# Project 1. Waste management system Report


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For what regard our problem I started analyzing and solving each part at time.

First of all I implemented the **Trash phase:** I provided each node with a Timer (garbageTimer) and meaning variables for this phase like capacity and garbage that are two int variables that represent, the first the still available space in our bin, while the second the quantity of garbage to put inside the bin in a specific moment. I randomized this value (together with the position of our mode represented by two variables: x and y and with the value of the garbageTimer) through the component RandomMlcgC using as seed the node id and the time (to obtain different random value in different simulations).

```
DEBUG (1): Application booted.
DEBUG (8): Application booted.
DEBUG (3): Application booted.
DEBUG (7): Application booted.
DEBUG (6): Application booted.
DEBUG (2): Application booted.
DEBUG (5): Application booted.
DEBUG (4): Application booted.
DEBUG (6): I'm node 6, my position is x = 85 , y = 47
DEBUG (6): I'm node 6: my first random timer is: 14
DEBUG (7): I'm node 7, my position is x = 92 , y = 36
DEBUG (7): I'm node 7: my first random timer is: 14
DEBUG (3): I'm node 3, my position is x = 0 , y = 15
DEBUG (3): I'm node 3: my first random timer is: 17
DEBUG (1): I'm node 1, my position is x = 86 , y = 73
DEBUG (8): I'm node 8, my position is x = 99 , y = 25
DEBUG (8): I'm node 8: my first random timer is: 28
DEBUG (5): I'm node 5, my position is x = 78 , y = 93
DEBUG (5): I'm node 5: my first random timer is: 30
DEBUG (2): I'm node 2, my position is x = 93 , y = 26
DEBUG (2): I'm node 2: my first random timer is: 3
DEBUG (4): I'm node 4, my position is x = 7 , y = 4
DEBUG (4): I'm node 4: my first random timer is: 17
clients 1, read 0, wrote 0
DEBUG (2): Serial Packet sent...
DEBUG (2): I'm node 2: my random timer fired at 0:0:2.929687510
DEBUG (2): Somebody threw away 1 units!
DEBUG (2): Inside me there are: 1 units
DEBUG (2): My new random timer is: 30
```

Random generated

When the timer fired new garbage goes inside to the bin.

