo Cui[1], Zhaoye Li [1*], Yi Liu[1], Feilong Yu[1] and Hongyue Sun[1]

[1]Tianjin University of Technology and Education, School of Electronic Engineering, China

*Email: zhaoyeqingdao@163.com

Abstract. Our intention for this design is to liberate the driver's hands without affecting the user's attention. The control of brain waves and sound can liberate the user's hands and make driving safer and more intelligent. During the vehicle driving, brain fatigue and the rhythm of brain cell activity becoming slow down, the waveform will changed. When the human brain is in the δ waveform, the speed of the vehicle will be reduced to ensure safety. Meanwhile, the user could control some device (such as adjust the temperature of refrigeration, control the window lifting and opening and closing) of the driving car with voice. During the vehicle driving, brain fatigue and the rhythm of brain cell activity becoming slow down, the waveform has changed. When the human brain is in the δ waveform, the speed of the vehicle will be reduced to ensure safety. Meanwhile, the user could control some device (such as adjusting the temperature of refrigeration, controlling the window lifting, opening and closing) of the driving car with voice.

1.   Introduction

First, the TGAM brain wave sensor ASIC module and the user's brain wave and mental state are interacted to collect the EEG signals [1-4], and the waveform of each frequency is statistically analyzed. When the frequency of the EEG signals is 4~7Hz in the δ band, the user enters a mild fatigue state when the amplitude is 5~20μV, then the control module Arduino[5].The chip processes the data and controls the sound module to produce sound prompting the user and monitors user's brain wave and mental state until the frequency of the wave signal rises to the normal state not only in the alpha band 8~13Hz (the average number is 10Hz), but the amplitude of the stimulus sound produced by the sound module in the state of 20~100 mV[6].

When the frequency of brain wave signal of the brain wave sensor is 1~3Hz and the amplitude is 20~200 V, the user enters the severe fatigue state when the amplitude is 20~200 mu, then the control module Arduino chip handles the data and sends out the high frequency warning sound, and the speed reduction treatment reduces the speed of the driving car[7].Under normal conditions, the frequency is alpha band 8~13Hz (average number of 10Hz), and the amplitude is 20~100 mu V. The user can perform voice operation through voice and brain wave, such as opening refrigeration or heating, opening the left front, right front window[8].

2.   Discussion and Results

This project uses Mind-Reader to collect EEG data on the basis of data collection, data analysis, data processing, and control output and feedback process. The ThinkGear chip carries out data analysis, transmits the analyzed data to the Arduino platform through the wireless module and converts the sent data algorithm into control. Signal, control of motor and sensor. Its flow chart is shown in Figure 1.
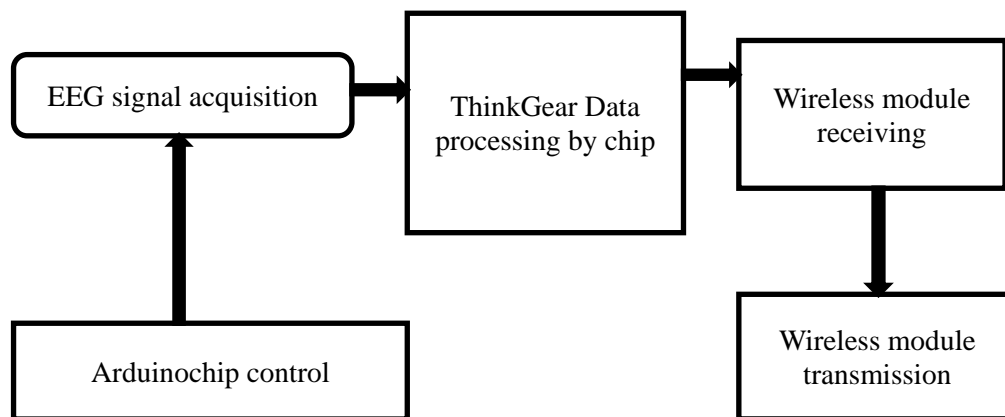
Figure 1. System structure diagram

2.1. Data Acquisition TGAM Module

TGAM (ThinkGear AM) is the ASIC module of brain wave sensor. It can process and output brain wave frequency spectrum, EEG signals quality, primordial EEG and three parameters: concentration, relaxation and blink detection. Including TGAT chip, advanced filtering technology can eliminate the noise of the environment, TGAM and human contact only need a simple dry contact, energy consumption low energy consumption of battery power supply low energy consumption of 3.3 volts, the maximum consumption of 15 mA, portable, small size (the largest) 2.79cm x 1.52cm x 0.25cm, light weight (Maximum value) 130mg, good safety performance, operating voltage: 2.97~3.63 volt, frequency range: 3Hz-100Hz

2.2. Arduino Control Module

Arduino open source electronic prototype platform, including hardware (circuit connected Arduino circuit board) and software (Arduino IDE) program development. It is built on the open source simple I/O interface version, and has the Processing/Wiring development environment similar to Java and C language. Arduino can perceive the environment through sensors, and feedback and influence the environment through the device. Because Arduino can identify the TGAM (ThinkGear AM) module and output signal, it can directly use Arduino to set the actions performed in each frequency range, and Mind Reader can collect a lot of values. When the system gets the relevant data, the relative values are quantized into corresponding parameters, and the value of the attention is finally sent to the control output unit by the value of the Text Data.

2.3. Controlled Module

A control system based on a car. Coding control on the ECU on the CAN bus, Set up control lifting and opening unit priority. Set the priority of the control speed unit to the highest priority. The speed control is realized by changing the electrical pulse signal into the open loop control of angular displacement or linear displacement , to achieve the purpose of speed regulation.

