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Concept Block Diagram

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| **Method** | **Component** | **Comparison** |
| Display | LCD | * Ability to display more complex characters * Higher power supply |
| 7-segment LED | * Good Visibility * Lower power supply * Limited capability of displaying characters |
| Position and displacement Sensor | Hall Effect Sensor | * Provided in digital configuration where on is the presence of the object and off is otherwise * No scale for how far away the object is from the sensor * Effective for applications not requiring highly detailed position info * Low price |
| Reflective Light Proximity Sensors | * Quick response time * Good when large gaps exist between sensor and target * Cost varies based on its accuracy * Line of sight to object required for sensing |
| Eddy-Current Sensors | * Use magnetic field to determine position * Medium cost * Medium accuracy, not good for high resolution application * Not applicable when a large gap exists between sensor and object * Applicable when mounted on a reasonably stationary mechanical structure |
| Potentiometer | * Good accuracy * Low price * Required to be physically attached to object * Add a small resistance to the movement |
| Optical Encoder | * Determines speed, direction, position * Fast and high accuracy * Adds no friction * Price can vary based on accuracy |
| Linear Variable Differential Transformers | * Use magnetic induction to determine position * Robust * High precision * Expensive |
| Processor | Microprocessor | * Eternal memory (storing more amount of data) * Several voltage power rails * More numeric-based application * More complex application regarding (processing, resolution, memory, …) * Higher power consumption * More expensive |
| Microcontroller | * Embedded flash memory(quicker start-up) * Single voltage power rail * Simpler applications * More real time/deterministic application * Lower power consumption and more cost optimized * Limited memory |
| Microcontroller Clock Source | * Mechanical oscillators: crystal and ceramic good accuracy, low temperature coefficient, insensitive to electromagnetic interference * Electrical phase-shift: RC oscillator provide fast startup and low cost, poor accuracy over temperature |
| Power | Wall Adapter | * Big in size * Need of other components: voltage regulator |
| Battery | * Various types and sizes and voltage rating * Various period of operation * Portable * Need of other components: voltage regulator |
| Power Switching | * Contact bounce effects: resulting in power spikes * Voltage drop, result in reducing battery life * Solutions: FET switch (need more components) * Higher cost |
| USB port of computer | * Easy to get relatively smooth 5 volts |

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| **Component** | **Vendor/Distributer Link** |
| **Microcontroller** | <http://www.digikey.com/product-detail/en/ATMEGA168A-MUR/ATMEGA168A-MURTR-ND/2271216> |
| **Programmer** | 1. <http://store.atmel.com/PartDetail.aspx?q=p:10500054#tc:description> 2. <http://www.ebay.com/itm/Atmel-AVRISP-Programmer-ATAVRISP2-/141370247882?pt=LH_DefaultDomain_0&hash=item20ea52caca> |
| **Debugger** | 1. <http://store.atmel.com/PartDetail.aspx?q=p:10500375;c:100112#tc:description> 2. JTAG: on-chip debugging while chip is running:   <http://store.atmel.com/PartDetail.aspx?q=p:10500269;c:100112#tc:inboxdesc> |
| **Crystal Oscillator** | 1. <http://www.digikey.com/product-detail/en/ABS06-32.768KHZ-T/535-10104-1-ND/2089921?WT.srch=1&WT.medium=cpc&WT.mc_id=IQ72619281-VQ2-g-VQ6-53968147755-VQ15-1t1-VQ16-c> 2. <http://www.newark.com/micro-crystal/cc7v-t1a-32-768khz-20ppm-12/crystal-smd-cer-32-768khz-12-5/dp/94M6641?CMP=KNC-GUSA-GEN-KWL-MICRO_CRYSTAL&gclid=CNmr3pLtwMECFQGPaQodOqkAOA#ProductSubstitutes> |
| **LCD** | 1. <http://www.amazon.com/microtivity-IM162-Module-Black-Backlight/dp/B0059H616G/ref=sr_1_4?ie=UTF8&qid=1413998055&sr=8-4&keywords=lcd+module> 2. <http://www.amazon.com/microtivity-IM161-Module-White-Backlight/dp/B0059H60SK/ref=cm_cr_pr_product_top> |
| **Sensor** | 1. <http://www.digikey.com/product-detail/en/MLX92212LSE-AAA-000-RE/MLX92212LSE-AAA-000-RETR-ND/3991739> 2. <http://www.digikey.com/product-highlights/en/amr-switches/52831> 3. <http://www.digikey.com/product-detail/en/SL353LT/480-3328-2-ND/2601655> 4. <http://www.digikey.com/product-detail/en/AH180N-WG-7/AH180N-WG-7DITR-ND/2334678> |

**References:**

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<http://www.maximintegrated.com/en/app-notes/index.mvp/id/1136>

<https://www.newbiehack.com/MicrocontrollersAlternativePowerSources.aspx>

<http://www.ermicro.com/blog/?p=820>

http://www.maximintegrated.com/en/app-notes/index.mvp/id/2154

**Oscillator info:**

<http://www.atmel.com/images/doc8333.pdf>