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EPIWRIST CO.

FINAL REPORT

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1. EXECUTIVE SUMMARY

EpiWrist has been found by 6 shareholders with the aim of producing biomedical products in an innovative way with high quality. The main aim of the firm is to produce biomechanical products for epileptic people to help them live safer, more comfortable lives. The quality of epileptic people's lives will be increased with the help of our products.

EpiWrist's first project is to product wristlets for epileptic people to remedy the deficiency in the biomedical market of Turkey. Considering the gap in the market, the target value is to reach producing and selling approximately 50000 units/year and the break point seems to be reachable approximately in four months.

EpiWrist's target market is the medical market, which consists of hospitals, patients and relatives of the patients. With its solution and care-seeking based products, it's acceptable that these products are needed, will be used and help epileptic people live more comfortable lives. The company is advantageous considering the gap in the local market and the importance of health issues.

Our primary product is the product that gives its name also to the company EpiWrist. EpiWrist is a wristlet, which detects seizures of a patient when he/she is asleep. It basically detects the seizure, monitor the details (such as the date, duration etc.), ring the alarm in the next room to warn people living in the house and call the hospital if necessary. It is a complete system composed of a wireless wristlet shaped sensor, a monitor and an alarm. When the seizures occur, the data of the seizures will be kept which is an important fact for epilepsy patients to keep the disease under control. Statistical data of the patients we have found shows that such a product is needed in the market, therefore our project is expected to be sold in great numbers in a couple of months. Another advantage of the product in the market is that its competitors are expensive services such as keeping a nurse in the house and the symptoms of epilepsy cannot be observed by human senses all the times.

EpiWrist is found by analysis of the gaps in the biomedical market by the shareholders. Considering the great vision and innovative thinking of the equipped team of the company, sale numbers are guaranteed in an accelerated path therefore the company aims to help people live their lives in a safer, healthier, more comfortable and qualified way.

1.1. Mission of the Company

Our mission is to be the first and only producer in Turkey by designing the safest system for epilepsy patients which informs and warns relatives of the patient in case of a seizure, calls the hospital and keeps and monitors the details of the seizure to provide the safest conditions for the patients.

1.2. Vision of the Company

Our vision is to help the patients and their families live happier, healthier and more confident lives by providing the safest sleeping conditions with the most equipped epilepsy-detecting wristlets with a fair price: for a good sleep with confidence.

2. COMPANY ORGANIZATION

2.1. DESCRIPTION OF BUSINESS AND LEGAL ORGANIZATION

EpiWrist was established in 2010 to meet the demand for epilepsy seizure detecting, alarming and keeping the records of the seizures for the biomedical industry. The project product is an epilepsy seizure detecting system, which detects seizures of a patient when he/she is asleep. It basically detects the seizure, monitor the details (such

as the date, duration etc.), ring the alarm in the next room to warn people living in the house and call the hospital if necessary. The main aim of the company is to help epileptic people and their relatives by increasing the quality of their lives with its qualified product. Company is housed in Ankara, which will provide the opportunity to access to most of the biggest hospitals in Turkey. It is a new firm that will enter the market with an innovative product that is not produced and sold in Turkey. Our ambition is to create new projects and fill the gaps in the sector with care-seeking biomedical products and to have the biggest local share of the market thinking that other innovative firms would enter the market in 5years projection, our advantageous position is that we have a talented and equipped management team which would be the leading producers of the local market.

EpiWrist is a corporation company starting with 6 shareholders since the shares will be served to new people and this initiative plan would increase the value of the company with new investments. Since our projection of sale numbers would be in an accelerated path in a couple of months, we would be able to take attention of new investors and the trust of the banks would be positive. The company's capital structure is thought to be limited ownership and 50 percent of the capital can be a long-term loan and also Ministry of Health has grants for successful projects, which may also be regarded as an advantageous condition for a start-up company.

2.2. MANAGEMENT AND HUMAN RESOURCES

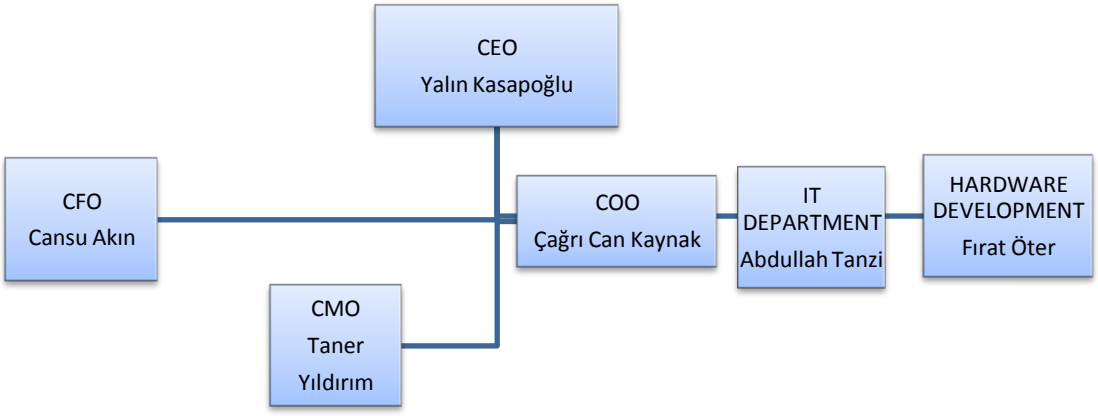


Figure 1: Organizational scheme of the company.

Yalın Kasapoğlu – *CEO (Chief Executive Officer)*

He advises the strategies and organizations as a leader. He grants motivation to employees and builds the interface between the firm and the community. He sets up the budgets within the firm, organizes the funds of the projects, and manages financial and human resources, organizational and operational decision processes. He sets up the Board. He ensures employees, creates and looks for future opportunities.

Cansu Akın – *CFO (Chief Financial Officer)*

She is responsible of developing the financial planning, provides internal d external financial reports, cost and revenue analysis and accounting management. In this direction he does the financial planning, cost and revenue analysis and accounting. Risk management, shareholder relation policies and procedures are also under her responsibility. She directly reports to the CEO.

Taner Yıldırım – *CMO (Chief Marketing Officer)*

He is responsible of marketing, product development and researches. He is responsible of market searches, how to operate and behave in the market and estimates tendencies of the market and the expectations of the customer.

Çağrı Can Kaynak – *COO (Chief Operations Officer)*

He is responsible of management of all strategic and operational activities of the company. Creating the value of inputs is under his responsibility. Improvement of the quality of the services and products, securing the facilities and the operations are his other main duties. He reports to the Board. The IT and Hardware Development Department are under his advise and management.

Abdullah Tanzi *(Head of IT Department)* **& Fırat Öter** *(Head of Hardware Development Department)*

These are engineering departments, responsible of developing the software and hardware designs. Head of IT Department has the responsibility of following up the

latest technological developments in the sector, analyses and process the necessary procedures within the company while the Head of Hardware Development Department have to make sure that his department produces the hardware with the company's strategy and satisfies the company by means of all hardware sources.

3. EVOLUTION of the PROJECT

EpiWrist first started as a bare and shallow idea as any other project. In the first steps of the project, as the project team, our aim was to establish a corporate and well functioning organization. After the establishment of such a structure, we started to search for methods in order to attain a properly evolving project management. Research and development techniques are the most crucial ones among those helped us to grant a solid state to our abstract idea.

The evolution of the project continued under three main branches all of which connected to each other with the means of relevance. The first main branch is the evolution of idea of granting epilepsy patients a more comfortable and sustainable life. Throughout the project, it is possible to detect the evolution of idea, form night-sleep seizure detection to an all-kind of tonic-clonic seizure detection at anytime at anywhere. The second branch is the evolution in design and product. The developments and changes that we decide to make on the idea inevitably create variances in the implementation of the idea, which is the product itself. Moving from this point of view, simultaneous with the movement from the first idea to the second, the product design moved from a stationary under-bad pressure sensor to a portable wristlet unit that is utilized by a 3-axis inertial sensor. Parallel with the variations in the idea and the product, the corporate structure of the company evolves to keep up with the requirements. The more the idea develops, the future expectations of the company increases, which inevitable lead the company to become a more rooted and well defined organization. The generations of business, marketing and development plans are all examples of corporate evolution.

The idea is the main branch of the whole project and directly connected to the remaining two branches of evolution: evolution of the product and the evolution of the

company. The relevance among all branches is two sided and all are fed by the other. The improvement in the company's corporate identity decreases the risks of reaching success at the product, as well as constructing a comfortable basis on which generating further ideas and developing the already existing ones is open and shut. Such kind of double sided or more complicated constructive relations amongst the three main branches of evolution are bare and strong, which ensures the future of the company and the product.

4. PROFESSIONAL AND ETHICAL ISSUES

4.1. COPYRIGHT & IP (Intellectual Property) POLICY

Today's industry is facing a serious treat, which is information theft. Plagiarism of original works and infringement of copyright is a well know reality of the moment and our company must strengthen its position in the market by enforcing the legal composition. To do this, it is vital to ensure that each and every work of EpiWrist Co. is original and this information is legally approved and secured. This is need for both verifying a trusted portray and more importantly protecting our original work.

According to TPE(Turkish Trademark Institute) there are five types of protection. "Trademark and Utility Model Protection" is what we need in order to protect and verify the originality of our system and thus is the most probable option to choose. The corporate designs of the company will be ensured and protected by regular trademark regulations of TPE.

The first product of the company, EpiWrist, is an electronic device that includes an original hardware and software design, as well as an original mechanical design. Thus the hardware, software and mechanical designs of the products will be verified, ensured and protected by specialized regulations.

4.1.1. Policy Decisions for SW Design and Production

The software of EpiWrist is produced after a research and development phase. This phase was regulated by strict policy decisions of the company, in order to avoid any kind of possible complications that may end up with plagiarism, which may be intentional or unintentional. Such kind of an event cannot be afforded by the company. Thus, all the research and development steps of software design were reported in detail, such as including the source of information. Each and every work that is not completely original to our company is cited and formally documented. It is the first step of avoiding any kind of unintentional information theft. The second step is legal approval of the software that the design is completely original. The approval is in a form of "Software Licence" and can be given by governmental institutions or special institutions that are approved by the government and international laws. The "Software Licence" will ensure that our design is completely original and can be trusted and also it will add our design into the international library of original software designs, which will protect our design legally against information theft and plagiarism.

