

HAULLELUJAH! A SOLUTION TO PACKING A U-HAUL!

ECE 445 Design Document
TJ Lambert, Nathaniel Stoll, and Zach Wong
Group 4
TA: Stephanie Jaster
February 27th, 2020

1 Introduction

1.1 Objective

<ZnujZ MZ Vhl y{M fjt k nfb` aH aZ{aZx{b'by'Myanx{hm| xl Zt`_xnk` ank Z{n'yWannj'nx'Mjnl` ` hm| xl Zt`_xnk` fMMl b` `nfZxyZM{`n`_jt b` `ank ZSuZnujZ MZ`Mj, My'nl {aZ`k nFZ`2 nxZ` yuZVb`Mj`fSuZnujZ MZ`Mj, My`_b`Xb` `M`Z, `ujWZ`{n`Vj`'ank Z`X|`xb` `{aZb`j`b`Z`{k`Z`Aaby`ank Z` Vh|j`X`UZ`{Zk`unxM`j`b`Z`M`Mj`Z`Z`X`nk` `nx`u`Z`x` M`Zl` {j`b`Z`M`an|`y`Z`{n`y`{M`{M`M`k` b`f`a`1` `k`Z`x`b`M` N`hl`Z`S`n|` `aj`f`P`a`a`k` b`j`b`l` `j`M`h|` {`U`P`o`A` `k`Z`x`b`M`y`k` nFZ`Z`M`a`f`Z`M`M`j`Z`M`y`{`n`l`V`Z`A`U`A`?`Z`M`y`n`l`y` j`b`Z`k`nfb` `m`x`j`n`V`M`b` `b`{n`M`Z, `M`X`UZ`{Z`X`'ank`Z`M`y', `Z`j`M`y`u`Z`nujZ`{x`b` ` {n`Z`y`{M`j`b`y`a`{aZ`b` n, `l`'an|`y`Z`anj`X`M`Z`h`y`{`aZ`{nu`{, `n`x`Z`M`y`n`l`y`b`'M`j`n`l` `j`b`{`n`l` ` , `a`f`u`Z`nujZ`V`any`Z`{n`k`nFZ`A`U`A` A`a`Z`y`y`{M`b`y`{b`y`X`n`l`n`{`Z`f`Zl` `b`V`|`X`Z`u`Z`nujZ`k`nfb` `b`'M`X`n`|`{n`_`{aZ`B`l` b`Z`X`@`M`Z`y`M`y', `Z`j`M`y` u`Z`nujZ`k`nfb` ` , `nx`j`X, `b`Z`a` `W`h`x`b` ` {n`M`B`3`y`|`X`f`S`b` {aZ`f`Z`M`Y`U`U`a`N`hl`Z`S`{aZ`Z', `Z`x`Z`M`{n`M`y` n`_Y`P`a`k` b`j`b`l` `u`Z`x`n`l`y`k`b`x`M`b` ` _x`nk` `V`h`l`|` {x`f`{n`V`h`l`|` {x`f`A`Y`A` `y`t`n`|`V`M`y`Z`Z`Su`Z`nujZ`M`Z`M`j, `M`y` n`l` {aZ`k`nFZ`a`5`l`Z`n`_`{aZ`k`n`y`{X`b`_b`|`j`{`M`y`y`b`k`nfb` `b`y`_b`X`b` `M`y`M`Z`M`X`Z`_b`Z`l`{, `M`{n` y`{n`x`Z`M`X`{x`M`y`unx`{t`n`|`x`UZ`j`n`l` `b` `y`a`1` `k`Z`x`b`M`S`u`Z`nujZ`k`nfb` `{aZ`b`j`Z`k`y`U`t`x`Zl`{b` `n`|`{` k`nfb` `{x`|`V`i`y`b`y`{aZ`y`Z`V`h`l`X`k`n`y`{`u`n`u`|`j`M`k`nfb` `{Z`V`al`b`y`Z`x`b`a`{U`Z`ab`X`u`Z`nujZ`|`y`b` `{aZ`b` n, `l`'u`Z`x`n`l`M`j`f`Z`ab`j`Z`{n`V`M`x`f`{aZ`b`U`Z`j`n`l` `b` `y`A`U`A`f`n`k`u`M`l`Z`y`j`b`Z`B`1`)}M`j`n`_Z`x`V`h`l`y`|`k`Z`x`y`M` f`M`Z`{t`n`_X`b`_Z`Z`l`{`y`b`Z`X`{x`|`V`i`y`{n`x`Zl`{`{n`{x`M`y`Z`x`t`n`|`x`UZ`j`n`l` `b` `y`a`)}n, `Z`f`Z`x`S`an, `X`n` V`h`l`y`|`k`Z`x`y`i`l`n, ` , `a`b`v`a`{x`|`V`i`y`b`Z`y`b`Z`X`M`j`n`x`{aZ`k` `b`Z`l`{aZ`b`y`b`Z`M`X`l`|`k`U`Z`x`n`_U`Z`j`n`l` `b` `y`f` `M`{n`n`k`M`l`f`{k`Z`y`u`Z`nujZ', `b`j` `n`_n`x`{aZ`V`a`Z`M`Z`y`{y`b`Z`{n`j`n, `Z`x`V`h`y`{n`x`{Z`j`{aZ`k`y`Z`f`Z`y`{aZ`f` X`n`l`n`{a`M`Z`M`j`n`{n`_U`Z`j`n`l` `b` `y`a`2`M`l`f`{k`Z`y`S`u`Z`nujZ', `b`j`Z`l`X`|`u`y`|`_b` `{aZ`b`j`Z`k`y`b`{n`{aZ` {x`|`V`i`n`x`y`w`Z`Z`%`{a`b` `y`b`{n`b`{n`Z`l`y`|`x`Z`Z`f`Z`x`f`{a`b` `b`y', `b`an|`{x`Z`M`y`b`b` `{aZ`f`V`h`l`j`X`UZ` X`M`k`M`b` `n`{aZ`x`b`j`Z`k`y`b`{aZ`u`x`n`V`Z`y`a`3`n`l`Z`n`_`{aZ`y`Z`n`u`{b`l`y', `n`x`i', `Z`j`, `a`Z`l`'t`n`|` `Z`{`{n`'t`n`|`x` X`Z`y`{b`M`l`b`l`M`X`a`M`Z`{n`X`Z`M`j, `b`a`{aZ`M`f`Z`x`k`M`a`n`_a`M`f`b` ` {n`k`nFZ`n`|`{M`j`{aZ`V`j`|`{Z`x`Z`X`b`Z`k`y` y`w`Z`Z`%`X`b`{n`{aZ`{x`|`V`i` `a`H`n`|`j`X`l`E`b`U`Z`l`b`Z`b`{aZ`Z', `M`y`M`y`n`j`|`{b`l`{a`M`l`n`{n`l`j`f`{Z`j`y`{aZ` V`h`l`y`|`k`Z`x', `a`M`y`b`Z`{x`|`V`i`{aZ`f`l`Z`Z`X`S`U`|`{M`y`n` `b`Z`y`{aZ`k`y`{Z`u`'U`t`y`{Z`u`'b`y`{x`|`V`{b`l`'n`l` ` , `a`M`M`X` ` , `aZ`Z`{aZ`b`U`Z`j`n`l` `b` `y`l`Z`Z`X`{n`U`Z`uj`W`Z`X`b` `n`x`Z`x`{n`Z`_b`Z`l`{j`f`k`M`l`k`b`Z`%`{aZ`y`u`W`Z`y`

5|`x` `n`M`j`n`x`n`|`x`u`x`n`Z`V`{b`y`{n`Z`_Z`V`{b`Z`j`f`M`X`Z`_b`Z`l`{j`f`a`Z`j`u`k`M`Z`{aZ`u`x`n`V`Z`y`n`_k`nfb` `n`l`Z`y` U`Z`j`n`l` `b` `y`b`{n`M`X`n`|`{n`_`{aZ`{x`M`y`unx`{f`Z`ab`j`Z`Z`M`y`Z`x`a`An`k`M`Z`{a`b`y`u`x`n`V`Z`y`Z`M`y`Z`x`S`n`|`x`u`x`n`Z`V`{ N`k`y`{n`M`y, `Z`x`{aZ`u`x`Z`f`b`l`y`j`f`k`Z`l`{b`l`Z`X`w`Z`y`{b`l`y`n`_b`X`b` `M`y`n`j`|`{b`l`{a`M`l`{Z`j`y`V`h`l`y`|`k`Z`x`y` Z`_M`f`j`f`, `a`M`y`b`Z`k`nfb` `{x`|`V`i`{aZ`f`l`Z`Z`X`M`y', `Z`j`M`y`'an, `{aZ`f`yan`|`j`X`j`n`M`k`{aZ`b`U`Z`j`n`l` `b` `y`{n` Z`_b`Z`l`{j`f`k`M`l`k`b`Z`%`{aZ`y`u`W`Z`a`An`M`W`n`k`uj`b`y`a`{a`b`y`_Z`M`S`b`b`y`y`k`uj`f`X`n`l`Z', `b`a`M`X`b`b`M`j`{M`u`Z` k`Z`M`y`|`x`Z`M`X`M`k`n`U`b`Z`M`u`j`b`M`l`b`l` `a`a`Z`{M`u`Z`k`Z`M`y`|`x`Z', `b`j`U`Z`|`y`Z`X`{n`x`Z`V`h`X`M`X`{x`M`y`k`b`{aZ` X`M`M`h`l`{M`b`b` `{aZ`X`b`Z`l`y`b`l`y`M`X`y`b`Z`y`n`_`{aZ`U`n`Z`y`anj`X`b` `{aZ`V`h`l`y`|`k`Z`x`y`U`Z`j`n`l` `b` `y`a`B`y`b` `U`j`Z`{n`n`{a`V`h`l`|`Z`V`{b`f`f`S`{aZ`X`M`M`_x`nk` {aZ`{M`u`Z`k`Z`M`y`|`x`Z', `b`j`U`Z`{x`M`y`_Z`x`Z`X`{n`n`|`x`k`n`U`b`Z` M`u`j`b`M`l`b`l` {a`M`l', `b`j`l`n`{n`l`j`f`V`j`M`j`M`Z`{aZ`b`Z`X`M`y`b`Z`k`nfb` `{x`|`V`i`l`Z`Z`X`Z`X`{n`anj`X`M`j`{aZ` U`Z`j`n`l` `b` `y`S`U`|`{M`y`n` `b`Z`f`b`y`|`M`j`b`y`{x`|`V`{b`l`y`{n`{aZ`|`y`Z`x`n`l` ` , `aZ`Z`M`X`'an, `{aZ`U`n`Z`y`yan`|`j`X`UZ`

ujMZX b {n {aZ {x| Vi {n'Z_bvzi {jt'k M.k b%{aZ {x| Vi 'yuWZ^° XX{bni NjtS{aZ'k nUbj' MuijbMlmi , n|jX'uxnfbZ {aZ | yZx'M bZ' b {Zx_MWZ {aM'Njn, y{aZ | yZx{n' i ZZu {xM' n_, ab'a' bZk y'MZ' b 'ZWa'Un..'Mj', Zjj'My_b{aZ'Un..'vhl {M' y_xMbjZ bZk y'nxl n{^°

1.2 Background

AaZxZ'MZ'MZ, 'ynj| {bni y{aM'Z. by{ b {aZ'k M'i Z{ {nXM' {aM'aZju'k b b% M'X'ynjFZ' {aZ' unUjZk 'uxnunyZX'MUnfZ' b' k M' b' {aZ'uxnVZyy'n_uM' b' b' bZk y' b' M'k nfb' {x| Vi' k' nxZ' Z_bvzi {M'X'ZM'Zx^° AaZyZ'ynj| {bni y' b' Vj| XZ' M'X' b' b' M'Z' k' ZM' y| xZSn{aZ'k nUbj' MuijbMlmi yS M'X'uxn_Zyybni M'k nfb' 'Vnk uM' bZy^° k' M' t' unu| jM'aM'X, MZ' y{nxZyjb' Z'2 ZI M'XyS1n, ZyS M'X' nk Z'ž Zun{Svhl y| k' Zxy'VM' b' X'Xb' b' M'Z' k' ZM' y| xZy^° y'tn| 'k' M'aM'Z' | ZyyZX'SXb' b' M' {M'Z' k' ZM' y| xZy' b'Z' vhl y| k' Zxy' {aZ' M'UbjZ' {n' xZVZ' b'Z' Xb' b' M'Z' k' ZM' y| xZk' ZI {y' _xnk' {aZ' bZk y{aZ' t' MZ' k' ZM' y| xZ' ^°) n, ZfZxSk M' t' vhl y| k' Zxy'Xn' i n' i l n, 'nx'aM'Z' {aZ' {b' Z' {n' _b' | xZ' n| {, aM' {n' Xn', b'a' {aZ' xZVZ' b'Z' X' b' ZI ybni y'nx'an, b' VM' UZ' MuijbZ'X' b' {aZ' vhl {Z. {n' _k' nfb' ^° M'X' b'ni S {aZ'xZ' MZ' n{aZ'k nUbj' MuijbMlmi yZ. by{ b' b' Mui'k M'i Z{y{ {nXM'SU| {k' M' t' n' {aZ'k' xZfnjFZ' M'X' | X' b' b' | yZxy'Vnyk Z{by' {aM', b'j' k' M'Z' {aZ' ZI {bZ' unVZyy'n_k' nfb' 'ZM'Zx^° @zVobM'NjtS Muiyjb' Z' H | I XZjby{ M'X' @nx|jt' b'Z' | yZxy' {aZ' M'UbjZ' {n' k' M'Z' jby' M'X' {M'Z' b' fZI {nxt' n_, aM' bZk y' n' b' 'ZWa'Un. SU| {I Z' b'aZx' {Zjjy' {aZ' | yZxy', aZxZ' {aZ' t' yan| jX' uM' {aZ' Un. Zy' b' {aZ' k' nfb' {x| Vi' Z_bvzi {jt' i nx' b'Z' b'Z' Nj'xZI {M' y' b% {x| Vi' y| ' Zy{bni y' A^° XX{bni NjtS n{aZ' k' nfb' ' jM'UjZ'X' Muiyjb' Z' ANyi ? M'U' b' M'X' 2 M' b' < jM' M'k' {n' M' y' b' | yZxy' {n' XZ' vhxM'Z' M'X' k' M' M'Z' {aZ' b' i Z, 'ank' Z' | unl' M'X' M' 3 Z' b'aZ' x' n' {aZ' yZ' Muiy' aZ' ju' b' {aZ' k' nfb' ' unVZyy' M' M'j' A^° b' NjtS {aZ'xZ' MZ' unx_Zyybni M'k' nfb' ' Vnk uM' bZy' n' {aZ' k' M'i Z{ 'Mj', Zjj^°) n, ZfZxS{aby' nu{bni by' Un{a' Z. uZi y' b'Z' M'X' VM' yZy' j' b' b'Zy^° Whx' b' {n' MZ' unx' {Sk' nfb' ' Vnk uM' bZy' VaM' Z' Ut' {aZ' an| x' _nx' ZWa', nxi Zx', b'a' ZWa' an| x' VaM' Z' xM' b' _xnk' O'Ya' {n' O'a' U' M' an| x' A^° Aaby' Vny{ by' _nx' n' l Z' , nxi Zx' Nhl Z' M'X', b'an| {M'k' nfb' {x| Vi' {nn' A^° AaZ' {n' M' M'Z' xM'Z' Vny{ n' _k' nfb' , n| jX' ZM' b' t' UZ' n' fZx' O'U' U' U', b'a' Nj' {ab' y' vhl y' b' ZxZx^° < x' b' Zy' Nj' yn' x' yZ' U' Nj' Z'X' n' {aZ' X' b' {M' VZ' i Z' Z' X' X' {n' {xM' FZ' {n' Z' {n' {aZ' XZy' b' M' b'ni A^° y'tn| VM' y' Z' Z' Sab' b' k' n' fZxy' UZ' Vnk' Zy' M' Z. uZi y' b'Z' nu{bni ' Nj' t' w' b' i j' t' ^° XX{bni NjtS ynk' Z' Vnk uM' bZy' VaM' Z' vhl y| k' Zxy' Z. {xM, aZi' aM' X' j' b' _xM' b' Z' bZk y' A^° Aaby' {M'Z' k' ZI {b' y' b' | M'Zy' {aM' b' vhl y| k' Zxy' X' b' i n' {VannyZ' {aby' nu{bni S, nxi Zxy' k' M' i n' { unxnuZ' j' t' aM' X' j' Z' M' uZ' xynl -y' UZ' jni' b' y', b'a' VM'Z', ab'a' VM' VM' yZ' j' b' b'Zy' _nx' {aZ' vhl y| k' Zx^°

