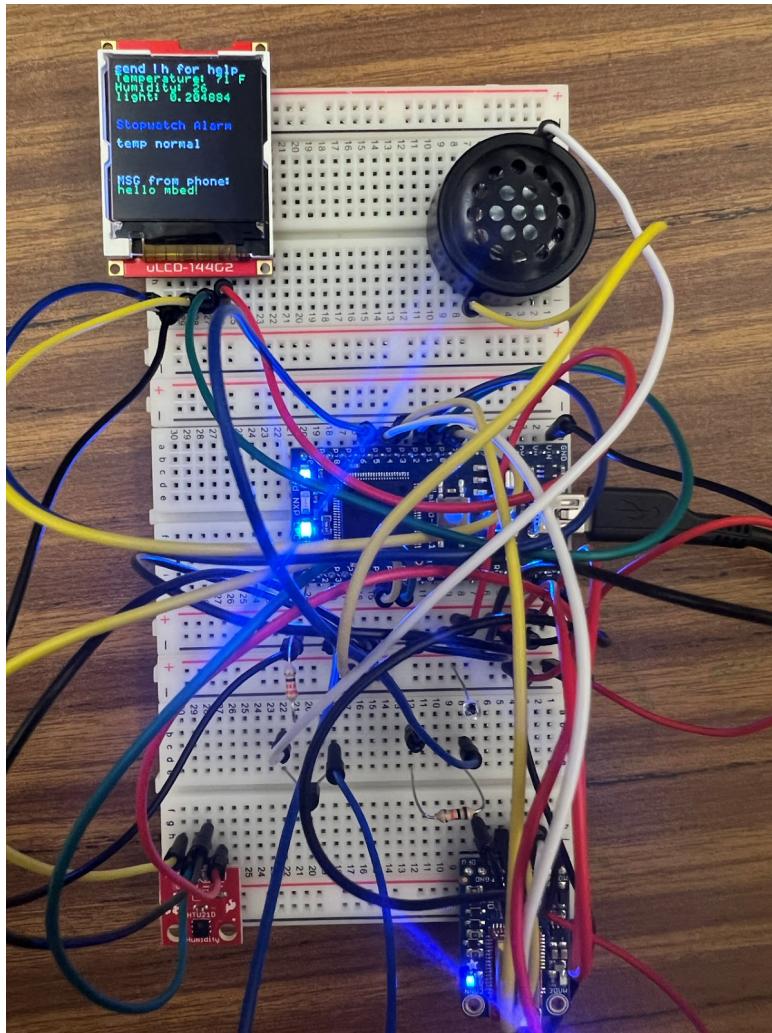


# Intelligent Home - IoT Embedded Systems

ECE 4180 Final Project

Team members: Kuai Fan, Yuchen Wang

Github: <https://github.com/ricejar/GT-ECE4180-Intelligent-Home>

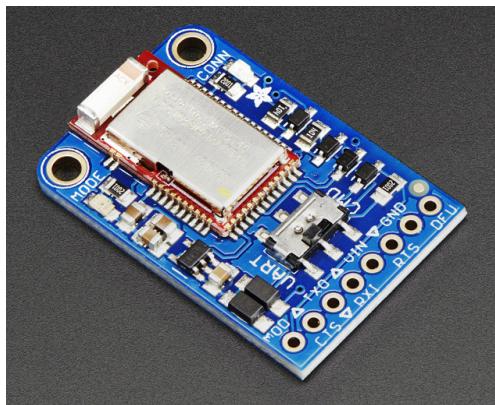


picture of the project

The project is purposed to provide a home use embedded system, which use sensor to gather indoor information, control components, through a bluetooth connection with cell phones. The purpose of the project is to improve living quality by providing and intelligent method to manage home use components. The mbed will use RTOS to manage data collection with sensors, control LED and speaker, receive and send data through bluetooth, and display information with an LCD screen. The function the team want to implement includes: temperature, humidity, light, remote data collection and control.

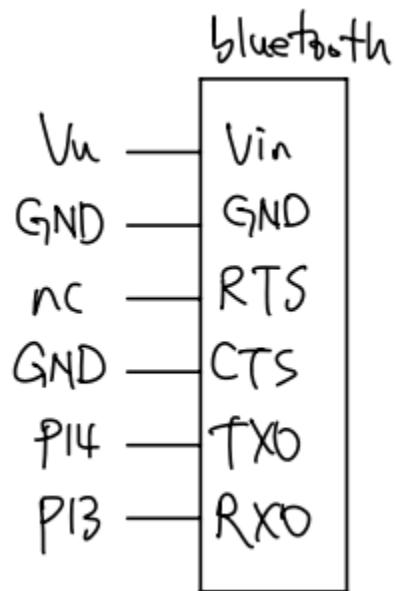
## Components:

## Bluetooth module:



The Bluefruit LE UART Friend makes it easy to add Bluetooth Low Energy connectivity to anything with a hardware or software serial port. This board is used for cell phone connection to transfer data to the mbed and sending commands from the user.

## Wiring:



### Product:

<https://www.adafruit.com/product/2479>

Wiki page:

[https://os.mbed.com/users/4180\\_1/notebook/adafruit-bluefruit-le-uart-friend---bluetooth-low-/](https://os.mbed.com/users/4180_1/notebook/adafruit-bluefruit-le-uart-friend---bluetooth-low-/)

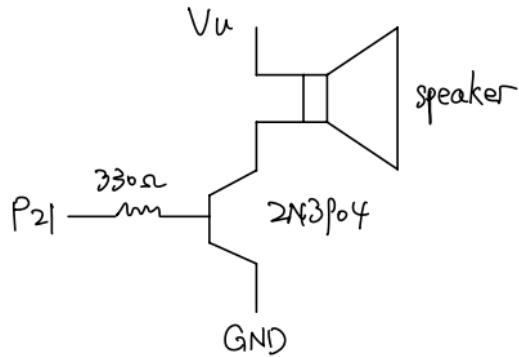
## Speaker:



Speaker - PCB Mount is a through-hole speaker is great for projects where you need something that sounds better than a piezo buzzer but don't have room for a full-blown speaker. This 30mm diameter speaker is encased in plastic and will handle about 100mW of power. The speaker is used to output alarm audio when high temperature detected or the user set a timer for an alarm.

## Wiring:

A BJT is used to amplify the current through the speaker, and a 330 ohm resistor is used to limit current from the mbed.



## Product:

<https://www.sparkfun.com/products/11089>

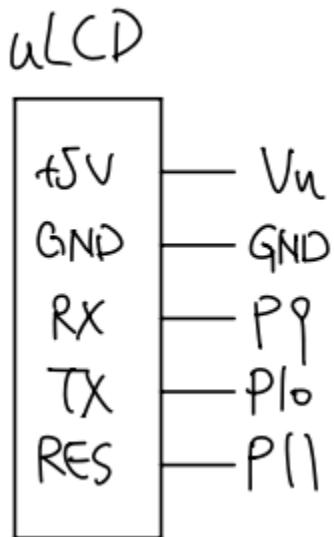
## Wiki page:

[https://mbed.org/users/4180\\_1/notebook/using-a-speaker-for-audio-output/](https://mbed.org/users/4180_1/notebook/using-a-speaker-for-audio-output/)

## uLCD:

The uLCD-144-G2 from 4D Systems is a low-cost (\$25 qty. 100) smart color LCD display board with a serial interface. It is used to display temperature, humidity, light, warning messages, and interactions between mbed and the user.

Wiring:



Product:

<https://www.sparkfun.com/products/11377>

Wiki page:

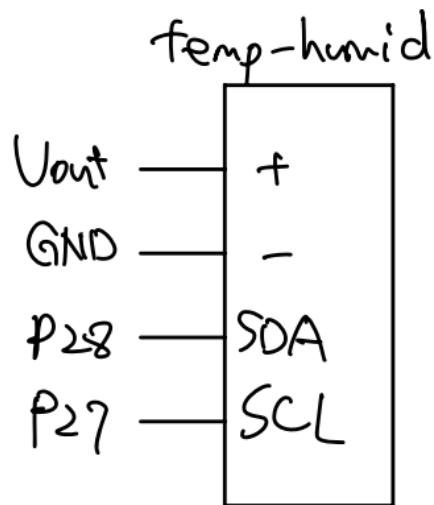
[https://os.mbed.com/users/4180\\_1/notebook/ulcd-144-g2-128-by-128-color-lcd/](https://os.mbed.com/users/4180_1/notebook/ulcd-144-g2-128-by-128-color-lcd/)

Temp-humid sensor:



The HTU21D is a low-cost, easy to use, highly accurate, digital humidity and temperature sensor. This sensor is ideal for environmental sensing and data logging and perfect for a weather stations or humidifier control systems. It is used to sense temperature and humidity through I2C protocol.

Wiring:



Product:

<https://www.sparkfun.com/products/retired/12064>

Wiki page:

<https://os.mbed.com/components/HTU21D-Temperature-and-Humidity-Sensor/>

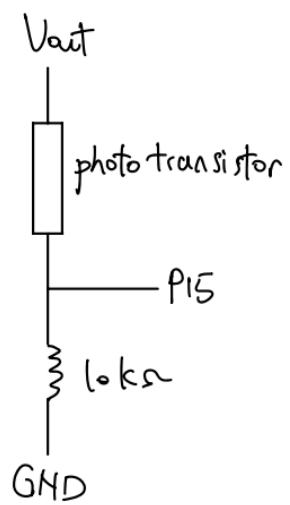
## Phototransistor:

A low-cost phototransistor in a through hole package can be used to determine different lighting levels in a room. The photocell seen below can cost under \$1.



