COMPOSITION BOOK

Hubert Elly

Senior Design Notebook

"Self-defense ring"

Wide Rule
100 Sheets • 200 pages
9.75 in x 7.5 in/24.7 cm x 19.0 cm

TOP|FLIGHT

Wide Ruling

CLASS SCHEDULE

NAME: _____ EMAIL ADDRESS: _____

SCHOOL: _____ GRADE: _____ CELL: _____

Semester/Quarter

Period	From/To	Subject	Rm #	Instructor	Days

ECE 4871 - Sweet Dreams

Contact info:

1. Hubert Elly - ~~hub~~. kelly3@gatech.edu
2. Elizabeth Herrejon - eherrejon3@gatech.edu
3. Christine Saw - csaw3@gatech.edu
4. Katie Roberts - Kroberts73@gatech.edu
5. Lara Kassabian - lkassabian6@gatech.edu
6. Katie Weathermax - katie.weathermax@gatech.edu
7. Radha Changela - rchangela3@gatech.edu

Semester/Quarter

Period	From/To	Subject	Rm #	Instructor	Days

Semester/Quarter

Period	From/To	Subject	Rm #	Instructor	Days

Advisor: Jennifer Hasler

jennifer.hasler@ece.gatech.edu

Semester/Quarter

Period	From/To	Subject	Rm #	Instructor	Days

12/2/2021 Advisor meeting

- Hesler suggests we start buying parts as soon as possible
- Can ask her for help in designing circuitry
- Consider using a Fitbit instead of coding our own GPS

To do

- ☐ formulate ~~plan to build~~ detailed circuit design plan (over Christmas break)
- ☑ Turn in design notebook (12/03/2021)
- ☐ Look for circuit parts (over break)

Semester 2

01/12/2022 First team meeting (everyone present)

1. Change of plan: ~~marketing ploy~~ stun glove instead of ring
   - more surface area to engineer features
2. glove features
   - ~~Taser~~ stun gun with electrode on knuckles – can be activated by pressing thumb on index finger
   - GPS system to track user
3. ~~Kate~~ Assigned engineering manager position

To do

- team ☑ Research on stun gun circuit and layout of glove
- indiv. ☑ Research on Transformer miniaturization (01/19/2022)
- team ☑ Powerpoint Slides (Deadline: next Tuesday)

8

01/12/2022 Glove Design idea

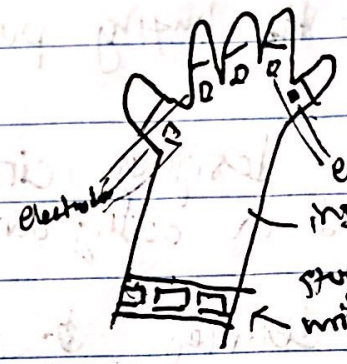


Fig 4: Design of glove

01/15/2022 Stun gun circuit (by Kathe Roberts)

