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DEVELOPMENT OF ADVANCED AUTOMATED RAILWAY GATE CONTROL SYSTEM

K.C.Shanmugapriya, R.Paarthasarathy, M.Siva kumar, G.Thenilavan
Assistant professor, Electronics and Instrumentation Engineering, Sri Ramakrishna Engineering College, Coimbatore, India1
Student, Final year, Electronics and Instrumentation Engineering, Sri Ramakrishna Engineering College, Coimbatore, India2
Student, Final year, Electronics and Instrumentation Engineering, Sri Ramakrishna Engineering College, Coimbatore, India3
Student, Final year, Electronics and Instrumentation Engineering, Sri Ramakrishna Engineering College, Coimbatore, India4

ABSTRACT:

Now a day's every system is automated in order to face new challenges. In the present days, automated systems have less manual operations, as they are flexible, reliable and accurate. Due to this, every one prefers automated control systems. Especially in home and industrial electronics, an automated system is performance effective and requires no human intervention. Hence it is very useful to do operations like liquid dispensing. Proposed project is designed using microcontroller and IR sensors to avoid railway accidents happening at unattended railway gates. This project utilizes two powerful IR transmitters and two receivers; one pair of transmitter and receiver is fixed upside from where the train comes at a level higher than a human being, in exact alignment and similarly the other pair is fixed at down side of the train direction. Sensor activation time is adjusted
by calculating the time taken at a certain speed to cross at least one compartment of standard minimum size of the locomotive fixed by the Indian railway. Here, we have considered 5 seconds as the activation time. Sensors are fixed at 1km on both sides of the gate. We call the sensor along the
train direction as 'foreside sensor' and the other as backward side sensors.

KEYWORDS:

LabVIEW, IR Sensor, DC motor, DC RPS.

1.INTRODUCTION

The main purpose of this project is to avoid railway accidents happening at unattended railway gates with the help of IR sensors and LabVIEW tool. Now a day's every system is automated in order to face new challenges. In the present days, automated systems have less manual operations, as they are flexible, reliable and accurate. Due to this, every one prefers automated control systems. Especially in home and industrial electronics, an automated system is performance effective and requires no human intervention. Hence it is very useful to do operations like liquid dispensing. Proposed project is designed using microcontroller and IR sensors to avoid railway accidents happening at unattended railway gates. This project utilizes two powerful IR transmitters and two receivers; one pair of transmitter and receiver is fixed upside from where the train comes at a level higher than a human being, in exact alignment and similarly the other pair is fixed at down side of the train direction. Sensor activation time is adjusted by calculating the time taken at a certain speed to cross at least one compartment of standard minimum size of the locomotive fixed by the Indian railway. Here, we have considered 5 seconds as the activation time. Sensors are fixed at 1km on both sides of the gate. We call the sensor along the train direction as ‘foreside sensor’ and the other as ‘backward side sensor’.

When foreside receiver gets activated, the gear motor at the gate is turn in one direction and the gate is closed, and stays closed until the train crosses the gate and reaches backward side sensors. Virtual instrumentation is the use of customizable software and modular measurement hardware to create user defined measurement systems, called virtual instruments. Traditional hardware instrumentation systems are made up of predefined hardware components, such as digital multi-meters and oscilloscopes that are completely specific to their stimulus, analysis, or measurement function. Because of their hardcoded function, these systems are more limited in their versatility than virtual instrumentation systems. The primary difference between hardware instrumentation and virtual instrumentation is that software is used to replace a large amount of hardware. The software enables complex and expensive hardware to be replaced by already purchased computer hardware. Additionally, software packages like National Instruments LabVIEW and other graphical programming languages helped grow adoption by making it easier for non-programmers to develop systems. LabVIEW is a system-design platform and development environment for a visual programming language from National Instruments. This programming approach helps the user to handle the programs much efficiently with proper equipped knowledge which generates easy understanding and better reliability of the programming methodology.