4.1.2. Policy Decisions for HW Design and Production

The hardware of EpiWrist is produced after a research and development phase. This phase was regulated by strict policy decisions of the company, in order to avoid any kind of possible complications that may end up with plagiarism, which may be intentional or unintentional. Such kind of an event cannot be afforded by the company. Thus, all the research and development steps of hardware design were reported in detail, such as including the source of information. Each and every work that is not completely original to our company is cited and formally documented. It is the first step of avoiding any kind of unintentional information theft. The second step is legal approval of the hardware that the design is completely original. The approval is in a form of "Integrated Circuit Topography Copyright" and is given by TPE. The "Integrated Circuit Topography Copyright" will ensure that our design is completely original and can be trusted and also

it will add our design into the international library of original hardware designs, which will protect our design legally against information theft and plagiarism.

4.1.3. Policy Decisions for Ensuring the Existence and Execution of NDA's

EpiWrist allows both kinds of Non-Disclosure Agreements: Inter-Company NDAs and Intra-Company NDAs. Non-Disclosure of the information is one of the prior principles of the company and must be accepted and ensured by each and every division of the company as well as each and every employee. The employees of the company will be accepted to the company after a series of interviews, including the request of legal papers, such as clearance. Each and every information source in the company such as external memory devices, computers and network servers will be protected by security software that allows the extracting of data only by an administration access. Moreover, a legal contract will be signed between the employees and the company that ensures the commitment of the employee to the decision of the company of non-disclosure of information. This official agreement between the employee and the company creates a legal trust and sustainability and also grants the company the right to take immediate legal action in the existence of a situation that contradicts with the agreement. Non-disclosure of the information is an indisputable business ethics and every individual that are participating the business is expected to obey this ethics statement. The company has nothing to do more than ensuring the existence of intra-company legal and official regulations that strictly reminds the individual one more time about the importance of the issue.

4.2. Dedication to Social and Professional Progress

EpiWrist is a start-up company and desires to be stable, sustainable and strong as well as to grow in the means of production capability and finance. To do this, company must construct a welcoming work atmosphere at which individuals find attraction. This

will maintain a dedication in the individual to the company, since the individual believes that he/she can find various opportunities that help and boost personal development. In shorter words, the company decides to build up a flexible work environment that is enriched by each and every personal development tools. Updating the technological devices annually, monthly personal development seminars, social events such as company dinners can be given as examples those allows the employee to improve. This is a win-win relation between the employee and the company, such that the more the employee is fed by the company by opportunities, the more the employee produces and trusts, dedicates him/herself to the company.

In the first few years of the company, the company does not aim to open itself to apprentices and interns. This is because the company is expected to be internally dynamic in the first years and there may be lots of issues to be solved before completely opening to the society. However, after attaining internal stability, the company will most probably be opened to public by accepting interns and apprentices and allow them to use the equal amount of opportunities that are given to the already existing employees. This is important for the company to show its internal functioning to public and attract a certain amount of potential-employee to itself in order to keep its employee profile fresh and competence.

5. IMPACT of EPIWRIST

Regarding the results of most recent researches on epilepsy, around one percent of world population is an epilepsy patient. In that sense, it is a must to develop a device to increase the life expectancy of 690 million people all around world. EpiWrist is a product that is designed just for that reason. A product that affects 690 million people all around the world is expected to have global, economic, environmental and social impacts.

5.1. Global Impact

EpiWrist allows the epilepsy patients to track their disease by themselves, with the help of a hi-tech device that is equipped with a user-friendly interface. Moreover, it is offered to public with a reasonably low price, all of which invokes the idea of portable and personal health centres that can be easily controlled by the user with a low price, compared to the health care prices of hospitals. This may sound science fiction regarding today's reality, but with the help of a proper marketing strategy and a long term and wide-spread success of the product, all of which supported with non-ending research and development practices, EpiWrist may open the way of a new era in the health care industry.

5.2. Economic Impact

In order to detect seizures and make assumptions in order to understand epilepsy patients' health conditions, patients have to stay at hospitals for long periods of time that may take weeks or even months. Staying at hospitals for such a reason creates massive expenses for patients. EpiWrist breaks down this dependency of epilepsy patients to health centers, waiting for a seizure to take place under surveillance. EpiWrist allows real time seizure detection at anywhere at any time, as well as interpreting the data to the user, giving information about the period and intensity of the seizure. Thus, healthcare expenditures of epilepsy patients decrease in a great portion as well as the decrease in effort and time of health care centres that is spent for the long term surveillance.

5.3. Environmental Impact

Regarding environmental concerns, the energy source of the product is being designed as a green technology. Lithium-polymer batteries may be used, which are long

living, rechargeable and recyclable. Moreover by using nature friendly materials, we decide to decrease the natural harm of the product to minimum.

5.4. Social Impact

Seizure detection at anytime in a day is very crucial in epilepsy cases. Our closest competitors only provide detection of night seizures. Thus, our product shines amongst others by providing the first portable seizure detector in the world. Being portable provides seizure detection at anytime. This directly increases the life expectancy of 690 million epilepsy patients on the globe and opens the way of the idea that focuses on the agronomy of medical devices.

6. CONCLUSIONS

After a four months period of time that is filled up with researches, hardware and software experiments, surveys and such, EpiWrist has taken its final form. The conclusions that we have derived from these researches and observations can be examined under two main branches: Technical Conclusions and Social Conclusions.

6.1.1. Technical Conclusions

The observations that are derived from the experiments and researches leaded us to a conclusion that it is better to design and produce a portable device. To do this, we must use a battery system that is long living and feasible. We may use lithium polymer rechargeable batteries that are both space and energy saving, but this issue is still under R&D. Since the device is decided to be portable, we decided where to put it on the user. After researches are completed on the tonic-clonic epilepsy seizures, we saw that the most moving part of the body during the seizures is arms. Thus we decided to design the portable detector as a wristlet and concluded the motion capturing systems as our

detection system. This step was immediately followed by the detailed design of the motion capturing system. After some research, it is decided to use inertial sensors that are capable of sensing the motion of an object in three dimensions. Thus we concluded to use a three axis accelerometer. Then we decided on the type of the accelerometer, whether it should be a digital output or analog output one. In the prototype step, we used the analog output one, but in the long term, both devices will be compared in function and the final decision will be made for the device. At this time, digital accelerometer seems to be space saving, which is an advantage for us. Finally we worked on wireless systems in order to maintain a short range wireless alarm system in an indoor environment. Zigbee protocol and modules was first decided to be used for wireless communication between the alarm unit and the wristlet unit, but in the prototype step we see that it is also possible to sustain a successful wireless communication with basic RT devices such as ARX34 and ATX34 that communicates at 433MHz and they are space and energy saving too, compared to Zigbee units. However, in the further steps, if we need a transceiver unit, Zigbee may become the prior option again.

In the prototype step, we successfully demonstrated a wireless communication and motion capturing in three axes, as well as the display of the data on an LCD screen. Moreover, with the help of the serial communication between a computer device and the wristlet circuitry, the data is transported to a computer medium and then plotted as amplitude over time. The plots strengthened our thesis that a detection of an epilepsy seizure is completely possible and accurate by a motion capturing system, especially by an inertial sensor complex. At this very point of time, we stick to our design and looking for further improvements, such as an agronomic wristlet design and further filtering of the output data generated by the accelerometer by using FFT algorithms.

6.1.2. Social Conclusions

Social conclusions are also derived from the design and researches, since the product will have a direct affect on the life style of millions of epilepsy patients all around the

world. The design of the product is in the form of a portable device that grants the users full time epilepsy detection. This is first in whole world, which will most probably increase the life expectancy of epilepsy patients and moreover they will feel secure and confident in the society since they will be under professional surveillance and protection during day time, anywhere and anytime, for the first time.

The design of the product brings up the idea of personal health care centres that are extremely cheap, small and patient-friendly that you can have them without any effort and also carry them with you to anywhere you want. Further improvements on the project may even let the user to be detected underwater. The issue is that if the detection of epilepsy seizures is possible with a portable wristlet device, it may also be possible to detect the hearth beats of the user full time with the use of a necklace unit. Further improvements and R&D practices will open the way of new portable disease detection systems. These systems may even be equipped with artificial intelligence that can take intelligent action by a following type of function sequence: detection, derivation of data, data processing and finally action taking. Think of a device that is in the form of a contact lens that is able to detect blood pressure from the eye by a hi-tech system and in the while of an heart attack, it communicates with GPS and locates its position and calls an ambulance with the help of internet. These all can be possible in a soon future, but requires a certain amount of interest to the issue of personal and portable health care devices that opens a new era in biomedical and health care industry.

