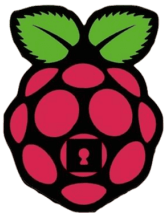


IoT Project Phase 2, Group 6: netBolt

Ryan Moe
Nazim Zerrouki

Winter 2023

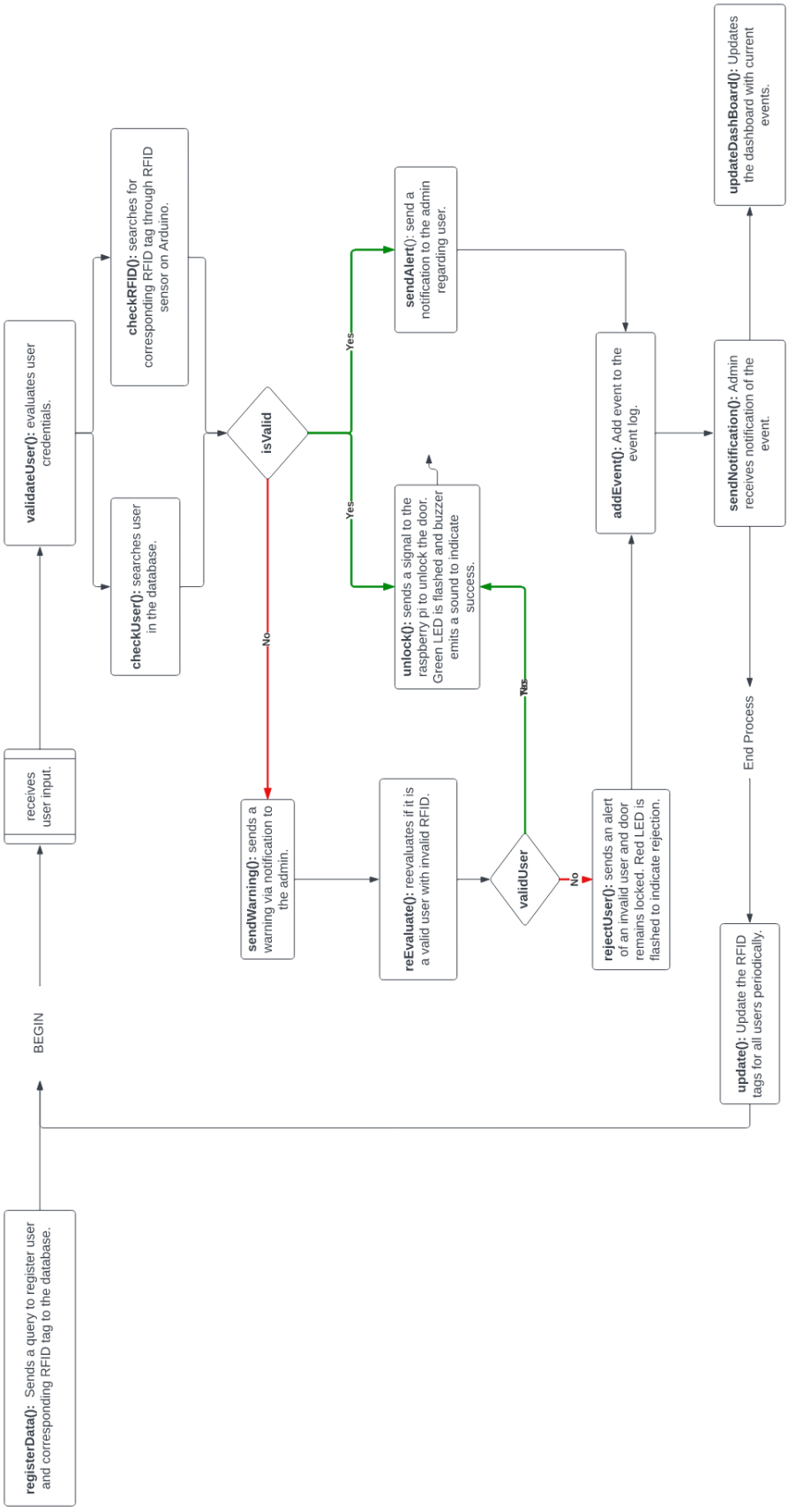
Description

NetLock will provide an intuitive interface for users when interacting with the lock. NetLock will integrate a SQLite Database hosted on the Azure Cloud Server. This database will contain information regarding user credentials, a corresponding RFID tag, and the time in which the RFID tag was produced. The information for every valid user will be stored within this database so that NetLock will be able to authenticate users for unlocking the door through the RFID sensor of the Arduino device. An integral aspect of this is enabling a connection between our locally executed program and the database within the Cloud. This connection will be invoked using Rest API so that the database will be prodded through an SQL query whenever a user needs to be authenticated when using NetLock. When the authentication is complete, the raspberry pi will invoke a response that indicates whether the