Mobile Railway Platform with Power Generation

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Abstract: The Primary objective of Automatic Railway Bridge System is to help the physically Challenged Passenger to move from one Platform to another. Crossing the railway track inside the railway station is very difficult. But it is quite difficult to the handicapped and aged persons to cross the railway track without the help of others. In this paper the agents make use of a set of resources – train characteristics, driving rules and information about other trains - to generate their action policy. The proposed system uses the train time for opening and closing of bridges. It also confirms the presence of the train using a sensor which is placed at a certain distance away from the platform. And by use of kinetic energy generated by pedestrian walking on bridge energy can be generated by piezoelectric crystals, This energy then can be used for lighting the station premises and to supply power to motors working in bridge operation .

Index Terms - Sensor, Controller, Bridge, Piezoelectric generation.

I. INTRODUCTION

The Indian railway network is the one of the biggest rail network in the Asia. Railways are recognized as a one of The safest mode of mass transportation and Safety has been recognized as the key issue for the railways networks. to make it a safe and reliable system is an enormous challenge. Unmanageable platform crossings are one of the problem areas for the Indian Railways, and one of the major issues of death. In spite of various measures taken by the Indian Railways, platform crossing deaths have continued to occur, that too frequently. Crossing the railway track inside the railway station is very tedious especially for handicapped and disabled person. They find it quite difficult to walk over the over bridge for crossing the platform. To solve this problem we use a new approach called Automatic Railway Bridge System. This can be installed in major subway stations and stations where the distance between platforms can be reduced the primary objective is to demonstrate the improvement of the train self capability in determining its own position and velocity which will help in stopping the train if necessary. This paper introduces overall system overview, configuration and detection process of the system

The proposed system has to overcome the difficulties in the existing system. It is planned to go with a pair of ultrasonic sensors on the either side of the railway station at certain distance. Initially, the flexible bridge is connected between the platforms which are fixed at one end and other end is movable by the functioning of the sensors and control unit. The sensors are connected to the Arduino Uno R3 microcontroller it is programmed with the logic and it is connected to the L293d driver circuit and the driver circuit is connected with the Geared motor. The function of the L293d driver circuit is to change the polarity of the terminals of motor to change the direction of the rotation of the motor shaft. The Geared motor is used to control the speed of the motor. Thus the sequential function of the connected components are controls the movements of the bridge perfectly. The piezoelectric crystals are use on the both side of the platform to generate energy from the movement of people who are crossing the bridge from one platform to another.

LITERATURE SURVEY

BACKGROUND STUDY:

Acy M. Kottalil, Abhijith S, Ajmal M M, Abhilash L J, AjithBabu. The research work carried out by above mentioned authors mainly focus on preventing of skilled worker to operate railway gate near Level crossings by establishing AT mega 16A microcontroller and IR sensors based systems to control gate opening and closing by receiving the signals accordingly

The paper describes automatic railway gate systems by using PIC 16F877A Microcontroller for saving precious Haman lives. Here Inductive and IR sensors used as input components while buzzer, light indicator, DC motor and LCD display are the output components Krishna, ShashiYadav, and Nidhi The paper deals with control the railway track by using a anti-collision technique, the entire system is modelled and controlled by 8952 microcontroller to avoid the railway accidents.

J. Banuchandar, V.kaliraj, P.Balasubramanian, N.Thamilarsi. The paper written by these authors mainly put a spot light on two things; one is the reduction of time for which the gate is being kept closed. And secondly, provide a safety to the road users to reduce the accidents by using unmanned way of opening the railway gate. HninNgwe Yee Pwint, ZawMyoTun, HlaMyo Tun.

Train to opening and closing of both railway gate and plat form bride, in this work focus should be taken to implement new additional feature which will finally makes feel free from accidents, waiting time and ease of crossings the platform with highly sensitive controlling systems.

