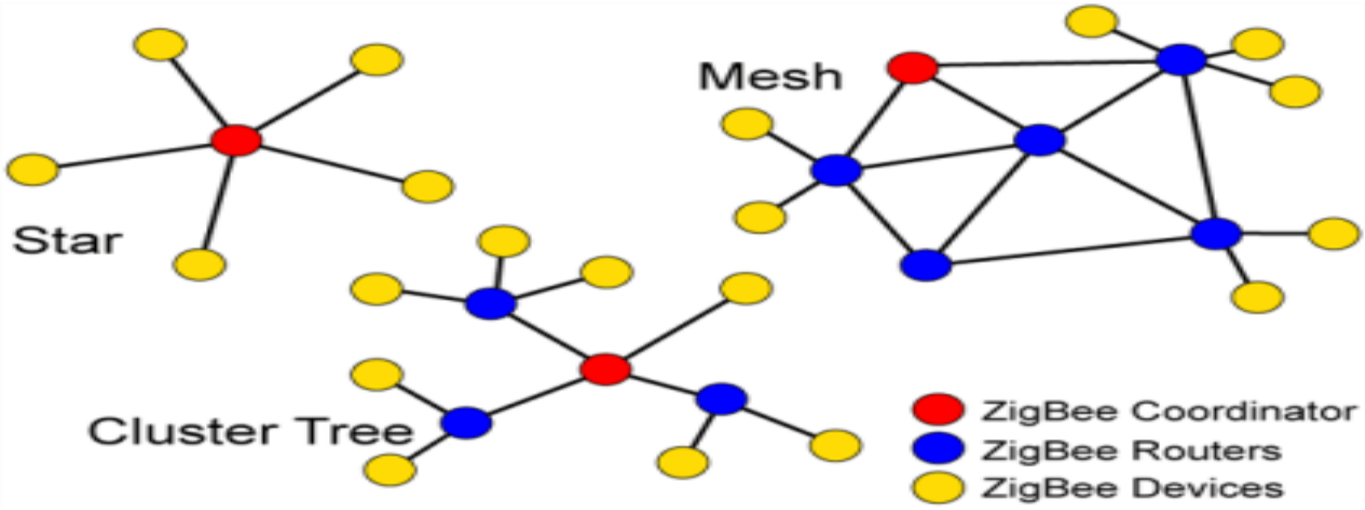
Initial clarification algorithm & operation of 3500 robots simultaneously

This is an algorithm for a project to participate in a competition to set a record for the presence of many robots working simultaneously with each other.

To achieve communication to control between devices requires choosing a type of communication that covers a wide area of robots in addition to a large number and a practical method for expanding it without delay.

- We will rely on **Wi-Fi (IEEE 802.11)** with **Zigbee (IEEE 802.15.4)**
- Assume that each robot size half a square meter (so we will need an area of $3500\ x\ 0.5\ =\ 1750\ m^2$ and reducing the size will benefit for smooth communication and location)
- We will use to design a **two-servo motor**, but this will require a sophisticated mechanical design to reduce their number according to the design and the form to be done.

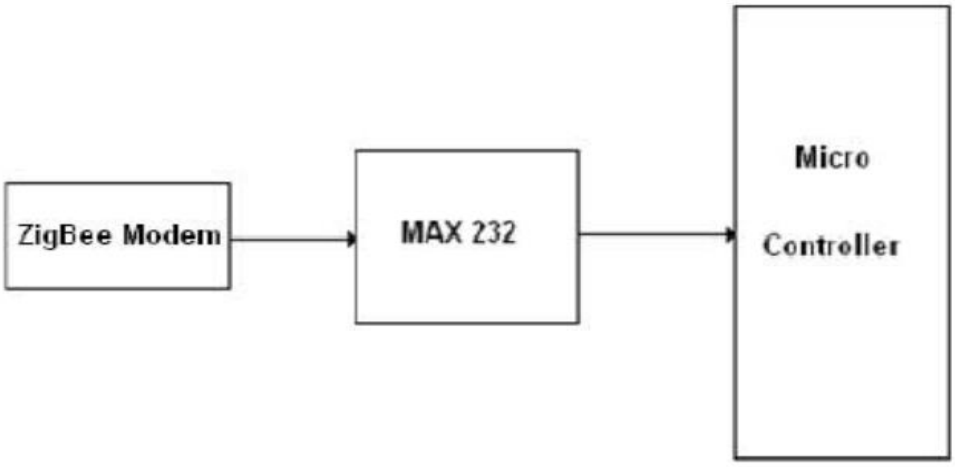
The Zigbee structure has three types of connection distribution as shown in Figure 1.



Figure(1)

We note that each method has certain requirements and we will use what serves us the most for the project.