APPENDICE A

Corporate Identity Designs

Figure 2: The logo of the EpiWrist Corporations

Figure 3: A sample business card of the EpiWrist Corporations

Figure 4: The letterhead of the EpiWrist Corporations

APPENDICE B

Product Tree, Subassembly Trees, Block Diagrams and Flow Chart

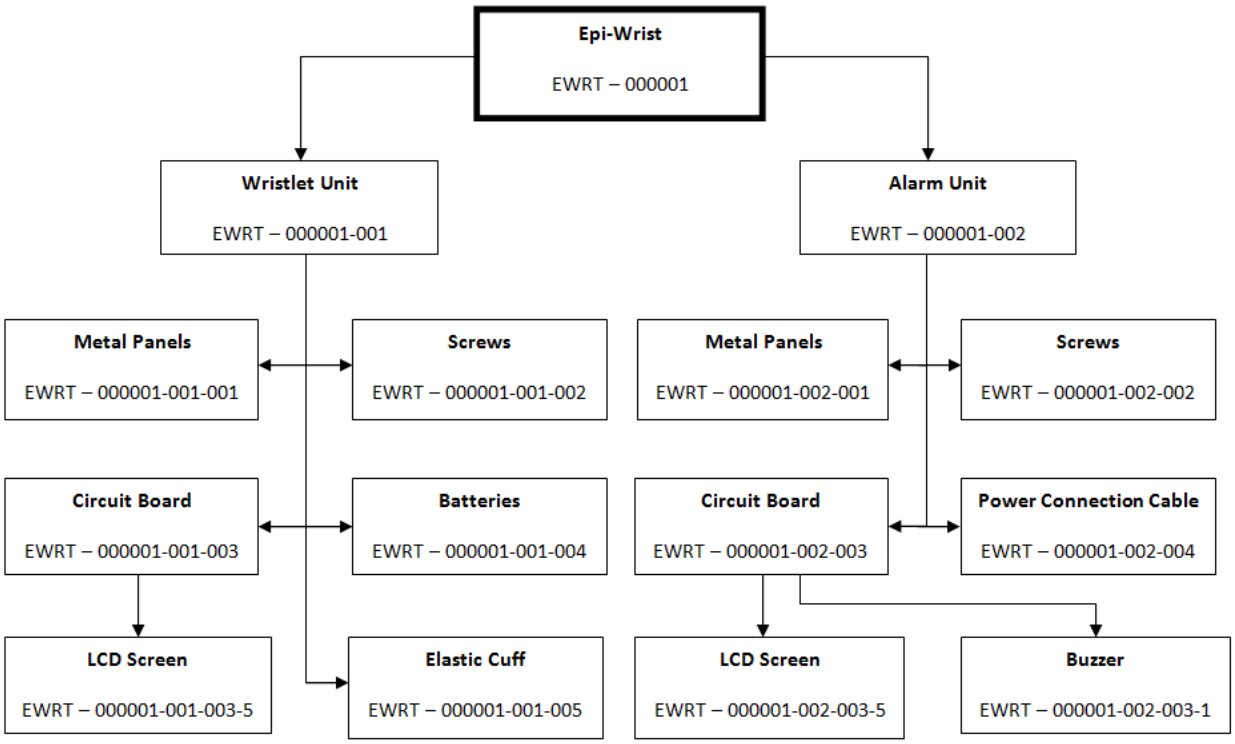


Figure 5: Product tree of Epi-Wrist

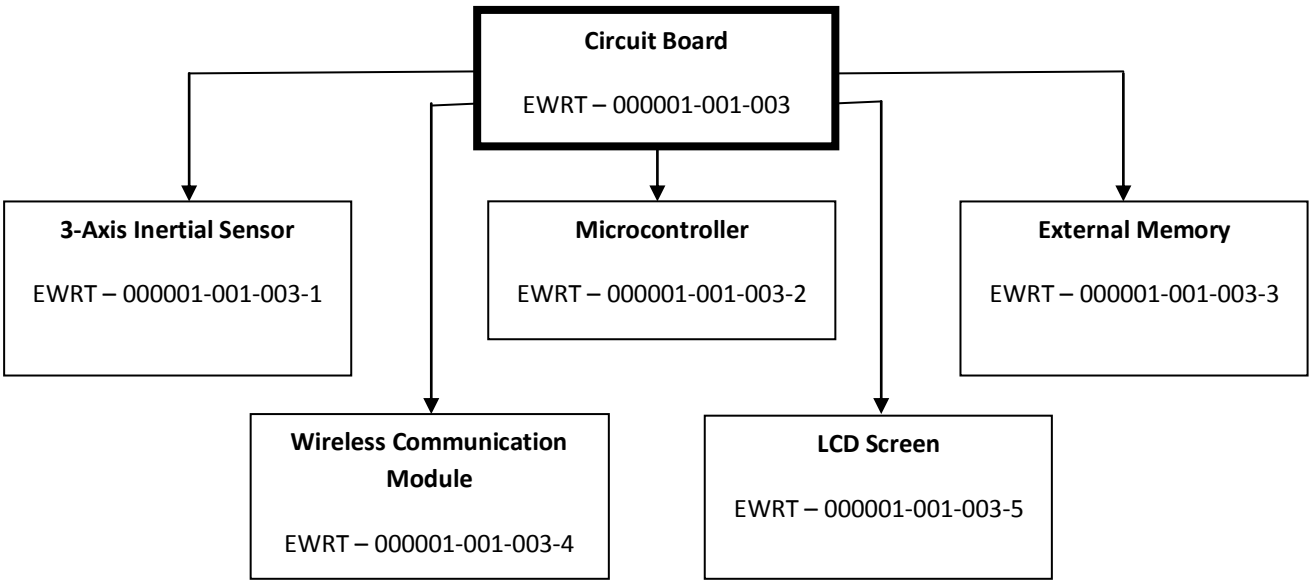