1.3 Visual Aid

' b | xZ' U' yan, y' Mab' a' jZ' fZj' b' {Zx' M' {bni n' n' | x' unx' t' ZV{^° AaZ' | yZx', b'j' k' ZM' y| xZ' M' Un..'y' {axZZ' X' b' ZI ybni y' | yb' {aZ' X' b' b' M'Z' k' ZM' y| xZ' S' M' X' {aZ' Uj| Z' {nn{a' k' nX| jZ' b' {aZ' {M'Z' k' ZM' y| xZ', b'j' yZi X' {aZyZ' k' ZM' y| xZk' ZI {y' {n' M' vhl | ZV{Z' X' k' nUbj' XZ' f' b' Z' {axn| ` a' Uj| Z' {nn{a^° AaZ' k' nUbj' XZ' f' b' Z' , b'j' xZVZ' b'Z' {aZyZ' b' u| {y' M' X' X' byujM' {aZk' VjZ' M' j' t' {n' {aZ' | yZx' {axn| ` a' {aZ' MuijbMlmi ^°

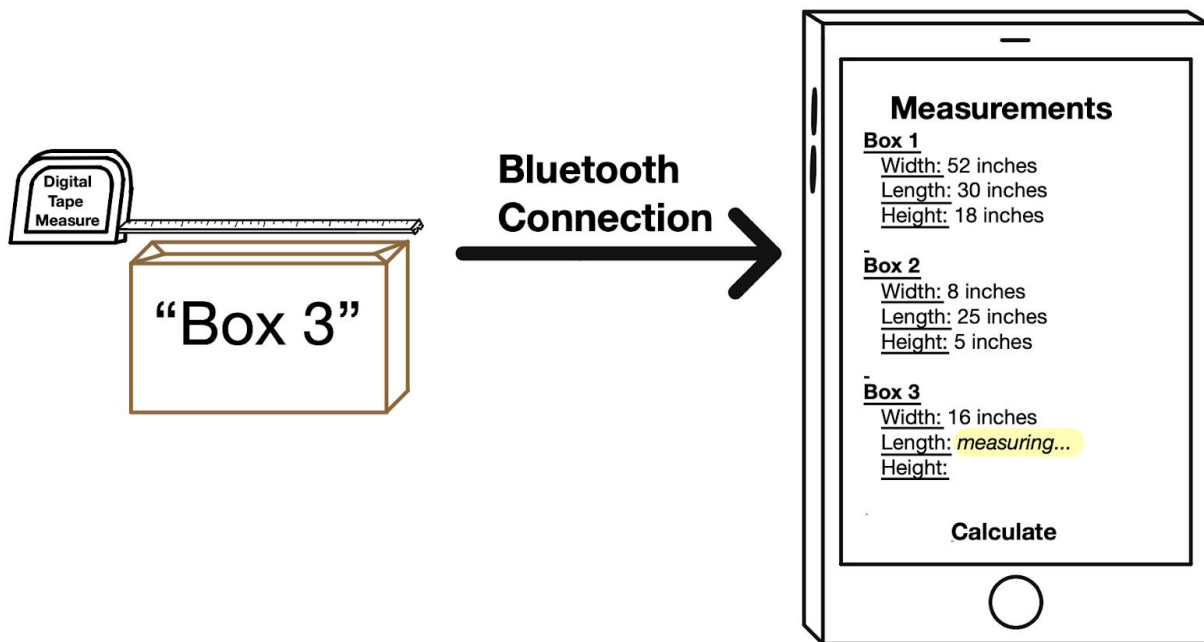


Figure 1. Sending Measurement Visual Aid

1.4 High-Level Requirements List

The user must be able to measure the dimensions of a box and send the data to a smartphone via Bluetooth. The smartphone must be able to receive the data and display it in a user-friendly format. The user must be able to calculate the volume of the box.

The user must be able to measure the dimensions of a box and send the data to a smartphone via Bluetooth. The smartphone must be able to receive the data and display it in a user-friendly format. The user must be able to calculate the volume of the box.

The user must be able to measure the dimensions of a box and send the data to a smartphone via Bluetooth. The smartphone must be able to receive the data and display it in a user-friendly format. The user must be able to calculate the volume of the box.

2 Design

2.1 Functional Overview

The user must be able to measure the dimensions of a box and send the data to a smartphone via Bluetooth. The smartphone must be able to receive the data and display it in a user-friendly format. The user must be able to calculate the volume of the box.

k nUqZ MuijBMlml a" Wa'y| Uyty{Zk 'by'MfMj'Vnk unl ZI {{n' {aZ'nfZxMj' XZyb| 'MIX', aZl ' Vnk Ub ZX'n` Z{aZxU| hXy'MuxnX| V{, Z'UZjZfZ', h'j'ynjZ'n| x'uxnUjZk 'y{Mzk ZI {^AaZ'un, Zx' y| uujt'Vnl {Nb'y{aZ'l ZVZyyMt hZk y{n'MXZw' MZj't'un, Zxn| x'k b'xnVnl {xnjjZxS, ab'a', h'j' b' {l' x' un, Zx{aZ'Uj| Z{nn{a'k nX| jZ'n {xM'y_Zx{aZ'k ZMj| xZk ZI {XMM{n'n| x'k nUqZ MuijBMlml ^AaZ' Vnl {xnj'| l' h'y| Uyty{Zk ', h'j'an| yZ'n| x'k b'xnVnl {xnjjZxSUj| Z{nn{a'k nX| jZSMIX'M_Z, 'Vnyk Z{b' hZk y'jB'Z'U| {{nl y'MIX'1" ž y^AaZ'` nM'n_ {aby'y| Uyty{Zk 'by' {n' xZVZb'Z' | yZx'b' u| {y' _xnk' {aZ' U| {{nl y'My', Zjj'My' xZVZb'Z' k ZMj| xZk ZI {XMM_xnk' {aZ'uxZ'Z. by{b' ` Xb' h'Mj' {Muz'k ZMj| xZ' ' b' Mj'tS {aby'y| Uyty{Zk ', h'j'n| {u| { {aZ'k ZMj| xZk ZI {y' xZVZb'Z' f' b' Mj' Z{nn{a' {n' {aZ'k nUqZ' MuijBMlml ^AaZ'uxZ'Z. by{b' ` {Muz'k ZMj| xZ' y| Uyty{Zk 'Vnl {Nb'y'M' Mj'ZMj't'Z. by{b' ` Xb' h'Mj' {Muz' k ZMj| xZ'nl' {aZ'k M' Z' {nXMS, ab'a', Z', h'j'| yZ' {n' -aM' @b' {n' h'y'Xb' h'Mj'XbyujM' {n' ubuZjB' Z' {aZ' k ZMj| xZk ZI {XMM'b' {n'n| x'Vnl {xnj'| l' h'^AaZ'k nUqZ MuijBMlml 'y| Uyty{Zk 'by'Vnk uxbyZX'n_M k nUqZ Mui {aM', h'j'| yZ' {aZ'uanl Z'y'Uj| Z{nn{a' Vnl l' ZV{b'nl' {n' xZVZb'Z' {aZ'k ZMj| xZk ZI {XMM M'X'uzX_nx' M' Mj' n'x'ak' {aM', h'j' VnxZVj't' XZ{Zx' b' Z' {aZ' y' b'Z'n_ {x| M' l' ZZX' _nx' {aZ' | yZx^Aaby' y| Uyty{Zk ', h'j' Mj'n' uxnf'XZ' {aZ' | yZx', h'a' M'f'by' Mj'b' {Zx_MZ'n_, aZxZ' {aZ't'yan| jX'ujM'Z' {aZ'b' UZjnl' ` b' ` y'My', Zjj^a'

' b | xZ'Y'yan, y'MujnV' Xb'MxM' Vnl {Nb' b' ` {aZ'uatyb'Mj'b' {ZxM' {b'nl' y'n_ {aZ'k M' t'uM' {y'n_n| x' uxntZV{^a'

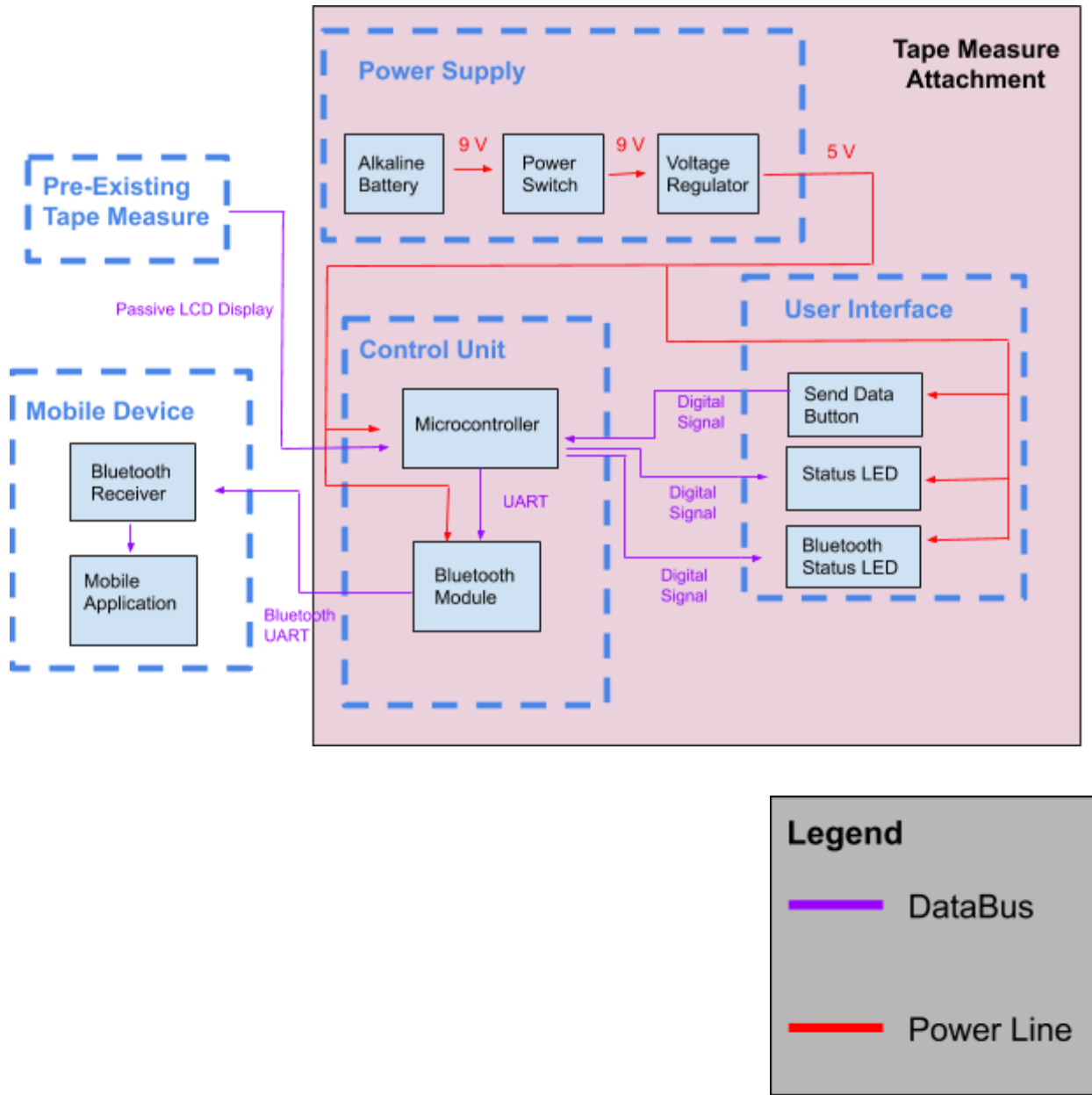


Figure 2. Block Diagram

2.2 Physical Design

At the end of the design process, the physical design is completed. This involves the final layout of the PCB, including the placement of components and the routing of traces. The physical design is then used to generate a Gerber file, which is used to manufacture the PCB. The physical design also includes the design of the enclosure, which is used to protect the PCB and its components. The enclosure is designed to be compact and efficient, with a focus on minimizing the size and weight of the device. The physical design is a critical step in the development of a PCB, and it is essential to ensure that the design is accurate and reliable.

