

# **Environment Monitor System**

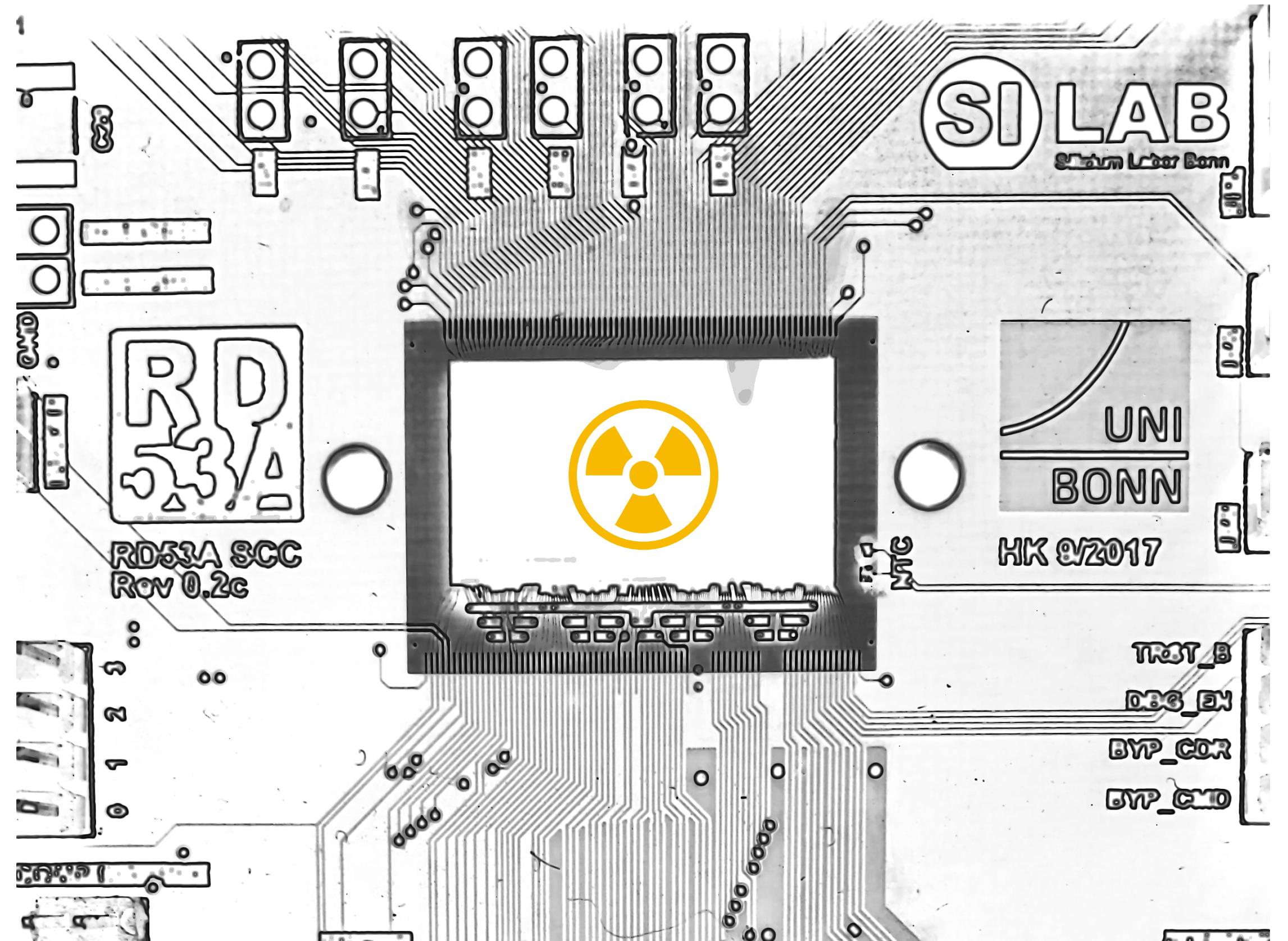
## for the Long-term Exposure Experiment

May 25, 2018 Yuxuan Zhang

# The long-term exposure experiment

The long term exposure experiment is designed to test the performance and stability of RD53A chip when exposed to radiation.

