BabyGuard

Wearable & Rich Featured
Baby Monitoring and Safety System

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What is the Problem?

This child, now 8 years old, never knew his real parents. He was a victim of kidnapping at only 1 year old after only 10 seconds of negligence by his parents.

Children missing/kidnapped each year

–200,000 kidnapped in China
http://www.dailymail.co.uk/news/article-2989404/Child-snatchers-abducting-200-000-boys-girls-openly-selling-online-10-000-kidnapping-epidemic-destroying-families-China.html

–800,000 missing in the USA
http://abcnews.go.com/US/missing-children-america-unsolved-cases/story?id=19126967

Now thanks to IoT, BabyGuard can provide an alarm, at the most critical moment.

It will cover other dangers surrounding our children

What is the Problem? (Cont.)

- Burnt when playing fire
- Heatstroke when left alone in car in summer
- Fever
- Parent and baby cannot see/hear each other when far apart (Anxiety)

Current Solution and Constrain

- Product A- Wireless Baby Monitor (Vvcare-851)
  - Monitoring Ambient‘s Temperature / Bidirectional voice and video interaction
  - *Only works according to fixed camera location*

https://www.banggood.com/Vvcare-851-3_5-Inch-2_4GHz-Wireless-Baby-Monitor-TFT-LCD-Video-Night-Vision-2-way-Audio-Infant-Baby-p-1256151.html?rmmds=search&cur_warehouse=CN

- Product B- Mini Smart Finder (Digoo DG-KF30)
  - Wireless Anti-Lost Locator for Kids
  - *Limited Feature without interaction*
  - *Too small to be carried by baby and may lead to suffocate*

	Product A	Product B	BabyGuard
Ambient Temp.	X		X
Body Temp.			X
Camera	X		X
Interaction	X		X
Distance alarm		X	X
Wearable		X	X
Cost	US$74.33	US$ 4.71	To Be Confirmed

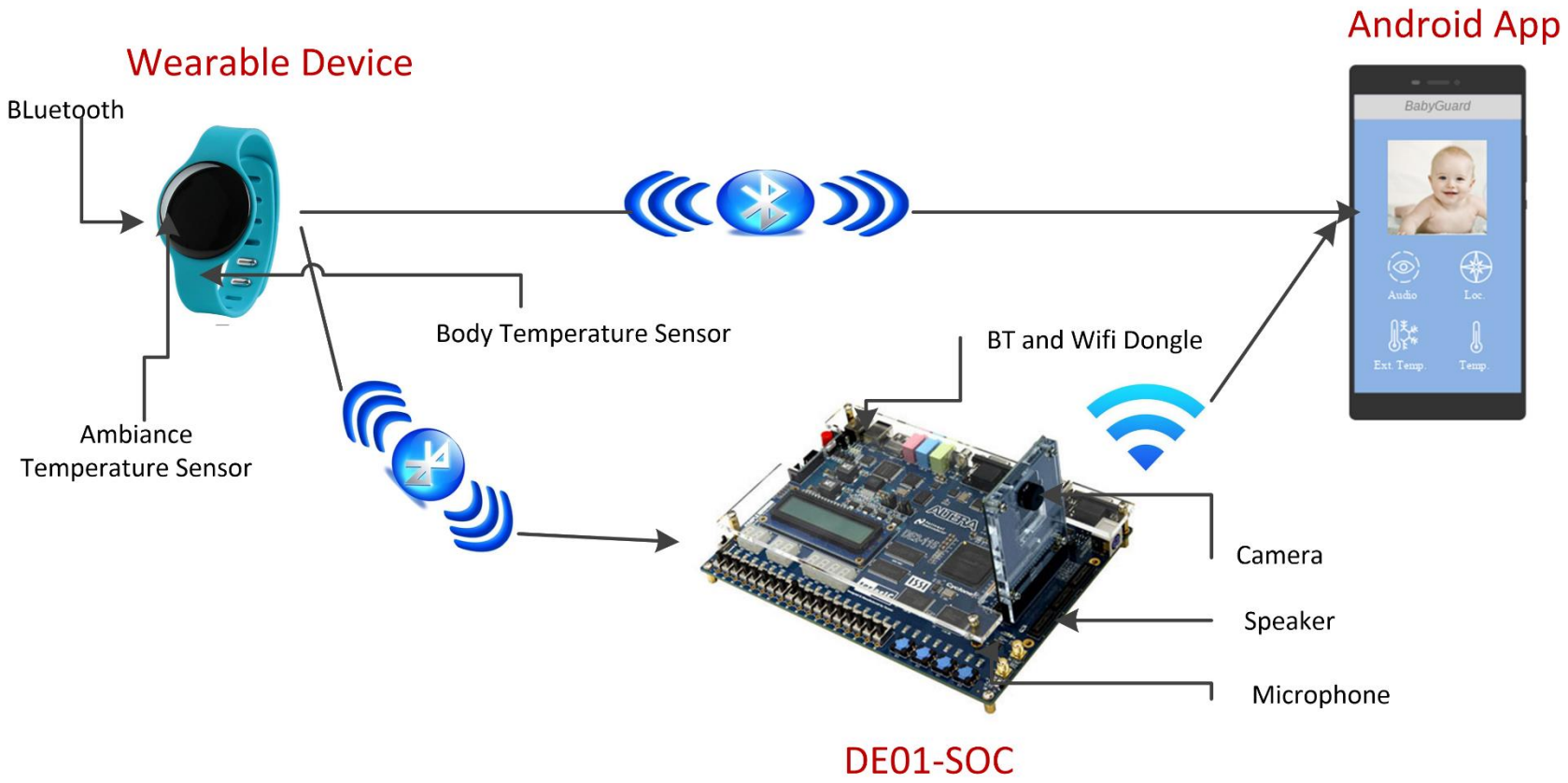
https://www.banggood.com/Digoo-DG-KF30-Mini-Smart-Finder-Wireless-Bluetooth-Alarm-Anti-Lost-Locator-Kid-Key-Phone-Tracker-p-1241224.html?rmmds=search&cur_warehouse=CN

