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ARDUINO BASED AUTOMATED MOBILE BRIDGE ACROSS THE RAILWAY PLATFORM

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ABSTRACT: Indian Railways was established on 16 April, 1853. For the past decades, the vertical lift forms, swings and foot-over bridges were used in railway stations .But it is difficult for aged and handicapped persons to reach the other platform through the foot-over bridges. To provide the flexible bridge for the railway platforms in order to overcome these difficulties in the usage of foot-over bridges in railway stations. It is planned to go with a pair of IR(Proximity) sensors on 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.

KEYWORDS: Arduino Uno R3, IR Obstacle sensor (pair), 16*2 LCD Display, L293D Motor Drive Module, Rack and Pinion Set (Actuator), Arduino IDE (Software).

1 INTRODUCTION

In India most of the commercial transport is being carried out by the railway network and therefore as any problem occurred during transportation directly affects the economy and railway operation efficiency, also consume lots if time for re-production. The difficulty of the existing methodology is shown in *Figure: 1.*

Over the last few decades, Rail Transportation has become one of the most effective means of transporting passengers and goods, so the safety and reliability is highly considered.

The old Indian railways had the Footbridge, Swing bridge, Level crossing, etc. to travel from one platform to another platform in railway station [1]. There are many disadvantages in these types of bridges they are, Pedestrian overpasses over highways or railroads are expensive, especially when elevators or long ramps for wheel chairs users are required. Without elevators or ramps, people with mobility handicaps will not be able to use the structure. Often, people will prefer to walk across a busy road at grade rather than expend the effort to climb up the bridge and go over it. Overpasses should only be used where the number of users justify the costs.

Figure: 1 Existing System

For a symmetrical bridge, the central pier forms a hazard to navigation. Asymmetrical bridges may place the pivot near one side of the channel.[2] Where a wide channel is not available, a large portion of the bridge may be over an area that would be easily spanned by other means. A wide channel will be reduced by the center pivot and foundation. When open, the bridge will have to maintain its own weight as a balance double cantilever, while when close an in use for traffic, the live loads will be distributed as in a pair of conventional truss bridges, which may require additional stiffness in some members whose loading will be alternately in compression or tension.

2 PROPOSED METHODOLOGY

The proposed system has to overcome the difficulties in the existing system. It is planned to go with a pair of IR(Proximity) 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 sequencial function of the connected components are controls the movements of the flexible bridge perfectly. The block diagram for the proposed methodology as shown in *Figure: 2*.

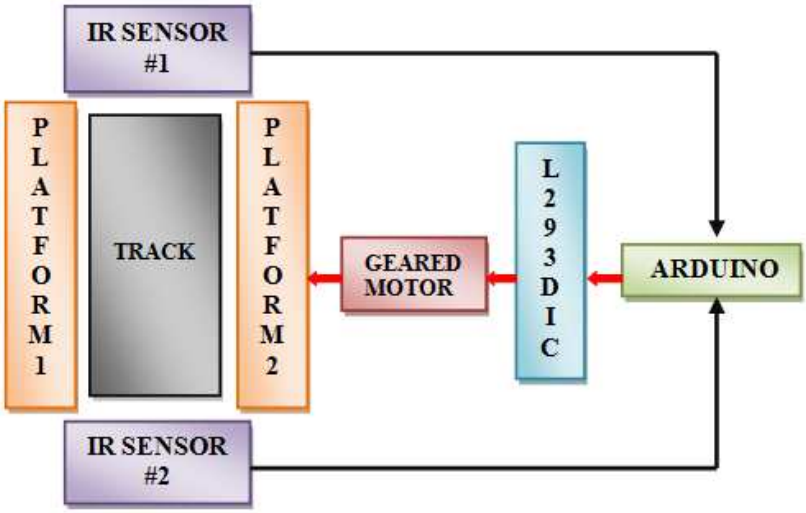

Figure: 2 Block Diagram of Proposed System

3 HARDWARE DESCRIPTION

3.1 ARDUINO UNO

Arduino is an open source,computer hardware and software company,project, and user community that designs and manufacturers microcontroller kits for building digital devices and interactive objects that can sense and control objects in the physical world. The **Arduino Uno R3** is a microcontroller board based on a removable, dual-inline-package (DIP) **ATmega328** AVR microcontroller. It has 20 digital input/output pins. Programs can be loaded on to it from the **easy-to-use Arduino computer program.** The Arduino has an extensive support community, which makes it a very easy way to get started working with embedded electronics.

