EL203 Embedded Hardware Design
Project Proposal

Face Recognition System For Door Unlocking using Raspberry Pi

Team 47
Group 5

Team Members:

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Introduction:

The applications of Embedded systems in home automation has increased in recent years. We plan to implement one such application in the domain of home security. Instead of just having a CCTV outside your door, why not use the camera to open the door when you arrive at the doorstep? Suppose you are carrying something in both your hands and you arrive at the entrance of your door. Now you can't open the door easily. Or you are with your friends and want to show them how you unlock your door without touching it. You can use this face recognition system. This system is even more useful for security purposes. Suppose a thief tries to get into your house. He stands in front of the door and his face is captured. As it doesn't match any of the stored faces, his photo is sent through mail to your email address. He tries inserting the key value to the door in the keypad as his face is not detected. He tries 3 times and then an alarm starts to ring. So the thief runs away and you have the photo of the thief too!

The system may be implemented in various other real time systems requiring user authentication such as attendance systems, ATM security, Network security, In Bank locker. The proposed system actually falls under the concept of smart homes.

Implementation:

The project aims to implement Secure locking Automation using Raspberry Pi for Door unlocking to provide essential security to our homes, bank lockers and associated control operations and send security alert through the Raspberry Pi via email.

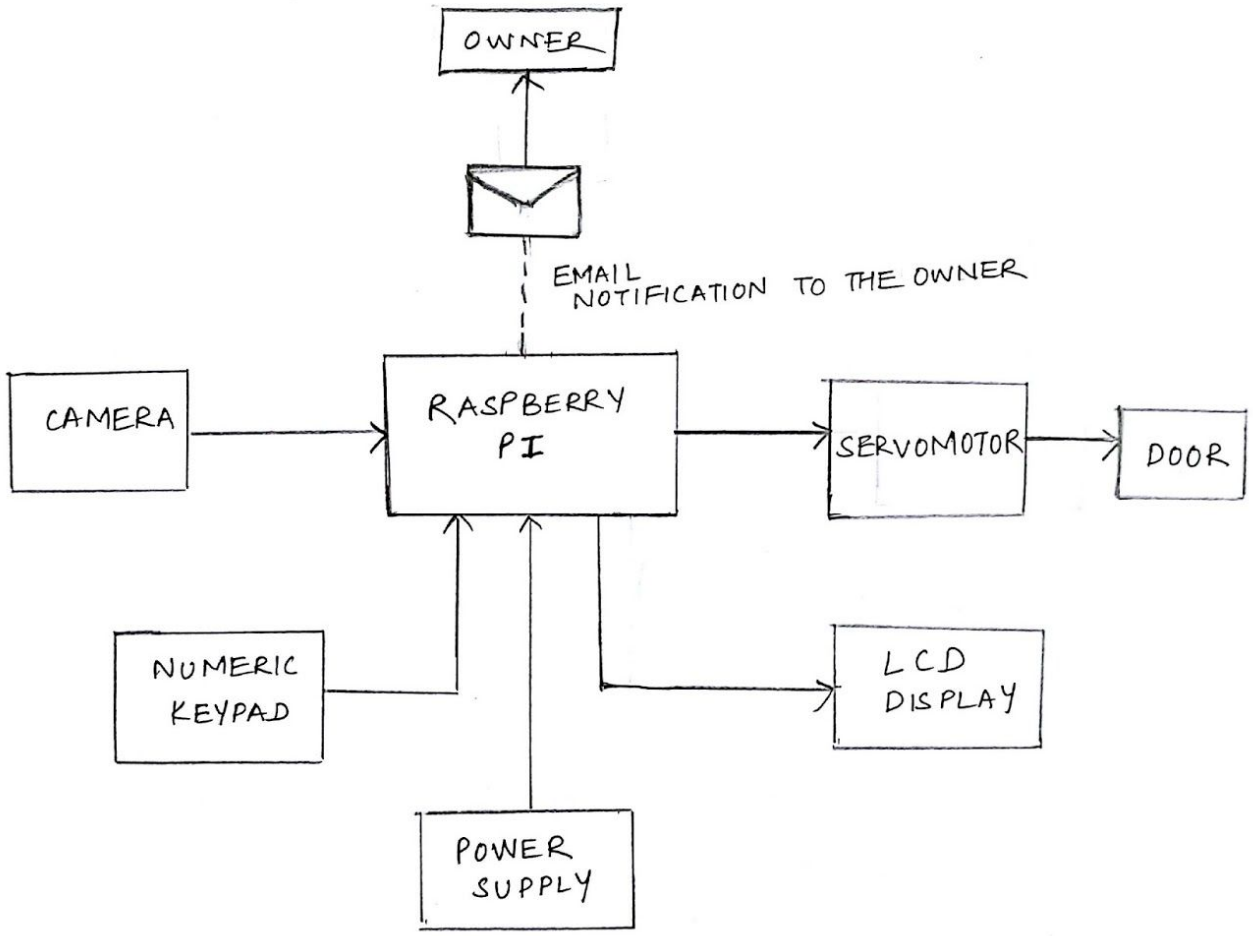
We plan to make a door unlocking system based on face recognition at the entrance. The face image is captured using with a camera and sent to the Raspberry Pi. Then it is compared with trained model using standard face recognition algorithms. We plan to use openCV or simpleCV libraries for the image processing tasks. If the confidence is above a predetermined threshold, then the door is unlocked using the servo motor.

In case the person's face is not recognized by the raspberry pi camera, an email with the image of the person attached is sent to the owner. This is to warn the owner regarding a possible attempt to breach security.

There are some limitations to the face recognition system, as it depends on the orientation of the face in front of the camera. The person can enter a backup password through the numeric keypad in such cases. He/She is given 3 attempts. The password is verified using the raspberry Pi. If there are three failed attempts, again, an email is sent to the owner notifying about the possible breach in security.

We were exposed to 3 boards during our lab experiments. Arduino doesn't have the processing power required for face recognition algorithms. Cost of beaglebone black is higher than raspberry Pi. Though the processor speed of 700 MHz and 512MB RAM of the Pi is sufficient for the image processing. Also Raspberry Pi has a wider support community compared to BeagleBone black. Hence we decided to go with Raspberry Pi.

Block Diagram:



Hardware Components required

1. Raspberry pi
2. Raspberry Pi camera
3. Servomotor
4. 4*4 Matrix Array/Matrix Keyboard 16 Key Membrane Switch Keypad
5. LCD Alphanumeric Display
6. 12 V Power Supply
7. 4 1k resistor

Cost approximation :

Excluding the cost of Raspberry pi (issuing from college), the approximate cost of the project is ₹2000.