Pitch Teacher

삼팀장

목차

개발 동기


MAXIMUMEXPOSURE
100+ PLATFORMS THAT MOVE MUSIC NOW
Billboard
500,000,000 PSY FANS
CAN'T BE WRONG


서바이벌
나는가수다


노래를 '잘' 하는 실력차!
노래를 '잘' 하고 싶은 음치!


TM

- **Project Name**

  Pitch Teacher

- **Enviroment**

  OS : Window 7 64bit

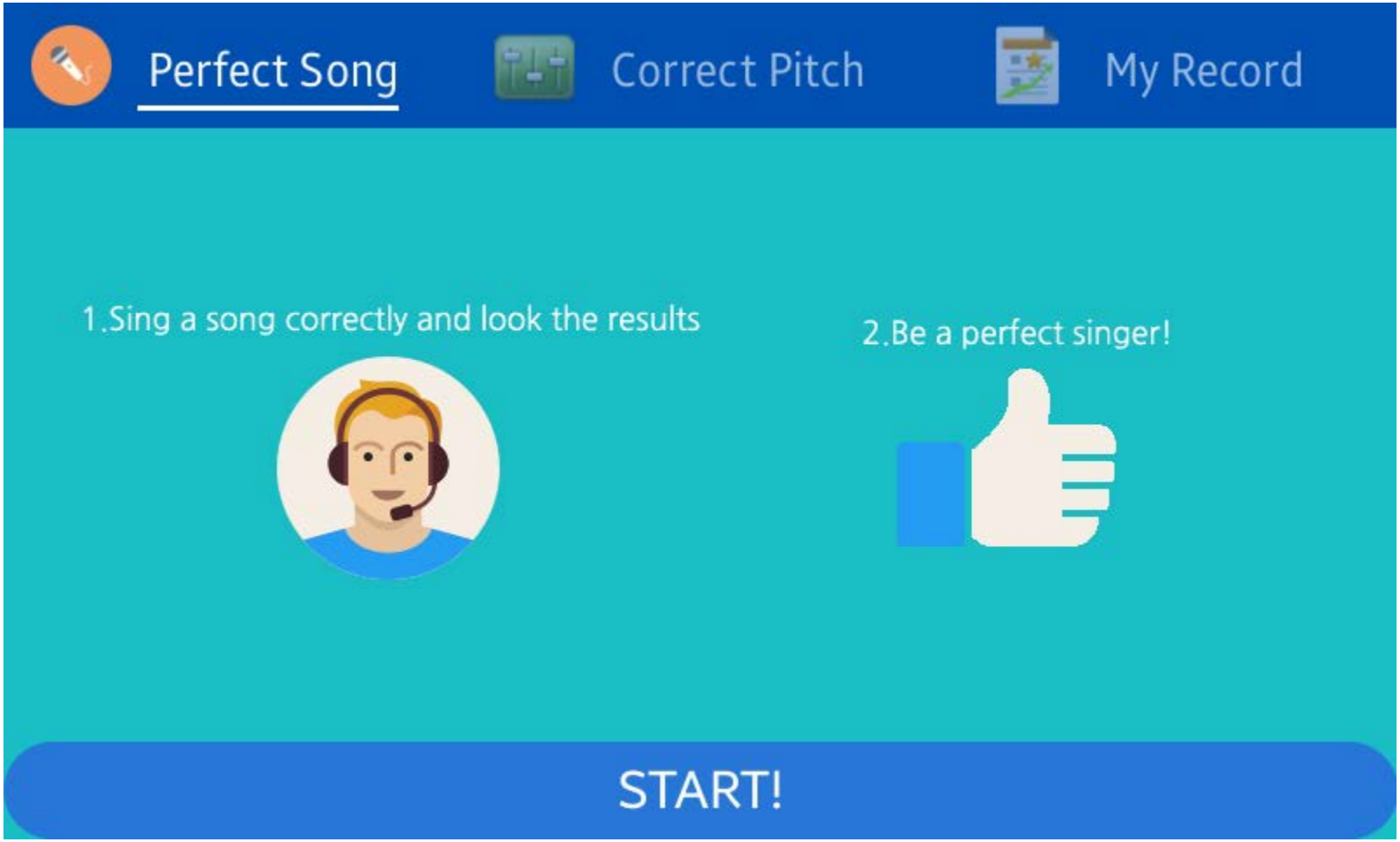
  Tools : Tizen SDK 2.3 Rev

  Library : middl

  Language : C

  Target : Tizen Z1

가능


Perfect Song
Correct Pitch
My Record
1.Sing a song correctly and look the results
2.Be a perfect singer!
START!

