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APPLICATION OF ELECTRONICS INSTRUMENTATION IN RAILWAYS FOR EARLY REPORT OF PROBLEMS

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ABSTRACT

This paper consist of the implementation of the major techniques of electronics in the order to create a multitasking device which can used in order to check the defects in the tracks of the railways. The idea is to implement a certain kind of tracking device which could check all the disparities present in the bogies of the train. The tracking device is present over the rails which track the distance between the rails, presence of a bomb, any breakage of track etc. The idea behind the device is by the use of proper sensor, multiplexer, data loggers, telemetry etc. the data is received and transmitted through a channel to the receiver. The use of this system can be done over certain tracks to record the information and provide it to the user when required.

KEYWORDS: Data Loggers, Telemetry, Encoders, Mux

INTRODUCTION

There are many principles in the field of electronics which can be applied in order to heal up the present status of railway etc. there were various type of accidents due to various problems, problems relating the status of the track or any mechanical problem. This paper deals with the implementation of a proper system which will track the problem regarding the following:

- Increase or decrease of the distance between the rails of the railway tracks.
- The presence of the bomb in which bogie at what distance.
- Whether the wheels of bogie are running in better condition, friction is perfect or not etc.
- Any interruption between the tracks.

The related above can be easily detected by the means of sensors and other electronic circuitry but the major problem is to correct it. This paper deals with a particular method which can be used in order to transfer this information to a hub and then proper steps must be taken to correct them.

Various sought of sensors are involved in the device such the infrared sensor used for the sensing distance between the rails and can also be used for finding out interruption in the tracks. The bomb sensor is used for sensing bomb. Actually the idea is to set up this device ten km. on the railway track. All the trains which pass through these rails will be sensed first and then proper report will be sent to nearest station by the system discussed below.

First dealing with the circuitry involve

CIRCUITRY

- The major circuitry is the sensing the distance between the rails this done by the mean of the infrared rays as the

time required to go from one rail to another is counted and that standard time is compared with the time of taken by the rays to actually cross the rails. Other type of rays in order to find whether track is clear or not. Any change in the time required can be detected and that can be concluded as a defect is present between the distance of the rails or the there is obstacle between the two rails.

- The other circuitry will test the presence of any bomb or any unnecessary items present in the bogie, as a particular sensor is implemented between the two rails this sensor will continuously check all the bogies right from engine to the last and report if there is any unnecessary object present. Also the distance between the engine and the bogie in which the bogie is counted. This is by the circuitry shown below as when the bomb or any other particle is detected then a trigger circuitry will be automated which will initialize a counter which will be provided the clock period same as that of the time required to pass one bogie from a particular point as we can say that time period can be automated as the average speed of the train is known also the length of bogie is fixed so the time required by the train to cover that distance will be Time period for clock =

$$\frac{length\ of\ bogie}{average\ speed\ of\ the\ train}$$

With this clock period the counter will count the number of bogies passed and the counted value is subtracted by the total number of bogies of that train. To stop the counter we use the concept of state machines of switching, generally state machines consist of output depicted by the mean of 0 or 1. This changing of zero to one or vice versa can act as a switch. Let a state be x in which the counting starts and state y in which the counting stops. The occurrence of both the states depends upon the variation of the switching. Consider a situation if a bomb has been detected in a particular bogie then the state will be changed from x to y and again when the train will complete its passing through the sensor then the state will again be changed from y to x. In the mean time the counter will count the number of bogies present. Subtracting it from total number of bogies will provide the bogie number in which the bomb is expected.

- In order to check the presence the proper friction between the rails and the wheels of the rails the sound of the rails is detected as when an improper friction is present between the wheel and the rails then the sound varies, the varying sound can be concluded by the presence some varied amplitude passed. This varying amplitude is being detected and the problem is solved. With the variation in the amplitude the kind of the problem is detected and solved.
- In this case the ideal sound which comes through an ideal wheel of a train is catch and these sound waves are recorded in terms of their amplitude v/s time. These recorded data has to be compared with the data which one gets from the case of non ideal rail.

