1. Frame Structure

CMD	DATA	CRC
1 byte	N bytes	1 byte

1. **CMD** — Defines the command or request type.
   Value: operation code that the microcontroller must execute.
2. **DATA** — Contains the payload required to execute the command.
3. **CRC (checksum)** — Used to verify data integrity.
   Calculation:
   CRC = CMD ⊕ LEN ⊕ DATA[0] ⊕ DATA[1] ⊕ DATA[2] ⊕ ...`

XOR truth table:

A	B	A ⊕ B
0	0	0
0	1	1
1	0	1
1	1	0

2. Field Structure

The field consists of 3 levels:

Level (z)	Size (X × Y)	Tile Count
0	5 × 5	25
1	4 × 4	16
2	3 × 3	9

Total: 50 tiles

STM stores the field as a three-dimensional array with coordinates:

x = 0–5
y = 0–5

z = 0–2`

a tile exists only within the boundaries of its level
(for example, level 2 does not have position 4×4).

3. DATA

PC → STM (Sending Coordinates)

The PC sends only coordinates.
Coordinates are encoded in **1 byte**:

Bits 0–2	Bits 3–5	Bits 6–7
y (3 bits)	x (3 bits)	z (2 bits)

STM → PC (Sending Tile Value)

Each tile is transmitted as **1 byte**:

Bits 0–4	Bits 5–7
value	group

Tile Groups

Code	Group
000	Bamboo
001	Characters
010	Circles
011	Winds
100	Dragons
101	Flowers
110	Seasons

If a tile is removed → value = 0x00

4. Command List

4.1 START (0x01)

Selected in the main menu.
Starts the game, generates layout and all tiles.
Starts the timer from 0:00:00.

PC → STM

CMD	DATA	CRC
1 byte	1 byte	1 byte
0x01	0xFF	XOR

0xFF in DATA means it is empty. The command only initiates the game start.

STM → PC

STM sends the full field state:

- 25 tiles (level 0)
- 16 tiles (level 1)
- 9 tiles (level 2)

CMD	DATA	CRC
1 byte	50 bytes (field state)	1 byte
0x01	0xXX	XOR

Transmission order:

1. Level 0 (5×5)
2. Level 1 (4×4)
3. Level 2 (3×3)

0x00 means no tile.

4.2 RESET (0x02)

Selected during the game.
Generates a new layout.
Restarts the timer from 0:00:00.

PC → STM

CMD	DATA	CRC
0x02	0xFF	XOR

STM → PC

CMD	DATA	CRC
0x02	50 bytes (new field state)	XOR

4.3 SHUFFLE (0x03)

Shuffles tile values without changing their coordinates.
Can be used a maximum of 5 times per game.

Important:

- Only tile values are shuffled.
- Positions remain unchanged.

PC → STM

CMD	DATA	CRC
0x03	0xFF	XOR

STM → PC

STM shuffles tile values and sends updated field state.

CMD	DATA	CRC
0x03	50 bytes (updated values, excluding empty tiles)	XOR

4.4 SELECT (0x04)

Selection of the first tile.

PC → STM

PC sends only coordinates.
Tile type and state are not transmitted.

CMD	DATA	CRC
0x04	1 byte (coordinate)	XOR

STM → PC

STM checks:

- if the tile exists
- if it is open (not blocked)

CMD	DATA	CRC
0x04	0x01 TRUE — tile can be selected	XOR
0x04	0x00 FALSE — tile cannot be selected	XOR

4.5 MATCH (0x05)

Selection of the second tile and pair verification.

PC → STM

DATA contains coordinates of the second tile.

CMD	DATA	CRC
0x05	1 byte (coordinate)	XOR

The coordinate is encoded as defined in Section 3.

STM → PC

STM always returns the result and the full field state.

CMD	DATA		CRC
1 byte	51 Byte		1 byte
0x05	Byte 0	Bytes 1–50	XOR
0x05	Result	Field state	XOR

Result values:

Value	Meaning
0x00	NO MATCH
0x01	MATCH

Field State Description

- 50 bytes
- Transmission order:
  1. Level 0 (5×5)
  2. Level 1 (4×4)
  3. Level 2 (3×3)
- Each byte corresponds to one tile position
- 0x00 means tile is removed

Behavior

- If **MATCH (0x01)**:
  - Both tiles are removed
  - Their values become 0x00
  - Updated field state is transmitted
- If **NO MATCH (0x00)**:
  - Field state is transmitted unchanged

Match Conditions

- Both tiles are open (not blocked)
- Same type (for suits and honors)
- Same group (for flowers and seasons)

4.6 GET STATE (0x06)

Checks current game state.

PC → STM

CMD	DATA	CRC
0x06	— (0 bytes)	XOR

STM → PC

CMD	DATA	CRC
0x06	1 byte (game state)	XOR

Possible values:

Value	State
0x00	RUNNING — game in progress
0x01	WIN — all tiles removed
0x02	LOSE — defeat
0x03	OUT_OF_MOVES — no available moves