Figure 6: Subassembly tree of the circuitry of wristlet unit

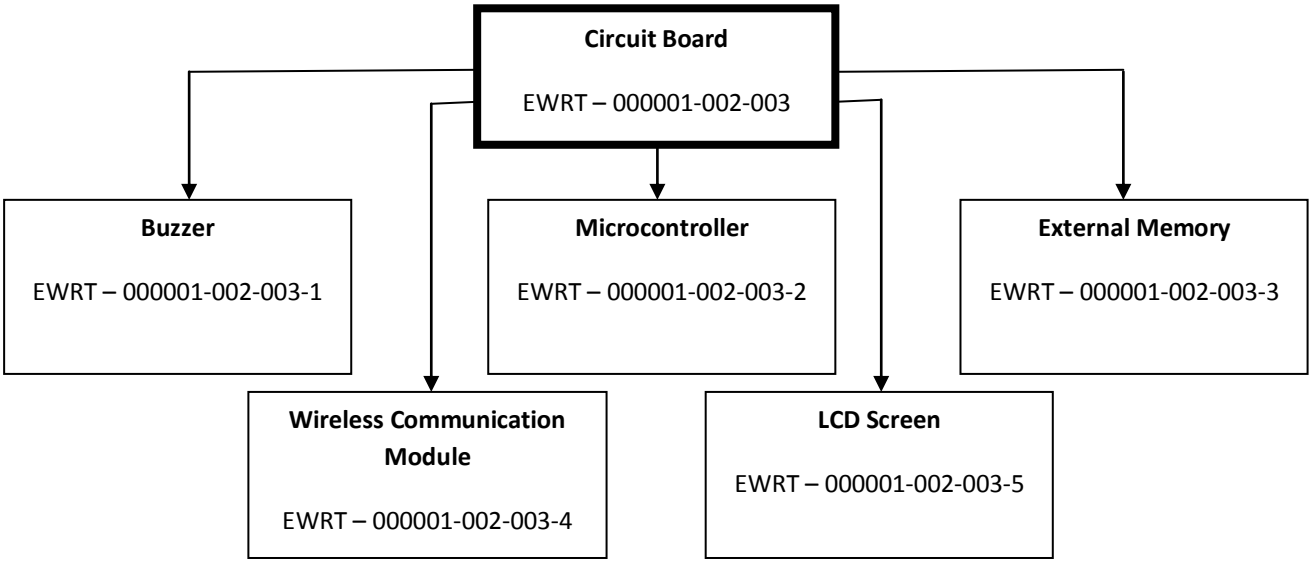


Figure 7: Subassembly tree of the circuitry of alarm unit

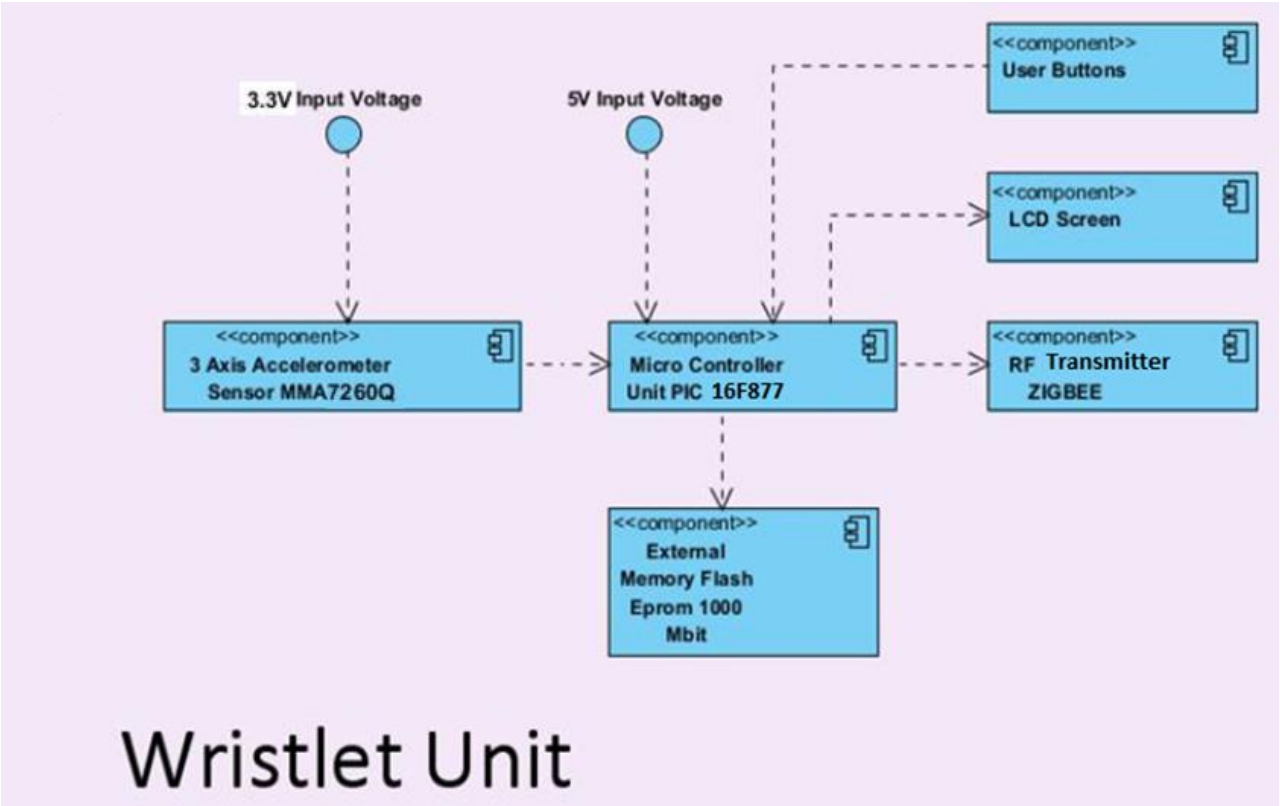


Figure 8: Block diagram of the wristlet unit

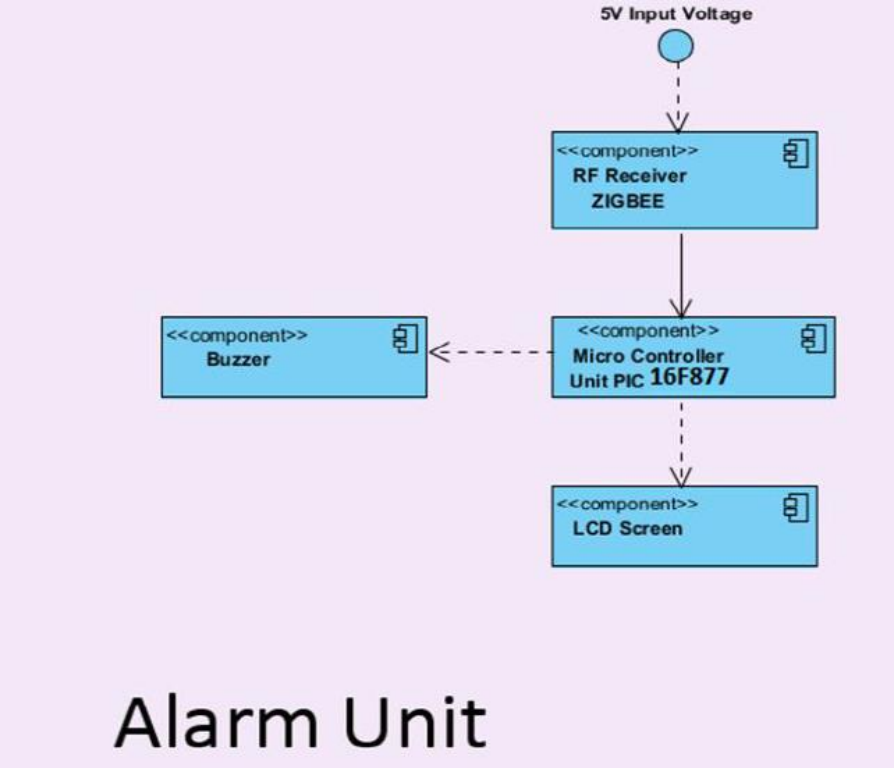


Figure 9: Block diagram of the alarm unit

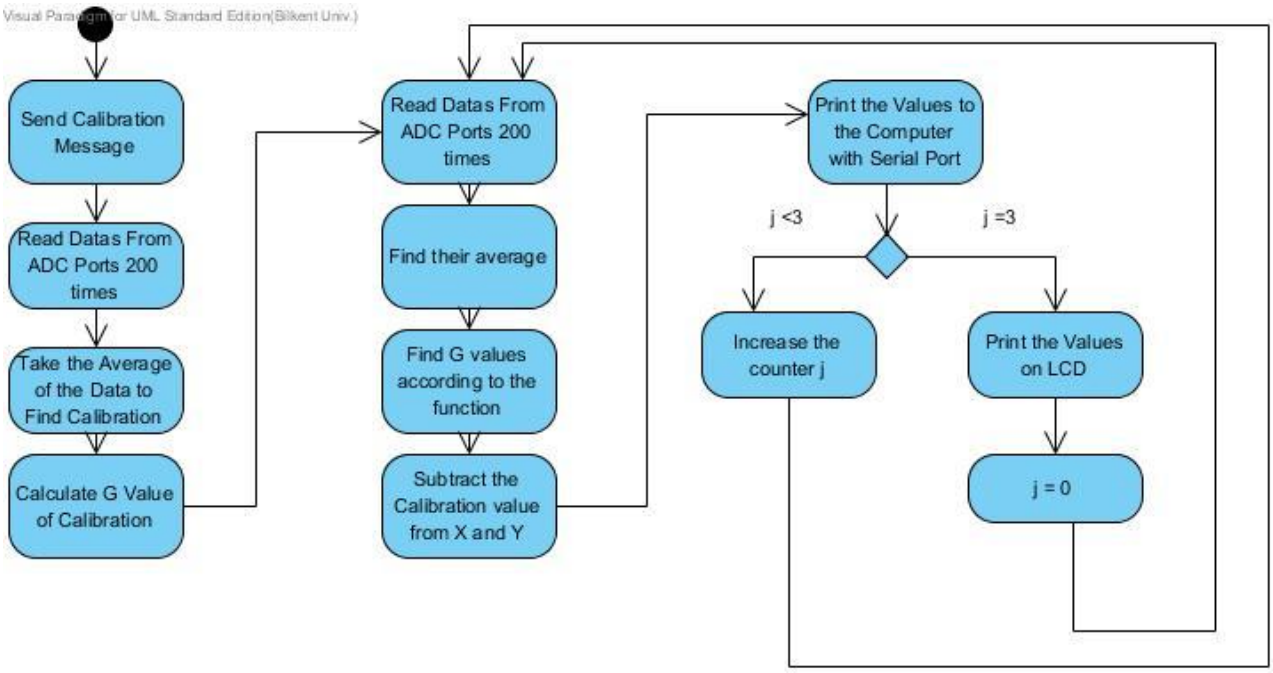
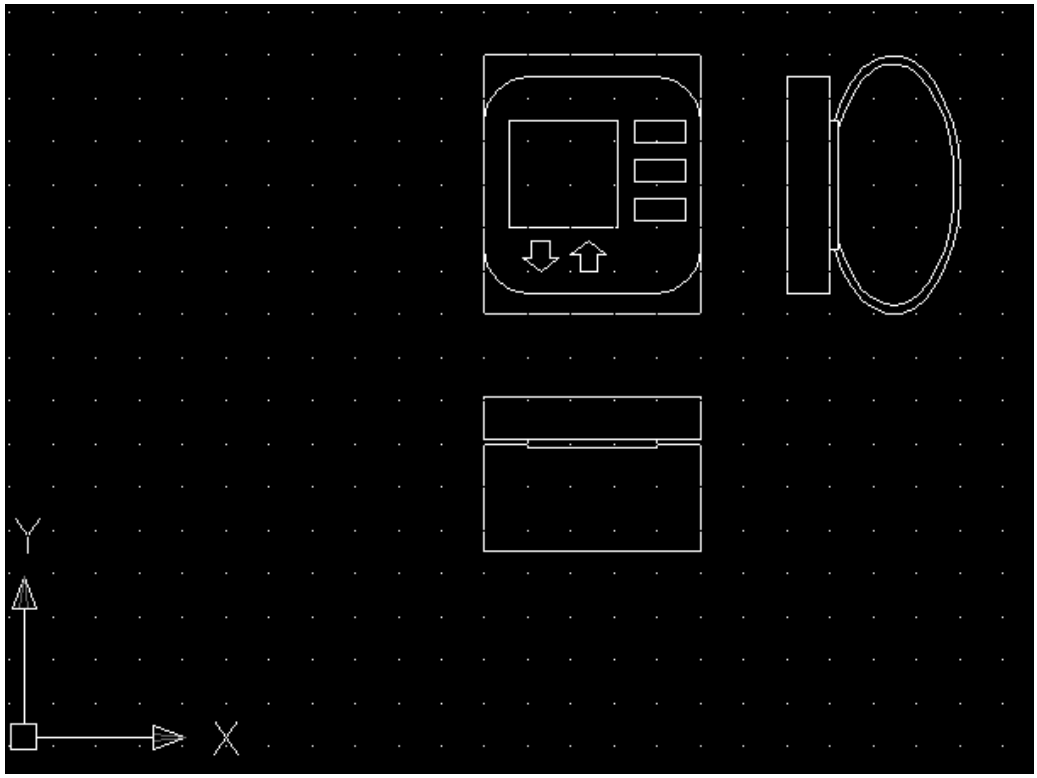


