INTERNATIONAL RESEARCH JOURNAL IN ADVANCED ENGINEERING AND TECHNOLOGY (IRJAET) E - ISSN: 2454-4752 P - ISSN : 2454-4744
VOL 4 ISSUE 2 (2018) PAGES 3102 - 3107
RECEIVED : 05.03.2018 PUBLISHED : 03.04.2018
April 03, 2018

Automatic Vehicle Turning Indicator

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Abstract

Bicycles are vehicles that do not require a license to operate and share the road with cars, motorcycles, and other fast moving vehicles. An improper lane change from a bicyclist, such as one without any warning, can lead to great injury or death (especially after sundown). Bike Safe addresses this safety concern by providing a low-cost device that mimics the warning system motorists' use every day. The system consists of a red brake light and amber turning signal lights that mounts to the rear of the bike, as well as a white headlamp that mounts to the front handlebars. The bicyclist safely and easily controls the turning lights signal without removing their hands from the handlebars. In addition, when the bicyclist applies the brakes, the red brake light significantly brightens until the bicyclist releases the brakes. Bike Safe also has a solar panel that charges the battery in order to provide a more reliable power source and a longer battery life for night-time bike rides.

1. INTRODUCTION

Bike Safe is a device that allows bicyclists to indicate that they are making a turn without having to take their hands off the handle bar. The system consist of a red brake light, a white headlight, and two amber turning lights, one on each side of the brake light to indicate left and right. The user activates the flashing amber lights from the control system mounted on the handlebar by using their fingers, thus, eliminating the use of hand signals. The Bike Safe's brake alert system consists of consist of red LEDs that increase in brightness when the bicyclist applies the brakes. This system is a necessary bicycle improvement when riding at night because it displays the bicyclist's intention to surrounding vehicles, thus preventing injuries or death

2. BACKGROUND

Bicycle riders that shares that public road with other motorists are subject to the same rules and regulations, such as having working brakes at all times and having lights and reflectors whenriding at night. According to the National Highway Traffic Safety Administration, there were726 bicyclist deaths and 49,000 bicyclist injuries in 2012 and nearly 29% of those injuries are caused collisions with cars. 48% of these fatalities occurred between 4:00pm to 11:59pm whenthe sun is setting. We can reduce these numbers by having the proper equipment to be morevisible to motorist at night, especially when the bicyclists are weaving through traffic lanes withother motorists.

3. REQUIREMENTS AND SPECIFICATIONS

For marketing appeal the device is light in weight in order to maintain the performance and comfort of the bicyclist. The low retail price will peak people's interest in investing with our product. Once customers view first hand the easy installation and usability as well as the safety Concerns it addresses, they will be inclined to purchase the product for their bicycle.

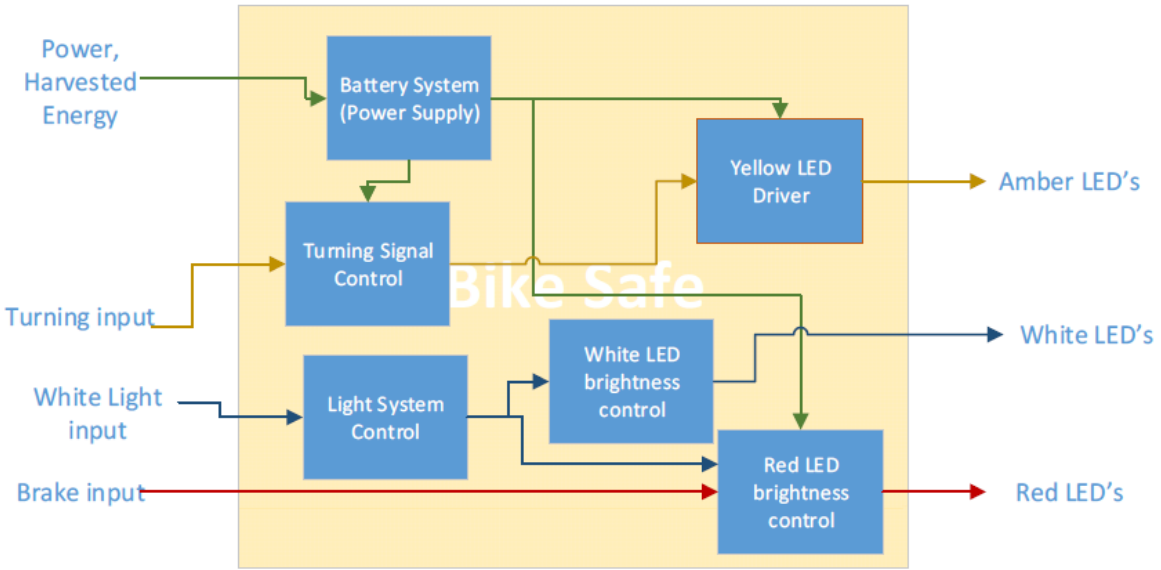

Fig 1. Level 1 Bike Turning Signal Functionality

The Bike Safe device operates from user input. ***Figure 1*** shows that the user determines the direction they want to turn and when they want to brake. After the user initiates their input, the system outputs amber LEDs and/or red LEDs. The white light input turns on/off the white headlamp and red back light for night-time riding. Rechargeable batteries power the system, which also uses a solar cell to slow down discharge during the day.

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Fig 2. Level-0 Bike Turning Signal Functionality

Design

Fig 3. Final Product of Turning and Brake Lights

This chapter describes the hardware and software design of the Bike Safe system.

Hardware Design

The system uses the ATmega328p microprocessor from the Arduino Nano development board. Because of its compact and its simplistic nature. ***Figure 4*** shows the complete layout and schematic of the device based on the pinouts from the Arduino Nano.