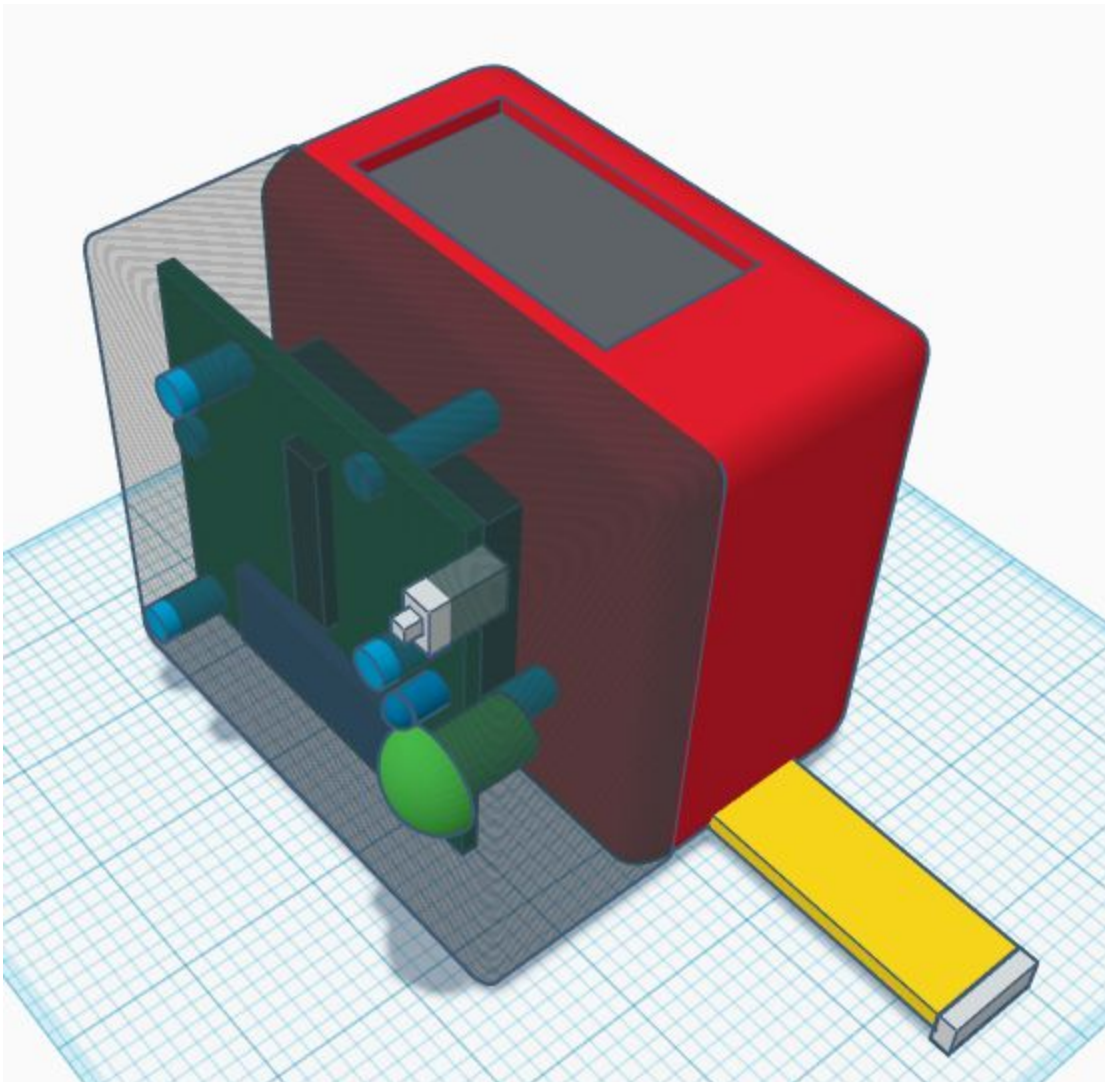


Figure 3. Physical Design

2.3 Power Supply

AaZxZ'NX'fNxb|y'Vnk unl Zl {y'UZb`'NXZX'n{aZ'k ZMyl xZ', abVa xZw' bZ'un, Zx'n' nuZxMZ'aAaZyZ'b Vj| XZ'k' bXnVnl {xnjjZxS(aZ'Uj| Z{nn{a'k nX| jZSjb a{ySMIX'U| {nl y'aH b'a' {aby'UZb`'y'NXS'byl ZVZyM'nx'| y'n'XZy' l' Mun, Zx'y| uujt', abVa', bjj'un, Zx'fayZ'f{ab`y'a' AaZ'un, Zx'y| uujt', bjj'UZ'k'NXZ'| u'n_{aZ'_njjn, b`@y'j' b'Z'UM{ZxZySun, Zx'y, bVaSMIX' fnj{MZ'xZ' | jMnx'a'

2.3.1 Alkaline Batteries

Bj{tk MZj+SZfZxt{ab`un, ZxZX'b' {aZ'Vnl {xnj| l' b', bjj'UZ'un, ZxZX'Ut'UM{ZxZy'aAaZ'UM{ZxZy' , Z'ub' l' ZZX'n'aMfZ'Mab a'ZI n|` a'fnj{MZ'n'i ZZu'ZfZxt{ab`un, ZxZX'SMIX'aZ't l' ZZX'n' aMfZ'ZI n|` a'VMiM'f'f'n'i ZZu'fay'Xb' b'Nj'f{Miz'k ZMyl xZ'nuZxM'b`'nx'Mi'Z' .{ZI XZX'Nk' n| l' {n'_{tk Z'a'k M{Zxt'fnj{MZ', bjj'UZ'M'ujb'ZX'n' M'fnj{MZ'xZ' | jMnxSyn' b' b'ni M'nx'aZ'f'n'f'fnj{MZ' Vnk' b`'xnk' f'ay'UM{ZxZy'n'Z' .VZZX'fay'fnj{MZ' l' ZZXZX'nx'fay'k' bXnVnl {xnjjZxUj| Z{nn{a' k nX| jZ'a'

Requirement	Verification
<p>äG'UM{Zxt'k y{UZ'MJZ'f'n'y uujt'UZ', ZZI' ä'a'a'ä'p'G'MIX'aÜ'ÜÜÜ'k'`'n{aZ'fnj{MZ' xZ' jMnx'a'</p>	<ul style="list-style-type: none"> ° a Byb`'M'nyM'jnyVhuZ'SyZ'f' l' u'M{Zy{b`' Zl' f'bnl' k' Zl' {nx'fay'<n, Zx'@' uujt' y Uyty{Zk' £ a 'j'bw'fay'un, Zx'y, bVa'f'n'fay'53' uny'f'bnl' a' † a 2 nl' b'nx'fay'fnj{MZ'nl' f'ay' nyM'jnyVhuZ'M'fay'b' u f'n_{aZ' fnj{MZ'xZ' jMnx'a' ž a " l' y xZ'fnj{MZ'xZVZ'b'ZX'by'UZ', ZZI' ä'a'a'G'ä'p'G'a'
<p>£M{ZxZy'k y{UZ'MJZ'f'n'jM'f'k' nxZ'fay'Mi'Ü' an x'n' l' nxk' Mj yZ'Ut'fay'Vnl {xnj l' b' y Uyty{Zk' a'</p>	<ul style="list-style-type: none"> ° a @' bVa'fay'un, Zx'y, bVa'f'n'fay'53' uny'f'bnl' . £ a " l' y xZ'f' nl' {xnj'BI' b' y Uyty{Zk' 'by' V xxZI' {j' l' l' V{bnl' b`' Ut'fZx'bt'b`' f'ay' @M y'1" ž' by'j' b' u'n'ynj' b'X'Vhjnxa' † a £Z' b' f'k' Zx'Z'f'fay'Z'nl' yk' M'fuanl' Z'nx' y{nu, M'Va'Ä' ž a £Z' b' k' ZMyl' x'b`' b'Zk' y'MIX'yZI' Xb`' XM'M'h'fZx'Uj Z{nn{a' " a H'aZI' f'ay'f'k' Zx'by'M'äÜ'k' b' {Zy'Ü' an x'f'ny'nu' b' M'IX'ZI' y xZ'1" ž' ynl' k' bXnVnl {xnjjZx'MZ' y{b'j'j' b' u'MIX' y Uyty{Zk' 'by'f' b' l' l' V{bnl' b`' a'

2.3.2 Power Switch

Ani ZZU {aZ UM {ZxZy jM {b` Myjnl` My`uny yUjZSMYk Nj y, bVa` j b ZjtSMYj bXZ y, bVaA, b j`UZ` | yZX`n`ZI MUJZ`{aZ`| yZx`n`{ | xl`nl` M`X`n`_un, Zx`n`{aZ`fnj`{MZ`xZ` | jM`nx`SM`X`{a`| yS`{aZ`Vnl`{xnj` | l`b`a`

Requirement	Verification
<p>2 y`y` WZyy`jjt`Xb`Vhl`I`ZV`un, Zx`_xnk` fnj`{MZ`xZ` jM`nx`, aZl` y, bVaZX`5`'` M`X` y WZyy`jjt`Vhl`I`ZV`un, Zx`n`{aZ`fnj`{MZ`xZ` jM`nx`j`U`UG`Xxnu`A, aZl` y, bVaZX`5`3`a`</p>	<p>° a H`b`ab`{aZ`<n, Zx`@` uujt`y Uyty`{Zk`S` yZ`{` u`M`{Zy`{b``ZI`f`bxl`k`ZI`{` yb``{aZ`ny`M`j`ny`VhuZ`a`</p> <p>£ a <xnUZ`{aZ`un, Zx`y, bVa`a`*` b`b`j`j`S`yZ`{`{aZ`y, bVa`b`{aZ`5`'` uny`b`l`a`</p> <p>† a "I`y xZ`I`n`fnj`{MZ`by`jn, b`n` `{n`_{aZ`un, Zx`y, bVa`a`</p> <p>ž a 'j`b`{aZ`un, Zx`y, bVa`{n`{aZ`5`3` uny`b`l`a`</p> <p>" a 2`nl`b`nx`nl`{aZ`ny`M`j`ny`VhuZ`{aM`fnj`{MZ`by`UZ`b``uxnX` VZX`_xnk`{aZ`un, Zx`y, bVa`j`U`UG`Xxnu`A`</p> <p>' a 'j`b`{aZ`un, Zx`y, bVa`UM`{n`{aZ`5`'` uny`b`l`a`</p> <p>(a 2`nl`b`nx`nl`{aZ`ny`M`j`ny`VhuZ`{aM`{aZ`un, Zx`y, bVa`y WZyy`jjt`xZX` VZ`fnj`{MZ`n`{aZ`fnj`{MZ`xZ` jM`nx`</p>

2.3.3 Voltage Regulator

@nk`Z`{tk`Zy`S`b`by`Xb`b`| j`{`_nx`UM`{ZxZy`{n`k`N`b`{N`b`MVZx`{N`b`fnj`{MZ`n`fZx`M`I`Z`{ZI`XZX`u`Z`x`n`X`n`_`{tk`Z`a`*_VZx`{N`b`Vnk`unl`ZI`{y`xZw`bZ`y`{ZM`k`f`fnj`{MZ`jZ`fZjy`S`b`by`{`b`XZM`{n`xZj`n`l`UM`{ZxZy`{n`NWnk`uj`b`y`{a`b`y`ZM`a``XX`b`l`n`l`Nj`j`S`b`by`{`N`l`M`y`uny`y`UjZ`{n`ub`l`n`|`{`UM`{Zx`Vnk`Ub`M`l`n`l`y` , ab`v`a`k`ZZ`{VZx`{N`b`fnj`{MZ`xZw`bZk`ZI`{y`j`_nx`Z`..M`k`ujZS`°`UM`{ZxZy`MZ`xM`ZX`M`U`pa`G`{xtb``{n`uxnX`| VZ`M`fnj`{MZ`jZ`fZj`, ab`v`a`by`{`M`k`| j`{b`ujZ`n`_U`pa`G`UZVnk`Zy`Xb`b`| j`{A`Aa`ZxZ`_nxZS`{aZ`Vnl`VZu`n`_fnj`{MZ`xZ` | jM`nx`y`UZVnk`Zy`| yZ`_j`a`*`n`| x`uxn`l`ZV`{S, Z, b`j`UZ`un, Z`x`b``M`k`b`x`n`Vhl`{xnj`Zx`M`X`MUj`Z`{nn`{a`k`nX`| jZ, ab`v`a, b`j`j`b`Zjt`xZw`bZ`y`u`Z`V`b`b`fnj`{MZ`jZ`fZjy, ab`v`a`M`X`Xb`_ZxZI`{`{aM`{aZ`UM`{ZxZy, Z`ub`l`a`£`†`| yb``fnj`{MZ`xZ` | jM`nx`yS, Z`VMI`y| uujt`{aZ`Vn`xZV`fnj`{MZy`{n`{aZy`Vnk`unl`ZI`{y`Z`fZl`{an`|`a`n`| x`UM`{ZxZy`k`M`I`n`{Z`..M`k`j`j`k`M`Va`{aZyZ`y`M`k`Z`fnj`{MZy`a`

Requirement	Verification
<p>Gnj{MZ'xZ' jMnxk y{ 'UZ' MJZ' {n'y uujt' UZ{, ZZI 'B'a'a'a'G'b u { 'n' {aZ' k b'xnVnl {xnjjZx'M'X'Uj Z{nn{a k nX jZ' b'Zl' {aZ' b' Vnk b' 'ä'G'b u { 'fnj{MZ' _xnk' {aZ' äG' UM{Zxt'a'</p>	<p>° a H b'ab' {aZ' <n, Zx'@ uujt' y Uyty{Zk \$ uxuUZ' {aZ' fnj{MZ' xZ' jMnx'M'X' k b'xnVnl {xnjjZx'j'b Z'a † a @ZVb' MJt'S yb' 'M' nyMjinyVhuZ' k ZMj xZ' {aZ' fnj{MZ' n {u { 'Vnk b' ' {aZ' fnj{MZ' xZ' jMnx' {n' {aZ' k b'xnVnl {xnjjZx'M'X'Zl' y xZ' b' b' UZ{, ZZI 'B'a'a'a' Gnj{y'a'</p>

2.4 Control Unit

AaZ'Vnl {xnj' | l b', b'j | yZ' M' ° xX| b' n' EA', ab'a' | yZy' M' ° Ak Z' N'P'ä < 2 b'xnVnl {xnjjZx' {n' xZVZb'Z' fMj| Zy' _xnk' n| x'uxZ'Z. b' {b' 'AMiZ' 2 ZMj| xZ' y' < M' yb'Z' t' ž ' ž byujM' SxZVZb'Z' b' u| {y' _xnk' {aZ' | yZx' {axn| ' a' U| {nl yS'XbyujM' y{M'Zy' {n' {aZ' | yZx' {axn| ' a' 1" ž yS' M' , Zjj' M' yZl' X'XM' M' {n' {aZ' k' nUjZ' XZ' f' b'Z' {axn| ' a' U| Z{nn{a' B' ° A'a'

2.4.1 Microcontroller

H Z'ujM' n| ' | yb' 'M' ° Ak Z' N'P'ä < 2 b'xnVnl {xnjjZx'a' AaZ' nuZxM' b' ' fnj{MZ' _nx' {aZ' k b'xnVnl {xnjjZx'xM' ' Zy' _xnk' 'Ü'a'a' 'ä'a'a' Gnj{y'a' H Z'ujM' n| ' nuZxM' b' ' b' M' 'E'a' Gnj{y' _nx'n| x'uxntZV' XZy'b' | 'ÄÄ' ' aM' y' P'Y' i' E' n' j' M' y'a' k' Zk' nxi', ab'a' yan| jX'UZ' k' nxZ' {aM' 'Zl' n| ' a' {n' y' {nxZ' n| x'VnXZ' 'ÄÄ' AaZ' ° Ak Z' N'P'ä < M' yn' Vnl {M' b' y' ÜB' Xb' b' M' i' ub' y' M' X' a' M' i' n' ' ub' y' _nx' | y' {n' | yZ' _nx'n| x'1" ž y' M' X' E' | {nl y' M' , Zjj' M' y' {xM' y' M' b' ' {aZ' < M' yb'Z' t' ž ' ž byujM' _xnk' {aZ' AMiZ' 2 ZMj| xZ' 'ÄÄ'

Requirement	Verification
<p>2 y{ 'UZ' MJZ' {n' MW xM'Zj' xZuxnX VZ' k ZMj xZk Zl' {XM' M' _xnk' {aZ' {M' iZ' k ZMj xZ' E' y' XbyujM'</p>	<p>° a ByZ' {aZ' uxZ'Z. b' {b' ' {M' iZ' k ZMj xZ' {n' xZ'VnxX' k ZMj xZk Zl' {XM' M' U' k ZMj xb' ' b' Zk y' † a ?ZVnxX' {aZyZ' k ZMj xZk Zl' {y'UZb' ' XbyujM' n {aZ' {M' iZ' k ZMj xZ' y' XbyujM' n ' uM' iZ' x' ‡ a <xZy' @Zl' X' ž M' M' U {nl ' ž a 5l' k' nUjZ' XZ' f' b'Z' S'VaZM' {n' yZ'Z' b' {aZ' k ZMj xZk Zl' {y' XbyujM' Z'X' n {aZ' l' n' {b' b' M' b' n ' b' {Zx' MW' M' Z' {aZ' y' N' k' Z' M' y' {aZ' n Zy' xZ'VnxX' n ' uM' iZ' x'</p>