- Last for 2 years.
- Chip Exposed to Radiation Source.
- 2 Independent Sample RD53A Chips.
- 3 Kr-85 Radiation Sources (One for backup).
- Controlled Environment in Freezer.
- Continuous Readout from the Chip.



# Why we need a monitor system

- **WATCH**

Keep monitoring the environment inside the refrigerator, 7×24.

- **ALERT**

Send an alert when something goes wrong.

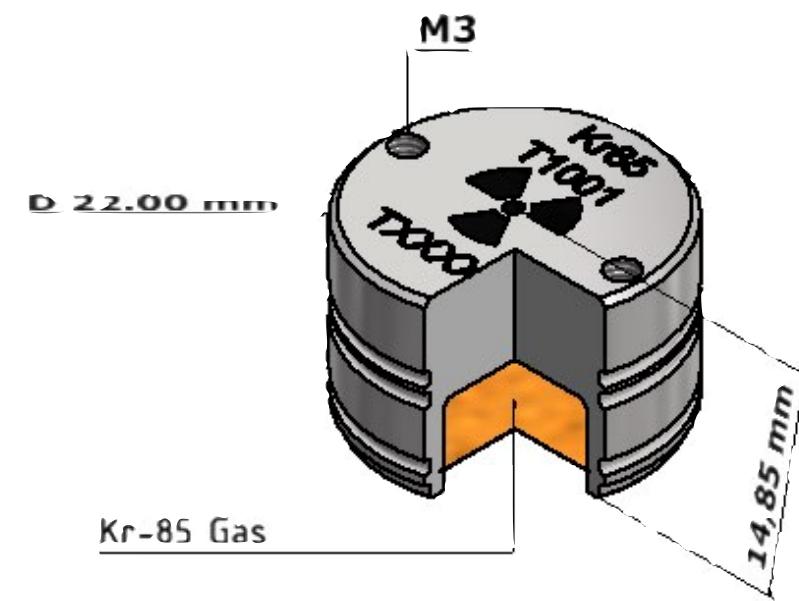
- **REACT**

Take automatic actions to protect the chip when necessary.

- **MONITOR**

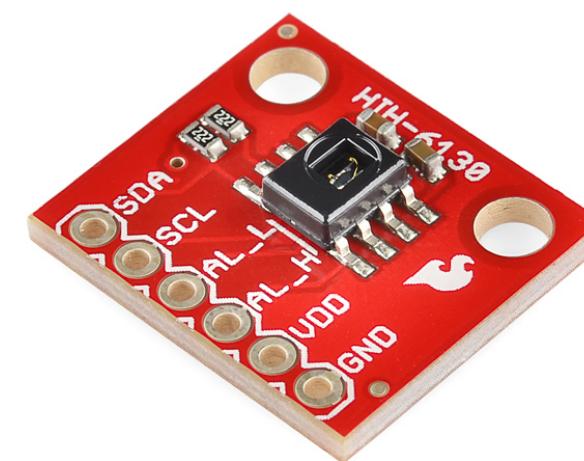
Give access to the readout data, anywhere around the world.

