# Home Security With Arduino/Raspberry Requirements Specification Document

The high-end home security systems that people usually buy off the shelf can be easily emulated using an Arduino and Wifi Shield and that too at an extremely lower cost. These high-end home security systems that you can set up somewhere in your home or outside, connect to your WiFi network, and then access the video stream from anywhere. However, they are usually using the interface given by the manufacturer, which means you are quite limited to what you can do with your camera.


The central idea I have is the development of an IoT camera, in other words, a programmable camera with wifi connectivity and full TCP-IP and HTTP stack. This can be done using a Wifi Shield. My IoT camera is designed to be used in a surveillance application, so the chosen camera has an embedded motion detection algorithm able to snap images when the scene changes and the motion detection feature can be simply programmed using the C++ library provided by Adafruit inc. in an Arduino's sketch.

I will be needing some extra components like a motion detector and Wifi Shield. Wifi connection is needed either to store video on the cloud as backup storage as on-device memory is limited. Also, we could live stream the video from the camera to an application on our mobile phones for remote surveillance. The camera can also notify us when the motion sensor is triggered over the internet using the wifi to send a message.

Considering the designer perspective we can set up the system in two ways. The first one being multiple stationary cameras accessing the different angles and points of significance. The second one is where we set up some kind of motor to move the camera to cover a wider angle of vision at a periodic interval. Depending on the demand of increasing project scope we might even need to introduce higher specifications cameras having night vision capabilities, 360-degree cameras, etc. A list of components are as follows:

- Arduino/Raspberry
- Camera/360-degree/night vision
- Motion sensor
- Power Supply
- Object detection Model
- Face recognition Model
- Wifi connectivity
- