The Pop Button

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Introduction

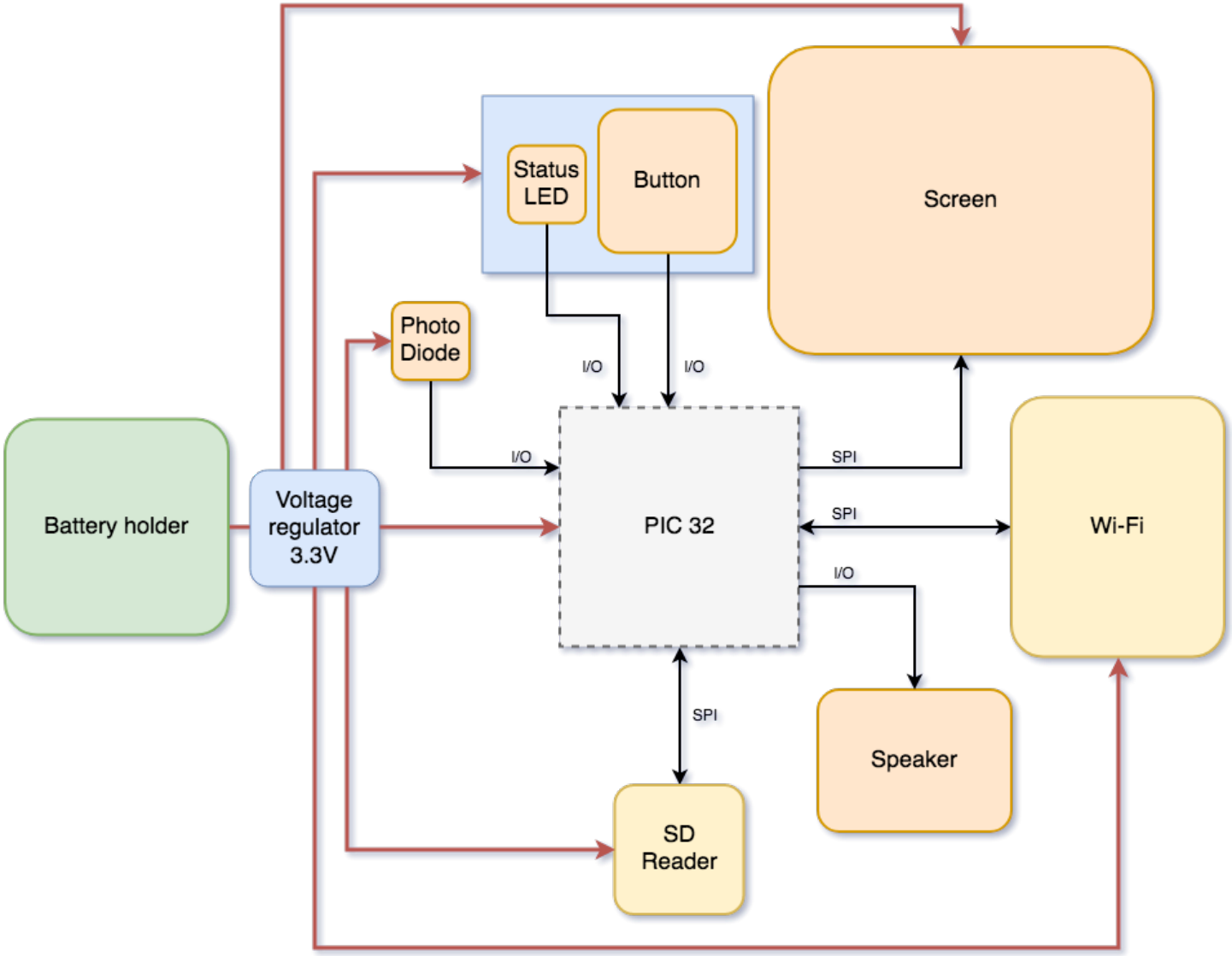
Do you know Sonia?
Sonia is a young mum, her little baby is sick and she needs to buy some medication. So she, as everyone in 19th century, grabs a piece of paper and notes down the medicine along other things as the eggs she needs for Patrick's birthday's cake...
The day after, at the grocery she realize that she left the list on the fridge and forgot about the medication, once she came back at home the baby was dying and the neighbour had called the police... She is now serving 5 years at Guantanamo for medical negligence.
Did you ever experienced something similar ???
Do you want to go in Guantanamo ???

Don't worry we have the solution :

The Pop Button !

The POP Button is a little device that fits in your cosy place and allows you to keep track of whatever item you need on the cloud in order to manage it the more efficient way.
If Sonia would have had a POP Button, once she realize she forgot the list on the fridge, she would be able to connect with here portable to our server and find back all the items she entered thanks to here POP friend.