Figure 10: Flow chart of Epi-Wrist

APPENDICE C

Technical Drawings



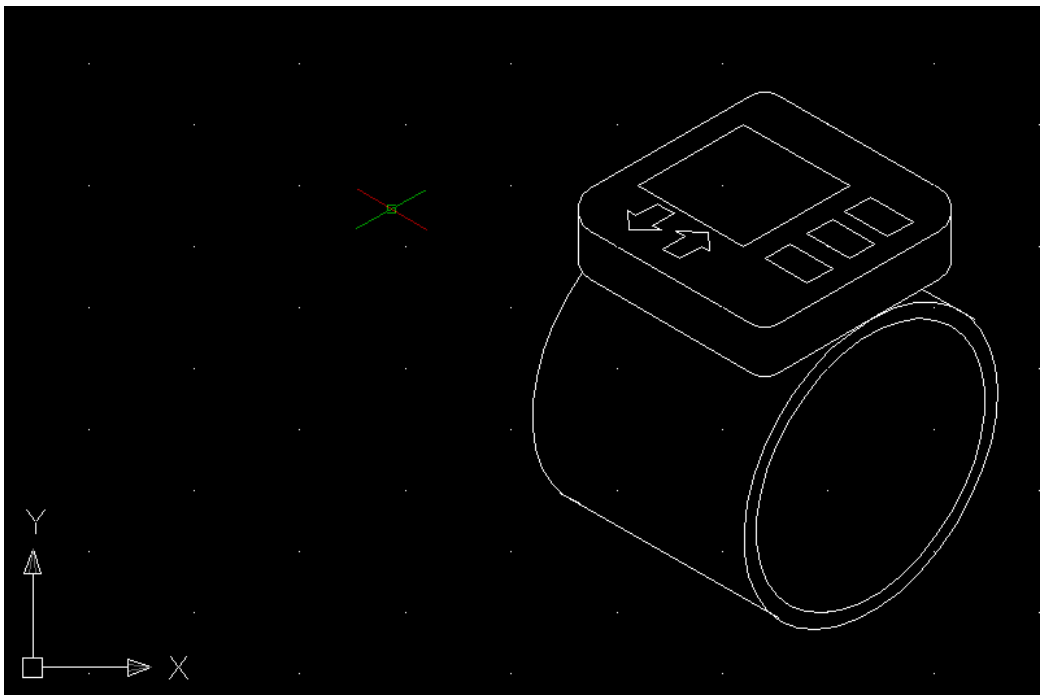


Figure 11: The Autocad design of the product

APPENDICE D

Circuit Diagrams and Software Codes

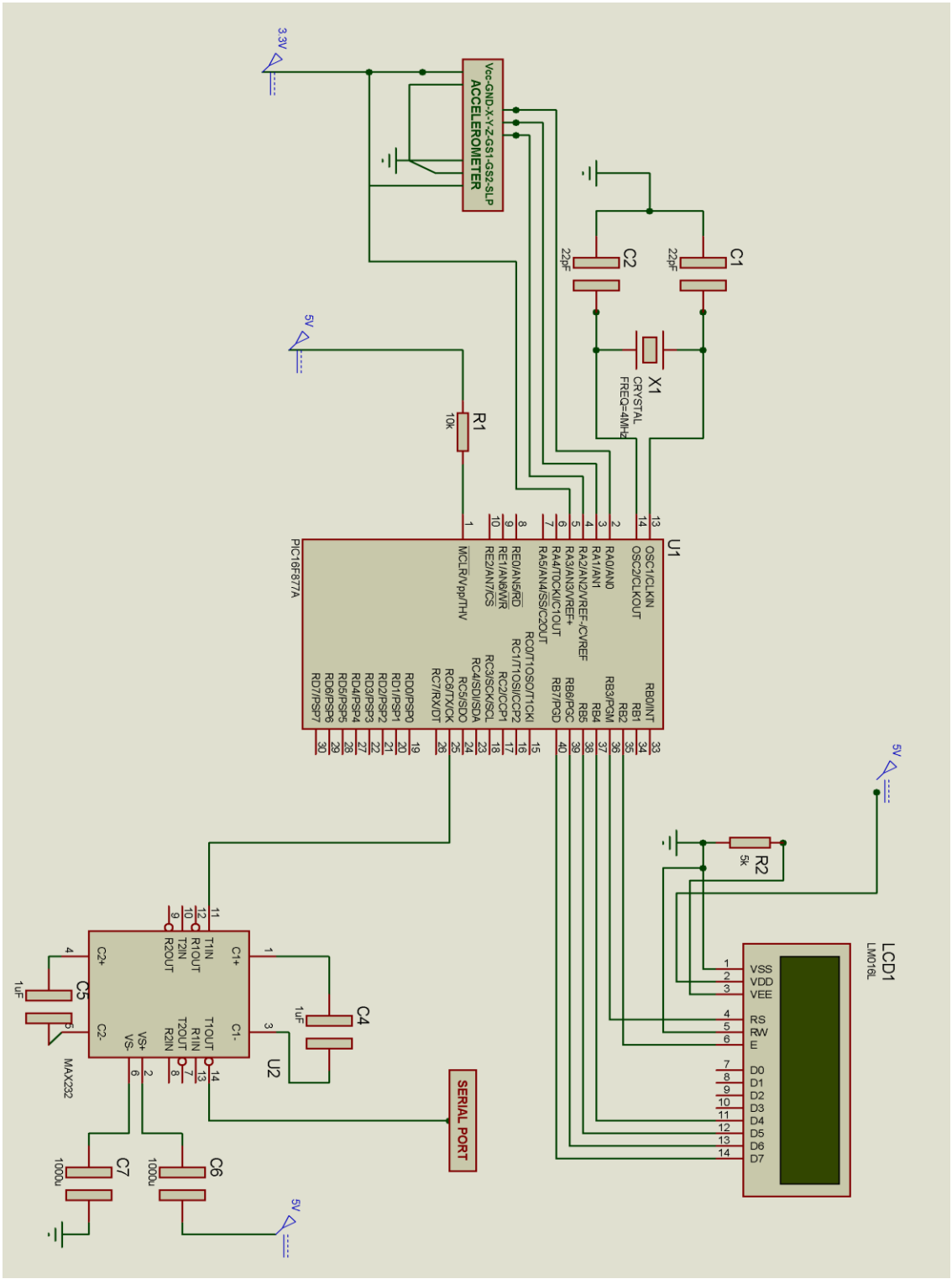


Figure 12: The circuit diagram of the wristlet unit, excluding the wireless module