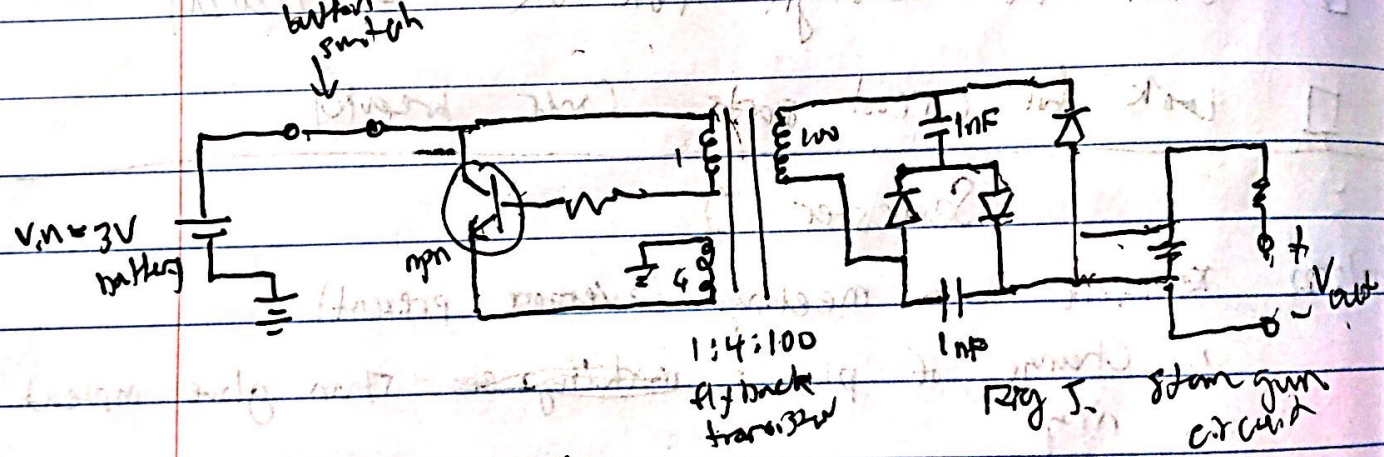


Fig 5. stun gun circuit

Operating principles

① When switch is on, potential difference between base and emitter of the BJT turns it on

② Current flows through primary (thin) coil, voltage induced in secondary coil boosting the voltage

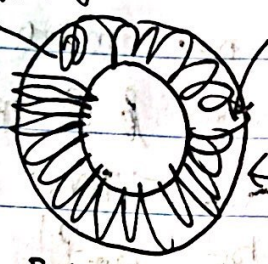
③ simultaneously, a small voltage is induced in the feedback (top), causing the transistor to turn off while stepping up the voltage

④ 2nd cycle repeats itself with a natural frequency

Source: loveoceans.com

01/17/2022 Transformer Research

Toroidal Transformer



use insulating tape to separate primary side from secondary side

Fig. 6. Toroidal ~~c~~ transformer layout

~~Advantages~~

- Compare area ~~less~~ more space efficient than cylindrical geometry

01/18/2022 Online meeting for slide preparation

- ~~Discuss~~ worked on slides and decided who is in charge of what slide
- Finish slide on Transformer

To do

team ☑ 1. Schedule meeting with Hasler (Elizabeth 01/19/2022)

advr. ☑ 2. End parts for transformer and update it on budget list

team ☑ 3. finish ppt slide

01/19/2022

In person meeting (everyone present)

- worked on powerpoint
- Finish ppt and sent to Hasler

To do

☑ 1. continuing updating budget list (02/03/2022)

01/24/2022 DPT revision meeting

1. Katie Roberts decided to change the ~~[illegible]~~ stun gun circuit, which requires ~ 1:2000 step up transformer
   - Mouser 74927546000: micro current transformer (check voltage rating & operating voltage limit)
2. ~~Stun gun circuit with~~ New circuit output voltage 7kV (a bit low?)

01/26/2022 ~~meeting~~ Meeting

1. Finished revised ppt and sent to [illegible]
2. Tested resistance of body parts for stun gun output voltage design

Table 1: Results of resistance testing for each group member

	Cheek	Arm	Temple
KR	6 MΩ	40 MΩ	4.3 MΩ
LW	5.5 MΩ	10 MΩ	5.6 MΩ
LK	7 MΩ	6.5 MΩ	5.5 MΩ
RC	5.0 MΩ	30 MΩ	7.1 MΩ
EH	5.7 MΩ	10 MΩ	6.2 MΩ
CS	9 MΩ	42 MΩ	6.6 MΩ
HE	0.9 MΩ	3 MΩ	0.5 MΩ
volunteer	5.2 MΩ	19 MΩ	

Observations

1. men have lower resistance?
2. Sweat might affect resistance

3. Need very high voltage to conduct current through clothes
   - perhaps use clothes piercing electrodes? sharp

To do

indiv ☑ 1. Research on flexible and wearable materials (02/04/2022)

team ☑ 2. prepare for presentation (Feb 2 1:00 pm) (Budget Slide)

02/01/2022 Advisor Presentation

1. Asked about ~~how~~ whether ~~we need to~~ GPS needs external telecommunications service
   - Figure out how much ~~it~~ costs or ~~what is~~ free alternatives Bluetooth

To do

team ☐ 1. Start building circuit (before expo)

team ☑ 2. order parts (02/03/2022)

02/09/2022 Meeting (on teams)

1. Lara completed PCB layout of stun gun circuit
2. ordered Adafruit flexible breadboard
3. reassigned to work on GPS code.