# What we need to launch the experiment



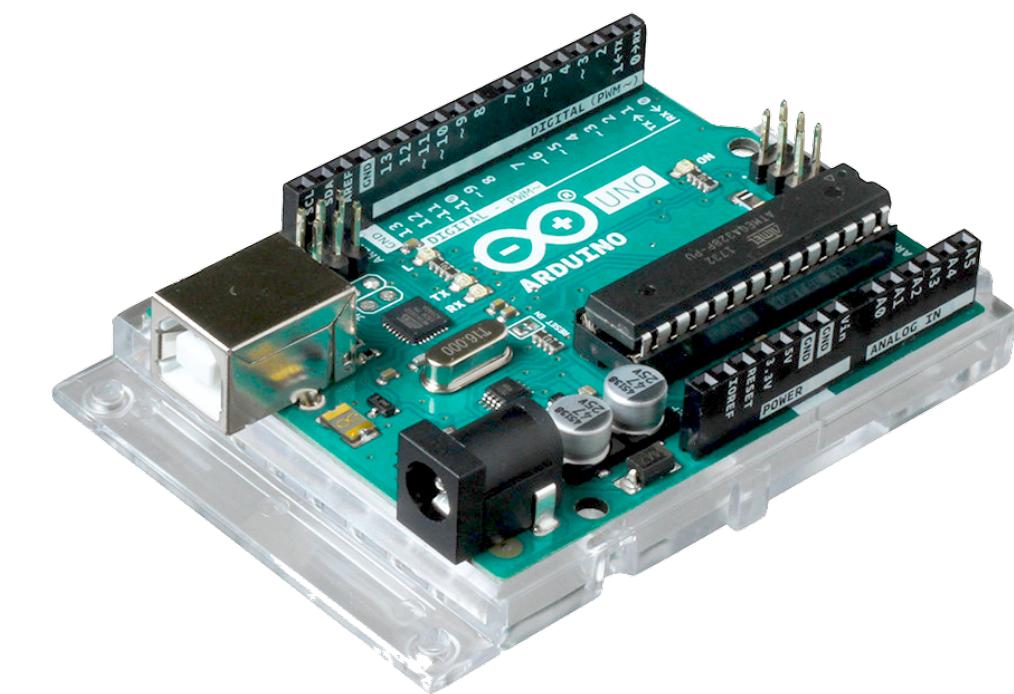
**Kr-85**

Radiation Source



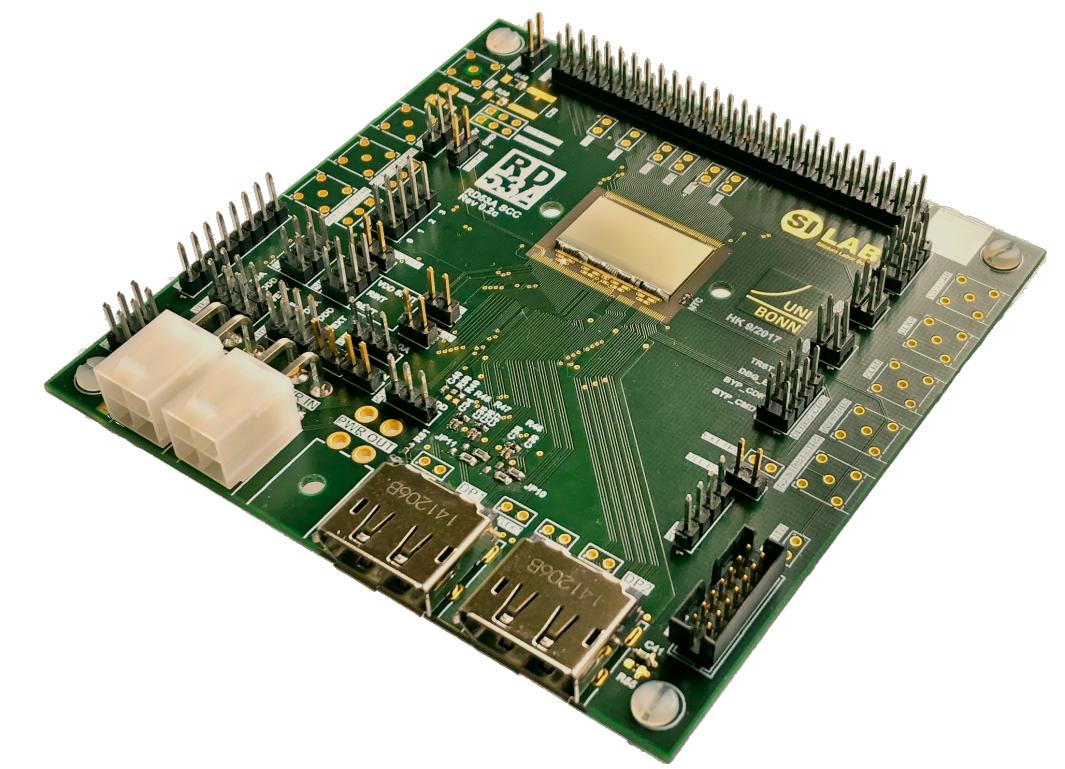
**HIH-6130**

The environment sensor



**Arduino UNO**

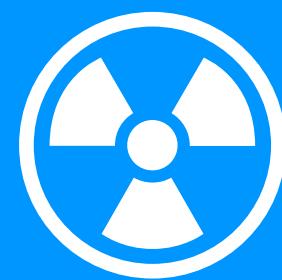
Programmed for Sensor Readout



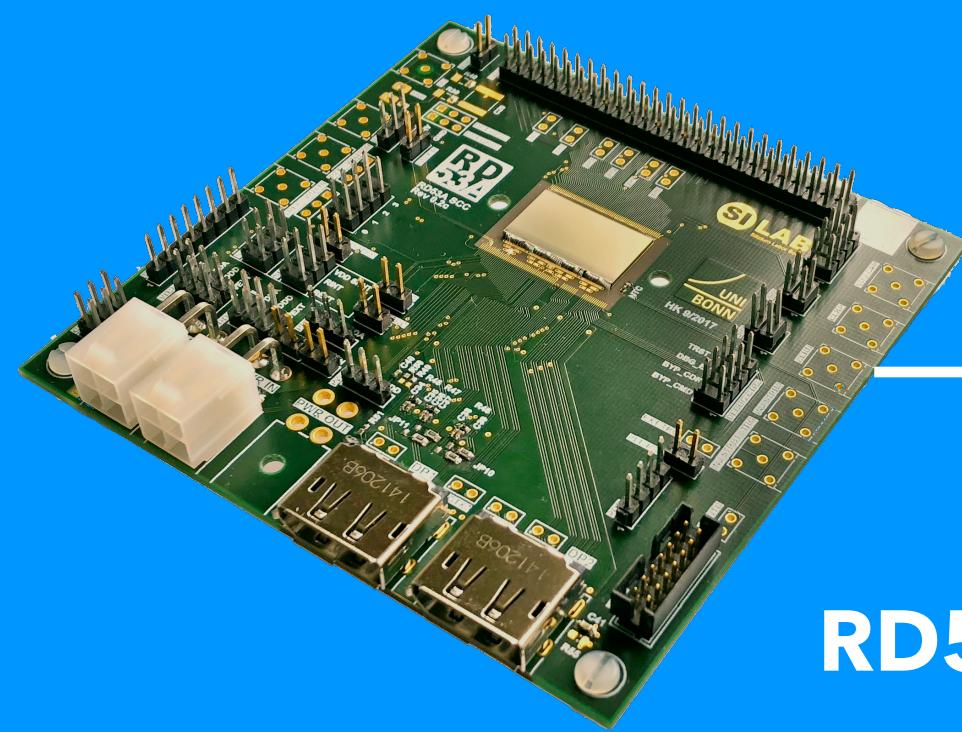
**RD53A**

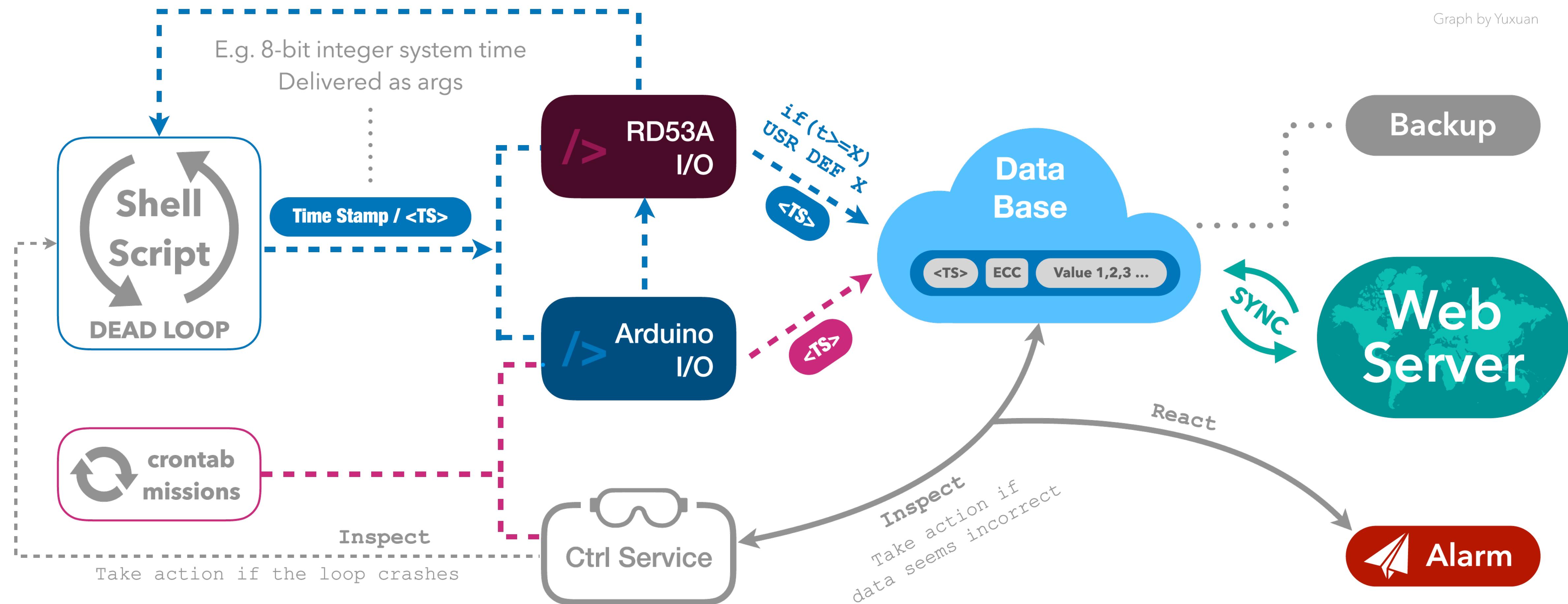
To be radiated

# Inside Freezer



**Radiation Source**  
Attached to each chip





# Logic Graph of the monitor system

# Inside the Database

## Log

| Key    | Type   | Description   |
|--------|--------|---------------|
| ID     | int    | auto-add, PRI |
| SRC    | int    | mag-source    |
| TYPE   | int    | message-type  |
| ERR_ID | int    | error-ID      |
| CONT   | string | detailed-info |
| TS     | int    | uni-timestamp |
| DT     | Time   | auto-update   |