<p>2 y{UZ'UjZ'n{xMlyk b'k ZMj xZk ZI {XMM fMuj Z{nn{a'n MuMkZX'XZfVZ'a'</p>	<ul style="list-style-type: none"> ° a <xZyy{aZ'<Mk'U {{nl' , b'ab {aZ' f nl {xnj'BI b'y Uyty{Zk' £ a 5l 'Mk nUljZ'XZfVZS y b`'Uj Z{nn{a' Vnl I ZV{b'f'fSuMk', b'a {aZ'Uj Z{nn{a' k nX jZ' † a (MlaZ'k ZMj xZk ZI {XMM y b`' {aZ' uxZ'Z. b'y{b`' {Miz'k ZMj xZ' ž a <xZyy{aZ'@I X'ž MjU {{nl' " a "I y xZ {aZ'XMM, Mj'xZVZb'ZX'nl {aZ' k nUljZ' Muij b'Ml'nl 'Ut'fVZ, b`' {aZ' k ZMj xZk ZI {XMM'nl {aZ' I n{b b'Ml'nl b {Zx'WZ'nl {aZ'k nUljZ' Muij b'Ml'nl'
---	--

2.4.2 Bluetooth Module

H Z', bjj'UZ' | y b`' {aZ'}) 2 'U'U'Uj| Z{nn{a'k nX|jZ'a' Aaby'Uj| Z{nn{a'k nX|jZ', bjj'UZ' xZyuni yUjZ' _nx' xZVZb' b`' XMM_xnk {aZ'' Ak Z' M'Y'a<2 b'xnVnl {xnjjZ'X'M'X'yZI Xb`' b' {n {aZ'2 nUljZ' ž ZfVZ'a' f' nuZxM'Zy' M'Y'a' 'P'PG' M'X'xZw' b'Zy'a'Uk ° 'Aa' AaZ' UxZM'nl { 'UnM'X' {aM' b' Vnk Zy'nl 'Vnl {M' y'M fnj{MZ'xZ' | jM'nx {aM' VM' MWZu{ 'P'a' 'a'G' {n' Ux b`' b' Xn, I {n {aZ' | yUjZ' Y'a' 'P'PG' Aa' AaZ') 2 'U'U'Uj| Z{nn{a'k nX|jZ' | yZy'Uj| Z{nn{a' B'£1" Aa' Aa'

Requirement	Verification
<p>£j Z{nn{a'k nX jZ'k y{UZ'UjZ'n'yZI X' k ZMj xZk ZI {y{n {aZ'yk M'xuanl Z'NW xMjZ'j' , b'a' M'xM'y_Zx'yuzZX'n_M'jZMj{ 'Y'2 Uuy'a'</p>	<ul style="list-style-type: none"> ° a ž Zy b' I 'M'X' b'k ujZk ZI {M'Zy{ 'uxn' xMk' y b`' {aZ'' xX b' n' yn' , M'Z' {aM', bjj' ux b`' {n' {Uj Z{nn{a' {xM'y_Zx'xMjZ' {n' yZx b' y'k nl b'nx' £ a ? I {aZ' {Zy{ 'uxn' xMk' † a "I y xZ {aZ' {xM'y_Zx'xMjZ' _xnk {aZ' Uj Z{nn{a'k nX jZ' b'y'n_M'jZMj{ 'Y' 2 Uuy'

2.4.3 Send Data Button

Aaby'U| {{nl' , bjj'UZ' xZyuni yUjZ' _nx' xMjU b`' {aZ' V| xZl {k ZMj| xZk ZI { _xnk {aZ' uxZ'Z. b'y{b`' {Miz'k ZMj| xZSM'X' , aZl 'uxZyyZX', bjj' y b' I M'f'n {aZ' Uj| Z{nn{a'k nX|jZ' {n'yZI X'k ZMj| xZk ZI {y{n' {aZ'yk M'xuanl Z'a''

Requirement	Verification
<p>H aZl uxZyyZXS{aZ'yZl X'XMIMU {{nl 'k y{ ybl Ml{aZ'Uj Z{nn{a'k nX jZ' {n'yZl X'XMIM\$ MIX{aZ'Uj Z{nn{a'k nX jZ'k y{ 'l n{ 'yZl X' XMIMh{aZx, byZ^a</p>	<p>^o a <xZyy@Zl Xž MIMU {{nl ^a" y xZ'ł' XnZy'l n{ 'Z{ 'y{ M ^a ^t a 5l 'Mk nUłZ'XZ'fVZ'SVaZV' {n'yZZ' b' l n{ bMIMl' b {Zx'WZ' MiuZMx'y' M' b`' {aZ' yZx' {n' b'j' b' XZ{M' y' b' xZ' MxY' {n' {aM' yuZVbV' Un..; b'a {aZ' yZl { 'nfZx' XMIMk Zl y' b' y^a ^t a ž n' l n{ 'uxZyy' XMIMU {{nl ' ^ž a 5l 'k nUłZ' XZ'fVZ'SZl y xZ' l n' l n{ bMIMl' b {Zx'WZ' XnZy'l n{ 'MiuZM' {n' yZx'</p>

2.4.4 Status LED

Aaby'1" ž', bj'UZ'jb', abZ' {aZ'XZ'fVZ' by'un, ZxZX'nl 'MIX' l n{ 'jb', abZ' {aZ'XZ'fVZ' by' | xl ZX'n^a

Requirement	Verification
<p>2 y{ 'UZ'jb', abZ' {aZ'XZ'fVZ' by'nl 'MIX' l n{ 'jb' , abZ' {aZ'XZ'fVZ' by'n^a2 y{ 'UZ' fby'WJZ' xnk 'Ü' k Z{Zx'M' M'</p>	<p>^o a 2 ZM' xZ'n { 'Ü'k Z{Zx'M' M' xnk '1" ž' ^t a " y xZ' XZ'fVZ' by'n' M' X'Zl y xZ' 1" ž' by' l n{ 'nl ' ^t a A xl 'XZ'fVZ' nl ' ^ž a " y xZ' 1" ž' by'n' ynjb' Vnjnx' MIX' fby'WJZ'</p>

2.4.5 Bluetooth Status LED

Aaby'1" ž', bj'UZ' ynjb'jb', abZ' {aZ'Uj| Z{nn{a'k nX| jZ' by'Vnl | ZV{ZX' {n' Mk nUłZ' XZ'fVZ'Sl n{ 'jb'
, abZ' {aZ'Uj| Z{nn{a'k nX| jZ' by' l n{ 'Vnl | ZV{ZX' {n' Mk nUłZ' XZ'fVZ' MIX' l n{ 'jn'ni b' ` 'nx'Mk nUłZ'
XZ'fVZ'SMIX'Ujb' i b`', abZ' {aZ'Uj| Z{nn{a'k nX| jZ' by', M' b' ` {n'UZ' uM' XZ' {n' MX'fVZ' jM' {Zx', Z'
uxZyy' {aZ' uM' U| {{nl 'SU| { 'UZ' nxZ', Z' Vnl | ZV{ 'ł' {n' Mk nUłZ' XZ'fVZ'A^a

Requirement	Verification
<p>2 y{ 'UZ'jb', b'a 'MynjB' Vnjnx', abZ' Uj Z{nn{a'k nX jZ' by'Vnl ZV{XZ'SUjb' i b`', abZ'</p>	<p>^o a ž n' l n{ 'uM' Uj Z{nn{a'k nX jZ', b'a' k nUłZ' XZ'fVZ'^a ^t a 2 ZM' xZ'n { 'Ü'k Z{Zx'M' M' xnk {aZ'</p>

Uj Z{nn{a'k nX jZ'byZM'ab`_nx'Mk nUqZ' XZfVZSMIXI n{jk'n{aZx, byZ^2 y{UZ'fbyUjZ' _xnk 'Ük Z{ZxM, M^a	1" ž' † ^ "l y xZ'1" ž' by'Uj b i b` fbyUj† ž ^ <M'Uj Z{nn{a'k nX jZ', k'a'k nUqZ' XZfVZ' " ^ "l y xZ'1" ž' by'n_ynj b' Vnjnx'MIX' fbyUjZ'
---	---

2.5 Mobile Device

AaZ'Vnl {xnj|l k', bjj'yZl X'XMIM{axn|`a'Uj| Z{nn{a'B°?A{n{aZ'k nUqZ'XZfVZ^aAaby'XZfVZ', bjj'
xZVZbZ'fVj| ZySy{nxZ {aZk' b' Mk nUqZ'MuujbMl bnl Sb u| {aZk' b' {n'MI' Mj' nxdak SMI X'XbyujM'
{aZk' b' M'fby| Mj'_nx{aZ'|yZx{n'i l n, , aZxZ'n'y{nxZ {aZ' b' bZk y'MIX'an, 'k | Va'yUWZ', bjj'UZ'
xZw| bZX^a''

2.5.1 Bluetooth Receiver

AaZ'|yZx', bjj'aMfZ'MI'Z.by{b`yk M{uanl Z{aM', bjj'UZ'MUjZ'n'uMk{n'n|xUj| Z{nn{a'k nX|jZ'b'
n|x'Vnl {xnj|l k^a''

Requirement	Verification
†j Z{nn{a'xZVZbZx'nI yZx'y'k M{uanl Z' k y{UZ'MUjZ'n'Vnl I ZV{`n'Uj Z{nn{a'k nX jZ' fVUj Z{nn{a'Vnl I ZV{b'†	° ^ 5l 'Mk nUqZ'XZfVZ'SnuZl 'Uj Z{nn{a' Vnl I ZV{bni 'yZ{{b`y'b {Zx_WZ' † ^ ' b'X{aZ'VhxxZyuni Xb`'Uj Z{nn{a' k nX jZ'XZfVZ'I M'Z'nl {aZ' Vnl I ZV{bni yjby{ † ^ 5l {aZ'k nUqZ'XZfVZ'S{M'`n' Vnl I ZV{pMk, k'a {aZ'Uj Z{nn{a' k nX jZ' ž ^ "l y xZ'Vnl I ZV{bni 'by'k M{axn `a' l n{bMl bnl ynl {aZ'yk M{uanl Z'y' b {Zx_WZ^a''

2.5.2 Mobile Application

5|x'k nUqZ'MuujbMl bnl , bjj'xZVZbZ'fVj| Zy_xnk {aZ'Uj| Z{nn{a'xZVZbZxSy{nxZ {aZk' b' {aZ'MiuS
x|l 'MI' Mj' nxdak {aM'jnni y'_nx{aZ'UZy{ujWZy'n'y{nxZ {aZ'Un.Zy'b {aZ'x| M S{Zjj {aZ'|yZx', aM'
y%o{x| M 'by'xZw| bZXSMIX'yan, 'M'fby| Mj'_n, aZxZ'n'y{nxZ {aZ' bZk y'b {aZ'x| M ^a''

Requirement	Verification
<p>AaZ`Nj` nxdak` l` ZZxy`{n`XZVbXZ`, aZxZ`bZk`y` k` y`{`UZ`uj`WZX`MIX`{MIZ`jZyy`{aM`Y`k`b` `{Zy` {n`Vnk`u` `{Z`a`</p>	<p>° a 5l`k`nUbjZ`XZ`fVZS`l`y` `xZ`Nj`XMM` k`ZMj` `xZk`Zl`{`by`yZl`{`Uf`uxZyyb``{aZ` @Zl`X`ž`MjMj` `{nl` t`a` ?` `l`{aZ`Nj` nxdak` f`a` ByZ`My`{nu,`MjVa`MIX`y`{M`{b` ž`a` @nu`{aZ`y`{nu,`MjVa`,`aZl`{aZ` l`n`{b`b`M`l`b`{Zx`WZ`XbyujM`y`nl`{aZ` k`nUbjZ`XZ`fVZ`y`{M`b``Nj` nxdak`by` Vnk`ujZ`{Z` "a` "l`y` `xZ`y`{nu,`MjVa`{tk`Z`by`jZyy`{aM`Y` k`b` `{Zy`</p>
<p>AaZ`Nj` nxdak`k` y`{`UZ`MjZ`{n`xZunx`{aZ` yk`NjZy`{uny`y`b`jZ`y`bZ`{x` `V`i`l`ZZXZX`_nx`{aZ` `yZx`{n`y`{nxZ`{aZ`b`bZk`y`a`</p>	<p>° a 5l`{aZ`k`nUbjZ`XZ`fVZS`l`n`{b`b`M`l`b` yan` `jX`MiuZM`{aM`{aZ`Nj` nxdak`by` Vnk`ujZ`{Z`a` t`a` ByZxy`yan` `jX`{aZl`UZ`MjZ`{n`yZZ` xZy` `j`{y`n`_`{aZ`Nj` nxdak` f`a` GbZ,`xZy` `j` ž`a` l`nni`nl`{aZ`uMj`b``{x` `V`i`,`ZUy`bZ` jZ`a`B1)`MjA`{n`Zl`y` `xZ`{aZ`xZy` `j` xZVZbZ`X`,`Mj`l`n`{`aZ`Ub`Zy`{`x` `V`i` y`bZ`a`</p>
<p>AaZ`Nj` nxdak`k` y`{`XbyujM`nl`Z`ynj` `{b`l`_`nx` {aZ`k`ny`{Z`_`bZl`{,`M`{n`uMj`{aZ`{x` `V`i`a`</p>	<p>° a 5l`{aZ`k`nUbjZ`XZ`fVZS`l`yZxy`yan` `jX` xZVZbZ`l`n`{b`b`M`l`b`y`{M`b``{aZ` Nj` nxdak`by`Vnk`ujZ`{Z`a` t`a` Bunl`Vnk`ujZ`{b`l`n`_`{aZ`Nj` nxdak`S` k`nUbjZ`Miu`b`M`l`b`yan` `jX`XbyujM`{n` {aZ` `yZx`Mj`b`{n`Z`_`bZl`{`uMj`b`` ynj` `{b`l`y` f`a` ByZxy,`b`j`{aZl`aMfZ`{aZ`nu`{b`l`{n` fZ,`Nj`uny`y`b`jZ`ynj` `{b`l`y`MIX`VannyZ` MvnxXb``j`f`{aZ`UZy`{ynj` `{b`l`{aZ`t`yZ` _`b`</p>

2.6 Pre-existing Tape Measure

5`|`x`Miu`b`M`l`b`l`l`ZZXy`n`UfZV`{y`-Xtk`Zl`y`b`l`y`b`n`xZx`{n`VjM`|`jMz`{aZ`UZy`{,`M`{n`uMj`bZk`y`b`M`
Vnl`_`b`ZX`y`u`WZ`a`AaZyZ`Xtk`Zl`y`b`l`y`S`|`j`{tk`Mz`j`fS,`b`j`UZ`Zl`{ZxZX`b`Uf`{aZ`|`yZx`n`n`|`x`Miu`b`M`l`b`l`a`
AaZ`w`b`M`Zx`{aZ`|`yZx`VMI`_`b`|`xZ`n`|`{`Xtk`Zl`y`b`l`y`n`_`{aZ`{ab``y`aZ`pyaZ`by`k`n`f`b``S`{aZ`k`nxZ`|`yZ`_`j`

n| x'MiujbMl |, bj'UZ{n'atk paZx^a5 | x'ynj| {nl {n'k b'k b'z{aZ' M' n| | {n_{tk Z' nx{aby'uxnVZyy' by{n| yZ'MuxZ'Z. by{b`'Xb' b'Nj{Miz'k ZMj| xZSxn| {Z{aZ'k ZMj| xZk ZI {xZM' b`'y_xnk' b'SMIXyZi X' {aby'XMVhfZx'Uj| Z{nn{a' {n'n| x'MiujbMl |^a

