Bicycle E – Kit

Engineering Design Project(EN1190)

Semester 2

Detailed Project Report

EN - 08 GROUP

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Abstract

Considering the increased popularity of bicycles recently we decided to design a product which would enhance the overall experience of the rider.The product includes a dark activated light system,anti theft alarm system which gives off an alarm if somebody touches the lock when the bicycle is locked ,turn indicating signal light system and a speedometer.

NE555 timer ICs are used for both the lock and the signal lights.ATMega32 microcontroller is programmed to build the speedometer.

We designed and constructed two PCBs for our system using Altium.Also an enclosure was designed and constructed using Solidworks software.

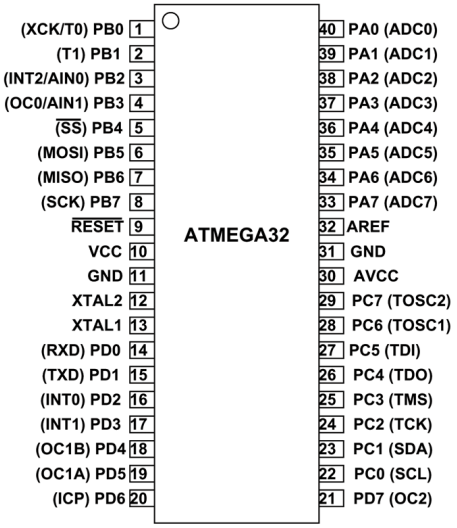
Finally the system was fixed on a bicycle to demonstrate the working prototype of our product.

Components

1.ATMega32 mcu

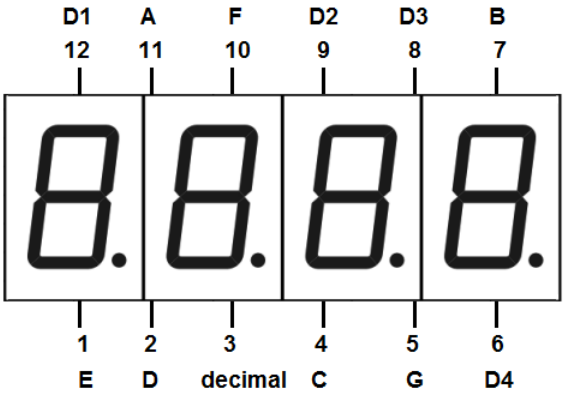
Initially, we planned on using attiny84 due to its small size but due its unavailability in the current market we had to search for alternatives. The only available and suitable replacement was the atmega 32, a 40 pin mcu of which 32 are i/o pins. We tried to go for a smaller mcu like attiny 13, but it did not have the required number of pins. Due to the larger size of the atmega 32 mcu, our final pcb size was larger than initially estimated.

We used an arduino uno board as an isp to program the atmega 32.



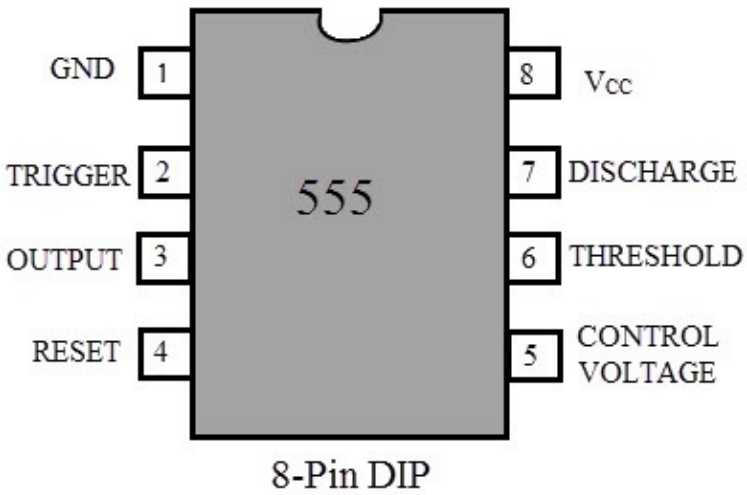
2. 4 Digit Seven Segment Display

We planned on using a three digit seven segment display as three digits would be enough to show the speed of the bicycle; however, we could not find a common anode three digit seven segment display, therefore we shifted to the 4 digit display. We used a 7447 ic to drive the 7SD.



3.NE555 timer IC

We used the 8-pin DIP NE555 IC which was commonly available in the Sri Lankan market.In our product, 555 timer acts as an astable multi vibrator.In the signal lights, the output of the IC is directly connected to the lights through a SPDT switch which makes the lights blink with a delay which can be set by changing the capacitor and resistor values.