## ENV Data

| Key   | Type  | Description    |
|-------|-------|----------------|
| TS    | int   | timestamp, PRI |
| ECC   | int   | err-correct    |
| Env_T | float | temperature    |
| Env_H | float | humidity       |
| DT    | Time  | auto-update    |

## RD53A Readout \*

| Key     | Type   | Description       |
|---------|--------|-------------------|
| TS      | int    | timestamp, PRI    |
| ECC     | int    | err-correct       |
| ana_V   | float  | analog-volt...    |
| dig_V   | float  | digital-vol...    |
| Env_T   | float  | temperature       |
| Env_H   | float  | humidity          |
| RD_path | string | readout-file-path |
| DT      | Time   | auto-update       |

This table contains information about system updates, regular inspections, and also have log of errors and exceptions.

This is the data table recording the environment temperature and humidity from Arduino, HIH-6130 sensor. We can easily get a graph of history environment condition using this table. And we can also predict the future humidity and temperature by studying its trend.

There are two tables of this kind, corresponding to two chips being tested.

\* These two tables are not yet been created, because the RD53A portal is not ready.

# SQL Log Table

| Field        | Type      | Null | Key | Default           |
|--------------|-----------|------|-----|-------------------|
| TS           | double    | NO   | PRI | NULL              |
| ECC          | int(11)   | YES  |     | 0                 |
| Env_Temp     | double    | YES  |     | 0                 |
| Env_Humidity | double    | YES  |     | 0                 |
| Last_Update  | timestamp | NO   |     | CURRENT_TIMESTAMP |

```
>>  
MySQL -u  
>>  
DESC ARDUINO_IO;
```