Power

The system obtains its power from a 9.6V 1600mAh rechargeable NiMH battery with a 12V 1.5W solar panel to extend the battery life. The solar panel has a diode at the positive terminal to prevent discharging the battery through the solar panel when it is dark. The amount of time the solar panel charges the battery depends on the battery level being read by the Analog Pin 0 of the Arduino Nano. In order to protect the microprocessor from overvoltage on the analog pin, the system uses a voltage divider to scale the 9.6V battery voltage down to an acceptable voltage, 5V, without harming the pin. The voltage divider has a 1MΩ and 510kΩ resistor allowing a maximum of 15V input from the battery using Vout=Vin(R2/(R1+R2)).

Turn Sensor

In order to detect that a completed turn, a unipolar hall-effect sensor AH201 in front of the bike detects a magnet that is in parallel to the hall-effect sensor when the wheels are straight. When the hall-effect sensor detects a magnet, the output of the sensor changes to from high to low. The Analog Pin 1 of the Arduino Nano detects the signal indicating that the wheels are back in the straight position and to turn off the turn signal lights.

LED Outputs

The system consists of two sets of three amber LEDs for the left and right signal, a red 12V trailer light module, and a white 9-LED headlight. The digital pins of the Arduino Nano controls these outputs. The outputs depend solely on the buttons being pushed and the state of the hall effect sensor.

Buttons/Switch Input

There are multiple input buttons in the system. There is a pair of buttons to input left or right turn, two buttons specially customized to fit on the brakes, and a switch for turning the white and red lights on when it gets dark.

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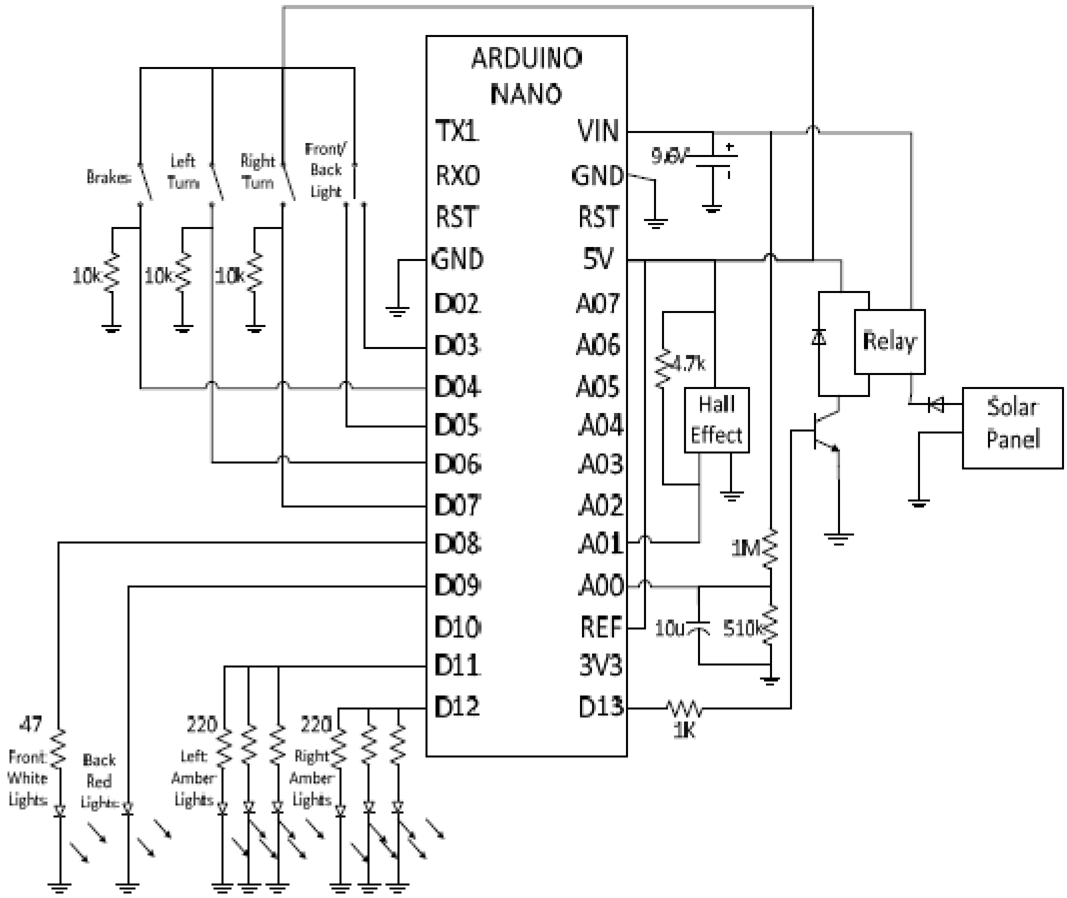

Fig.4. Layout of Circuit Connection

Future Improvements

This project has potential for improvement. The Arduino Nano in this system has a power indicator LED that uses 15mA. By removing this LED, we will save 15mA and will improve battery life. The project can also be made compact by using surface mount components on a custom PCB. By minimizing the PCB, the battery will fit inside the project enclosure. By adding a buzzer to the project, it will alert more motorist within the vicinity of the bicyclist providing a safer experience for the bicyclist.

CONCLUSION

Making this project happen has been a great learning experience, especially on time management and project planning. We were able to quickly get a prototype up and running on a breadboard, but the most time-consuming part of the project was the construction of the project. In order to make the project more permanent, we decided to transfer the prototype to a small PCB and have all the components of this project routed to this PCB. Since there was a lot of soldering involved and not a lot of room to work with on the PCB, mistakes were made, but in the end, we got the device up and running.

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