Shifthelper (v1.1.4) overview Sept. 2017

Glossary:

- Shifter: The single person responsible for 24 hours of FACT operation.

  The shifthelper(SH) defines the "Shifter" as the person entered in the shift schedule. The SH considers the Shifter to be responsible from noon to noon.

- Shift: The time between Startup and Shutdown.

  The SH defines the "Shift" as the time between "Startup" and "Shutdown" task in the observation schedule

General Description

The shifthelper(SH) continously monitors the state of the FACT telescope via the publicly available status smartfact website. In case human attention is needed (details below) the current *Shifter* is alerted per phone call and optionally Telegram instant message. In case the shifter does not acknowledge the issue on the SH-webinterface in time, automatically a (hardcoded) fallback person is alerted. In case a function inside the shifthelper throws an exception a hardcoded developer is alerted.

How does it work?

FACT serves a public status websites called smartfact. The dynamic content of the wesite is provided as text(`*.data`) and binary(`*.bin`) files in this public web-folder: http://fact-project.org/smartfact/data/. For example the textual content of this smratfact frontpage:

is provided as this text file:

```
1504781095555   1504553178701       0   0
#ffffff Idle [single-pe]
#ffffff  &#9788; [09:32&darr;] &otimes;
#f0fff0 6.38
#f0fff0 15.6    19
#ffffff
#ffffff
```

A parser named smart_fact_crawler has been written for these text-files and can be used or tried out independently from the shifthelper. In order to allow this parser to be further developed extrernally of the SH project, the SH requires the specific version 0.3.0.

NOTE: For a secure operation the format of the `.data` files must not be changed.

When is human attention needed?

Name	limit	Interval[s]	conditions
SmartFactUpToDate	> 10 min	120	only during shift
ParkingChecklistFilled	after 10min	120	only **outside** shift
IsUserAwakeBeforeShutdown	20min before	120	only during shift
MAGICWeatherUpToDate	> 10 min	120	only during shift
Shifter in shift scheduler		120	only during shift
MainJsStatusCheck	Running?	120	only during shift
WindSpeedCheck	> 50 km/h	120	only during shift & not parked
WindGustCheck	> 50 km/h	120	only during shift & not parked
MedianCurrentCheck	> 115 uA	120	only during shift
MaximumCurrentCheck	> 160 uA	120	only during shift

Name	limit	Interval[s]	conditions
RelativeCameraTemperatureCheck	> 15.0°C	120	only during shift
BiasNotOperatingDuringDataRun		120	only during shift
BiasChannelsInOverCurrent		120	only during shift
BiasVoltageNotAtReference		120	only during shift
ContainerTooWarm	> 42°C	120	only during shift
DriveInErrorDuringDataRun		120	only during shift
BiasVoltageOnButNotCalibrated		120	only during shift
DIMNetworkNotAvailable		120	only during shift
NoDimCtrlServerAvailable		120	only during shift
TriggerRateLowForTenMinutes	< 1/sec	120	only during shift
Flare	(individual)	300	

Experience?

Shifthelper is running unmodified since 23.07.2017

23.07. Remove unnecessary fallback calls:

Under certain conditions acknowledged alerts were not being removed form the alert list and thus the fallback was called unnecessaringly.

At the same moment, a more severe bug was found an removed. In case the call to the shifter threw an exception, the fallback was not called. An exception was raised, because the number to be called was an international number from a country our Twilio contract was (for security reasons) not allowed to make calls to. Now we may make calls to the whole world. This bug was found using the test call during startup. Making test calls (DummyAlert) is a part of the startup checklist.

17.07. Fix cache misses

This lead to expert calls about every 200 minutes. Using a different cache library fixed these.

19.04. Fix connection timeouts of the mysql db

These lead to expert calls. Recycling the connection pool fixed these.

13.04. Multiple:

- set smart_fact_crawler timeout = 5 seconds –> expert calls when smart_fact cannot be seen.
- Fix cloning of local DB copy –> lead to expert calls

28.02. Allow shifters to change their phone numbers.

The shifter contact DB was cloned only once at SH startup. So changes in contact details would require a SH restart.