# SQL

## Environment Data Table

```
>> MySQL -u  
>>  
SELECT *  
FROM ARDUINO_IO  
WHERE ... ;
```

| TS            | ECC | Env_Temp | Env_Humidity | Last_Update         |
|---------------|-----|----------|--------------|---------------------|
| 1526943121482 | 0   | 22.8871  | 51.0387      | 2018-05-21 15:52:03 |
| 1526943181225 | 0   | 22.8569  | 51.0142      | 2018-05-21 15:53:03 |
| 1526943241974 | 0   | 22.8267  | 51.002       | 2018-05-21 15:54:04 |
| 1526943301700 | 0   | 22.8367  | 51.1119      | 2018-05-21 15:55:04 |
| 1526943361434 | 0   | 22.8367  | 51.0142      | 2018-05-21 15:56:03 |
| 1526943421147 | 0   | 22.8367  | 51.0142      | 2018-05-21 15:57:03 |
| 1526943481882 | 0   | 22.8166  | 51.002       | 2018-05-21 15:58:04 |
| 1526943541639 | 0   | 22.8166  | 51.002       | 2018-05-21 15:59:04 |
| 1526943601400 | 0   | 22.8166  | 50.9776      | 2018-05-21 16:00:03 |
| 1526943661150 | 0   | 22.8367  | 51.2094      | 2018-05-21 16:01:03 |
| 1526943721902 | 0   | 22.8267  | 51.124       | 2018-05-21 16:02:04 |
| 1526943781625 | 0   | 22.8166  | 51.0752      | 2018-05-21 16:03:04 |
| 1526943841366 | 0   | 22.8267  | 51.0265      | 2018-05-21 16:04:03 |
| 1526943901104 | 0   | 22.8166  | 50.8679      | 2018-05-21 16:05:03 |
| 1526943961851 | 0   | 22.8166  | 50.8434      | 2018-05-21 16:06:04 |
| 1526944021595 | 0   | 22.8267  | 51.0265      | 2018-05-21 16:07:04 |
| 1526944081345 | 0   | 22.8367  | 51.0387      | 2018-05-21 16:08:03 |
| 1526944141088 | 0   | 22.8166  | 50.7947      | 2018-05-21 16:09:03 |