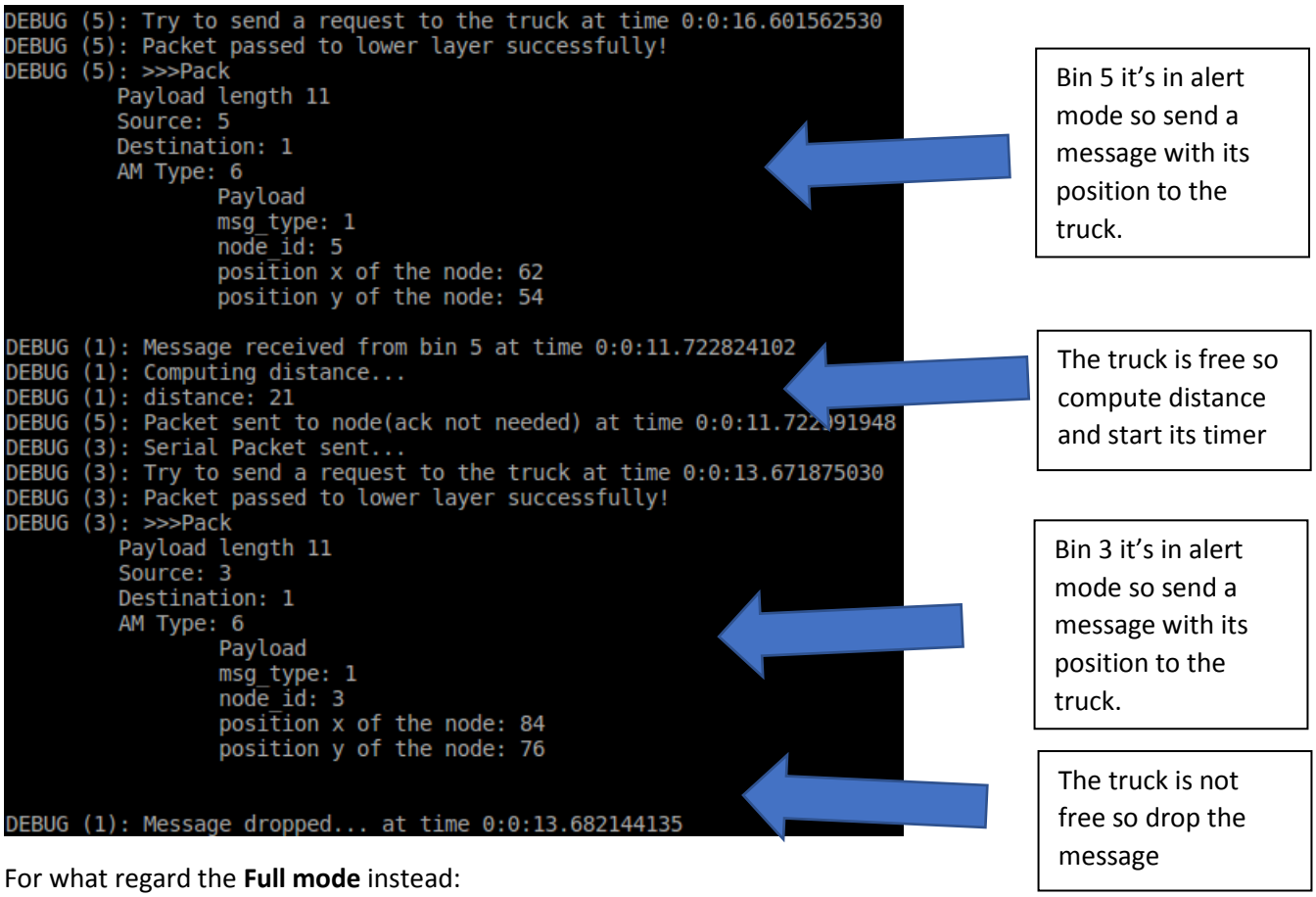
Then the **Sensing phase** starts in which each node checks its status with the new garbage:

- If the capacity + garbage < 85: we are in the normal status, the garbage goes inside the bin and the garbageTimer (with a new random value) restarts.
- If 85 <= the capacity + garbage < 100: we are in the alert mode, the garbage goes still inside the bin, but this time a period timer starts and the node sends a message to the truck each time that the timer fired.
- If capacity + garbage >= 100: we are in the full mode, the garbage can't go inside the bin, so the node sends a request to the other nodes.

In the **Alert mode:** When the periodical timer fired the node fills a message of type BT (bin-truck or ALERT MSG) with its position and send it to the truck.

When the truck receives this message:

- if the value of its variable “drop” is equal to 0 sets this variable to 1, compute the distance between him and the node, a timer that represents the time needed to reach the node starts and when this fired the truck sends a message of type TB (truck-bin), sets its position equal to the node position and sets also the drop variable again to 0. When the bin node receives this message of type TB its capacity is set to 0.
- Otherwise the truck simply discards the message.




For what regard the **Full mode** instead:

The node in this status sends a message of type BB (bin-bin request or MOVE MSG, this kind of message is ignored by the truck) to all its linked nodes and start a timer of 2 seconds.

During these 2 seconds the nodes that received this type of message have to answer only if they are in normal status, sending back their position with a message of type BBR (bin-bin response).

When the node asking help receives a BBR message computes the distance between him and the message sender and if it is lower than the variable minDistance, sets it equal to the distance and sets also the variable closestNeighbour equal to the node id of the sender. (minDistance and closestNeighbour at boot time are set to 100000 and 0).

After the 2 seconds the timer fired and if closestNeighbour is different from 0 the node sends is garbage with a message of type BBG (bin-bin garbage) to the other node. Otherwise no one is available and so the garbage is dropped.