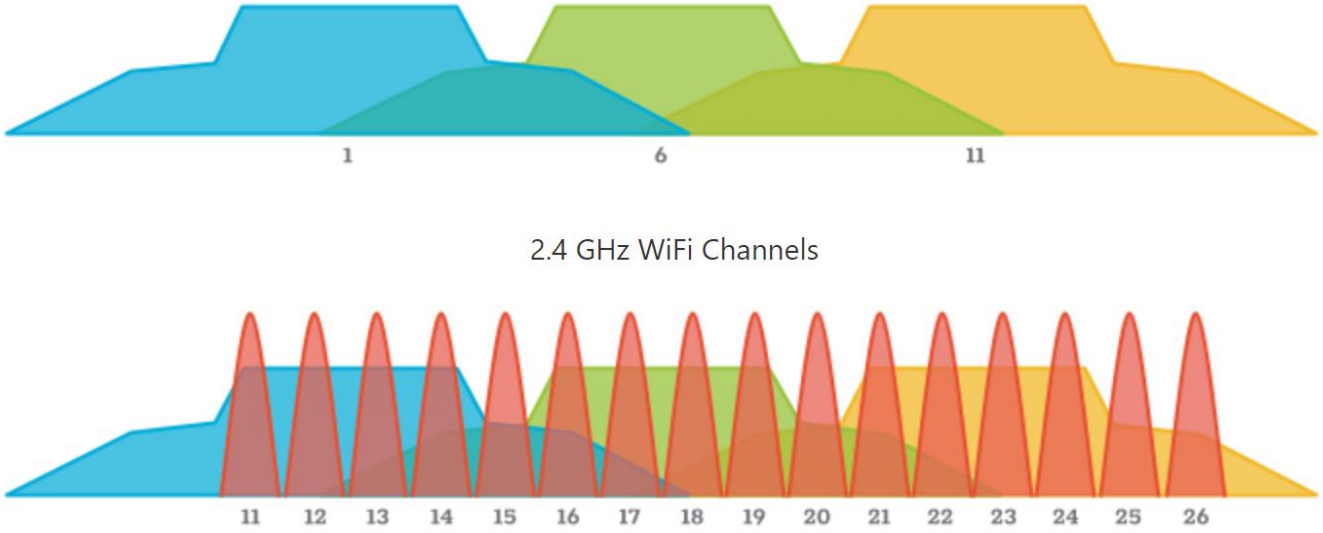
To connect the robots to the Zigbee network, add a piece to it, such as (max232 interface), such as Figure (2).



Figure(2)

But to solve the problem of an area that is approximately 2000 square meters, we will need more than one distribution to indicate the rest of the devices, to ensure that no data is lost ; using data aggregation mechanism (DAM).

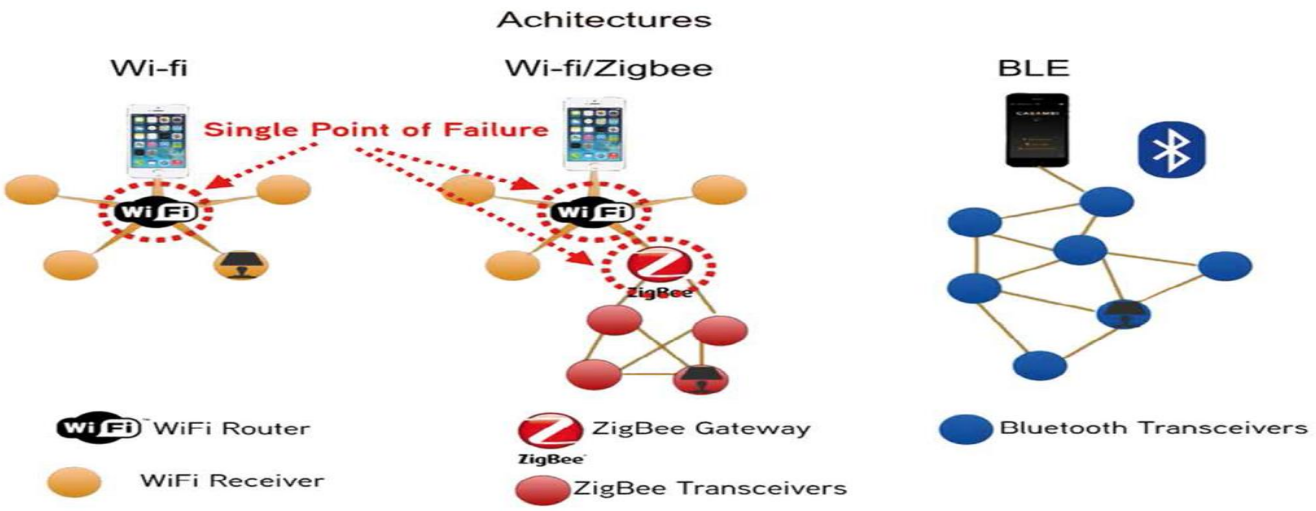
And we merge with **(Wi-Fi)** their nature by interfering for a connection proven in place as shown in Figure (3)



Figure(3)