2. BLOCK DIAGRAM EXPLANATION

This chapter describes briefly about the various hardware components and their function in the automated railway gate control using IR sensors in LabVIEW. Flow diagram is a collective term for a diagram representing a flow or set of dynamic relationships in a system. The term flow diagram is also used as synonym of the flowchart, and sometimes as counterpart of the flowchart. Flow diagrams are used to structure and order a complex system, or to reveal the underlying structure of the elements and their interaction.

The Fig.1.shows the flow diagram of the process. The DC motor is supplied with power and the object under test is placed over it at position 1.As the object is sensed by the sensor at position, the gear motor closes the gate. Using the required DAQ interface, the signals are interfaced with the simulation process. After the process, the output signal is sent to the DC motor which is used to open the gate. It could be in the form of modules that can be connected to the computer's ports or cards connected to slots in the motherboard

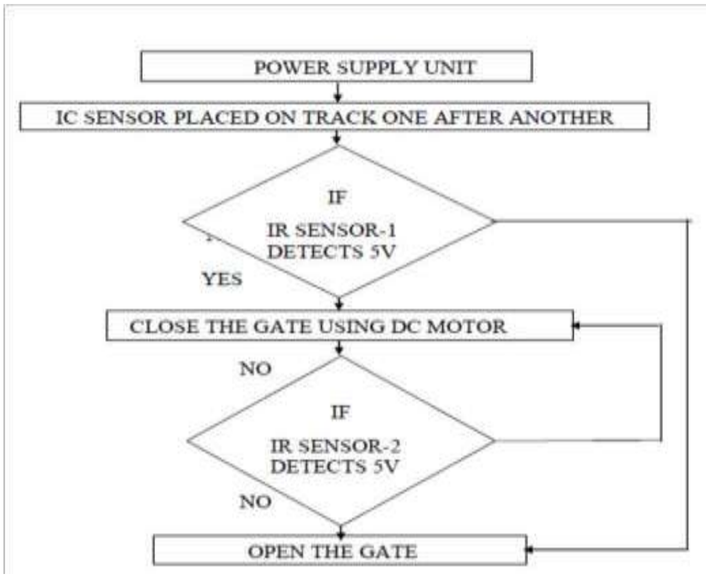

Fig.1.Block diagram of hardware setup

3. HARDWARE DESCRIPTION

Infrared sensor to detect the objects.IR transmitter has an LED which emits infrared rays generally called as IR Transmitter. Similarly IR Receiver photo diode is used to receive the IR rays transmitted by the IR transmitter. One important point is both IR transmitter and receiver should be placed in a straight line. The signal to be transmitted is given to IR transmitter whenever the signal is high, the LED in the IR transmitter conducts, and passes the IR rays to the receiver.

The IR receiver is connected with comparator. The comparator is constructed with LM 741 operational amplifier. In the comparator circuit the reference voltage is given to inverting input terminal. The non inverting input terminal is connected IR receiver. When there's an interrupt, the IR receiver does not conducting. So the comparator non inverting input terminal voltage is higher than inverting input. Now the comparator output is in the range of +12V.This voltage is given to base of the transistor Q1. Hence the transistor is conducting. Here the transistor act as switch so the collector and emitter will be closed. The output is taken from collector terminal.

Now the output is zero. When IR transmitter passes the rays to receiver, the IR receiver is conducting due to that non inverting input voltage is lower than inverting input. Now the comparator output is -12V so the transistor is cutoff region. The 5v is given to 40106 IC which is the inverter with buffer. The inverter output is given to microcontroller or PC. This circuit is mainly used to for counting application, intruder detector etc. A DC motor relies on the fact that like magnet poles repel and unlike magnet pole attract each other.

The motor's position can then be commanded to move and hold at one of these steps without any feedback sensor, as long as the motor is carefully sized to the application. A simple DC motor typically has a stationary set of magnets in the stator and an armature with a series of two or more windings of wire wrapped in insulated stack slots around iron pole pieces (called stack teeth) with the ends of the wires terminating on a commutator. The armature includes the mounting bearings that keep it in the center of the motor and the power shaft of the motor and the commutator connections. Switched reluctance motors are very large stepping motors with a reduced pole count, and generally are closed-loop commutated. A step motor can be viewed as a synchronous AC motor with the number of poles increased, taking care that they have no common denominator.