Wiring:

The easiest way to hookup this device is to use a voltage divider circuit connected to an analog input pin. The resistance of the device changes based on the lighting level (light levels are measured in lux). This low cost device can measure approximate lighting levels and that is all that is needed in many applications.



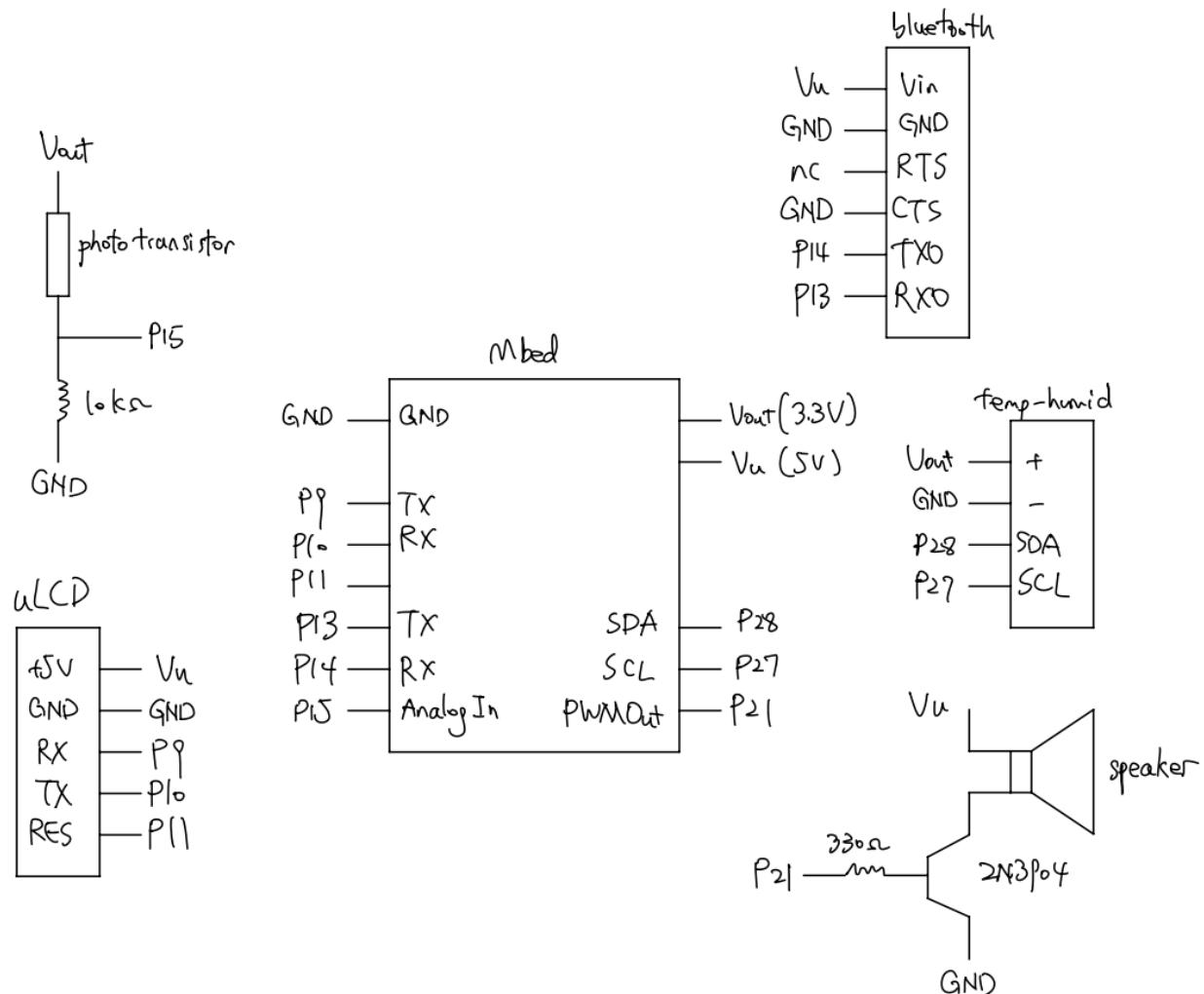
Product:

<https://www.amazon.com/HiLetgo-Phototransistor-Photosensitive-Sensitive-Sensors/dp/B00M1PMHO4>

