Software Design Study for Radiation Forecasting Server

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Introduction

Purpose

This document describes the software design study of radiation forecasting server module.

Scope

The scope of the Radiation forecasting server is to be able to issue warning in case of an expected SEP event,to prevent the radiation exposure for the crew.

Reference Documents

- [1] -- PREDICCS.
- [2] -- CACTUS.
- [3] -- FORSPEF.
- [4] -- Software Engineering Practices Guidelines.

Glossary

Overview

The module attempts to forecast a SEP event using both deterministic as well as machine learning approaches.In the deterministic approach the data from the sources are monitored at regular intervals and the alarm is triggered once the values goes over the threshold.

Design Considerations

Assumptions and dependencies

Scrapy,falcon,pymongo are the dependencies for the module. Scrapy is used for web spiders for crawling the different sources to fetch data for both the deterministic as well as the machine learning approach.falcon framework is used for creating the REST service.pymongo is used for working with the MongoDB database.

General Constraints

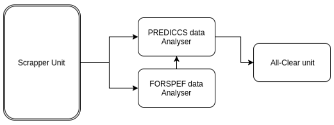
The constraint for the module are the data sources. Data sources

Software Architecture

The module can be divided into five main sections

1. Data Scrapper Unit
2. Alarm unit
3. All-Clear signal Unit
4. REST service
5. Web based GUI

A brief software architecture diagram is presented here :



Software Design

Unit 1 : Data Scrapper Unit

Definition

The unit scraps data from various sources and stores in the MongoDB database

Responsibilities

The responsibility of this module is to scrap data from different sources(FORSPEF,PREDICCS,CACTUS) to create a common database.

Constraints

The module is constrained on the correctness of the data retrieved.

Composition

The unit utilises Scrapy for web spiders and pymongo for working with the MongoDB database.

Uses/Interactions

This is meant to be an automated module.The mongod daemon must be turned on for the Unit to access the MongoDB database.The Unit is used by the Alarm and All-Clear units for their operations.

Unit 2 : Alarm Unit

Definition

The unit sends the alarm both in a higher time frame(in days) and in a lower time frame(in hours).

Responsibilities

The responsibility of this module is to produce alarms whenever there is a SEP event forecasted by the sources. For the higher time frame alarm the unit is also required to deliver an expected time for the event to strike using the velocity information provided by the sources.

Constraints

An assumption taken for the unit is that there won't be two separate events in one hour. Which is a relevant assumption since the CME velocity is in the range of 300-3000 km/s and so the change in time will be more than 1 hour between the arrival of the fastest and slower particle.[227.6million kms/3000*9]

Composition

The module is composed of two main methods alarm() and prediccs_alarm(). Whenever a new set of data arrives its validated by the alarm() method. The method will check FORSPEF data and checks if the SEP probability is above a certain threshold (TBA) then it will give the expected time of arrival from CACTUS data which will give the velocity. If the probability is below the threshold it will just pass.[Forcasts in a larger time frame (in days)] The prediccs_alarm() method will also validate the incoming data and will trigger the All-Clear unit once it detects a SEP event.[Forcasts in a smaller time frame (in hours)]

Uses/Interactions

The unit also depends on the data provided by the Data scrapper unit for its operations.This unit compossed of the methods of the StartClass() class and it triggers another method all_clear() which makes up the All-Clear unit.

Unit 3 : All-Clear Unit

Definition

The unit triggers the all-clear message once the SEP event has died out.

Responsibilities

The responsibility of this module is to produce all-clear signal by analysing the prediccs data taking into account the sensor error.

Constraints

The module is constrained on the correctness of the data retrieved.

Composition

prediccs_alarm() method would trigger the all_clear() method which is to indicate the end of the SEP event.

Uses/Interactions

This is meant to be an automated module.The mongod daemon must be turned on for the Unit to access the MongoDB database.Use service mongod start to start the mongod daemon before running the script.

Unit 4 : REST service

Definition

It provides the REST API for the Radiation forecast Server.

Responsibilities

The responsibility of this module is to provide the informations such as the alarm,all-clear and all such relevant information as response to the get request.

Constraints

For each get request it sends the alarm,all-clear(if any) as the response.

Composition

Falcon web framework is used for the REST API.

Uses/Interactions

The module takes inputs from the Alarm and the All-Clear units.

Unit 5 : Web based GUI

Definition

GUI interface for the package

Responsibilities

The responsibility of the module is to give a streaming data plot and issue alarm information as given by the REST Service.

Composition

Plotly.js library is used for the plots and flask for hosting the service.