ENSC 351 - Fall 2023

Embedded and Real-Time System Software

Group name: Guanyu Li's Group

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System Explanation:

A device that functions as both an alarm clock and a baby monitor, making life easier for parents. It detects the baby's cries at night using microphone hardware controlled by noise detection algorithms. The system can play soothing sounds or melodies if the baby becomes agitated. It also functions as an alarm configured to wake you up at optimal times based on the pre-set time or an ordinary digital clock as the default.

When the cry detection mode is on, the system monitors surrounding sound and determines whether it is from human talk, room noise, or babies' cries. The picture on the left shows the terminal difference between babies' cries detected and detecting mode. The picture on the right shows the BBG playing soothing music when babies' cries are detected. However, the detection module needs more trading samples for
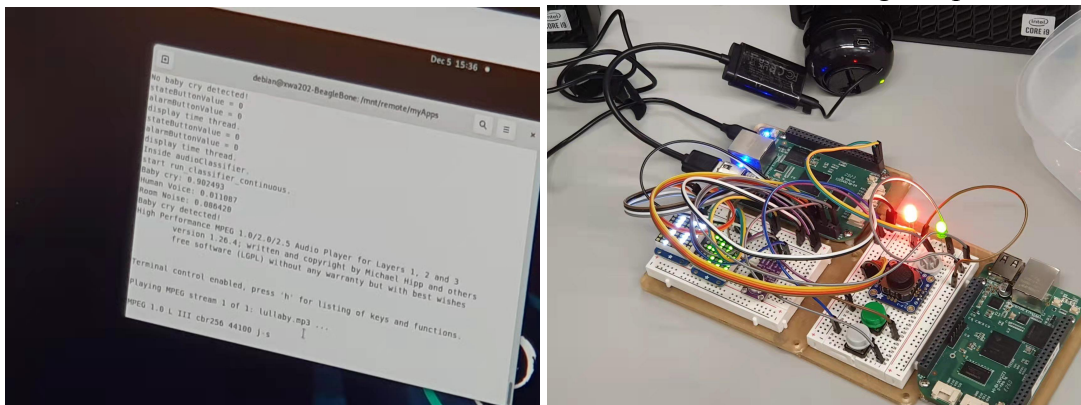
further enhancement. Furthermore, the detection accuracy greatly depended on the code downloaded from the server and the C++ to C code translation quality.

When pushing the(white button, the BBG switches to alarm mode. First, the BBG lets the user set the desired wake time shown on the left below. The picture on the right below shows the user selecting the time with the joystick. When pushing the green button, the green LED turns on and indicates the alarm is on. The green button can also be used to cancel the alarm.
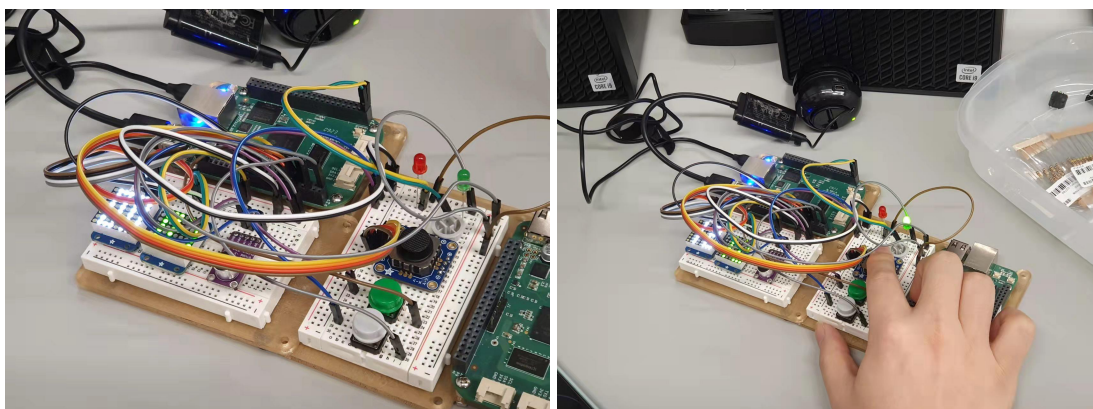
The alarm and time display modes worked as expected for the project. The possible error comes from the alarm playing time because the BBG must regularly check and update the time with the inner time seed. Otherwise, the program uses up too many resources from the CPU. Tuning the threshold can only minimize the problem instead of solving it.

Features Table:

Description	Host / Target	Comp	Code	Author(s)	Notes
Cry Detection Algorithm	H	5	C/C++	Guanyu / Xin	Works but needs more data and machine learning knowledge for enhancement
Time Update	H	5	C	Li-Yu	Get current Time
Microphone Receive	T	5	C	Xin / Matt	Receiving surrounding noise
JoyStick	T	5	C	Xin / Li-Yu / Guanyu	For Alarm Set
LED Matrices	T	5	C	Xin / Li-Yu / Guanyu / Matt	Display time on 8*8 LED Matrices
Buttons / LED	T	5	C	Xin / Matt	Set and indicate the program's mode
NFS Files / USE Port	T	5	C	Xin	Music Store and display
Alarm	H	5	C	Guanyu / Xin / Li-Yu	Play alarm at set time
Systems Integration	H	5	C	Guanyu / Xin	Functions Design

Extra Hardware & Software Used:

- MAX9814 Microphone
- USB Audio Player
- Machine Learning Server Code