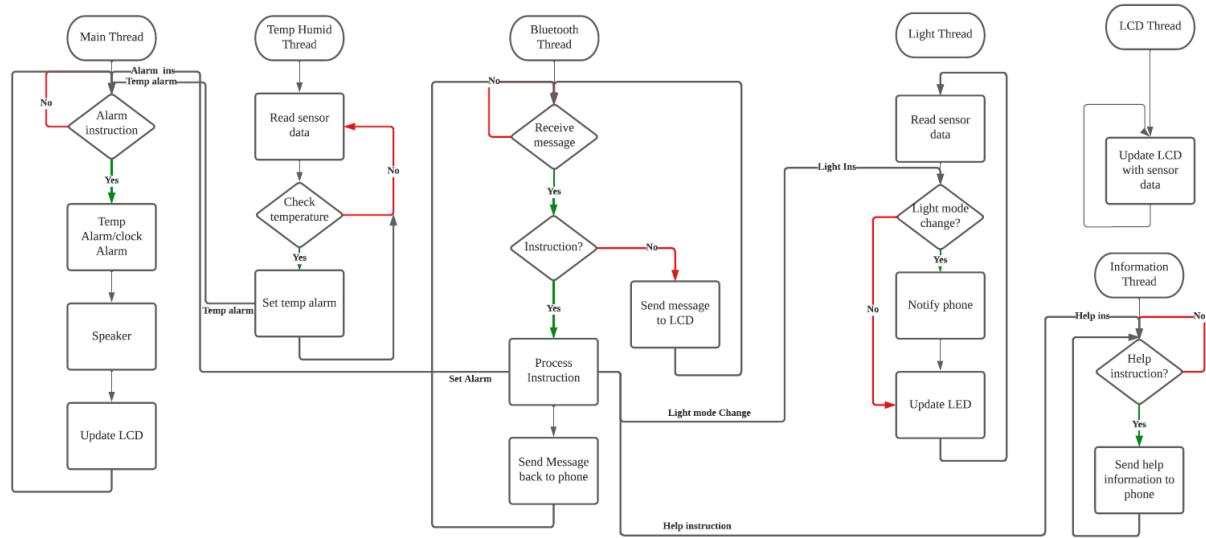
Wiki page:

[https://os.mbed.com/users/4180\\_1/notebook/using-a-photocell-to-determine-light-levels/](https://os.mbed.com/users/4180_1/notebook/using-a-photocell-to-determine-light-levels/)

## Complete Wiring Diagram:



## Software:



Original file:

[https://drive.google.com/file/d/1Q5IOPTFy\\_PSYc6JXOZQYM238HCiLoB57/view?usp=share\\_link](https://drive.google.com/file/d/1Q5IOPTFy_PSYc6JXOZQYM238HCiLoB57/view?usp=share_link)

Github for source code: <https://github.com/ricejar/GT-ECE4180-Intelligent-Home>

## User's commands:

!h: help, to get help information.

!a: followed by a number to set alarm ring after this number of seconds.

!l0: LED follow room light intensity

!l1, !l2: turn on/off LED.

!b: display light level on phone.

!w: display temperature and humidity on phone

any typos will give error to the user

The screenshot shows a mobile application interface with a dark theme. At the top, there are tabs for "Modules", "UART" (which is selected), "MQTT", and a gear icon for settings. Below the tabs is a terminal-like window displaying the following text:

```
!h
Instructions:
!a + number to set an alarm rings after
seconds
Example: !a10 for ring after 10 second

!10 for led follow room brightness
!11 turn on LED, !12 turn off LED

!b for light level
!w for temperature and humidity

Temperature higher than 74 F, siren alarm
will ring
!b
light level: 26.886%
!w
Temperature: 73 F
Humidity 25
!12
LED turns off
!11
LED turns on
!10
LED follows room light level
!a4
Set an alarm after 4 seconds
!a)3)::?
Invalid Instruction
!uuri
Invalid instruction!!
```

## Video Demo:

User reads light intensity on the phone, a flashlight is put on the phototransistor to read a higher value and displayed on LCD:

[https://drive.google.com/file/d/1FVahkUPiLfSa9A8yLhN\\_r4oJEwLXVJOq/view?usp=share\\_link](https://drive.google.com/file/d/1FVahkUPiLfSa9A8yLhN_r4oJEwLXVJOq/view?usp=share_link)

User reads sensor data (temperature, humidity, light) with command “!w”, “!b”

[https://drive.google.com/file/d/1uk7n-\\_BdCcZvkdvHR6MgoGt2b9t-FfAd/view?usp=share\\_link](https://drive.google.com/file/d/1uk7n-_BdCcZvkdvHR6MgoGt2b9t-FfAd/view?usp=share_link)

Once high temperature sensed (finger touching the sensor), alarm will trigger. Once it cools (finger left the sensor), the alarm stops.

[https://drive.google.com/file/d/1sKkx5SaYJO2mQuKC8N1yECIzKsA1Tva4/view?usp=share\\_link](https://drive.google.com/file/d/1sKkx5SaYJO2mQuKC8N1yECIzKsA1Tva4/view?usp=share_link)