

VIBRATION SENSOR BASED TRAIN ARRIVAL DETECTION SYSTEM TO PREVENT ELEPHANT –TRAIN ACCIDENTS

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ABSTRACT

The proposed system aims to protect animals from undesirable effects which happen due to human activities. The system generates high frequency signal within elephant sensitive frequency range to inform train arrival and expel elephants from railway track to avoid train/elephant collisions. The system used vibration sensor to detect train arrival. PIC microcontroller was programmed to fulfill other requirements. As an energy source, the system used solar power battery charger. This is a low cost device and this can be placed anywhere.

Keyword: Vibration detection, Solar power, Elephant's protection

1. INTRODUCTION

According to the Sri Lanka railways the average number of elephants that get killed due to elephant/railway accidents is about 9 per year. Sometimes these elephants run to the railway track when they are chased from Chena cultivations and if this happens just when a train is passing by it is very difficult to stop the train when the elephant is seen a few yards ahead². Sometimes the cargo trains have about 15 compartments and it is not possible to halt a train suddenly¹. In such a situation there should be some system in place to avoid this problem. This project covered design and operation of automatic train arrival detection system using 801S vibration sensor and PIC16F876 microcontroller. The circuit has in-built power supply and alarm system which generates alarm with frequency within the elephant sensitive frequency range. As energy source of this system solar power was used. Solar energy has been identified as a very popular renewable energy source during the past few decades, since it's clean and free. This system also contains a solar power battery charger and here the solar

panel produces 12V DC. The charging current passes to LM317 voltage regulator through the diode. Sensor circuit is used to provide the signal to PIC16F876 after detection of the vibration on the railway track. The sensed signal will pass to alarm system through PIC16F876. The alarm system works at high frequency within the elephant sensitive frequency range and it is directly proportional to the vibration level. When a train comes towards the system, vibration level goes high and the alarm frequency is also increases.

2. EXPERIMENTAL

1.1 Operation of the system

Train arrival detection system is used to detect the train arrival using 801S vibration sensor. When a train arrives in particular direction, vibration sensor will detect the vibration and generate output signal. This is an analogue output and output voltage is directly proportional to the vibration level. At the same time, when sensor detecting the vibration, whole circuit will be on, and the alarm rings based on sensor output. PIC16F876 was programmed to switch alarm system and alarm frequency is set to high frequency in the elephant sensitive frequency range. Alarm frequency goes high according to the vibration level. That means when decreasing the distance between train and detection system, alarm frequency goes high because sensor output is directly proportional to frequency value. Sensor is placed in side of the railway track. Solar power battery charger is used to charge the battery and output voltage of designed solar power charger circuit is adjustable. The output voltage and current are regulated by adjusting the adjust pin of LM317 voltage regulator.

1.2 Block Diagram of the System

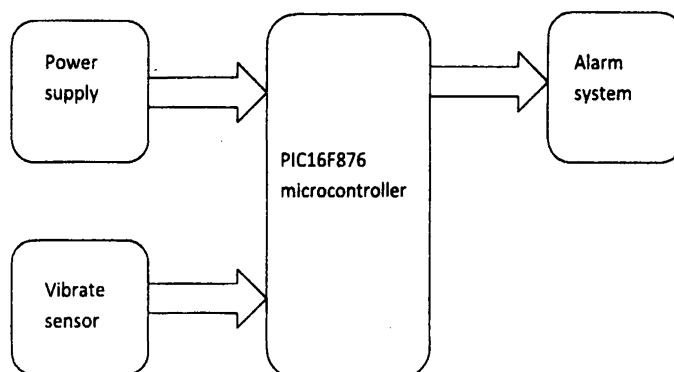


Figure 1 : block diagram of the circuit

1.3 Solar Power Battery Charger

Here the solar panel produces 12V DC. Solar panel consists of 1.2V rated solar cells. The charging current passes to LM317 voltage regulator through the diode D1. Pot RV1 is used to set the output voltage to the battery. Diode D2 prevents the discharge of battery. The output voltage and current are regulated by adjusting the adjust pin of LM317 voltage regulator⁶.