Requirement	Verification
AMiz'k ZMj xZ'k y{aMfZ' MWZyyb'UjZ' M' X' yMjZ' XMMyb' l' Nj', ab'va' VM' UZ' yZX' Ut' n x' Vhl {xnj' l' b ^a	<ul style="list-style-type: none"> ° a ž ZVhl y{x V{uxZ'Z. by{b`' {Miz' k ZMj xZ' Ł a GŁ, 'Z. by{b`' ZjZV{xnl b'y'n_{Miz' k ZMj xZSyuZVb' b'Nj' t' XMMyb' Zy' {aM' xn {Z{ n' X'byujM' nl' {Miz' k ZMj xZ' † a † aZV' {aZyZ' yb' l' Nj' {n' yZZ' b', Z' MZ' MjZ' {n' xZxn {Z{ aZk' {n'n x'Uj Z{nn{a' k nX jZ'
AaZ' l' k UZx'n_ XMMyb' l' Nj' yZX' Ut' {aZ' {Miz' k ZMj xZ' yan jX' UZ' jZyy' {aM' n' xZw' Mj' {n' {aZ' l' k UZx'n_ b' u {y' M' Nj' MjZ' nl' n x' k b'xnVhl {xnjjZx ^a	<ul style="list-style-type: none"> ° a ž ZVhl y{x V{uxZ'Z. by{b`' {Miz' k ZMj xZ' Ł a † aZV' b' Z. by{b`' XMMyb' l' Nj' nl' {Miz' k ZMj xZ' MZ' jZyy' {aM' l' k UZx'n_ b' u {y' nl' k b'xnVhl {xnjjZx' Ut' Vn l' {b`' {aZ' XMMyb' Zy'

2.7 Schematics

<ZxMiy'nl Z'n_{aZ'k nxZ' VaMjZi ` b`' uM{y'n_{aby'uxnlZV{ by{aZ' _M{ {aM' {aZxZ' MZ' M' | k UZx'n_ VxV| b' ZjZk ZI {y', ab'va' k | y{UZ' Vhl | ZV{ZX' {n` Z{aZx'b' M'yk Nj' MZM' t' M' Z' nx{ {n' yan, 'an, ' {aZyZ' ZjZk ZI {y' MZ' Vhl | ZV{ZX' {n' nl' Z' M' n{aZxS{aZ' yVaZk M' b'y' VhxxZyuni Xb`' {n' Z' Wa' k nX| jZ' VM' UZ' _n| l' X' UZjn, ^a

2.7.1 Power Module Schematic

' b | xZ' B' UZjn, ' n| {jb Zy' {aZ' <n, Zx' 2 nX| jZ' @vaZk M' b' Vhl {M' b`' {aZ' aG' UM{ZxtS{aZ' yj' bZ' y, b'Va' SMIX' {aZ' aG' j' b' ZM' f' nj{MZ' xZ' | jM' n' x' AaZ' UM{Zxt' b'y' | yZX' M'y' {aZ' un, Zx' yn| xVZ' nx' Mj' n_ {aZ' M' XZ' XZ' ZjZV{xnl b'yS{aZ' yj' bZ' y, b'Va' b'y' | yZX' {n' { | xl' nl' M' X' n_ un, Zx' {n' {aZ' M' XZ' XZ' ZjZV{xnl b'yS' M' X' {aZ' f' nj{MZ' xZ' | jM' n' x' y{Zuy' Xn, l' {aZ' f' nj{MZ' jZ' fZ' j' _xnk' aG' {n' aG^a

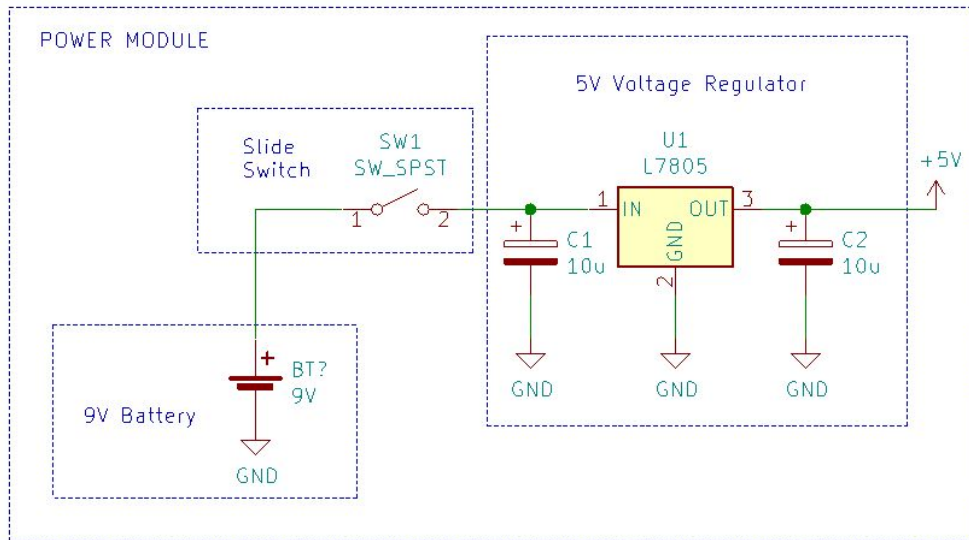


Figure 4. Power Module Schematic

2.7.2 Control Unit Schematic

' b | xZ`à UZjn, `n | j b Zy {aZ`† n | {xnj`BI b`@vZk MlV`Vnl {N b` b` {aZ`k b`xnVnl {xnjjZxS{aZ` Uj | Z{nn{a`k nX | jZSMIX`{aZ`XMIMyb | Njy`Vnk b` ` _xnk` {aZ`{MlZ`k ZMj | xZ`aAaZ`k b`xnVnl {xnjjZx` yZxfZy`Mj`Mk b`XjZ`k Ml`UZ{, ZZI` {aZ`XMIMyb | Njy`MIX`{aZ`Uj | Z{nn{a`k nX | jZ`2 nxZ`yuZVb`Mj`†S b` b` {ZxuxZ`y`{aZ`XMIMMnk b` ` _xnk` {aZ`{MlZ`k ZMj | xZSMIX` | yZy`{aZ`Uj | Z{nn{a`k nX | jZ`Mj`M k ZMj`{n`Vnk k | I b`MjZ`, b`a` {aZ`uMlZ`X`Uj | Z{nn{a`XZ`fVZ`a`

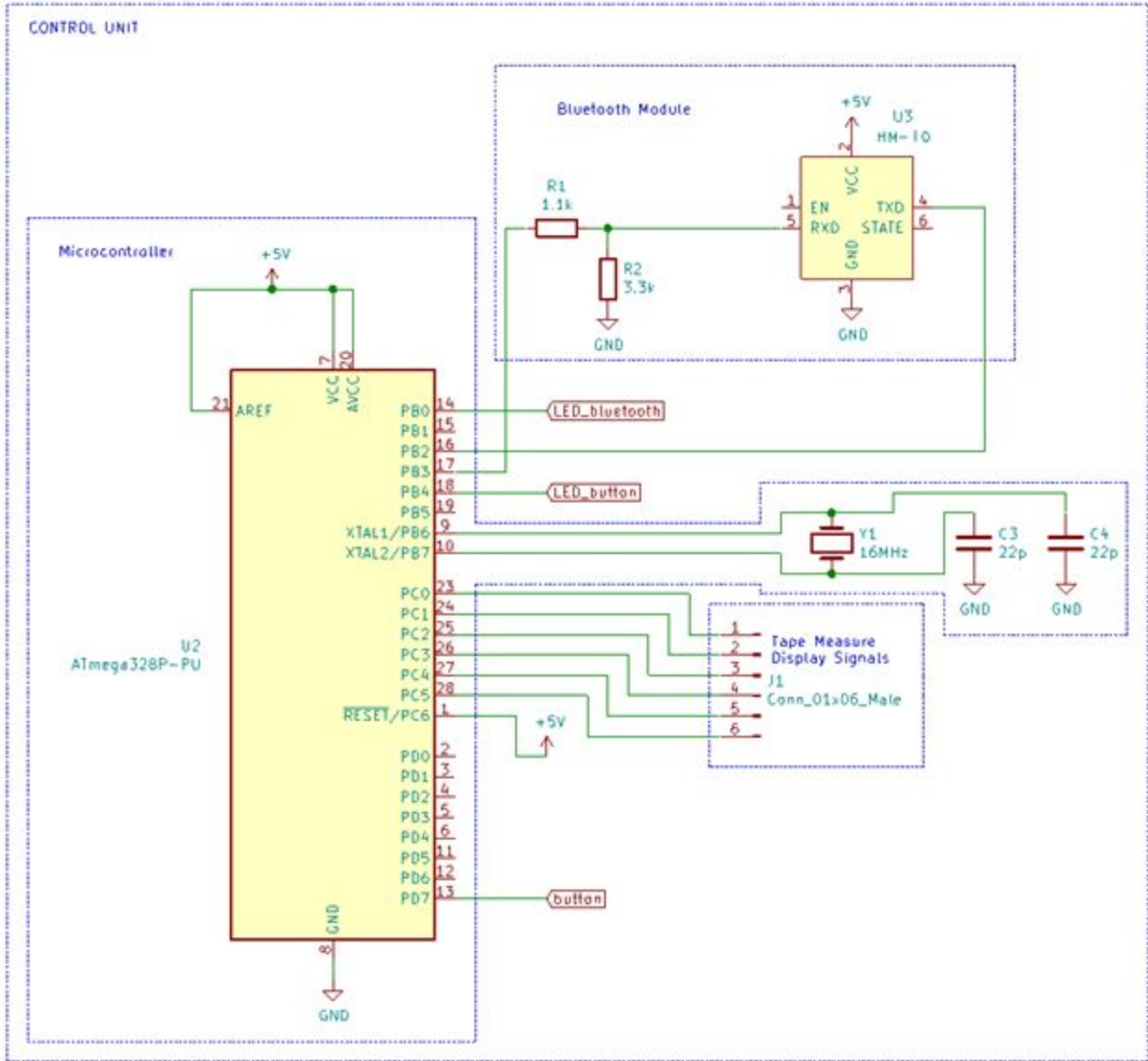


Figure 5. Control Unit Schematic

2.7.3 User Interface Schematic

' b | xZ ' a UZjn, ' n | j b Zy { aZ ' ByZx ' i { Zx ' WZ ' @ / aZk M l v Vnl { N b b ' ' { aZ ' 1 " ž y ' M X { aZ ' U | { { n l ' aAaZ ' 1 " ž y ' M XZ ' | yZ X { n ' u x n f b X Z ' f b y | M j b ' n x k M l m l { n { aZ ' | yZ x xZ ' M X b ' ' 5 3 μ 5 ' ' y { M | y ' M X U j | Z { n n { a ' Vnl | Z V { b l ' y { M | y ' aAaZ ' U | { { n l ' , b j ' UZ ' | yZ X { n ' y b l M j { n { aZ ' k b x n Vnl { x n j j Z x , a Z l { n ' y Z l X X M l M { n { aZ ' u M X Z k n U b Z X Z f b V Z ' a ' 3 n { Z S M j ' n { aZ y Z ' Vnk un l Z l { y ' M XZ ' Vnl | Z V { Z X { n ' X b b M j ' u b y ' n { aZ ' ° A2 " (° b Ÿ ā < ^ a

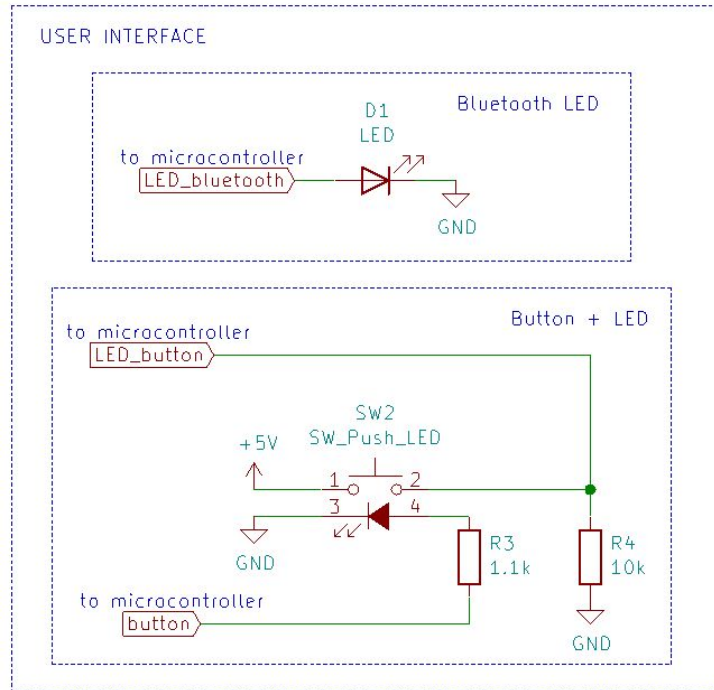


Figure 6. User Interface Schematic

2.8 Software

AaZ`{Muz`k ZNy| xZ`b {ZxW(y, k`a {aZ`k nUjZ`MuujbMl`l {axn|`a {aZ`Uj| Z{nn{a`k nX| jZ`b`n|x` Vnl {xnj}| l k`a` ab`a`jZfZj`nfZxfZ, `n_{a`b`b {ZxW{l`l`b`y`X`b`ujMZX`b`_b`| xZ`B`a`