- In order to keep the synchronization between the circuitry an additional circuitry will be required as an encoder is provided as it will encode the particular problem regarding the bomb problem, distance between the rails has increased or decreased, problem of friction etc. to the user. Once the user will know the problem, proper steps can be taken to prevent it.

PROCESS

The process includes the various steps which need to be followed to transfer the information from one point to other. Here point refers to the place where the information is converted from analog signals to binary bits and these binary bits are travelled through a proper channel and after that data is received at a proper station and properly coded.

According to block diagram we have we have firstly the sensing element followed by an encoder or multiplexer. There are a lot of sensing devices as a lot of items need to be checked so there would be need of a binary code to each of the sensing device and when a particular problem arrives that particular binary code provided to that particular sensing device will become active thus acts a select line for the multiplexer.

The next thing is transmission channel takes place through the telemetry. The telemetry consist of the telemetry transmitter, telemetry channel, telemetry receiver and then a switch is provided through which one can switch to

- Display.
- Storing device
- For further transmission.etc

The information can be directly displayed depends on the user and if the user wants to store another circuitry is present refers to DATA LOGGERS. The data loggers refers to a proper circuitry which consist of firstly input scanner, signal conditioning, analog to digital signal convertor, recorder, clock signal and a proper programmer is required.

The device will store the information in a proper format and will be delivered to the user when required.

The next circuitry involves the conversion of these binary encoded data to the analog signal through any digital to analog signal converter the digital signal is analyzed and the further action is taken.

ANALYZATION OF CIRCUITRIES

Sensing Element

The sensing element is just a type of circuitry consisting sensors which will sense the individual objects and transfers the information on any change in the value of sensing.

The circuitry involves a lot of sensors so to keep a proper flow of these sensors are terminated to a proper binary bit value so the signal coming from them can be differentiated. These binary bits are used as the select lines for multiplexers.

Use of State Machines

As provided in the introduction about this circuitry here there are two states first one the sensing state itself and the other is the state when the binary data is provided to state in which there is select line input.

This circuitry will be provided to all the sensing system.

- Consider the condition of the sensing system for bomb detection in this case if the bomb is not present the state will be changed but changed to itself that is zero state is changed to zero itself hence after every clock pulse it will change its state. If the bomb is found then it will be shifted to state one in which it has changed its state from itself to the select lines inputs.
- Taking the case of distance measuring sensor in this case we have the state (0) is as usual the state itself that is the sensor continue to do its sensing till it don't get any fault. When any fault is detected then the state (1) becomes active in that case the state (1) resembles the state of being the select line of the multiplexer.
- Taking the case of checking the proper friction between the wheels of the trains and the rails. In this case a proper ideal signal (waveform) is provided in order to compare the signal secured so in this case the state (0) is the state in which the signal matches with the original signal (signal matching here doesn't means as the exact overlapping of the waves but just comparing the magnitude of the waveforms by the mean of quantization of magnitude) and when any large change in magnitude of amplitude occurs then the fault is occurred and this will change state from

(0) to (1). Here state 1 refers to the state in which the binary resembled to this problem is provided to the select lines of the multiplexer.

Use of Mux

In this case the 4:1 mux can be used or any other can be used depends on the amount of sensors involved. The multiplexer will encode the value of the proper fault by the mean of proper select lines. Generally the encoded data will be provided to further circuitry. The use of this circuit is only to differentiate between the problems as when the problem of variable distance occurs then the state machine provided there will switch to state one from zero which means to make the switch one as then these binary bit will be provided to next state that is to the select line inputs.

Counters

It is the type of circuitry required in the case of bomb detection as the position of the bogie where the bomb is present should be reported in this case when the bomb is denoted a counter should initiate so in order to initiate that counter a proper trigger is present. The problem generally arises when the counter need to stop counting, in that condition a back up circuitry is present as shown in the block diagram. It will be from the state machine providing the information regarding the end of event. So as the event is over then automatically the clock provided to the counter will be disbanded. In the case the counters stops counting.