Bin 6 can’t collect more garbage, so asks help to the neighbor.

```
DEBUG (6): I'm node 6: my random timer fired at 0:3:46.562500010
DEBUG (6): Somebody threw away 9 units!
DEBUG (6): I can't collect anymore stuff :( I have to send it to my neighbors!...
DEBUG (6): My new random timer is: 14
DEBUG (6): Packet passed to lower layer successfully!
        Source: 6
        Destination: 255
DEBUG (8): REQUEST FOR HELP RECEIVED
DEBUG (7): REQUEST FOR HELP RECEIVED
DEBUG (5): REQUEST FOR HELP RECEIVED
DEBUG (6): Packet sent to node(ack not needed) at time 0:3:46.571411130
DEBUG (6): Serial Packet sent...
DEBUG (5): Serial Packet sent...
DEBUG (5): I'm node 5: my random timer fired at 0:3:47.539062510
DEBUG (6): Try to send a request to the truck at time 0:3:47.539062530
DEBUG (6): Packet passed to lower layer successfully!
DEBUG (6): >>>Pack
        Payload length 11
        Source: 6
        Destination: 1
        AM Type: 6
                Payload
                msg_type: 1
                node_id: 6
                position x of the node: 85
                position y of the node: 47


DEBUG (5): Somebody threw away 7 units!
DEBUG (5): Inside me (5) there are 88 units, I can still collect stuff but I will be full soon... Let's call the truck!
DEBUG (5): My new random timer is: 22
DEBUG (1): Message dropped... at time 0:3:47.546707138
DEBUG (6): Packet sent to node(ack not needed) at time 0:3:47.546874984
DEBUG (5): Packet passed to lower layer successfully!
DEBUG (5): >>>Pack
        Payload length 11
        Source: 5
        Destination: 6
        AM Type: 6
                Payload
                msg_type: 4
                node_id: 5
                position x of the node: 78
                position y of the node: 93
```

```
user@user-iot: ~/Desktop/IOT-examples/TinyOS/aaaa
File  Edit  Tabs  Help
Bin 5 called the truck
Bin 6 called the truck
Bin 4 called the truck
Bin 6 is full it's new garbage has to be send to the neighbours
Bin 4 is full it's new garbage has to be send to the neighbours
Bin 3 called the truck
Bin 4 filled
Bin 2 filled
Bin 3 filled
Bin 4 filled
Bin 5 called the truck
Bin 4 called the truck
Bin 6 called the truck
Bin 7 filled
Bin 4 is full it's new garbage has to be send to the neighbours
Bin 3 is full it's new garbage has to be send to the neighbours
Bin 4 filled
Bin 3 called the truck
Bin 5 filled
Bin 6 filled
Bin 4 is full it's new garbage has to be send to the neighbours
Bin 4 called the truck
Bin 7 called the truck
```

```
DEBUG (8): Packet passed to lower layer successfully!
DEBUG (8): >>>Pack
        Payload length 11
        Source: 8
        Destination: 6
        AM Type: 6
                Payload
                msg_type: 4
                node_id: 8
                position x of the node: 99
                position y of the node: 25


DEBUG (8): Packet sent to node(ack not needed) at time 0:3:48.043212863
DEBUG (5): Packet sent to node(ack not needed) at time 0:3:48.043899505
DEBUG (7): Packet sent to node(ack not needed) at time 0:3:48.045043907
DEBUG (4): Serial Packet sent...
DEBUG (6): Serial Packet sent...
DEBUG (4): Try to send a request to the truck at time 0:3:48.515625030
DEBUG (4): Packet passed to lower layer successfully!
DEBUG (4): >>>Pack
        Payload length 11
        Source: 4
        Destination: 1
        AM Type: 6
                Payload
                msg_type: 1
                node_id: 4
                position x of the node: 7
                position y of the node: 4


DEBUG (6): I'm sending my garbage to 7
DEBUG (6): Try to send a request to the truck at time 0:3:48.515625030
DEBUG (6): Packet passed to lower layer successfully!
DEBUG (6): >>>Pack
        Payload length 11
        Source: 6
        Destination: 7
        AM Type: 6
                Payload
                msg_type: 5
                garbage sent: 9
DEBUG (1): Message dropped... at time 0:3:48.517715471
DEBUG (4): Packet sent to node(ack not needed) at time 0:3:4
DEBUG (7): NODE: 7 received: 9... at time 0:3:48.519912724
```

Bin 8,7 and 5 are in normal status so answered.

Bin 6 computed node 7 as closest and sends its garbage to it.

Bin 7 received it.