



Room Automation

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Introduction

In this project we implemented a Door Lock along with Automated Light Control Simulation and a fun component called Mood Light.

System Overview

A block diagram of the lock system is given in Fig. 1.

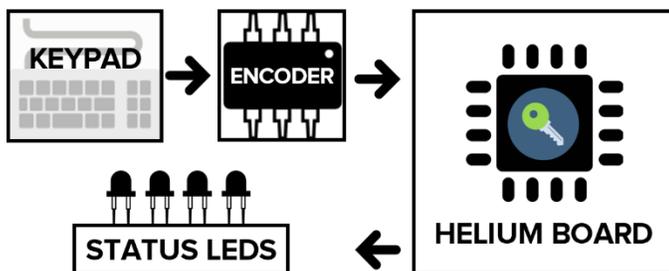


Fig. 1: Block Diagram for Door Lock.

The elements of the Door lock are:

1. Keypad with 9 buttons and 4 LEDs
 - Takes input from buttons and gives a 4-bit Binary output
 - LEDs have a separate input which shows the Current status
2. Helium Board
 - All the logic work happens here
 - Takes input and stores in a latch bank, Compares and gives a single bit output along with output for status LEDs.

A block diagram of the Person Counter is given in Fig. 2

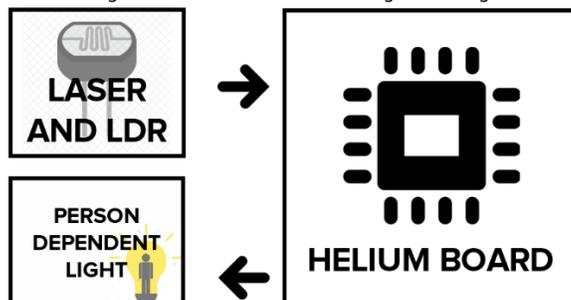


Fig. 2: Block Diagram for Person Counter

The elements of the Light Controller are as follows

1. Sensing Circuit

- Using laser and LDR Module to detect entry/exit of a person.
2. Helium Board
 - Bidirectional counter that counts the no. of people in the room and runs a 24-hour clock to auto disable function at night
 3. Light with Manual Switch
 - This is manual Override for the light

A block diagram of the Person Counter is given in Fig. 3.

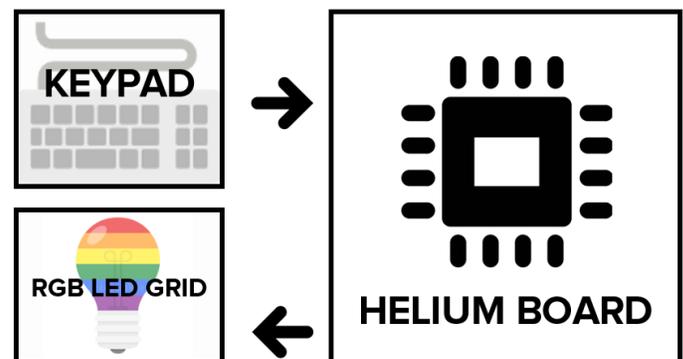


Fig. 3: Block Diagram for Mood Light.

The elements of Mood Light are:

1. LED grid
 - RGB LEDs all connected to form a grid and selects color based on input.
2. Helium Board
 - Takes input of various moods available and does the logic part to send analog signal through digital pins.

Implementation Details

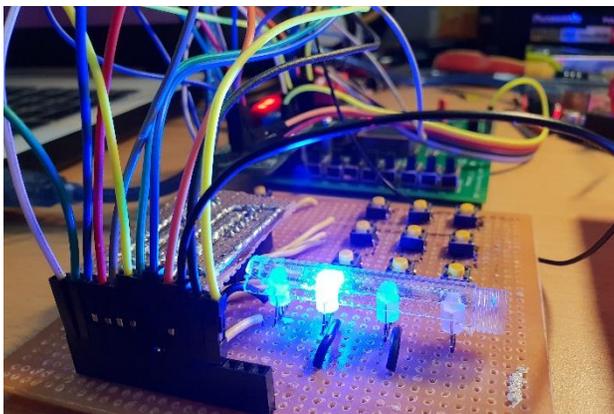
We have made a Door lock that is close to a fully functional door lock. We could not complete the physical lock due to lack of time. It takes a 4-digit PIN and as soon as ENTER is pressed it sends lock/unlock signal.

We have 4 LEDs to show the current Digit. The same LEDs are used for to show Invalid PIN or Success. The Bouncing on the buttons were reduced using software debouncing. All Logic Functions except for the initial encoder are implemented using a Helium board.

Secondly, we have tried to simulate **Room lights control** whenever a person *enter/exits* a room. For this we have used laser to detect whenever a person is entering/exiting the room. We have used a button for the second laser as we couldn't arrange for second set of laser and LDR module. Depending on the order of Laser trigger, it counts Up/Down. A FSM is used for this purpose. This turns off the light whenever the room is empty and turns on whenever the first person enters the room. A 24-hr clock is always running which is used to disable this feature during night. **Mood light** has been improved and now it can display up to 1000 custom colors. For this 3 switches are assigned, one for each Red, Green and Blue. Depending on the Duration for which the Buttons are pressed custom color is selected. Max. Time for each is 10 sec. So, with this it can generate up to 1000 colors. For giving Analog output we are sending pulse waves instead of constant voltage, this is interpreted as analog signal of a lower voltage.

Results

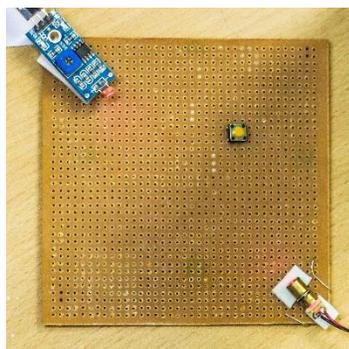
We are facing a small issue with the Lock. Sometimes junk values get loaded due to loose connections. There is an issue with the Enter and Clear Button. Apart from this it is



working just like the way we wanted. The Lock is not unlocking for invalid PIN.

Pic 1. The Door Lock

Light controller is also working fine. It counts the no. of person currently in the room, and the trigger is used to control light. Manual override is also working. Since, this is just a



simulation, the detectors are not placed on an actual door.

Pic. 2 The Laser and Detector (above) and Pic. 3 Laser in action (below)



Mood light is Working as expected. All Presets are working perfectly and the custom color mode sometimes fails to generate new color.

Conclusion

This Project helped a lot in knowing the subject from the inside. We learned a lot about the issues one can face while practically implementing any idea. We now know how every complex machine has been implemented using simple logic functions at machine level. We brushed up our technical skills and gained a lot of experience. It was fun working as team all along.

We would like to thank **Prof. Nandakumar Nambath** for giving this opportunity and guiding us all throughout the entire process.

References

- [1] Course Lecture Notes
- [2] Lab Course VHDL codes.