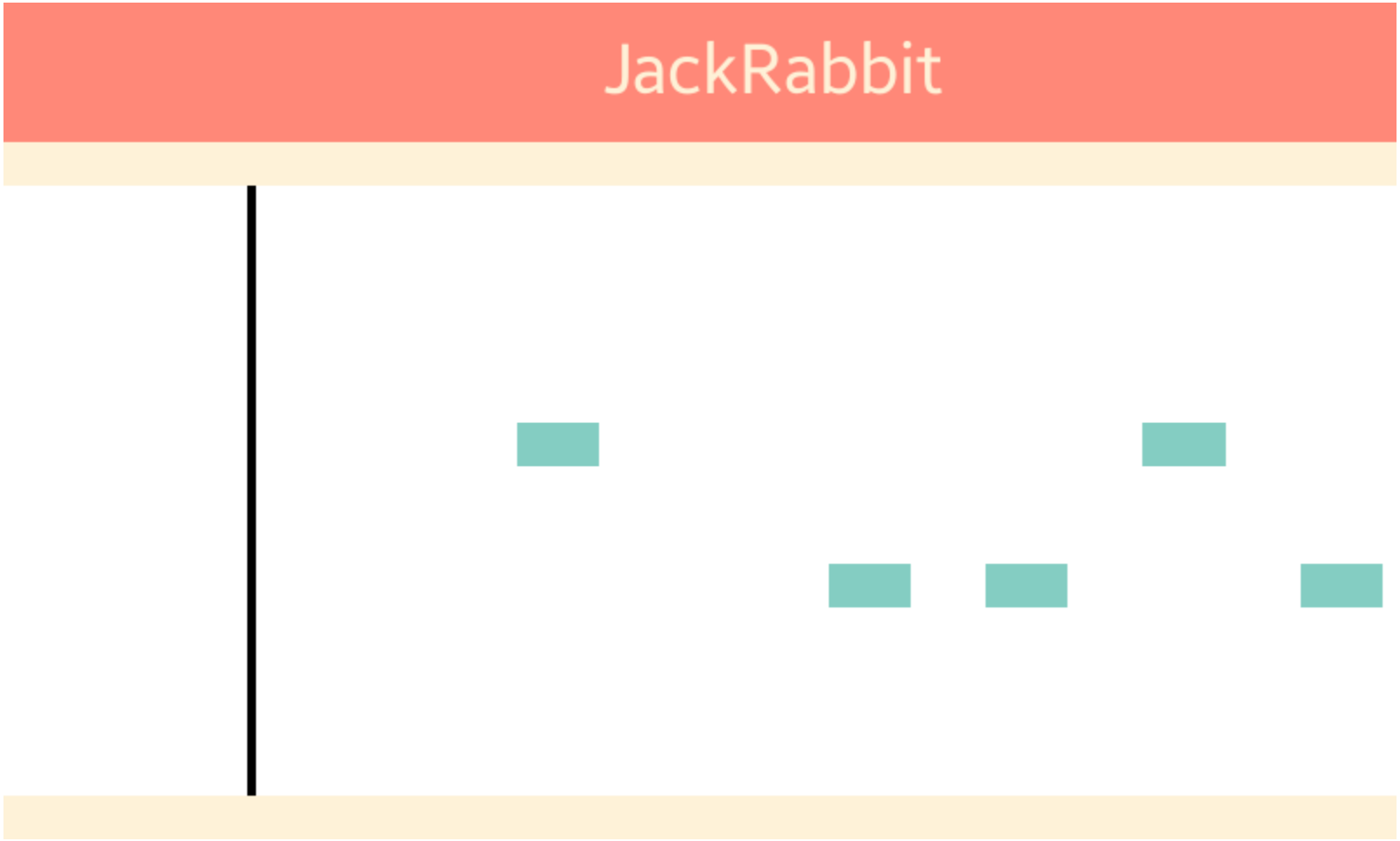
Music List

JackRabbit

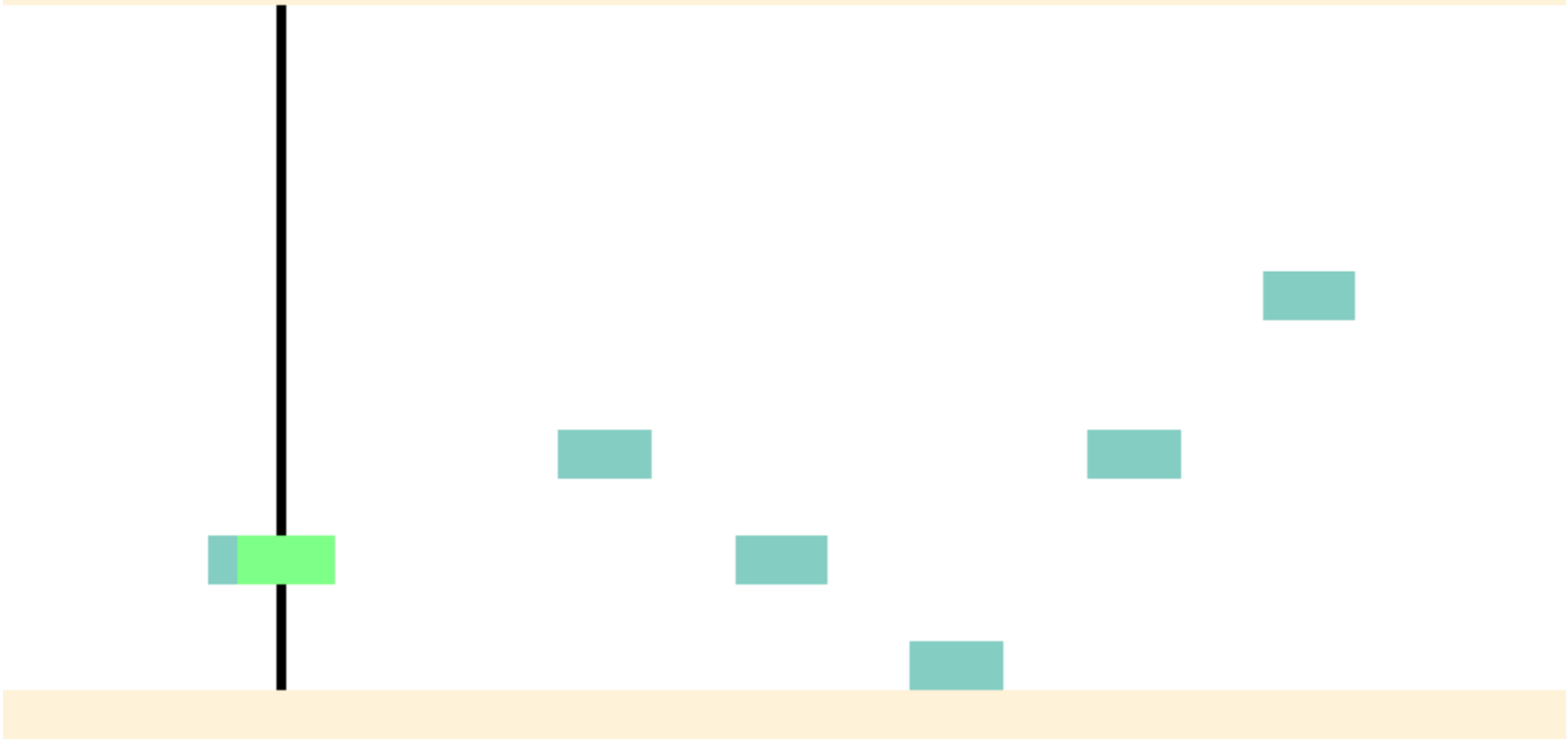
spaceTrain999

babyDinosaurDooly

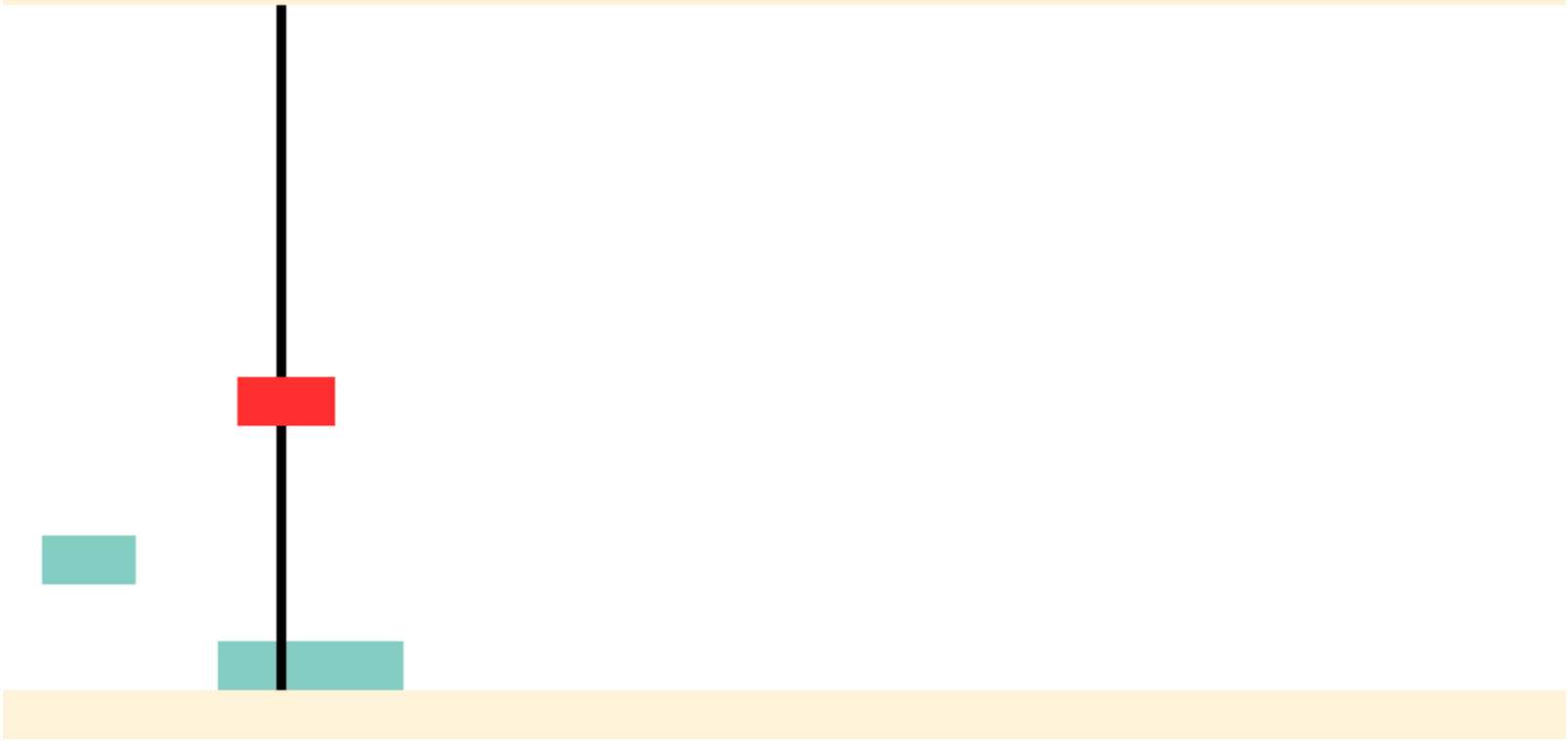
IslandBaby


JackRabbit

JackRabbit



JackRabbit



JackRabbit

Score : 33

B


Perfect Song
Correct Pitch
My Record
You can have the
absolute pitch
by using this function !
START!

Correct Pitch

LEVEL1

LEVEL2

LEVEL3

LEVEL4

Level3

Keep Note for 1sec!

Do#(C#3)

-

Level3

Keep Note for 1sec!

