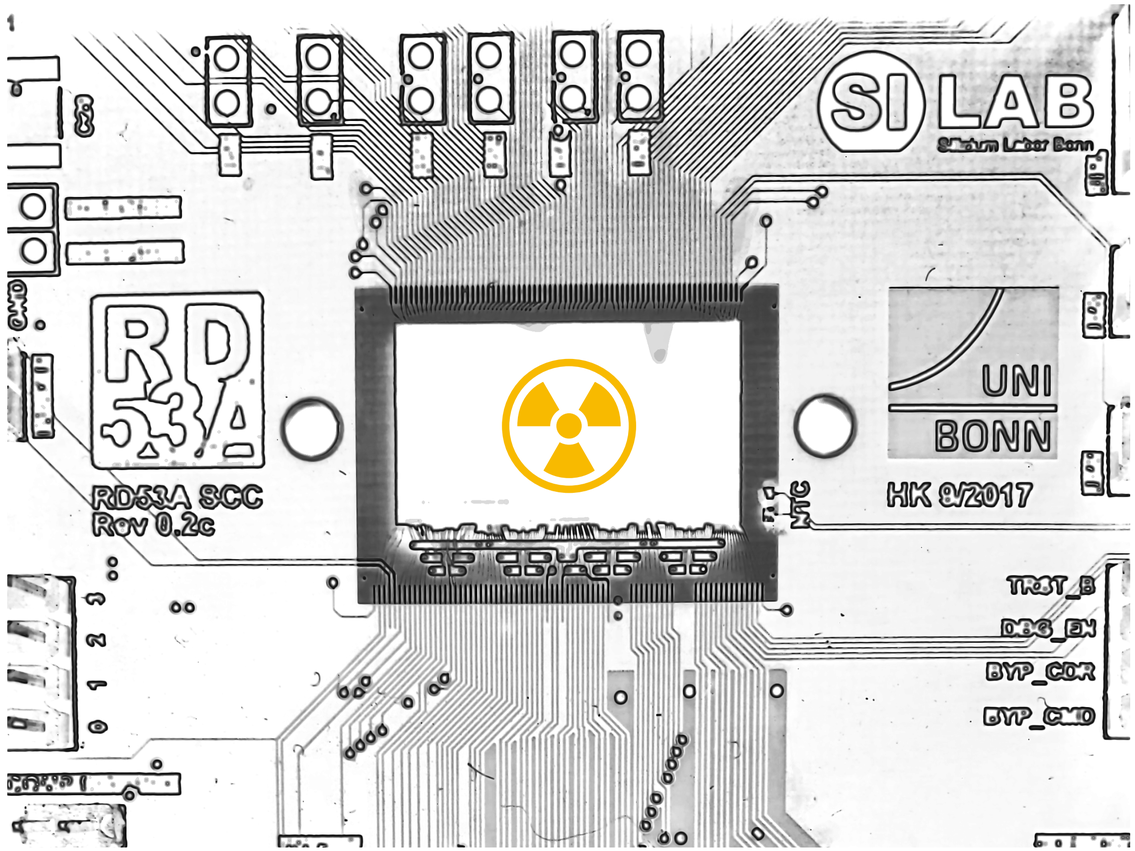
The long-term exposure experiment

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

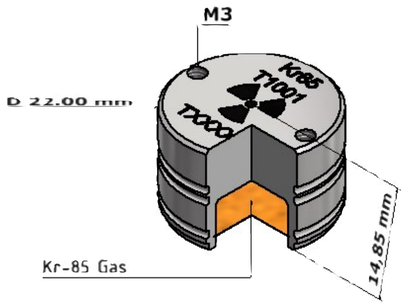
- Last for 2 years.
- Chip Exposed to Radiation Source.
- 2 Independent Sample RD53A Chips.
- 3 Kr-85 Radiation Sources (One for backup).
- Controlled Environment in Freezer.
- Continuous Readout from the Chip.



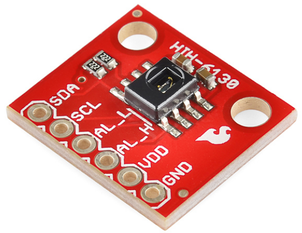
Why we need a monitor system

- 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.