Block Diagram



Manual

First Use / Configuration

Before using the POP Button you have to configure the SD Card, connect the SD Card to a computer and use our program to format it. To use the product for the first time open the rear panel to reveal the battery and SD Card holder. First, slide the SD Card into its holder and then put the AA-type batteries. Finally, make sure the switch is in the On position and close the back panel.
Now the screen should light up and you can start to use the product normally. If it doesn't, refer to the troubleshooting section.

Normal Use

Usually, the screen will be turned off when the device is in sleep mode. The screen should light up when you approach your hand to the device, if it doesn't, press the knob to turn on the screen.
Once the screen is lit up you then can select the product you want to order by turning the knob to change the selected item.
Once you're done, the screen will show you a confirmation and you will hear a sound signal to confirm the order, also the knob will change it's color accordingly.

Settings

Most advanced settings are edited via the SD Card. But some of them can be edited through the machine. To enter settings long-press the knob. Once you enter the settings menu, select the desired option and then press to select the option you want then turn the knob to adjust the value and when you are done press again to confirm.

Knob Color Codes

Off / Black	Sleep	When the button is off it means that the device is in sleep mode
Blue	Ready	The device just turned on
Orange	Working	The order has been recorded but the device is still sending it to the server
Green	Done	The order was processed successfully
Red	Error	The device encountered an error
Blinking Red	Low Battery	The device is running out of battery. The screen won't turn on until you replace the batteries.

Troubleshooting

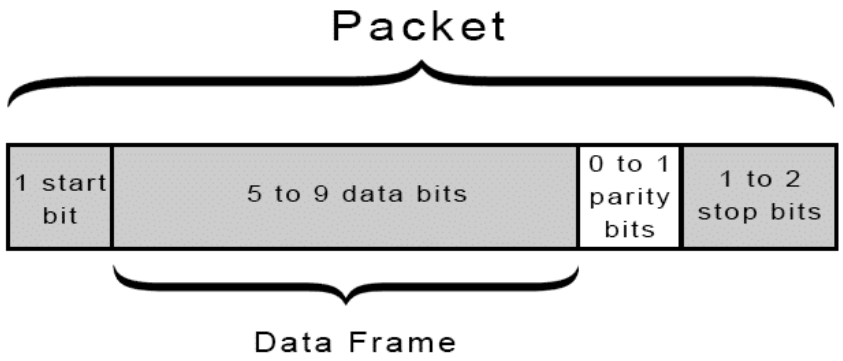
Almost all of the errors can be resolved by following the on-screen instructions. However, here are some other problems that might arise:

Symptom	Solution
The device won't turn on	Check that the switch on the back is turned on.

Protocols

UART

UART stand for "Universal Asynchronous Receiver Transmitter" it is a little circuit in a micro-controller which transmit and receive serial data. As it doesn't use clock it needs to work on a fixed frequency known as the baud rate, the baud rate is explained as bits per second (bps) and both peripherals needs to work on the same one in order to communicate. UART transmitted data are packets which consist of 1 start bit, 5 to 9 data bits, an optional parity bit, and 1 or 2 stop bits.



SPI

SPI stand for "Serial Peripheral Interface" it is a communication protocol synchronous and full-duplex which means that it uses a clock and it can receive and send at the same time

This protocol need 3 pins in order to work and uses one pin more for each slaves to select them

- SCLK ⇒ Serial Clock
  (SCK, SCL)
- MOSI ⇒ Master Output, Slave Input
  (SDI, DI, SI)
- MISO ⇒ Master Input, Slave Output
  (SDO, SDA, DO, SO)
- SS ⇒ Slave Select
  (nCS, CS, nSS, STE, CSN)

There is 4 modes available to use the clock depending on the peripherals properties

SPI mode	CPOL	CPHA
0	0	0
1	0	1
2	1	0
3	1	1

The master start by pulling down the Slave Select and starting the clock, then it send a Read/Write bit, a multiple/single bit an adress it wants to access. Finnaly it reads or write the actual data

i²C

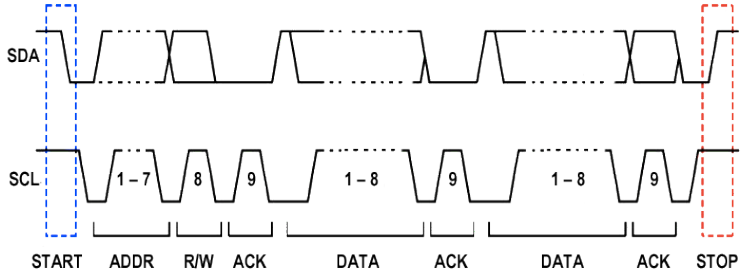
I²C or IIC stands for Inter-Integrated Circuit, it is a protocol which is synchronous, half-duplex, multi-master and multi-slave. It can adress between 127 and 1024 devices but is slower than spi

This protocol only needs 2 pins

- SCL ⇒ Serial Clock Line
- SDA ⇒ Serial Data Line

timeline

First the master send a start bit by pulling down the SDA right before the clock, then send the device address (7 or 10 bits), a Read/Write bit and wait for the acknowledgment of the slave. Then send the real data which can be the data adress of the device wait for acknowledgment and start again until the stop signal by pulling up the SDA right after the clock.