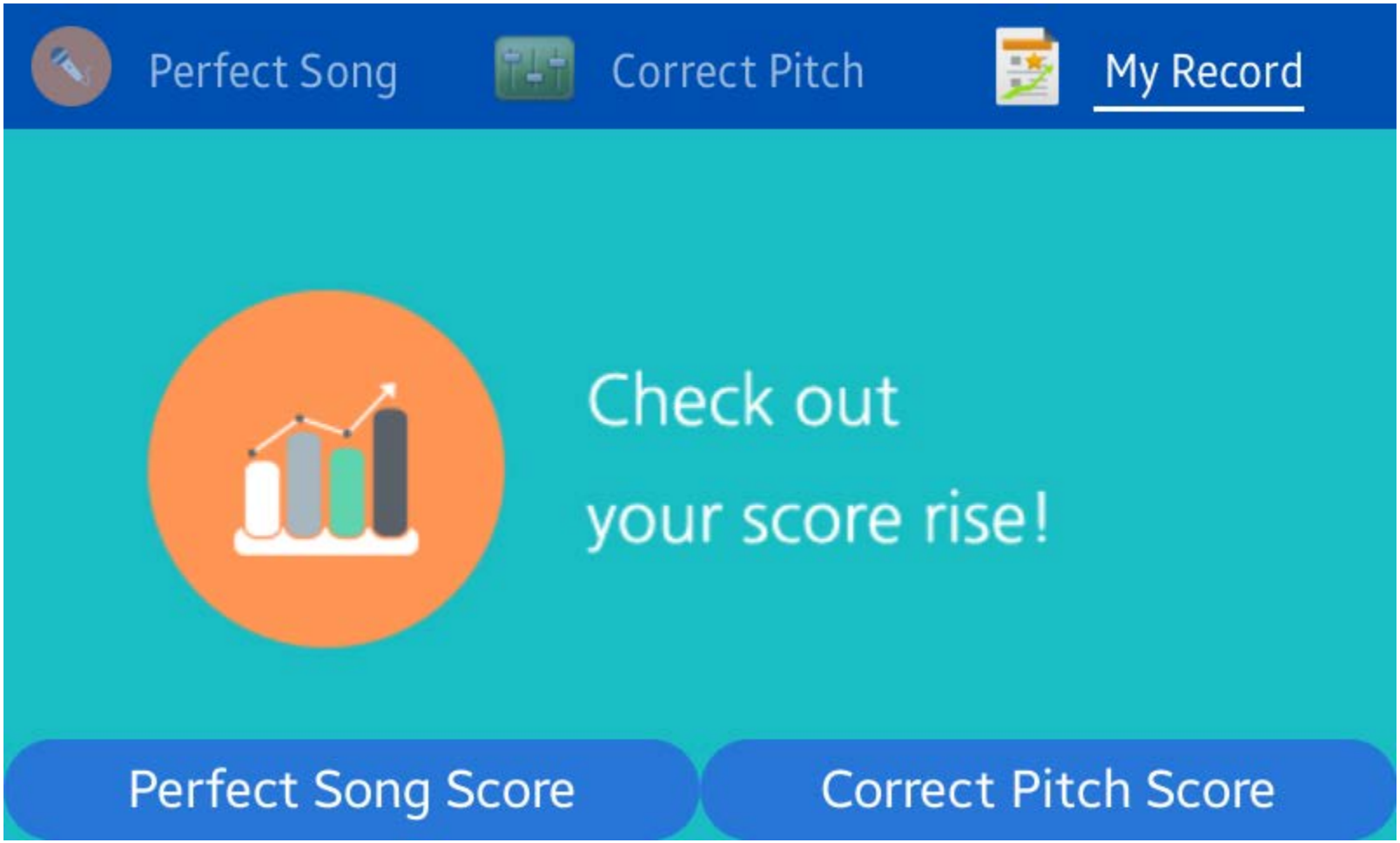
 Do#(C#3)

 Do(C3)

Level1

Clear!!!

Time : 45sec


Perfect Song
Correct Pitch
My Record
Check out
your score rise!
Perfect Song Score
Correct Pitch Score

Perfect Song Record

Recent

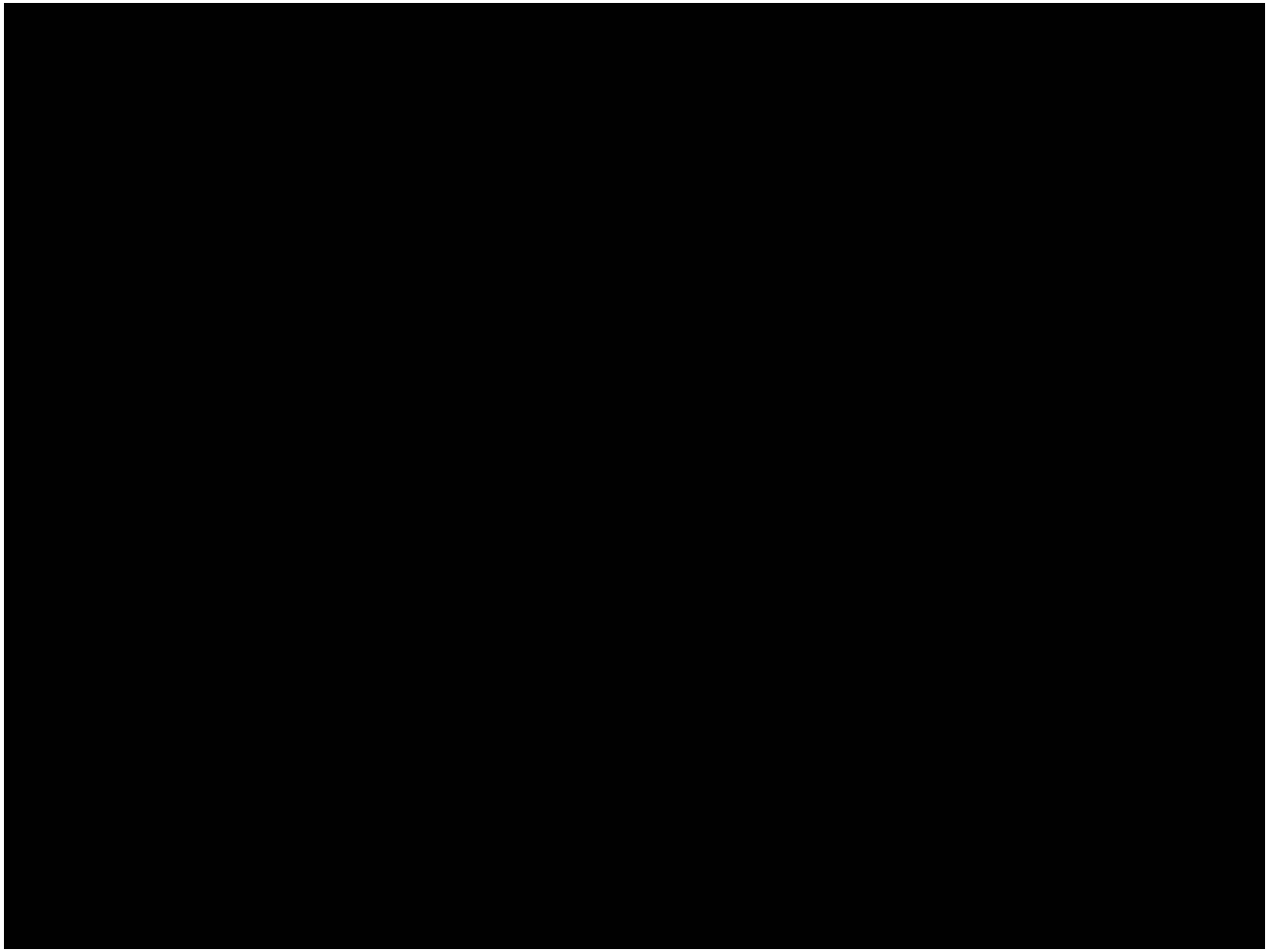
Music	Score	Grade
JackRabbi	9	F
JackRabbi	6	F
JackRabbi	33	B

