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Smart Engine System for Train using Arduino Uno Kit and Generation of Electricity using Hybrid Energy

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ABSTRACT

The railway network of India is the biggest in South Asia and perhaps the most complicated in all over the world. There are so many different types of train local, fast, superfast, passenger, goods etc., and there are so many multiple routes. Although the timetable is perfect, it is not at all possible to maintain it. Moreover, that is why the train accidents are becoming more and more usual. The accidents between trains are increasing due to negligence of intelligent techniques implemented in the trains and improper control signaling from the Train Traffic Control Station (TTCS). Therefore, this a kind of intelligence to the train engines itself, so that it prevents accidents.

In our project we aim at generating electricity using combined renewable energy resources of wind and solar from a running train and using a part of this energy to detect damages in the railway track system by passing a minute voltage over the track, thus avoiding the train accidents. Remaining energy can be saved using battery and used for train lighting system.

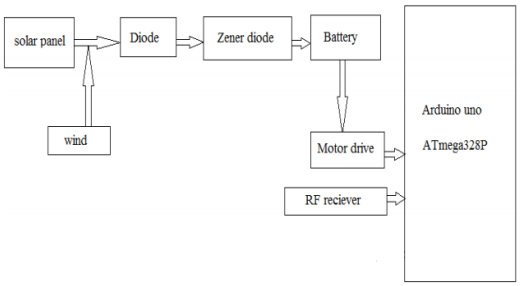
Keywords: Arduino Uno Kit; Solar Panel.

I. INTRODUCTION

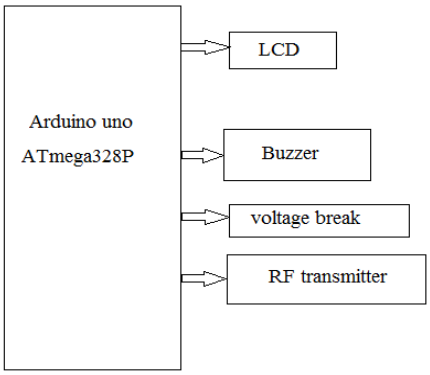
Train accidents occur normally due to safety violations resulting from 'human error or limitations' and 'equipment failures' losing precious lives. The ministry of railways (railway board), Govt. of INDIA has referred for developing and efficient train anti-collision system. The goal of this work is to design and implement a cost effective and intelligent full-fledged micro-controller and wireless based train anti-collision system to successfully prevent the train collisions. It aims to efficiently integrate into the existing signalling system and avoids accidents in manned as well as un-manned level crosses, without changing any of the existing system implemented in Indian railway.

We also aim at avoiding the different possibilities of train accidents such as accidents due to damage of track and we provide wireless communication for the engine system to slow down at receiving station. The second part of the project aim at generating electricity using combined renewable energy sources of wind and solar from a running train and using a part of this energy to detect damages in the railway track system by passing a minute voltage over the tracks using wheels of the train, thus avoiding the train accidents. Remaining energy can be saved using battery and used for train lighting system.

II. METHODS AND MATERIAL



BLOCK DIAGRAM FOR RECEIVER



BLOCK DIAGRAM FOR TRANSMITTER

A. WORKING PRINCIPLE

In this project, we are using Arduino Uno as a controller, which controls the various input, and output signals. Both the transmitter and receiver are of RF type with minimum range so that train can get enough time to decrease its speed and stop before the signal pole. A minute voltage of below 5V is passed through the track to check the gap or any damage in the railway tracks. The controller then receives the signal and it gives alarm with LCD display. Thus, we can avoid the different possibility of train collision. We are generating the electricity in train using combined sources of wind and solar. When the train is running on the track the generated wind and solar panel provided on the top of train, combined and used to generate electrical energy. This energy can be stored in battery and used.