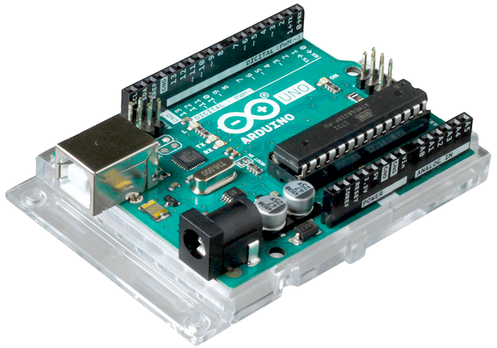
What we need to launch the experiment



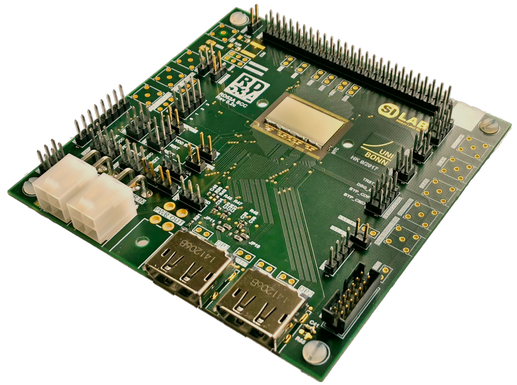
Kr-85
Radiation Source



HIH-6130
The environment sensor



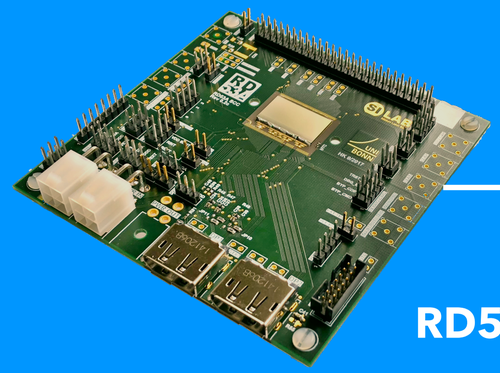
Arduino UNO
Programmed for Sensor Readout