Additionally, soft magnetic material with many teeth on the rotor and stator cheaply multiplies the number of poles. Modern steppers are of hybrid design, having both permanent magnets and soft iron cores. To achieve full rated torque, the coils in a stepper motor must reach their full rated current during each step. Winding inductance and reverse EMF generated by a moving rotor tend to resist changes in drive current, so that as the motor speeds up, less and less time is spent at full current thus reducing motor torque. As speeds further increase, the current will not reach the rated value, and eventually the motor will cease to produce torque. It consists of a suitable motor coupled to a sensor for position feedback. It also requires a relatively sophisticated controller, often a dedicated module designed specifically for use with servomotors. DC motors are not a specific class of motor although the term servomotor is often used to refer to a motor suitable for use in a closed-loop control system. The fig.2.shows the physical hardware setup of the proposed project. The Hardware consists of the gate with motors, power supply unit and the IR sensor.

Fig.2.Setup of Automated Railway Gate Control System Hardware

4. SOFTWARE DESCRIPTION

In this chapter the brief description about the use of LabVIEW in our project is explained and the loops & symbols, associate functions, toolkits and interfacing methods using LabVIEW software are explained.

Data acquisition is the process of sampling signals that measure real world physical conditions and converting the resulting samples into digital numeric values that can be manipulated by a computer. Data acquisition systems (abbreviated with the acronym DAS or DAQ) typically convert analog waveforms into digital values for processing.

The components of data acquisition systems includes Sensors that convert physical parameters to electrical signals, Signal conditioning circuitry to convert sensor signals into a form that can be converted to digital values. Analog-to-digital converters, which convert conditioned sensor signals to digital values.

Data acquisition applications are controlled by software programs developed using various general purpose programming languages such as BASIC, C, Fortran, Java, Lisp, Pascal. The DAQ series we used in our project is NI-USB 6009.

The National Instruments USB-6009 provides basic data acquisition functionality for applications such as simple data logging, portable measurements, and academic lab experiments. It is affordable for student use and powerful.

LabVIEW Signal Express LE so you can quickly acquire, analyze, and present data without programming. In addition to Every NI USB data acquisition device includes a copy of NI LabVIEW Signal Express, USB data acquisition modules are compatible with the following versions (or later) of NI application software USB data acquisition modules are also compatible with Visual Studio .NET, C/C++, and Visual Basic 6.

The block diagram contains graphical source code. Front panel objects appear as terminals on the block diagram. Terminal cannot be deleted from the block diagram. The terminal disappears only after corresponding object on the front panel gets deleted. Every control or indicator on the front panel has a corresponding terminal on the block diagram. The front panel is the user interface of the VI. It is build the front panel with controls and indicators, which are the interactive input and output terminals of the VI, respectively. Controls are knobs, push buttons, dials, and other input devices. Output devices and supply data to the block diagram of the VI. Indicators simulate Indicators are graphs, LEDs, and other displays. Control simulates instrument output devices and display data the block diagram acquires or generates.

DAQ hardware is what usually interfaces between the signal and a PC. It could be in the form of modules that can be connected to the computer's ports or cards connected to slots in the motherboard. Usually the space on the back of a PCI card is too small for all the connections needed, so an external breakout is required. The cable between this box and the PC can be expensive due to the many wires, and the required shielding. DAQ cards often contain multiple components (multiplexer, ADC, DAC, TTLIO, high speed timers, RAM). These are accessible via a bus by a microcontroller, which can run small programs.

A controller is more flexible than a hard wired logic, yet cheaper than a CPU so that it is permissible to block it with simple polling loops. For example: Waiting for a trigger, starting the ADC, looking up the time, waiting for the ADC to finish, move value to RAM, switch multiplexer, get TTL input, let DAC proceed with voltage ramp. DAQ software is needed in order for the DAQ hardware to work with a PC.