Trigger Circuit

The trigger circuit consist of state machine which consists of two states one is self and other is to trigger the counter to initiate. Particularly if a train is passing over the device and bomb is detected at a particular bogie then the state of trigger circuit changes from self (0) to the state in which the counter will initiate (1). When the train will be passed completely there is requirement of a circuitry to stop the counter.

Similar procedure of state machines can be implemented over there as there should be switch which should be terminated accordingly by the mean of the initial sensing circuitry. As the sensing stops the clock of counter should be automatically stopped. The counter can’t be able to count if there is no clock.

Logic Circuitry

In the case of the distance measurement we have to display the distance which is the difference between the actual distance and the measured distance. So a logic circuitry is required which will convert these data to binary data and take a difference of it. Then again converting to proper BCD format and display on the binary decoder display.

L.E.D. Circuitry

In order to make the user known about the increasing friction or sparking from the rails an L.E.D. need to be lightened up as proper voltage is provided to it so that it can light up the L.E.D. when required.

Telemetry

It is actually the circuitry which is required to transfer the information to the desired place. It consists of TELEMETRY TRANSMITTER which is used to transmit the information to the particular position by the mean of TELEMETRY CHANNEL. At the end TELEMETRY RECEIVER which is used to receive the information and retrieve it according to the application, as to display or memory or the information can be passed for further procession.

Data Loggers

This concept is used for memory as the data need to be used for procession and future use. The circuitry involves the SIGNAL CONDITIONING. Firstly the data is taken as an input in the data logger through the input scanner; it refers to a proper sink where the any type of information can be provided. Later, signal conditioning is used as the signal which we are passing through the system must be well equipped with the system so we must take care that the signal is properly signal conditioned or not. It is a process through the codes of the data is changed according to the system which is storing

the data.

In order to save a particular data in memory the data need to be converted in the digital form so the analog to digital signal converter is required in this process. It follows the principle of quantization and then compares the quantized data to the fixed values providing the digital signal and then these digital values are sent to memory according to the programmer. In order to initiate the programmer that is the user a particular clock is required which will be acting as a triggering agent. through the codes of the data is changed according to the system which is storing the data.