Our Solution

The solution (BabyGuard) includes a small wearable and a Server.

- Wearable device connects and sends temperature data to mobile phone if connected, if not then checks connection with main server if not found then alarms.
- Wearable device connects main server and send temperature data periodically.
- Home server/base station connects to mobile app if available through Wifi and send gathered data.

Our Solution(Cont'd)



System Requirements - The Wearable

- The small wearable must have Bluetooth, and be pre-paired with smartphone(s) and DE1-SOC(s)
- The small wearable will connect a pre-paired smartphone if within 10 meters
- When the small wearable loses BT connection to all its pre-paired devices, alarms: Smartphone and the wearable both beep, and flash light on mobile app and with warning message
- Send temperature of baby's body & ambient to paired device (phone or DE1) every 2 seconds
- Smartphone alarms if baby's body temperature exceeds threshold 38 Celsius degree, or baby's ambient temperature exceeds 45 Celsius degree
- A small wearable can be worn on wrist
- Can be enclosed in a sleeve or covering so cannot be poked or swallowed

* Exact Numbers TBD

System Requirements - The DE1-SOC

- Can be fixed at home (one DE1 for one room)
- If the small wearable is not connected with phone, will connect the DE1 through Bluetooth within 10 meters
- On connection of the wearable, the DE1 will activate its camera/microphone and take video/audio, and connect pre-configured smartphone through WIFI
- DE1 will stream video/audio of baby to parent's smartphone in real-time
- The DE1 will forward temperature of baby's body & ambient to smartphone
- On parent's pressing on a button/menu on Smartphone, the phone will send real-time video/audio of parents to DE1
- The DE1 has screen/speaker, and will play received video/audio of parents

