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Data Display System for Mars Color Camera Onboard MOM

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ABSTRACT

Mars Orbital Mission (MOM) is first mars mission undertaken by ISRO and also India's first interplanetary space mission. One of the main scientific objectives of the mission is to explore mars surface and study its morphology, topography and mineralogy. To facilitate this study Mars Colours Camera has been installed on the probe. The MCC (Mars Colour Camera) in addition to mars also probes the planet's two satellites, Phobos and Deimos. The camera has sent hundreds of images since its inception, hence a vast database of mars images have been created. There is no debate in the enormous use of the images sent by MCC in facilitating research in studying Mars's surface, morphology, weather, topography etc.

Planetary Data System (PDS) evolved in response to scientists' request for improved availability of planetary data from NASA missions with increased scientific involvement and oversight. PDS archives and distributes scientific data from NASA planetary missions, astronomical observations and laboratory measurements.

Keywords:- NASA, PDS, MOM

I. INTRODUCTION

PAGE L Ever since Mars Orbiter Mission is in the orbit , it has sent millions of data and images of the mars. It has documented each and every aspect of the Martian surface, climate, weather etc.

Building a data archival system is important to facilitate present and future research in the planetary sciences field. It helps to store the data obtained from different planetary missions. The archival system if successful can be implemented to other missions of ISRO.

A. MOTIVATION

Since ISRO is planning to undertake many future space expeditions, the data-sets obtained from those missions have to be archived for the benefit of the scientific community. Thus developing an archiving tool in accordance with standards set by PDS will help to achieve this intention.

This will also benefit ISRO scientists along with other scientific community and students also .since it will help them to obtain the relevant data from the planetary missions aiding their research .

B. OBJECTIVE

ISRO has expanded its horizon since its inception through launching various satellites, interplanetary missions. In order to maintain the enormous data obtained from various satellite missions , an independent integrated system like PDS is the need of the hour.

Since its inception, PDS has been helpful with substantial data archives available scientists. An independent archival system like PDS is required for ISRO to develop and maintain standards and tools for assembly and documentation

C. EXISTING SYSTEMS

Existing system which is accepted by the scientific community is the standard set by PDS The problems that existed before the implementation of archival system is documented by CODMAC [1]. The PDS works in four different stages or tasks [1]. PDS uses metadata which is collected from Planetary science data archive. The meta data in the archive is primarily collected to ensure that future. Scientists would be able to understand the context within which the science data was collected and archived. This metadata can be implemented using XML[2].

D. PROPOSED SYSTEM

We are going to develop an data query and display system for the data obtained from the data archiving system. This archival system basically operates on the data-sets of planetary missions, so that the data can be used for future reference and also retains the regulatory compliance. The System consists of a GUI which enables the user to search for the required data. The input from the user is used to query the required data from the database and the relevant data is displayed in the GUI.

II. LITERATURE SURVEY

An exhaustive Literature Survey regarding Mars Orbiter Mission, PDS and Mars Color Camera is given below.

A. *Mars Orbiter Mission(MOM)*

MOM was launched on 5th Nov 2013 and entered the mass orbit on Sept 24th 2014 with a designed life of six months.

The mission has a highly elliptical Martian orbit imaging from 372 km (Periareion) to 80,000 km (Apoareion).[5]

The MOM mission involved three phases, namely, the Earth-centred phase, the heliocentric phase and the Martian phase MOM carried on-board five special payloads to study the surface and atmosphere of Mars. Mars Colour Camera(MCC), Methane Sensor for Mars (MSM), TIRS (Thermal Infrared Imaging Spectrometer), MENCA (Mars Exospheric Neutral Composition Analyzer), LAP (Lyman–Alpha Photometer). All these payloads have been performing as designed, ever since insertion in the orbit and voluminous data have been generated The MOM mission involved three phases, namely, the Earth-centered phase, the heliocentric phase and the Martian phase MOM carried on-board five special payloads to study the surface and atmosphere of Mars. Mars Color Camera(MCC), Methane Sensor for Mars (MSM), TIRS (Thermal Infrared Imaging Spectrometer), MENCA (Mars Exospheric Neutral Composition Analyzer), LAP (Lyman–Alpha Photometer). All these payloads have been performing as designed, ever since insertion in the orbit and voluminous data have been generated[6]