door was unlocked or remains unlocked. If the user was rejected, then the red LED on grovepi will turn on using a digital output node to indicate. Otherwise, the green LED on grovepi turn on and the buzzer will be invoked using an analog command to provide clear user feedback. The lock status as well as the process of reading the RFID tag will be reflected on the dashboard.

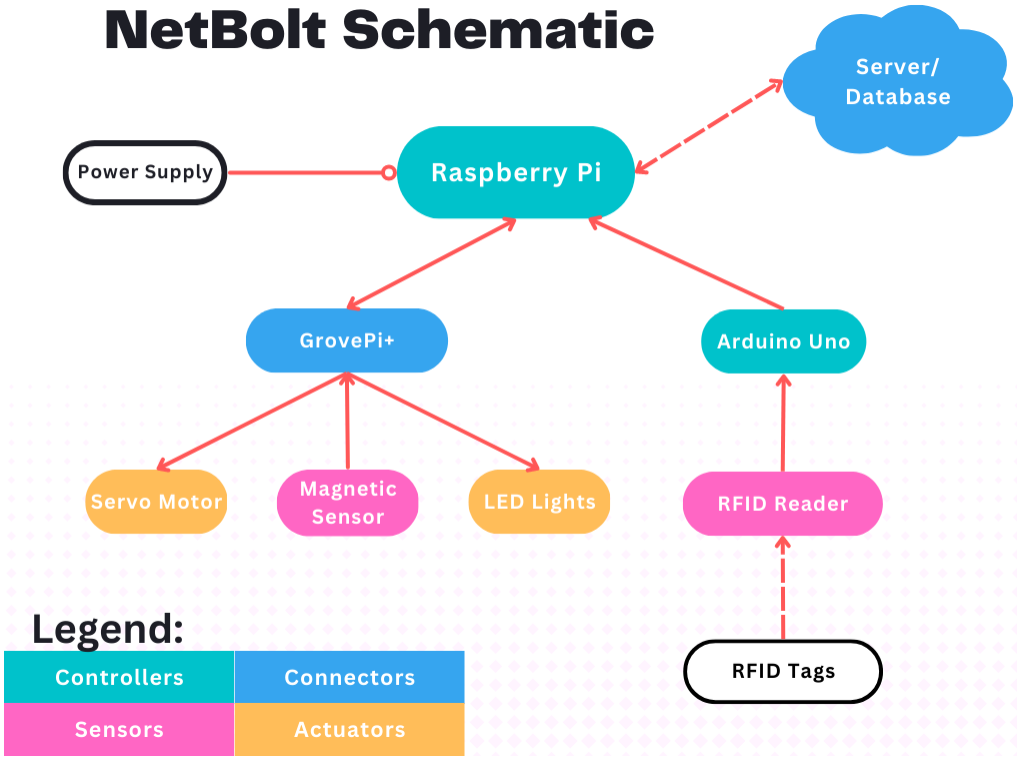
When the authentication response is complete, a notification will be sent to the owner of the lock to illustrate important details. This will act as an event log that will be added to the database using Rest API by invoking an SQL query. The event log will be shown on the dashboard to indicate recent uses of the lock. To ensure security, the RFID tags that are read by Arduino are regularly updated at a specific time and this will reflect changes within our database as well. Ideally, we would like to implement facial recognition and possibly use the camera of the raspberry pi to stream user interaction with the NetLock to the dashboard.