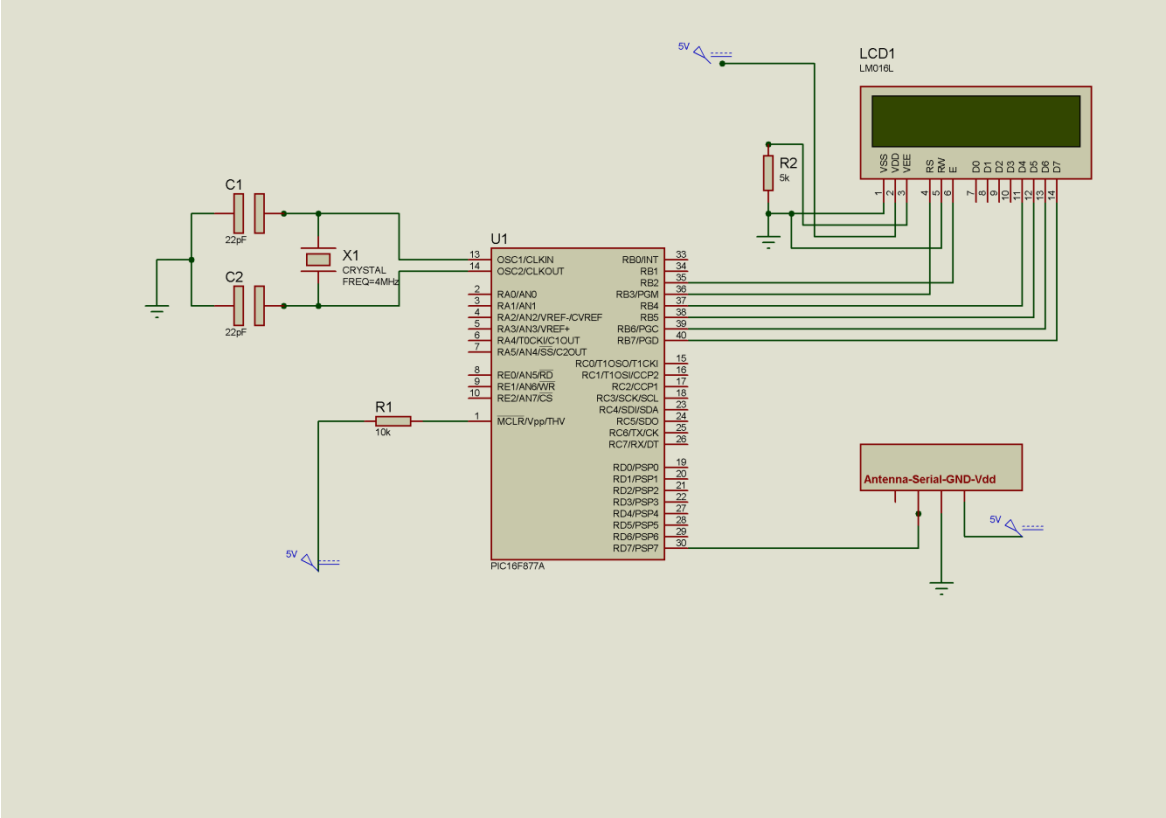


Figure 13: The circuit diagram of the receiver unit

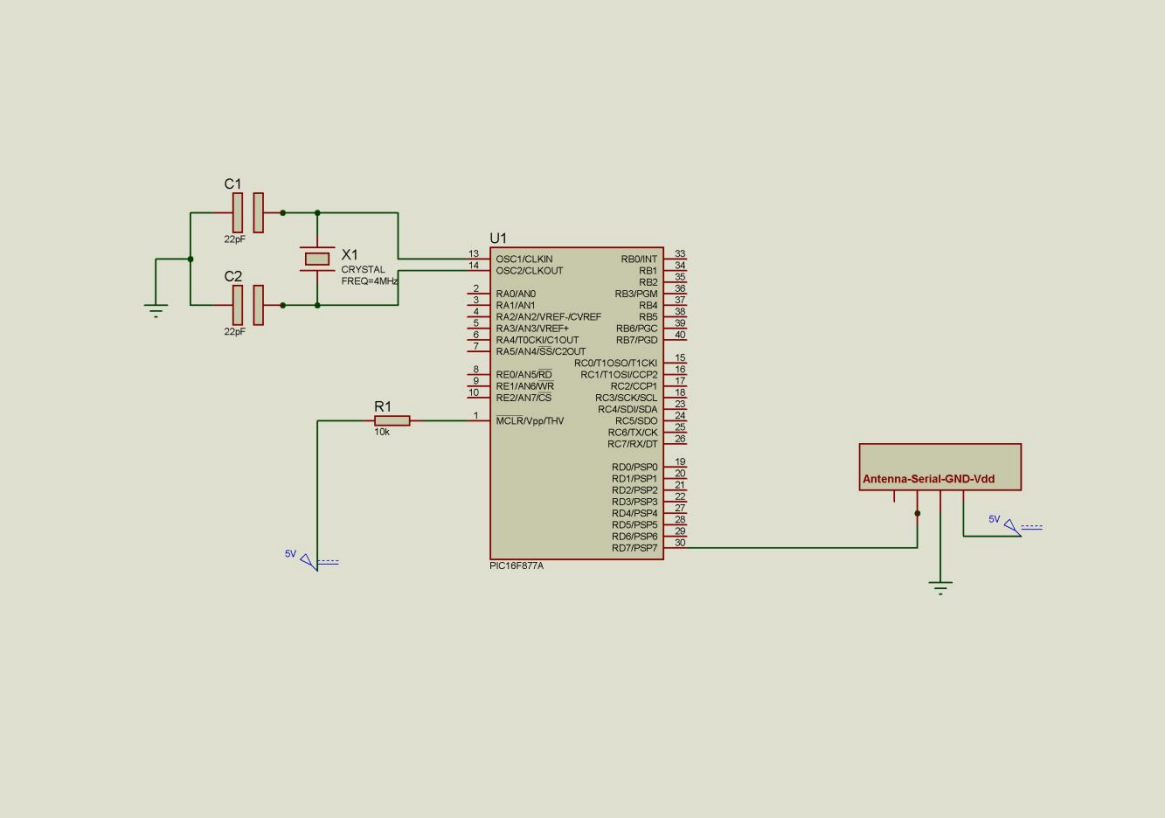


Figure 14: The circuit diagram of the transmitter unit

The Accelerometer Processing Code

```
#define LCD_ENABLE_PIN PIN_B0
#define LCD_RS_PIN PIN_B1
#define LCD_RW_PIN PIN_B2
#define LCD_TYPE 2
#define use_portb_lcd TRUE

#include "Epiwrist.h"
#include <float.h>
#include <math.h>
#include <lcd.c>



float XAxis,YAxis,ZAxis;
int i,j;
float XVoltage,YVoltage,ZVoltage;
float XCalibration,YCalibration;


void main()
{
   setup_adc_ports(AN0_AN1_AN2_AN4_VSS_VREF);
   setup_adc(ADC_CLOCK_DIV_2);
   setup_psp(PSP_DISABLED);
   setup_spi(SPI_SS_DISABLED);
   setup_timer_0(RTCC_INTERNAL|RTCC_DIV_1);
   setup_timer_1(T1_DISABLED);
   setup_timer_2(T2_DISABLED,0,1);
   setup_comparator(NC_NC_NC_NC);
   setup_vref(FALSE);
   lcd_init();


   lcd_gotoxy (1,1);,
   printf(lcd_putc,"Calibrating...");
   lcd_gotoxy (1,2);
   printf (lcd_putc,"Please Wait.");
   delay_ms (1000);

   XAxis = 0; YAxis = 0; ZAxis = 0;
   for (i=0 ; i!=200 ; i++)
   {
    set_adc_channel (0);
    delay_us (250);
    XAxis = XAxis + Read_ADC();
    delay_us (250);
    set_adc_channel (1);
    delay_us (250);
    YAxis = YAxis + Read_ADC();
    delay_us (250);
   }
   XAxis = XAxis/200;

YAxis = YAxis/200;

XCalibration = (float)(0.004*XAxis - 2.06);
YCalibration = (float)(0.004*YAxis - 2.06);

delay_ms (1000);
lcd_gotoxy (1,1);printf(lcd_putc,"\f");
```

```
 j = 0;
while (1)
{
 XAxis = 0; YAxis = 0; ZAxis = 0;
 for (i=0 ; i!=200 ; i++)
 {
  set_adc_channel (0);
  delay_us (25);
  XAxis = XAxis + Read_ADC();
  delay_us (25);
  set_adc_channel (1);
  delay_us (25);
  YAxis = YAxis + Read_ADC();
  delay_us (25);
  set_adc_channel (2);
  delay_us (25);
  ZAxis = ZAxis + Read_ADC();
  delay_us (25);
 }
 XAxis = XAxis/200;
 YAxis = YAxis/200;
 ZAxis = ZAxis/200;

 //XVoltage = XAxis*0.0032;
 //YVoltage = YAxis*0.0032;
 //ZVoltage = ZAxis*0.0032;

 //XVoltage = 1.25*XVoltage - 2.06;
 //YVoltage = 1.25*YVoltage - 2.06;
 //ZVoltage = 1.25*ZVoltage - 2.06;

 XVoltage = (float)(((float)(0.004*XAxis - 2.06)) - XCalibration);
 YVoltage = (float)(((float)(0.004*YAxis - 2.06)) - YCalibration);
 ZVoltage = (float) (0.004*ZAxis - 2.06);
 if(XVoltage>=0.00)
 {
    if(YVoltage>=0.00)
    {
       if(ZVoltage>=0.00)
       {
          printf ("X=        %g        Y=        %g        Z=
      %g",XVoltage,YVoltage,ZVoltage);
       }
       else
       {
          printf ("X=        %g        Y=        %g        Z=
      %g",XVoltage,YVoltage,ZVoltage);
       }

    }
    else
    {
       if(ZVoltage>=0.00)
```

```
            {
                printf ("X=        %g        Y=        %g        Z=
          %g",XVoltage,YVoltage,ZVoltage);
            }
            else
            {
                printf ("X=        %g        Y=        %g        Z=
          %g",XVoltage,YVoltage,ZVoltage);
            }
        }

    }
    else
    {
        if(YVoltage>=0.00)
        {
            if(ZVoltage>=0.00)
            {
                printf ("X=       %g        Y=        %g        Z=
          %g",XVoltage,YVoltage,ZVoltage);
            }
            else
            {
                printf ("X=       %g        Y=        %g        Z=
          %g",XVoltage,YVoltage,ZVoltage);
            }

        }
        else
        {
            if(ZVoltage>=0.00)
            {
                printf ("X=       %g        Y=        %g        Z=
          %g",XVoltage,YVoltage,ZVoltage);
            }
            else
            {
                printf ("X=       %g        Y=        %g        Z=
          %g",XVoltage,YVoltage,ZVoltage);
            }
        }
    }
    //printf ("X=        %g        Y=        %g        Z=
          %g ",XVoltage,YVoltage,ZVoltage);
    //printf("                        ");

    if (j>=3)
    {
        lcd_gotoxy (1,2);printf (lcd_putc,"                          ");
        lcd_gotoxy (1,2);printf (lcd_putc,"X=%g Y=%g Z=%g",
          XVoltage,YVoltage,ZVoltage);
        j=0;

    }
    else
    {
      j++;
    }
   }

}
```

Serial Communication Code

```
#include <16F877A.h>
#device adc=10

#FUSES NOWDT
//No Watch Dog Timer
#FUSES HS
//High speed Osc (> 4mhz)
#FUSES NOPUT
//No Power Up Timer
#FUSES NOPROTECT
//Code not protected from reading
#FUSES NODEBUG
//No Debug mode for ICD
#FUSES NOBROWNOUT
//No brownout reset
#FUSES NOLVP
//No low voltage prgming, B3(PIC16) or B5(PIC18) used for I/O
#FUSES NOCPD
//No EE protection
#FUSES WRT_50%
//Lower half of Program Memory is Write Protected

#use delay(clock=20000000)
#use rs232(baud=9600,parity=N,xmit=PIN_C6,rcv=PIN_C7,bits=8)
```

Wireless Communication – Transmitter Code

```
TRISA=%00000001    'A PORT UNUN SADECE 1. BIT I GIRIS DIGERLERI CIKIS

TRISB=0          'B PORTU TUM PIN LER CIKIS

TRISC=0          'C PORTU TUM PIN LER CIKIS

TRISD=0

'--------------------------------------------------------------------------

@ DEVICE pic16F877

@ DEVICE pic16F877, WDT_on

@ DEVICE pic16F877, PWRT_ON

@ DEVICE pic16F877, PROTECT_OFF

@ DEVICE pic16F877, XT_OSC

'--------------------------------------------------------------------------
```

```
DEFINE LCD_DREG         PORTB 'LCD data bacakları hangi porta bağlı?
DEFINE LCD_DBIT         4           'LCD data bacakları hangi bitten başlıyor?
DEFINE LCD_EREG         PORTB 'LCD Enable Bacağı Hangi Porta bağlı?
DEFINE LCD_EBIT         2           'LCD Enable Bacağı Hangi bite bağlı ?
DEFINE LCD_RSREG    PORTB 'LCD RS Bacağı Hangi Porta bağlı ?
DEFINE LCD_RSBIT    3           'LCD RS bacağı Hangi Bite bağlı  ?
DEFINE LCD_BITS         4           'LCD 4 bit mi yoksa 8 bit olarak bağlı?
DEFINE LCD_LINES    2           'LCD Kaç sıra yazabiliyor


DEFINEADC_BITS  10    'A/D çevirim sonucu kaç bit olacak
DEFINEADC_CLOCK   3         'Clock kaynağı (3=rc)
DEFINEADC_SAMPLEUS    100       'Örnekleme zamanı mikro saniye cinsinden.
'-----------------------------------------------------------------------------
ADCON1=%10001110 '7. bit 1 yapıldı 10 bit sonuç almak için.
'-----------------------------------------------------------------------------
ADC   var  word
I    VAR  BYTE
TEST  VAR  WORD
OUTPUT1  VAR  PORTD.7
'-----------------------------------------------------------------------------
LCDOut $FE,1  ' LCD de CLS yapar
pause 200     ' LCD nin açılması için gerekli süredir.
'-----------------------------------------------------------------------------


TEST= 100
LOOP1:
```

```
    SEROUT2 OUTPUT1,396,["EPIWRIST",TEST]
    PAUSE 10
GOTO LOOP1
END
```

Wireless Communication – Receiver Code

```
TRISA=%00000001    'A PORT UNUN SADECE 1. BIT I GIRIS DIGERLERI CIKIS
TRISB=0          'B PORTU TUM PIN LER CIKIS
TRISC=0          'C PORTU TUM PIN LER CIKIS
TRISD.7=1
'--------------------------------------------------------------------------------
@ DEVICE pic16F877
@ DEVICE pic16F877, WDT_on
@ DEVICE pic16F877, PWRT_ON
@ DEVICE pic16F877, PROTECT_OFF
@ DEVICE pic16F877, XT_OSC
'--------------------------------------------------------------------------------
DEFINE LCD_RWREG    PORTB   'LCD read/write pin port
DEFINE LCD_RWBIT    1       'LCD read/write bit
DEFINE LCD_DREG             PORTB 'LCD data bacakları hangi porta bağlı?
DEFINE LCD_DBIT             4               'LCD data bacakları hangi bitten başlıyor?
DEFINE LCD_EREG             PORTB 'LCD Enable Bacağı Hangi Porta bağlı?
DEFINE LCD_EBIT             2               'LCD Enable Bacağı Hangi bite bağlı ?
DEFINE LCD_RSREG    PORTB 'LCD RS Bacağı Hangi Porta bağlı ?
DEFINE LCD_RSBIT    3               'LCD RS bacağı Hangi Bite bağlı  ?
```

```
DEFINE LCD_BITS                4                'LCD 4 bit mi yoksa 8 bit olarak bağlı?
DEFINE LCD_LINES     2                'LCD Kaç sıra yazabiliyor


DEFINEADC_BITS   10    'A/D çevirim sonucu kaç bit olacak
DEFINEADC_CLOCK    3            'Clock kaynağı (3=rc)
DEFINEADC_SAMPLEUS         100      'Örnekleme zamanı mikro saniye cinsinden.
'-----------------------------------------------------------------------------
'-----------------------------------------------------------------------------
ADC    var  word
I     VAR  BYTE
RECEIVE     VAR  WORD
INPUT1  VAR  PORTD.7
'-----------------------------------------------------------------------------
LCDOut $FE,1  ' LCD de CLS yapar
pause 200      ' LCD nin açılması için gerekli süredir.
'-----------------------------------------------------------------------------
LOOP1:
    SERIN2 INPUT1,396,[WAIT("EPIWRIST"),RECEIVE]
    PAUSE 10
    lcdout $FE,1, #RECEIVE
    PAUSE 100
GOTO LOOP1
END
```