The ground segment for MOM comprises four major elements, namely Deep Space Network (DSN), Spacecraft Control Centre (SCC), Indian Space Science Data Centre (ISSDC) and Payload Operations Centre (POC). During the Earth Bound Phase of Mars Orbiter Mission, almost all instruments were turned on to acquire data about earth and its neighborhood to verify the instrument's output.[7]

B. ***Mars Color Camera(MCC)***

Mars Color Camera (MCC) operates in visible range (0.4 to 0.7 μm) and uses RGB Bayer pattern. Its IGFOV varies from 19.5 m to 4 km. The detector array has 2048x2048 elements on a pixel pitch of 5.5μ.. The objectives that MCC supposed to meet are surface features, methane source, polar ice caps etc. An MCC image is a Bayer filter mosaic, a colour filter array (CFA) for arranging RGB colour filters on a square grid of photo sensors. [8]

C. ***Planetary Data System***

In 1982, the National Academy of Sciences chartered the Committee on Data Management and Computation (CODMAC) [1], which identified serious problems in the way data was managed by NASA. Historically, much planetary data was not delivered to any archive facility. Frequently, data that was stored was difficult to locate or use because the documentation was inadequate for scientists outside the original investigation teams. In addition, in the years since early planetary missions, their tapes containing data were becoming physically unreadable. The NASA Planetary Data System is an active archive that provides high quality, usable planetary science data products to the science community Within PDS, there are four major tasks. The first task is to publish quality, well-engineered data sets.PDS provides easy access to these data products by a system of online catalog sorted by

TITLE	PAPERS AND AUTHORS	PROS	CONS
Mars Orbiter Mission(MOM)	[2] S. Seetha , S. K. Satheesh , "Mars Orbiter Mission" in CURRENT SCIENCE, VOL. 109, NO. 6, 25 SEPTEMBER 2015	This provides us the details of the overall mars mission and instrumental details of the experi-mentsonboard and of articles would beuseful to the wide community, interested in the details of the mission.	But they don't mention technical part of the mars mission which are also helpful for people to do more research.
	[3] S.ManthiraMoorthi, A.S.Arya , " MARS ORBITER MISSION: SCIENCE DATA PRODUCTS AND ARCHIVE PIPELINE." in 46th Lunar and Planetary Science Conference, 2015	Planetary Data Processing activities goparallel with every mission activity since inception through various operational stages and continue to stay in focus even beyond the mission life into pos-terity. Science finding from the data sets and experi-ments is the prime focus of the planetary missions; need to be supported by data processing activities	Initial phase data is trusted with only PI teams till the data sets are ma-tured and validated and no else are entrusted with initial phase data.
	[4] S. Arunan and R. Satish ,"Mars Orbiter Mission spacecraft and its challenges" in CURRENT SCIENCE, VOL. 109, NO. 6, 25 SEPTEMBER 2015	The configuration and design of MOM spacecraft haveworked perfectly well throughout all the phases of the mission. The excellent working of all the systems of the spacecraft has established the deep space mission heri-tage for these systems and the bus. The configuration and design of these systems/elements can also be adopted future interplanetary missions of ISRO.	The configuration and subsequent design of the space-craft had to take into consideration the mwould face during its mission life.During the mission due to some problem in thermal environmitigation or radiation it may cause trouble during the mission.

planetary disciplines. The next task is to leverage with flight projects for PDS compatible data sets. The great advantages of having projects deliver well-documented products are that the investigator expertise are available and those data can be then be used immediately by the general science community. The third PDS task is to maintain the archive data standards to ensure future usability. The final PDS task is to provide expert scientific help to the user community. PDS is an active archive, rather than a storehouse, which is staffed by engineers and scientists familiar with the data.

