

# Improvement of Truck Dispatching System with Its Computational Process

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**Abstract** – Truck haulage now a days is the most widely recognized methods which is utilized for moving mineral/squander in open-cast mining activities. The truck haulage is generally the costliest unit activity in a truck shovel open cast mining. The growth in creativity in PC coding has advanced to a point where there are many truck dispatching systems that will provide the potential to boost truck-shovel performance and future investment funds. We decided on a decision to make it on the shovel dumper blend using GPS to know about the truck dispatch system (TDS). The PC shows the area and position in the TDS network whether the dumper is complete or void and the heading of each vehicle in the armada. For example, the system investigates generation numbers, pull courses, noteworthy information on driving time to a specific shovel area, and the process duration and time taken to complete a trip. The dispatch computer can also be used to find out the most efficient location for the truck to dump its load at any given time.

**Keywords** – Computer, GPS Application in Mining, Common Optimization Problem, TDS

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## INTRODUCTION

Truck haulage now a days is the most widely recognized methods which is utilized for moving metal/squander in open-cast mining tasks. The truck haulage is normally the costliest unit activity in a truck shovel open cast mining. The progression in computer coding innovation has progressed to a point wherever are several truck dispatching frameworks that would provide the capability of propelling truck-shovel efficiency and future reserve funds. Attempting a dispatching framework in a mine can give operational gains by minimizing waiting times and acquire other useful points of interest through great monitoring, ideal steering. Limit of the utilized truck-shovel armada relies upon the dispatching technique being used, the complexity of the truck shovel framework and various different factors. It is an extremely basic circumstance in mining that significant number of examination of the accessible systems is embraced before dispatching is taken. In many number of cases, computer reenactment is the better pertinent and viable strategy for relating the option dispatching procedures.

In shovel dumper mix framework the primary destinations are To expand the profitability and to diminish the time of activity. These are finished by:

- Minimizing shovel wait time (MSWT): The vacant truck in this goal is doled out to the shovel which will wait for a truck the longest time, or is relied upon to be inactive next.
- Minimizing truck cycle time (MTCT): The essential point of this methodology is to allocate an accessible void truck to the shovel which will give the base an incentive to consummation of the normal truck cycle time to amplify the absolute tons or ton-miles per unit of time.
- Minimizing truck waiting time (MTWT): The essential point of this methodology is to allocate an unfilled truck to the shovel where the truck stacking activity will be started first.
- Minimizing shovel saturation (MSS): The essential point of this procedure rule is to dole out the trucks to the shovel at equivalent time interims to keep a shovel working without waiting for trucks. The truck is dispensed to the shovel which has the most minimal proportion of the present inclusion against wanted inclusion.

## INDIAN SURFACE MINING STATUS

Significance of surface mining in the Indian coal industry with a portion of over 80% and 54% separately of complete generation in Coal India Limited and SCCL, calls for inside and out investigation of the various ways and strategies for expanding the creation and Performance of surface mining frameworks in the up and coming years. Regardless of whether there will be any surface Mining frameworks of disparate sizes and improvement, there is no way that surface mining frameworks from little scale to medium scale and uber estimated mines, would call for unmistakable contributions of new innovation to be viable exorbitant, eco-accommodating and meet the creation needs. In taking a stab at new degrees of working in the aggressive condition, innovation will be the corpus level for change, where computer innovation will assume a focal job. Benchmarking of surface mining tasks overall unveil a yawning hole between the exhibition capability of the better of the mines and the most manufactured of the mines and there exists a jussive mind-set need to traverse this hole. Since, the size of activities in opencast coal mines in India has developed significantly; the traditional strategies like surveying, arranging and working the mines ought to be moved up to arrive at the requests. A total host of driving technology products and systems for good, efficient management of surface mines have evolved in the past decade [1].

## MINES WHERE COMPUTER EQUIPMENT PERFORMANCE MONITRING IS BEING USED INSIDE INDIA

1. Jayant's open cast mine administration, Northern Coalfields Ltd (NCL), has reported a general increase of seven percent in the profitability of capital-concentrated mining equipment such as excavators and trucks using dynamine.
2. Tata Steels installation of a Truck Dispatch System at the Opencast Coal Mines in West Bokaro (Jharkhand State of India's Hazaribagh District)
3. At Nalco, Damonjodi, truck dispatch systems using an Australian organization's GPS systems.