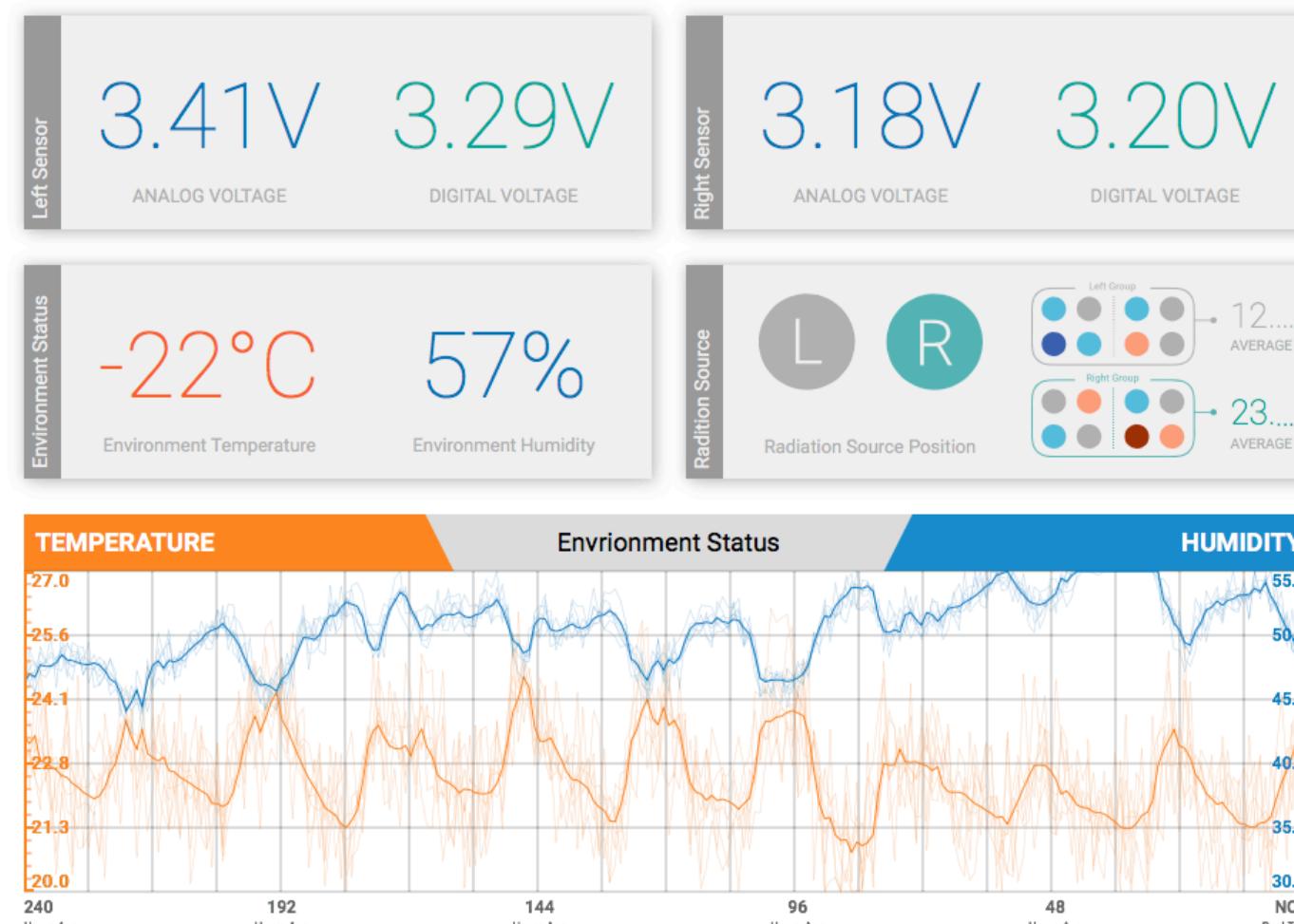
# SQL Log Table

| Field      | Type         | Null | Key | Default           |
|------------|--------------|------|-----|-------------------|
| ID         | int(11)      | NO   | PRI | NULL              |
| MSG_Source | varchar(20)  | NO   |     | Unknown           |
| MSG_Type   | varchar(20)  | NO   |     | Unknown           |
| Priority   | int(11)      | NO   |     | 0                 |
| ERR_ID     | int(11)      | NO   |     | 0                 |
| MSG_Index  | varchar(200) | YES  |     | NULL              |
| Stamp      | int(11)      | NO   |     | 0                 |
| Date_Time  | timestamp    | NO   |     | CURRENT_TIMESTAMP |

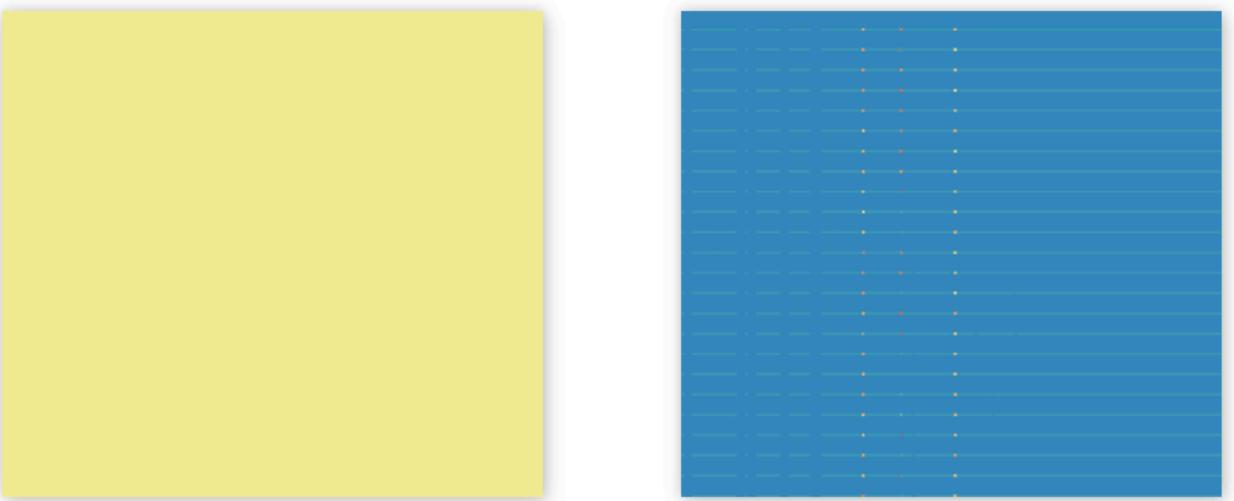
\*This table will soon be updated. See [Github-Repo](#) for details.