Solution Design

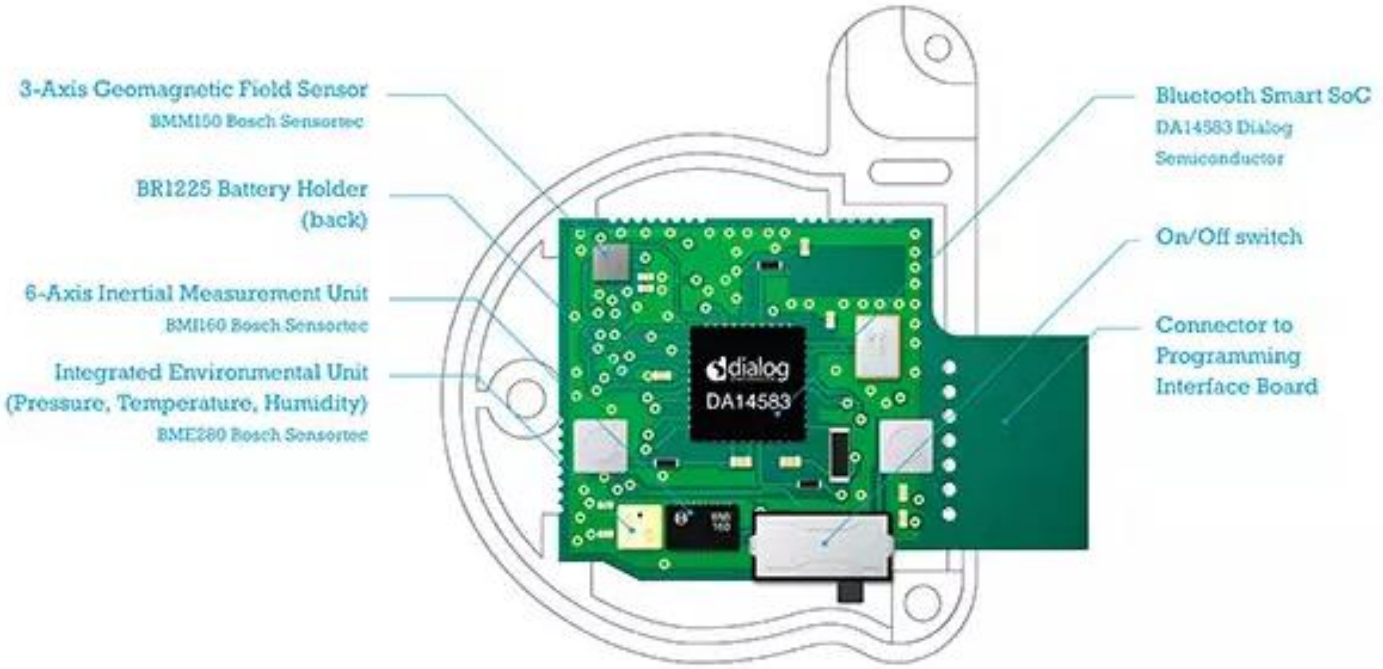
Detailed functionality of wearable device.

- Small and compact device worn on wrist or ankle.
- Connect via Bluetooth to the mobile phone or home server and transmits temperature data of the baby/ambience periodically(2s) to the mobile app or home server.
- Sends panic signals if baby or ambient temperature crosses threshold to the android app or home server.
- Alarms if Bluetooth connection broken with mobile phone and home server not reachable by **flashing light/sound*.

***Searching for devices with LED or Speaker**

Solution Design (Cont'd)

Detailed functionality of wearable device.



Solution Design (cont.)

Detailed functionality of home server

- Installed inside baby room and connects to wearable device via Bluetooth and to the mobile phone visa Wifi.
- Powerful with BT/WIFI/camera/microphone/screen/speaker
- When the wearable device connects the home server through Bluetooth, the server knows the baby is in this room, and activates its camera/microphone
- Server sends video/audio of baby to parent's smartphone (for example in other room/office) through WIFI
- Wearable device sends temperature of baby's body & ambient through Bluetooth to board, and the latter forwards to parent's smartphone through WIFI
- Smartphone sends video/audio of parents to board, which plays on screen and speaker to calm down baby

Argument for Feasibility

Proposed solution

- solves conflict between wearable and rich features
- through dividing into following 2 parts