06.02. Fix Flare Alerts

- In case of FlareAlert a shifter was called without end.
- Fallback shifter was not called in this case.

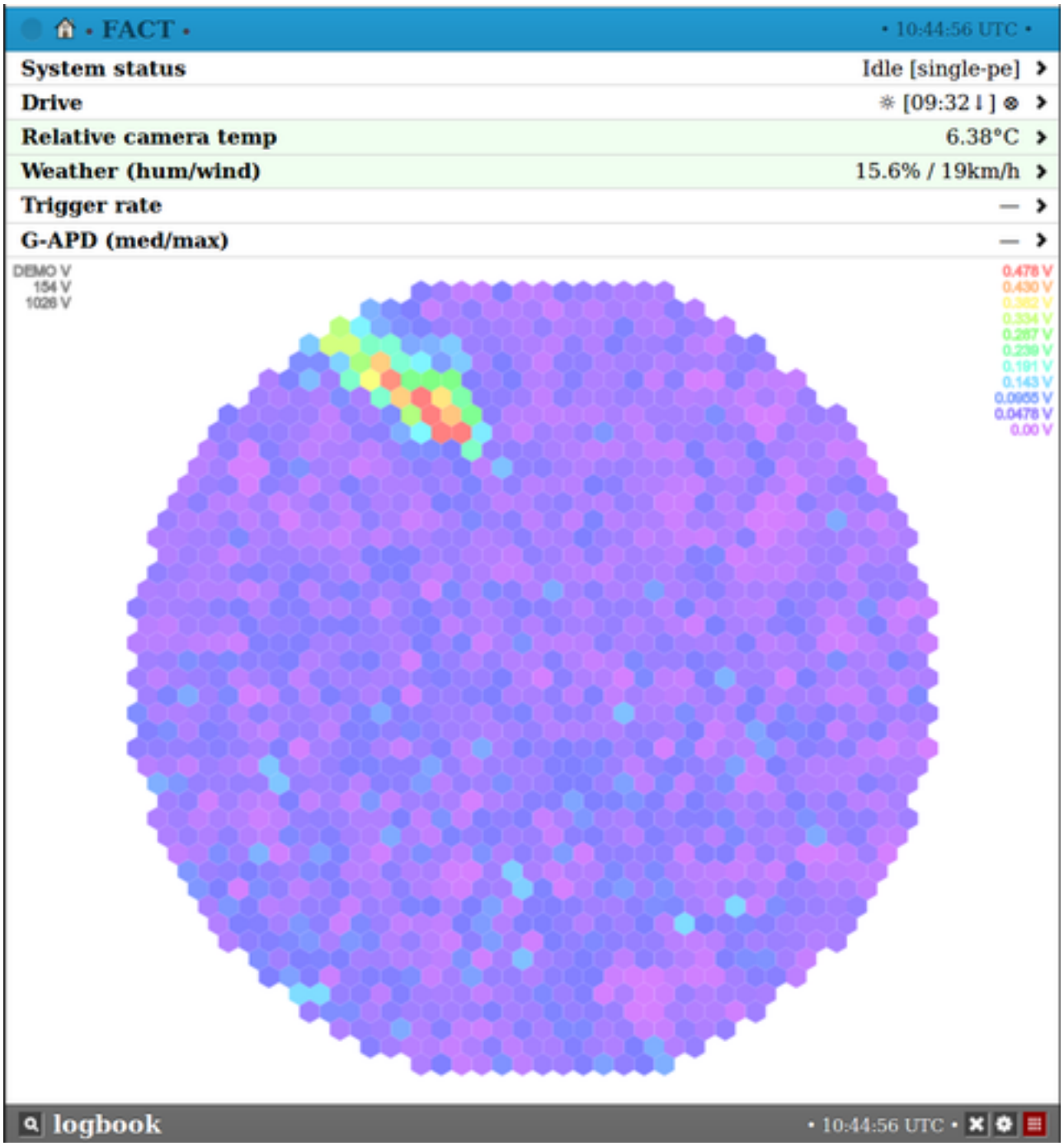

Figure 1: smartfact_example_frontpage_small.png

How is it running?