As per the objective, we have designed the above functional diagram. Its working is as follows,

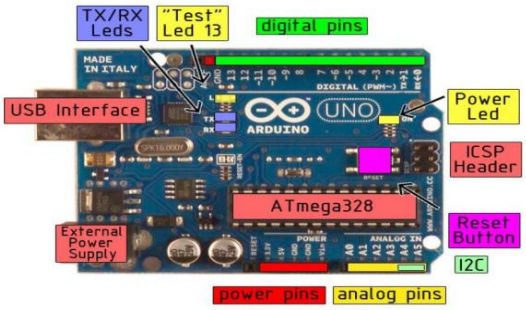
1) CONTROLLER: We use ARDUINO UNO as a controller, which receives signal from various input, output devices, and control its operations based on the signal received.
2) POWER SUPPLY (6 to 8V): It is used to give input supply to the kit. Software is used to identify the object across railway track.
3) RADIO FREQUENCY RECEIVER AND TRANDMITTER: The control signal from the train is transmitted to the station using RF transmitter and received by the receiver at the station.
4) LIQUID CRYSTAL DISPLAY: To display the output detected.
5) SOLAR PANEL with WIND (FAN) HYBRID ENERGY SYSTEM: To generate electricity from a running train. Here we are placing solar panel on the top of the train and fans are placed at sides of the train windowpanes. The combined energy of solar and wind is use to generate electricity through generating part.
6) BATTERY: To store the energy that is generated from the solar panel and wind hybrid energy system.

B. MATERIALS REQUIRED

1) ARDUINO UNO KIT: The Arduino Uno is a microcontroller board based on the ATmega328. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. 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. Instead, it features the Atmega8U2 programmed as a USB-to-serial converter. "Uno" means one in Italian and is named to mark the upcoming release of Arduino 1.0.

The Arduino Uno can be powered via the USB connection or with an external power supply. The power source is selected automatically. External (non-USB) power can come either from an AC-to-DC

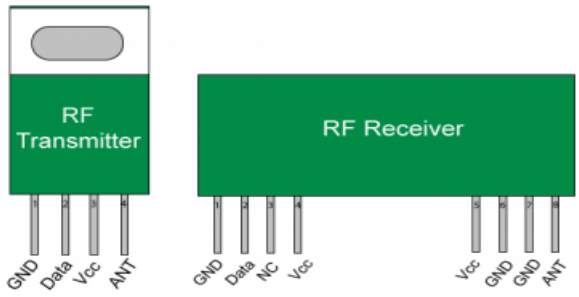
adapter (wall-wart) or battery. The adapter can be connected by plugging a 2.1mm center-positive plug into the board's power jackThe board can operate on an external supply of 6 to 20 volts. If supplied with less than 7V, however, the 5V pin may supply less than five volts and the board may be unstable. If using more than 12V, the voltage regulator may overheat and damage the board. The recommended range is 7 to 12 volts.



ARDUINO UNO

2) RF TRANSMITTER AND RECEIVER:

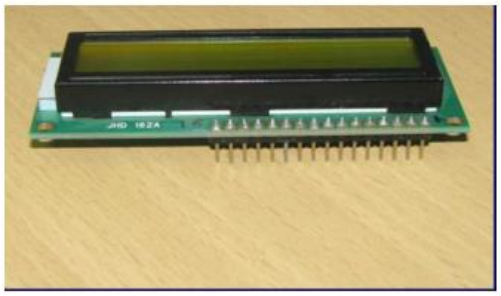
RF module, as the name suggest operates at radio frequency. The corresponding frequency range varies between 30 kHz and 300 GHz. In this RF system, the digital data is represented as variation in amplitude of carrier wave. This kind of modulation is known as Amplitude Shift Keying (ASK). Transmission through RF is better than IR because of many reasons. Firstly, signal through the RF can travel through larger distance making it suitable for long range application. Also, while IR mostly operates in line of sight modes, RF signals can travel even when there is an abstraction between transmitter and receiver. Next RF transmission is most strong and reliable than IR transmission. RF communication uses a specific frequency unlike IR signals which are affected by other IR emitting sources. This RF module comprises of an RF transmitter and receiver. The TX/RX pair operated at a frequency of 434 MHz .An RF transmitter receives serial data and transmit it wirelessly through RF through its antenna pin. The transmission occurs at the rate of 1kbps-10kbps. The transmitted data is received by an RF receiver operating at a same frequency as that of the transmitter.



