MagicShifter Manual V1.2

This manual is available online @ http://magicshifter.net

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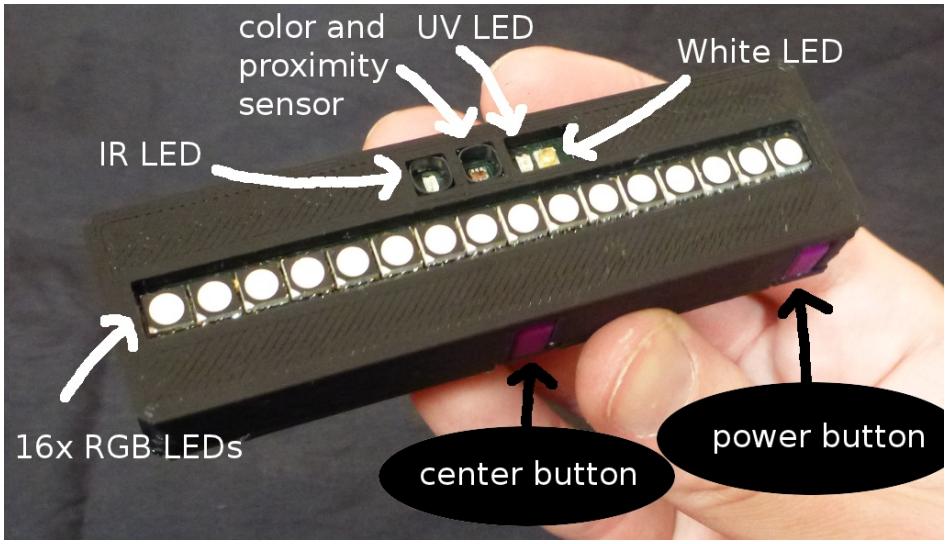


Picture 1: The visible components of the MagicShifter

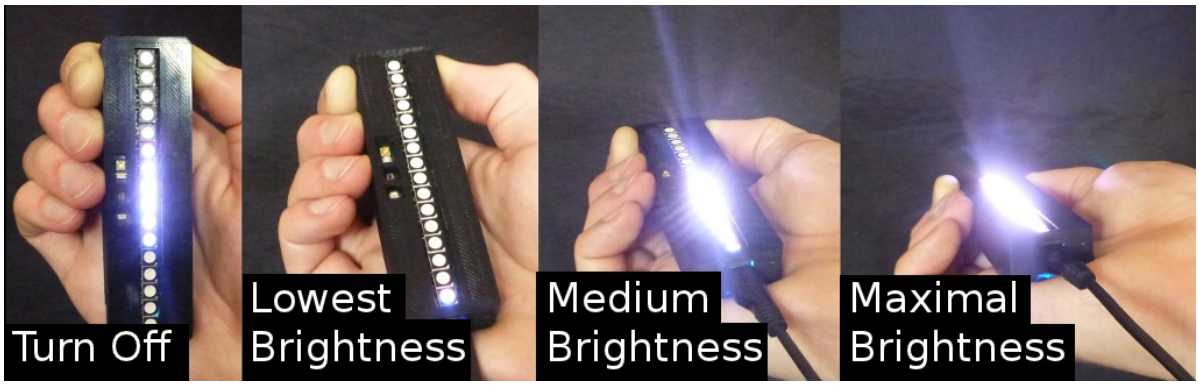
Basic Interface

How to turn the MagicShifter on

Click the power button. It starts up in the same mode that was active when it was powered off.

How to change the brightness (brightness menu)

Press down (keep it pressed) the power button. The display changes to a white light bar.
Rotate the MagicShifter around the Y axis to change the brightness level.
Release the power button to select the desired brightness.



Picture 2: Rotate the device while pressing down the power button to adjust brightness or to turn off the device

To turn the Magicshifter off

Select the lowest brightness in the brightness menu. A “sleep” animation will appear.
Release the power button to turn the device off. Before it powers down the charge status is displayed.