8-Pin DIP

4.Other components

- 12 V DC Relay
- LDR resistor
- 1N4001 Diode
- 100 K Ohm Potentiometer
- 5 W LED chips
- Switch
- 12 V Battery
- BC 547 Transistor
- Neodymium magnets
- Alarm buzzer

PCB Design

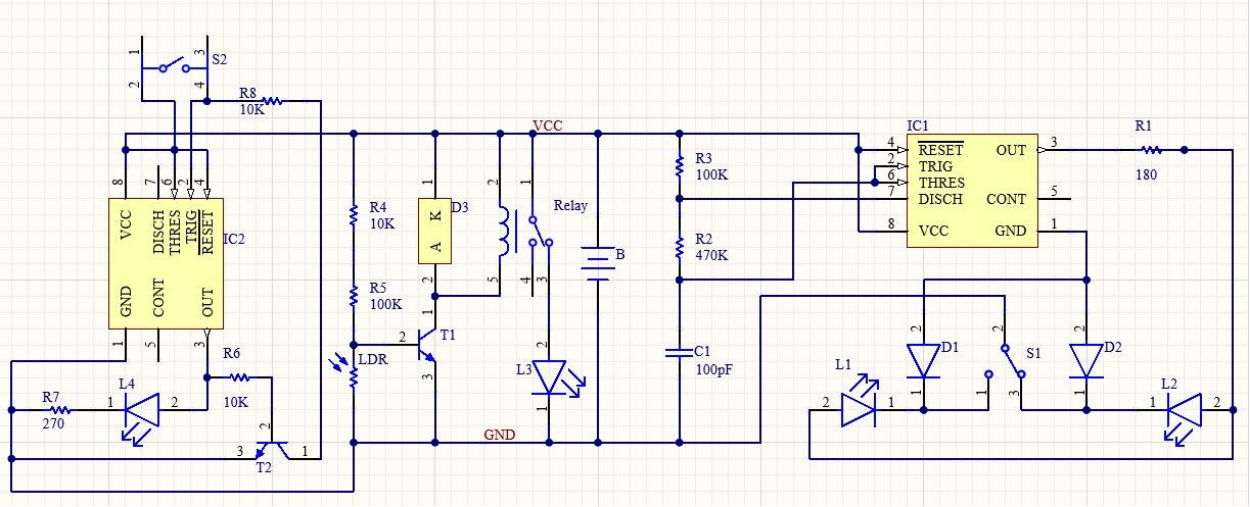
PCB design was done using Altium Designer software. A one-layer PCB layout was designed for Anti-theft alarm system, dark sensor light system, signal light system and a two-layer PCB was designed for speedometer.

1-layer PCB layout dimensions (L x W) - 96.2 mm x 48.725 mm

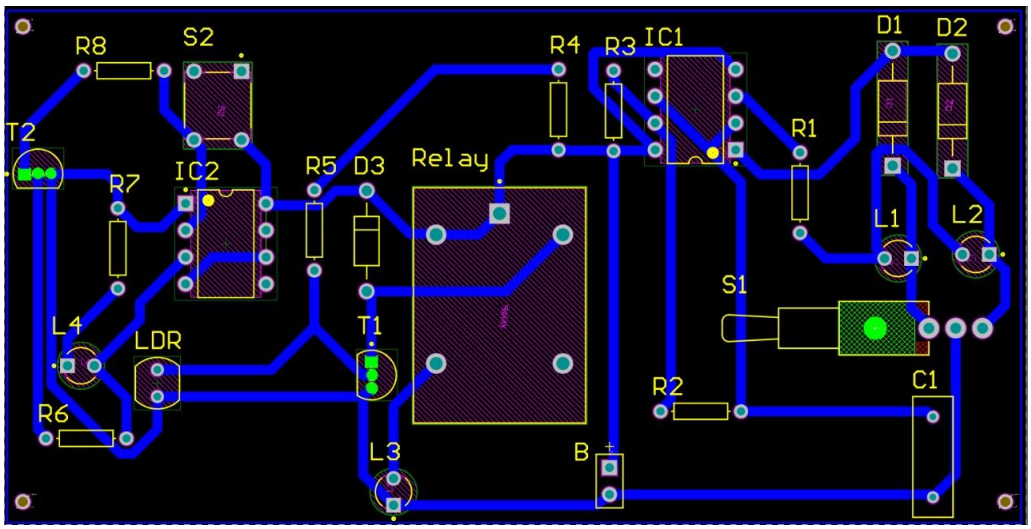
2-layer PCB layout dimensions (L x W) - 95 mm x 65mm