The data flow will be as follows:

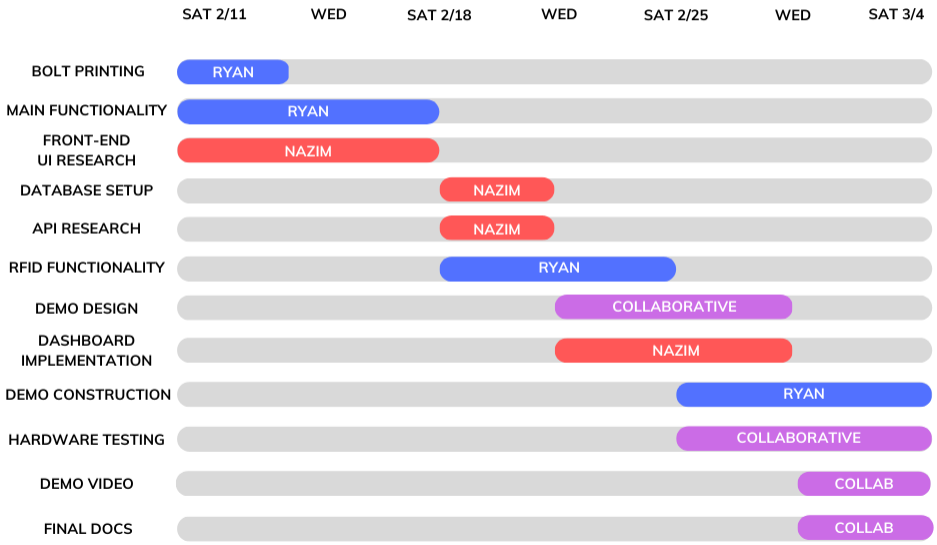
1. Upon user interaction, Arduino will read the user's RFID tag using the RFID sensor.
2. The process of sensing the RFID tag can be shown on the dashboard.
3. The authentication process is initiated which will invoke a connection to the database.
4. Once complete, a notification will be sent to the owner.
5. The raspberry pi will use grovepi digital sensors using the green and red LEDs to depict the lock status of the door. The buzzer will be triggered when the door is successfully unlocked.
6. The dashboard will also receive a signal and toggle the lock status when it is unlocked.
7. A notification is sent to the user. This will represent an event which is added to a separate table within the database.
8. During this process, we would like for the raspberry pi to stream user interactions and display them on the dashboard but this is a dubious component for now.


registerData(): Sends a query to register user and corresponding RFID tag to the database.
BEGIN
receives user input.
validateUser(): evaluates user credentials.
checkRFID(): searches for corresponding RFID tag through RFID sensor on Arduino.
checkUser(): searches user in the database.
isValid
No
Yes
Yes
sendWarning(): sends a warning via notification to the admin.
reEvaluate(): reevaluates if it is a valid user with invalid RFID.
validUser
No
Yes
rejectUser(): sends an alert of an invalid user and door remains locked. Red LED is flashed to indicate rejection.
unlock(): sends a signal to the raspberry pi to unlock the door. Green LED is flashed and buzzer emits a sound to indicate success.
sendAlert(): send a notification to the admin regarding user.
addEvent(): Add event to the event log.
sendNotification(): Admin receives notification of the event.
updateDashBoard(): Updates the dashboard with current events.
End Process
update(): Update the RFID tags for all users periodically.