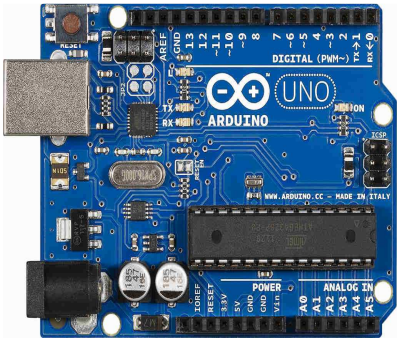

Figure: 3 Arduino Kit with different ports

The Arduino Uno R3 is shown is *Figure: 3*. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button.[6] It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. The Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega16U2 (Atmega8U2 up to version R2) programmed as a USB-to-serial converter.

3.2 INFRARED- SENSOR

An Infrared sensor is an electronic sensor that measures infrared light radiating from objects in its field of view. All objects with a temperature above absolute zero emit heat energy in the form of radiation. A pair of Infrared sensors are shown in *Figure: 4*.

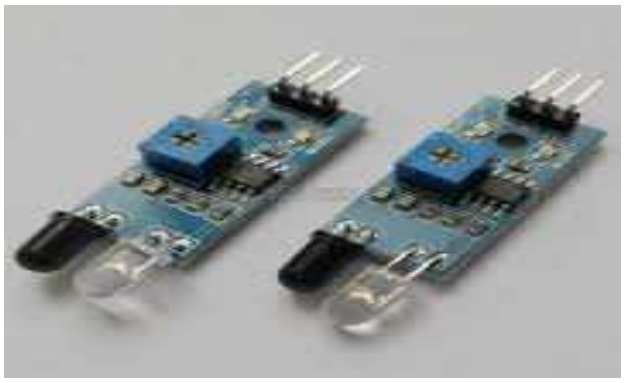

Figure: 4 Pictorial Representation Of Infrared-Sensor

Usually this radiation isn't visible to the human eye because it radiates at infrared wavelengths, but it can be detected by electronic devices designed for such a purpose. The IR sensor consists of two parts are the emitter circuit and the receiver circuit.[8] The emitter is simply an IR LED (**Light Emitting Diode**). The detector is simply an IR **photodiode,** which is sensitive to IR light of the same wavelength as that emitted by the IR LED.

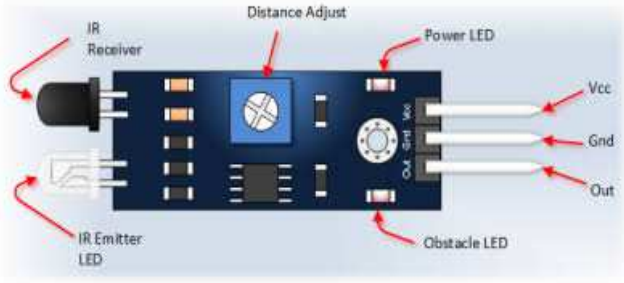

Figure: 5 Functional Pin Diagram of IR Sensor

The pin diagram of Infrared sensor is shown in *Figure:5*. HC-SR501 is based on infrared technology which acquires the information of train arrival. It has features of Voltage: 5V-20V is used. Power consumption: 65mA is available. TTL output: 3.3V, 0V. Sensor module is powered up after a minute, in this initialization time intervals during this module will output 0-3 times, a minute later enters the standby state. Should try to avoid the lights and other sources of interference close direct module surface of the lens, in order to avoid the introduction of interference signal malfunction; environment should avoid the wind flow, the wind will cause interference on the sensor.[7]

