

# Secure Implementation of RTS2 on RPi

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## ABSTRACT

*Remote Telescope System Version-2(RTS2) is an integrated open source package which works under Linux Operating System for remote observatory control. The main goal of RTS2 is to build an autonomous system to run observatory, keep record of each and every activity, capturing images and help to do science. RTS2 is designed in such a way so the observatory can take observations itself, you can easily select targets from database, and even you can store images and its metadata in the database. RTS2 is presently running on a variety of telescope globally, RTS2 supports variety of mounts, Cameras, Controllers, Dome.*

*The Raspberry Pi is a product of Raspberry Pi Foundation based in the UK. In size it's like credit-card which can be plugged into a screen either monitor or television, and you can use keyboard and mouse for it. RPi is a proficient small device that can be used to explore computing, programming languages and much more by all ages of people. RPi is able to do entire task that a desktop computer can do. You can make use of RPi in browsing the internet, making word file, excel file, playing games. RPi is having capability to communicate with the exterior globe, and have been used in extensive range of digital maker projects, like musical machine, parental detector to weather station and twittering birdhouse with infra-red camera.*

*The implementation of RTS2 on RPi will provide the features of both. Current implementation of RTS2 in client-server mode is with socket communications based on IP address without any security. We plan to implement a security layer using MAC address in the communications with the help of iptables to ensure network safety and security for the entire system of multiple RPi with each RPi controlling and monitoring different aspects of the observatory.*

**Keyword:** - RTS2, Implementation of RTS2 on RPi, Security in RTS2, Secure Communication in RTS2.

## 1. INTRODUCTION

### 1.1 RTS2

RTS2 stands for Remote Telescope System Version-2. RTS2 is an integrated open source package which works under Linux Operating system for remote observatory control [1]. The main goal of RTS2 is to build an autonomous system to run observatory, keep record of each and every activity, capturing images and help to do science [2].

RTS2 is designed in such a way so the observatory can take observations itself, you can easily select targets from database, store images and its metadata in the database. RTS2 is presently running on a variety of telescope globally, RTS2 supports variety of mounts, Cameras, Controllers, Dome [3].

RTS2 is currently implemented on Debian based Linux distributions. You can easily install RTS2 on Debian based Linux machine with the use of following commands.

```
wget http://rts2.org/ubuntu-rts2-install/
```

```
source ./ubuntu-rts2-install/
```

The script downloads, compiles and installs the required packages and configures the system for the use of most recent RTS2, after it you can make use of dummy devices.

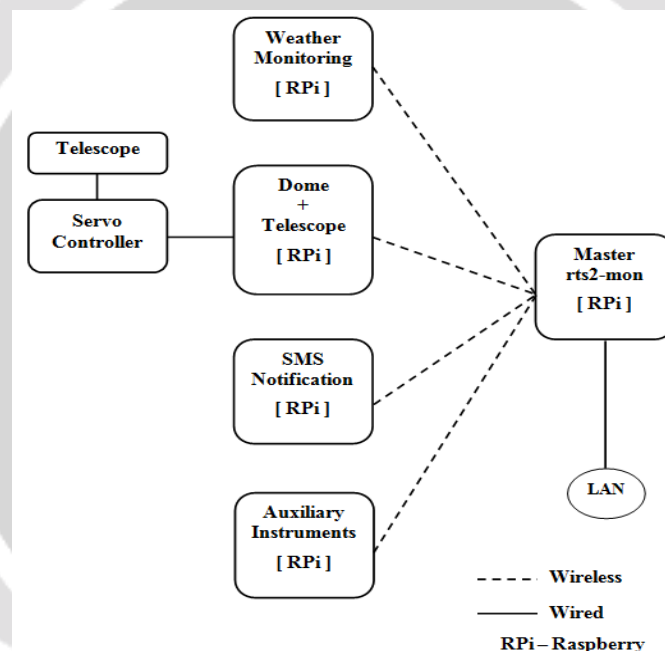
## 1.2 RPi

The Raspberry Pi is a product of Raspberry Pi Foundation based in the UK. In size it's like credit-card which can be plugged into a screen either monitor or television, and you can use keyboard and mouse for it. RPi is a proficient small device that can be used to explore computing, programming languages and much more by all ages of people. RPi is able to do entire task that a desktop computer can do. You can make use of RPi in browsing the internet, making word file, excel file, playing games.

