Communication Protocol for Smart Street Light System

There are three types of communication in our system.

1) Communication initiated by the hub, intended for a particular node.
2) Communication initiated by a node, intended for the hub.
3) Communication initiated by a node, intended for another node.

Hub to Node:

This communication is initiated whenever the Hub needs to control an individual node. This message is broadcasted to all the nodes. Each node has a unique node id and it performs the necessary action. The communication packet consists of 11 bytes. The character '$' is the start character and '#' is the stop character. A comma separates each useful field.
The packet format is as shown below.

a) '$'
b) 'H'
c) ','
d) Hub Id
e) ','
f) Node Id
g) ','
h) Message Type
i) ','
j) Message
k) '#'

$: Start character

H: Denotes that the packet is from the hub

,: Separation character

Hub Id: Unique Id for each hub

Node Id: Unique Id for each Node

Message Type: There are two types of message that the Hub can send to each node. Command type message and Query type message.

> **Command Type**: The value 1 in the message type field denotes that this message is command type message. This means that the hub wants to change the current state of the node.
>
> **Query Type**: The value 2 in the message type field denotes that this message is a query type message. This means that the hub wants to know the current state of the node.

Message: If the above field is a query type message, then this field is ignored by the node (reserved for future use). If it is command type message then, this field contains the information, which is to be used by the node.

> **Bits 7 – 3:** Ignored by the node (Reserved for future use).
> **Bit 2**: If this bit is 1, then the node must switch on the emergency light.
> **Bit 1 - 0**: If these values are 00, then the node must switch off the streetlight. If 01, then the node must Dim the street light. If 11, then the node must switch on the streetlight.

#: Stop character

Node to Hub:

This communication is initiated whenever the node wants to communicate to the hub. This message is broadcasted to the hub. The communication packet consists size is variable depending on the type of message. A comma separates each useful field.
The packet format is as shown below.

a) '$'
b) 'N'
c) ','
d) Hub Id
e) ','
f) Node Id
g) ','
h) Message Type
i) ','
j) Variable length(Explained below)
k) '#'

$: Start character

N: Denotes that the packet is from the node intended to be received by the hub.

,: Separation character

Hub Id: Unique Id for each hub

Node Id: Unique Id for each Node

Message Type: There are two types of message that the node can send to the hub. Event type message and Query answer type message.

> **Event Type**: The value 1 in the message type field denotes that this message is event type message. This means that the node wants to inform the hub of any event that has occurred or change in state.

Query Type: The value 2 in the message type field denotes that this message is a query type message. This is the answer that the node sends when the hub requests for a query.

Message: If the above field is a event type message, then this field is a single byte which contains the information of the street light.

Bits 7 – 5: Ignored by the hub (Reserved for future use).
Bit 4: If this bit is 1, then the streetlight is in dimmed state.
Bit 3-2: If Bit4 is 0, then the hub ignores these two bits. If these bits are 10, then this denotes to the hub that this street light has detected a transition from night to day. If these bits are 11, then this denotes to the hub that this street light has detected a transition from day to night.
Bit 1-0: If Bit2 is zero, the hub ignores these two bits. If these two bits are 10, the hub ignores these two bits. If these two bits are 11, then this denotes to the hub that the PIR sensor has detected motion.

If the above field is query type message, then this message is 11 bytes. The packet format is as shown below.

Byte 11: This denotes the LDR value. If this is 1, then it indicates that this node is experiencing nighttime, if 0 then daytime.
Byte 10: Separation character comma.
Byte 9: This denotes the streetlight status. If this is 1, then it indicates that the streetlight is on, if 0 then it is off.
Byte 8: Separation character comma.
Byte 7: This denotes the emergency light status. If this is 1, then it indicates that the emergencylight is on, if 0 then it is off.
Byte 6: Separation character comma.
Byte 5: This denotes the PIR sensor status. If this is 1, then it indicates that motion has been detected.
Byte 4: Separation character comma.
Byte 3: This denotes the Current sensor value(analog).
Byte 2: Separation character comma.
Byte 1: This denotes the Voltage sensor value(analog).

#: Stop character

Node to Node:

This communication is initiated whenever the node wants to communicate to the hub. This message is broadcasted to the hub. The communication packet consists size is variable depending on the type of message. A comma separates each useful field.
The packet format is as shown below.

a) '$'
b) 'M'
c) ','
d) Hub Id

e) ‘,’
f) Destination Node Id
g) ‘,’
h) Reserved for future use
i) ‘,’
j) Reserved for future use
k) ‘#’

$: Start character

M: Denotes that the packet is from the node intended to be received by another node (next streetlight).

,: Separation character

Hub Id: Unique Id for each hub

Destination Node Id: The destination node id for the intended use.

The next two bytes will be ignored by the hub. Reserved for future use.

#: Stop character

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