Specifications

- 2.4GHz Wi-Fi Connection
- Screen Size of 128 x 64 pixels ($46.5x27.7mm$)
- Endless rotary button
- RBG light
- Maximum distance to activate the device of 76.2 mm
- 4 x AA Batteries Required
- 3 months autonomy

So what do we need ?

A PIC

The choice of the PIC have been done mostly on the power consuption performance and the availability on farnell as well as the number of SPI ports.

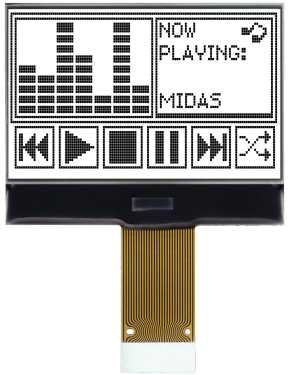
A Wifi Module

In order to communicate with the server we needed a wifi connection that we found in the atwinc1500, this module is compatible for most wifi encryption and has an SPI interface as well as a low-power mode.

A Button

We choose this encoder because it feets exactly our needs: it rotate infinitly either ways, it has a push button integrated enabling the ability to choose and select within an instant, further to that it also has an RGB led incorporated !

A screen



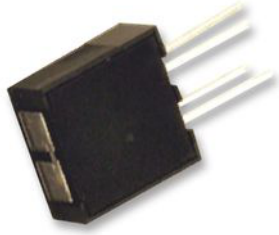
We choose this screen because it is large enough to contain a good list of word,it has a english and Japanese font set, it is bright so we can see it in different environnements and it is 3.3V powered wich make it easy to interface with all other modules.

Screen Connector

Memory Socket

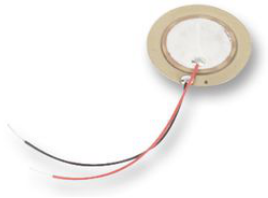
If you are a compusilve buyer you will need a lot of product in your list, that's why we choose to add a memory extension.

Photo-Diode



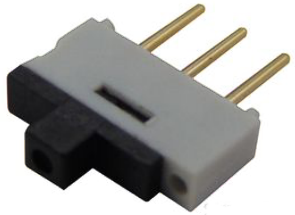
Thanks to the half-god Gregory Le Grand we will use a photo-diode to interact with the device, we choose this one because it can detect a distance of 7.4cm

Piezo



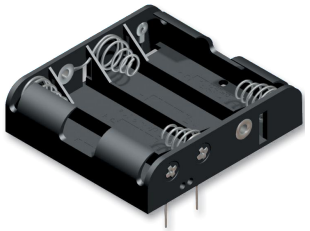
Because everyone love music, we necessarily wanted a good audio interface that satisfy this requirement.

Switch



This basic switch will be the one to turn all the lights off, in order to store the product we want a way to switch it completly off keeping the batteries inside

Battery Holder



Because it wont hold itself, we choose this one because it widely used, well appreciated and we needed enough mAh to be able to use the device during several months
we have 4 AA batteries holding each one 2850mAh
4 * 2850 = 11400
Our device consume at most 500mA in case everything work at the same time
so 11400/500 = 22.8 hours the hard way
considering using the device 15 minutes a day we use it 7h45 by month
22 / 7.75 = 2,84 months
In this conditions we can use the device during three months without changing the batteries witch is acceptable.

References and links

component	reference	price(€)	consumption	Frequency	Datasheets
SoC	PIC32MX174F256B-I/SO	3.48	~ 200mA @ 3.3V = 660mW	72Mhz	
Wi-Fi	ATWINC1500	6.61	70mA / 172mA @ 3.3V = 564mW	26Mhz	
Screen	MCCOG128064B12W	8.69	40mA @ 3.3V = 132mW	64hz	
Screen connector	28FLZ-RSM2-TB(LF)(SN)(P)	1,37		-	
Rotary Encoder	PEL12T-4225S-S1024 COM-10597	1.88	10mA @ 5V = 50mW	-	
Photo-Diode	OPB732	3.2	50mA @ 3.3V = 165mW	-	
Buzzer	7BB-20-6L0	1.26		-	
Voltage Regulator 3.3V	UA78M33CDCY	0,461	350 mA @ 2V = 700mW	-	
Micro SD socket	DM3AT-SF-PEJM5(40)	2,64	?	-	
Battery Holder	2477	1.41	?	-	
Switch	09-03290.01	1.05	?	-	
total		32,051			