User Requirements:

The battery efficiency is a crucial aspect for our project, and we can distinguish the duration according to the use of the device. Specifically, we can identify two macro scenarios:

- **At least one day:** in case we lost our pet it is important that the device remain active for at least one day, that could be a sufficient amount of time to track and retrieve it;
- **At least one week:** in case we do not lose contact with our pet, it is sufficient that the device remains active for at least one week because it is a good interval so that it does not always require the intervention of the possessor.

The **accuracy** of the system must be of 10-15m, that is a sufficient range in order to be able to find our pet. The chosen gps respect these constraint:

Precision (Test condition 3)	Horizontal positioning accuracy	2.5	m
	High positioning accuracy	3.5	m
	Speed positioning accuracy	0.1	m/s
	Timing accuracy	30	ns

Position update (and so **duty cycle**) is another important aspect, and also for this requirement we could distinguish two macro scenarios:

- **Never:** in case our pet is in our view, we could avoid to update the position because we know where it is;
- **Each 10 min:** when we lost the contact with the pet, 10 minutes could be a sufficient amount of time to update the position, because in 10 minutes the pet could not do so much road, and we could reach him;

Security is another crucial aspect: data exchanged by the application must be encrypted in order to hide sensitive information (like the position of the pet) to malicious attackers.

Why Lora?

Since data transfer are in the order of 50 bytes (assuming that latitude and longitude are float data types, and that the data transferred has a form like:

{"Latitude": float, "Longitude": float}

therefore, the total size of the given string would be circa 48 bytes), and since we need that the system has to be energy efficient and since we need a communication in the order of km, LoRa is strongly suitable for our project, because allows **long range communication** (over 10 km in rural areas, 3–5 km in heavily urbanized areas), low data rate and low power consumption. Moreover, it is also useful for security: indeed, LoRaWAN is the first Internet of things to propose double encryption, preventing the possibility of radio eavesdropping.
LoRa is beautiful but, since there are still issues in making it work on ESP32, we will use Wi-Fi. We will make simulations on IOT-LAB, we will make a prototype using WIFI (instead of LORA) to show real measures, and we will integrate simulation and prototype making realistic assumptions.