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Automatic Railway Gate Control System

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I. ABSTRACT

The objective of this paper is to control the railway tracks by using anti-collision techniques. The model of railway track controller is designed to avoid railway accidents. When we go through the daily newspapers we come across many railway accidents occurring at unmanned railway crossings. This is mainly due to the carelessness in manual operations or lack of workers. And also the collision of two trains due to the same track. This model is implemented using sensor technique. We placed the sensors at a certain distance from the gate detects the approaching train and accordingly controls the operation of the gate. Also an indicator light has been provided to alert the motorists about the approaching train. The arrival and leaving of the system is monitored and the gate is operated accordingly.

II. INTRODUCTION

The objective of this paper is to provide an automatic railway gate at a level crossing replacing the gates operated by the gatekeeper. It deals with two things. Firstly, it deals with the reduction of time for which the gate is being kept closed. And secondly, to provide safety to the road users by reducing the accidents. By the presently existing system once the train leaves the station, the stationmaster informs the gatekeeper about the arrival of the train through the telephone. Once the gatekeeper receives the information, he closes the gate depending on the timing at which the train arrives. Hence, if the train is late due to certain reasons, then gate remain closed for a long time causing traffic near the gates. By employing the automatic railway gate control at the level crossing the arrival of the train is detected by the sensor placed near to the gate. Hence, the time for which it is closed is less compared to the manually operated gates and also reduces the human labour. This type of gates can be employed in an unmanned level crossing where the chances of accidents are higher and reliable operation is required. Since, the operation is automatic, error due to manual operation is prevented. Automatic railway gate control is highly economical arrangement, designed for use in almost all the unmanned level crossings in the country.

III. SCHEMATIC DIAGRAM

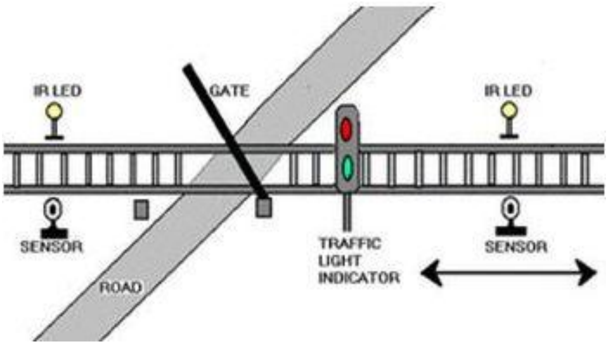

Fig.1 Railway Crossing

IV. INTERFACING OF SERVO MOTOR

A servo is a mechanical motorized device that can be instructed to move the output shaft attached to a servo wheel or Arm to a specific position .Inside the servo box is a dc motor mechanically linked to a position feedback potentiometer, Gearbox,

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electronic feedback control loop circuitry and a motor drive electronic circuit as shown in fig.2.

Servos are controlled by sending them a pulse of variable width. The control wire is used to send this pulse. The parameters for this pulse are that it has a minimum pulse, a maximum pulse, and a repetition rate. Given the rotation constraints of the servo, neutral is defined to be the position where the servo has exactly the same amount of potential rotation in the clockwise direction as it does in the counter clockwise direction. It is important to note that different servos will have different constraints on their rotation but they all have a neutral position, and that position is always around 1.5 milliseconds (ms).

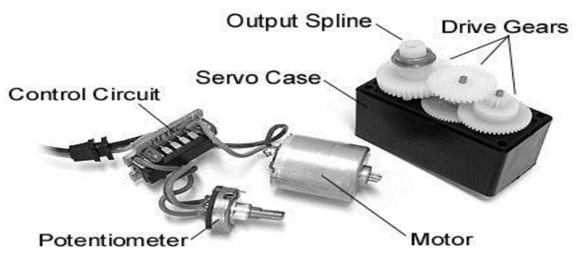

Fig.2 Servo-Components

The angle is determined by the duration of a pulse that is applied to the control wire. This is called Pulse Width Modulation. The servo expects to see a pulse every 20ms. The length of the pulse will determine how far the motor turns. For example, a 1.5 ms pulse will make the motor turn to the 90 degree position(neutral position).When these servos are commanded to move they will move to the position and hold that position. If an external force pushes against the servo while the servo is holding a position, the servo will resist from moving out of that position. The maximum amount of force the servo can exert is the torque rating of the servo. Servos will not hold their position forever though; the position pulse must be repeated to instruct the servo to stay in position.

V. IR TRANSCEIVER

IR transceiver is used here for determining the arrival and departure of train. This is done by using IR Transceiver in which presence of train is detected as logical zero.

A. TRANSMITTER

The Infrared Emitting Diode(IR333/H0/L10) is a high intensity diode, molded in a blue transparent package. The device is spectrally matched with phototransistor, photodiode and IR receiver module. It finds applications in IR remote control units, smoke detectors, free air transmission systems etc.

B. RECEIVER

The IR LED converts the incident IR radiations to an equivalent electric current which when passed through a resistor results in a certain amount of voltage drop. This value of voltage will depend upon the intensity of incident IR radiations or in other words, the distance between IR transmitter and receiver. The receiver is connected in reverse bias in the circuit. The IR rays emitted by the transmitter get reflected back after hitting the target. Receiver coverts this received radiations to a corresponding electric current.