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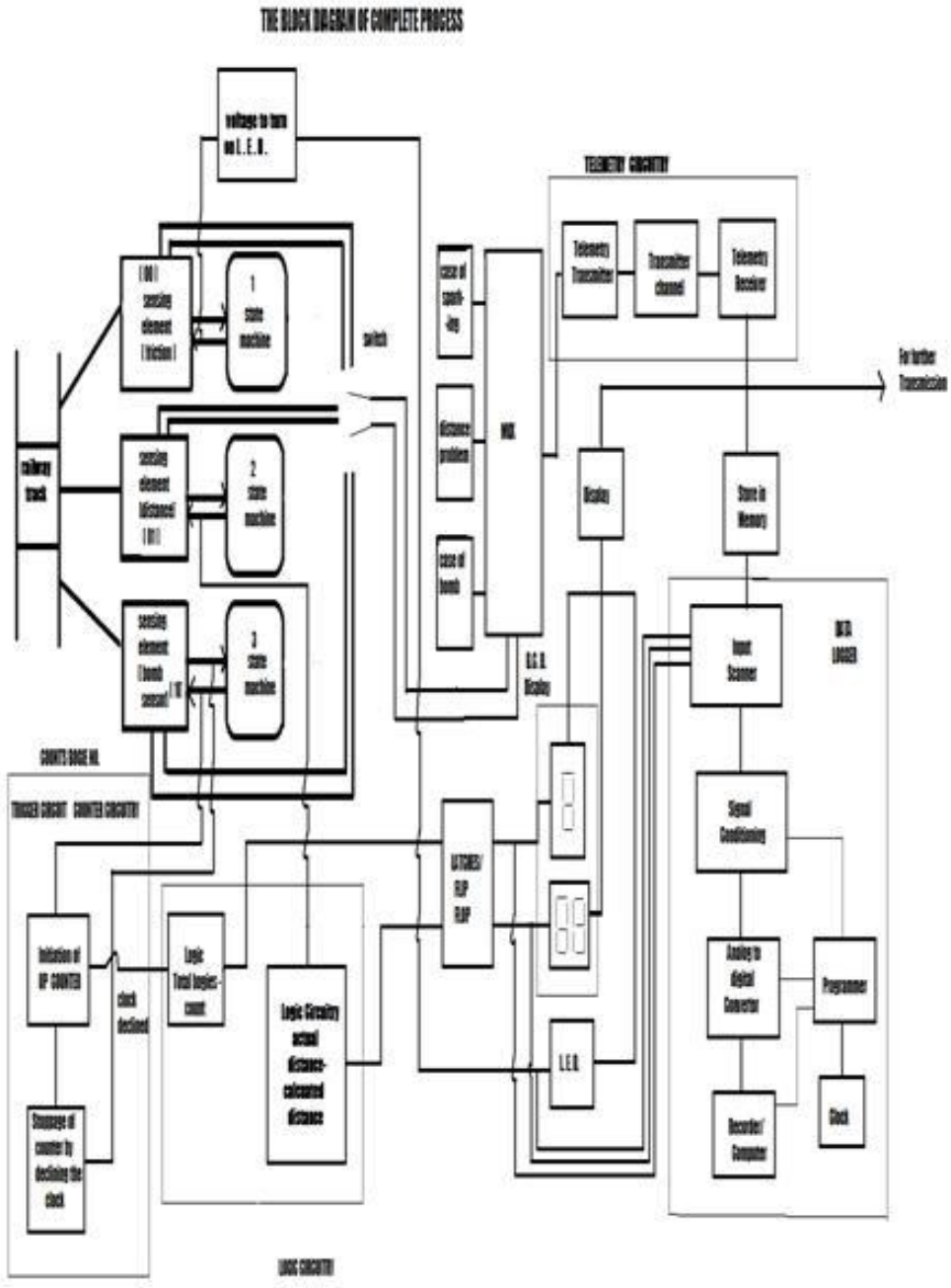
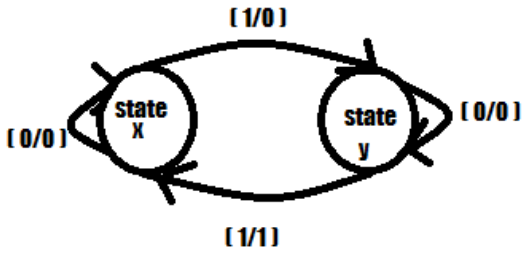


The case described here of the state machine. Consider the case of state machine 1, here the state “x” refers to the state in which either there is no train present on the rails or there is no friction or no case of sparking. State “y” includes the states in which the value of the quantised signal is unequal to the signal found.

Consider the case of state machine 2, the state machine consists of of two states x and y. “x”refers to the state in which the either the train is not present over the rails or the there is no problem over the rails. The state “y” is the state in which the value of the distance found is less or more then the value of the of the actual distance.



Consider the case of state machine in this case, the state “x” refers to the state in which either the train is not present over the rails or there is no bomb this is (0/0). The case of state “y” in which there is presence of bomb over the train. When the bomb is present over the train then the state changes as the state is changed from x from y.

PROBLEMS

The major problem regarding this system is the presence of more then one problem at one time. The system can hang as there if more then one problem exists. This problem can be solved by providing a priority encoder. The priority encoder will provide the priority to the first problem. So if the other problem is present, then it can be detected by the next (same) circuitry. The next circuitry here defines as the circuit present over the next rails.

CONCLUSIONS

This paper discuss the proper way through which the major accidents regarding the train can be avoided or earlier by the mean of electronics instrumentation circuitry. The major block diagram and the individual circuitries are explained. The major circuitry may consists of some problem which are also discussed. An alternative is also provided in the paper which can solve the problem.

REFERENCES

1. E. J. Mc Cluskey, Introduction to the Theory of Switching Circuits. New York: McGraw-Hill, 1965.
2. J. F. Poage, "Derivation of optimum tests to detect faults in combinational circuits," in Proc. Symp. Mathematical Theory of Automata. Brooklyn, N.Y.: Polytechnic Press, 1963..