APPENDICE E

Tables and Charts about Expenditure, Business and Development Plans

Product	per unit	per 1000	Total number used per product
Accelerometer Kit	30 TL	9 TL	2
LCD Screen	10 TL	5 TL	2
Microcontroller	15 TL	8 TL	2
Zigbee Modul	100 TL	25 TL	2
Buzzer	2 TL	0.4 TL	
Battery	50 TL	22 TL	
Alarm Box	10 TL	2 TL	
WrisTLet Box	5 TL	1 TL	
Minor Circuit Components	30 TL	12 TL	
(diode, regulator, capacitor,			
wiring, cables etc.)			
mold design cost		10.000 TL	
mold cost		25.000 TL	
mold material cost	2 TL		
Mass Production Costs	**Monthly Unit Cost**	**Annual Cost**	
Labour Cost	450$		
Electricity	1500$		
Maintanence	1000$		
Marketing Costs	**Unit Cost**		
Advertisement Costs	5000$		
Transportation Costs			
Other Costs	**Monthly Unit Cost**	**Annual Cost**	
Rentals	2500$		
Salaries	9000$		
Taxes			
One Time Costs			
Machinary Costs	200000$		

Table 1: Expenditure Plan

	Jan	Feb	March	April	May	June	July	Aug.	Sept	Oct	Nov	Dec	Total
Net Sales		417.825	433.300	464.250	489.010	513.770	526.150	544.720	563.290	581.860	588.050	612.810	6.137.385
COGS	284.742	295.694	306.645	328.549	346.071	363.594	372.355	385.497	398.639	411.781	416.162	433.684	4.343.413
Gross Profit	117.608	122.131	126.655	135.701	142.939	150.176	153.795	159.223	164.651	170.079	171.888	179.126	1.793.972
Operating Expenses	17.700	17.700	17.700	17.700	17.700	17.700	17.700	17.700	17.700	17.700	17.700	17.700	212.400
Operating Loss	99.908	104.431	108.955	118.001	125.239	132.476	136.095	141.523	146.951	152.379	154.188	161.426	1.581.572
Interest Expenses	-	-	-	-	-	18.750	8.000	-	-	-	-	18.750	45.500
	99.908	104.431	108.955	118.001	125.239	113.726	128.095	141.523	146.951	152.379	154.188	142.676	1.536.072

Table 2: A forecasting table

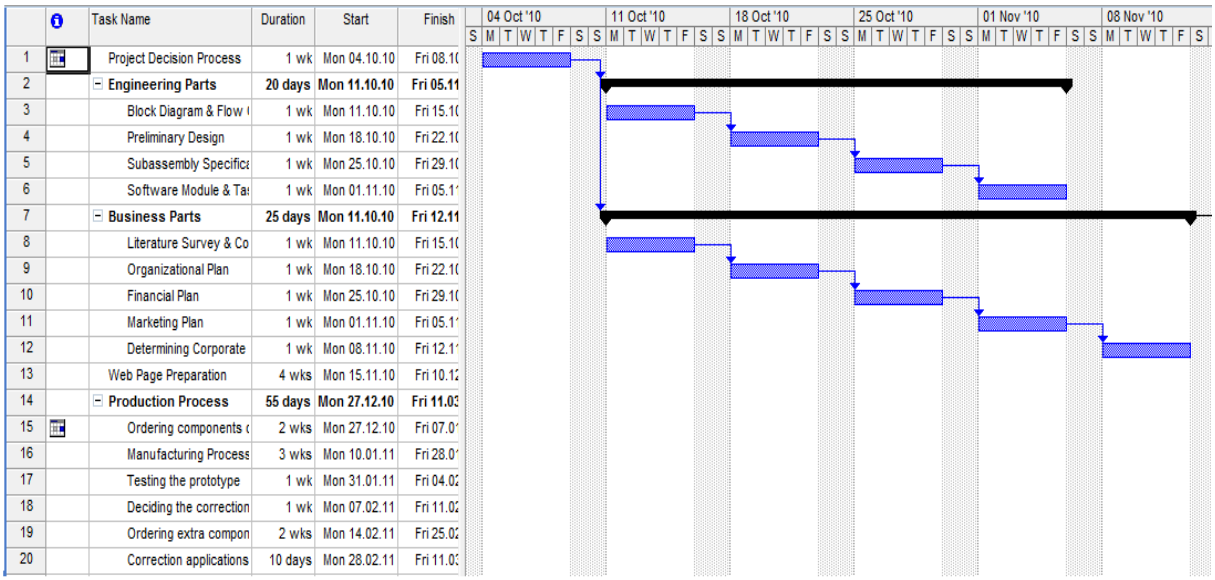
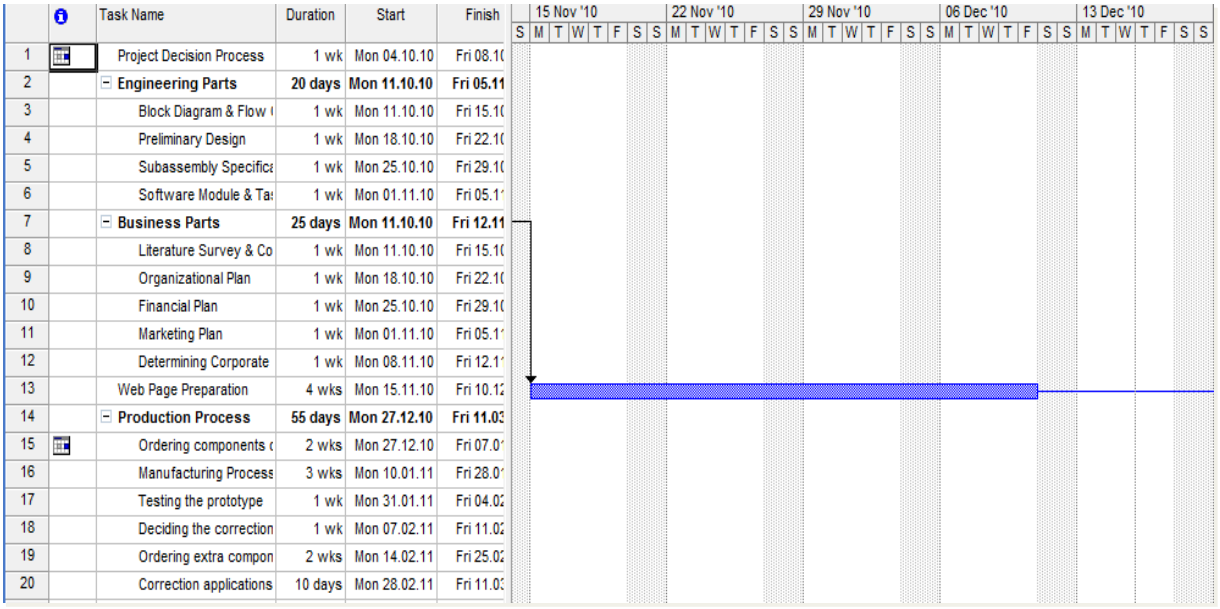
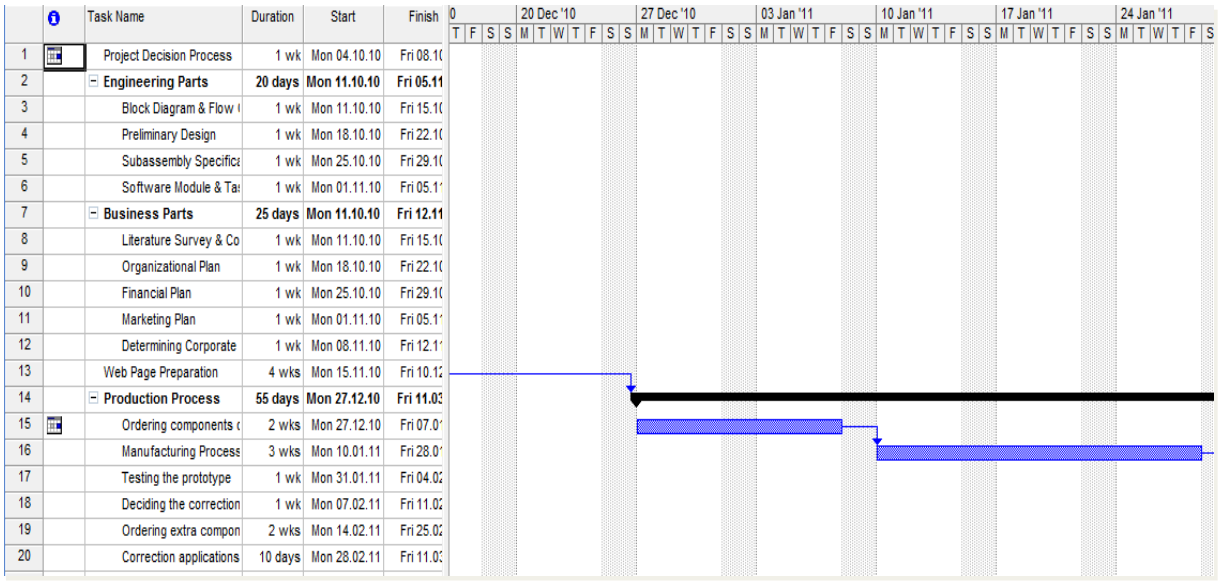


