Summarizing Report IoT Course Project

Activity Monitoring Cat Litterbox

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Abstract-

This project is supposed to show us a smart cat litter box who can monitor the activity in it and send the data to the cloud for later use. It's done by simulating 2 sensors, one that will act as a humidity sensor and the other as a motion sensor that will detect if the cat is entering the litterbox. After being stimulated, the data is sent to the cloud using the MQTT protocol in a secured way via port 8883 (which is the port for the secured version of the protocol). It also shows a simulation of a few devices sending data. After being sent to the cloud the data is saved and stored inside a database with two tables, one for all the humidity readings and the other for every entrance that has been recorded.

Introduction-

The average house cat uses his litterbox three to five time a day (including all usages), the times that a cat actually uses the litterbox can actually help us understand if the cat is healthy or not, for example if the cat uses the litterbox too much it can indicate that he has some kind of a bladder problem only if he uses it too little it may indicate the tea is dehydrated and not drinking enough water throughout the day.

By monitoring the times that the cat uses the litterbox we can predict a health issue or catch it right when it starts and because of it take care of it before it becomes and major or even minor health problem.

To monitor the cat activity A proximately sensor will be installed it's the door of the litterbox which will help determine if the cat uses it. in addition to it that will be a humidity sensor that will help us see the humidity inside the litterbox, and if the humidity is too high it can indicate that the sand inside is crystallizing, and we'll make it harder for the cats to use it. We can see a simple diagram of how the sensors are set up in figure 1 below.

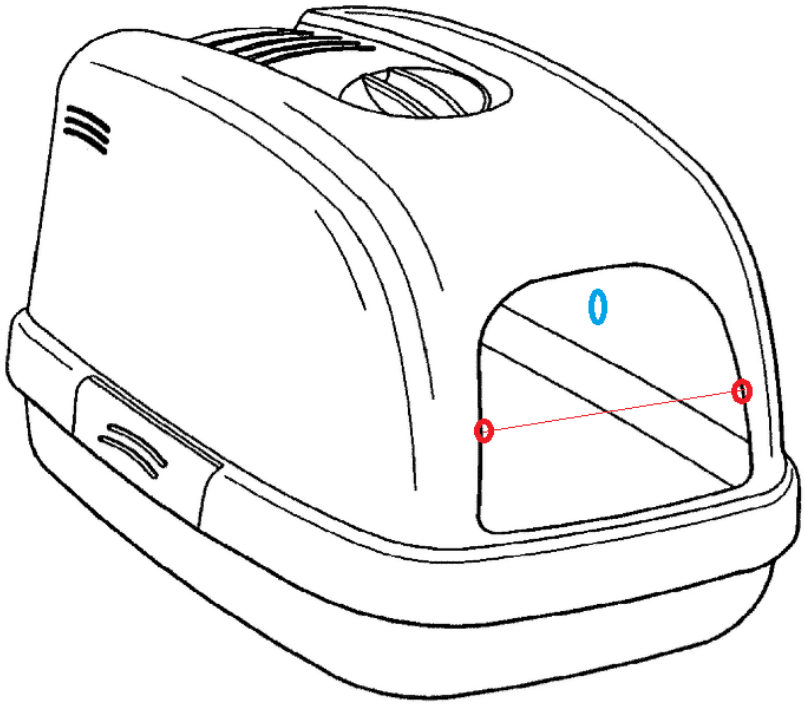


Figure 1, you can see the location of the proximity sensor marked in red and the humidity sensor in blue.

Methodology-

The religion of the idea of the architecture after meeting the minimum requirements was to add a secured line over port 8883 (which is the secure port of the MQTT protocol) and using Amazon generated certificates to ensure the authenticity of the data and by doing that simulating the security aspect of this project. In addition there would have been another MQTT broker the cloud's side that would have read data from the database and send it back to a phone app which wloud hae added compexity to the project. You can see this architecture in figure 2 below.