RELATED WORK:

As per the statistics provided by the railways in south western division (SWR), there are 1270 Level Crossings of which 750 are manned and 520 are unmanned. Overall, the state has 445 unmanned level crossings spread across Karnataka. Let's take a look on the approach of Level crossings across the worlds as given bellow, "

2.1 Asia All Indonesia level crossings are operated automatically and use sirens in place of conventional bells.

2.2 Hong Kong The underground railway network or elevated viaduct is most common in Hong Kong, this means the use of automated Level crossing are rare

2.3 Japan The Japan also deployed underground railway network system across different cities, but it has established around 34000 Level crossings all around

SYSTEM ARCHITECTURE:-

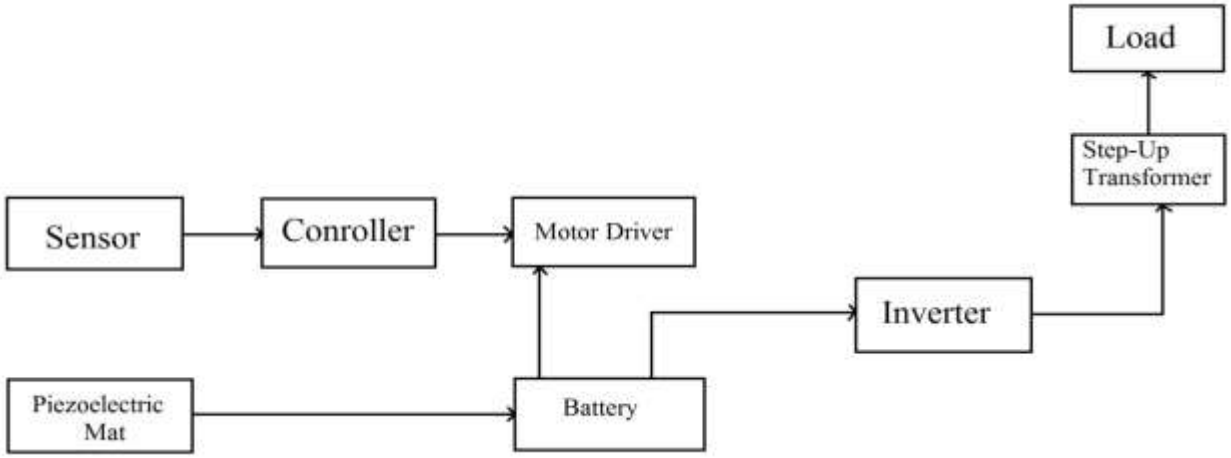

Fig. Internal Block Diagram

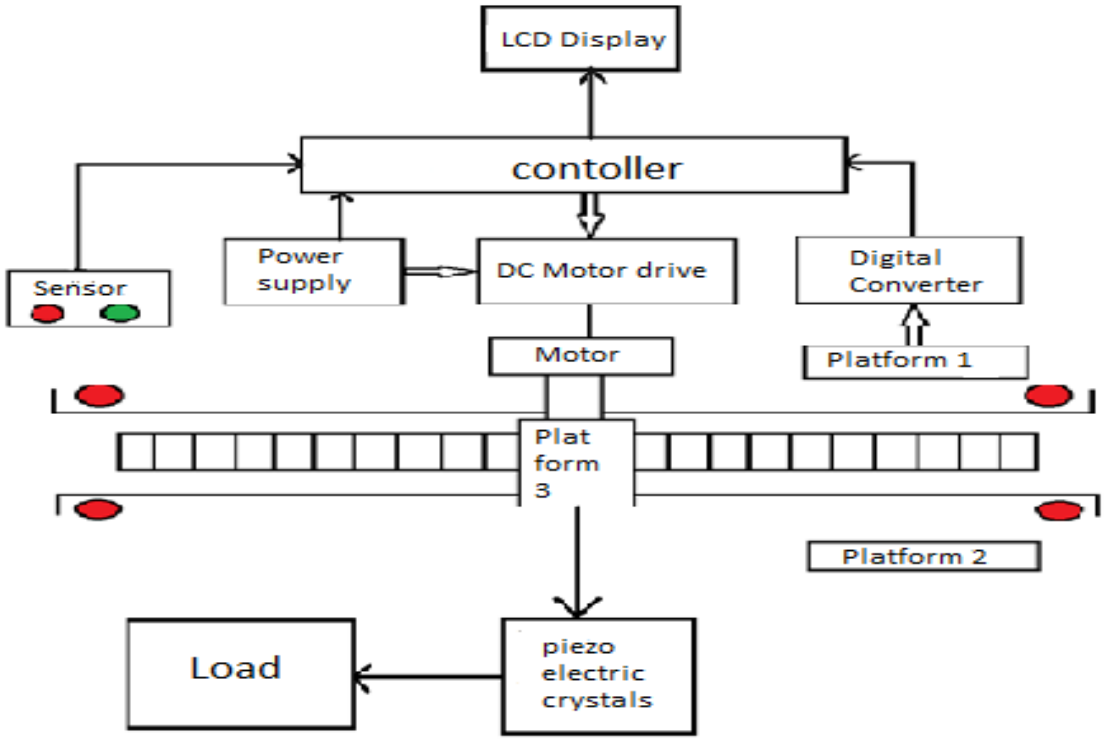

Fig. Working Block Diagram

WORKING PRINCIPAL

In the system there are two ultrasonic sensors placed at a distance from station platforms
One sensor detects the arrival of train and sends signal to controller which rotate the motor in backward direction as motor rotate backward it will take bridge to its initial position
So train can easily arrive in the station without any hassle
After the train departs its departure is detected by the sensor placed at the distant from station which will send signal to controller to rotate the motor in forward direction

As motor rotates in forward direction it connects both the bridges again so that people can walk easily walk over the bridge and cross the two platform easily with help of this mobile bridge As a lot of people will move from one platform to other through the bride it will great a large amount of energy which will due to the foot movement of everyone so this kinetic energy can be easily converted into the electrical energy by means of piezoelectric crystals This energy generated by piezoelectric crystals can be stored in battery which can used for illuminating the station premises or this electric energy can be utilized to supply power to motor

By use of this electrical power generated by use of foot step generation the energy demand for motor will reduce which will help in reduce the cost of electricity billing.

REQUIRED COMPONENTS

1) TRANSFORMER: It is the device which step up or step down the AC electrical power. In this project we are using step down transformer for the DC Circuit operation. A transformer is an electrical device that transfers electrical energy between two or more circuits through electromagnetic induction. A varying current in one coil of the transformer produces a varying magnetic field, which in turn induces a varying electromotive force (emf) or "voltage" in a second coil. Power can be transferred between the two coils through the magnetic field, without a metallic connection between the two circuits. Faraday's law of induction discovered in 1831 described this effect. Transformers are used to increase or decrease the alternating voltages in electric power applications.

