SENSOR BASED AUTOMATIC CONTROL OF RAILWAY GATES

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ABSTRACT

From this project we'll know how to implement the automation in railway gate control using Arduino. Application of this project is direct implementation in real world. Some components will required more but the main working principle will be same. Now, other alerting systems can also be developed by using various controllers. The main aim of this project is to reduce train accidents at railway level crossings.

Keywords:- *Railway-gate, IR-sensors, Arduino UNO, Stuck detection, Alarm generator.*

1.INTRODUCTION

The Level crossing is that area where track and highway/road intersects each other at the same level. To prevent the accidents a system "Level Crossing" has been developed. But in now a days all the level crossings were operated by humans. So human interference was mandatory. But manual control is not error free. The railway gate crossing is opened or closed by a gatekeeper who was informed from the nearest railway station about the arrival of a train. There are many level crossings in India which are unmanned. So they are potentially dangerous for road users. In India develop a prototype for automatically control railway gate upon arrival of train. The project should not expensive. So we used Arduino UNO R3 which is quite reliable as well as affordable. We started to develop our project based upon ATmega328p microcontroller which is also cheaper then Arduino. But for reliability and implementation of featured we upgraded to Arduino UNO. A level crossing is an area where a railway track crosses a road at the same level, as opposed to the railway line crossing over using a bridge or tunnel. Another names for level crossing are railway level crossing, grade crossing, road through railroad, railroad

crossing, train crossing. India having a world's largest railway network. More than hundreds of railways running on track every day. As railway has straightway running so it has dangerous as per as general public and traffic concern. As we know that it is not possible to stop the running train at instant is some critical situation or emergency arises. Level crossings are common in many areas, as they protected the railway from people trespassing and livestock, and they protected the users of the crossing when closed by the gateman. Automatic crossings are now common in some countries as motor vehicles replaced horse-drawn vehicles and the need for animal protection diminished with time.

2.LITERATURE SURVEY

Xishi discussed about the advanced train safety system. They defined that in the process of developing ATSS, a fault tolerance method is applied for both the hardware and the software components. The railway gate automation system is successively implemented since 2000 in Korea. The implementation of the system effectively reduced the accident rate at the level cross and the sensors used in the Korean railway gate automation system is magnetic sensors. Magnetic sensors placed underground are less affected by environmental changes and recognizes the direction of movement of vehicles [2]. Jeong [3] defined the railway auto control system using OGSi and JESS. The method by which the state of railway cross is estimated using

JESS is described in their paper. The different methods with which the locomotive pilots can avoid the accident situations and the safety measures to be taken in the level crossings are also discussed. In [4], a detailed introduction about the present railway technology is presented.It discusses the disadvantages of manually activated railway signals and the railway warnings at the level cross. The train detectors acts as the major component in the train automation system**.**

3.1. Arduino UNO

It is a microcontroller board developed by Arduino.cc and based on Atmega328. Arduino is an open-source prototyping platform in electronics based on easy-to-use hardware and software. Subtly speaking, Arduino is a microcontroller based prototyping board which can be used in developing digital devices that can read inputs like finger on a button, touch on a screen, light on a sensor etc. and turning it in to output like switching on an LED, rotating a motor, playing songs through a speaker etc.UNO is based on ATmega328P microcontroller. There are two variants of the Arduino UNO: one which consists of through – hole microcontroller connection and other with surface mount type. Through-hole model will be beneficial as we can take the chip out in case of any problem and swap in with a new one. Arduino UNO comes with different features and capabilities. As mentioned earlier, the microcontroller used in UNO is ATmega328P, which is an 8-bit microcontroller based on the AVR architecture.

Fig -1: Arduino UNO

3.2. Ultrasonic Sensor

Ultrasonic sensors work by sending out a sound wave at a frequency above the range of human hearing. The transducer of the sensor acts as a microphone to receive and send the ultrasonic sound. Our ultrasonic sensors, like many others, use a single transducer to send a pulse and to receive the echo.

Typically, a microcontroller is used for communication with an ultrasonic sensor. To begin measuring the distance, the microcontroller sends a trigger signal to the ultrasonic sensor. The duty cycle of this trigger signal is 10µS for the HC-SR04 ultrasonic sensor. When triggered, the ultrasonic sensor generates eight acoustic (ultrasonic) wave bursts and initiates a time counter. As soon as the reflected (echo) signal is received, the timer stops. The output of the ultrasonic sensor is a high pulse with the same duration as the time difference between transmitted ultrasonic bursts and the received echo signal.

Fig-2: Ultrasonic Sensor

3.3. IR Sensor

An infrared (IR) sensor is an electronic device that measures and detects infrared radiation in its surrounding environment. Infrared radiation was accidentally discovered by an astronomer named William Herchel in 1800.

While measuring the temperature of each colour of light (separated by a prism), he noticed that the temperature just beyond the red light was highest. IR is invisible to the human eye, as its wavelength is longer than that of visible light (though it is still on the same electromagnetic spectrum).