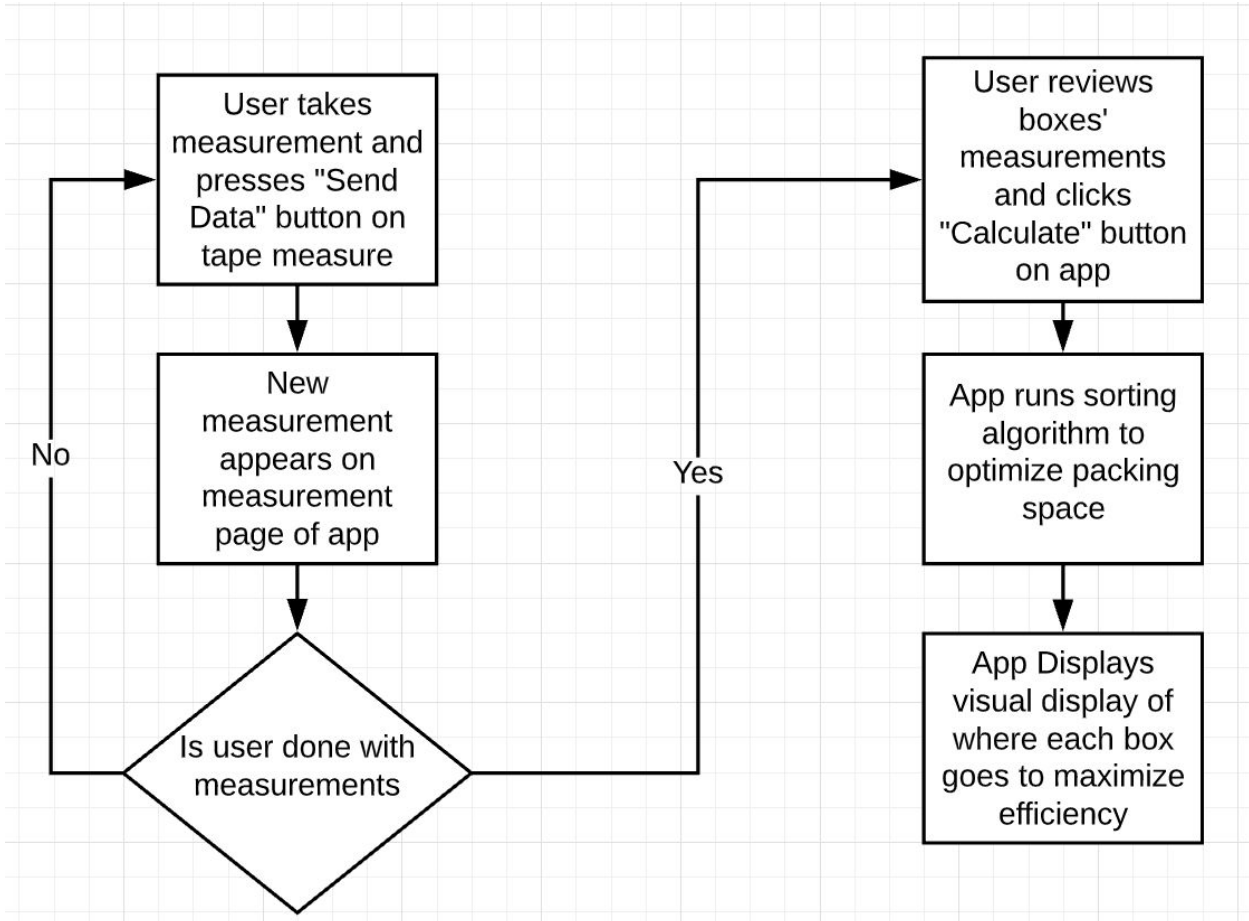


Figure 7. High-level Tape Measure and App Interaction

2.9 Fault Tolerance

<ZxMrynl Z'n_{aZ'Ub`Zy{nUy{MjZy', ab/a', bj'UZ'_MZX'b`{aby'uxnlZV{by'XZVnXb``{aZ' k ZMyl xZk Zl {yb l Mjy', ab/a' MZ' yZl {n{aZ'XbyujM'n_{aZ' {Miz'k ZMyl xZ'aAaZxZ' MZ'k | j{bujZ' xZMynl y', at{aby'Vn|jX'UZ'MVaMjZl`Z'a" by{Syb'VZ', Z'aMfZ'l n{tZ{aM{aZ'nuunx{| l b{t{n'jnni' b'yxZ' {aZ' {Miz'k ZMyl xZ', Z'ujMl {n' | yZ'Z'aZ'ZAMizUa' AUPAS{aZxZ' by'Mjn{n_| l VZx{M{t', b'a' , aM'ZjZV{xnl by', Z', bj'_b' X'b' ybXZ^a'H b'a {aby'UZb` `yMKS{an|` aS, Z' aMfZ' aM{aZ'nuunx{| l b{t {n'nuZl | u'MXb_ZxZl {Miz'k ZMyl xZ', ab/a' aMj'MXb' b{Mj'XbyujM'S' b'fb` ` | y'Mxn|` a' bXZMh_, aMj' , Z'VM' j'b'Zjt'Z'.uZV{ {n'_b' X'b' ybXZ' {aZ'nl Z', Z'anuz' {n' | yZ'a" nxxZ'_ZxZl VZSub{| xZ'n_{aby' {Miz' k ZMyl xZ'VM' UZ'_n| l X'b' ` uuZl Xb.:` j' b| xZy'a'UUA^*1 {aZ' {Miz'k ZMyl xZ', Z', ZxZ' MjZ' {n' XbyMjyZk UjZS, Z'_n| l X' {aZ'XbyujM' by'Vnl l ZV{ZX' {n{aZ'k' M{ <t' E' fBMUB' ub' xUUnl' VMjZ'n_ , ab/a'nl jt'a'ub' y'MduZM' {n' UZ' | yZX^*1 VM' UZ' Mjy| k ZX' {aM'f', n'n_{aZyZ'ub' y'MZ' j'b'Zjt' | yZx' n'

un, Zx{aZ'XbyujM'jZMfb`á'ub'y{n'UZ'|yZX'nx'Vnk k |I bMlbnl 'u| xunyZy^a1nni b`'M'" wj Mlbnl 'ÜS {aZxZ' MZI -k M'f'l |k UZxy', ab/a VM 'UZ'xZuxZyZl {ZX'|yb`'nl jt'á'Uqy©

....."Ncti gw'F geko cñTgrt gupvc vkpp" ? 4^{%dku} ? 4⁸ ? 86 "w^aÜ"

AaZxZ'nxZSb' VM 'UZ'Wjy| k ZX'uM'WjZj'Vnk k |I bMlbnl 'by| n{ {aZ'uxtk Mkt'k Z{anX', q'a', ab/a {aZ' nl 'UnMXX'k b'xnVnl {xnjjZx{Mj' y{n {aZ'XbyujM'SU| {xMaZxSyZxbj'Vnk k |I bMlbnl 'k |y{ 'UZ' b' VnxunxMZX'ynk Zan, ^aAabyjZM'xy'b {n {aZ'yZVnl X'un{ZI {b'j'uxnUjZk ©_b |xb`'n|{', ab/a {tuZ' n_yZxbj'Vnk k |I bMlbnl 'by| yZX^aAaZxZ' MZ'k M'f'Vnk k nl 'yZxbj'Vnk k |I bMlbnl 'uxn{nVnjy' , ab/a Z'by{^aAaZyZ' b'Vj| XZ' ?@YpY\$@< *S^af SM'X'B' ?AS{n'l M'k Z'M_Z, 'ÄÜBÄ^aAaZxZ' by| n` | M'M {ZZ'San, ZfZxS{aM' M'f'n_{aZyZ' MZ'| yZX'Ut {aZ'Xb' b'j' {Miz'k ZMj| xZ^aAaZxZ'nxZS, Z', b'j' jö Zjt'l ZZX' {n'uxnUZ' {aZ' b'Xb'X| M'ub' y'n_{aZ'xb'UUnl 'VMWjZ' {n'_b |xZ'n| {an, 'Z'W'a'yö'l Mj' tk uM'W'y{aZ'n| {u| {nl {aZ'XbyujM^a2 nxZ'yuZVb'Wj'f'f'S, Z', b'j'UZ'jnni b`'M' {aZ'yö'l Mj'-fnj{MZ' jZfZjyS{aZ' M'uM'ZI {UM'X'xM'Z'Z'XZ'Z'k b'ZX'Ut'" wj Mlbnl 'YÄSy{M'f'py{n'u'Uq'uM' {Zx' ySM'X'xM'k b`' uM' {Zx' yjZl `ay{n'xt' {n'VaM'W'Z'x'Z', ab/a uxn{nVnj'k b'a {UZ'|yZX'UZ', ZZl {aZ' {Miz' k ZMj| xZ-y'k b'xnVnl {xnjjZx'M'X' b'y'XbyujM^a''

....."Dcwf'Tcvg ? $\frac{\%uf\ o\ dqu}{3'ugeqpf}$? $\frac{3}{rgt\ kjf}$. "cuumo kpi *3"dk'r gt "uf o dqm+ "w^aY"

5l Z'_b Mj'Vnl VZx' {n'l n{Z'aZxZ'by{aZ'uaatyb'j' {ZxM'f'bnl 'UZ', ZZl {aZ' {Miz'k ZMj| xZ-y'XbyujM' yö'l Mj'M'X' {aZ'' A2 " (° PÝã<y'b u| {y^aAaZxZ' by'M nnX'VaM'VZ' {aZ'fnj{MZ' {aZ' {Miz'k ZMj| xZ' |yZy'nx'Vnk k |I bMlbnl 'by| n{ 'àG'jn' b'j'ö Z' {aZ' b' u| {y{n' {aZ'' A2 " (° PÝã<^a5l Z'unyyb'WjZ' , nxi M'n| I X'nx' {aby', n| jX'UZ' {n| yZ' {aZ' M'j'n` b' u| {y'n| {aZ'' A2 " (° PÝã< b'y{ZM'k'n_{aZ' Xb' b'j'nl Zy'M'X'k M' {aZ'fnj{MZ' xM' Z' {n'ynk Z{ab`'k nxZ'XZyxb'WjZ^aAaZ' byj| Z', q'a' {abyS an, ZfZxSb'y'uZx'nxk b`'M' M'j'n' ?ZM'Ä'Vnk k M'X'Z'xk {aZ'' x| b'n`'l M'n' 'µ5 jöxb'Ä' ÄÜaÄ' {MZY'M'Wj'f'f'yö'l b'Wj' {M'k n| I {n_{tk Z^a WnxXb`' {n'ÄÜaÄ' b' {MZY'M'Wj' {ÜÜÜ'k b'xnyZVnl Xy{n' Wj' M'j'n' ?ZM'Ä'Änl VZ^a@Z'b`' M'y' {aZxZ'k M'UZ'k nxZ' {aM'nl Z'yö'l Mj', ab/a , n| jX'l ZZX' {n'UZ' M'j'f'Z'X'Z' {aZ' {n' M'j'k n| I {n_{tk Z' b', n| jX'jö Zjt' {MIZ' {n' M'j'f'Z' yö'l Mj'by`' b'Zl' b`' wj Mlbnl ' p©

....."VqwnTgcf"Vko g ? $\frac{322''\ u}{3''iki\ pcn}$? *%iki pcn+ "w^aP"

AM' b`' {aZ' b' fZxyZ'n_{aby'xZy| j{ uxnx| VZy{aZ'k M'k |k 'UM'X'xM'Z'j'M'Wj' SMy| k b`' Ü'Uq'uZx' ytk UnjÄ', ab/a {aZ'' A2 " (° PÝã<Vn| jX' {aZnxZ' {b'Wj'f'f' b' {ZxuxZ' S' b'Zl' b`' wj Mlbnl ' B©

....."O cz'Dcwf'Tcvg ? $\frac{3}{VqwnTgcf"Vko\ g}$? $\frac{3''iki\ pcn}{322''\ u}$ " %iki pcn+ "w^aB"

* {aZ'ZfZl { {aby'Yk'ujb`' _xZw'Zl Vt'by| -w' b'Zl n| `aSt'k M'UZ'UZy{ {n'xt' M'ujb'f'f' {aZ' yö'l Mj'Vnk b`' _xk' {aZ' {Miz'k ZMj| xZ'yn {aZ'UZ'Vnk Z'Vnk uM'WjZ', q'a' {aZ'' A2 " (° PÝã<y' Xb' b'j' b' u| {y', ab/a MZ'Vnl yXZx'Wj'f'f' M'Z'x' {aM' {aZ' M'j'n` b' u| {y^aAaby'San, ZfZxS, n| jX'jö Zjt'

xZwł bZ {aZ | yZ n_MjZfZj yab{Zx^a1ZfZj yab{Zxy'aMfZ jtk b'y'n l'an, 'wł b'j t {aZ t'VM UZ'y, b'VaZX^a (Zl ZxMj t'yuZM b`S{an|`aS{aZ_xZwł Zl Vt', b'a', ab/a Xb b'Mj b ul {y'VM y'VM {aZ y'b l Njy» ZfZl` , b'a {aZ'y, b'Vab` jtk b'y'n_{aZ jZfZj yab{Zxy» y{b'j, n|jX'uxn'f'XZ UZ{{Zx'uZx_nxk MlVZ`j b` {Zxk y' n_yMk uj b` xMZYA{aM ytk ujt | yb` {aZ'MlMj h` ub y^aAaZxZ_nxZS, Z'yan|jX'UZ'MUjZ {n'xZMk` y'b l Njy Vnk b` _xnk {aZ {MlZ k ZMj| xZ`_nx'Xb_ZxZl {`fnj{MZ jZfZj y'Ml X'pux'y{Ml X'MX'UM| X'xMZY^a

H b'a Mj {aby'UZ b` y'MXSZfZl b` {aZ', nxy{VMjZ yVZl M'k, aZxZ', Z', n|jX'UZ | l MjZ {n'xZMk XMM _xnk {aZ {MlZ k ZMj| xZS{aby', n|jX' l n{ l ZVZyM' b' t' UxZM' n| x'uxn'ZV{^aBj{tk MZj tS, Zl ZZX {n` Z{ k ZMj| xZk Zl {X'MlMynk Zan, SMI X' | yb` 'MXb b'Mj {MlZ k ZMj| xZ' b'y'n l Z'n_k Ml t', M'y {n'Xn {aby^a H Z Vn| jX'S b` y{ZM'S | yZ V'k ZxMjSZl VnXZxySMl X'pux'n{aZx'Xb{MlVZ`yZl ynxy{n'uZx_nxk {aZ y'Mk Z' {Mj' b' 'MXb_ZxZl {, M^aBj{tk MZj tS, Z'UZjZfZ {aZ {MlZ k ZMj| xZ', n|jX'UZ {aZ UZy{`nu{b' l `nx' {aZ Vn l y| k ZxSU| {{aZxZ' MZ'n{aZx'nu{b' l y'n| {{aZxZ', ab/a', Z'Vn|jX' | yZ M'y| y| Uy{b' | {Zy'b` n| x' uxnhZV{ b` {aZ'ZfZl {, Z'MZ' | l MjZ {n` Z{ {aZ {MlZ k ZMj| xZ' {n', nxi^a

3 Costs

5| x'XZfZjnuk Zl {Vny{y'Vnk Z'_xnk {axZZ'uZnujZ', nxi b` 'UÜ'an| xy'M, ZZi 'M'ÖaÜ'M' an| x'uZx' uZxynl^aAMl b` {aby'fMj| Z'_nx{aZ'Üá', ZZi y{aM', Z'MZ', nxi b` n l {aby'uxnhZV{` b'Zy| y'ÖaÜSÜÜÜ'_xnk "" wł M' b' l 'a^a

".....5", "&72lj qwt", "32"j qwt uly ggm', "38"y ggm', "40"? "&82.222" "w^a

AaZ Vny{`n_n| x'uxn{n{tuZ', b'j UZ ÖaÜ^apä^a*_, Z u| xVaMjZ n| x'uMk{y'b` U| j i` j'Ut {aZ'ÜÜÜ'uMk{y'Än| x {n'Mj', b'j UZ ÖaÜ^aBä^aAaZ UxZMlXn, l`n_{aZyZ Vny{y'MZ j b{ZX'UZjn, ^a

<Mk'	† ny{`<xn{n{tuZÄ'	† ny{`< j j i` 'ÜÜÜ'uMk{y'Ä'
2 b'xnVn l {xnjjZx' ž` A2 " (° p'Yā<l<B'1'ž b b ZtÄ'	Ó ^a Üá'	Ó ^a äp'
Yā<b` @nVl Z{`ž` ž YāÜž A'1' ž b b ZtÄ'	Ó ^a äp'	Ó ^a Y'Y'
àG'Gnj{MZ'Z' jM'nx' žB° äāÜat O' @'1'ž b b ZtÄ'	Ó ^a ää'	Ó ^a Bä'
ÜÜy' † MlMl{nx'ž. YÄž<āYā'13ž` 1'ž b b ZtÄ'	Ó ^a Bä'	Ó ^a Üá'
ÜÜi ?Zy{`nx'žÜÜÜ>ŁO'13ž` 1'	Ó ^a ÜÜ'	Ó ^a Üp'