RF TRANSMITTER AND RECEIVER

3) LCD (LIQUID CRYSTAL DISPLAY):

A 16*2 LCD pin display 16 characters per line and there are two such lines. In this LCD each character is display in 5*7 pixel matrix. This LCD as two resistors, namely, command and data. The command resistor stores the command instructions given to the LCD. A command is an instruction given to LCD to do a predefined task like initializing it, clearing its screen, setting the cursor position, controlling display etc. the data resistor stores the data to be display on the LCD. The data is the ASCII value of the character to display on the LCD.



4) SOLAR PANEL:

Solar panel refers to a panel designed to absorb the sun's rays as a source of energy for generating electricity or heat. A photovoltaic (PV) module is a package, connected assembly of solar cells. Solar photovoltaic panels constitute the solar array of a photovoltaic system that generates and supplies solar electricity in commercial and residential applications. A photovoltaic system includes a panel or an array of solar modules, solar inverter and sometimes a battery or solar tracker in inters connection wiring.

SOLAR PANEL

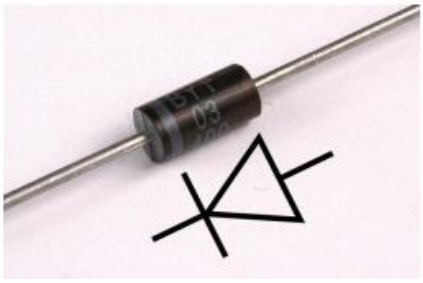
5) FAN: To represent the generation of electricity from the wind.

FAN

ZENER DIODE: The Zener diode is like a general purpose signal diode consisting of a silicon PN junction. When biased in the forward direction it behaves just like a normal signal diode causing the rated current, but as soon as reversed voltage applied across the Zener diode exceeds the rated voltage of the device, the diode breakdown voltage is reached at which point a process called "Avalanche Breakdown" across in the semi-conductor depletion layer and a current starts to flow through the diode to limit this increase in voltage.

ZENER DIODE

6) DIODE: 1N4001 is a member of 1N400x diodes. Diode is a rectifying device which conducts only from anode to cathode. Diode behaves open circuited for the current flow from cathode to anode. 1N4001 is a 1A diode with low forward voltage drop and high surge current capability. It comprises of diffused PN junction and has low reserve leakage current of 5μA. its DC blocking voltage is 50V.



DIODE

7) DC MOTOR IC DRIVE:

L293D is a dual H-BRIDGE motor drive integrated circuit. Motor drives act as current amplifiers since they take a low-current control signal and provide a higher-current signal. This higher current signal is used to drive the motors.

DC MOTOR IC DRIVE

8) BATTERY:

A primary cell is a battery that is designed to be used once and discarded, and not recharged with electricity and reused like a secondary cell. In general, the electrochemical reaction occurring in the cell is not reversible, rendering the cell rechargeable. As a primary cell is used, chemical reaction in the battery use up the chemicals that generate the power; when they are gone, the battery stops producing electricity and is useless. In contract, in a secondary cell, the reaction can be reserved by running a current into cell with a battery charger to recharge it, regenerating the chemical reactants. Primary cells are

made in a range of standard sizes to power small household appliances.

BATTERY

9) RECHARGEABLE BATTERIES:

A rechargeable battery, storage battery, secondary cell, or accumulator is a type of electrical battery which can be charged, discharged into a load, and recharged many times, while a non-rechargeable or primary battery is supplied fully charged, and discarded once discharged. It is composed of one or more electrochemical cells. The term "accumulator" is used as it accumulates and stores energy through a reversible electrochemical reaction.

RECHARGEABLE BATTERIES

C. SOFTWARE DESCRIPTION

1) ARDUINO COMPILER:

The open source Arduino software (IDE) makes it easy to write code and upload it to the board. It runs on Windows, mac OS X, and Linux. The environment is written in Java and based on processing and other open source software. This software can be used with any Arduino board. The program is dumped to Arduino board to run it.

III. RESULTS AND DISCUSSIONS

Once the whole hardware component is installed, the system can be operated and the desired effect can be obtained. That is a cost-effective and intelligent full-fledged micro-controller and wireless based train anti-collision system and also generating electricity using hybrid energy of solar and wind.

IV. CONCLUSION

The features implemented in this project such as Generating electricity using solar and wind energy can be used for lighting system of train. The design and implementation cost is effective and intelligent full-fledged Arduino controller and wireless based Train Anti Collision System to successfully prevent the train collisions has been done.

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