Fig-3: IR Sensor

3.4. Servo Motor

The servo motor is a closed-loop mechanism that incorporates positional feedback in order to control the rotational or linear speed and position. The motor is controlled with an electric signal, either Analog or digital, which determines the amount of movement which represents the final command position for the shaft.
A servomotor is a closed loop servomechanism that uses position feedback to control its motion and final position. The input to its control is a signal (either analogue or digital) representing the position commanded for the output shaft.
The motor is paired with some type of position encoder to provide position and speed feedback. In the simplest case, only the position is measured. The measured position of the output is compared to the command position, the external input to the controller. If the output position differs from that required, an error signal is generated which then causes the motor to rotate in either direction, as needed to bring the output shaft to the appropriate position. As the positions approach, the error signal reduces to zero and the motor stops.
The very simplest servomotors use position-only sensing via a potentiometer and bang-bang control of their motor; the motor always rotates at full speed (or is stopped). This type of servomotor is not widely used in industrial motion control, but it forms the basis of the simple and cheap servos used for radio-controlled models. More sophisticated servomotors use optical rotary encoders to measure the speed of the output shaft and a variable-speed drive to control the motor speed. Both of these enhancements, usually in combination with a PID control algorithm, allow the servomotor to be brought to its commanded position more quickly and more precisely, with less overshooting.

Fig-4: Servo Motor

4.WORKING METHOD

When we turn ON the circuit there is no IR radiation towards photodiode and the Output of the comparator is LOW. When we take some object (not black) in front of IR pair, then IR emitted by IR LED is reflected by the object and absorbed by the photodiode. Now when reflected IR Falls on Photodiode, the voltage across photodiode drops, and the voltage across series resistor R2 increases. When the voltage at Resistor R2 (which is connected to the non-inverting end of comparator) gets higher than the voltage at inverting end, then the output becomes HIGH and LED turns ON. Voltage at inverting end, which is also called Threshold Voltage, can be set by rotating the variable resistor's knob. Higher the voltage at inverting end (-), less sensitive the sensor and Lower the voltage at inverting end (-), more sensitive the sensor.

5. BLOCK DIAGRAM

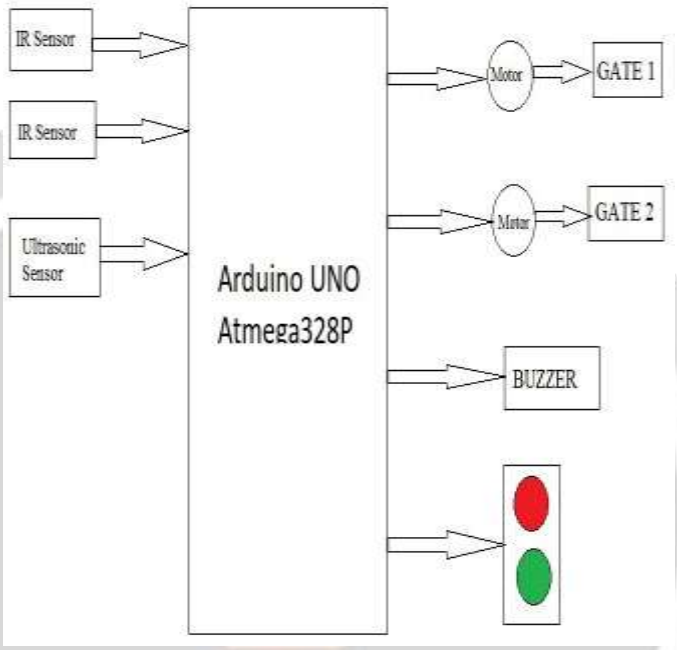

Fig-5: Block Diagram

6.OPERATION

The working principle of the prototype is quite simple. Two IR sensors are placed at the both sides of railway crossing. They are placed 1Km apart from level crossing. The arrival or departure of train is sensed by the IR sensors and transmitted to the Arduino uno. There is a loop that keeps running in the Arduino that always checks the IR sensor output. If the IR sensor outputs the signal, the Arduino instructs the Servo motor to close the gate and play the buzzers to alert the road users. The Servo motor exactly rotated at 90 degrees and the railway gate gets closed. After passing the train the departure is sensed by another IR sensor which is placed at the opposite side of the other IR sensor. When the departure is sensed by another IR sensor the Arduino gets the acknowledgement signal to open the gate. The delay between sensed signal and closing of gate is kept small here(500ms). But in real life the delay is more.

7.CONCLUSION

To save the humans and vehicles from train accidents is a challenge for modern technology. TheWorking model was design under the laboratory premises. The results shows that it is one of the expedient approach for secure railway system. The IR sensors detects the train and the Ultrasonic sensor detects the stuck on the level crossing and communicate with the control unit. The control unit takes proper steps which lead the train and vehicles movements either to move forward or to avoid collision. Also this system plays a great role in automation of railway gate with lower cost and reliability.

8.REFRENCES

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