## COMPUTERS

Computers used on board mining equipment must contend with difficult environmental conditions. When the machines are unattended in the field the temperatures can range from the very cold to the very hot. When the machine is in operation, it is subjected to vibration and sometimes to relatively high dust levels. To be useful to the operator it must be easy to use and be visible under varying ambient

light conditions. Rotating hard disks have a short life in this application and must be replaced by solid state memory. At least 2 GB of non-volatile memory is necessary to hold the operating system, system software and complex designs. The computer ought to have a touch screen for simple activity. It must be sufficiently quick to process pail positions and update screen foundations in a creation circumstance.



**Figure1: Computer Screen Showing the Movement of Machines Telemetry**

Radio telemetry systems are expected to transmit GPS amendment signals, to download structures to the machines and to transfer as assembled DTMs when the activity is finished. Numerous GPS study units use VHF signals for GPS rectifications.

These radios are useful for inclusion however have insufficient data transmission to transmit complex structures. UHF radios working at 400 to 900 MHz give enough transmission capacity to transmit plans. Remote LAN radios working at 2.4 GHz enable machines to be associated into the mine's intranet framework, or even into the web for remote association. Remote LAN systems have extraordinary transmission capacity however are constrained to viewable pathway correspondence and distances as much as 2 kilometers. A portion of the constraints of remote LAN can be overwhelmed by fit systems in which each machine is a repeater. On the other hand a double framework can be introduced with UHF or VHF for the mission basic GPS amendment factors and other information reserved until the LAN association is established.



**Figure2: Foreman's Vehicle System Equipped with Wireless LAN to Duplicate Shovel Operators View.**

At the point when machines are associated with the intranet, downloading structures is a straightforward intuitive procedure. Intranet association additionally enables supervisors and engineers to sign in and see precisely the screen that the administrator is seeing, and along these lines answer any inquiries or concerns. Intranet associations for this reason can be installed on supervisors' vehicles.

**GPS APPLICATIONS IN MINING INDUSTRY**

GPS set out the Mining Industry as a quick and savvy instrument for overview. A moving to a great extent scene is the easygoing organization of mining techniques; the shovels and dozers will evacuate the coal and metal, the shovel and dumper will reshape the mine's air foil. The steady changes happenings in mining industry can be gotten to by ongoing GPS and heavy equipment operators are provided with the updated operating information. In add on, GPS systems give a rapid and exact solution for substituting and asseverate control points and by calculating the volume of material moved. By using advanced GPS technology heavy machines like dozers draglines can be assessed and used. By using Modern GPS systems we can also track and monitor the scenario and position of dump trucks, given reports to their targets, movements and speed covered per distance and also the amount of the truck's load. GPS live now a days is decorous for observing and bumping of haul trucks or drills and for giving grade assure on shovels. The data obtained can also be tied to a GPS to observe the location position of every equipment, in real-time. As GPS is an all-weather real time, frequently usable, economical and very exact positioning technique, will be having great array of applications in Indian mining industry. The potential areas for using GPS in the Indian coal industry include Surveying Various advanced surveying skills such as satellite remote sensing, photogrammetric, field surveying methods using digital theodolites, short-and long-range EDM tools such as Total Station, etc. are now usable a day[2]. The main advantages when using satellite-based GPS survey skills are:

- GPS measurement does not need point-to-point inter-visibility, whereas the ancient survey devices used to allow measurement line of sight.
- The GPS approach offers a point location in 3 D. We can get the horizontal and vertical position in one measurement of the point, where as in ancient old surveying, we need 2 operations one is horizontal traverse for plan metric control and the other is a level loop for height control.

- A very eminent accuracy mensuration can be done in a very short time for baseline lengths of a few 100 meters to few 100 kilometres. It can also provide the very exact accuracy anywhere on earth, and also in any. Whether condition at any point or any temperature conditions. GPS offers many rewards relatively when we compare with conventional survey methods. As there will be no necessity for a rod person, each surveyor will work alone when required. GPS also needs very much less setup time rather than any traditional surveying equipment, so the team can use its time more effectively. It will also keep a much more conciliatory schedule and can actuate from one area to the next or from one seam to another when it is needed[3].