The device driver performs low-level register writes and reads on the hardware, while exposing a standard API for developing user applications. A standard API such as COMEDI allows the same user applications to run on different operating systems, e.g. a user application that runs also run on Linux.

5. SIMULATION RESULT

After building the front panel, it is added with source code using graphical representations of functions to control the front panel objects. The block diagram shown in the fig.3.contains the graphical source code. Front panel objects appear as terminals on the block diagram.

Terminal cannot be deleted from the block diagram. The terminal disappears only after corresponding object on the front panel gets deleted. Every control or indicator on the front panel has a corresponding terminal on the block diagram.

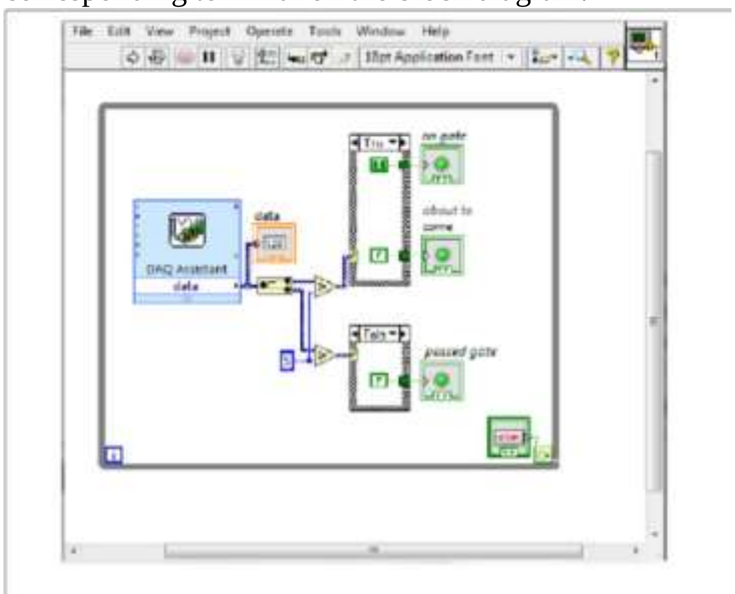

Fig.3.Block Diagram of Simulation

The front panel shown in the fig.4.is the user interface of the VI. It is build in the front panel with controls and indicators, which are the interactive input and output terminals of the VI, respectively.

Controls are knobs, push buttons, dials, and other input devices. Indicators are graphs, LEDs, and other displays. Control simulates instrument output devices and supply data to the block diagram of the VI. Indicators simulate instrument output devices and display data the block diagram acquires or generates.

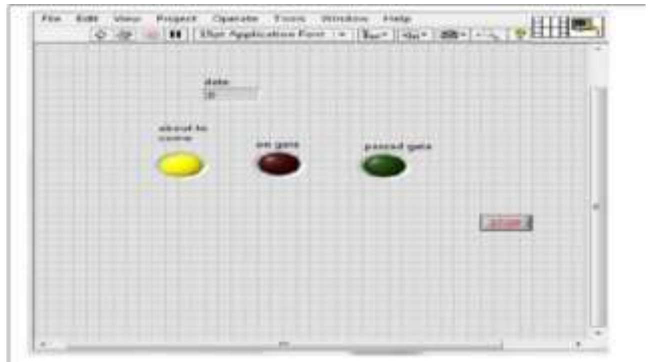

Fig.4.Front Panel of Simulation

6. CONCLUSION

The results are shown for the LabVIEW based automated railway gate system. Some of the most important feature is to avoid unwanted accident. The PC-based simulated control system is found to be effective. It integrates both hardware and software. Designing a low cost machine system with sophisticated software that enables automatic defect detection in object accomplishes this goal. The complete project is simple, inexpensive and efficient. The main purpose of this paper is to control the railway gate without mankind action at present. The inspection procedure is automatic and straight forward. The system consider real-time control, portability, robustness and cost.

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