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# Protocol guidelines

The system consist of one master and many number of bricks .Both to and fro communication is possible .The slave consist of two UART and the master consist of one UART .The TX pin of master is connected to RX pin of first slave and then the RX pin is connected to TX pin of the first slave.

TX

RX1

Master brick

TX2

RX1

Brick 2

Brick 1

TX1

RX

RX2

TX1

The protocol consist of two frames

* Synchronization frames
  + Color Synch. Frame(C)
  + Name frame(N)
  + Potentiometer frame (conditions apply).(P)
  + Acknowledgement frame(Special character)
* Data frames
  + Data forward frame(F)
  + Data reverse frame(R)

## Synchronization Frames

**Color synch. Frame:** This frame consist of bits which defines the color of the indicator LED placed on the brick.

This bits moves from master to slave and it is a permanent frame. It will be sent from master to the first slave and then moves to the second slave and so on. (Master to Slave).The first bit of this frame will consist of a bit(C) which helps the slaves to identify that it is a color synch frame.

|  |  |  |
| --- | --- | --- |
| C(8bit) (43 H) | Payload(8 bit) | E(8bit) |

**Name frame:** The payload of this frame consist of 8 bits in which only 7bits are used to name the slave bricks. The eight bit is preserved for the future purposes. When each new brick is connected, the slave’s name is sent to the master through each slaves. The bits are send from slave to master brick.(Slave to Master).The first bit of each frame consist of a bit which defines that it is a NAME FRAME. Each name frame is added when it is moving from one slave to another. When it reaches the master the name frame consist of all the names of the connected bricks.

|  |  |  |  |
| --- | --- | --- | --- |
| N(8bit)(4E H) | Payload(7bit) | 0(Additional bit) | E(8bit) |

**Potentiometer frame:** This frame is introduced in the protocol when potentiometer is connected in the system. The bits are transferred from master to slaves. Used when both the potentiometer and LED bricks are connected.

|  |  |  |
| --- | --- | --- |
| P(8bit)(50 H) | Payload(8bit) | E(8bit) |

**Acknowledgement frame:** This frame is used to send ACK bits, once the slaves receives the data from the master brick.

Where, **Hex value of ACK is 06.**

|  |
| --- |
| 06 H |

## Data frames

**Data forward frame:** The data from the master to the slave is sent through this frame. It moves from master to slaves. It is a decrementing frame. Null bits are being used in this frame format.

|  |  |  |
| --- | --- | --- |
| F(8bit)(46 H) | Payload(8bit) including null bit | E(8bit) |

**Data reverse frame:** The data from the slave to master is sent through this frame. The frame moves from slave to master. It’s an incrementing frame. Null bits are being used in this frame format.

|  |  |  |
| --- | --- | --- |
| R(8bit)(52 H) | Payload(8bit) including null bit | E(8bit) |

## Important points 9-12-2020

## Acknowledgement bit

Whenever the target brick receives the data frame from the master, it should send back the acknowledgement bit to the master. Only After receiving the acknowledgement (ACK) bit, the master sends next data frame to the bricks. The acknowledgement bit will be a special character.

How the brick does understands that it is the target brick? The data frame sends from the master to the slave bricks, after jumping each brick the content of the data frame gets decremented and finally when it reaches the target, only 3 byte frame is present including start byte and end bytes. So whenever a brick receives 3 byte frame, it should send back the acknowledgement bit. The advantage of using ACK bit is, while we transmits the data frame and if any malfunctions or interruptions occurs for any bricks in between, the data won’t reaches at the correct destination, so by implementing ACK bit, the master can recognize the corresponding issues.

# Types of bricks

1. Input bricks
2. Output bricks
3. Logic bricks
4. Functional bricks

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Sl.no. | Input | Output | Logic | Functional |
| 1 | Switch | LCD display | NOT | Triangular |
| 2 | Potentiometer |  | AND | Square |
| 3 | Sound sensor |  | OR | Pulses |
| 4 | Distance sensor |  | NAND | Sine |
| 5 | Color sensor |  | NOR | Saw tooth |
| 6 | Temperature sensor |  | XOR |  |
| 7 | Light Sensor |  |  |  |

# Naming of bricks

|  |  |  |
| --- | --- | --- |
| SL.NO | INPUT BRICKS | NAMES OF THE BRICKS(Decimal) |
| 1 | Switch brick | 01 |
| 2 | Potentiometer | 02 |
| 3 | Light Sensor | 03 |
| 4 | Distance sensor | 04 |
| 5 | Temperature sensor | 05 |
| 6 | Color sensor | 07 |
|  |  |  |
|  | (0-39) assigned for input bricks. Total 40 |  |

|  |  |  |
| --- | --- | --- |
| SL.NO | OUTPUT BRICKS | NAMES OF THE BRICKS(Decimal) |
| 1 | Led brick | 40 |
| 2 | Buzzer | 41 |
| 3 | BCD Counter | 42 |
| 4 | Motor | 43 |
| 5 | Mini Display | 44 |
|  |  |  |
|  |  |  |
|  | (40-79) bricks are assigned for output.  Total 40 |  |

|  |  |  |
| --- | --- | --- |
| SL.NO | LOGIC BRICKS | NAMES OF THE BRICKS(Decimal) |
| 1 | NOT | 120 |
| 2 | AND | 121 |
| 3 | OR | 122 |
| 4 | NAND | 123 |
| 5 | NOR | 124 |
| 6 | XOR |  |
|  |  |  |
|  | (120-127) bricks are assigned for output.  Total 8 |  |

|  |  |  |
| --- | --- | --- |
| SL.NO | FUNCTION BRICKS | NAMES OF THE BRICKS(Decimal) |
| 1 | Triangular | 80 |
| 2 | Saw tooth | 81 |
| 3 | Square | 82 |
| 4 | Pulses | 83 |
| 5 | Sine | 84 |
|  |  |  |
|  |  |  |
|  | (80-119) bricks are assigned for output.  Total 40 |  |