REMOTE MONITORING AND CONTROL SYSTEM

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I. ABSTRACT

Remote monitoring and control (M&C) systems are designed to control large or complex facilities such as factories, power plants, network operations centres, airports, and spacecraft, with some degree of automation. M&C systems may receive data from sensors, telemetry streams, user inputs, and pre-programmed procedures. The software may send tele-commands to actuators, computer systems, or other devices. M&C systems may perform closed-loop control. This is designed to carry out automatic operations of the entire ground segment of ISTRAC towards tracking and supporting satellites round the clock. The interface to the user shall be in the form of a web based client towards remote monitoring of the station operations.

II. INTRODUCTION

ISRO Telemetry, Tracking and Command Network (ISTRAC), Bengaluru is entrusted with the major responsibility to provide telemetry, tracking and command support for all the satellite and launch vehicle missions of ISRO hand in hand. ISTRAC is a part of ISRO. The major objectives of the centre are: carrying out mission operations of all operational remote sensing and scientific satellites, providing Telemetry, Tracking and Command (TTC) support services from launch vehicle lift-off till injection of satellite into orbit and to estimate its preliminary orbit in space .The hardware and software developmental activities enhance the capabilities of ISTRAC for providing flawless TTC and Mission Operations services. ISTRAC monitors the health through telemetry & control the satellites through commanding and tracking for entire life period. Towards, these objectives, ISTRAC has a series of Network Ground stations in INDIA & other parts of the globe which include network of ground stations at Bengaluru, Lucknow, Mauritius, Sriharikota, Port Blair, Thiruvananthapuram, , Bhopal, Brunei, Biak (Indonesia), Antarctica and the Indian Deep Space Network(IDSN) Stations, Byalalu. These ground stations receive the satellite data comprising of health and image information and also, the stored information when the satellite is out of visibility of these stations. The received data is made available to the spacecraft control facility in Bangalore for further use.

III. LITERATURE SURVEY

- **Existing System**

Having the network ground stations spread across the globe, remote and automatic operations of these unmanned ground stations becomes necessary. Remote operations call for monitoring and control of the station components on a 24/7/365 basis.

The system at present is layered architecture wherein each layer will perform well-defined tasks. All ground station equipment will be continuously monitored for their correct functioning. The following layers are defined for remote monitoring and automatic operations of the ground station:

General Equipment Interface (GEI) – Equipment interface pertaining to all equipment's of typical ground station.

Monitoring and Control Processors (MCP) – Interfaces will all GEIs of a ground station to carry out automated operations based on schedule.

Network Control processor (NCP) – Interfaces with MCPs of all stations to carry out

remote monitoring and control of Network stations of ISTRAC ground segment.

➢ **Limitations**

- The monitoring and control GUI is local to the system.
- Also the equipment specific details are in the form of Access database that is huge, defined to accommodate all types of equipment's. This calls for an expert or designer's presence to add or delete equipment from the station.
- Use of Access database insists Windows OS.

➢ **Proposed System**

- It is proposed to have a web client based GUI so that anyone in the network could monitor station activities.
- Adding/removing station equipments is made easier by means of plug and play of equipment configuration xml files in place of huge database that exists in the current system.
- Use of xml files has no OS dependency.

➢ **Objectives**

Design, develop and implement arugged software that enables

- Remote and automatic operations of the ISTRAC ground segment by means of
  - Web based client for monitoring and configuring station parameters.
  - Provide alerts and alarms with appropriate colours to the station controller.
  - Provide facility to monitor satellite tracking sessions.
  - Carryout schedule driven automatic operations.
  - Read system time and trigger an event for an upcoming pass support.
  - Appropriate authentication for the user, to ensure security requirements.
  - Provide user friendly environment in terms of addition of a new satellite or station.

IV. MODULE DESCRIPTION

1. Scheduler

Input: Schedule File

Output: Trigger for upcoming pass schedule details.