Since the invention of the first constant-potential transformer in 1885, transformers have become essential for the transmission, distribution, and utilization of alternating current electrical energy. A wide range of transformer designs is encountered in electronic and electric power applications. Transformers range in size from RF transformers less than a cubic centimeter in volume to units interconnecting the power grid weighing hundreds of tons.

2) RECTIFIER: It is the device which is used to convert the AC Power to the DC Power. The rectifiers are used to reduce the AC sinusoidal waveform to DC pulsating waveform. A rectifier is an electrical device that converts alternating current (AC), which periodically reverses direction, to direct current (DC), which flows in only one direction. The process is known as rectification, since it "straightens" the direction of current. Physically, rectifiers take a number of forms, including vacuum tube diodes, mercury-arc valves, stacks of copper and selenium oxide plates, semiconductor diodes, silicon-controlled rectifiers and other silicon-based semiconductor switches. Historically, even synchronous electromechanical switches and motors have been used. Early radio receivers, called crystal radios, used a "cat's whisker" of fine wire pressing on a crystal to serve as a point-contact rectifier or "crystal detector".

Rectifiers have many uses, but are often found serving as components of DC power supplies and high-voltage direct current power transmission systems. Rectification may serve in roles other than to generate direct current for use as a source of power. As noted, detectors of radio signals serve as rectifiers. In gas heating systems rectification is used to detect presence of a flame.

Because of the alternating nature of the input AC sine wave, the process of rectification alone produces a DC current that, though unidirectional, consists of pulses of current. Many applications of rectifiers, such as power supplies for radio, television and computer equipment, require a steady constant DC current (as would be produced by a battery). In these applications the output of the rectifier is smoothed by an electronic filter, which may be a capacitor, choke, or set of capacitors, chokes and resistors, possibly followed by a voltage regulator to produce a steady current.

More complex circuitry that performs the opposite function, converting DC to AC, is called an inverter.

3) REGULATOR: It is the device which regulates the pulsating DC Power and results into the Pure DC Form. It is also used to limit the voltage as per requirement.