RPi is having capability to communicate with the exterior globe, and have been used in extensive range of digital maker projects, like musical machine, parental detector to weather station and twittering birdhouse with infra-red camera. Above this RPi is being used by kids of entire globe to learn programming and understanding the computation of computers.

Raspbian is the recommended OS for regular use on RPi. Raspbian is a Debian based open source OS. It comes with more than 35,000 packages. The most recent version of the Raspbian OS is Jessie before this Wheezy was in use. You can install any Raspbian OS with the use of NOOBS or directly by its image.

## 2. PROPOSED WORK



**Fig -1:** Proposed System

The existing system uses the computer system [4]; instead of the computer system we are implementing RTS2 on RPi. Above Fig-1 shows the proposed system for Secure Implementation of RTS2 on RPi2. Five Raspberry Pi Boards are used to create this system.

**1. Master** – This RPi controls all other Raspberry Pi. Directly communicate with Local Network. RTS2 monitoring will also be done on this RPi. It will communicate with other RPi using wireless network.

**2. Weather Monitoring** - This RPi is used for monitoring the Weather. It is directly connected with Weather Station combilog device. It communicates with master RPi using wireless network.

**3. Dome + Telescope** - This RPi is directly connected with Telescope's Servo Controller Part. This RPi controls the Telescope and Dome. It communicates with master RPi using wireless network.

**4. SMS Notification** - This RPi is used for the notification system based on SMS. This system will be used to send the command to the RPi whenever internet connectivity is down. It communicates with master RPi using wireless network.

**5. Auxiliary Instruments** - This RPi is used for connecting extra instruments like CCD, Focusers, Filter wheels, Field Rotators. It communicates with master RPi using wireless network.

The proposed system will increase the remote interaction, so physical present of observer is not needed. It will increase the observation time. The proposed system is stable and fault tolerant and provide the continuous monitoring of some astronomical objects.

### 3. SECURING THE COMMUNICATION

Current implementation of RTS2 in client-server mode is with socket communications based on IP address without any security [5]. If a person knows the IP address of the system he or she can easily access the whole system without any failure. We plan to implement a security layer using MAC address in the communications to ensure network safety and security for the entire system of multiple RPi with each RPi controlling and monitoring different aspects of the observatory. The use of MAC address to verify the legitimate user and IP address for the communication increases the security of the system.

Implementation of allowing the specified is done using iptables. The default policies for the INPUT chain is set to DROP; then add the rule to allow the legitimate system's MAC for access. The following commands are used to set the iptables rule.

```
iptables -P INPUT DROP
iptables -P OUTPUT ACCEPT
iptables -P FORWARD ACCEPT
iptables -A INPUT -m mac --mac-source XX:XX:XX:XX:XX:XX -j ACCEPT
```

It blocks all the traffic from unknown users and only legitimate user can access the system.

### 4. RESULTS

As shown in the previous section, it is far easier to add a security layer with using MAC address in the iptables. Secure implementation of RTS2 on RPi has several advantages:

- Secure communication between two different systems.
- Implementation cost compare to computer system is very low.
- System is fault tolerant and easy to replace.
- Take the dual advantage of RTS2 and RPi.

### 5. CONCLUSIONS

With emergence of new technology there is a requirement to combine two different domains like RTS2 and RPi2. With the combination of these two domains we can get all the benefits of both the domains which are useful for emerging remote observatory. The proposed system is using the MAC address to verify the legitimate user and IP address for the communication so it increases the security of the system. Observers will be able to access the telescope remotely in a cost-effective manner. This is a very useful mechanism for fully autonomous system. This paper gives detailed idea about the RTS2, RPi2 and implementation of RTS2 on RPi2 with security feature.

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## BIOGRAPHY

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