CmpE245

August 25 (Wed)

Introduction.

Today's Topics
- Bill of materials
- Target platforms For Prototyping

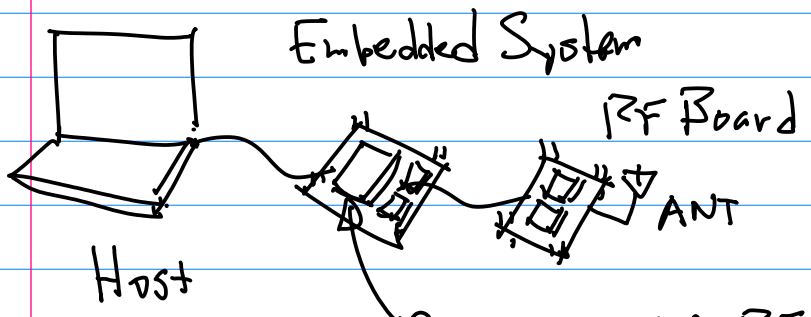


Fig. 1.

Model:

Bill of Material

1. Target CPU NXP LPC1769 OR NANO (NVDA)

2. RF modules, physical Layer only.

(2) ASK R.F. module, (1) frequency ~433 mHz

Amplitude Switching

(3) F.C.C. certified Open Spectrum.

Power ≤ 1000 mW. (1W)

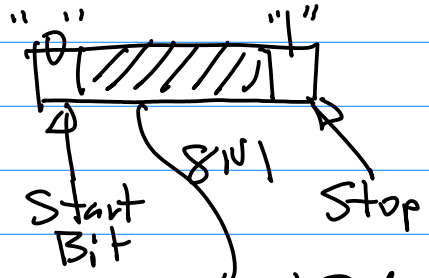
Tx: Transmitter

(4) No MAC (media Access Control) Needed

Note: Your RF module(s) is to be interfaced to GPIO of your target Board.

Why? General Purpose → No Data Framing.

for UART, Data Frame



Note: CPU Target

Option to use NVDA Jetson NANO

Guide Line for selection of target platform.

1. Register Level Control of GPIO, SPI Controllers

For LPC1769 ✓

For NANO → Devices Drivers.

(1) Datasheet 4 root pages

(2) Software Dev. Environment, tools.

Jetpack (OS + Libs)

(3) O.S. Distr.

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2° Access to CPU pins, e.g.
GPIO pins, SPI pins.

Homework: Purchase ASK RF module By Sept. 8th (Wed) OR ideally Sept 3rd (Fri)

Note: To provide hardware Debugging Ckt. on the RF. Board

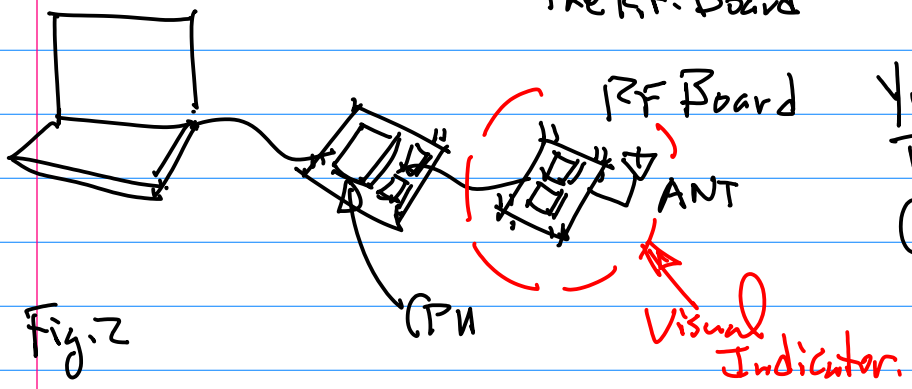


Fig. 2

Debugging Capability on the RF. Board:

① Objective: To visualize/observe GPIO Output.