SH is running on host off the island of La Palma. In the past it was running either on a host at ETH or at TU Dortmund. The process was relocated when one of the two locations had to be shut down for maintenance. In the future a high availablity host is planed to be used.

The shifhelper runs two processes in supervised containers which get restarted when they crash (Docker container):

- shifthelper
- webinterface

In case the webinterface gets DDOSed, the shifthelper still runs and calls people, but they cannot acknowledge the calls anymore. Very annoying but at least safe.

Reported Safety issues?

In order to see if we can really trust the shifthelper v1.1.4, I listed below the issues which were reported.

The plot below and the link list gives an overview about "Safety" issues.

As one can see from the Titles, even in these cases, still **sombody was called**, just not the right person. So often fallback instead of shifter. Or there was really no call, but it was realized during startup.

In fact **No critical issue was reported to us in 2017** but these issues here come closest to what might have been ciritcal.

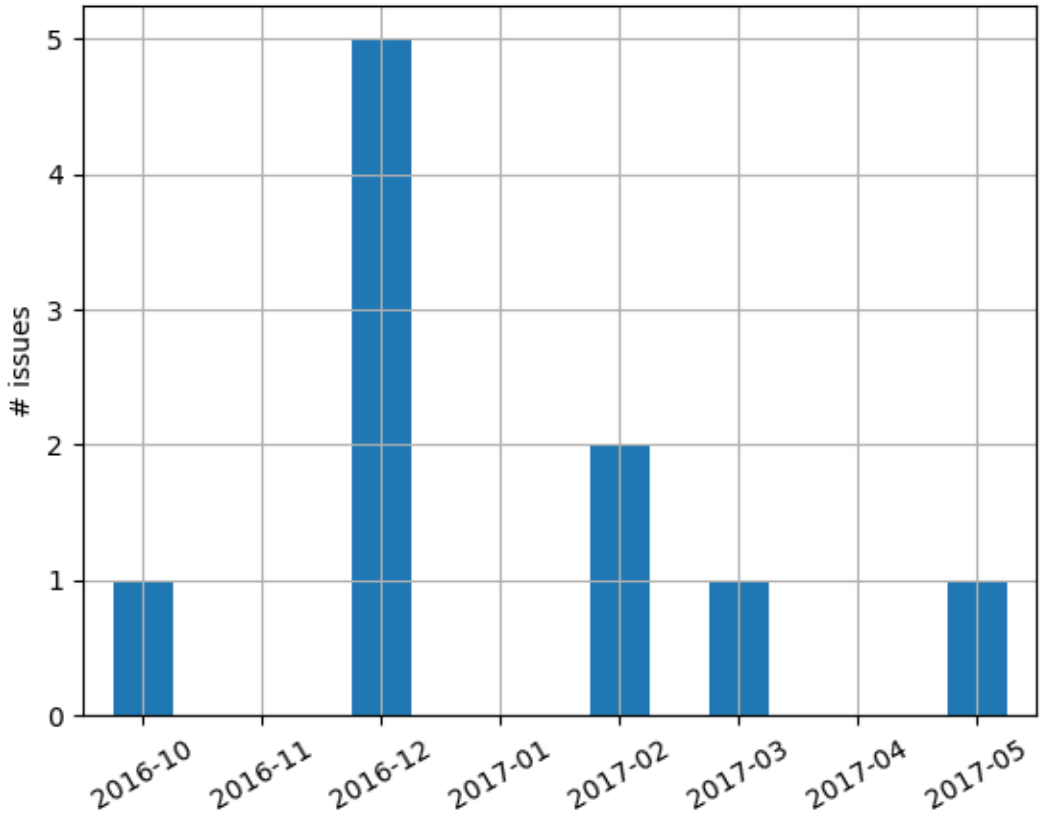

Figure 2: fact-project-shifthelper-issues.png

- 2016-10-22 - no call - during test 21.10.16

- 2016-12-05 - Calling fails comlpetely if shifter has not a valid phonenumber
- 2016-12-05 - shifthelper does not call shifter - directly fallback shifter. tescall insufficient?
- 2016-12-10 - no call, when smartfact dies
- 2016-12-16 - shifters were not called
- 2016-12-29 - shifter was not called - fallback was called instead

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- 2017-02-04 - Shifthelper kept calling and sending me Telegram messages every 5 minutes and informed me about FlareAlert
- 2017-02-04 - Shifthelper does not call fallback shifter in case of FlareAlerts

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- 2017-03-25 - Test call does not work on first try

- 2017-05-24 - FAD Loss results in call to Developer, not the shifter

How often is the Shifthelper touched?