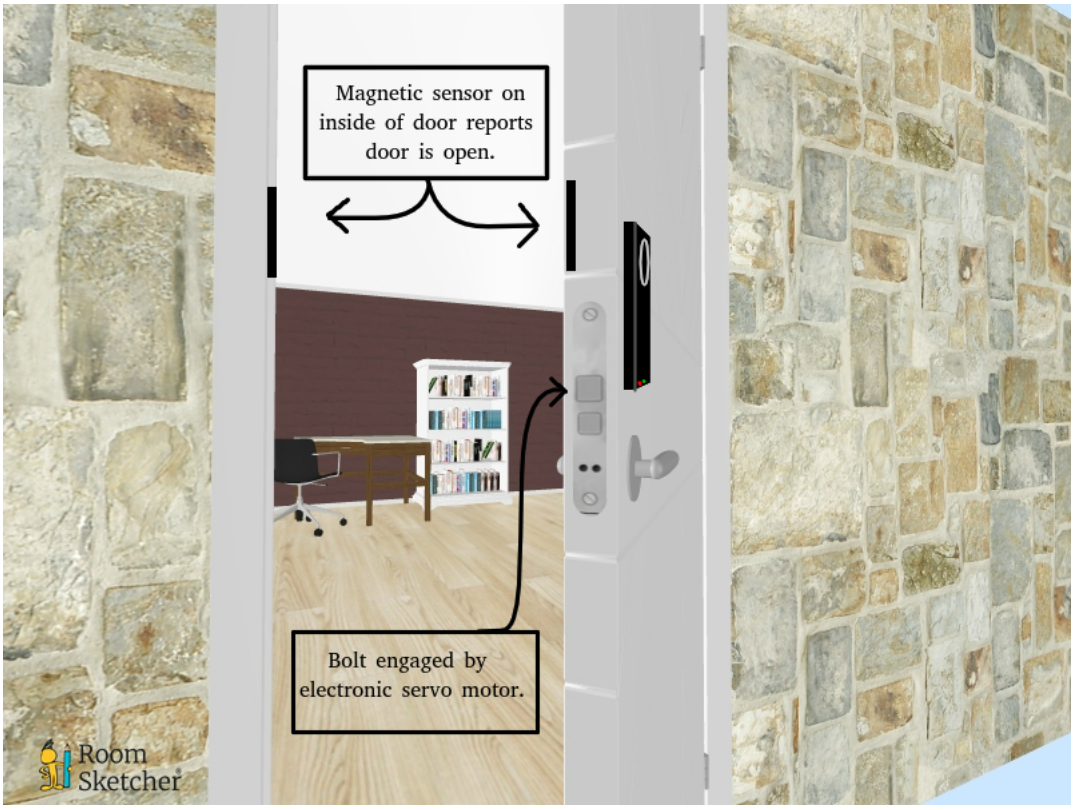
NetBolt Schematic



WORK SHARE



RFID Reader (or button on dashboard) causes bolt to disengage.
Red and Green LEDs display locked/unlocked status and whether RFID was read.
Room Sketcher


Magnetic sensor on inside of door reports door is open.
Bolt engaged by electronic servo motor.
Room Sketcher

Logistics

In order to build the prototype for the NetBolt, we will make use of provided hardware, as well as some acquired externally from vendors, and some that must be 3D-printed or otherwise fabricated. All externally-sourced hardware has already been ordered and received. We have access to a personal 3D-printer, as well as one at the campus maker-space, however some of the parts to be fabricated must first be custom designed. For the bolt assembly, we will use a publicly available design or modification thereof. The physical materials needed to build our prototype are as follows:

Equipment	**Source**
Raspberry Pi	Provided
GrovePi+ Shield	Provided
LED Lights	Provided
Piezo Buzzer	Provided
Grove Connecting Wires	Provided
Arduino Uno	External
RFID Scanner	External
RFID Tags	External
Magnetic Door Sensor	External
Servo Motor	External
NetBolt Housing	Printable
Bolt Assembly	Printable
Mock Door Demo	Buildable