To do

indivi ☐ 1. Research on Fitbit open source code (ongoing as of 02/28/2022)

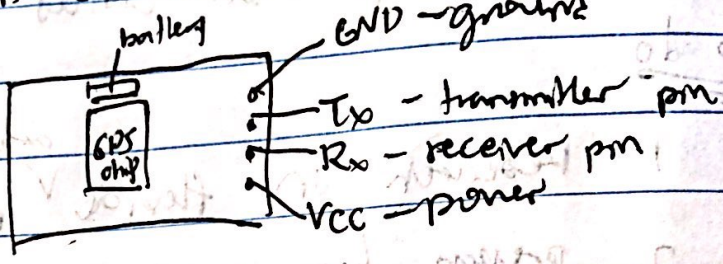
~~[illegible]~~

12

Intent cog

02/14/2022 Research on ~~[illegible]~~ GPS coding on Arduino

NEO-6M GPS module



GPS ⇒ arduino

GND ⇒ GND

TX ⇒ D3

RX ⇒ D4

Vcc ⇒ 3.3V

More info: create.arduino.cc/projecthub

how to interface GPS module with Arduino

Note: method can be modified to become compatible with atmy microcontroller

02/16/2022 Team meeting (Elizabeth virtual, everyone present)

- Katie Roberts finalized circuit schematic
- Christie working on pseudocode
- New parts ordered

To do

Indiv. ☐ Open source code research (Due 2/25/2022)

02/23/2022 Team meeting [Elizabeth missing]

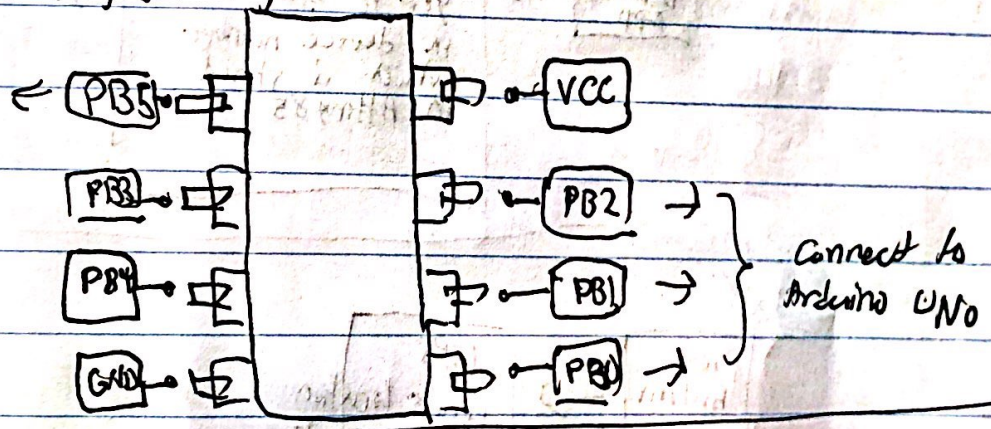
- Discussion with Radha on GPS coding
  - Radha found open source code for App - device connection on Github
- Lara designed PCB for boost converter, < 1 sq inch

To do

- work with Christine on attiny85 GPS programming (02/02/2022)

02/28/2022 Research on microcontroller

- Attiny 85 layout



03/02/2022 Team meeting

People: Katie W, Katie R, Radha, Christine, Lara, Elizabeth, Hubert

- Discussed with christine about microcontroller + GPS design
- Radha worked on connecting Bluetooth to app
- Lara finished PCB layout for stun gun
- Lara and Katie W examined stun gun circuit

