

# An Incredible Multitasking Resource Algorithm For Real Time Embedded System Applications

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**Abstract:** Now a days, the scheduling plays key role in Real time Embedded systems. It brings automation in many areas and gives more reliability and sensitivity. Scheduling is the process of getting plan to prepare a schedule dynamically and share resources effectively. It makes all hungry calling bodies for resources to reside under compromise environment and avoids conflicts by generating the different instruction to those bodies. It is very useful in all deadline areas where peoples face struggles and cause deaths. The passenger, who ensures their journey in train, may experience many problems (when the train is on moving) due to unavailability of crew person and his resources and some time's leads to harm. In this paper an Internet of Things (IoT) based system is used to introduce automation concept in catering and even to provide extremity issues to the passengers the passengers in moving train. It consists of raspberry pi as a server for maintaining the database and provides wireless communication in between the passenger and crew member. A user interface provided in each compartment is used to send the requests from passenger. A smart phone is held with the all crew members is to get resource list. The Composite Scheduling for multitask (CSM) Algorithm is responsible for fairly distributing resource list to the crew members continuously.

**Index Terms:** Crew member, Composite scheduling for multitasking (CSM) Algorithm, requests list, Resource/service list.

## 1. Introduction

Now a day's, many people in the world, are ensuring train journeys for transportation. Globally, our nation is the second largest populated country and stood on fourth place in utilizing the train transportation. Generally the passengers are used to stay in the railway station to catch the train. In future, the crowd will be increased and this steady growth will shows the negative impact on passenger comfortable journeys. The passenger who resides in the moving train, they cannot be satisfied with the services provided by a crew person because of his unavailability. a recent economic survey was stated that, the productivity in such railway network is low. The major cause is either of longing action or negligence of crew person. It also stated that, the railways department needs to take responsibility to Introduce the automatic resource technique to provide the safety and comfortable journeys to the passengers in the railways. The service quality is poor because, lack of management, dependable communication, and confirmation. So, these problems are encountered in the existing system. The Internet of Things (IoT) [1] is a new technology and it plays the major role in network computations, Wherein all devices are interconnected and one can control the process/task from anywhere through the internet. In its Paradigm, all connected devices have unique identification so that, dependable communication can be possible without conflicts and collisions. In this paper an IoT technology is used to issue resources to passengers. Each and every compartment has separate IoT Set up and one among them will be acted as master. The user can make the requests through the web link. All the requests are gathered at the raspberry pi [6] and it again forwards to the server with the help of built in Wi-Fi module. A router is placed in each coach/compartment. The CSM algorithm creates the optimized resource list and server distributed the resource list to all crew members effectively.

## II. Motivation to automation in railways

### Existing systems:

There are some reasons to encourage the automation in the railways.

1. Normally, when the train is at stationary at railway station, will make a phone call to rail administrator number (given on the ticket) for getting the required resources. The crew person is one who actually provides a resource to users. The rail admin is the person who dwells behind the screen in contribution of the users' resources from crew person to passengers. When he knows all requirements of the user and will distribute those requirements to the crew person by giving instruction and he will serve the resources to travelers. Each and every crew person will receive instruction to do different tasks. The rail admin has to ensure about the crew persons status, i.e. whether any crew person is free or engaged. If he is free, then the rail admin will assign task else he will search for another crew person to assign the same task. There will be some situation like, when all crew persons were engaged with some tasks, and then the rail admin has to provide service compulsorily. Therefore, the existed servicing style is time taking process and this system will give more inconvenient to the travelers in the train and also it affixes the more cellular cost.
2. The rail admin needs the Information about the crew person's location to assign the tasks accordingly. In order to know his status as well his location the admin has to establish the wireless connection to him (crew person) with a walkie-talkie device. This hand held devices are operated with some specified range of frequencies.



Fig1: Walkie-Talkie.

This frequency range refers to coverage of the area. Sometimes, the information will be lost from rail admin to crew member or vice-versa when any hand held device is not resides not in an area covered (interrogation zone).

3). In existing system, all the crew members are may not have the unique workload because of, few crew members handheld devices may not dwells in the interrogation zone of administrator device. So may not able to receive the instruction from admin instead, he assigns the same tasks additionally to other crew person. This leads to an imbalanced workload burden is situated among the crew members.

4). The existing style is useful only when trains are in a stationary position at railway stations but not for moving trains. The railways departments are providing the e-catering system to have hygienic foods, but not preventing the act of stealing and snatchings so the passengers are not able have their journey comfortably and safely.