ž b b ZtÀ		
ÝŸÛ?Zyby(nx'¿.ÝÄ¿ÝŸÛ(ŁO'3ž '1' ž b b ZtÀ	ÓŸaŸÛ'	ÓŸaŸÛa'
ŸaŸÛi '?Zyby(nx'¿ŸaŸÛO>ŁO'3ž '1' ž b b ZtÀ	ÓŸaŸÛÛ'	ÓŸaŸÛP'
PaPi '?Zyby(nx'¿PPO>ŁO'3ž '1' ž b b ZtÀ	ÓŸaŸÛÛ'	ÓŸaŸÛP'
ÝŸÛ' † MŸMŸ(nx'¿.ÝÄ¿ ¿Paa'ŸaŸÛa'3ž '1' ž b b ZtÀ	ÓŸaŸaa'	ÓŸaŸPa'
Ÿa2) %b jnV † xty(NŸi' ¿PŸÛŸaŸÛP'3ž '1' ž b b ZtÀ	ÓŸaŸaB'	ÓŸaŸPa'
< yaU {{nl ' , k'a (xZZI '1" ž '¿ ¿BaaŸiŸaa'3ž '1' ž b b ZtÀ	ÓaŸÛÛ'	ÓaŸÛP'
Łj Z'1" ž '¿ ¿¿ aŸPŁ'ŁŁ 3Ł GŸLŸBaaŸi'3ž '1' ž b b ZtÀ	ÓŸaŸŸÛ'	ÓŸaŸŸÛa'
@bXZ@ kVa ¿ 03ŸÛaa'3ž '1' ž b b ZtÀ	ÓaŸaŸŸ'	ÓBaaB'
äGŁM{Zxt'¿' k NŸd ŁMŸŸyÄ	ÓPaŸBa'	ÓŸaŸŸŸ'
Łj Z{nn{a'2 nX jZ'¿) 2 'ŸÛ'1' NŸ NŸd aŸnk Ä	ÓaŸaa'	ÓaŸÛP'
ž b b NŸiAMŸZ'2 ZMŸ xZ' ¿ZAMŸZŸa' " AŸaŸaa'1XU'?'<'1' NŸ NŸd aŸnk Ä	ÓŸaŸaa'	ÓŸaŸaa'
<Ł Ł ¿<Ł ŁH MÄ	Óa'	ÓŸaŸŸÛa'
† MŸb ` ¿Pž 'uxb {Zy{tk MZA	ÓP'	ÓP'
5{aZx?Zyby(nxySaxMŸyby(nxyS MŸX'(ZI ZxNŸi" jZV{xŸNŸi' † nk unl ZI {y¿ž b b Zt' Zy{tk MZA	ÓŸÛ'	ÓŸaŸÛ'
An{NŸi† ny{'	ÓaŸŸPa'	ÓaŸŸBa'

4 Schedule

H ZZi	3MaM lzj	A/	LNWa
' ZU ^a ÝBSÝÜYÜ	AMj , b'a k Wab Z yanu Mln xZVnk k ZI XMlbnl y_nx uatybMjXZyb l ^a @ Uk b'nxXZx_nx{MIZ k ZNy xZ M X b b'bj Vnk unl ZI {y ^a	?ZyZMVA <MI b` <xnUjZk ` j` nxbak y l` ujM {aZ Vnny ujM_nxk` Mdu`nl` Gby Mj@ Xbn`	?ZyZMVA b'z` fby Mj b {Zx_MWZyMIX` y{x V{ xZy{n`Zk UZX` _nx`k nUbjZ` MdujbMlbnl` XZfZjnuk ZI {a ^a
2 M ^a ÝSÝÜYÜ	5I VZ {MIZ k ZNy xZ by xZVZbZXSUZ` b` _b xb` n {an, yb l Mj {n {aZ XbyujM` , nxi ^a	ŁZ` b` Vnl I ZV{b` {aZ` Mdu`{n`Uj Z{nn{a`MIX` XbyujM b` {n {aZ yZx` b_{aZ`uanl Z`by` Vnl I ZV{ZX`{n`{aZ` Uj Z{nn{a`k`nX jZ ^a	ŁZ` b` Vnl y{x V{bnl` MIX`XZyb l` n`_b'z` k`nXZj Mj nxbak` UMWZX`nl` b'Zl` xZy j{y`_xnk` jnx{b` Mj nxbak`
2 M ^a aSÝÜYÜ	' b MjZujM`_nx` VnjZV{b` `yb l Mj _xnk` {aZ XbyujM S nxXZxZ. {xMuM{yMj` I ZZXZX ^a @ Uk b` uxnunymj_nxXZx_nx` <Ł Ł ^a	H nxi`nl` {aZ`uMZ` , aZxZ`{aZ` k`ZNy xZk ZI {fMj Zy` , b'j`UZ`NXXZX`MIX` Mjn, {aZ` yZx`{n` b`u {fMj Zy` k`M Mj t`MIX`y{M{` `Z{{b` k`ZNy xZk ZI {y`_xnk` Uj Z{nn{a`k`nX jZ ^a	<xn`xM` Uj Z{nn{a` k`nX jZ`{n`yZl`X` b`Vnk`b` `XMIM_xnk` {aZ` k`b'xnVnl {xnjjZxp{MIZ` k`ZNy xZ` Vnk`Ub`Mlbnl` {n`n x` k`nUbjZ`MdujbMlbnl` , aZl` @Zl` X`z`MIM Uj {{nl` by`uxZyyZX ^a " I y xZ`Mj`XMIMby` UZb` `yZl` {n`fZx`_xnk` k`nX jZ`{n`k`nUbjZ` Mdu ^a
2 M ^a ÜaSÝÜYÜ	Axt`{n`b`VnxunxMZ` k`b'xnVnl {xnjjZx`{n` xZNX`XMIM_xnk` XbyujM ^a	Ł nl` {b Z` Z{{b` k`ZNy xZk ZI {y`_xnk` {MIZ`k`ZNy xZ`MIX` yMfZ`{aZyZ`fMj Zy`b` Łn..VjMy, abZ` uMxyb` `MIX`k`Ml b` y xZ`{aZ`b`u {y`MZ` Xn UjZy ^a jyn`y{M{` Mj nxbak` ^a	ŁZ` b` NXXb` Vnyk`Z{b`_ZMl`xZy`{n` {aZ`k`nUbjZ` MdujbMlbnl` j'b`Z` jMUZj b` Sb`fZl` {nxt`S` MIX`VjMybMlbnl` n` b'Zk`y ^a ByZxy`VM jMUZj` {aZbx`Un. Zy`MIX` yuZVb t` b`{aZ t`MZ` j'b`a`{SaZMf t`S`_xMl b'ZS

			Z{V ^a AaZ† VMi Mjyn {MIZ' b fZI {nxt' n_ , aM' bZk y' MZ' b' Z' N' Wa Un. . .
2 M ^a YpŠYŮYŮ	@jXZxVnk unl ZI {y' nl {n' <† t ^a	† nl {b Z {n', nxi' nl' {aZ' Mj' nxbak' {aM' VMi' ujmWZ' {aZ' Un. Zy' b' Pž' MxM'	† xZMZ' l n{bMl' b' b {Zx MWZy' nx yZxy' , aZl' {aZ' Mj' nxbak' by' Vnk ujZ{ZSyn' {aZ†' VMi' fZ, unyybJZ' ynj {bni y ^a ° XXb' ni Mj†' VxMZ' M ank Z' B* _nx' k nUbZ' MdujbMl' bni ^a
2 M ^a PŮŠYŮYŮ	ž Zyò Z. {Zxnx' Vnyb' _nx {MIZ' k ZMy xZ ^a	H nxi' nl' {aZ' Un. . . XbyujM' uMZ' M' X' VxZMZ' Pž' b' MZ'	tZ' b' {Zy{b' _n_{aZ' ynx{b' _Mj' nxbak' M' X' Pž' k nXZj Mj' nxbak' , b'a' {aZ' Uj Z {nn{a' k nX jZ'
° ux ^a áŠYŮYŮ	° yyZk UjZ' {MIZ' k ZMy xZ' M' X' k MIZ' k nXbMl' bni y' My' l ZZXZ ^a	† nl {b Z', nxi' b' _nl' {aZ' XbyujM' uMZ'	BuXMZ' M' X' xZ' b' Z' Mj' nxbak' UMyZ' X' n_ n_{Zy{b' _xZy j{y' M' X' M' Mj† yby'
° ux ^a ÜpŠYŮYŮ	ž Zyò 'M' X† M' Va' u' , ZZi'	ž Zyò 'M' X† M' Va' u' , ZZi'	ž Zyò 'M' X† M' Va' u' , ZZi'
° ux ^a YŮŠYŮYŮ	ž Zyò 'M' X† M' Va' u' , ZZi'	ž Zyò 'M' X† M' Va' u' , ZZi'	ž Zyò 'M' X† M' Va' u' , ZZi'
° ux ^a YaŠYŮYŮ	ž Zk n'	ž Zk n'	ž Zk n'
2 M' BŠYŮYŮ	<xZyZl {Ml' bni	<xZyZl {Ml' bni	<xZyZl {Ml' bni

5 Safety and Ethics

AaZxZ' MZ' MZ, yMZ{† M' XZ{abMj' Vnl VZxl y{aM' xZy' XZ', b'a' n | x' uxn' hZV{^a 5l Z' n_{aZ' k M' yMZ{† Vnl VZxl y' Vnk Zy' _nxk' {aZ' j' b' a' b' k' b' ni U' M{ZxZy | yZX' Ut' n | xXb' b' Mj' {MIZ' k ZMy | xZ^a AaZyZ' U' M{ZxZy' VMi' Z. ujnXZ' b' {aZ†' UZ' Vnk Z' n' fZx' VaM' X' ZX' nx' xZ' M' Wa' M' i' Z. {xZk Z' aZM' {Zk uZxM | xZ' ÁÁ' ° XXb' ni Mj†' S{aZyZ' U' M{ZxZy' yan | jX' l n{ 'UZ' VaM' X' ZX' b' Z. {xZk Z' VnjX' {Zk uZxM | xZyZ' b'aZx' My' {aZ†' VMi' XZ{ZxnxMZ' M' X' jZM' VaZk' b' Mj' M' X' ÁÁ' An' Zl' y | xZ' yMZ{† S, Z', b' j' M' XZw' j' MZj†' {Zy' M' X'

k nI bnx{aZ'UM{Zxt'VZjj{Zk uZxM| xZ {n'ZI y| xZ b'yn'fZxMj' w| Nj' b' t' M' X' uZx' n' k' M' VZ' _njjn, b'` {aZ'` | bXZj' b' Zy' n' } {b'` {a' b' y' U' M' {Z' x' t' j' M' y' MZ' {t'` | bXZ' A' U' A'`

° I n{aZ'x'y'MZ{t' Vnl VZxl' y{Zk' y' _xnk' {aZ' ZI' VjnyZX' Uj| Z{nn{a' k' nX| jZ' M' {M' WaZX' nI' {n' {aZ' X' b' b' M' j' {M' Z' k' Z' M' y| xZ' a'` @b' VZ' {aZ' {M' Z' k' Z' M' y| xZ' V' M' UZ' | yZ' X' b'` Un{a' b' Xnnx' M' X' n' | {Xnnx' ZI' f' b' nI' k' ZI' {yS' {aZ' Uj| Z{nn{a' k' nX| jZ' yan| jX' UZ' ZI' V' yZ' X' b'` k' MZ' x' b' j' b' y| Va' M' M' t' l' n' k' n' b' y{ | xZ' n' x', MZ' x' V' M' y' yanx| {aZ' V' b' V| b' a' n' x' n' | x' yuZ' V' b' b' M' l' nI' S' {aZ' V' y' b'` ` k' MZ' x' b' j' b', b' j' N' X' aZ' xZ' {n' * < a' a' y' {M' X' M' X' y' ZI' y| x' b'` b'` , b' j' , b' ay' {M' X' | u' {n' U' k' Z' Z' x' n' _ , MZ' x' _njjn, b'` {aZ'` | bXZj' b' Zy' n' _ {aZ'` t'` ` xZy'` < n' {Z' V' {b' nI' y' {M' X' M' X' A' U' A'`

AaZ' Uj| Z{nn{a' k' nX| jZ' b' yZ' j' _ Nj' n' x' M' y' Z' y' M' y' MZ' {t' Vnl VZxl' ` X| Z' {n' {aZ' Z' . uny| xZ' n' _ , bXZy' {a' M' {aZ' k' nX| jZ' V' M' X' Z' y' a'` . unyZX' , bXZy' V' M' y' Z' y' b' y| Zy' _ n' x' Un{a' {aZ' | yZ' x' M' X' {aZ' XZ' f' b' Z' b' yZ' j' a'` n' x' {aZ' XZ' f' b' Z' S' {aZ' Z' . unyZX' , bXZy' V' M' UZ' X' M' k' MZ' X' M' X' u' n' x' yanx| V' b' V| b' Z' X' {axn| ` a' M' f' M' Z' {t' n' _ k' Z' M' y' b' V| X' b'` ` a| k' M' i' b' X| VZ' X' a'`) n, ZfZxS' {aZ' U' b'` Z' x' y' MZ' {t' b' y| Z' V' n' k' Zy' _ xnk' {aZ' | yZ' x' ZI' X' M' y' Z' . unyZX' , bXZy' V' M' V' M' y' Z' a' M' k' {n' {aZ' | yZ' x' | y' b'` ` {aZ' XZ' f' b' Z' a'` jZ' V' {x' b' M' j' i' yan' V' i' y' M' X' U| xI' y' MZ' h' y' { ynk' Z' n' _ {aZ' X' M' k' MZ' {a' M' | yZ' x' y' V' M' xZ' V' b' Z' X' | Z' {n' {aZ' b' {Z' x' M' {b' nI' _ xnk' Z' . unyZX' , bXZy' a' n' N' X' x' Z' y' {a' b' y' MZ' {t' b' y| Z' S, Z' , b' j' _ b' y' {Z' I' y| xZ' {aZ' V' n' x' Z' V' {M' k' n| I' {n' _ f' n' j' {MZ' M' X' V| xZ' I' {b' j' _ j' n, b'` {axn| ` a' Z' M' a' Z' jZ' V' {x' b' M' j' V' n' k' unI' ZI' {b' n' | x' Uj| Z{nn{a' k' nX| jZ' U' t' u' x' n' U' b'` ` Z' M' a' u' M' k' {M' X' f' Z' x' b' t' b'` ` b'` , b' a' n' | x' xZ' w' b' Z' k' ZI' {y' a' 3Z' . {S, Z' , b' j' {aZ' I' b' y| j' MZ' {aZ' , bXZy' {n' u' x' Z' f' ZI' {M' i' t' n' _ {aZ' k' _ xnk' UZ' b'` ` Z' . unyZX' {n' {aZ' | yZ' x' a' H' Z' u' j' M' i' nI' b' y| j' M' b'` ` {aZ' , bXZy' | y' b'` ` Z' jZ' V' {x' b' M' j' i' n' x' {aZ' x' k' M' j' b' y| j' M' b'` ` {M' Z' nI' n' | x' , bXZy' a' n' ZI' y| xZ' {aZ' {M' Z' a' M' y' M' XZ' b' b' b' Z' yZ' M' i' nI' {aZ' , bXZyS, Z' , b' j' {Zy' {M' X' k' MZ' y| xZ' b' X' n' Z' yI' n' {Vnl X| V' {M' i' t' Z' jZ' V' {x' b' M' j' i' M' y' , Z' j' j' M' y' aZ' M' | u' a' H' Z' , b' j' {Zy' {U' t' _njjn, b'` ` {aZ' y' { XZ' I' {k' M' | M' i' n' x' Z' jZ' V' {x' b' M' j' i' y' MZ' {t' A' U' A'`