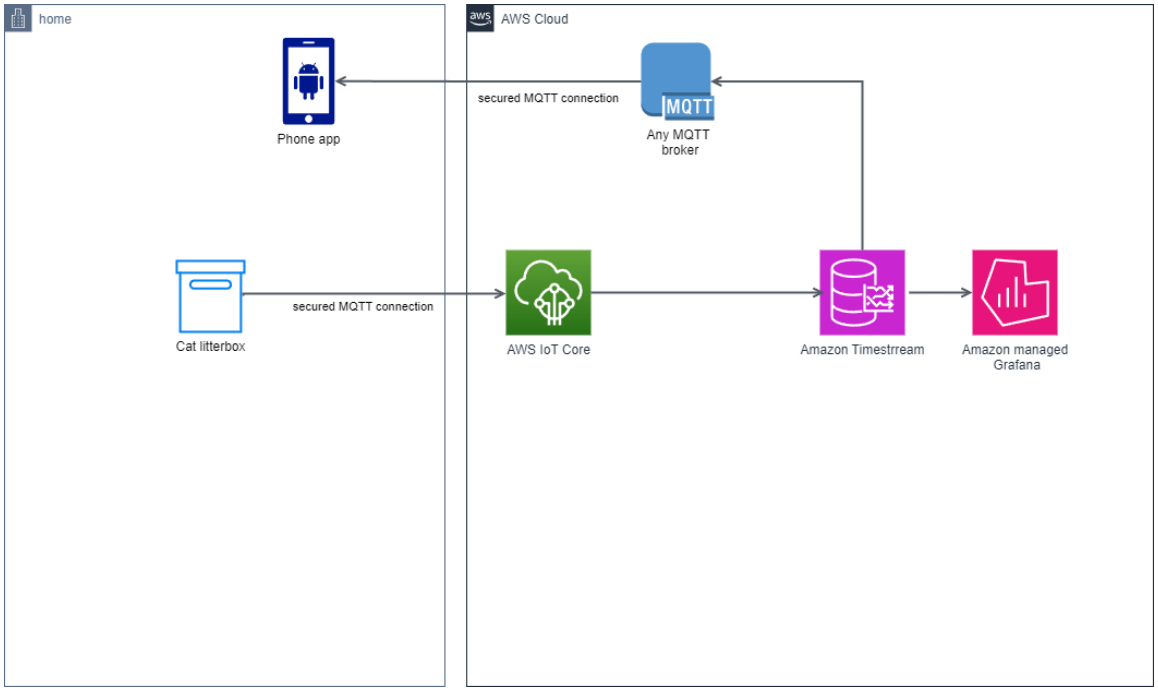


Figure 2. Originally planned architecture of the project.

Sometime of trying to find a free way to create this architecture and some accidental devices management billing from Amazon's side it seemed like there is no way to create the phone app part of the architecture in the free tier (you can create a mosquito or other broker in Amazon but it will charge you money for it).

So to compensate the part that was removed from the original plan I decided to add another device on the litterbox side and by that showing scalability. Since the database now holds two separate humidity measurements and two separate cat entrance measurement in the database showing it can hold more than one and by that showing it can oparate in quantity. You can see the new architecture in figure 3 below.