Means: LED.

material:

a. LED (Red, Green), 4 ~ 10 mA

b. Connectors (to cable to RF Board)
RJ45 Right Angle Connectors (2)

A piece of CAT 5 Cable (Ethernet)

c. Components { Resistors, Caps. (1117?)

d. External PWR Regulator (7805, 7812 OR

Note: On your RF Board.

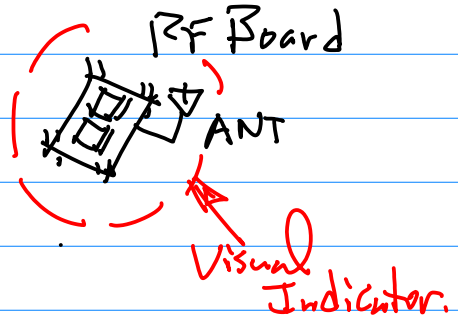


Fig 3.

2 Blocks { RX, TX

Both Need to Be Powered.

You may want to have the DC PWR Delivered via CAT 5 Cable from your Embedded Board.

RJ45 POS (Pin): 8

August 30th.

RF. module, to Build RF Board.

1° ASK RF.
Amplitude Switch Keying

2° RX: Receiving
TX: Transmission

3° GPIO I/F
Data Pin

Homework: Identify/Bring Your Wire Wrapping Board for RFB Design. 4x3 Inch;

To Build RFB

1° Board

2° 4 standoffs

3° Build I/O I/F Testing CKT.

- To Light up LED when CPU output "1"
- To Turn off LED when CPU output "0"

Output Testing

- S/W Toggles to Vcc, when Vcc, CPU Reads as "1"
- S/W " " to GND, CPU Reads as "0"

Input Testing

4° CAT-5 Ethernet Cable

RJ45 Right Angle Connectors (2)

One for Embedded;

One for RF Board,

5. PWR Distribution to RF Board:

a = 5VDC is adequate But R.F. module can be operated with Bigger Power, 9VDC OR 7.5VDC may be needed during Debugging;

Sept 1. (Wed)

Ref: IEEE802.6

1. github/hualili/cmpe245/2018F "2021F-"

2. Topics: Design R.F. Board for the 1st homework. 2pts. (Hardware)

Example:

From pp.2. System View

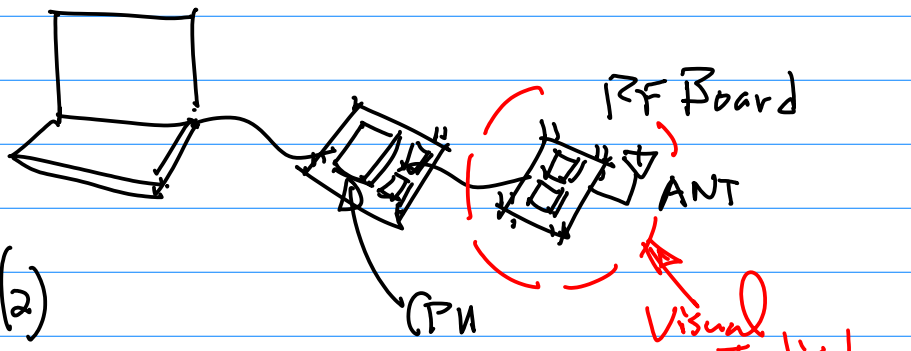
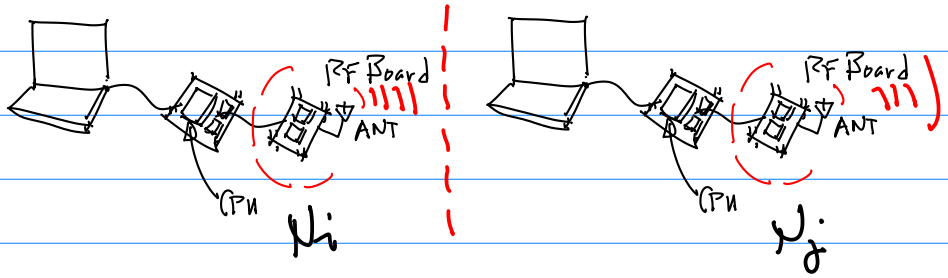