High Score

Music	Score	Grade
IslandBaby	183	S

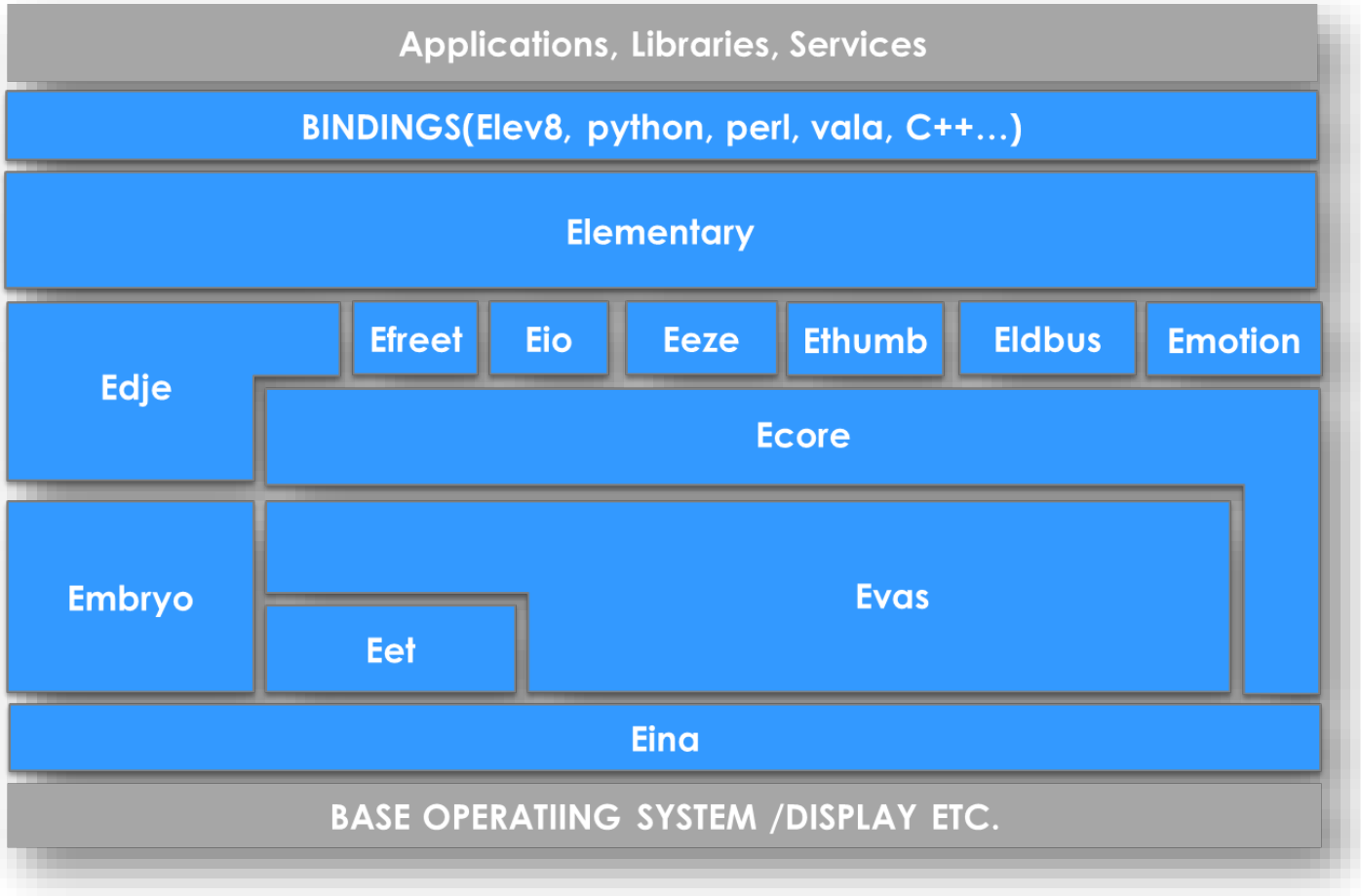
Correct Pitch Record

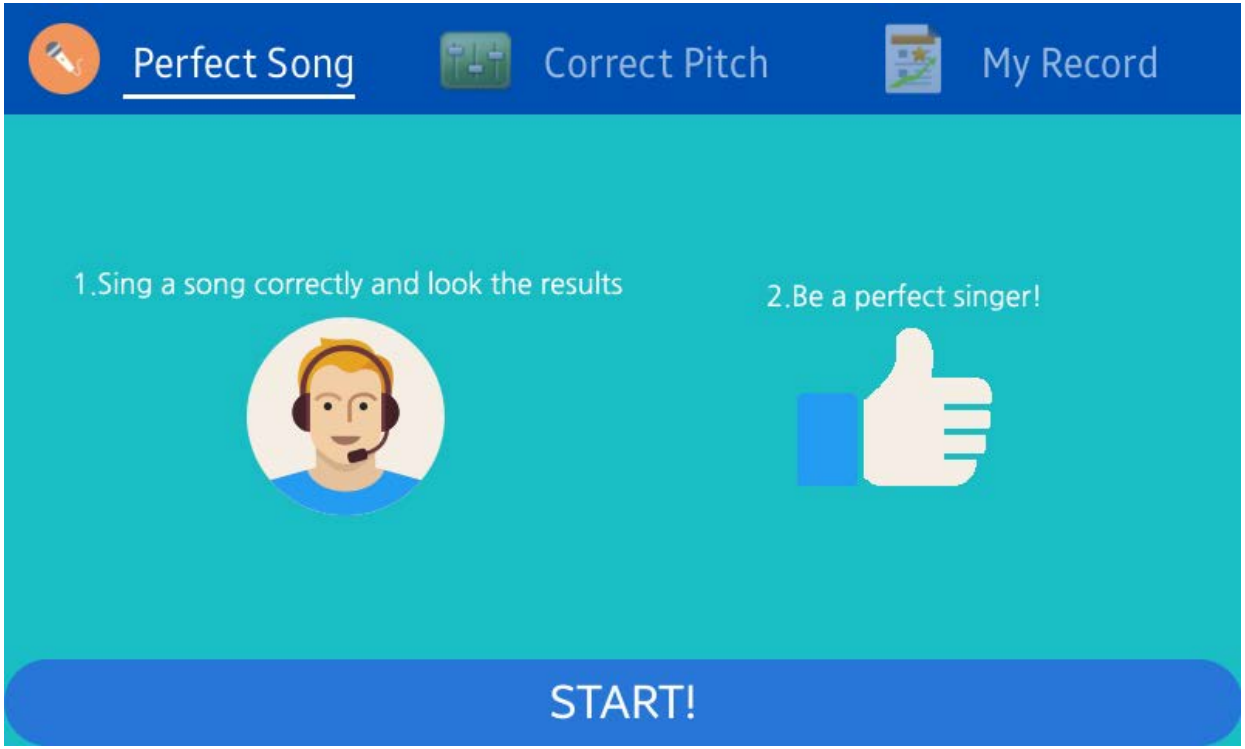
LEVEL1	13 sec
LEVEL2	None
LEVEL3	None
LEVEL4	None
LEVEL5	42 sec



7條

UI


Applications, Libraries, Services
BINDINGS(Elev8, python, perl, vala, C++...)
Elementary
Edje
Efreet
Eio
Eeze
Ethumb
Eldbus
Emotion
Ecore
Embryo
Evas
Eet
Eina
BASE OPERATIING SYSTEM /DISPLAY ETC.


Perfect Song
Correct Pitch
My Record
1.Sing a song correctly and look the results
2.Be a perfect singer!
START!