1.4 Circuit Design

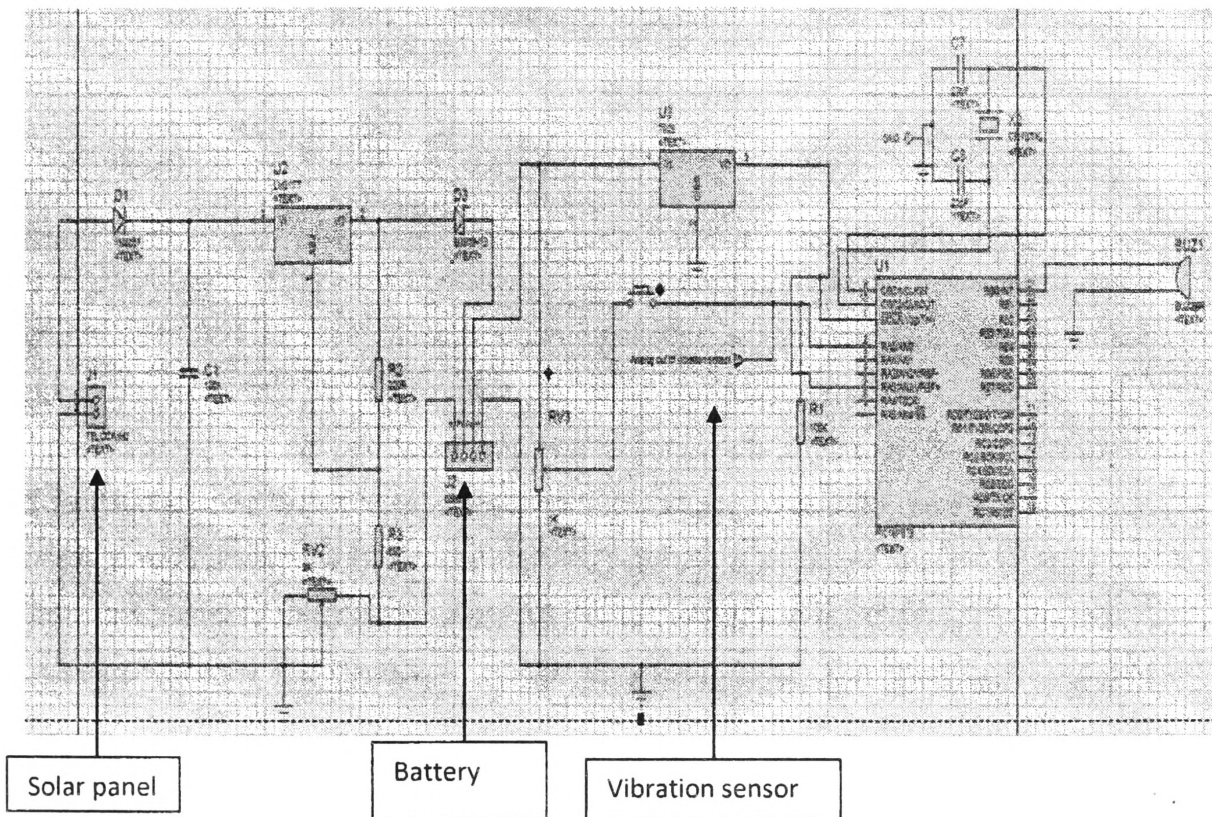


Figure 2: Circuit Diagram of the circuit

3. RESULTS AND DISCUSSION

The circuit was designed to detect the train arrival using vibration sensor and to generate signal to expel elephants from railway to avoid train/elephant collisions. The vibration sensor detects the vibration of railway track when train is arriving and at the same time generates alarm signal with high frequency within elephant sensitive frequency range.

801S vibration sensor has high sensitivity. There are many factors affecting to vibration induced by train on the railway. Some of those are mass of the train, speed, type of the train etc⁷. The system can detect the train arrival up to 150m for any train. The system should be placed at the best suitable position of the railway track to get high accuracy of the system. So the vibration sensor of the system can be placed as follows.

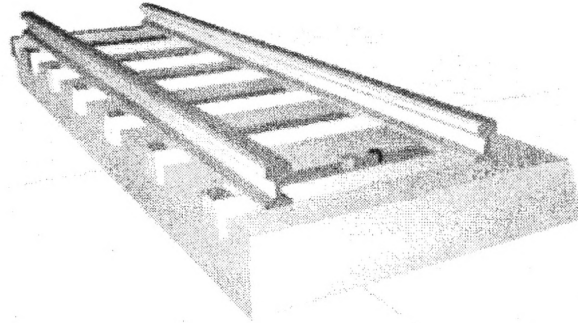


Figure 3: sensors place on a rail road

When considering the alarm system it is important to consider the behavior of the elephants due to selected frequency range. Elephants respond to the buzz of disturbed and aggressive bees with alarm by moving away from the sound source. The evidence suggests that elephants are aware of bees, they retain a memory about bees and they can identify bees by sound alone. Their response suggests that they remember or associate the sound of bees with a negative historical event be it individual or collective, to which the correct response was rapid retreat⁹. In this system used the bee sound frequency to expel elephant from the railway. It is the frequency in between 200Hz to 300Hz. Because, bee sound frequency band is between 225 and 285 Hz¹⁰.

This is low cost and easy to build. Another advantage of this system is it can be placed anywhere because there is not any problem to implement and it is easy to maintain, because this system has a solar power battery charger to charge the battery. There are many advantages with this solar power battery charger. Main purpose of this circuit is supply input voltage of the above circuit can be get automatically using solar energy without human involvement. Other than this purpose this solar power battery charger gives more benefits. Those are adjustable output voltage, simple and inexpensive circuit design because it uses commonly available components and zero battery discharge when no sunlight falls on the solar panel.

Limitation of the system is it is impossible to active the system for wet season. Because, there is not existed power supply which can be use based on that situation. As further work, can be design proper method or system for supply voltage.

4. CONCLUSIONS

The system was designed and constructed using 801S vibration sensor and PIC16F876 microcontroller to prevent elephant/train collision. The system is an effective low cost solution to save the elephants from train accidents. This work deals with an important area which has not yet been considered properly.

ACKNOWLEDGEMENTS

The authors would like to acknowledge and express gratitude to staff of Department of Electronics Wayamba University of Sri Lanka, Kuliypitiya.

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