Fig.1 Node i, Wi



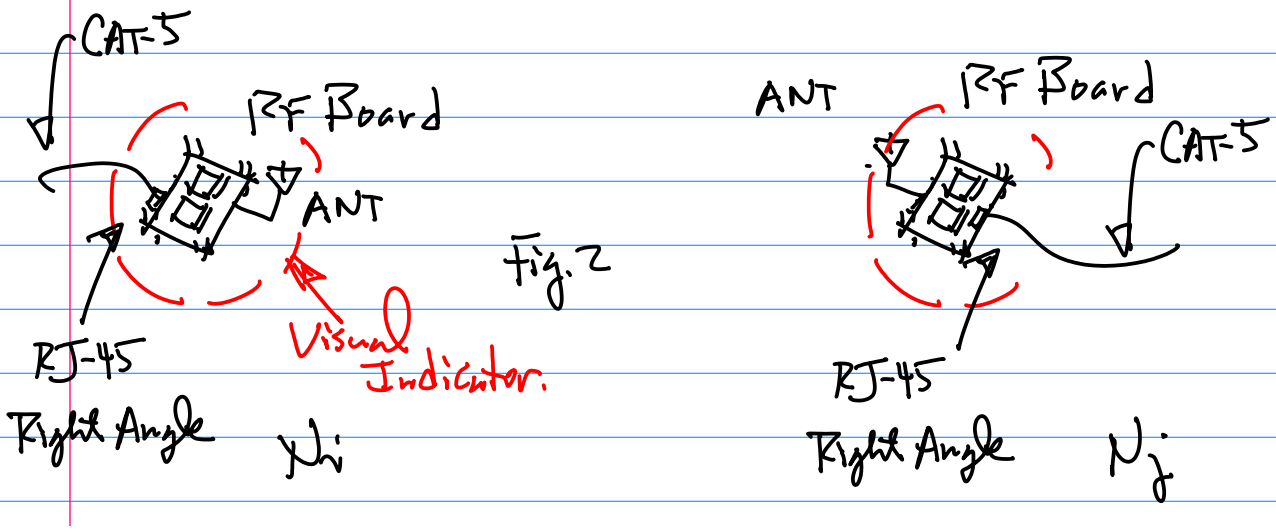
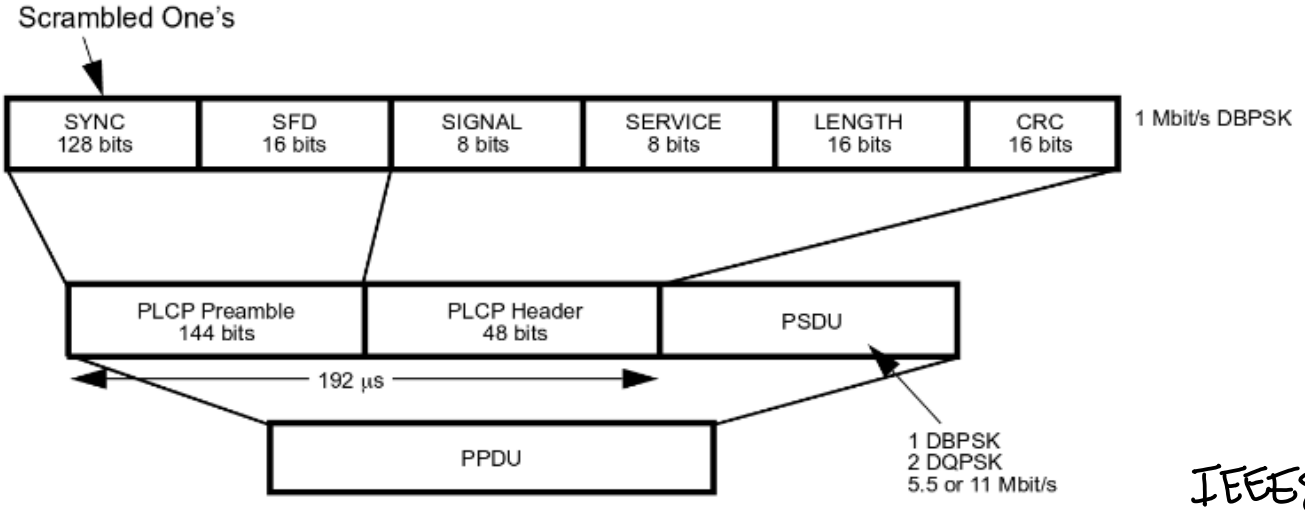