- Regulator (sewer), a control device used in a combined sewer system
- A device in mechanical watches attached to the balance spring for adjusting the rate of the balance wheel
- A precision pendulum clock, originally used as a time-standard for adjusting or regulating other clocks and watches
- A British term for a steam engine's throttle

4) MICROCONTROLLER: It is a Programmable IC in which we burn the program that required performing the operation of system as per our instruction.

The Atmel 8-bit AVR RISC-based microcontroller combines 32 kB ISP flash memory with read-while-write capabilities, 1 kB EEPROM,2 kB SRAM,23general purpose I/O lines, 32 general purpose working registers, three flexible timer/counters with compare modes, internal and external interrupts, serial programmable USART, a byte-oriented 2-wire serial interface, SPI serial port, 6-channel 10-bit A/D converter (8-channels in TQFP and QFN/MLF packages), programmable watchdog timer with internal oscillator, and five software selectable power saving modes. The device operates between 1.8-5.5 volts. The device achieves throughput approaching 1 MIPS per MH.

Configuration Summary		
Sr. No.	**Features**	**ATmega328/P**
1	Pin Count	28/32
2	Flash (Bytes)	32K
3	SRAM (Bytes)	2K
4	EEPROM (Bytes)	1K
5	General Purpose I/O Lines	23
6	SPI	2
7	TWI (I^2C)	1
8	USART	1
9	ADC	10-bit 15kSPS
10	ADC Channels	8
11	8-bit Timer/Counters	2
12	16-bit Timer/Counters	1

5) DC MOTOR: It is the Brushless DC Electrical motor which gives high starting torque. To reduce the vibrations we use Geared BLDC motor to get the smooth operation.

DC motor relies on the fact that like magnet poles repels and unlike magnetic poles attracts each other. A coil of wire with a current running through it generates an electromagnetic field aligned with the center of the coil. By switching the current on or off in a coil its magnetic field can be switched on or off or by switching the direction of the current in the coil the direction of the generated magnetic field can be switched 180°.

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. Different number of stator and armature fields as well as how they are connected provides different inherent speed/torque regulation characteristics. The speed of a DC motor can be controlled by changing the voltage applied to the armature.

6) ULTRASONIC SENSOR: It is the sensor which emit the Ultrasonic Wave and when a body cut this wave then receiver gets the returned wave and gives a signal to the Microcontroller for next operation. An Ultrasonic sensor is a device that can measure the distance to an object by using sound waves. It measures distance by sending out a sound wave at a specific frequency and listening for that sound wave to bounce back. By recording the elapsed time between the sound wave being generated and the sound wave bouncing back, it is possible to calculate the distance between the sonar sensor and the object

WORKING PRINCIPLE OF USS:

Since it is known that sound travels through air at about 344 m/s (1129 ft/s), you can take the time for the sound wave to return and multiply it by 344 meters (or 1129 feet) to find the total round-trip distance of the sound wave. Round-trip means that the sound wave traveled 2 times the distance to the object before it was detected by the sensor; it includes the 'trip' from the sonar sensor to the object AND the 'trip' from the object to the Ultrasonic sensor.

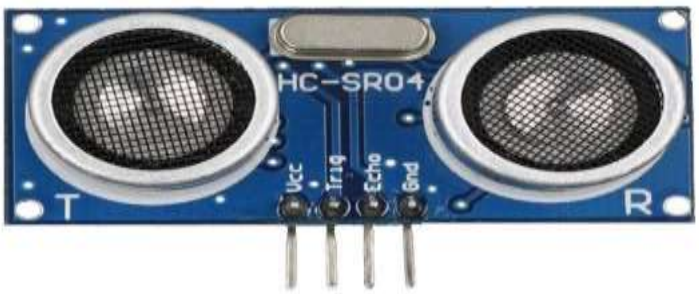

Fig. Ultrasonic Sensor

7) ANALOG TO DIGITAL CONVERTER (ADC):

In electronics, an analog-to-digital converter (ADC, A/D, or A-to-D) is a system that converts an analog signal, such as a sound picked up by a microphone or light entering a digital camera, into a digital signal. An ADC may also provide an isolated measurement such as an electronic device that converts an input analog voltage or current to a digital number representing the magnitude of the voltage or current**.**

8) PIEZOELECTRICITY CRYSTAL: when you apply the mechanical stress (by squeezing it) to the crystals then there is a appearance of voltage across the terminals of crystals.