Pitch Detection

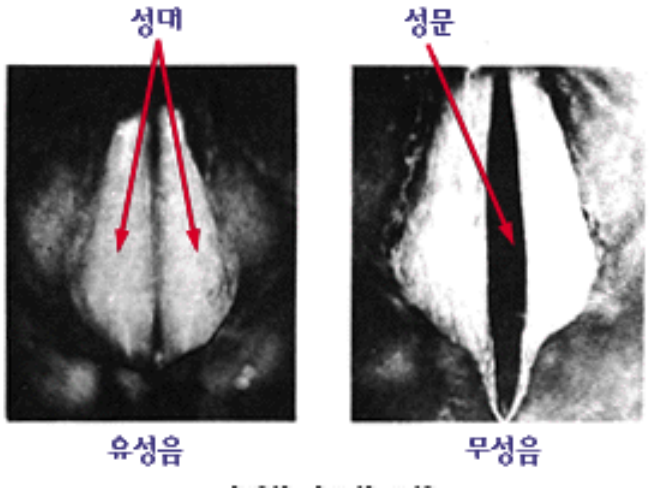
Pitch + Energy

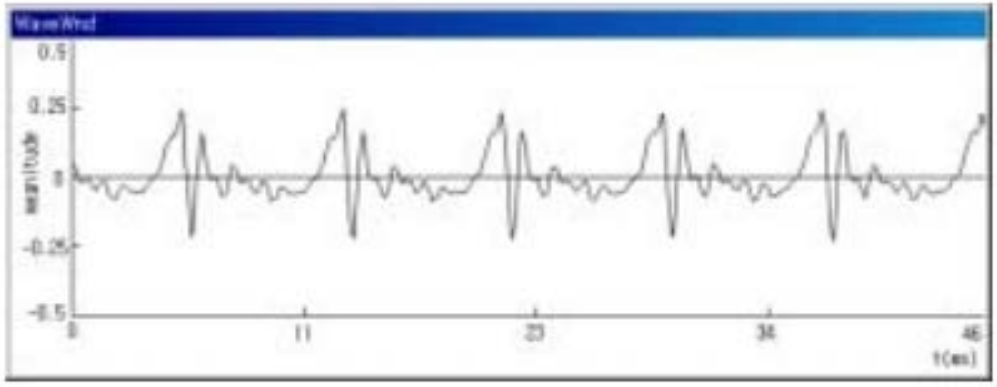
Voiced sounds

성문이 거의 닫힌 상태에서 얇은 막의 두 성대가 진동하며 만들어지는 음

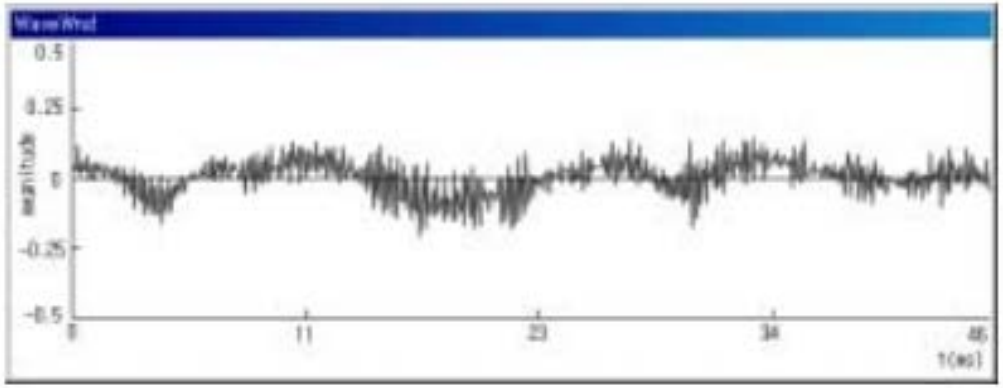
Voiceless sounds

성문이 열려져서 성대가 진동하지 않는 음





Voiced sounds

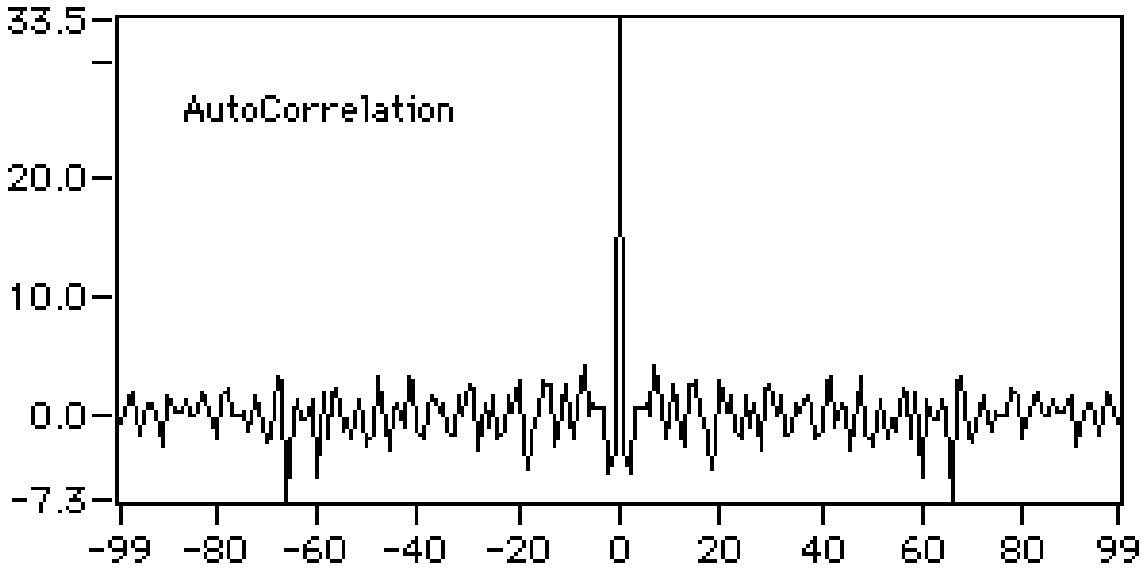


Voiceless sounds

Average Magnitude Differential Function

Cepstrum

Autocorrelation Function


AutoCorrelation
33.5
20.0
10.0
0.0
-7.3
-99
-80
-60
-40
-20
0
20
40
60
80
99

Pitch Detect System Block

1. Input Speech Signal

2. Voiced/Voiceless Decision
   - Short Time Energy, Zero Crossing Rate

3. Pre-Processing
   - Half Rectifier

4. Autocorrelation Function

5. Pitch Detection

Note	1	2	3	4	5	6	7	8
B	62	123	247	494	988	1976	3951	
A sharp/B flat	58	117	233	466	932	1865	3729	
A	55	110	220	440	880	1760	3520	
G sharp/A flat	52	104	208	415	831	1661	3322	
G	49	98	196	392	784	1568	3136	
F sharp/G flat	46	92	185	370	740	1480	2960	
F	44	87	175	349	698	1397	2794	
E	41	82	165	330	659	1319	2637	
D sharp/E flat	39	78	156	311	622	1245	2489	4978
D	37	73	147	294	587	1175	2349	4698
C sharp/D flat	35	69	139	277	554	1109	2217	4434
C	33	65	131	262	523	1047	2093	4186

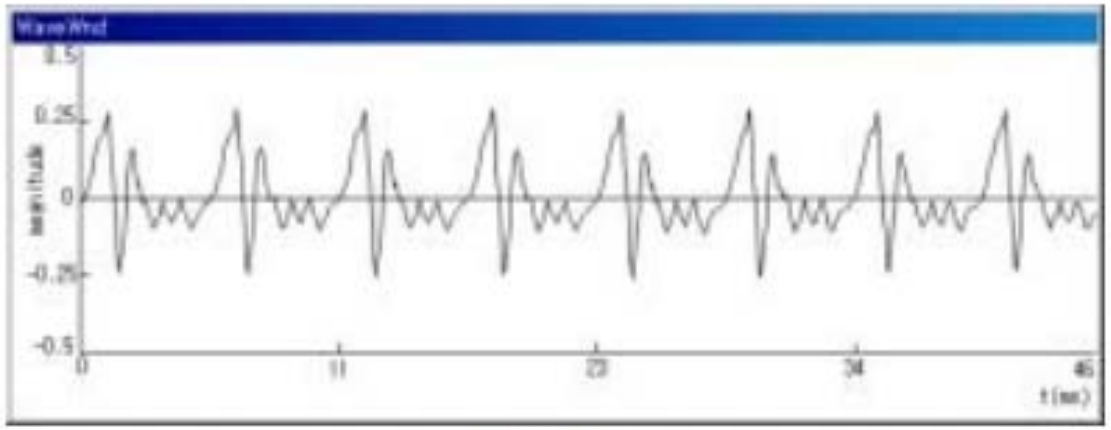
27 ~ 3951 Hz
(C1 ~ B7)
Lookup table

1 / Sampling Rate * sample = N ms

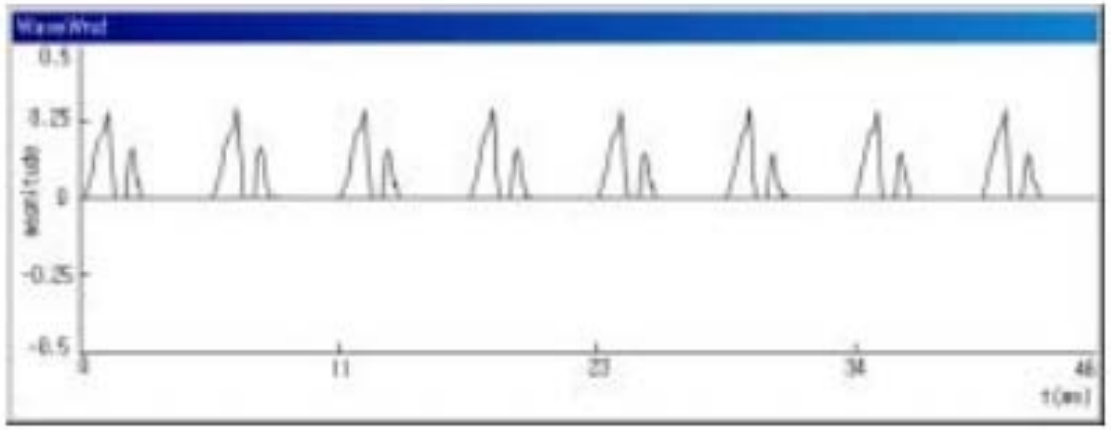
Sampling rate / Frame window size	8000Hz	11025Hz	22050Hz
256 sample	32ms	23.22ms	11.61ms
512 sample	64ms	46.44ms	23.22ms
1024 sample	128ms	92.88ms	46.44ms
2048 sample	256ms	183.04ms	92.88ms