The number of code changes per week got less and less over the past year.

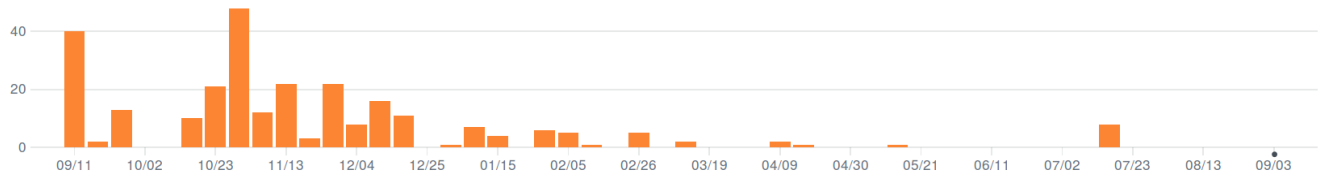

Figure 3: commits_per_week.png

Future plans

We think the shifthelper v1.1.4 is very stable. So we want to avoid any changes to the code, apart form the necessary bug fixes, that might turn up.

However already now a future change is foreseen, that will need changes in the code base.

Mutual Cross Check

In case the shifthelper process (or entire host) is unavailable, nobody is informed. This is a safety issue. We plan to solve it by introducing an independent process named maybe "shifthelper-heartbeat-check", running on an independent node, that continously checks if the shifthelper is running. At the same time, the shifthelper will get an additional check, that ensures this "shifthelper-heartbeat-check" is really up and running. Only such a mutual check ensures (with fairly high probability) that we get notified in case either one dies.

For this, we need to give the heartbeact-check something to check. We propose to show a human readable timestamp on the shifthelper webinterface, that is updates by the shifthelper process, not by the webinterface. This timestamp is the shifthelper heartbeat. So this requires some changes in the webinterface and in the shifthelper.

Starter-Shifter-Parker Mode

During short summer nights it can happen that between Startup and Shutdown there are only 5 or 6 hours. So even when shifters may sleep during the actual data taking phase, Startup and Shutdown duty still disrupt peoples sleep. So we think it is beneficial to divide the shift duty into 3 parts:

- Starter:

  The Starter helps the shifter by making sure the observation is started in the evening. She performs the checks mentioned on the Startup Checklist and starts the observation scripts well in time.

  The SH will call the Shifter, not the Starter, if the observation is not started after the Startup was scheduled in the observation schedule. In case the observation schedule is empty, in case of moon shutdown nights but also when no shifter is entered in the shift schedule, the SH will not call the Shifter.

- Shifter:

  The Shifter is responsible for the observation within the time of her shift. She needs to make sure her availability via phone. Unless in case of problems she will not need to actually operate the telescope.

- Parker:

  The Parker helps the shifter by making sure the telescope is parked in the morning. The parker notifies the SH that she is awake at 25minutes before the scheduled shutdown. Whe observes the correct shutdown and performs the Shutdown Checklist within 20 minutes after the scheduled shutdown. In case of problems the SH wil call the shifter, not the Parker.

From a technical point of view, only the Shifter exists. The SH only knows about the Shifter neither the Starter nor the Parker exist for the SH. Thus for this mode to work, no changes in the SH code base are needed nor foreseen. We are convinced that shift duty in within the Starter-Shifter-Parker (SSP) shift model is sufficiently easy, that shifters can be on shift for a prolonged time, such as e.g. one month. We further think that being Starter/Parker for a month, is a great opportunity for shifters to learn more about the telescope or even become experts, as typically problems occur during these phases.