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Electronic systems railway buildings

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Abstract: To ensure an orderly and logical progression and movement of trains, the station complex operation and safety of rail transport block without the use of devices is not possible symptoms. Especially, when operating with maximum efficiency is also taken into consideration. The role of electrical equipment, signs, safety, accuracy and speed in the transportation.This rail paper has introduced the various electronic circuits such as interlocking systems include CTC and PRC and software as well as how the automatic block system.

Keywords: Rail Transport, Electrical PRC, CTC Systems, Automatic Block System.

1. Introduction:

Phenomena of electrical signals with the emergence of railways in the face of a new method of Danny's moving in the rail. This development led to a new experience was examined based on the objectives of the mechanizing the operations and dispatch and avoid the error of my labor with you to help speed up the transfer of the underlying technology was realized [1]. With Frequently asked symptoms of exploitation of electric railway system railway in the world, Iran is the first step to obtain. Iran began in Tehran central which now well along the axis of Qom, Isfahan and Yazd newer systems Julfa to Tabriz Razi in Tehran axis is in exploitation.

2. CTC System:

Train's safety in a station is usually ensured by the operators that monitor control signal devices through control panels. In this case, safety depends on telephone communication among adjacent stations and traffic command centre and other stations [2]. In the past, these communications were used as the source of information on the train's departure and consequently the source of any modification of the train's movements with the changes in the timetable. These process took a long time. With the application of CTC, this problem was resolved. CTC is stands for centralized traffic control and a modern and advanced control system. CTC requires the establishment of a traffic control system for a particular area or region. Once establish, it enables the responsible personnel to control directly the interlocking system of any station remotely. Major equipment of CTC Command Center include control panels, display panels, train number display unit, blocked line panel, automatic system of program registration and monitoring table [3],[4]. Not only the full control of the train movements is possible with CTC display panel, train number display unit, line status indicator but also with its installation, immediate adjustment of the timetable is possible, thus the time required to restore program is reduced.

Figure 1: System CTC

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3. PRC System

PRC has been developed to control the set route and to avoid confusion in setting the route etc. This is done by reducing the manual operation that is carried out by CTC personnel. Furthermore the complex decisions such as the dispatch of trains and the sequence of crossings is automatically done. Routes are controlled according to data from the trains schedule (based on operational timetables) previously prepared using the number of trains. This schedule can be altered using the information of the changes in operational timetable (for weekdays, weekends and holidays) [5]. It is stored as a three day schedule (today, tomorrow and the day after tomorrow). This is called train schedule control technique. The schedule includes train departure days, departure times, parts of the operation (source station and the midway stations, destination station, the entrance line number) the arrangement of departures, crossings and junctions and all the other information necessary for the operation. In addition, an alert system is activated in the event that command personnel decisions are necessary.

4. CTC and PRC:

4.1. PRC Mode:

PRC system tracks the trains status according to information received from the CTC and controls the routs in the source station and departure lines according to various provisions (such as train's departure and order of train departures and the dispatched trains). With the use of junction information (the entrance to the three successive line circuits), PRC controls the route for train departure from and entrance to the main line of stations such as entrance operation in the midway stations and destination stations. It is also in charge of restoring the route.

4.2. PRC Types:

In the integrated PRC-CTC system, timetable control and route control are both carried out at the center. CTC system includes the required hardware (CPU) and software for operations the main features of this system include:

1. Route control is based on train numbers. Train timetable and process depends on the operational status of the train.
2. To locate the train, route control operation and track control are used at the same time and the tracking results are sent to PRC by the train number display unit.
3. This system is used for 24 hour movement operation.
4. This system is double and asynchronous and the relationship between CTC and PRC is based on direct sampling of CTC.

5. The Dispatcher System of Sub-centers.

In these systems CTC consists of two rings that the m system is between the central unit and the sub-centers and the s system is between the sub-center devices and the stations under their command. PRS is composed of a central unit and sub-centers. The central unit coordinate the operation and surveillance the traffic and controls the train schedule. The duty of sub-centers is to monitor, track and trace the movement of a train and to change the train's number. Each day the operational plan is set for that day, the next day and two days after. Files containing information about the main program and updated data are stored as a file and after that the operational plan data is sent to each sub-centers at a fixed and determined time. Each sub-centers controls the data and controls the routs in accordance with the train status. Updated programs which are developed according to traffic coordination of the same day is always set by the control center and sent to the sub-centers. A sub center receives these updated programs and alter the operational plan according to the latest data .Given that the control route operation is divided between sub-centers, one of the most important features of this system is that in case of failure, the entire line is not blocked.