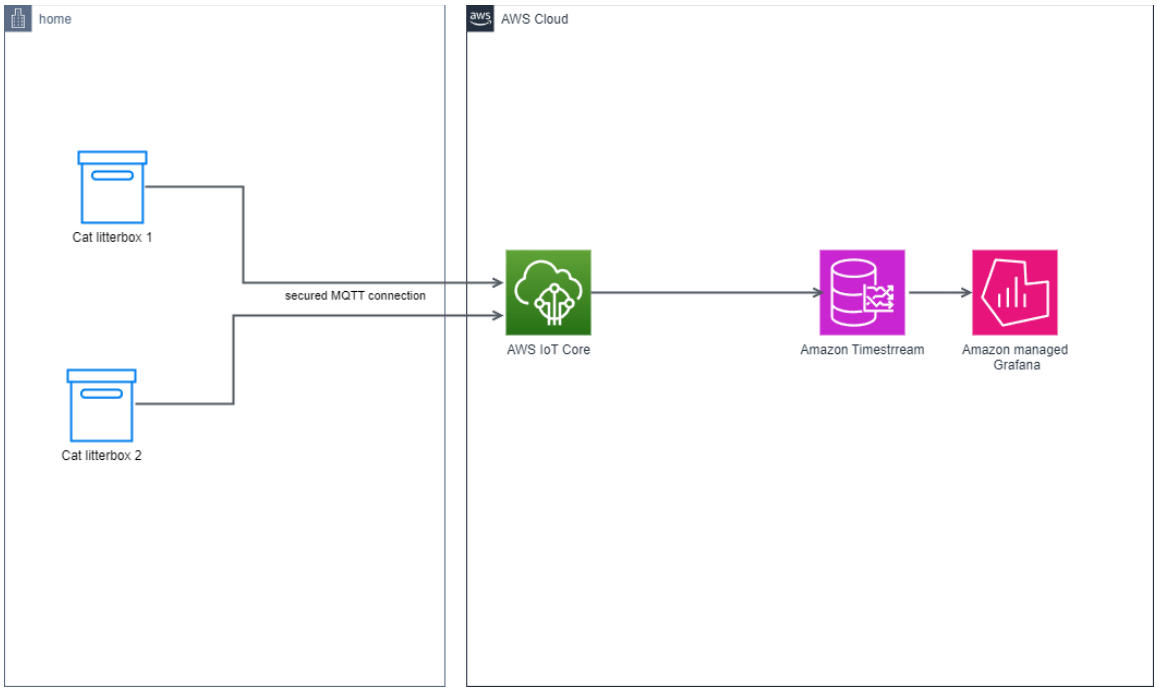


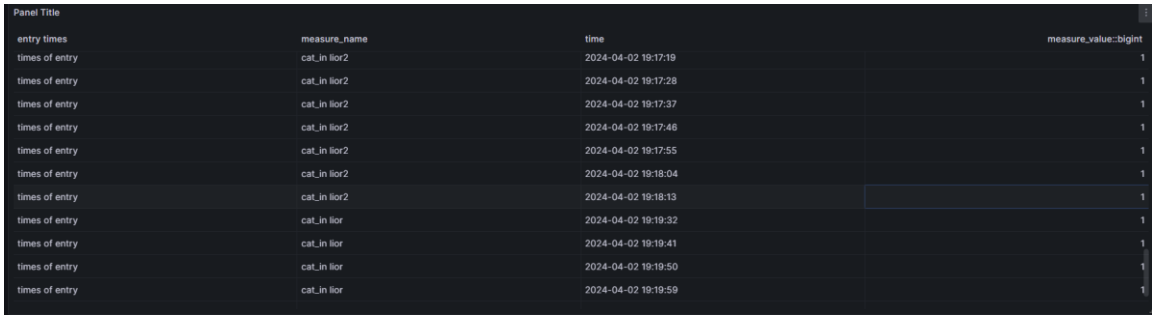
Figure 3. Actual project architecture.

Every litterbox will have its own device on the AWS IoT core, and every one of them will publish these two topics: “cat/litterbox/*username*/humidity”, “cat/litterbox/*username*/entry”.

In this manner we will know to distinguish between two different devices and if we have two litterboxes in our house, we can use the same username and track the two little boxes as one unit.