PDS was developed to both prescribe the metadata to be collected for the planetary science data archive and to design the PDS catalogue, a high level inventory of the data holdings in the archive. The meta data in the archive is primarily collected to ensure that future scientists would be able to understand the context within which the science data was collected and archived. This metadata can be implemented using XML.[2] PDS format is the standard data format to be used in all planetary science research. The software pipeline with MCC produces calibrated data to generate minimum Planetary Data System (PDS) compliance product.[3] Data processing system processes instrument data for edited and calibrated, derives metadata about mission events etc and housekeeping details from ancillary data to generate data products following PDS standard Data Processing system also produces "Active Archive" for raw and calibrated data form instruments , is minimum PDS compliant which will be accessed by researcher and other users[4] .

III.LITERATURE SURVEY

Mars Color Camera(MCC)	[1] A.S. Arya, R.P. Rajasekhar et al , "MARS COLOR CAMERA ONBOARD MARS ORBITER MISSION: SCIENTIFIC OBJECTIVES & EARTH IMAGING RESULTS"聽 in 45th Lunar and Planetary Science Conference , 2014.	Mars color camera have been useful in providing various features of mars surface,details of methane source on mars surface and many other aspects like polar caps.dustdevils,temperature and climate. Due to mars color camera scientist get the details of the mars surface and try to research on the basis of the details provided by the mars color camera.	But sometimes mars color camera are not able to give proper details on mars surface due to some error in camera or some other problem,so scientists should be careful in these matters.
Planetary Data System	[5] Lynn D. V. Neakrase , Reta F. Beebe , Nancy J. Chanover , Lyle F. Huber , Daniel Crichton 聽 , Sean Hardman , "PLANETARY DATA SYSTEM: SUPPORTING ARCHIVING OF DERIVED DATA" in 47th Lunar and Planetary Science Conference ,2016	PDS provides easy access to these data products by a system of online catalog sorted by planetary disciplines. The next task is to leverage with flight projects for PDS compatible data sets. The great advantages of having projects deliver well-documented products are that the investigator expertise are available and those data can be then be used immediately by the general science community. The third PDS task is to maintain the archive data standards to ensure future usability. The final PDS task is to provide expert scientific help to the user community.	In some cases where the PDS found problems with a product but PDS was not able to rework it, usually due to financial limitations, the product was released but peer review comments were entered in the PDS catalogs so that product users could be warned.
	[6] D. Crichton ,R. Beebe et al ,"PDS4: Developing the Next Generation Planetary Data System" in EPSC-DPS Joint Meeting ,2011	Significant progress has been made over the past year on PDS4, and PDS is now planning for the operational release. PDS is now testing the software and planning for the transition. The transition covers migration to	But still after so much significant progress sometimes pds faces some slight problems while involved in the missions.So this has to be kept in mind while design.

		PDS4, changes in the software infrastructure, and planning for missions support. As part of this project, the PDS has gained significant experience in upgrading a major archive system that involves a number of stakeholders.	
	[7]Susan K. McMahon, " Overview of the Planetary Data System" ,Planetary and Space sciene 1996	PDS format is the standard data format to be used in all planetary science research. The software pipeline with MCC produces calibrated data to generate minimum Planetary Data System (PDS) compliance product.	But still isro doesn't have its own data archiving system,so it wants to build one similar to nasa which is a part of a project undertook by isro.

IV. CONCLUSIONS

Since its inception, PDS has been helpful with substantial data archives available to scientists. An independent archival system like PDS is required for ISRO to develop and maintain standards and tools for assembly and documentation of datasets. The display system for this archive will facilitate research by scientists and enthusiasts alike.

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