Charging

The device can be charged via USB micro cable. While charging the blue LED next to the USB connector lights up. when the device is fully charged the green LED will light up (the colors might be hard to see in daylight because of the case).

To change modes (Main Menu)

Press down (keep it pressed) the center button for more than two seconds. All LEDs will blink white 3 times to indicate that you entered the main menu**.** You can now **release the center button**. Now can navigate through the menu by **clicking the power or center button**. To select a mode **press down the center button and hold it for half a second**. Each mode has a unique position combined with a color.

Available Modes

1. POV (Persistence of Vision) Image Mode (red)

- **Shake fast in Y direction** to display bitmaps via POV.
- **Click the center button** to cycle through the available bitmaps.
- **When not shaken:** displays a physics simulation based on the accelerometer values
- **Click the power button** to change the type of physics simulation:
    - bouncing ball
    - spring/mass
    - level

2. Color and Proximity Sensor Demo Mode (green)

- **Click the center button** to pick up the color of an object. The color sensor should be ~1cm away from the object to sense. The white LED will light up while the color gets sampled. Color gets saturated to be brighter so white and black will not work as expected. No white balancing yet.
- **move your hands in front of the sensor** and the proximity value gets indicated by the RGB leds.

3. Vibration Mode (yellow)

- **Place on a surface** to visualize vibrations. Can be used to visualize music or heartbeats
- **Click the center button** to pick up the color of an object just like in Mode 2.

4.Moving Shadow Mode (blue)

- This mode is very bright when you start it up. Be careful not to temporarily blind yourself or other people when using this in the dark! **Use the brightness menu to adjust the brightness.**
- Hold a lazzzored stencil (or your hand or any other object) between the MagicShifter and a white surface and **click the center button** to create an interesting lighting effect. Works best in dark environments!
- **Click the power button** to change the type of light effect:
    - color shadows
    - warping shadow

5. Rainbow Shadow Mode (purple)

- This mode is very bright when you start it up. Be careful not to temporarily blind yourself or other people when using this in the dark! **Use the brightness menu to adjust the brightness.**
- Similar to the Moving Shadow Mode but continuous.
- **Click the center button** to change the speed of the movement.

6.DISCO mode (turquoise)

- This mode is very bright when you start it up. Be careful not to temporarily blind yourself or other people when using this in the dark! **Use the brightness menu to adjust the brightness.**
- **Shake** to emit flashes of RGB light
- **Click the center button** to change to “Police Mode” now it behaves like a (european) police light siren. Note to self: implement US type for next firmware update.