>>  
**MySQL -u**  
>>  
**DESC Log;**

## Current Status



## Occupancy Map



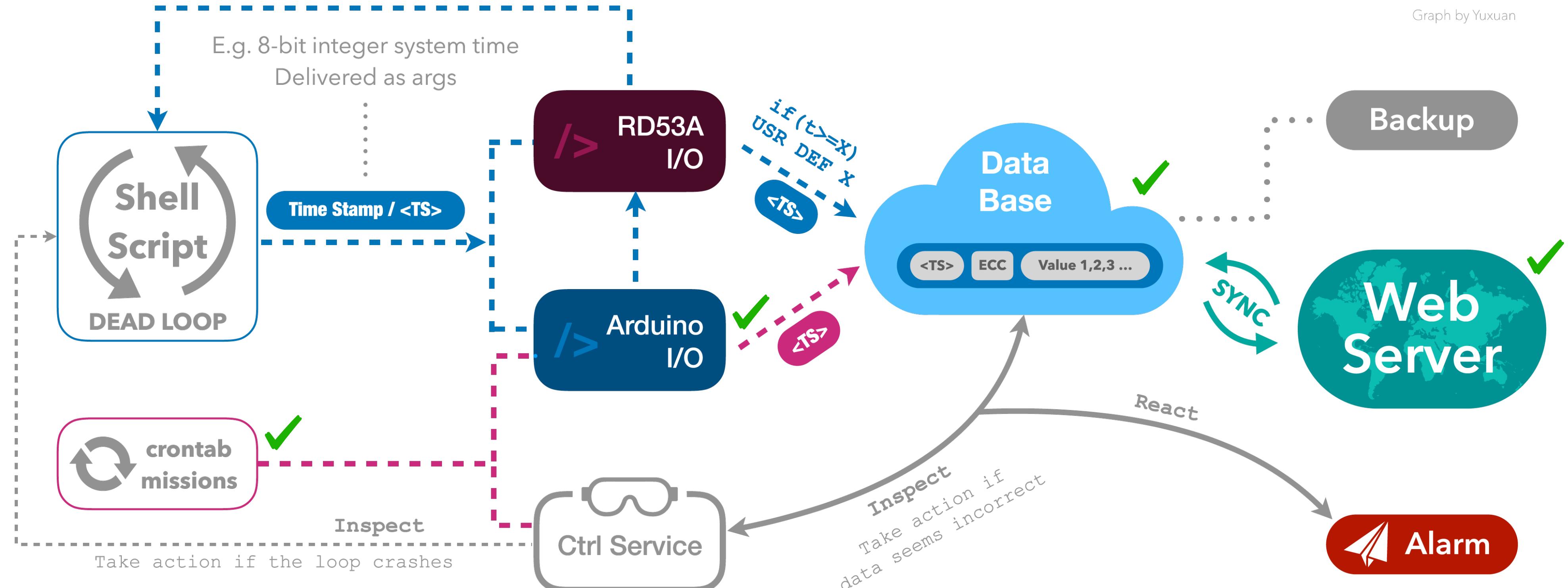
## System Log

| ID  | SOURCE        | TYPE   | CONTENT  | DATE                |
|-----|---------------|--------|--|---------------------|
| 244 | Arduino_Board | ERROR  | <Serial_Connection_Error><br>Serial_Port_Not_Responding<br>/dev/ttyACM1<br>(Abort) | 2018-05-18 16:43:02 |
| 243 | Arduino_Board | ERROR  | <Serial_Connection_Error><br>Serial_Port_Not_Responding<br>/dev/ttyACM1<br>(Abort) | 2018-05-18 16:42:01 |
| 242 | VERSION       | Note   | V4.18 Upgrade Note: V4.18 Log table filter is plugged into the webpage             | 2018-05-16 15:17:01 |
| 241 | VERSION       | UPDATE | From V4.17 To V4.18  | 2018-05-16 15:17:01 |
| 240 | VERSION       | Note   | V4.17 Upgrade Note: V4.17 This version is made compatible with Github versioning   | 2018-05-15 10:57:01 |
| 239 | VERSION       | UPDATE | From V4.16 To V4.17  | 2018-05-15 10:57:01 |
| 216 | Arduino_Board | ERROR  | <Arduino_Board_Error><br>INVALID_Serial_INPUT<br>U%47471027622.141100              | 2018-04-25 20:50:04 |

# Front End Development and Webpage Demo

CLICK ME ^\_^

# Summary



## Completed:

- Shell Script      launch.sh config.sh
- Arduino Portal    Arduino\_IO.py (**AIO**)
- Data Base          MySQL (OR Mariadb)
- Web Server        WebPageGenerator.py (**WPG**)  
Additional Javascript

## Next step:

- I/O Portal        Cpp, triggered @intv
- Control Service   Python, always alive
- Backup            Enabled thru lab system