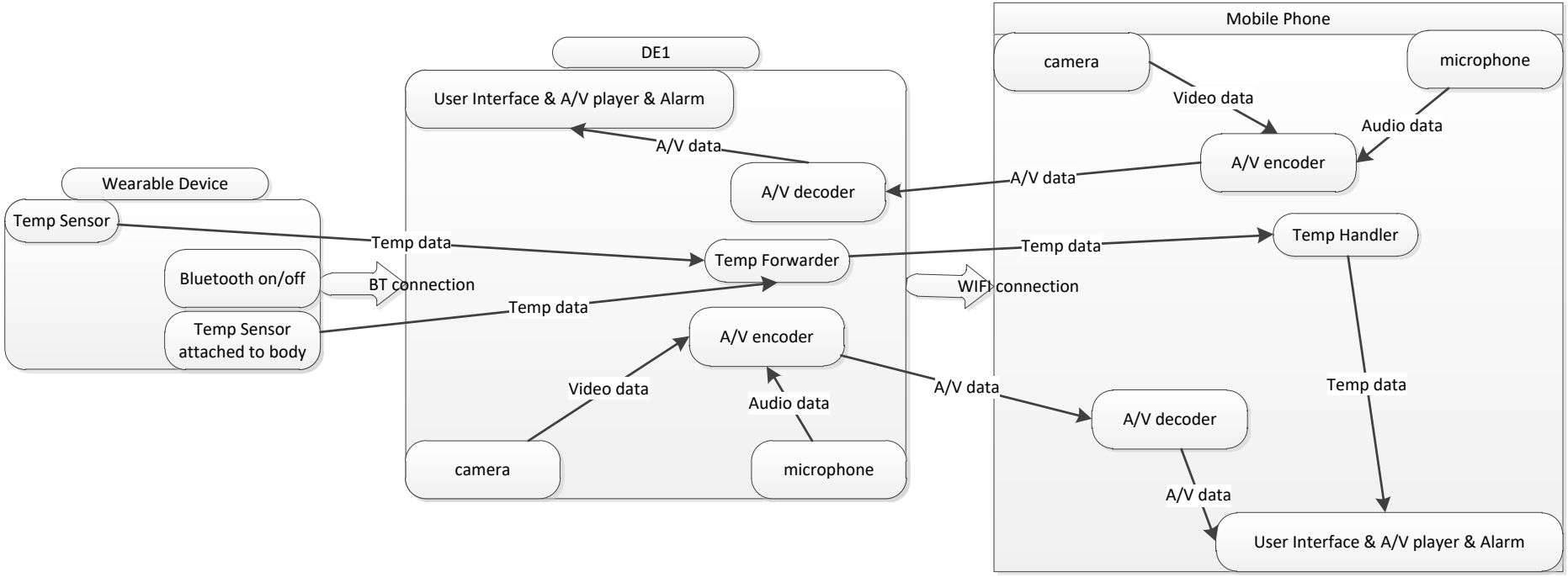
Wearable device

- Small and comfortable to wear
- Fewer sensors, needs smaller battery
- Safe with fewer sensors ruggedly attached and no loose ending parts
- Yet provides vital features: prevent baby missing or burnt/heatstroke

Home Server

- Interactive and always connected system
- Powerful, cover most features of other competitors
- can be extended to many new fancy ideas

Block Diagram (DE1)



- BT will transfer a dozen of bytes of temperature data every 2 seconds
- WIFI will transfer video @ 2.4Mb/s, and audio @ 128Kb/s for HD.
- https://www.adobe.com/devnet/adobe-media-server/articles/dynstream_live/popup.html

Hardware Selection

Below hardware components needed for the project.

Wearable device

Smart wearable wireless temperature sensor ➔ DigiKey Low Energy Bluetooth IoT sensor device.

Home server / base station

Powerful computer board DE01-SOC

Camera, microphone, speaker, LCD display, Bluetooth and Wifi dongle.