Fig. 2



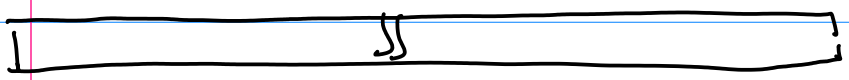
IEEE802.6

Figure 127—Long PLCP PPDU format

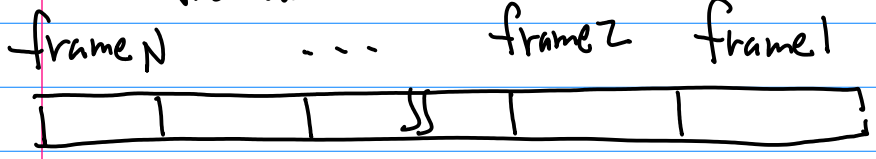
Fig. 3. pp. 13

Node Ni, Node Nj, Each Node is illustrated in Fig 1.

Sending Stream of Data from Ni to Nj



String of Bits sent in A "Framed" fashion.



Note: Consider the construction of Each frame, frame i, i = 1, 2, ..., N;

What are the contents to be placed into A Frame?

like start bit(s) → to mark the Beginning of the Communication.

→ Timing/Sync.

C.R. (Cognitive Radio), SDR (Software Defined Radio)

multiple Bits in Sync. Design → more Reliable → "Robust" performance
Maybe

Question: What is the general guideline in terms of designing "Sync" Field?

multiple Bits of what?

3 bits Example: b2 b1 b0

$2^3 = 8$

0 0 0
0 0 1
0 1 0
⋮
1 1 1

Transition → Change of State

"Zero Crossing"

for Example

Fig 5.

To provide best possible "Transitions", e.g. "ZC"

Pick 0x5 Binary: 101

The Objective for R.F. Board Homework/Design:
To Allow Ni, Nj to Sync.

2-Step Approach:
Step 1. Based on Land Line;
Step 2. then R.F (Wireless)

Hence, R.F. Board will have to Support 2 Options.