16bit mono
11025Hz (5012Hz via Nyquist Theory)
2048sample (185ms)
Overlapping 50%

Half Rectifier

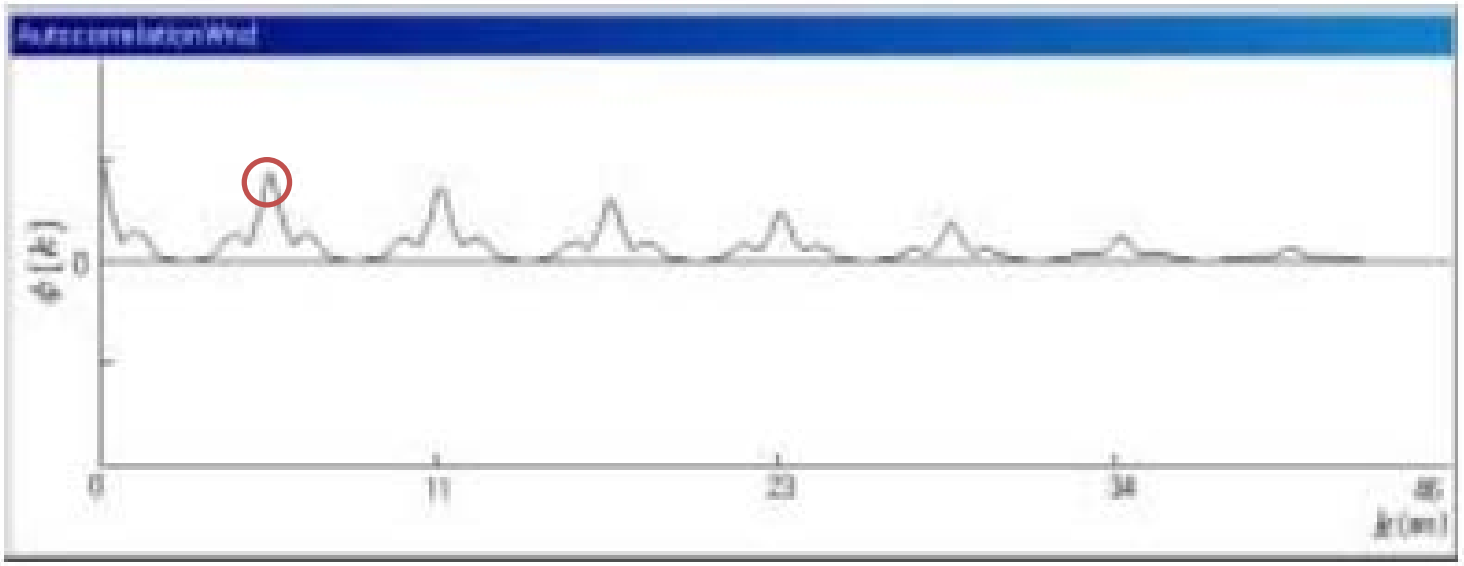


(a)음성신호

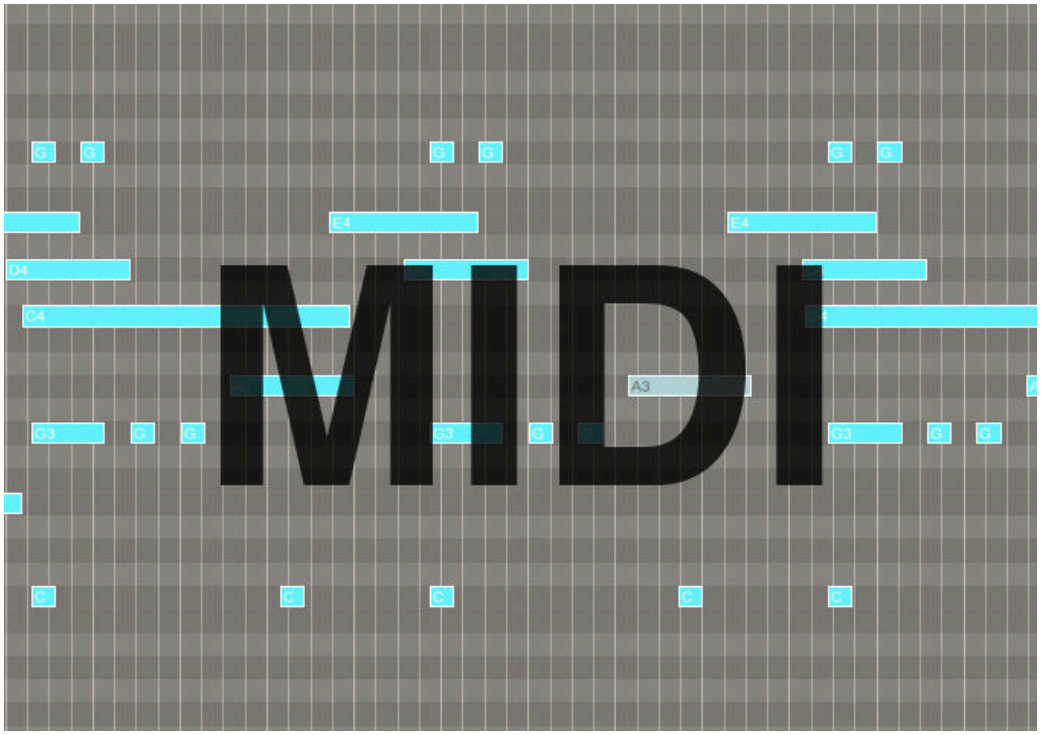


(b)반파정류 신호

Half Rectifier



MIDI



MIDI(Music Instrument Digital Interface)