5. Software:

The interlocking function essentially involves maintaining an up-to-date record of the state of the railway and applying a defined set of rules to all state changes. The state of the railway is described in terms of real entities such as track occupancy, signal aspects and point settings, and abstract functions associated with the principles of railway signaling, such as overlaps, approach locking and train-in-section proving. In the SSI this representation of the railway is held in read/write memory in the form of arrays of variables representing the states and attributes of signals, points, routes and track circuits. Other variables are reserved for latches and timers and for maintaining an up-to-date record of the system's input and output states. The interlocking performs a full cycle of operation referred to as a major cycle, approximately every 650 ms. A major cycle is made up of 64 minor cycles, each of which involves the interlocking processor in the following operations.

1. An exchange of information with the two processor handling the trackside data highway communications; the data to be transmitted in the current cycle is exchanged for the data received during the previous cycle.
2. An exchange of information with the panel processor block of' state-of-the-railway' information is passed to the panel processors and a panel request code is passed to the interlock in.
3. An exchange of information with the communication processor handling safety-level communication with the other interlockings of the installation.
4. Updating the 'state-of-the-railway' record from information received.
5. Performing the interlocking logic for the signalling functions associated with the data to be passed to the trackside communication processors at the start of the next minor cycle.

The duration of a minor cycle is allowed to vary according to the complexity of the interlocking function associated with the outgoing message, subject to a minimum of 9.5 ms required by the data highway message protocol and a minimum of 30 ms set by other timing constraints. The interlocking software comprises about 4 Kilo Byte for redundancy management, initialization and interfacing functions, and about 12 Kilo Byte for the interlocking function itself. The size of the geographic database varies with the complexity of the installation, but is typically 12-20 Kilo Byte. The primary function of the two trackside communication processors (TCPs) is to handle the flow of information between the interlocking processor and the trackside data highway. Two TCPs are provided because significant differences in transmission path length are permitted which prevent one processor handling both message streams. Information passed from the interlocking processor is subjected to both Hamming and Manchester coding before transmission, and messages received from the highways are likewise checked for coding validity before the received data is passed on to the interlocking processor. The integrity of outgoing data is protected by a redundant check of each bit as it is sent. If an error is detected the data highway is forced into a Manchester invalid state (e.g. all ones), causing the entire message to be rejected as invalid. Fault analysis software enables the triple redundant system to identify.

Which module is responsible for incorrect data and take the appropriate action. The processor handling communication with other interlockings over the internal data highway (ICP) has a particularly difficult job to do, as it is impossible to synchronize one interlocking with another. The flow information of the internal data highway is therefore asynchronous with respect to the interlocking process and has to be organized solely by cooperation between the several ICPs, each of which also has to maintain synchronization with its parent interlocking. In addition the ICP initialization has to be able to cope with all the possible start-up modes of the triple redundant system and with all possible initial states of the data highway. Fault analysis and safety management is handled in a similar way to the TCP.

6. Track Side Interfaces:

A trackside interface module is a selfcontained safe controller which is designed to be connected directly to a signalling apparatus such as signal heads, point machines and track circuit equipment. It responds to commands from the interlocking, with it communicates over the trackside data highway, and sends back to the interlocking information about the state of the railway. The two types of module so far developed, the points module is specifically designed for direct connection to hydraulic point machines, while the signal module is a flexible general-purpose interfacing unit which has been optimized for use in connection with multiaspect colour light signals. The two types of trackside interface modules are required to carry out the following functions

1. To manage the system redundancy 'o er behaviour under fault conditions.

2. To receive and decode data highway message, addressed to the module, and to assemble, encode and transmit replies to diagnose and report datahigh way unreliabilityand impose safe conditions when communication is lost.

3. To detect the states of external switch or relay contacts**,** to control and monitor the state of power level outputs and the power interface fault protection mechanism. In addition, the signal module is required to monitor signal lamp current and to ensure the illumination of the red signal lamp under fault conditions. The points module is required to detect the position of the points being controlled and to control the switching of a high-current nonsafety interface to hydraulic pump motors Safe control of the modules is maintained using the dual-processor technique described previously. Although the technique is capable in principle of satisfying the stringent safety requirements of trackside interface modules, translating these principles into a robust mechanism for switching AC at relatively high power levels presents considerable difficulties. The solutions adopted for the two types of module reflect subtle but fundamental differences in safety requirements and the wish to maintain a degraded performance in the presence of faults where this can be achieved without compromising safety. The internal structure of both types of trackside interface module is illustrated in Figure 2. The design aims from to divorce the management of processor redundancy from the safety management of the power output switching function. Only the failure of one or both processors, or an irreconcilable difference of opinion between the two, causes total (safe) failure of the module. Other failures cause only partial loss of function and are reported to the diagnostic processor in the control centre.

