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Automatic Movable Railway Bridge & Energy Generation from Piezoelectric Sensor

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Abstract - *The motive to come up with this project was to build automated MOVABLE RAILWAY BRIDGE, that can be used to bridge the gap between two platforms which in turn could avoid many accidents. Movable bridge concept enhances and broadens the efficient use of technology that can be used to satisfy human demands such as less wastage of time and energy to cross platforms and save guards human life. Piezoelectric tiles can be placed on the movable bridge to generate electricity through human footsteps. Through this idea we plan to construct an automated bridge which senses the position of the train and opens or closes accordingly. The main controller used in this project is ATMEGA 328 which is Arduino programming. Wireless detection of the train can be done from a distance and people can be alerted to leave the movable bridge. Departure of the train can be sensed using loadcell or pressure pads. LORA module, can be used for Wireless Communication System during real-time implementation. To avoid accidents due to system breakdowns, manual control can also be designed.*

***Key Words*: DC Motor, ATMEGA328P, RF Transmitter, RF Receiver, Loadcell, Rack & Pinion.**

1. INTRODUCTION

Indian Railways are the largest rail network in Asia and world's second largest. Railway stations are one of the most crowded areas. Government earns a lot of revenue through Rails. Railways are used by enormous number of people which in turn makes it more challenging to make it safe and reliable. Most of the people don't use over bridges to cross the platforms, which makes it more dangerous and life threatening. This mobile bridge between platforms can help people to cross the platform easily, without causing any harm.

Mobile platform can be fully automatic as well as semi-automatic so that fatal accidents can be reduced.

1.1 PRESENT SCENARIO

Over-bridge and escalators are the only modes of crossing two Railway platforms. Escalators are only available in metropolitan cities and consumes a huge amount of electricity. They are not fully automatic which can create problems for senior citizens and for physically challenged people. Over-bridge are not safe these days as they are more accident prone, this can be referred by a recent incident in CST, Mumbai [1]. Most of the systems based on this issue is not feasible for real time application.

Fig -1 [1]

1.2 PIEZOELECTRIC SENSOR

Piezoelectric sensor is a device that uses the piezoelectric effect to measure changes in pressure, acceleration, temperature, strain or force by converting them to an electrical charge. The prefix piezo- is Greek for 'press' or 'squeeze'. Two main groups of materials are used for piezoelectric sensors: piezoelectric ceramics and single crystal materials. The ceramic materials (such as PZT ceramic) have a piezoelectric constant/sensitivity that is roughly two orders of magnitude higher than those of the natural single crystal materials and can be produced by in-expensive sintering processes. The piezo effect in piezoceramics is "trained", so their high sensitivity degrades over time. This degradation is highly correlated with increased temperature.

2. BLOCK DIAGRAM

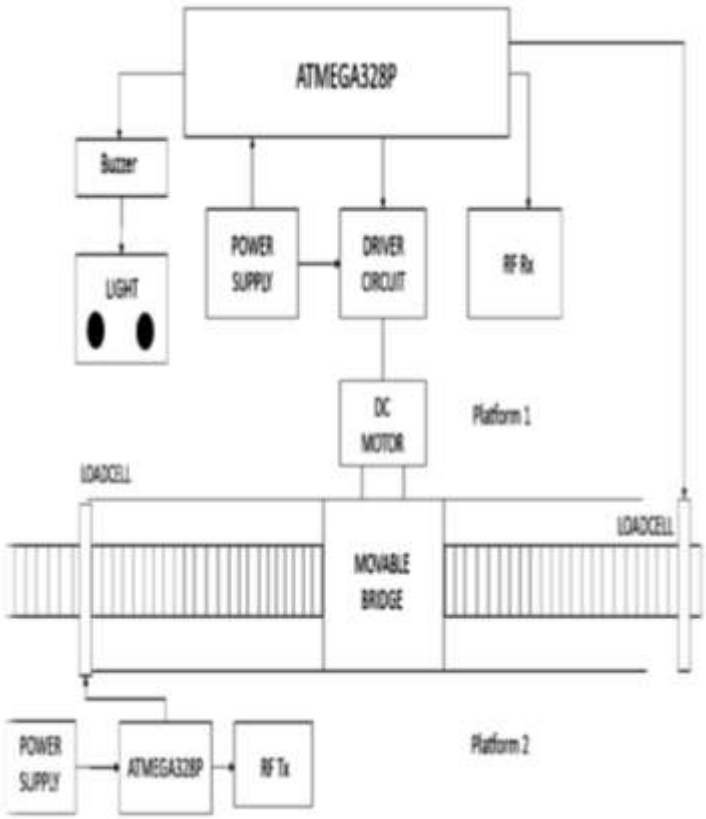

Chart -1: Block Diagram of the System

2.1 WORKING

When 5V regulated DC supply is provided to the circuit, the load cell of the transmitter section located at a specific safe distance from the railway station, detects the arrival of the train by sensing the load on the loadcell. This analog information is given to the H bridge i.e. HX711 which converts the analog input into digital. The digital signal is provided to the RF transmitter. By using Radio Waves, the digital information is transmitted to the RF receiver present at the railway station. As soon as the signal is received from RF transmitter to RF receiver, the piezo buzzer beeps and led is turned ON, which in turn makes the DC motor rotate in appropriate direction resulting in closing the bridge between the platform. As the train leaves the station which is detected by another loadcell present at a specific distance from the railway station and which results in rotation of DC motor in reverse direction of the above stated condition thus resulting in opening the bridge again for use. Piezo sensor is used to generate electricity from passenger footsteps. Piezoelectric sensor converts the mechanical energy into electrical energy. This energy can be saved in batteries and later can be given for the automation of the entire station.

2.2 SYSTEM ALGORITHM

a) Algorithm for mobile bridge between platforms:

Step1: Switch on the power supply.

Step2: When load is detected by loadcell of transmitter i.e. arrival of train is detected, transmit a high pulse.

Step3: High pulse is transmitted from RF transmitter to RF receiver.

Step4: When receiver detects high pulse, buzzer and led turns ON.

Step5: Motor starts rotating.

Step6: When load is detected by receiver loadcell i.e. departure of train is detected, motor rotates in other direction.

b) Algorithm for energy generation by piezoelectric sensor:

Step1: Piezoelectric sensors are connected in parallel.

Step2: Due to footsteps the piezoelectric transducer converts mechanical to electrical.

Step3: Save the energy generated in battery.

2.3 ADVANTAGES

- Useful for handicap & senior citizens.
- Avoid fatal accidents.
- Time consumed for crossing the platform is reduced.
- Piezoelectric energy generation is one of the cheapest form of energy generation.
- It is completely programmable.
- Manual control is also provided through switch in worst case situation.

3. CONCLUSION

The main aim of the paper was to design a system that would help a physically challenged individual to easily cross two platform with reduced time and efforts. As being automated the mistakes caused due to human interventions are also reduced to a great extent. Movable Bridge using piezoelectric tiles used to generate electricity serve as a better option than escalators or elevators that consumes lots of electricity. It's a great boon to people who suffer from life time illness and chronic foot pain. Thus, the complete project turns out to be a savior when looked upon some past fatal accidents.

4. SCOPE

None of the railway security systems are fully automated since the schedule and the situations associated with trains are not always the same that is manual operation of platform. Hence partial automation ensures more safety. This system automates the controlling of bridge by programming as well as manual operation.

This system can be applied for Trains coming and leaving in both directions and necessary steps are taken each time. If trains approach same track in both directions with the help of sensors, we can detect the situation to avoid collision and give alarms to the loco pilots.

REFERENCES

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