Results-

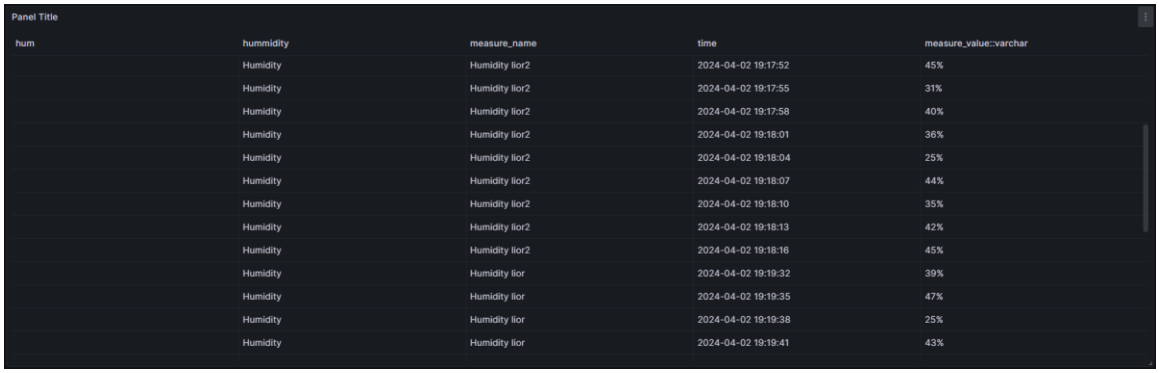
In here you can see the Database after running the two codes of the two separate transmitters you can see that in figure 4. the entry table saves each time of the cat's entry simulation for each user later this can be used in the original design to send data back to the phone application. In addition, in figure 5. You can see the humidity table for each device. This table will be deleted quite fast for scalability reasons since the only humidity data that is relevant is the most recent data, so it saves the data for the minimal time available by Amazon.



Panel Title

entry times	measure_name	time	measure_value::bigint
times of entry	cat_in lior2	2024-04-02 19:17:19	1
times of entry	cat_in lior2	2024-04-02 19:17:28	1
times of entry	cat_in lior2	2024-04-02 19:17:37	1
times of entry	cat_in lior2	2024-04-02 19:17:46	1
times of entry	cat_in lior2	2024-04-02 19:17:55	1
times of entry	cat_in lior2	2024-04-02 19:18:04	1
times of entry	cat_in lior2	2024-04-02 19:18:13	1
times of entry	cat_in lior	2024-04-02 19:19:32	1
times of entry	cat_in lior	2024-04-02 19:19:41	1
times of entry	cat_in lior	2024-04-02 19:19:50	1
times of entry	cat_in lior	2024-04-02 19:19:59	1

Figure 4. the database table of the entry times for each user.



Panel Title

hum	hummidity	measure_name	time	measure_value::varchar
	Humidity	Humidity lior2	2024-04-02 19:17:52	45%
	Humidity	Humidity lior2	2024-04-02 19:17:55	31%
	Humidity	Humidity lior2	2024-04-02 19:17:58	40%
	Humidity	Humidity lior2	2024-04-02 19:18:01	36%
	Humidity	Humidity lior2	2024-04-02 19:18:04	25%
	Humidity	Humidity lior2	2024-04-02 19:18:07	44%
	Humidity	Humidity lior2	2024-04-02 19:18:10	35%
	Humidity	Humidity lior2	2024-04-02 19:18:13	42%
	Humidity	Humidity lior2	2024-04-02 19:18:16	45%
	Humidity	Humidity lior	2024-04-02 19:19:32	39%
	Humidity	Humidity lior	2024-04-02 19:19:35	47%
	Humidity	Humidity lior	2024-04-02 19:19:38	25%
	Humidity	Humidity lior	2024-04-02 19:19:41	43%

Figure 5. the database table of the humidity levels for each user.

A video of the project working can be seen with the added files where I show connection and data sending with one user and in the second video you can see the data sending from the second device.

Conclusions-

As we saw, this project works as intended in the simulation. It can store all the data that we need and in the future with improvements use it to send data back to the user. Hopefully in the future it can be used on an actual system which will be mounted on my cat’s litterbox, as intended in my original idea.