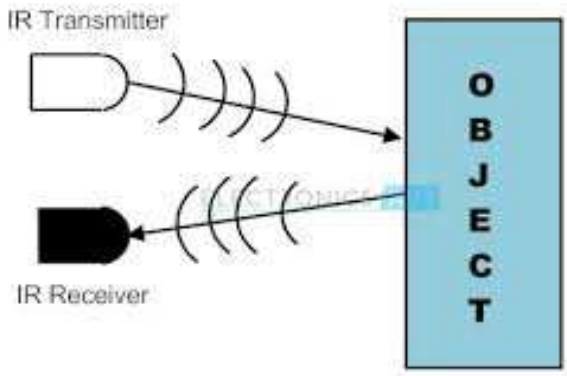

Figure: 6 Functional Representation of IR Sensor

The function of Infrared sensor is shown is *Figure: 6*. Sensor module with dual probe, the probe window is rectangular, dual (A B) in both ends of the longitudinal direction so when the human body from left to right or right to left through the infrared spectrum to reach dual time, distance difference, the greater the difference, the more sensitive the sensor, when the human body from the front to the probe or from top to bottom or from bottom to top on the direction traveled, double detects changes in the distance of less than infrared spectroscopy, no difference value the sensor insensitive or does not work; The dual direction of sensor should be installed parallel as far as possible in inline with human movement.

3.3 RACK AND PINION

A rack and pinion is a type of linear actuator that comprises a pair of gears which convert rotational motion into linear motion.[4]A circular gear called the pinion engages teeth on a linear gear bar called the rack, the rotational motion applied to the pinion causes the rack to move relative to the pinion, thereby translating the rotational motion of the pinion into linear motion. A rotational motion applied to the pinion causes the rack to move relative to the pinion. A rack and pinion with two racks and one pinion is used in actuators. The rack and pinion diagrammatic representation is shown in *Figure: 7*.

Figure: 7 Pictorial Representation of Rack & Pinion

Rack and Pinion combinations are often used as part of a simple linear actuator, where the rotation of a shaft powered by hand or by a motor is converted to linear motion. The rack carries the full load of the actuator directly and so the driving pinion is usually small, so that the gear ratio reduces the torque required. This force, thus torque, may still be substantial and so it is common for there to be a reduction gear immediately before this by either a gear or worm gear reduction. Rack gears have a higher ratio, thus require a greater driving torque, than screw actuators.

3.4 12V GEARED MOTOR

"Gear motor" refers to a combination of a motor plus a reduction geartrain. These are often conveniently packaged together in one unit. The Geared motor diagram is shown in *Figure: 8*. The gear reduction (gear train) reduces the speed of the motor, with a corresponding increase in torque. Gear ratios range from just a few to huge.[3] A small ration can be accomplished with a single gear pair, while a large ration requires a series of gear reduction steps and thus more gears. There are a lot of different kinds of gear reduction.

Figure: 8 Pictorial Representation of Geared Motor

In the case of a small transmission ration, the unit may be back drivable, meaning you can turn the output shaft, perhaps by hand, at angular velocity and cause the motor to rotate at angular velocity. A larger transmission ratio may make the unit non-back drivable. Each has advantages for different circumstances. Back drivability depends not just on transmission ration, but on many other factors. The combination of an electric motor and gearbox reduces design complexity and lowers cost, particularly for motors built for high torque and low speed applications.

3.5 L293D MOTOR DRIVER

The L293d motor driver is called as H-bridge. The term H-bridge is derived from the typical graphical representation of such a circuit. The L293d motor driver Ic is shown in *Figure: 9*.

Figure: 9 Pictorial Representation of L293D IC

The H-bridge arrangement is generally used to reverse the polarity/direction of the motor, but can also be used to brake the motor, where the motor comes to a sudden stop, as the motor term;inals are shorted, or to let the motor free run to a stop, as the motor is effectively disconnected from the circuit.

Figure: 10 H Bridge with different ports

Most DC to AC converters, most AC/AC converters, the DC to DC push-pull converter, most motor controllers, and many other kinds of power electronics use H-bridges.[5] In particular, a bipolar stepper motor is almost invariably driven by a motor controller containing two H bridges. A way to build an H-bridge is to use an array of relays from relay board. The Pin diagram of L293d motor driver is shown in *Figure: 11*.