2.4. System Software Design

System software includes EEG data. Acquisition, wireless connection management, serial communication, EEG data analysis, database ADO, Arduino vehicle control system. The main program of the system is the initialization of the system, (serial port initialization, database initialization).Processing the collected signal data, then send data to the Arduino development board through Bluetooth serial port. The data received by the Arduino development board is processed. Its flow chart is shown in Figure 2.
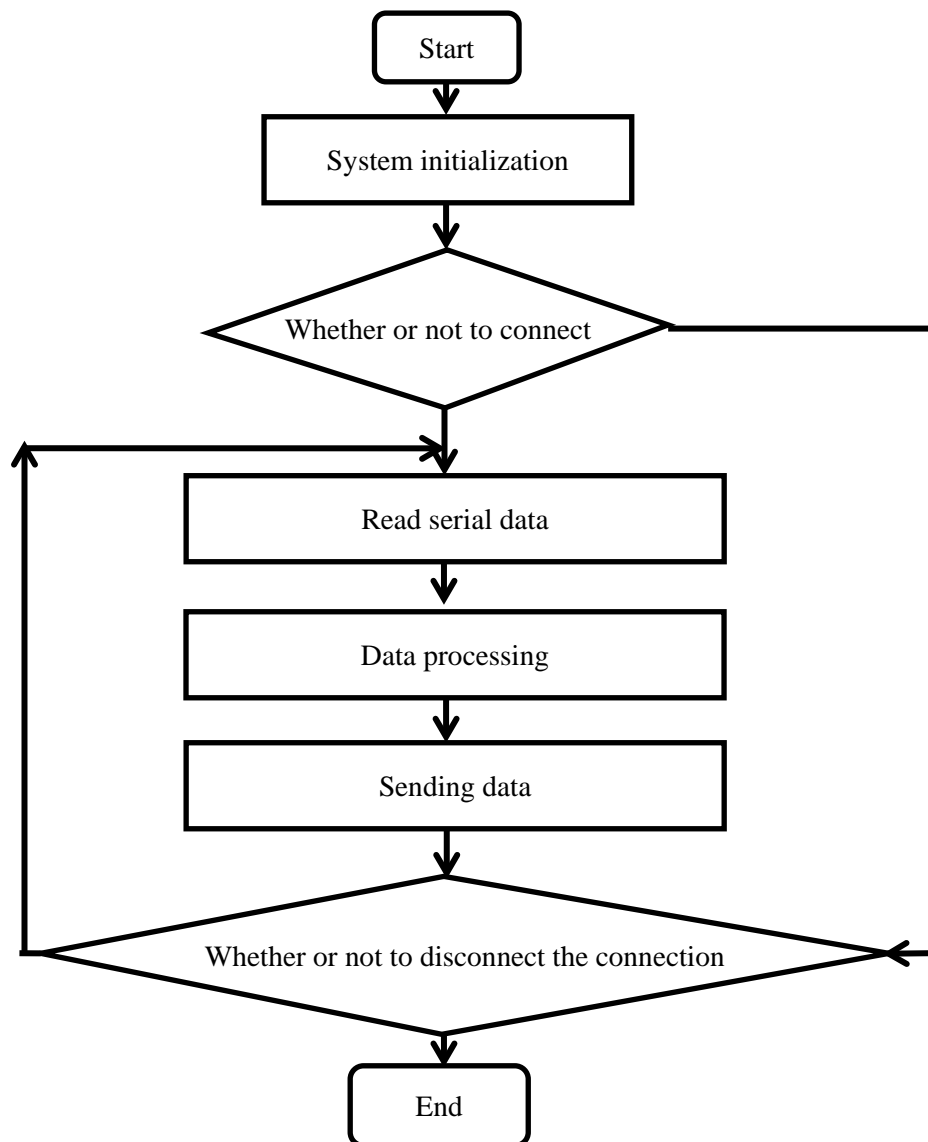
Figure 2. System master program flow

3.   Conclusions

Brain wave intelligent car housekeeper design is based on Arduino equipment as control system, based on the simple I /O control platform, the control system and the TGAM (ThinkGear AM) module to carry on the data connection recognition, can realize the segmentation of the acquisition of the frequency of the brain wave, the EEG information is non-stationary and random continuous information, when it is in different bands, the corresponding operation can be carried out, and the voice control can be implemented according to the difference of the recognition voice to realize the function of the elevator window opening and closing the air conditioner, so as to get rid of the way of using the button and make the driving more convenient and safer. The feasibility of intelligent identification of targets by feature information of trace points has high engineering practical value.

References

[1] HaijunZhang, HaochuanWang. Multi lead EEG signal classification and recognition research. Computer engineering and application, 2008, 24.

[2] YanbinLi, DaweiLiu, XiyuLv. Developmentsand clinical applications of electroencephalogram apparatus. China medical device information, 2002.

[3] HailongLiu, JueWang, ChongxunZheng. Extraction and expression of conscious information based on EEG: brain computer interface. Chinese rehabilitation theory and practice, 2005, 11 (3).

[4] JianliZhang, WenfengLi.Design of EEG acquisition system based onTMS320LF2407A. World electronic components, 2004,

[5] NGKA, CHANPK. A cmosanalog front end IC for portable EEG/ ECG monitoring application. IEEE.

[6] Wenhk. Active selection of electroencephalogram and evoked potential. Proceeding of the 20th Annual International Confer.