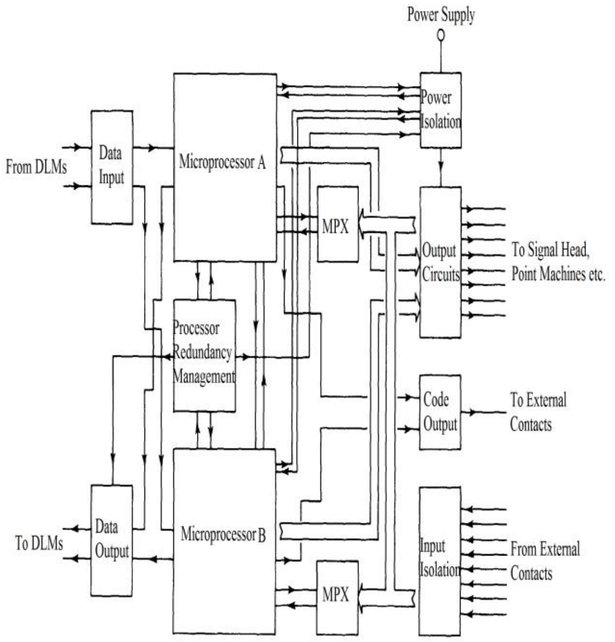

Figure 2: Internal structure of a trackside interface module

7. Automatic Block System:

Breking distance the distance needed to a complete halt after brakes are applid is longer fore trains than it isfor road vehicls. Consequntly only one train can occupy a specific section of track is called a block. Track circuits are used to determine whether a train is in a specific ablock. Figure 3 shows how the rails form part of an electric circuit (track circuit), when the trains wheens pass a certain point, they cause a short circuit, pareventing electric current from proceeding further this makes it possible to detect a train in a block. An automatic block system uses the track circuit to automatically detect trains in blocks and to control the signals for each block all double tracked sections in Iran usd in automatic block system. As figure 2. shows there are basically three signal aspects: red meaning stop immediately before enterning the next track sction occupied by and ahead train yellow meaning procced with caution. At a speed no greater than 45 Km/h (55 Km/h or faster is permitted on some section) as far as the signal, and green meaning the next track section at the maximum speed. In heavily used sections two other signal aspects are also used fig 3., two yellow lights (ristericted speed) and, one yellow and one green light (reduced speed).

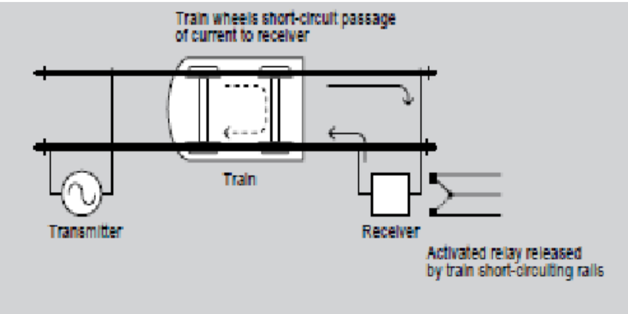

Figure 3: General principles of track circuit

8. Other block systems:

In addition to the outomatic block system,a number ofother block system are used on single tracks in many cases , track circuit system or an electric block system (electronic coding verify cation system) in used both are semi outomatic block systems. The track circuit system controls train movement in the blocks between stations. And involves interlocing signal levers at the two stations that the train is traveling between. The trains departure and arrival are detect by the track circuits at the station entrance and exit .in the electronic block system , each train has a radio communictions d,evice that transmits the trains id, when the driver is ready to leave a station , presses a button and the signal changes outomatically to green . When the train arrives at the next station, the trains id is transmitted to a receiver, clearing driver basically controls the block the block. This type of electronic block system requires fewer staff because the driver basically controls the block.