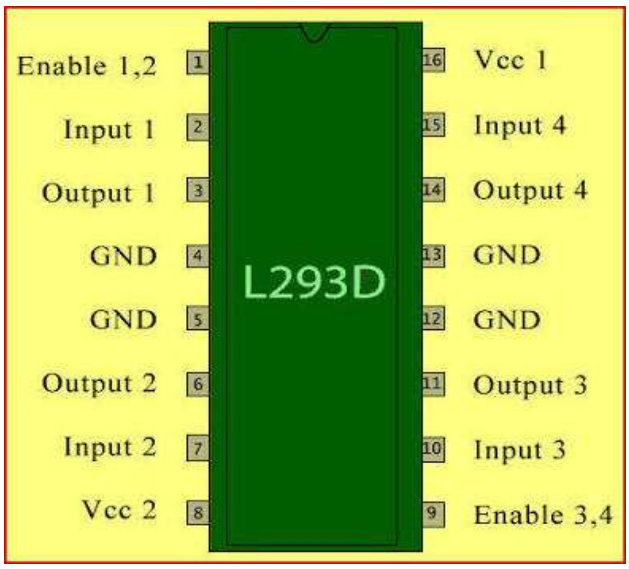

Figure: 11 L293D IC Pin Configuration

An H bridge is an electronic circuit that enables a voltage to be applied across a load in either direction. These circuits are often used in robotics and other applications to allow DC motors to run forwards or backwards[9]. The L293d motor driver circuit diagram is shown in *Figure: 10.*

4 RESULT AND DISCUSSION

Initially, the flexible bridge is in closed condition passenger can utilize the bridge. When the train arrives the platform before it can sensed by the IR sensor, the signal from the sensor given to the Arduino Uno R3 microcontroller. The Arduino takes the signal as an input and runs the program and gives output to the L293d motor drive to change the polarity of motor terminals. It makes to change the direction of motor shaft depends upon the output of the Arduino. As per the motor rotation rack and pinion gets moved in the reverse direction and flexible bridge gets opened. LCD displays the instruction to the passengers.[10] After the train leaves the platform the sensor gets sensed and the process is repeated. The flexible bridge gets closed. The Final hardware kit pictorial representation is shown in *Figure: 12*.

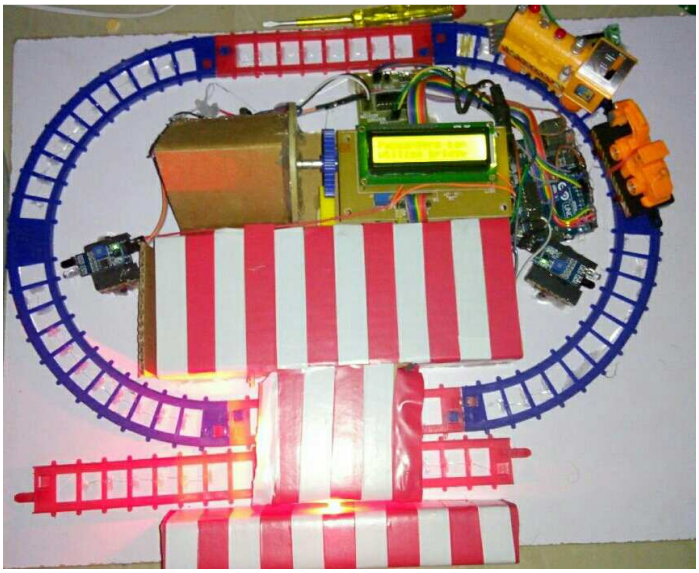

Figure: 12 Pictorial Representation of the Hardware kit

5 ADVANTAGES

- Enhance reliability at plat form crossing.
- Low cost and Less maintenance.
- It is very useful for handicapped and aged people to cross the platforms by using flexible bridges.

6 FUTURE SCOPE

- In future we can reduce accidents by using the camera pixels.
- By extending this Project the Platform of each train can be easily detected by each other.
- Train can transmit the info to station when the train is within some distance range from station.

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