**III. Experimental Work**

The major works of this paper are, do optimization in distributing of resource list (equal workload) to all crew persons and to meet the needy travelers with suitable resource. Minimum Four crew members are needed to implement this project in railways. With the help of inbuilt Wi-Fi facility of raspberry pi, it becomes very easy to exchange the information from one place to another place. So, here we chosen Raspberry pi 3 model B to utilize this as mediator in between passenger and the server. The router is also fitted along with the raspberry pi. The passengers are allowed to send the requests to the server via raspberry pi. In response, the server will assigns the task to crew persons based on the arrived requests of the passengers from sleeper/AC coaches. This raspberry pi replaces the need of rail administrator in moving rail. Whenever the user wants to get the resource from a crew person, user can make requests at any time during their journey through the web link provided to him with login credentials and as [http://192.168.15.251/RT\\_HTML/](http://192.168.15.251/RT_HTML/). The master starts execute the CSM algorithm and prepare the resource list (new database) after receiving of requests. The server will make that list into the segments and assigns those segments to all crew persons for the first time no one get the same segment list. The server will keeps record of the crew persons location based on the segment list (is the list of requests grouped from the same coach or few consecutive coaches). The server will continuously assigns the segment lists to all crew persons based on previous database records. It has the inbuilt Wi-Fi facility so the server will also sends segment list to all crew persons. The crew person also has the web links, through which the crew person will receive the segments continuously and this link is given as [http://192.168.15.251/RT\\_HTML/Admin.php](http://192.168.15.251/RT_HTML/Admin.php).

**IV. Block Diagram and internal architecture.**

The raspberry pi is invented by a Qualcomm company with the help of BCM2387 architecture, It is 64 bit quad-core ARM cortex- a53 processor.

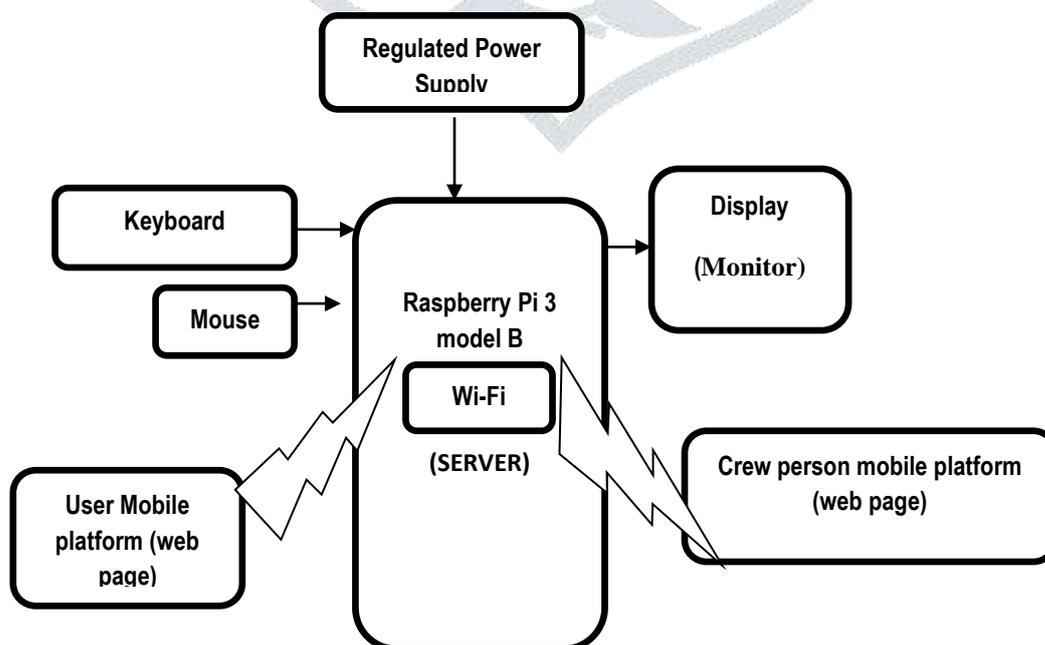


Fig2: IoT system based architecture.

It has the features of inbuilt Wi-Fi, Bluetooth and HDMI port, 3.5mm audio jack, MicroUSB power port, four USB ports, 40 GPIO pins, video core GPU, 1.2 gigahertz clock speeds, 1 GB RAM. This pi 3 is very useful to make excellent prototype system board also for the IoT [9] development board.