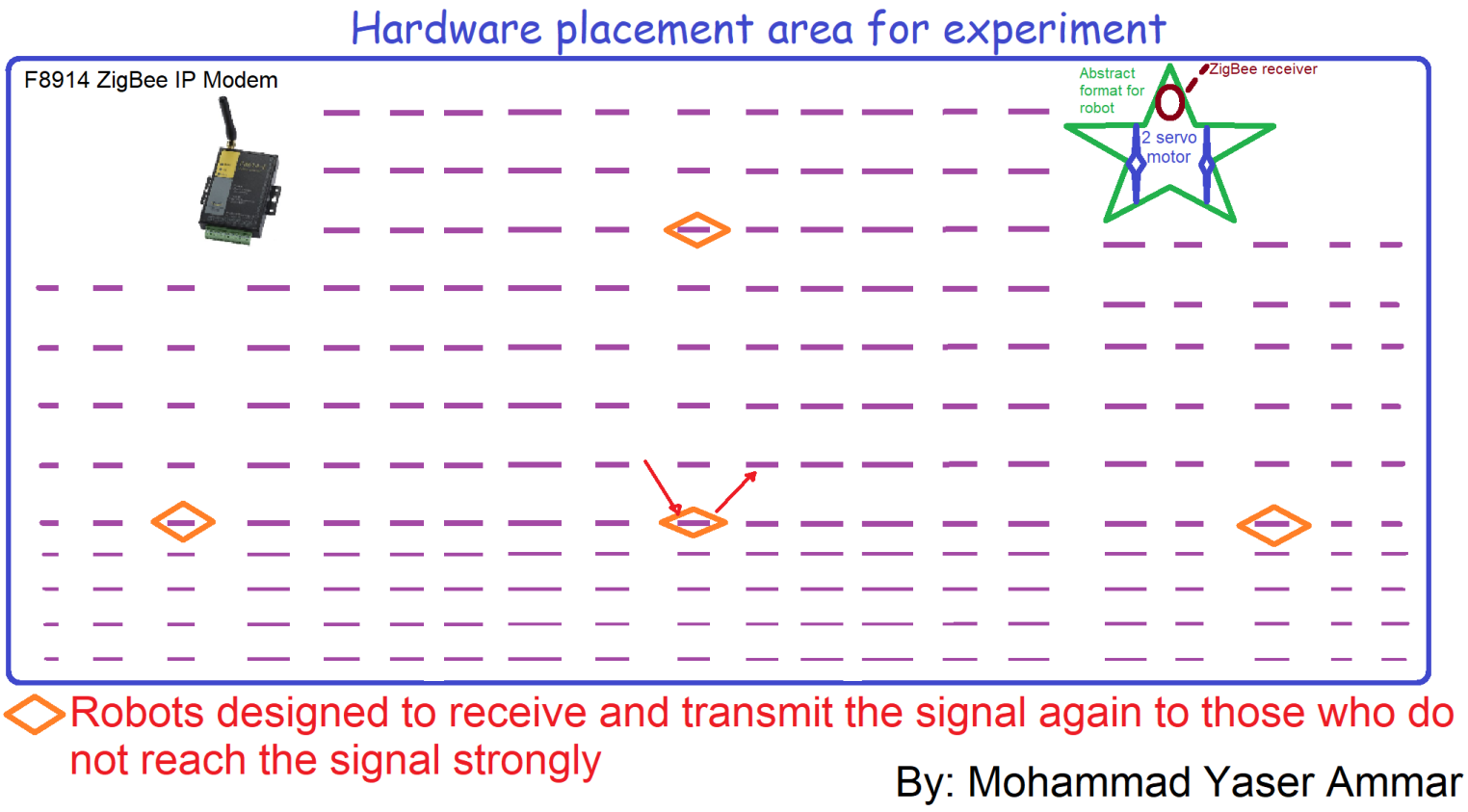
For transmission, there is a device that can be compatible (F8914 ZigBee IP Modem)

According to their specifications, it is possible to support an area of up to 2 km and support to (65,000 nodes), and with it (one to one) method, and that there are devices that receive and at the same time distributed to others, this is how the middle architecture in Figure (4) is the optimal



Figure(4)

This illustration is designed by; To show the idea more realistically in Figure (5)



Figure(5)

Remember that the project requires that the movement of the robots be simultaneous if doing so requires the signal to reach all devices with the same strength, it is possible to add a delay time after the movement command in addition to the verification status that everyone is connected to seeing the number of devices and that adding a multi-colored light to each robot to know Connection status *; To distinguish which devices are not connected.

*It is preferable to make a method of controlling the devices in a broader way, such as a map, but it is possible that there is an additional cost

And for energy, we put the robot running for as long as possible, minutes, at the lowest possible cost.

The more designed the project, the clearer the idea can be

Good luck in the competition 😊

References:

- http://www.networkset.net/2012/07/13/%D8%AA%D9%82%D9%86%D9%8A%D8%A9-%D8%A7%D9%84%D9%80-zigbee/
- https://www.researchgate.net/publication/329738640_ZigBee_Implementation_on_Multi_Robot_System
- https://core.ac.uk/reader/295548334
- https://support.metageek.com/hc/en-us/articles/203845040-ZigBee-and-WiFi-Coexistence

-https://en.four-faith.com/f8914-zigbee-terminal-ip-modem.html?gclid=EAIaIQobChMI1cubo5bw6gIVjrd3Ch3zNwchEAAYASAAEgJ-aPD_BwE

By:

Mohammad Yaser Ammar

A student in the Department of Computer Engineering

During summer training with the smart methods company