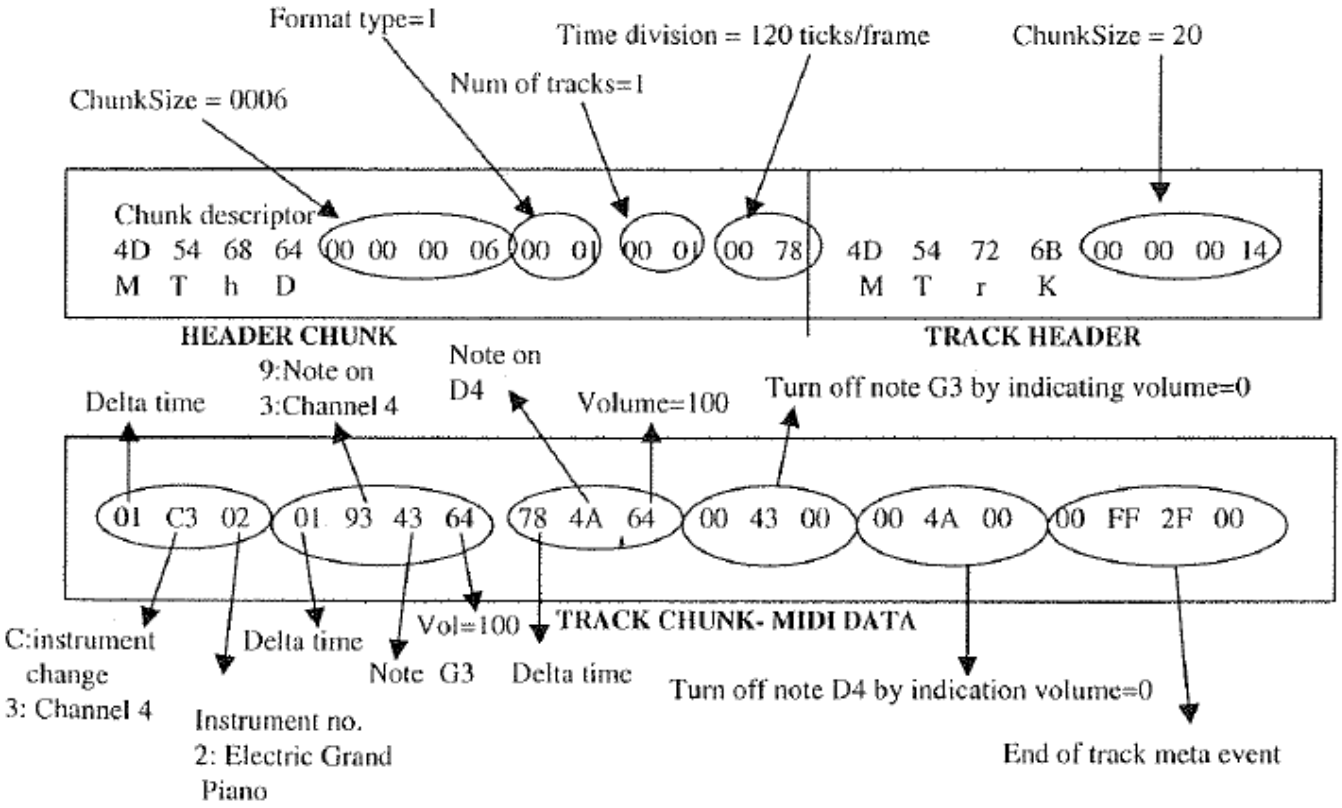


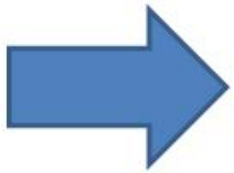
Figure 2.12. Explanation of the MIDI file in Example 2.2.

a.mid

```
Offset(h)  00 01 02 03 04 05 06 07 08 09 0A 0B 0C 0D 0E 0F

00000000   4D 54 68 64 00 00 00 06 00 01 00 14 00 C0 4D 54  MThd.........ÀMT
00000010   72 6B 00 00 00 B9 00 FF 03 22 B4 D9 BA F1 C4 A1  rk...¹.ÿ."´Ù°ñÄ¡
00000020   2D 38 32 38 32 28 BB A1 B8 AE BB A1 B8 AE 29 20  -8282(»¡¸®»¡¸®)
00000030   66 6F 72 20 53 43 38 38 20 50 72 6F 00 FF 02 37  for SC88 Pro.ÿ.7
00000040   43 6F 70 79 72 69 67 68 74 20 A8 CF 20 32 30 30  Copyright ¨Ï 200
00000050   39 20 62 79 20 C1 F1 B1 E2 BC BC BF E4 2E BB FD  9 by Áñ±â¼¼¿ä.»ý
00000060   C8 B0 C0 C7 C7 CF B7 E7 20 3A 3A 20 B3 D7 C0 CC  È°ÀÇÇÏ·ç :: ³×ÀÌ
00000070   B9 F6 20 C4 AB C6 E4 00 FF 01 20 47 65 6E 65 72  ¹ö Ä«Æä.ÿ. Gener
00000080   61 74 65 64 20 62 79 20 4E 6F 74 65 57 6F 72 74  ated by NoteWort
00000090   68 79 20 43 6F 6D 70 6F 73 65 72 00 FF 51 03 06  hy Composer.ÿQ..
000000A0   66 FC 00 FF 58 04 04 02 18 08 BC 00 FF 51 03 0B  fü.ÿX.....¼.ÿQ..
000000B0   71 B0 C8 00 FF 51 03 06 66 FC 81 96 00 FF 51 03  q°È.ÿQ..fü.-.ÿQ.
000000C0   0B 71 B0 C8 00 FF 51 03 06 66 FC 00 FF 2F 00 4D  .q°È.ÿQ..fü.ÿ/.M
000000D0   54 72 6B 00 00 0D 52 00 FF 21 01 00 00 FF 03 09  Trk...R.ÿ!...ÿ..
000000E0   41 30 31 2D 46 6C 75 74 65 00 C0 49 00 B0 07 64  A01-Flute.ÀI.°.d
000000F0   00 B0 0A 40 00 B0 5E 00 BC 60 90 39 6E 5E 90 39  .°.@.°^.¼`.9n^.9
00000100   00 02 90 3E 6E 5E 90 3E 00 02 90 40 6E 5E 90 40  ...>n^.>...@n^.@
00000110   00 02 90 42 6E 5E 90 42 00 02 90 40 6E 5E 90 40  ...Bn^.B...@n^.@
00000120   00 02 90 3E 6E 5E 90 3E 00 02 90 40 6E 5E 90 40  ...>n^.>...@n^.@
00000130   00 62 90 39 6E 5E 90 39 00 02 90 3D 6E 5E 90 3D  .b.9n^.9...=n^.=
00000140   00 02 90 3E 6E 5E 90 3E 00 02 90 40 6E 5E 90 40  ...>n^.>...@n^.@
00000150   00 02 90 3E 6E 5E 90 3E 00 02 90 3D 6E 5E 90 3D  ...>n^.>...=n^.=
00000160   00 02 90 3E 6E 5E 90 3E 00 62 90 36 6E 5E 90 36  ...>n^.>.b.6n^.6
00000170   00 02 90 3B 6E 5E 90 3B 00 02 90 3D 6E 5E 90 3D  ...;n^.;...=n^.=
00000180   00 02 90 3E 6E 5E 90 3E 00 02 90 3D 6E 5E 90 3D  ...>n^.>...=n^.=
00000190   00 02 90 3B 6E 5E 90 3B 00 02 90 39 6E 5E 90 39  ...;n^.;...9n^.9
000001A0   00 02 90 3B 6E 5E 90 3B 00 02 90 3E 6E 5E 90 3E  ...;n^.;...>n^.>
000001B0   00 62 90 39 6E 2E 90 39 00 02 90 39 6E 2E 90 39  .b.9n..9...9n..9
000001C0   00 02 90 40 6E 5E 90 40 00 02 90 40 6E 81 3E 90  ...@n^.@...@n.>.
```

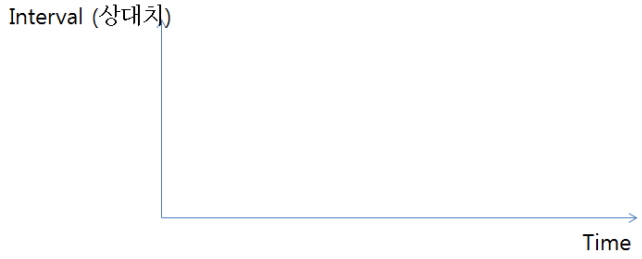
```
0 FF 58 0004 04 02 18 08
0 FF 59 0002 00 00
0 FF 51 0003 00 00 18
0 B0 01 79 00
0 C0 01 0B
0 B0 01 07 64
0 B0 01 0A 40
0 B0 01 5B 00
0 B0 01 5D 00
0 FF 21 0001 00
3840 90 01 4F 74
4079 90 01 4F 00
4320 90 01 4C 74
4559 90 01 4C 00
4560 90 01 4C 74
4799 90 01 4C 00
4800 90 01 4F 74
5039 90 01 4F 00
5040 90 01 4C 74
5279 90 01 4C 00
5280 90 01 48 74
5519 90 01 48 00
5760 90 01 4A 74
5999 90 01 4A 00
6240 90 01 4C 74
6479 90 01 4C 00
6480 90 01 4A 74
6719 90 01 4A 00
```