**COMMON OPTIMIZATION PROBLEMS – TAKES CARE BY SOPHISTICATED MINING SOFTWARE SYSTEM:**

- Truck queuing– Increased fuel consumption and decreased performance result in unnecessary truck queuing. Active engineering model provides validated optimization of truck assignments in real time, reducing truck queuing at loading and dumping sites.
- Hanging time for the shovel / excavator– A shovel or excavator does not load the truck with time and money lost every minute. For each excavator, the proper mathematical model accounts for the number of trucks, automatically allocating trucks and increasing the hanging time.
- Unrealized plant capacity and/or poor blends–Incorrect head feed grade may lead to reduced plant equipment efficiency and may also result in damage to equipment. Effective mathematical system maximizes production whereas on the identical time with regard to the constraints of material mixing.
- Inefficient change of switch–inefficient change of operator holds machinery out of operation and reduces efficiency.
- Unnecessary travel time–Unnecessary travel Results in waste fuel and running time when removing and breaking needless equipment. Through determining the best path between starting and end points and using the correct guidance system, it is possible to eliminate excessive travel time.

- Mining sequence delays – When steps in a mining process occur out of order, operational delays may accumulate. An effective Engineering model proactively manages and schedule equipment and personnel.
- Misdirected loads–This practically throws money away from sending material to waste dump. Likewise, dumping waste in a crusher will cause expensive downtime and affect the value of the mixture. An efficient system continually reconciles the grade of mining material.
- Uneven benches–Uneven benches require substantial rework of the support equipment to prevent damage to the equipment being transported. To avoid such damage, continuous monitoring of the elevation of the track is necessary.
- Improper blast design–blast design must be unique to product strength in order to avoid explosive waste and fragmentation inappropriate. The efficient system optimizes the layout of the blast. Real-time machine guidance ensures plan-based drilling by operators [4].

## TRUCK DISPATCH SYSTEM (TDS)

This is the fully computerised Global Positioning System. This has been used in NALCO mines for the last few years. This is used to locate the Positions of different equipment's within the range of the satellite. There is a Satellite installed for this purpose. This has a particular range. There are several zones called Dark Zones which are out of the range of the satellite or is in a weaker part of it. The GPS Based Truck Dispatch System implemented at Panchpatmali Bauxite Mine has been a great success in achieving its objectives.

### TDS Operators: The truck driver

The basic actions that the truck driver needs to take are to inform TDS when the truck arrives at a shovel, when it is loaded, when a dump assignment is required, to confirm arrival at the dump and return to a request shovel. Other required input is that related to the condition of the truck being experienced, downs or delays the amount of fuel put in the truck, etc. Communication with the driver is via a 32 character digital display on the operator interface panel.

### The shovel operator

The shovel operator has same facilities as basically the truck driver, except that he is required to indicate to TDS information pertaining to the loaded, and

when composites being the loading of a truck has been completed[5].

### The lookout operator

The nerve center of the entire operation is the open pit lookout tower. Here there are computer terminals in use, which serves a different function in assisting the lookout operator to control the mining operation.

### The crusher operator

The crusher operator's primary function is to tell TDS what ore stockpile he's tipping on and when he starts and finishes crushing a load. Within its linear programming calculations, TDS uses the latter information to determine the feed rate of trucks to the right crushers and thus the proper feed rate of trucks to the ore shovels. In order to optimize the cycle time of the network with minimal waiting, TDS determines the optimal inventory to dump for each specific vehicle.

### Mine Engineer

Mine engineering personnel are responsible for the upkeep of the TDS system, particularly to consider the primary pit configuration data like haul routes, composite data, production equipment information, etc. As with computer operating systems, TDS has many configurable system parameters which affect the efficiency with which it operates. It is the responsibility of mine engineering personnel to ensure that these parameters are set to optimize the efficiency of the dispatching operation at all times[6].

## ADVANCEMENT IN TDS

All digital inputs of the TDS hardware capture key information like Engine Run Hours, Idle Hours, Over Temperature and Over Pressure, which will assist maintenance. Operators are provided with an easy to use interface. Operators may also provide with audio visual feedback with regard to messages from the base during loss of communication with the base, and GPS unavailability.

## BENEFITS OF TDS

- Real Time Monitoring of Equipment.
- Improved Safety of Operation.
- Improvement in Production and Productivity.
- Reduction in Operational and Maintenance Delays.
- User Friendly & Flexible Reporting System.

- Ease of Re-deployment of resources during breakdowns.