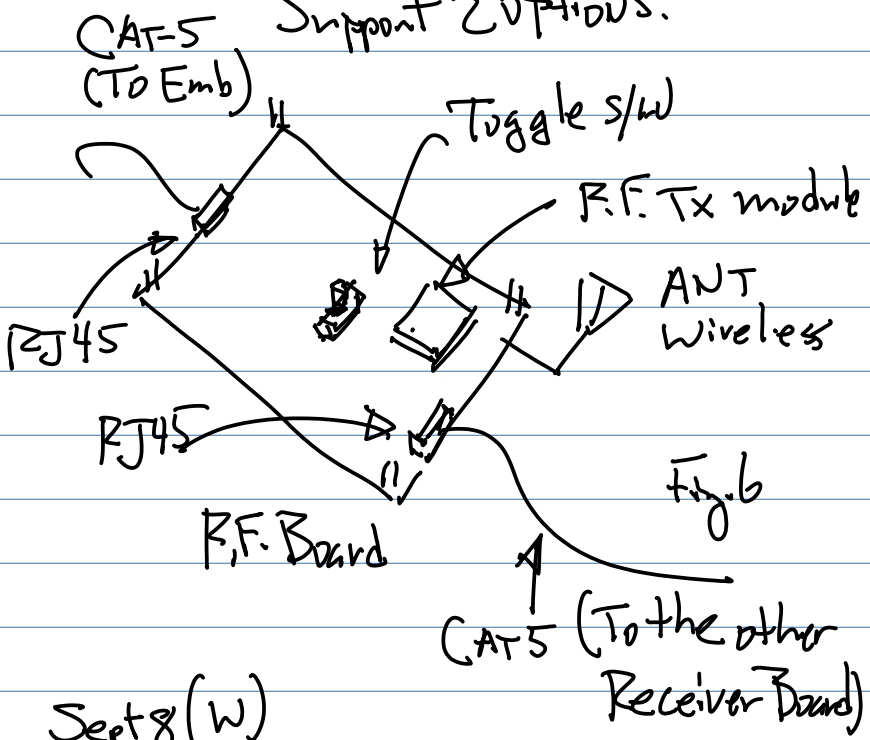


Fig. 6

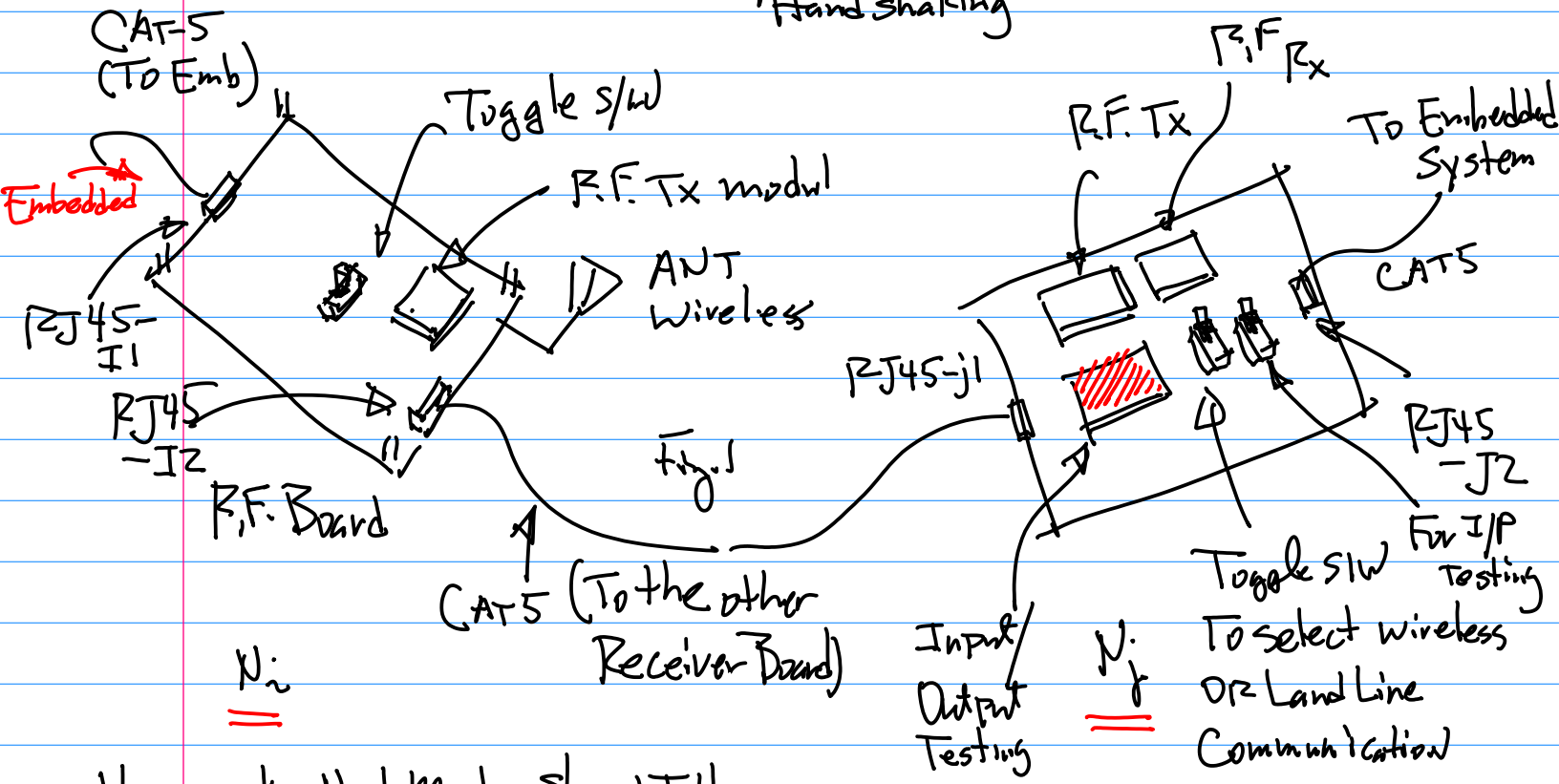
Sept 8 (W)