To do

3/5/2022 ☑ Christine, Hubert: Research on micro controller 3/9

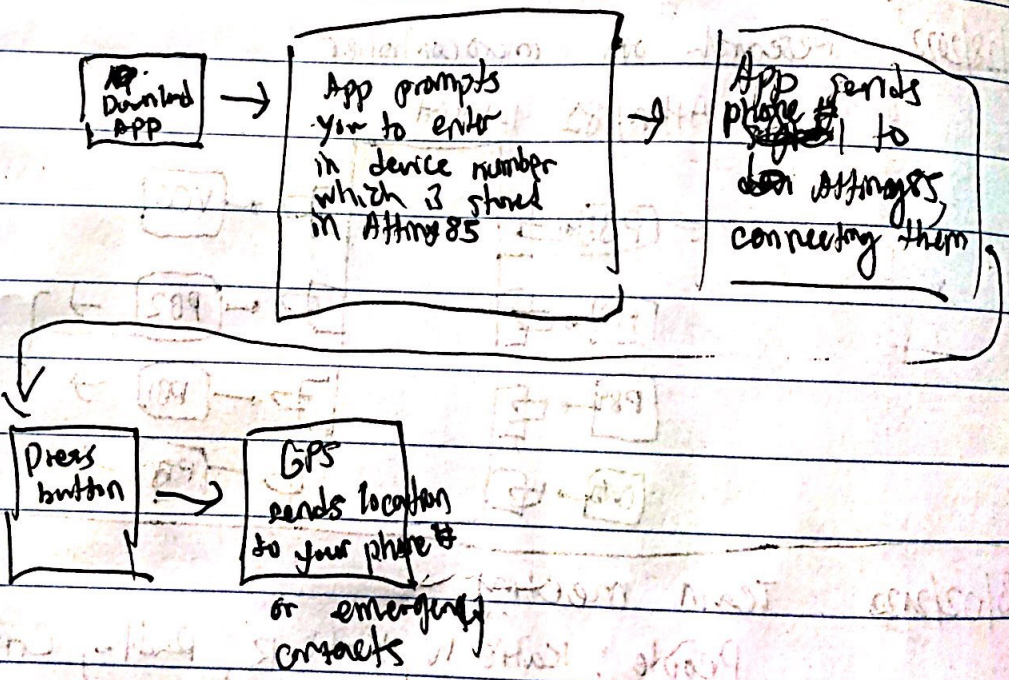
3/6/2022 ☑ Lara: finish boost converter layout and print PCB (3/9)

3/9/2022 ☑ Radha + Elizabeth: work on app 3/9

3/3/2022 ☑ Katie W, Katie R: figure out breadboard 3/9

3/5/2022 Meeting with christine (people: Hubert & Christine)

- Came up with a plan for GPS



To do

3/7/2022 ☑ • Research on GPS module (3/9) and test Attiny 85

3/9/2022 Team Meeting

People: Katie R, Katie W, Radha, Lara, Christine, Hubert, Elizabeth

- Elizabeth recruited test subjects for stem gun
- Katie W worked on expo items

- Laura redesigning circuit with capacitor bank
- Rachel testing out phone numbers for SMS

To do

3/9 ☑ Christine, Hubert: test attiny 85 3/16
3/16 ☑ Elizabeth: message Taylor about oral presentation 3/16
3/14 ☑ Rachel: ~~research~~ work on SMS 3/16
3/16 ☑ Rest of team: work on stun gun 3/16

3/16/2022 Team meeting -

People: Katie R, Katie W, Rachel, Laura, Christine, Hubert

- ordered new parts
- Christine managed to light up LED with attiny 85

To do

3/29/2022 ☑ Hubert: work on GPS circuit (3/30)
3/30/2022 ☑ Elizabeth: work on app (3/30)
3/30 ☑ Katie W: work on powerpoint and poster 3/30
3/30 ☑ Rest of team: work on stun gun circuit (3/30)

03/27/2022 GPS research

- May need sim card to get GPS location of glove
- Perhaps use phone GPS and bluetooth to connect glove to phone

16

Meeting

03/30/2022 Team meeting

People: Katie W, Radha, Christine, Elizabeth, Heribert

- Discussed difficulties with GPS
- Assigned roles for video presentation

To do

04/06/2022 ☑ - Me: research on bluetooth - attempt connection (4/6/2022)

4/6 ☑ - Elizabeth + Radha: work on app

4/6 ☑ - Rest of team: test stun gun

04/06/2022 Team meeting (People: Katie W, Katie R, Radha, Christine, Lara, Elizabeth, Heribert)

- Discussed plans for the app
- ~~Discuss~~ Katie W shared progress on poster

To do

4/13 ☑ - Me + Christine: continue working on attempt bluetooth connection (4/13/2022)

4/10 ☑ - Elizabeth + Radha: work on app (in particular connection of app with bluetooth) 4/13

4/13 ☑ - Katie R, Lara: work on stun gun 4/13

4/13 ☑ - Katie W: work on poster and ppt 4/13

04/13/2022 Team meeting

People: Katie W, Katie R, Radha, Christine, Lara, Hubert, Elizabeth

- Discussed app functionality and logo design
- worked with Christine afterwards on bluetooth circuit
- Lara completed stun gun circuit
- Katie V. completed poster

To Do

- Hubert + Christine: finish bluetooth circuit 4/20 ✓ 4/13

Final bluetooth circuit design

Procedures: (based on steps outlined on: makersportal.com/blog/2018/11/25/internet-of-things-bluetooth-arduino-board web page)