Android mobile phone

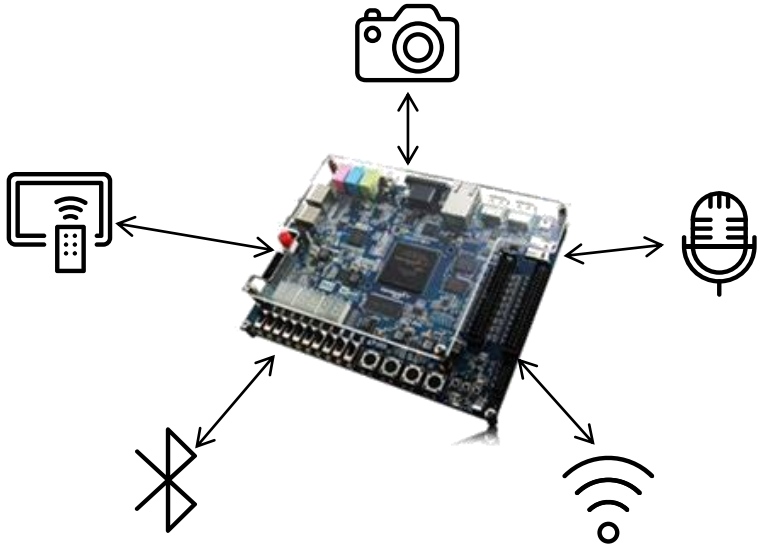
Sensors

Wearable device

- Temperature sensors
- Bluetooth connector

Home Server

- Camera
- Microphone
- Speaker
- LCD display
- Bluetooth/Wifi connectors

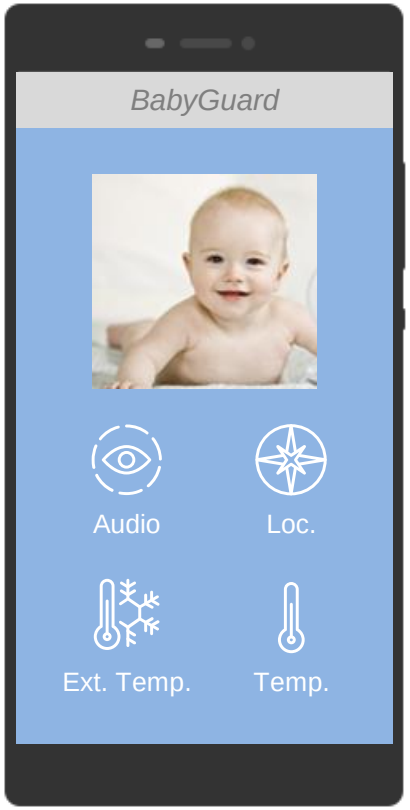


Camera/Audio/Video/Speaker on DE1

- Camera on DE1 pointing direct to the front
- On connection of the wearable, the DE1 will activate its camera/microphone and take video/audio
- On receiving video/audio from parents, the DE1 will play on its screen and speaker
- Extended through USB dangles

APP User Interface

- Android Application for Phone
- Display and/or Track Baby's Location
- 2-way Audio and Video Interaction via Phone
- Real-Time Interaction by Using Built-In Camera
- Allow for Notification of Body and Ambient Temperature



Challenges

Wearable device

- Miniaturizing the devices as small and compact as possible and water proofing.
- Error correction and distinguishing temperature sensor data before forwarding.
- Self issue detection like failure of any components and sensors.
- Auto Bluetooth connection priority first to home server and then to mobile phone.

Home Server

- Provide reliable connections between wearable and mobile device.
- Efficiently gather requested data and forward to mobile phone.
- Self issue detection like failure of any components and sensors.
- Powerful to multitask and respond efficiently.

Estimated Costs

Item	Estimated Cost
Bluetooth Dongles	¥100
Temp. Sensor	¥60
DigiKey Low Energy Bluetooth	¥200
DE-1 Board	Provided
Video Sensor	¥25
Audio Sensor	¥50
Android Device	¥2000 (Testing Purpose)
TOTAL COST	¥435 (US$70)

Distribution of Responsibilities

Tony

- DE1's BT/WIFI communication with other 2 devices
- Make sure the Bluetooth connection between DE1 and wearable doesn't raise a false alarm
- DE1 and its camera/microphone/screen/speaker development

Kiran

- Work on Hardware design
- Wearable device development, interfacing and programing
- Determine technical feasibility of the solution.

Yun Shi (Jackie)

- Establish connection detection among DE-1 board, wearable and phone
- Create mobile app that displays the monitoring status
- Implement a website to illustrate BabyGuard

Goals of MDR

- Establish connection between the wearable and laptop
- The wearable sends temperature data to laptop
- The laptop forwards temperature data to Smartphone
- Smartphone shows temperature data in GUI

(We use a laptop instead of the DE1 to ease development for MDR demo)