Functions:

- A scheduler will enable automatic detection of AOS and LOS timings and alert the controller in advance.
- Scheduler handles parsing of schedule file.
- Scheduler keeps track on Schedule data.
- Execution of a pass as per scheduled timeline.

2. Equip Process

Input: Xml files of station equipments

Output: Equip details to the RT controller

Functions:

- A equip process handles the equip details.
- Configuring of equipment's.
- Monitoring of equipment's.

3. RT Controller

Input:Trigger for upcoming pass schedule details.

Output: Trigger the Equip handler to configure the Equipment.

Functions:

- The controller keeps an eye on the overall functioning of the application.
- Admin keeps track on Schedule and the Equip data.
- Admin keeps track on number equipment registered.
- Track on number of users registered to the ground stations.
- Track on equip process to configure the required equipment.
- Handles the state machine changes and Predicates.

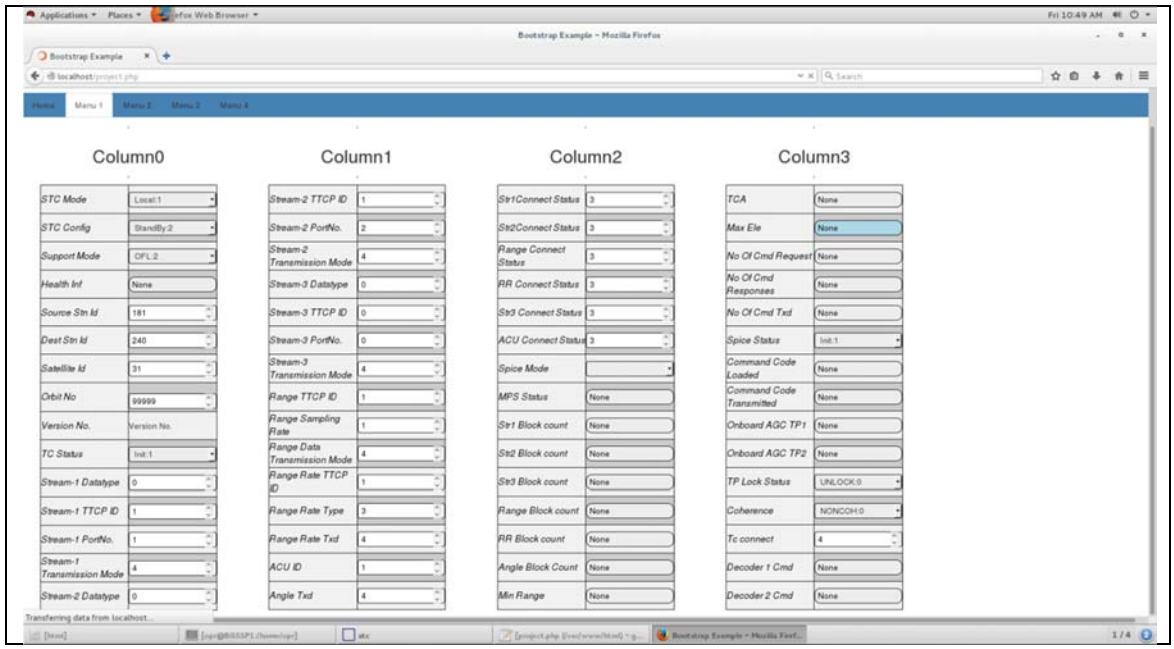
4. Graphical User Interface GUI

Input: Schedule data

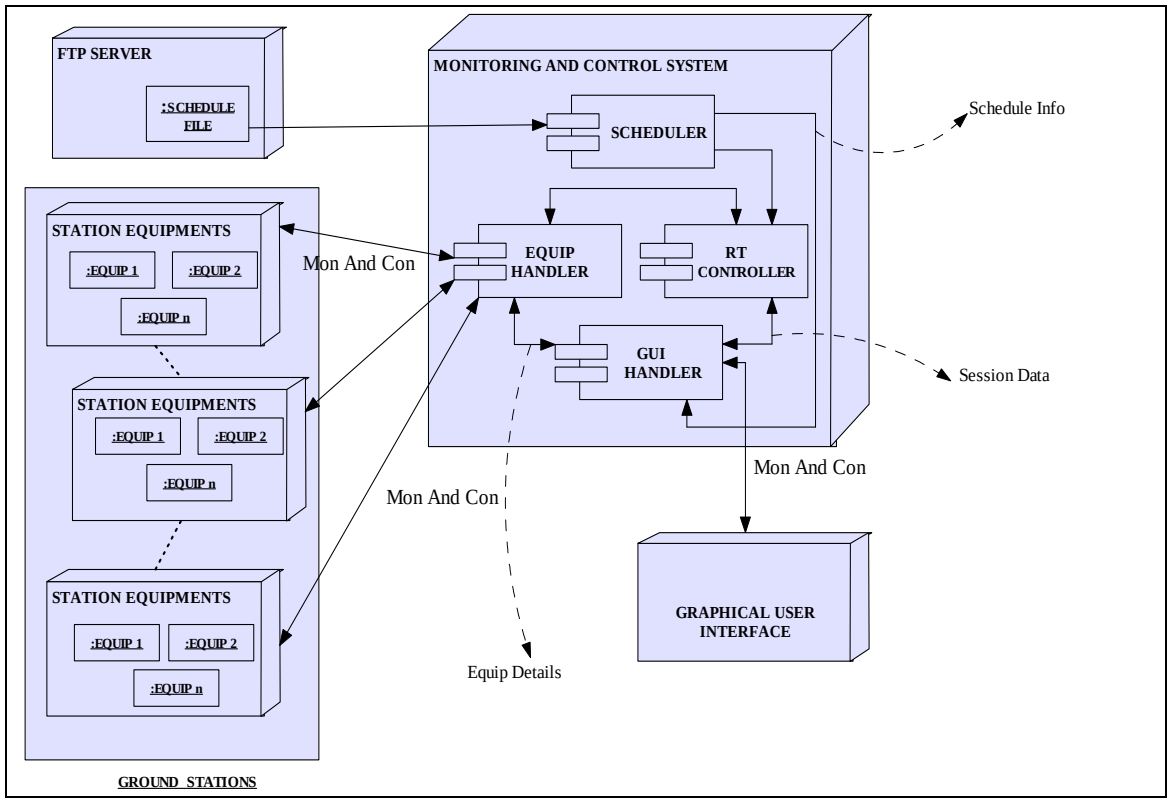
Output: Equipment parameter details

Functions:

- GUI handles the Authentication and validations for the users.
- It takes user input /commands from authenticated users.
- Displays the total parameters of the equipment using param files (xml files).
- Displays the Monitoring and control data.



V. SYSTEM WORKING



VI. CONCLUSION

The software aids in overall remote operations and status monitoring of ISTRAC ground segment.

Adding/removing station equipments is made easier by means of plug and play of equipment configuration xml files in place of huge database that exists in the current system.

The software will carry out all equipment configurations pertaining to a satellite support in a station automatically on maturity of time as per schedule. The software is scalable to accommodate up to 100 satellites and 100 stations. This can be deployed for operations for ongoing missions of ISRO as well as for future missions.

VII. FUTURE ENHANCEMENT

The software lacks the following important elements that are needed for a typical

operations environment. These could not be implemented due to time limitations.

Login Status

Admin will track the Login and logout status of Users.

Error Log

Appropriate error logs with date and time stamp, with error log levels and error codes.

Status Summary

Automated generation of pass summary to enable user to know Daily activities. This summary could be mailed every day automatically to a list of mail Ids.

Messaging Service

The software shall generate SMS alerts for alerts that exceed predefined priority to a list of important numbers.

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