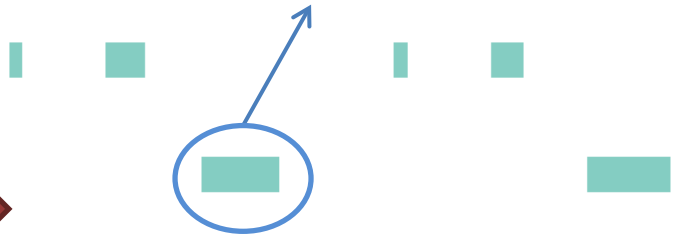
```
시간 : 0.001250, Tick : 0, Tempo : 600000, 음정 : 0, 세기 : 0
시간 : 0.000000, Tick : 0, Tempo : 600000, 음정 : 121, 세기 : 0
시간 : 0.000000, Tick : 0, Tempo : 600000, 음정 : 11, 세기 : -1
시간 : 0.000000, Tick : 0, Tempo : 600000, 음정 : 7, 세기 : 100
시간 : 0.000000, Tick : 0, Tempo : 600000, 음정 : 10, 세기 : 64
시간 : 0.000000, Tick : 0, Tempo : 600000, 음정 : 91, 세기 : 0
시간 : 0.000000, Tick : 0, Tempo : 600000, 음정 : 93, 세기 : 0
시간 : 4.800000, Tick : 3840, Tempo : 600000, 음정 : 79, 세기 : 116
시간 : 5.098750, Tick : 4079, Tempo : 600000, 음정 : 79, 세기 : 0
시간 : 5.400000, Tick : 4320, Tempo : 600000, 음정 : 76, 세기 : 116
시간 : 5.698750, Tick : 4559, Tempo : 600000, 음정 : 76, 세기 : 0
시간 : 5.700000, Tick : 4560, Tempo : 600000, 음정 : 76, 세기 : 116
시간 : 5.998750, Tick : 4799, Tempo : 600000, 음정 : 76, 세기 : 0
시간 : 6.000000, Tick : 4800, Tempo : 600000, 음정 : 79, 세기 : 116
시간 : 6.298750, Tick : 5039, Tempo : 600000, 음정 : 79, 세기 : 0
시간 : 6.300000, Tick : 5040, Tempo : 600000, 음정 : 76, 세기 : 116
시간 : 6.598750, Tick : 5279, Tempo : 600000, 음정 : 76, 세기 : 0
시간 : 6.600000, Tick : 5280, Tempo : 600000, 음정 : 72, 세기 : 116
시간 : 6.898750, Tick : 5519, Tempo : 600000, 음정 : 72, 세기 : 0
시간 : 7.200000, Tick : 5760, Tempo : 600000, 음정 : 74, 세기 : 116
시간 : 7.498750, Tick : 5999, Tempo : 600000, 음정 : 74, 세기 : 0
시간 : 7.800000, Tick : 6240, Tempo : 600000, 음정 : 76, 세기 : 116
시간 : 8.098750, Tick : 6479, Tempo : 600000, 음정 : 76, 세기 : 0
시간 : 8.100000, Tick : 6480, Tempo : 600000, 음정 : 74, 세기 : 116
시간 : 8.398750, Tick : 6719, Tempo : 600000, 음정 : 74, 세기 : 0
```

ThreeBears

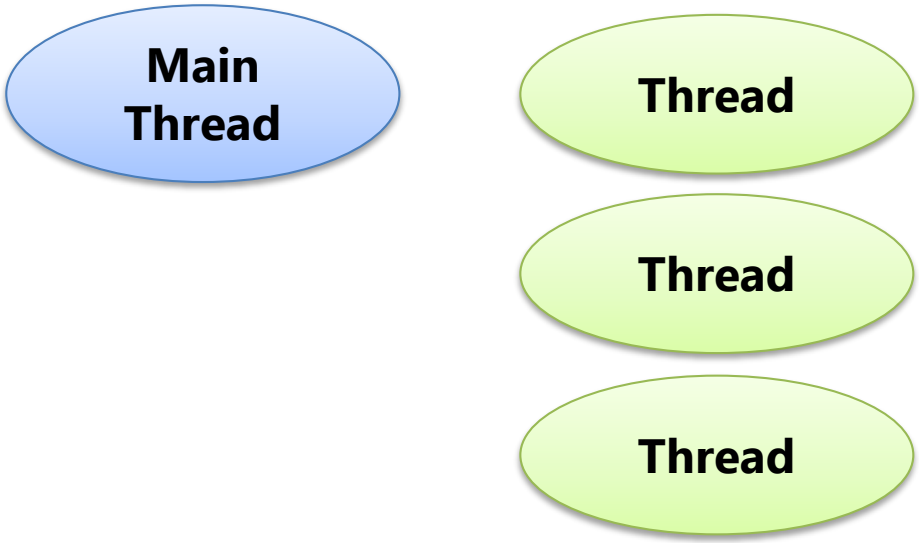
Time : 11.666662, Tick : 5376, Tempo : 833333, Interval *: 71, Power : 84*
Time : 11.710065, Tick : 5396, Tempo : 833333, Interval *: 71, Power : 0*
Time : 11.770829, Tick : 5424, Tempo : 833333, Interval *: 71, Power : 84*
Time : 11.814231, Tick : 5444, Tempo : 833333, Interval *: 71, Power : 0*
Time : 11.874995, Tick : 5472, Tempo : 833333, Interval *: 71, Power : 84*
Time : 11.918398, Tick : 5492, Tempo : 833333, Interval *: 71, Power : 0*



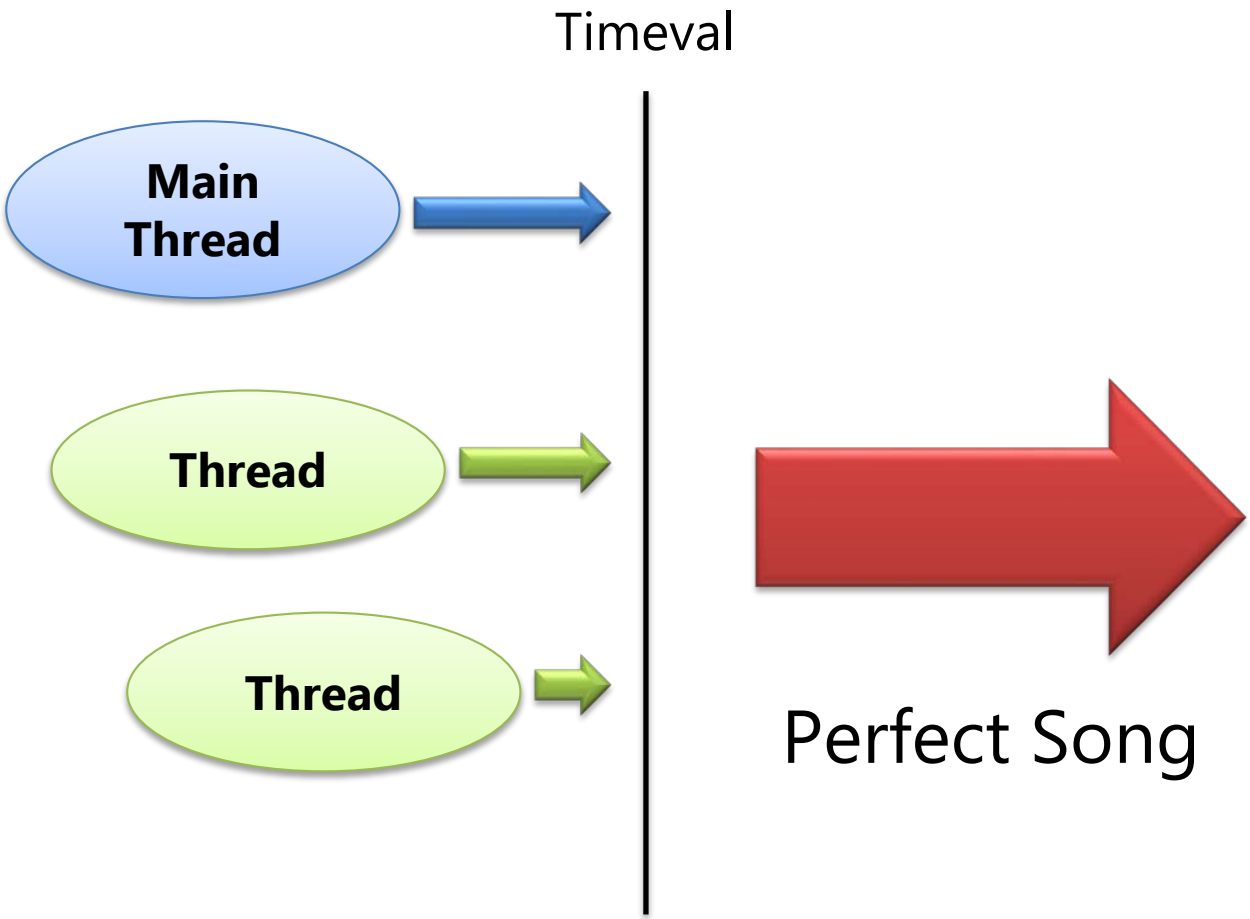
분석된 음 Note



Sync



Synchronization


Timeval
Main Thread
Thread
Thread
Perfect Song

향후계획

- 사용자 **MIDI** 파일 등록
- **SNS**나 서버를 이용한 랭킹시스템 및 파일 공유
- 사용자 맞춤 교정 기능

Q & A

Thank You