1. Connect attiny85 to Arduino UNO

Attiny85	Arduino
VCC	5V
GND	GND
PB2	13
PB1	12
PB0	11
PB5	10

2. Copy code from website

- add global const variable for button pin

```
const int buttonPin = 4;
```

- add led pin

```
const int ledPin = 3;
```

Instructions

- In method void setup() initialize pushbutton pin as input with
  pinMode(buttonPin, INPUT);
  ble_device.begin(9600); initialize LED pin with
  pinMode(ledPin, OUTPUT);
  > starts bluetooth
- In method void loop(), first line reads pushbutton value

```
buttonState = digitalRead(buttonPin);
if (buttonState == HIGH)
    digitalWrite(ledPin, HIGH);
    BLE_device.println(1);
if (buttonState == LOW)
    digitalWrite(ledPin, LOW)
```

LED turns on/sends signal to bluetooth → HIGH

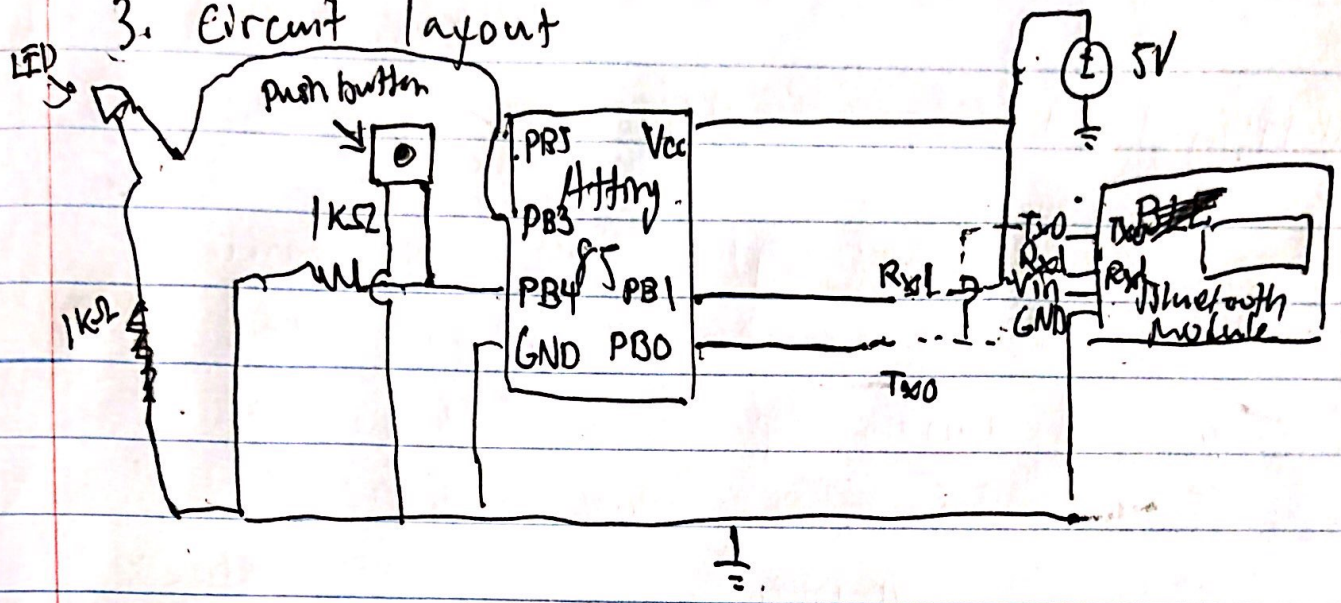
LED remains low → LOW

i.e. code will continuously track whether button has been pushed via the loop. If button is pushed, LED will light up and a signal is sent to bluetooth

2. ~~Circuit layout~~

[redacted]

3. Circuit layout



4. Download ~~Adafruit~~ Bluefruit Connect and connect bluetooth module to phone
(the app we are trying to make should also have this function)

04/20/2022 Team meeting
- Discussed Expo procedure
- Assigned roles to video presentation
- Christine and I soldered the bluetooth circuit onto a flexible PCB to be placed inside the glove
- Stun gun capable of delivering 40kV after replacing To 2x BJT with MOSFET

04/22/2022 ☑ ~~RECORD~~ VIDEO (4/22)

04/25/2022 ☑ sew circuits onto glove (Christine) 4/25

04/26/2022 ☑ Attend capstone expo 4/26

04/28/2022 ☑ turn in design notebook 4/28