7. Flashlight Mode (white)

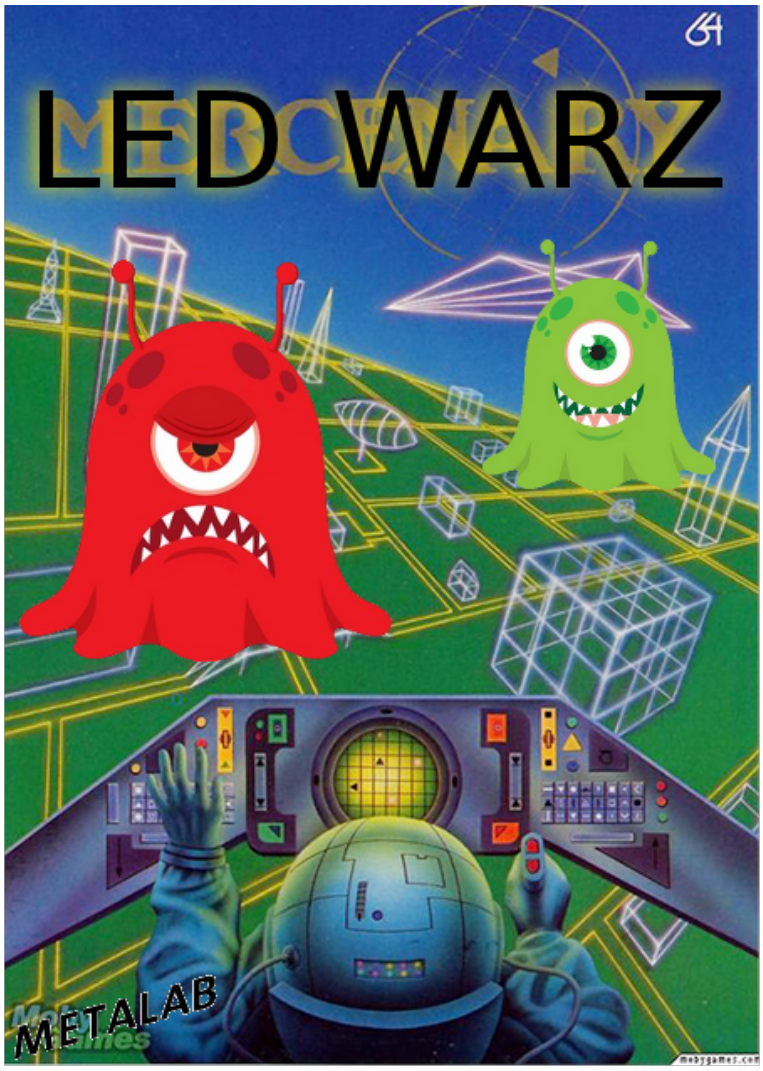
- This mode is very bright when you start it up. Be careful not to temporarily blind yourself or other people when using this in the dark! **Use the brightness menu to adjust the brightness.**
- Use the MagicShifter as a flashlight.
- **Click the center button** to cycle through the 4 flashlight modes:
    - white LED only
    - UV LED only
    - ALL LEDs on
    - darkness
- **Don’t use the ALL LEDs on mode for more than 2 minutes in full brightness** otherwise it might get hot and warp the PLA casing. Also this will drain the lipo very fast (about 20 minutes). Next firmware update will include a auto off using the internal temperature sensor in the microcontroller. **The hardware is rated for the high current (~1A) but the PLA case is not!**

8. Binary Watch Mode (red)

- Displays the current time or date as binary numbers
- **Shake fast in Y direction** to display time or date via POV.
- **Click both buttons at the same moment** to set the time or date
    - setting the time works like the main menu
- **Click the center button** to switch between displaying the time or the date.
    - Hours and Year are **blue**
    - Minutes and Month are are **green**
    - Seconds and Day are **red**

9. LED WARZ: an 8 bit arcade game (green)

- You control the **blue** spaceship by **rotating the Magicshifter slightly around the Y axis**.
- You can change the lane in which you are traveling by **rotating the MagicShifter slightly around the X axis**. There are 3 lanes: left, center and right. If you are traveling on the center lane this is indicated by the spaceship turning white.
- The Monsters also travel on the 3 lanes.
    - If you are on collision course with a monster it will show up as **red**.
    - If you can pass through the monster it will show up as **green**
- If you collide with a red monster your spaceship explodes and your score gets displayed via red and blue pixels. Then and the game restarts



Picture 3: Cover art of LED WARZ
based on Mercenary cover art: http://en.wikipedia.org/wiki/Mercenary_(video_game)

10. Bike Light Mode (yellow)

Does not turn off after inactivity. Attatch to back of bike and you have a red back light. It will automagically light up more as soon as you break.