1. The MicroUSB power port is used to give power to the Raspberry pi. Graphics Connect pi with HDTV/Monitor and easily could watch BluRay quality video, using H.264 at 40MBits/s.
2. It has totally four built-in Universal Serial Bus (USB) ports any two of them is used as input ports are named as mouse, keyboard. Remaining two ports can also used as a power hub with 1.2Amps through which we can able to connect power hungry USB devices externally.
3. It has 40 General Purpose Input Output (GPIO) pins, out of 40 pins 27 are available for the user as GPIO and a few pins are used for UART, I<sup>2</sup>C, SPI communication protocols. Remaining pins for 3V and 5V sources.
4. The Broadcom BCM2837 system-on-chip (SoC) consists of four high-performance ARM Cortex-A53 processing cores and each one is running at 1.2GHz.

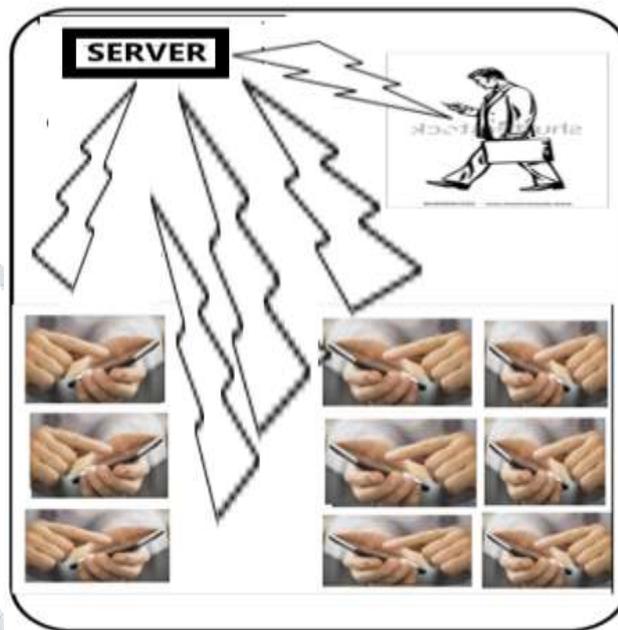


Fig.3: crew member servicing to the passenger within the train.

5. There's no need to connect an external antenna to the Raspberry Pi 3. Its radios are connected to this chip antenna soldered directly to the board, in order to keep the size of the device to a minimum. Despite its diminutive stature, this antenna should be more than capable of picking up wireless LAN and Bluetooth signals - even through walls.
6. User mobile platform is for generating resource requests to pi, Crew person mobile platforms are used to get the resource list from pi.
7. Wi-Fi provides the internet environment to pi, user's mobile phones, and crew person's mobile phones. From fig. 3, It is explicitly represented about the servicing mechanism. There are nine passengers (indicated with fore finger choosing an option on smart phone) are making requests (indicated with wave shaped arrows). A raspberry pi (as master) is fitted and a symbol like Bluetooth is for knowing the crew person's status at the server. Crew person has resource box, distributes resources to users according to the resource list given to him. This algorithm is suitable for only reserved passengers. All the passengers' reservation tickets are preserved in database.

**V. Passengers Requests and Priority**

The CSM [4] algorithm is developed with static priority [3] concept The static priority assigned style is given below in table form.

| Priority (P) | Type of request     |
|--------------|---------------------|
| 1            | Fire/security issue |
| 2            | Health emergence    |
| 3            | Caterings           |
| 4            | Cleaning            |

Table 1: types of requests with priority

From table 1, we have assigned higher priority to fire accidents, health emergence services and lower priority to caterings, cleaning services.

**VI. Software Architecture**

**Composite Scheduling for Multitask (CSM):**

This CSM algorithm will execute repeatedly every 100 seconds. The execution steps are followed. The CSN algorithm is developed with C++, and the tool is GCC Compiler [5].

- 1). In each and every compartment a raspberry pi is placed and one among them will acted as master.

- 2). Each pi model in every compartment will receive randomly produced requests from a passenger's mobile platform.
- 3). Once the requests are gathered at raspberry pi (server) then, it starts to create a new database (resource list) on static assigned priority based. The new list consists of; the higher priority tasks are occupying the first few places. Lower priority tasks are occupying last places. If two requests have same priority then, the priority is given based on their arrival time.
- 4). If any, requests are made while algorithm runs, then the master will check the priority of that newly arrived request and if it has higher priority then, immediately assigns that task to him on emergence.
- 5). If the newly arrived task has low priority then, at that time again if all crew members are engaged with some task, then it just put request into the waiting state until the appropriate resource becomes free else, the server assign that task to crew person.. 7). Once the crew member tasks are finished, then he/she needs to stay there only until the new segment or otherwise, he has to arrange all resources from pantry room.

### VII. IoT ENVIRONMENTAL SET UP

The set up includes; a monitor (Output device), a raspberry pi 3 model B, keyboard and mouse (Input devices). The HDMI to RS232 converter is used to interface monitor with raspberry pi.