Table 3: Development plant of the interval 4OCT-13NOV



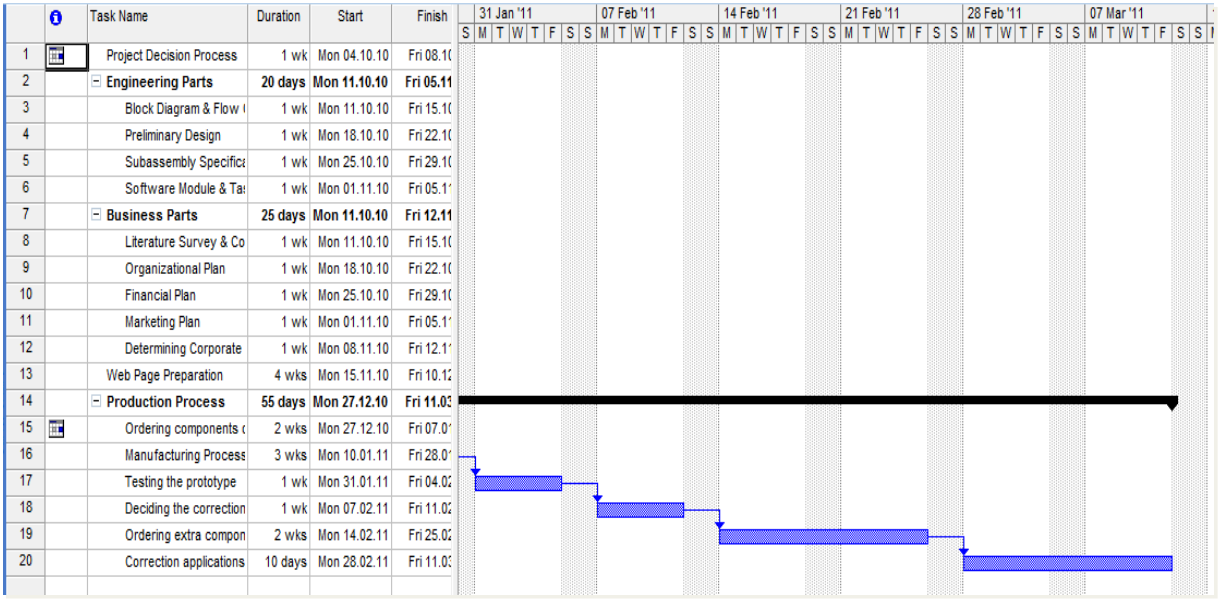
	Task Name	Duration	Start	Finish
1	Project Decision Process	1 wk	Mon 04.10.10	Fri 08.10
2	**Engineering Parts**	**20 days**	**Mon 11.10.10**	**Fri 05.11**
3	Block Diagram & Flow	1 wk	Mon 11.10.10	Fri 15.10
4	Preliminary Design	1 wk	Mon 18.10.10	Fri 22.10
5	Subassembly Specifica	1 wk	Mon 25.10.10	Fri 29.10
6	Software Module & Ta	1 wk	Mon 01.11.10	Fri 05.11
7	**Business Parts**	**25 days**	**Mon 11.10.10**	**Fri 12.11**
8	Literature Survey & Co	1 wk	Mon 11.10.10	Fri 15.10
9	Organizational Plan	1 wk	Mon 18.10.10	Fri 22.10
10	Financial Plan	1 wk	Mon 25.10.10	Fri 29.10
11	Marketing Plan	1 wk	Mon 01.11.10	Fri 05.11
12	Determining Corporate	1 wk	Mon 08.11.10	Fri 12.11
13	Web Page Preparation	4 wks	Mon 15.11.10	Fri 10.12
14	**Production Process**	**55 days**	**Mon 27.12.10**	**Fri 11.03**
15	Ordering components	2 wks	Mon 27.12.10	Fri 07.01
16	Manufacturing Process	3 wks	Mon 10.01.11	Fri 28.01
17	Testing the prototype	1 wk	Mon 31.01.11	Fri 04.02
18	Deciding the correction	1 wk	Mon 07.02.11	Fri 11.02
19	Ordering extra compon	2 wks	Mon 14.02.11	Fri 25.02
20	Correction applications	10 days	Mon 28.02.11	Fri 11.03

Table 4: Development plant of the interval 13NOV-20DEC



	Task Name	Duration	Start	Finish
1	Project Decision Process	1 wk	Mon 04.10.10	Fri 08.10
2	**Engineering Parts**	**20 days**	**Mon 11.10.10**	**Fri 05.11**
3	Block Diagram & Flow	1 wk	Mon 11.10.10	Fri 15.10
4	Preliminary Design	1 wk	Mon 18.10.10	Fri 22.10
5	Subassembly Specifica	1 wk	Mon 25.10.10	Fri 29.10
6	Software Module & Ta	1 wk	Mon 01.11.10	Fri 05.11
7	**Business Parts**	**25 days**	**Mon 11.10.10**	**Fri 12.11**
8	Literature Survey & Co	1 wk	Mon 11.10.10	Fri 15.10
9	Organizational Plan	1 wk	Mon 18.10.10	Fri 22.10
10	Financial Plan	1 wk	Mon 25.10.10	Fri 29.10
11	Marketing Plan	1 wk	Mon 01.11.10	Fri 05.11
12	Determining Corporate	1 wk	Mon 08.11.10	Fri 12.11
13	Web Page Preparation	4 wks	Mon 15.11.10	Fri 10.12
14	**Production Process**	**55 days**	**Mon 27.12.10**	**Fri 11.03**
15	Ordering components	2 wks	Mon 27.12.10	Fri 07.01
16	Manufacturing Process	3 wks	Mon 10.01.11	Fri 28.01
17	Testing the prototype	1 wk	Mon 31.01.11	Fri 04.02
18	Deciding the correction	1 wk	Mon 07.02.11	Fri 11.02
19	Ordering extra compon	2 wks	Mon 14.02.11	Fri 25.02
20	Correction applications	10 days	Mon 28.02.11	Fri 11.03

Table 5: Development plant of the interval 20DEC-30JAN



	Task Name	Duration	Start	Finish
1	Project Decision Process	1 wk	Mon 04.10.10	Fri 08.10
2	**Engineering Parts**	**20 days**	**Mon 11.10.10**	**Fri 05.11**
3	Block Diagram & Flow	1 wk	Mon 11.10.10	Fri 15.10
4	Preliminary Design	1 wk	Mon 18.10.10	Fri 22.10
5	Subassembly Specifica	1 wk	Mon 25.10.10	Fri 29.10
6	Software Module & Ta	1 wk	Mon 01.11.10	Fri 05.11
7	**Business Parts**	**25 days**	**Mon 11.10.10**	**Fri 12.11**
8	Literature Survey & Co	1 wk	Mon 11.10.10	Fri 15.10
9	Organizational Plan	1 wk	Mon 18.10.10	Fri 22.10
10	Financial Plan	1 wk	Mon 25.10.10	Fri 29.10
11	Marketing Plan	1 wk	Mon 01.11.10	Fri 05.11
12	Determining Corporate	1 wk	Mon 08.11.10	Fri 12.11
13	Web Page Preparation	4 wks	Mon 15.11.10	Fri 10.12
14	**Production Process**	**55 days**	**Mon 27.12.10**	**Fri 11.03**
15	Ordering components	2 wks	Mon 27.12.10	Fri 07.01
16	Manufacturing Process	3 wks	Mon 10.01.11	Fri 28.01
17	Testing the prototype	1 wk	Mon 31.01.11	Fri 04.02
18	Deciding the correction	1 wk	Mon 07.02.11	Fri 11.02
19	Ordering extra compon	2 wks	Mon 14.02.11	Fri 25.02
20	Correction applications	10 days	Mon 28.02.11	Fri 11.03

Table 6: Development plant of the interval 31JAN-12MAR

APPENDICE F

An Analytical Analysis of a Seizure

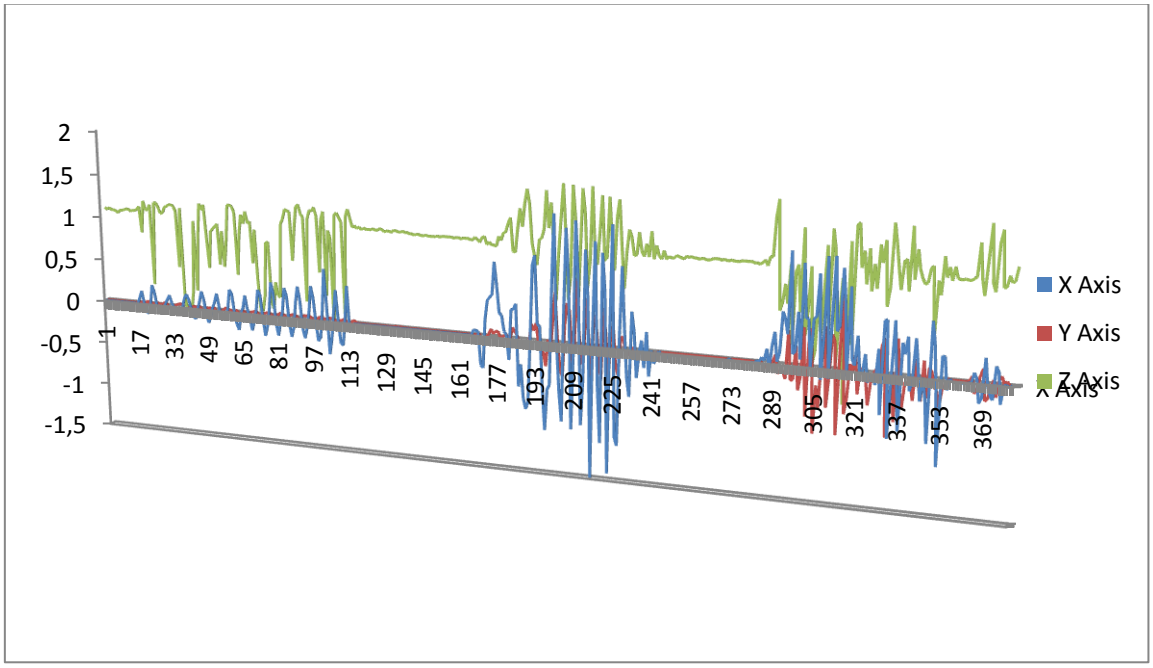


Figure 15: The graph of 379 data that is generated by the accelerometer in the while of varying motions.

In order to analyse the data properly, we started to take data at every 125us. Then at every 200 data we took the average since there is too much data to process in a very short time. At the end we obtain approximately 33 data per second. Analysing a simulation for 12 seconds we obtained the graph above with 379 samples for three axis g values. The first part is a simulation of a running person. As we can see from the graph, maximum peak to peak g value in any axis is less than 1 g. The second and third parts are the simulations of a seizure. As we can see, most of the peak to peak values at x axis and y axis are more than 1.5g. Since this value can be obtained by a high frequency motion, we can conclude that a seizure might be occurring. We can observe that a peak to peak value occurs at every 10-15 sample. So finding the difference between the maximum and minimum values on any axis at every 15 sample will lead us to find the peak to peak values. Obtaining 4 or 5 peak to peak values greater than 1.5 in a row will tell us that there is a seizure.

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- Datasheets of:
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    - MICROCHIP PIC16F877
    - EasyBee 802.15.4 RF Transceiver
    - POWERTIP 2x8 PC 0802-A
    - EEPROM-ATMEL AT24C1024