1-layer PCB

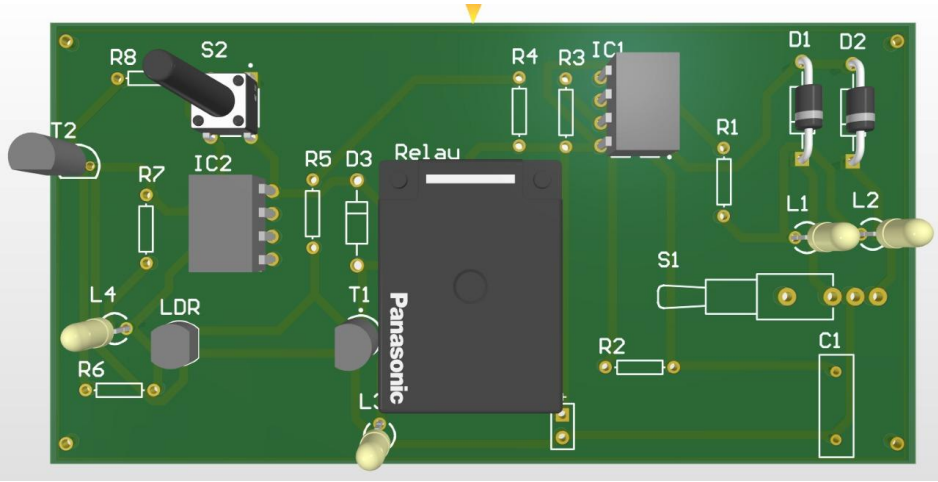
Schematic Diagram



PCB Layout

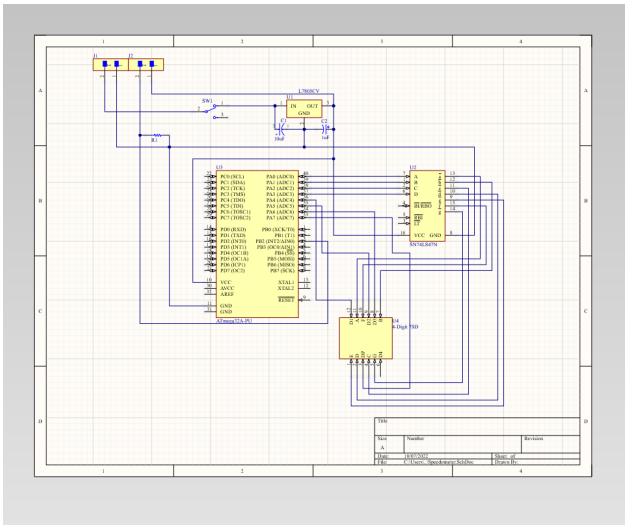


3D view of the PCB

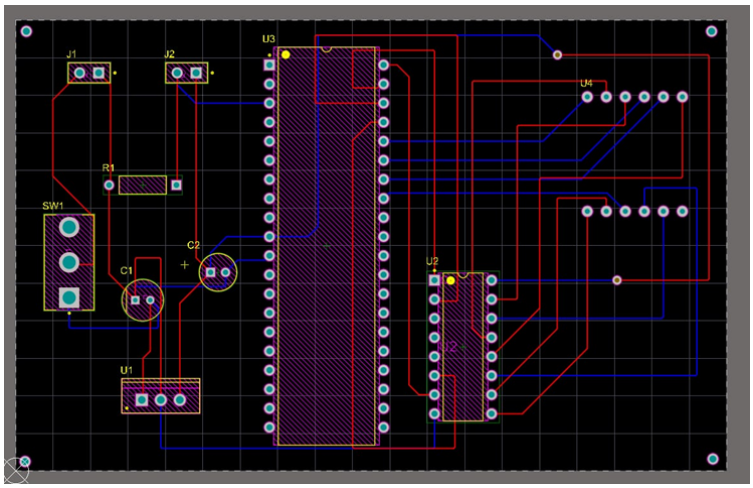


2-layer PCB

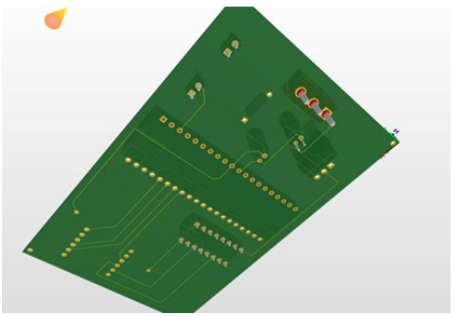
Schematic diagram

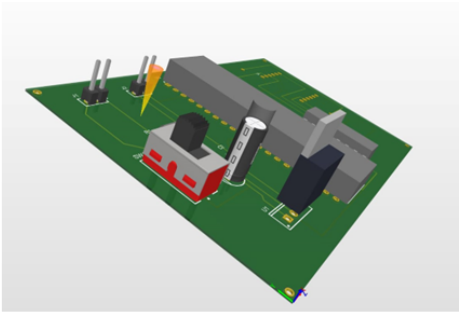


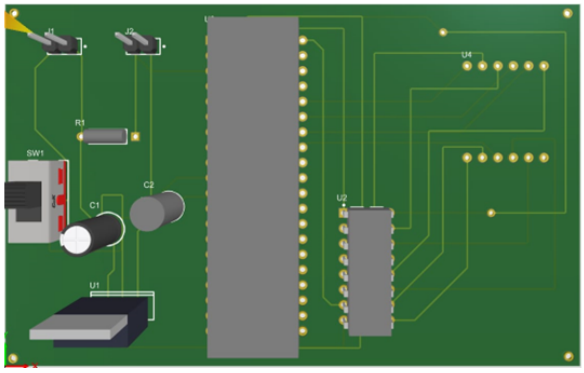
PCB Layout



3D view of the PCB



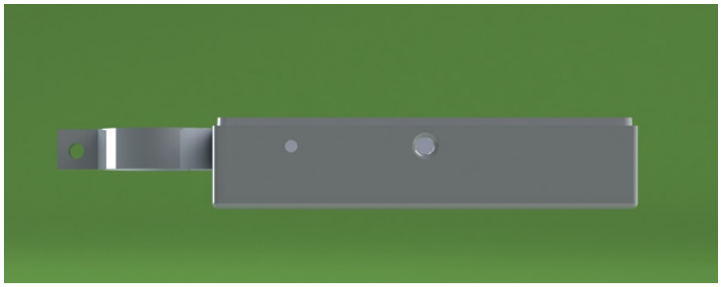




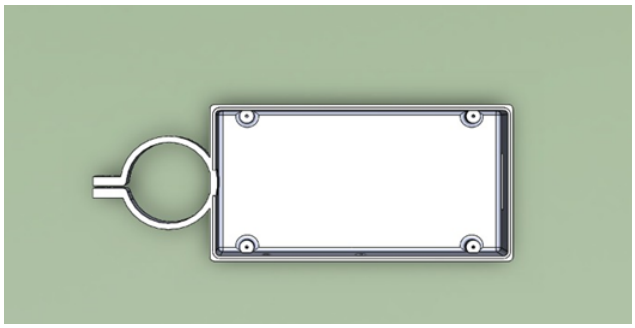
Enclosure Design

After the PCB design was finalized, a Solid works design for the enclosure was created.

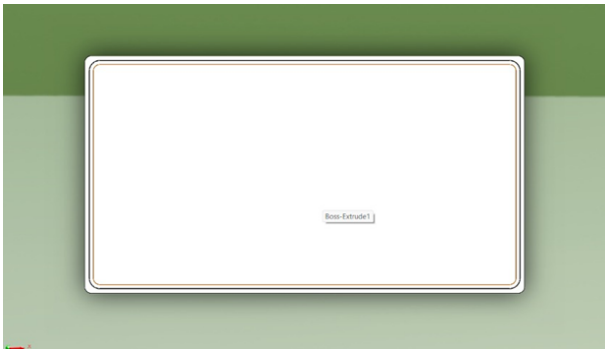
Side views of the enclosure