Fig 4: Prototype IoT based server set up..

Whenever the proper interfacings, power on the raspberry pi were done then only, the users are allowed to make requests. This project is a prototype IoT experimental board and is restricted to only single compartment not for all compartments in a moving train. Here, Distribution of resource lists/segment lists to all crew persons will not be done because, one crew person is enough to serve a compartment. If we place the each raspberry pi in all compartment, then multi segments list are generated and distributed.

### VIII. Experimental Result

When the CSM algorithm runs, then it starts to create a resource list.



Fig.5: User's operating window.

The user web link helps them to have a users operating window and now the users are allowed to make the requests from the menu of window.

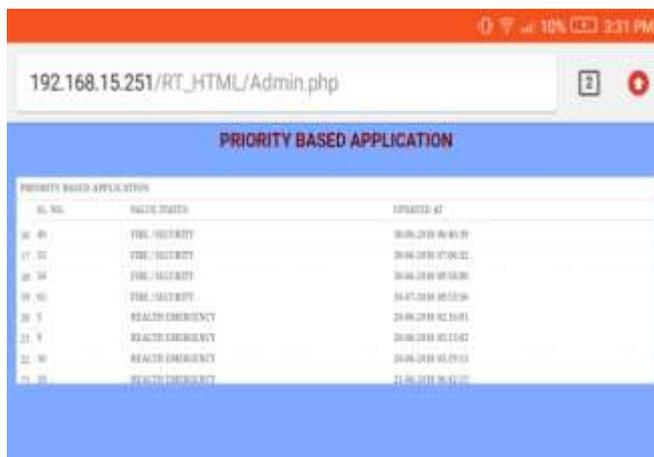


Fig.6: crew person Segment list.

From figure 6, The optimized resource list is given to a crew person.

| Request Ids          | Assigned static priority value | Execution time | Arrival time At server |
|----------------------|--------------------------------|----------------|------------------------|
| Catering(food/water) | 3                              | 7              | 5:30 PM                |
| Health emergency     | 2                              | 6              | 5:29 PM                |
| Fire accident        | 1                              | 5              | 6:40 PM                |
| Cleaning             | 4                              | 9              | 6:50 PM                |

Table 1: Real Requests Details.

From table 1, it shows the different requests along with their execution and arrival time. Execution time [9][10] refers to, number clocks are needed to complete one task/process, and arrival time refers to, the time at which the request is generated. The graphical representation is shown in figure 7 and it is prepared with the data from table 2. The proposed CSM algorithm giving good response to all the calling bodies.

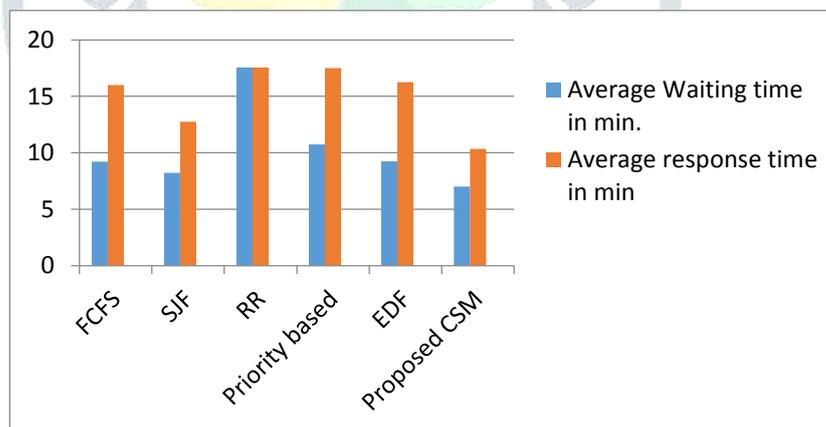


Fig.7: Relation between  $w(t)$  and  $r(t)$ .

From table 2, the proposed CSM algorithm gives good average waiting time [5][6], response time when compared with all existing algorithms. So this CSM algorithm is very essential for all multi tasking and resourcing embedded applications.

**IX. Conclusion**

An IoT based prototype model is developed to distribute the services all to every passenger in moving train. The automation concept in railways, will bring more profit to the government of India For future coming days. Each and every compartment has separate IoT installation with raspberry pi, one among them will be acted as master or severer. The raspberry pi is responsible for provide wireless communication between passenger and server. The proposed CSM algorithm offers lesser delay when compared with existing algorithms and will prepare the segment resource lists and also provide equal, effective work-load to all crew persons. The server will distributes segmented resource lists to all crew persons and he/she will meets all passenger requirements with suitable resources without longing or delay action. Therefore, the people who ensures the journey in train, will get safe and comfort journey.

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