RD53A
To be radiated

Inside Freezer

Radiation Source
Attached to each chip



RD53A X2

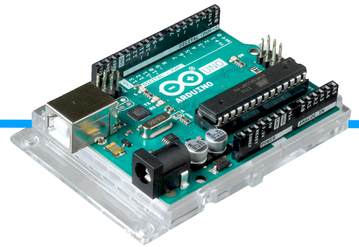
HIH-6130

FPGA

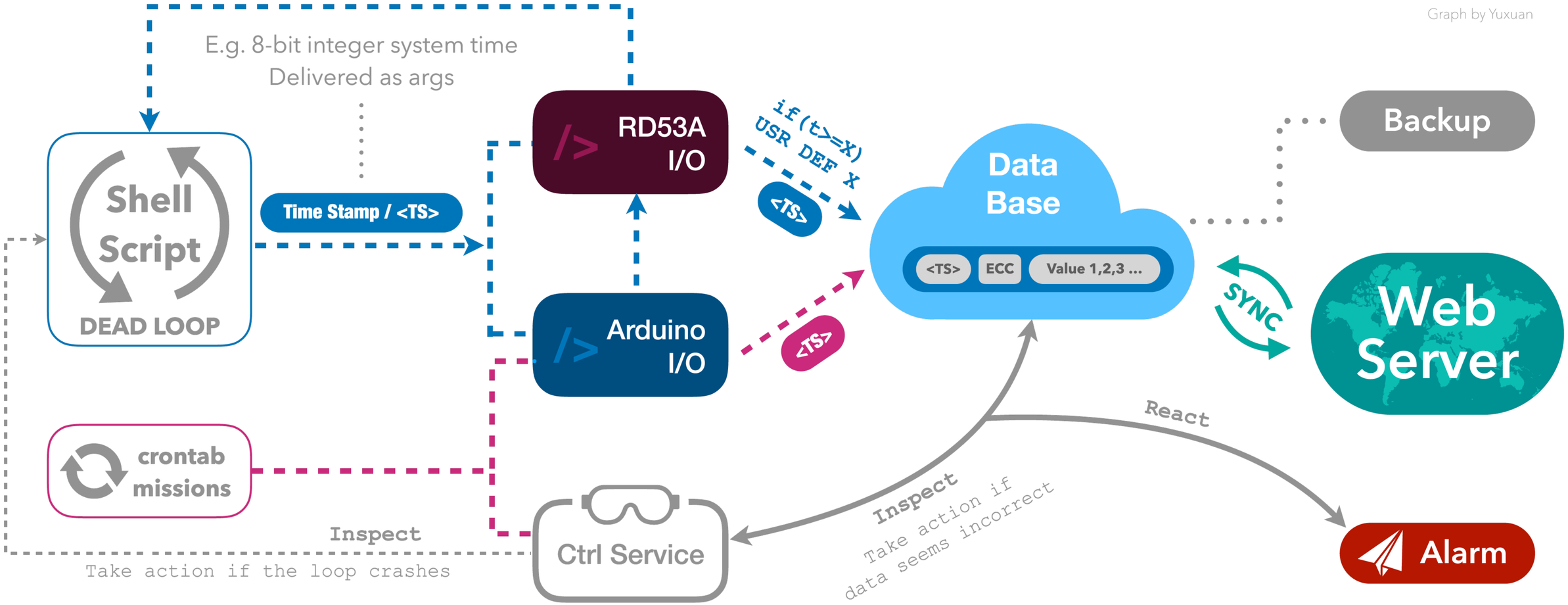
I/O Bus

Host Computer

(LOCAL Database)



USB Serial



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

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

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

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.

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

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;
```

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

Environment Data Table

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

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

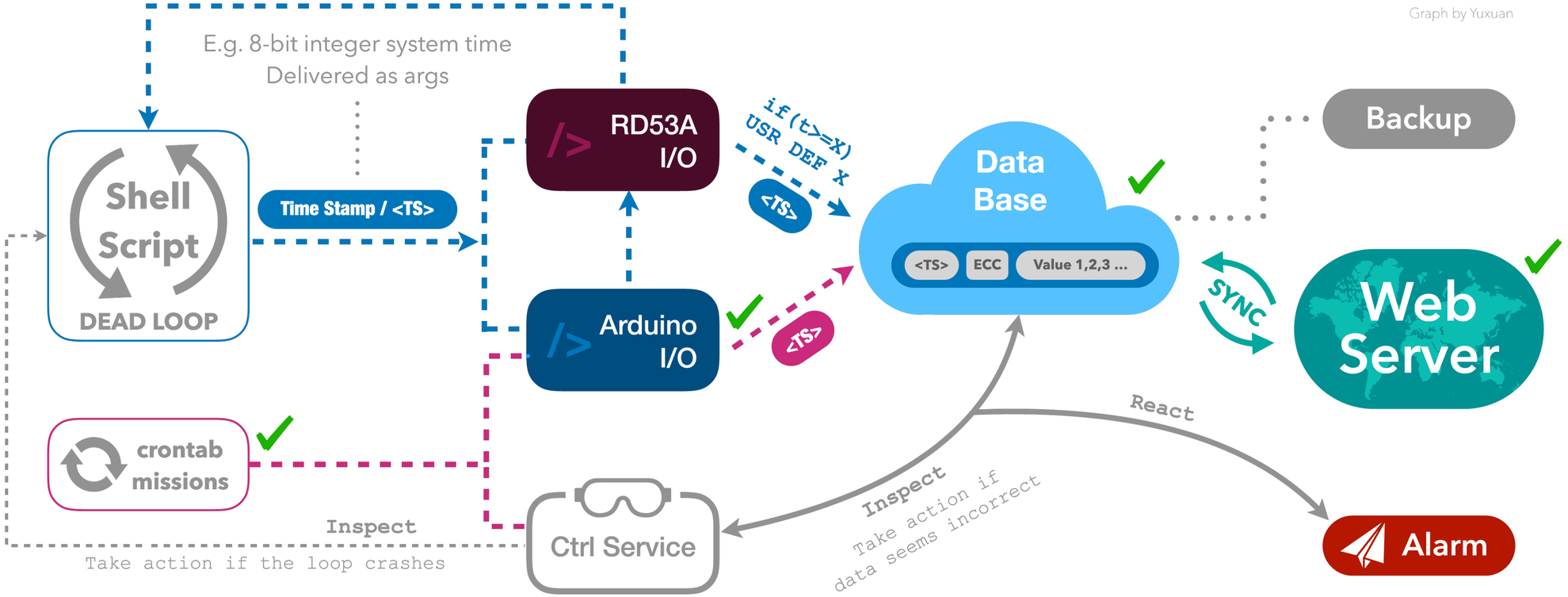
*This table will soon be updated. See **Github-Repo** for details.

```
>>
MySQL -u
>>
DESC Log;
```

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

Environment Monitor System

for the Long-term Exposure Experiment

May 25, 2018 Yuxuan Zhang