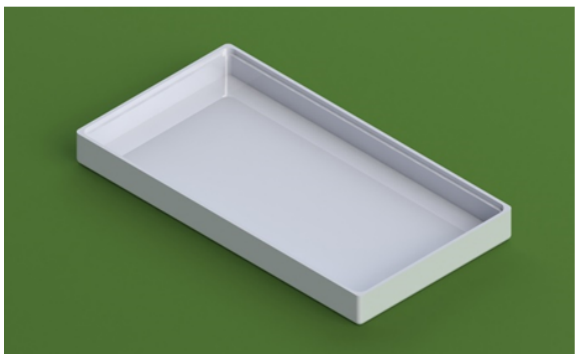
Top view of the enclosure



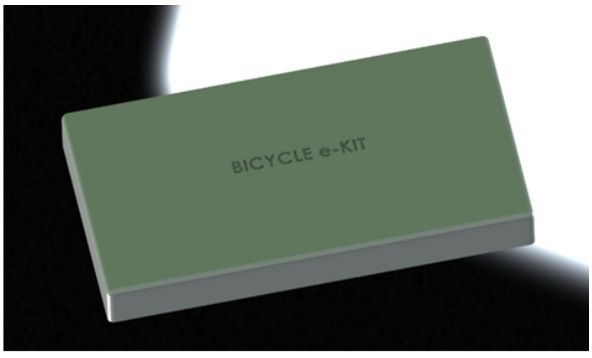
Bottom view of the enclosure



3D view of the Lid for the enclosure



Bottom view



Top view

Acknowledgements

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References

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https://www.electronicshub.org/understanding-555-timer/

Guide on programming the mcu:

https://www.google.com/amp/s/www.instructables.com/Programming-ATMEGA32-or-Any-Other-AVR-Using-Arduin/%3famp_page=true

For the Altium design:

https://www.altium.com/documentation/altium-designer/tutorial-complete-design-walkthrough