° I' Z' {a' b' M' j' i' Vnl VZxl' n' | x' u' x' n' Z' V' {x' M' y' Z' y' b' f' n' j' f' Z' y' {aZ' Vnl {M' k' ZI' {n' _ u' x' b' f' MZ' | yZ' x' X' M' M' i' H' b' a' b' n' | x' k' n' U' j' Z' M' i' u' j' b' M' l' nI' S| yZ' x' y' , b' j' UZ' M' U' j' Z' {n' y' {n' xZ' {aZ' b' n' , I' u' x' b' f' MZ' X' M' i' M' {a' M' y' i' Z' u' {a' b' X' XZ' I' _ xnk' ` n' {aZ' x' | yZ' x' y' a' a' b' y' b' y| Z' x' M' y' Z' y' {aZ' Vnl VZxl' n' _ uny' y' b' j' Z' X' M' i' M' j' Z' M' i' y' n' x' u' b' M' t' {a' M' V' M' {M' Z' u' j' MZ' {axn| ` a' k' M' j' b' nI' y' n' _ , MZ' M' {M' i' y' _ nV| yZ' X' nI' M' i' u' n' x' u' a' nI' Z' X' M' i' M' i' AaZyZ' b' y| Zy' ` n' M' i' M' b' y' {aZ' *` ` ` t' nXZ' n' _` {a' b' y' @a'` ` i' n' M' f' n' b' X' b' h' x' b' ` n' {aZ' x' y' S' {aZ' b' u' x' n' u' Z' x' t' S' x' Z' u' | {M' l' nI' S' n' x' Z' k' u' j' n' t' k' ZI' {U' t' _ Nj' yZ' n' x' k' Nj' b' nI' y' N' W' {b' nI' A' A' a' n' k' b' b' MZ' {a' b' y' b' y| Z' S, Z' , b' j' a' M' Z' M' n' {b' b' M' l' nI' M' i' u' Z' M' {n' | yZ' x' y' xZ' V' n' k' ZI' X' b'` ` unu| j' M' y' Z' V| x' b' t' M' i' u' j' b' M' l' nI' y' {n' b' y' {M' j' b' {aZ' t' MZ' I' n' {b' y' {M' j' Z' X' Nj' k' Z' X' t' a'`

@b' VZ' {aZ' k' n' U' j' Z' M' i' u' j' b' M' l' nI' V' Nj' M' j' MZy' {aZ' I' Z' Z' XZ' X' M' k' n| I' {n' _ yu' MZ' {n' a' n' j' X' nI' Z' y' UZ' j' nI' ` b'` yS' n| x' u' x' n' Z' V' {x' M' y' Z' y' Vnl VZxl' n' _ {M' i' b'` ` N' X' f' M' {MZ' n' _ {aZ'` b' ZI' k' Z' M' y| xZ' k' ZI' {X' M' i' M' M' i' X' y|` ` Zy' {b'` ` {aZ' U' b'` ` Zy' {y' b' % {x| V' i' uny' y' b' j' Z' a' a' a' b' y' Vnl VZxl' f' b' n' j' MZy' {aZ' *` ` ` ` t' nXZ' n' _` {a' b' y' @P'` ` i' n' UZ' a' nI' Zy' {M' X' xZ' Nj' y' {b' b' y' {M' b'` ` V' Nj' k' y' n' x' Z' y' {b' k' MZy' U' M' yZ' X' nI' M' f' n' j' M' j' Z' X' M' i' M' i' A' A' a' n' M' f' n' b' X' f' b' n' j' M' l' nI' S, Z' , M' i' {n' Vnl y' {x| V' {M' X' XZ' f' Z' j' n' u' M' i' M' j' n' x' b' a' k' {a' M' X' n' Z' yI' n' {h' y' {Zy' {b' k' MZ' {aZ' yu' MZ' _ xnk' {aZ' ` b' ZI' | yZ' x' k' Z' M' y| xZ' k' ZI' {X' M' i' M' S' U| {nI' Z' {a' M' V' Nj' M' j' MZy' {aZ' ZI' {bX' X' M' i' M' yZ' {M' X' Vnl Vj| XZy' M' {n' M' j' M' k' n| I' {n' _ yu' MZ' I' Z' Z' XZ' X' _ n' x' {aZ' | yZ' x' a'` ` X' X' b' nI' Nj' j' t' S' {a' b' y' k' Z' M' y' {a' M' {aZ' X' M' i' M' xZ' V' b' Z' X' _ xnk' {aZ' u' x' Z' I' . b' y' {b'` ` {M' Z' k' Z' M' y| xZ' k' | y' {UZ' N' W' | x' MZ' M' X' u' xZ' V' yZ' , aZ' I' yZ' I' {n' f' Z' x' Uj| Z{nn{a' Vnl I' Z' V' {b' nI' a'`

H Z k | y{ ZI y| xZ {aM{aZ k ZM y| xZk ZI {XMIMy'NW| xMZ'My'VM'UZ' b' nxXZx'nx'n| x'Nf' nxdak {n' VjM| jMZ {aZ' bXZM'IM'X'nu{bk' M'y'nj| {bnl' _nx{aZ'| yZx' AaZ' Mf' nxdak \$' bZl' {aZ' MW| xMZ' M'X' uxZVyz' k ZM y| xZk ZI {XMIM\$, n| jX' {aZl' uZx' nXk' n'fZx' {aZ' Zl' {bZ' XMIMyZ' {M'X' xZVnk k Zl' X' {n' {aZ' | yZx', aM'y' %x| V' {aZ' t' yan| jX' Z' bZl' {aZ' | yZx' k ZM y| xZx' k ZM y| xZk ZI {XMIM'

' b' Mj' tS {n' M' fnb' fbnj' M' bnI' n_*' "" ' i' nXZ' n_' {a' b' y' Ø' U' ' anj' X' u' M' M' n' | I' {aZ' y' MZ' {t' SaZ' M' {a' S' M' X' , Zj' MZ' n_ {aZ' u| Uj' b' S' {n' y' b' Z' {n' Vnk' ujt', b' a' Z' {a' b' M' j' X' Z' y' b' l' ' M' X' y| y' {M' M' Uj' Z' XZ' fZ' j' nuk' Zl' { uxW' {b' Z' y' S' M' X' {n' X' b' M' j' ny' Z' uxnk' u' j' t' _W' {nxy' {aM' k' b' a' {Zl' X' M' Z' x' {aZ' u| Uj' b' /' nx' {aZ' Zl' f' bnI' k' Zl' { ÁÁÄ', Z' MWZu' {xZy' unI' y' b' j' b' t' _nx' n| x' XZy' b' l' °5| x' ux' n' h' Z' V' {M' k' y' {n' Zl' y| xZ' {aZ' y' MZ' {t' n' b' y' | yZ' xy' M' X', a' b' Z', Z' anuZ' {n' {Zy' {M' j' uny' y' b' j' Z' y' Zl' M' t' ny' {aZ' xZ' MZ' M' Uj' j' bnI' k' nxZ' {aM' k' M' t' n' W| x' AaZxZ' _nxZ\$, Z' MWZu' {xZy' unI' y' b' j' b' t' _nx' _M' j' {y' b' n| x' XZy' b' l' ' M' X' Zl' y| xZ', Z' {M' Z' M' u' x' n' u' x' b' MZ' M' W' {bnI' {n' Zl' y| xZ' | yZx' y' MZ' {t', aZl' {aZyZ' _M' j' {y' n' W| x'

- .
- .
- .
- .
- .
- .
- .
- .
- .
- .
- .
- .
- .
- .
- .
- .
- .
- .
- .
- .
- .
- .
- .
- .

?Z_ZxZI VZy©

ÁÛÄ! a) njk ZyS-YÜÜä @MyMIX" W(y'n_{aZ" k ZxVM '2 nfZxS® 2 nfZ^{hx} SÜb'2 M'YÜÜä^a
Á5I jß ZÄ" fNjMjZ@a{{uy@µ, . , °k nfZ^{hx} µk nfb ` `y{My' _W(yµ^a Á WZyyZX©Üä" ZU'YÜYÜÄ^a

ÁYÄ-<nu|jMl " W(yS® BI kZX'3Ml y<nu|jMl ž bfybl Sfnj^aàSl n^aYÜÜäSuu^aÜ° àŞZ ZV'YÜÜä^a

ÁÄ@ž, tZxS-Jn| x'2 nfZ @k ujbZX©AaZ'ä ŁZy{ " uuy_nx'2 nfb ` S®? @ ZXWjÜY' / j'YÜÜä^a
Á5I jß ZÄ" fNjMjZ©

a{{uy@µxk ZXWjMnk µYÜÜäµÜäµÜYµtn| x'k nfZ'yk ujbZX'ä'UZy{ 'Muuy'k nfb ` µ^a Á WZyyZX©
Üä" ZU'YÜYÜÄ^a

ÁBÄ^a (xZZI S-) n, '2 | Va ž nZy'ž' ny{ 'An') bZ'2 nfZxy'1' nk ujZ{Z (| bZS® 2 t'2 nfb ` ?ZfZ, yS
Üä'3nf'YÜÜä^a Á5I jß ZÄ" fNjMjZ©

a{{uy@µ, . , °k tk nfb ` xZfZ, y^aVnk µk nfZµan, 'k | Va'XnZy'k'Vny{ 'n'abZ'k nfZxyµ^a Á WZyyZX©
Üä" ZU'YÜYÜÄ^a

ÁÄÄUM{Zxt| | bZxyk^aVnk S-1káb k 'lml @MZ{t' t' nI VZxl yS® 1káb k 'lml @MZ{t' t' nI VZxl y° ŁM{Zxt'
BI bZxyk^a Á5I jß ZÄ" fNjMjZ©

a{{uy@µUM{Zxt| | bZxyk^aVnk µjZMl µWVabZyjáb k 'lml ½yMZ{t' ½nI VZxl y^a Á WZyyZX©
Üä" ZU'YÜYÜÄ^a

ÁÄÄ*ZZZ^{hx} SÉ" " " * " " ' t nXZ'n_" {abWESYÜÜä^a Á5I jß ZÄ" fNjMjZ©

a{{u@µ, . , °ZZZ^{hx} µWn| {µVnxunxMZµ nfZxl M'VZµá'á^aa{k j^a Á WZyyZX©Üb'1" ZU'YÜYÜÄ^a

ÁÄÄ° a) Mxys-ŁZy{ ž b bNj'AMIZ'2 ZMj| xZy'YÜYÜ'1?ZfZ, yI 'Anu'<bl yS®) ZN(at) MIXtk MIS

Üä'1M'YÜYÜÄ^a Á5I jß ZÄ" fNjMjZ@a{{uy@µaZNj{ataMIXtk M^aVnk µUZy{ 'Xb bNj' {MIZ'k ZMj| xZyµ^a
Á WZyyZX©Üä" ZU'YÜYÜÄ^a

ÁÄÄ-° xX| b n'EA'ž|j| Z{nn{a^{S®} ° xX| b n' Á5I jß ZÄ" fNjMjZ©

a{{uy@µ, . , °Mx| b n^aWµZI µ2 M µ^a xX| b n' nMXŁA¥_xnk ø2 M^a xX| b n' nMXŁj| Z{nn{a^a
Á WZyyZX©ÜÜ'1" ZU'YÜYÜÄ^a

ÁÄÄ2 °t | xxT+S-) 2 'ÜÜŁj| Z{nn{a' BŁ'1" '2 nX| jZyS®2 M{tI 't | xxT+SÜä'1M'YÜÜä^a Á5I jß ZÄ"

° fNjMjZ@a{{u@µ, . , °k M{tI V| xxT^aVnk µak 'ÜÜ'1Uj| Z{nn{a' BÜJ'1k nX| jZyµ^a Á WZyyZX©
ÜY'2 M'YÜYÜÄ^a

ÁÚÛÄ-ž b7b7bnl 'n_?ZyZMVA'@MZ{tS®*jbb nbyªÁ5I jbb ZÄª° fNjMjZ©
a{{uy@µXxyªjbb nbyªZX| µkMZµ@MZ{t1buxMtµkMf(Zxt@MZ{tªª WZyyZX©ÝP' ZU'ÝÜÝÜÄª

ÁÚÛÄ-ª `xZyy<xn{ZV{bnl ì `*ªAZy{b `©3A©S®3Mlbnl MjAZVal bMj'aty{Zk yªÁ5I jbb ZÄª° fNjMjZ©
a{{uy@µ . .ª {yªVnk µyZxfbZyµ{Zy{b `µZI fbnl k ZI {Njµb `xZyy'uxn{ZV{bnl µªª WZyyZX©
ÝP' ZU'ÝÜÝÜÄª

ÁÚÛÄ-" jZV{xnbMj'@MZ{t©@MZ{tì) ZMf(a `nx" jZV{xnbMj'AxNkZy;@| XZI {`2 Ml | NjAS®ZjVhyaªÁ5I jbb ZÄª°
° fNjMjZ©a{{u@µ . .ª ZjVhyaªnx µXnV| k ZI {µÜáÝBµäÜµXÜÜÜàBµµyZV{bnl àªª{k jªª WZyyZX©
ÝP' ZU'ÝÜÝÜÄª

ÁÚPÄZAMIZÜBªÁ5I jbb ZÄª° fNjMjZ©a{{uy@µZ{MIZÜªªVnk µyanupZ{MIZÜªªXb kMj'f{MIZªk ZMj| xZµª
ª WZyyZX©ÝÜ' ZU'ÝÜÝÜÄª

ÁÚBÄªª<MxMj S-@xnbMj'<xn{nVnjy† nk uMZX§®Zk UZXXZXªVnk §PÜ'2 M'ÝÜÜÝªªÁ5I jbb ZÄª° fNjMjZ©
a{{uy@µ . .ª Zk UZXXZXªVnk µyZxbMj'uxn{nVnjyªVnk uMZXµªª WZyyZX©Ýªª' ZU'ÝÜÝÜÄª

ÁÚªÄ-Ml Njñ`?ZNXjAS®ª xX| b nSªª@Zu'ÝÜÜªªªÁ5I jbb ZÄª° fNjMjZ©
a{{uy@µ . .ªªX| b nªWµxZ_ZxZI VZµZI µjMl ` | MZµµ| | V{bnl yµMl Njñ` 'bnµMl Njñ` xZNXµªª WZyyZX©
Ýªª' ZU'ÝÜÝÜÄª

° uuZI Xb.: © ž b kMj'AMUZ'2 ZMj| xZ''' .Mk ujZ'



Figure 8. Digital Laser Tape Measure