Topics: 1° Prototype for Handshaking (for LPC1769, NANO, OR your choice, such as Pic)

Note: NANO Boards are not delivered yet. So, please find your solution.

Note 2. Semester Long Project, please form 4 person team;

Example: "LAND-Line" Based Design for Handshaking



Homework: Next Monday, Show + Tell for Each Person's R.F. Prototype Board.

Things to show for the next class: 1. 4x3" Prototype Board; the Bare Through-Hole; metal coating of the through-Holes only; 2. Stand-offs 3. RJ45 Connectors (2x), Right Angle; Mounted on the Board;

4. Testing Circuit
   - Output Testing
     - Output "1" from the Host/Embedd System
     - Output "0" .. ..
   - Input Testing
     - Input "0" originated on your R.F. Board
       - ↓ RJ45-J1
       - ↓ RJ45-I2
     - Input "1" .. .. ..

Continued,

Input Testing { Input "0" originated on your RF Board
Input "1", ... (Similar to Input "0")

RJ45-J1
↓
RJ45-I2
↓
RJ45-I1 → Embedded System/Host PC Laptop

Testing CKT:

Output Testing CKT → Red LED.

Embedded → RFB (N_i) → LED1 → RJ45-I2
via RJ45-I1
RFB (N_i)

RJ45-I2 → CAT5 ⋯⋯ RJ45-J1
RFB (N_j)
RJ45-J1 → LED2 → RJ45-J2 → Embedded

On RFB (N_i & N_j)

GPIO Output from LPC/NAND

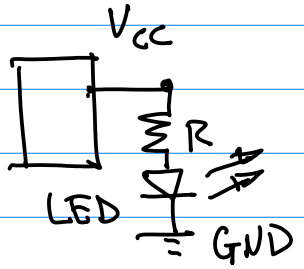


Fig. 2

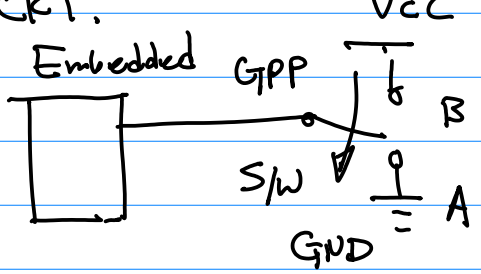
$V_{CC} = IR + V_{LED}$ ... (1)

V_{CC} (CMOS) = 3.3VDC

V_{LED} = 1.8V DC ; I = 10mA ;

Solve for R ~ 250 ± Ω or higher ;

Input Testing CKT.



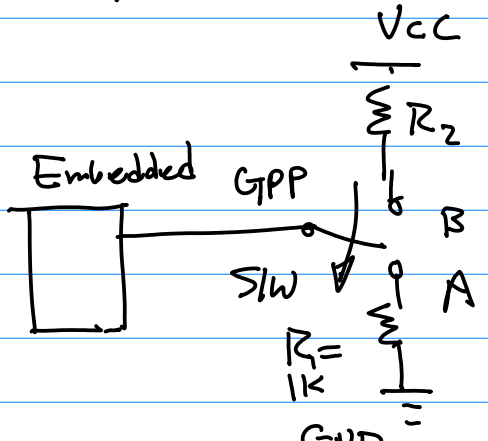


Fig. 3a

Sept13 (Monday)

Today's Topics: 1° Hardware platform.