Creating Bitmaps, animations and Fonts

use the http://magicshifter.net/MagicConverter.html webapp to convert images with 16pixel height to magicshifter raw images

Uploading Images

to upload a file use the MagicTest.py script.
Example:
python MagicTest.py up <filename> <sectorNr>
Atm sector 0 is used for the calibration data and can not be written to
Atm sectors 1-127 are used for images
Atm sectors 128 and above are used for fonts

Flashing new Firmware with pre compiled HEX file

Flashing the firmware is done by using the linux/windows command line utility dfu-programmer availabe at: http://dfu-programmer.sourceforge.net/
If you are using Linux it is in the packet manager ;)

To flash the MagicShifter with a new hex file follow these steps:

1. Connect USB micro cable to the USB connector. The MagicShifter should power on. If the battery is very low USB turn on might not work. If that is the case press the power button to turn the device on.
2. Reset the device to switch it to bootloader mode. The reset button is accessible through the small hole on the bottom of the case (located next to the USB connector and on the left side of the “MagicShifter” text on the bottom). Use a thin stick to press the reset button to activate the bootloader.
3. Erase the previous firmware by typing these 3 lines on the command line:
```
sudo dfu-programmer atmega32u4 erase
sudo dfu-programmer atmega32u4 flash firmware.hex
sudo dfu-programmer atmega32u4 start
```

Compiling/Flashing custom Firmware

For compiling the firmware we currently use a Makefile based build system that can be used to compile custom firmwares and also includes a make target (“flash”) to automate ploading the compiled HEX file via the dfu-programmer command line tool. The code repository, which is currently not publicly viewable, is currently hosted at:
https://bitbucket.org/wizard23/magicshifteros
For access to the firmware prior to the public release send a request with your

bitbucket-username to: wizards23@gmail.com

System requirements for compiling

- The “gcc-avr” and the “avr-libc” packages
- Arduino > 1.0.1
  we use the Arduino library because it provides a complete USB library and the MagicShifter CPU (ATMEGA32U4) is the same that is used in the Arduino Leonardo. The only difference is that the MagicShifter runs at 3.3V and the Arduino Leonardo runs at 5V.

How to adapt the Makefile for your system

You only have to point the Makefile to the directory of your Arduino installation. To do this:

1. open the Makefile (in the /Firmware subdirectory of the repository) with a text editor
2. find the line that starts with “ARDUINO_DIR = ” and enter the path to your Arduino Installation here. For example if you installed Arduino in /software/arduino write:
   `ARDUINO_DIR = /software/arduino`

Compiling the firmware

1. switch to the /Firmware subdirectory of the repository and type:
2. on the command line type:
   `make`
3. If the code compiles successfully you now have a new firmware.hex file.

Flashing the firmware

1. switch to the /Firmware subdirectory of the repository
2. connect the MagicShifter to the PC via USB
3. press the reset button (reset button is located next to the USB connector on the MagicShifter PCB you can access it with a small stick of 1.75mm PLA (ABS works too but it stinks, any other small cylinder will aso do the trick;) filament from the backside of the case) `(TODO: add picture here)`
4. on the command line type:
   `make flash`
   this will compile the hex file AND upload it via the dfu-programmer utility described above

Hard Power Off

If you pressed the reset button but did not intend to upload a new firmware or If you manage to upload a faulty firmware the power off over the buttons might not work anymore. To turn off the device (it will also turn off automatically before the battery is fully empty) press the hard power off button located at the right side of the “MagicShifter” text on the back of the device (located under the small hole. use a thin stick to press it.)
`(TODO: add picture here)`

Need Help?

contact me at wizards23@gmail.com

Feature List/Used Components

MagicShifter is an open source hardware gadget for lighting, gaming, and POV applications.
You can charge and reprogram it over USB!

- **Atmel ATMEGA32U4 CPU**
- **16 RGB LEDs** Cree CLV6A-FKB-CK1P1G1BB7R3R3
- **3-axis accelerometer** Freescale MMA8452QT
- **RGB color/proximity sensor** AMS TCS37717FN
- **high power white LED** Osram LUW CN5M-GAHA-5P7R-1
- **UV LED** Bivar SM1206UV-395-IL
- **IR LED** Everlight HIR11-21C/L11/TR8
- **RTC** Microchip MCP79410-I/MS
- **1MB EEPROM** Microchip SST25VF080B-80-4I-SAE
- **USB LiPo Charger** Microchip MCP73831T-2ACI/OT

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