VI. DESCRIPTION

A. CIRCUIT DIAGRAM

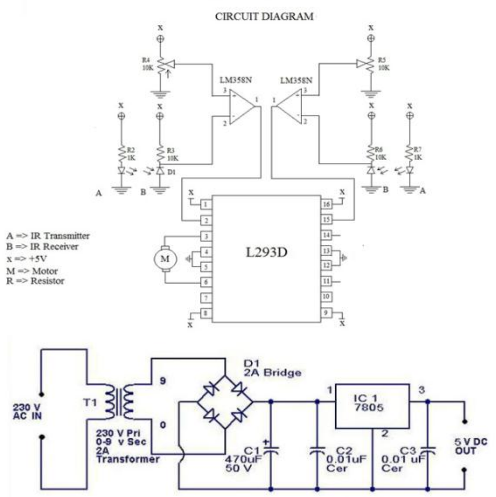

Fig.3 Circuit diagram

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One of the major advantages of this system is its simple circuit and working principle. The circuit is divided into two parts. First one is the IR sensor section kept on rail and third is the servo motor which is used to operate the gate. All of them are discussed in detail in coming sections. The fig.3 shows the detailed circuit diagram of the system. By employing the automatic railway gate control at the level crossing the arrival of train is detected by the sensor placed on either side of the gate at about 5km from the level crossing. Once the arrival is sensed, the sensed signal is checks for possible presence of vehicle between the gates, again using sensors. Subsequently, buzzer indication and light signals on either side are provided to the road users indicating the closure of gates. Once, no vehicle is sensed in between the gate the motor is activated and the gates are

closed. But, for the worst case if any obstacle is sensed it is indicated to the train driver by signals (RED) placed at about2km and 180m, so as to bring it to halt well before the level crossing.

WORKING METHODOLOGY:

In this paper we are concerned of providing an automatic railway gate control at unmanned level crossings replacing the gates operated by gate keepers and also the semi-automatically operated gates. It deals with two things. Firstly, it deals with the reduction of time for which the gate is being kept closed. And secondly, to provide safety to the road users by reducing the accidents that usually occur due to carelessness of road users and at times errors made by the gatekeepers.
By employing the automatic railway gate control at the level crossing the arrival of train is detected by the sensor placed on either side of the gate at about 5km from the level crossing. Once the arrival is sensed, the sensed signal is sent to the microcontroller and it checks for possible presence of vehicle between the gates, again using sensors. Subsequently, buzzer indication and light signals on either side are provided to the road users indicating the closure of gates. Once, no vehicle is sensed in between the gate the motor is activated and the gates are closed. But, for the worst case if any obstacle is sensed it is indicated to the train driver by signals(RED) placed at about 2km and 180m,so as to bring it to halt well before the level crossing. When no obstacle is sensed green light is indicated, and the train is to free to move. The departure of the train is detected by sensors placed at about 1km from the gate. The signal about the departure is sent to the microcontroller, which in turn operates the motor and opens the gate. Thus, the time for which the gate is closed is less compared to the manually operated gates since the gate is closed depending upon the telephone call from the previous station. Also reliability is high as it is not subjected to manual errors.

B. GATE CONTROL

Railways being the cheapest mode of transportation are preferred over all the other means .When we go through the daily newspapers we come across many railway accidents occurring at unmanned railway crossings. This is mainly due to the carelessness in manual operations or lack of workers. We, in this project have come up with a solution for the same. Using simple electronic components we have tried to automate the control of railway gates. As a train approaches the railway crossing from either side, the sensors placed at a certain distance from the gate detects the approaching train and accordingly controls the operation of the gate. Also an indicator light has been provided to alert the motorists about the approaching train.

C. INFRARED CIRCUITS

IR CIRCUITS: This circuit has two stages: a transmitter unit and a receiver unit. The transmitter unit consists of an infrared LED and its associated circuitry.

IR TRANSMITTER: The IR LED emitting infrared light is put on in the transmitting unit. To generate IR signal, LM358 IC based operational amplifier is used.

IR RECEIVER: The receiver unit consists of a sensor and its associated circuitry. In receiver section, the first part is a sensor, which detects IR pulses transmitted by IR-LED.

D. STEPPER MOTOR:

Stepper motors convert electrical energy into precise mechanical motion. These motors rotate a specific incremental distance per each step. The number of steps executed controls the degree of rotation of the motor's shaft. This characteristic makes step motors excellent for positioning applications. For example, a 1.8° step motor executing 100 steps will rotate exactly 180° with some small amount of non-cumulative error. The speed of step execution controls the rate of motor rotation. A 1.8° step motor executing steps at a speed of 200 steps per second will rotate at exactly 1 revolution per second.

Stepper motors can be very accurately controlled in terms of how far and how fast they will rotate. The number of steps the motor executes is equal to the number of pulse commands it is given. A step motor will rotate a distance and at a rate that is proportional to the number and frequency of its pulse commands.

V. CONCLUSION

The circuit for our project was designed and set up in a breadboard. It is found to be very reliable and stable. The circuit was able to control the railway gate precisely. The circuit was tested in both direction and worked perfectly. Our project is a necessary tool for today's railway crossings due to the increased number of accidents and also due to the problems occurring to the road passenger's while waiting a longer time during the passage of train unnecessarily.

VI. ACKNOWLEDGMENT

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