Introduction:

Mass Rapid Transit is a type of high-capacity public transport generally found in urban areas. Unlike buses or trams, rapid transit systems are electric railways that operate on an exclusive right-of-way. They are typically integrated with other public transport and are unchallenged in their ability to transport large numbers of people quickly over short distances with little to no use of land. Each rapid transit system consists of one or more *lines and e*ach line is serviced by at least one specific route. Some lines may even share track with each other for a portion of their route.

Our system aims to minimise human intervention by solving the rerouting using various technologies that fall within the domain of artificial intelligence. This is necessary since this will not only improve the efficiency of the entire system, but also allows for optimization in relation to distance, time, etc. This system also makes use of fuzzy controllers to determine the level of “problem” pertaining to a specific route and using that information in tandem with the already available information of optimized variables to choose the best route possible.

The new system makes use of fuzzy controllers in tandem with the algorithms that determine optimized variables that are independent of other variables that are “indeterministic”. Fuzzy controllers enable us to read level values that are in between 0-1, instead of the binary output values, that enable us to determine the best solution depending on the “level” of the output. This means that the fuzzy system is now more accurate compared to the binary system.

Similar/Existing Systems:

Rapid Transit systems have many different topologies, which are determined by a large number of factors including geographical barriers and existing or expected travel patterns, although the most popular topologies are the Circular-Radial and the Complex Mesh. Large cities have an interconnected, multi-tier systems thet allow either direct or indirect transfers.

The Tokyo Metro and the Singapore MRTS are two examples of well known. Rapid systems that form the backbone of public transportation in their respective cities.

Singapore is a land scarce city-state, where there is a pressing need for a rail based above-ground/underground transport system. The MRTS started operations in 1987, and the daily ridership has since increased to more than 3 million, against a total population of 5 million people, becoming the backbone of the public transport system in Singapore. It is also the world's largest fully automated MRT system.

The city's modern metro system, in recent years, has been prone to frequent breakdowns affecting more than 200 thousand commuters. These breakdowns have plagued even the newer lines, causing significant problems and leading to investigation and even calls to scrap the LRT, which is a part of the MRTS. Poor maintanence is cited as the leading

cause of problems, which lead to commuters having to use other alternatives, mainly the city's extensive Bus transport service.

To deal with these problems, the government reviewed the penalties for train disruptions and made free travel available for all bus services passing MRT stations affected during any train disruptions. Exits were also made free. The government also plans to make the buses play a feeder role to the extensive rail network.

Tokyo Metro is responsible for transporting seven million people on a daily basis. It is generally seen as a success story and a model to emulate. One of the greatest challenges for Tokyo Metro is to ensure they keep up with their image as one of the most punctual transportation companies in the world. Keeping delays to a minimum is priority number one.
Because of restrictions on the lines of the rail network, rerouting trains is close to impossible. Any problems on the tracks have to be spotted before-hand and commuters are to be warned. Therefore, rather than trying to resolve delays, Tokyo Metro has initiated methods to prevent them from happening in the first place. They use a japanese-innovated industrial safety method known as pointing-and-calling; a system that reduces workplace errors by up to 85 percent.

In order to make things easier for commuters and for tourists, the Tokyo Metro has launched an app which advises users on what lines to use in order to minimise their commute time. If there are problems in a certain line, it provides an alternative path. The user is also shown the amount of time it would take and the amount to be paid.
By having a large and dense network of lines, the metro ensures that even in the event of a line failure, a commuter has other viable alternatives.

Necessity:

The current system of metro/subway networks use manual methods for rerouting and rescheduling the metro/subway systems in case of an unprecedented situation that either leads inefficiency in the system or a delay in rescheduling which in turn would lead to more problems.

In most of the current metro/subway systems, rerouting is done manually by operators who have access to the live route information which helps them to decide on the most efficient solution. This may lead to an “efficient” solution not being efficient enough due to various reasons which include cost optimization, distance optimization, time optimization or even minor details like track/route overloading which tend to be overlooked by a human.

Feasibility Study of Components involved:

Python Backend:

The difficulty in the Python Backend will be in implementing the Coffmann-Graham Algorithm due to its mathematical complexity since it is a parallel rescheduling algorithm compared to the minimum spanning tree which is a single rescheduling algorithm. Difficulty will also be faced in the fuzzy algorithm used to take into account the indeterministic variables.

Android Frontend:

The difficulty in the Android frontend will be faced in battery optimizing the application in such a way that it does not consume significant processing power in the back and forth http requests

Django Web service:

The difficulty in the Django web service will be faced in the multithreading of the python backend in the django, due to the poor interface of multithreading in python. Other difficulties will be face in preventing network vulnerabilities in the server.

NoSQL Database:

The difficulty in the NoSQL database arises from the structuring of the data, the organization of the train schedule, the stations and their respective neighbours. The resulting structure must not only be fast but also logical to understand.