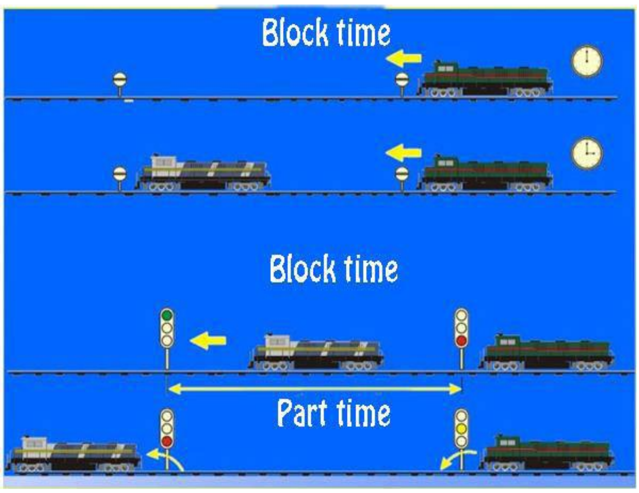

Figure 4: Automatic block signaling system

9. Challenges in System Line Circuit:

Damage to the insulation of the rails: rails insulated circuit is separated from the adjacent lane. It may not hurt either disable or stability of the circuit can disrupt their work. As a result of the polarity of the circuit adjacent to the crash without safety lines arise. The dilemma of the circuit failure insulated conductor rails in particular, this document sets out the permissible error of his opposite poles of the circuit. most likely to fail in the height of summer to winter insulation, and other times, the extreme temperature changes cause expansion and contraction of the rails and it will creep in there. Concern insulating rails through ensuring the maintenance staff while performing their job duties such as signing tamping near insulation, tighten the fitting rails, rails set between summer and winter is another creep rails believe, should to minimize.the foreign object in insulating rails: the high and insulated rail joints are loose metal objects and other external Comments can find The following ties.

This condition causes leakage into the adjacent lane circuit. If any two adjacent pole line circuit failure without maintaining the same safety arises The circuit includes two-way line, a central piece of insulated rail at its opposite end is very near the interface due to the conductor rails (shrup) or small metallic foreign objects, etc., there will be short at this point Increased resistance to abrasion or the use of an extension cord because the extension cord is faulty or incorrectly stunned rail connections to be applied electrical resistance increases and This situation has led to a change in voltage in the receiver and the performance of the circuit is faulty.

Increased resistance wire interface. Improper connection of thin, conductive wires used in the device relays are working irregularly Work irregular Relay for lowering high play strength. Where quality is low and the high seed rain or melting snow and ice can increase the leakage current is Infected flowers Resulting in irregularities in the operation of the relay circuit is created so that it looks wrong. Such a situation occurs when maintenance personnel should be required to take action to remedy the situation there came a time share situation, the control circuit is configured correctly and the information is necessary to create favorable conditions for voltage and current circuit is set to a range of values nominal. Short circuit line from the intersection of pipelines, bridges, transit and metal beams and cables, wires or other objects Besides the insulation of the bridge, or in locations that require special attention are the cross beam, etc. Failure to detect the location of the hidden parts of the work and requires much time.

10. How Do Japanese Machine Point:

This 220 volt, 50 cycle AC electrical machine point axes Software and equipment, especially roads and railways RC, CTC has been usedBelong to this type of equipment, machine point, electric cars than in Germany and Iran, and for this reason Installing and maintaining single phase electric cars Japanese point should refully Operation be carried out. Voltage is 220V machine by a cable needle 5.5 mm from the reels of the machine point case has been drawnPin 24V power voltage indicates that a 4-strand cable with a diameter of 2 mm. were satisfied. This cable point by a flexible pipe into the vehicle electrical are guided by a strong cast iron collars were inside the Terminal screen point machine has been assembled and form and by a 15 amp fuse inside The machine point controlled switching power supply. Time change The point of normal Reversi (Othello), or vice versa in the case of three seconds and when a single parallel Six seconds and if the blade tip when replacing the point thing Drlalay For about one minute after the power supply is disconnected and the engine needle work will remain au Flalashyng.

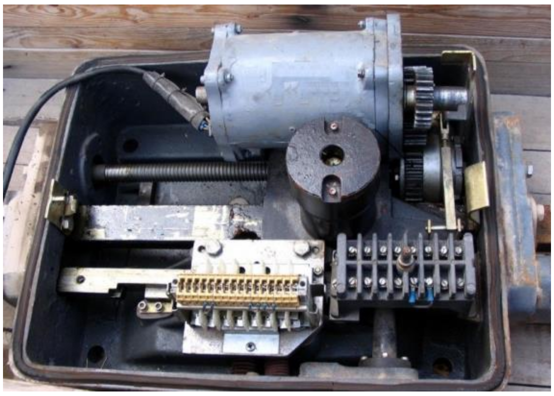

Figure 5: Point machine system

11. Conclusions:

This article has descried some signaling equipment used by Iran railway to ensure safe railway operations. Other devices such us interlocked signals and pointsin stations are used as well. Most othe many thousands of interlocks are either relay or soild state electronic interlocks and there are about 1000 of the latter now in service. In addition almost all level erossings in Iran are controlled by automatic derices that detect on apdroaching train and lower barrier automatically. Some level erossings on very buse roads have extra obstraction warning devices to detect motor rehicles on the crossing when the crossing when the barriers come down and stop the approaching train howerer although all signaling derices play an essential role railway safety there is still nosubstitute for skilled conscientious and vigilant operations staff.

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