## LITERATURE REVIEW

Yuan Huang (2019) et al. Coal mine catastrophe early cautioning dependent on sight and sound enormous information is a successful measure to dodge mishaps, for example, gas, water, fire and rock burst, and to diminish setbacks and property misfortunes. Through the examination of different information of coal mine, the investigation model is set up and the connection investigation is completed, to all the more likely do hazard early cautioning and forecast examination, give early cautioning and expectation data for supervision and law authorization, and improve the logical idea of supervision and law requirement and the capacity of early notice and expectation for mishap chance. Focusing on the investigation and expectation of huge mine mishap information, the displaying and Simulation of huge mine mishap information examination and forecast dependent on choice tree-BP neural system are done. The report of coal mine gas mishap is investigated by utilizing the technique for interactive media huge information mining, and the key elements of coal mine gas mishap are distinguished. Along these lines, we can concentrate on fortifying the checking of mishap factors, decrease the danger of mishaps from the source, and improve the wellbeing the executives level of coal mines [7]

Rahul Khokale (2017) et al. Today we are living in an information driven world. Advancements in information age, assembling and putting away innovation have enabled associations to accumulate informational collections of monstrous size. Information mining is a term that mixes conventional information examination strategies with refined calculations to deal with the undertakings remained by these new types of informational indexes. This paper is a near investigation of different Data Mining of traffic information utilizing large information, representation and information mining strategies to anticipate and break down traffic. Remote sensor systems are an innovation which has assumed a huge job empowering a Smarter City urban communities is utilizing this innovation to accumulate information identified with traffic. The goal is to have a total framework that empower the checking of traffic practices so choices on city advancement can be made in a more brilliant manner. The work investigating the utilization of information mining apparatuses to help in the advancement of traffic signal judgment gadgets. The group examination approach can apply a high-goals system state portrayal that exploits the wide-running arrangement of sensors orchestrated in a rush hour gridlock signal system. [8]

Xiaoyan Gong (2003) et al. Ongoing improvement in ITS (Intelligent Transportation Systems) strategies

and advancements has moved traffic working systems from uninvolved to proactive control and the executives, where constant and exact traffic stream data is basic to real usage. So far numerous calculations have been proposed for traffic arrange stream forecasting, yet issues in precision practicality still stay to be the significant hindrance for their effective applications. For instance, assumed human travel propensity and vehicle turning probabilities at convergences have enormously restricted the utilization of dynamic task calculation. So as to improve the forecasting and continuous responsiveness, another calculation dependent on information mining which can do affiliation rules mining and affiliation examination is proposed here for foreseeing traffic organize stream. Reenactment results utilizing Corsim 5.0 have shown viability of the new calculation in both precision and timeliness[9].

Thanrawee Phurithitanapong (2014) et al. Power producers are looking for ways not only to improve efficiency of power plant assets but also to grow concerns about the environmental impacts of power generation without compromising their market competitiveness. To address this difficulty, this examination shows the utilization of information mining systems for process improvement in a coal-terminated power plant in Thailand with 97,920 information records. The principle design is to determine which components greatly affect both (1) heat rate (kJ/kWh) of electrical vitality yield and (2) obscurity of the pipe gas fumes emanations. Rather than the customary exceed expectations based relapse investigation as of now utilized at the plant, progressively complex systematic models utilizing SAS® Enterprise Miner™ help supporting administrative choice to improve the general execution of the current vitality framework while decrease outflows through an adjustment in the vitality supply structure[10].

Nimish Mishra (2019) et al. Quantum AI is at the junction of two of the most energizing ebb and flow regions of research: quantum registering and old style AI. It investigates the communication between quantum processing and AI, researching how results and methods from one can be utilized to take care of the issues of the other. With a regularly developing measure of information, current AI systems are quickly moving toward the breaking points of old style computational models. In this sense, quantum computational power can over bit of leeway in such AI undertakings. The field of quantum AI investigates how to devise and actualize quantum programming that could empower AI that is quicker than that of old style PCs. Fuelled by expanding processing power and algorithmic advances, AI systems have become useful assets for discovering designs in information. Quantum systems produce atypical examples that traditional systems are thought not to create proficiently, so it is sensible to

hypothesize that quantum PCs may beat old style PCs on AI errands. Here, we audit the past writing on quantum AI and give its present status. [11]

## CONCLUSION

Truck dispatching issue is one of assigning trucks to shovels in a well-designed system on real-time basis so as to ensure the achievements of some goals or minimize the underachievement of such goals. The general problem solved by truck dispatching routines is to determine the shovel to which the current truck at the dispatching station should be assigned. The objective of computer-based truck dispatching to enhance the apparatus exploitation and increasing manufacture subject to a variety of realistic constrains. A computer truck dispatching system consists of two major components as hardware and software. Developments in hardware are concentrated on signal acquisition and transmission equipment and computer. Computational procedures are becoming relatively easier with the development of high-speed computers. Also, truck dispatching software presents many opportunities for improving the performance of open-pit mining systems.

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