Piezoelectricity is the electric charge that accumulates in certain solid materials in response to applied mechanical stress. The word piezoelectricity means electricity resulting from pressure and latent heat. It is derived from the Greek , which means to squeeze or press, which means amber, an ancient source of electric charge. Piezoelectricity was discovered in 1880 by French physicists Jacques and Pierre Curie.

The piezoelectric effect is understood as the linear electromechanical interaction between the mechanical and the electrical state in crystalline materials with no inversion symmetry. The piezoelectric effect is a reversible process in that materials exhibiting the direct piezoelectric effect also exhibit the reverse piezoelectric effect (the internal generation of a mechanical strain resulting from an applied electrical field). For example, lead zirconate titanate crystals will generate measurable piezoelectricity when their static structure is deformed by about 0.1% of the original dimension. Conversely, those same crystals will change about 0.1% of their static dimension when an external electric field is applied to the material. The inverse piezoelectric effect is used in the production of ultrasonic sound waves.

Piezoelectricity is exploited in a number of useful applications, such as the production and detection of sound, generation of high voltages, electronic frequency generation, microbalances, to drive an ultrasonic nozzle, and ultrafine focusing of optical assemblies. It forms the basis for a number of scientific instrumental techniques with atomic resolution, the scanning probe micros copies, such as STM, AFM, MTA, and SNOM. It also finds everyday uses such as acting as the ignition source for cigarette lighters, and push-start propane barbecues, as well as being used as the time reference source in quartz watches

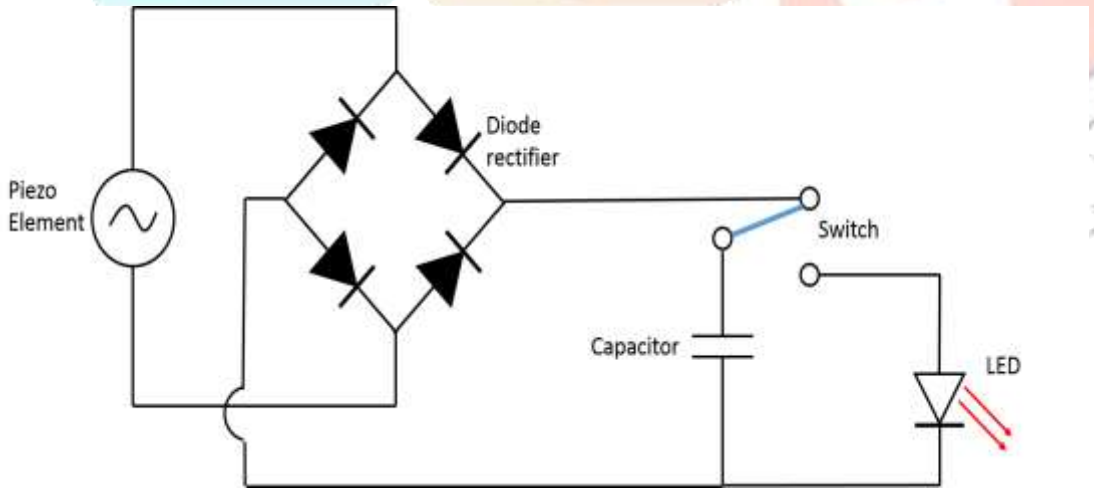

Fig. Piezoelectric crystal

Equations

All of the calculations in this section will be worked out using the distance, speed and time equation.

1. Time = Distance/Speed
2. Speed= Distance/Time
3. Distance= (Time x Speed of Sound in Air (340 m/s))/2

Advantages:

1. This project will help physically challenged persons
2. Save time in goods transfer
3. Can generate electricity

Limitations:

1. This system is complex.
2. System could be expensive at some places

Applications:
1. in rural railway stations.
2. in suburban railway stations.

IV. RESULTS

The project work is heading towards trying to avoid accidents and reduce the number of fatalities in the field of railway transportation system. The concept is to shift from a manual system,
To unmanned type i.e. fully automatic microcontroller based system, this helps in preventing deaths caused near level crossings, also declines the time for which people wait near a level crossing and completely prevent error that has been done by gatekeeper, Secondly To help physically challenged or aged persons to easily move from one platform to another.

By use of piezoelectric crystal we can use the energy generated by the foot movement of pedestrians to generate electricity which can be either fed back to the grid or can be used to charge batteries..

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