RFID Room Access System

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Introduction

Keeping in mind the many cases of lost keys, through this project we aim at making a digital system that controls the door lock and the power supply in a room (can be practically applied to our hostel rooms). It makes use of the Radio Frequency Identification (RFID) technology as well as a servo motor for a locking mechanism and a relay circuit for allowing power supply to the room.

System Overview

A block diagram of the system is given in Fig. 1. Give detailed description of each blocks is given below.

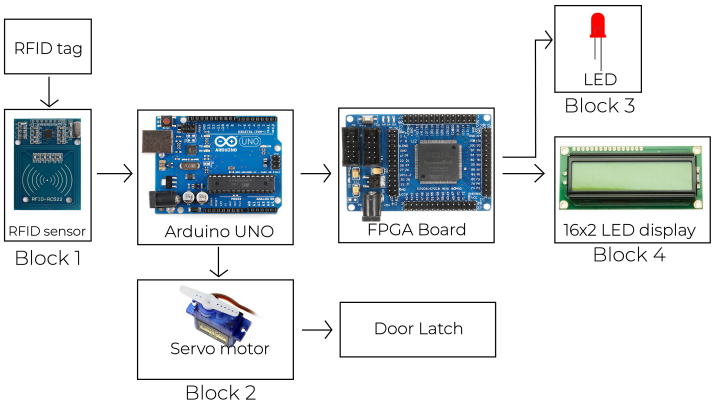


Fig. 1: Basic Block Diagram of the Project.

The project broadly consists of 4 blocks. The first block consists of the RFID sensor which detects the presence of radio frequency from the RFID tag and the output from it controls the functioning of the servo motor in the second block to change its position so as to lock or unlock the latch. It also signals the relay circuit in the third block determining whether the room is allowed access to power supply or not. The fourth block is for display which gives output based on the information it gets from the previous blocks.

Implementation Details

In this project, we have made use of an interesting technology known as RFID. Now,

What is RFID?

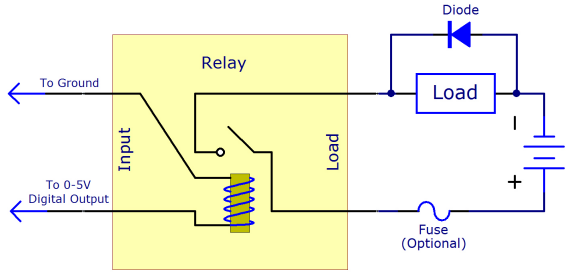
It basically stands for Radio-frequency identification. It uses electromagnetic fields to automatically identify and track tags attached to objects. The tags contain electronically stored information. Passive tags collect energy from a nearby RFID reader's interrogating radio waves. An RFID reader transmits an encoded radio signal to interrogate the tag. The RFID tag receives the message and then responds with its identification and other information.

Making use of this identification technique, we gauratee that the door is unlocked only for specific people.

- Block 1 comprises of an RFID sensor connected to and controlled by an Arduino UNO board. This block is responsible for detecting the RFID tag on a card, and reading that tag. It then sends signal to the second block, which consists of a servo motor(SG90 Micro).
- This motor makes the shaft rotate as per the angle specified in the code for a specific amount of time. This rotating motion of the shaft is responsible for the door latch being open or closed.

We also make use of a relay switch so here's a little info about it:

A relay is an electrically operated switch. A relay is an electrically operated switch.Relays are used wherever it is necessary to control a high power or high voltage circuit with a low power circuit.The traditional form of a relay uses an electromagnet to close or open the contacts, but other operating principles have been invented.

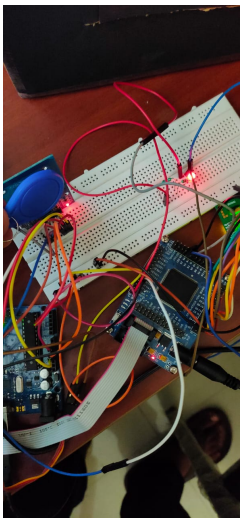


- So,the next block controlled by the FPGA, features a relay circuit, controlling the main power supply to the room. This component aims at diminishing the power wastage by cutting off the power supply to the room when it is locked.
- There's another block which has an LCD display board, on which the current status of the door lock is displayed. This display works with the VHDL code burned on the Altera Cyclone II device. All of these components of the blocks are connected to each other on a bread board using jumper wires.

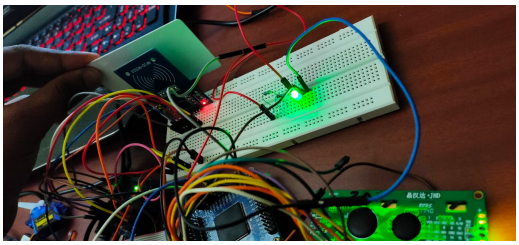
Results

We have been able to successfully implement all the blocks of our project to make fully functional door lock mechanism

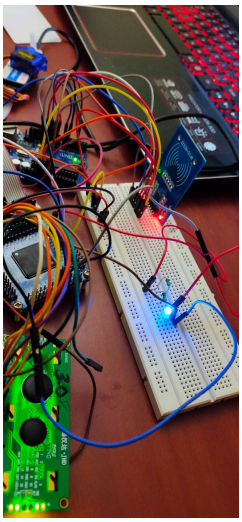
along with other features. We do experience a minor glitch in the LCD display, connected to the FPGA board yet it does not hinder the working of the circuit from addressing it's original functionality. A few images of the working circuit are attached below



A red LED indicates "ACCESS DENIED"



A green LED shows that the access has been granted.



Conclusion

The circuit built and the code written successfully model an efficient room access system. Implementing it using latest technology, such a system can be feasibly used in our hostels where each student ID can be implanted with a RFID tag which they can use to access rooms.

We got the opportunity to learn many new things during the course of this project which helped to broaden our knowledge of the practical applications of technical concepts beyond the classroom and it will definitely stay with us for a long time.

Though this system can have it's own drawbacks yet it can pave the first step on a long road, opening new avenues in the digital world.