ECE 411

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Detailed Design:

## Speed Demon Speedometer



**Level 0**

|  |  |
| --- | --- |
| Module | Speedometer |
| Inputs | * Sensor * Power supply: various DC power * 5- way tactile switch |
| Outputs | * LCD screen |
| Functionality | Receive signal from sensor, calculate/display speed |



## Level 1



|  |  |
| --- | --- |
| Module | Sensor Module |
| Inputs | * Proximity-induced magnetic field flux from wheel magnet * +~4VDC (direct from battery) |
| outputs | * Binary pulses |
| Functionality | Provide edge-detectable information about wheel location. |

## Level 1



|  |  |
| --- | --- |
| Module | External Crystal Oscillator |
| Inputs | * Thermal noise/OSC loop |
| outputs | * 32.768kHz Clock |
| Functionality | Provide a stable clock reference for the MCU |

## Level 1



|  |  |
| --- | --- |
| Module | 5-Way Switch |
| Inputs | * User tactile input |
| outputs | Binary ‘button press’ data. NP = +3.3VDC, P = GND   * CENTER * UP * DOWN * LEFT * RIGHT |
| Functionality | Provide user interfacing and device control capability |

## Level 1



|  |  |
| --- | --- |
| Module | Microcontroller |
| Inputs | * 1 bit Sensor inputs * 3.3V DC power supply * CENTER: Power on and select * LEFT: Left operation * RIGHT: Right operation, Select operation * UP: Up operation * DOWN: Down operation |
| Outputs | * Data to LCD to display |
| Functionality | * Receive signal from input, calculate the speed, output to LCD |

## Level 1



|  |  |
| --- | --- |
| Module | 8x2 LCD display |
| Inputs | * 8-Wire binary data bus from MCU + 3 ctrl inputs (tot. 11) * 3.3V DC Power supply |
| outputs | [Visual information] |
| Functionality | Visualize the speed by showing it on the screen |

## Level 1



|  |  |
| --- | --- |
| Module | Power supply |
| Inputs | * ON/OFF switch (CENTER) * 5V from USB |
| Outputs | * +3.3VDC regulated power * Raw battery power (~+4VDC) |
| Functionality | Power supply for the device |



**Level 2**

|  |  |
| --- | --- |
| **Master Module** | **Power Supply** |
| Submodule | USB Power Inlet |
| Inputs | * USB connection (all pins except PWR/GND are NC) |
| outputs | * ~+5VDC |
| Functionality | Source of charging power for battery |

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| --- | --- |
| **Master Module** | **Power Supply** |
| Submodule | Li-Po battery |
| Inputs | * Current from charge controller |
| outputs | * ~+4VDC |
| Functionality | Power source for device |

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| --- | --- |
| **Master Module** | **Power Supply** |
| Submodule | Charge controller |
| Inputs | * USB power * Battery power |
| outputs | * Battery charging current * Battery power thru |
| Functionality | Routes power either from USB inlet to battery, or from battery to rest of device |

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| --- | --- |
| **Master Module** | **Power Supply** |
| Submodule | ON/OFF Switch Timer Circuit |
| Inputs | * Center switch push * Raw battery power |
| outputs | * Binary ON/OFF signal @ batt voltage |
| Functionality | User control for device power state. Outputs ‘on’ (batt voltage) with a momentary press of center button, outputs ‘off’ (GND) after long press of ~1s. |

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| **Master Module** | **Power Supply** |
| Submodule | Power OP Defeat Logic |
| Inputs | * ON/OFF signal from timer switch circuit * USB power (+5VDC) |
| outputs | * Binary EN signal |
| Functionality | Controls device power state using EN input of DC-to-DC converter. Follows signal from ON/OFF Timer Circuit unless USB power plugged in. Disables power when USB present. Circuit is powered by ON/OFF signal from timer circuit. |

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| --- | --- |
| **Master Module** | **Power Supply** |
| Submodule | DC-to-DC Converter |
| Inputs | * Binary EN signal from Power OP Defeat Logic * DC power from charge controller |
| outputs | * +3.3V regulated power |
| Functionality | Switching power regulation circuit. Input power can be either battery or USB power, but EN should be off if USB power applied, so functional input should always be battery voltage. |