2° Sync Algorithm, LISA

(Linear Invariant Sync. Algorithm)

Ref: 1° ... github, ID: ~106...

2021F-106

for Target RISC-V

(System On Chip)

2° github/hualili/Cmpe245/...

2021F-105~ (NAND Connector)

FPGA Solution (RISC-V), Iglu2.

a Board from Future Electronics

b IP-Core for CPU in Verilog

Can be down Loaded;

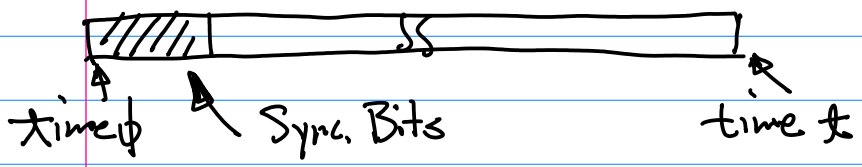
c TAP Plastics

NAND Board. Connector J-41

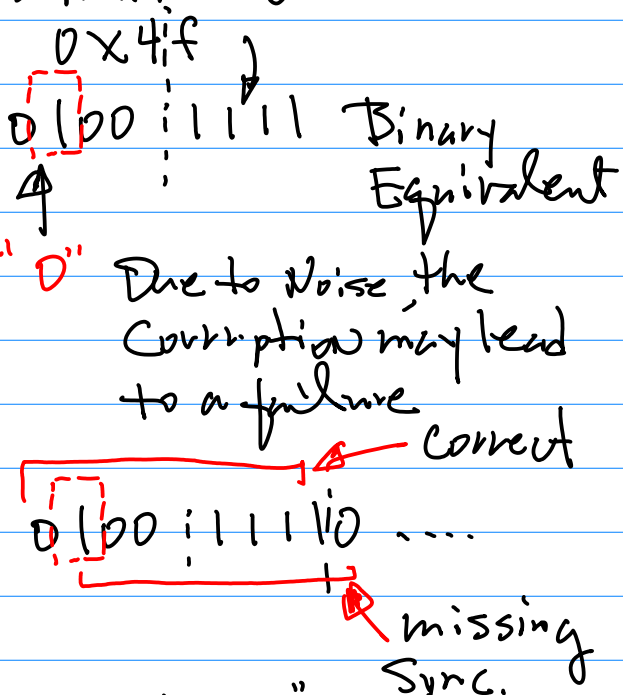
Identify GPIO

Example: Let's consider the Design of Sync. Field in Wireless Communication

Consider 1° Place to define sync. Bits.



Suppose we have a letter in a Hex Number



2° Sync is established Based on "2 C"

The change of the State of a Signal, For Example

"0" → "1" OR "1" → "0"

Preferred Change is to include "1".

Requirements:

1° Establish Sync with Change of State

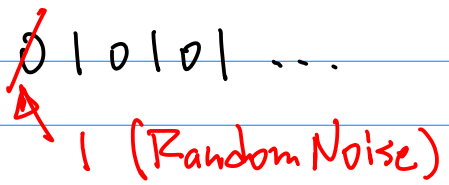
01010101 ...

OR

101010...

{ 01010101 ... OR ... (1a)
  101010... ... (1b)

Consider Random Disturbances, alters one bit in the Sync field. (1a) of the Sync Field, e.g. the Beginning of the payload.



Suppose we know the sync. field consists of 10 Bits. → Discard the 1st 2 bits until we have 0101...

Pattern again, to satisfy the total Number of bits in the Sync, Definition.

Question: How to utilize the Sync Pattern even when this pattern is corrupted, And not to start over again?

(1) The Need to Re-use the Sync Field Even if it is corrupted;

(2) The Need to Known where is the end of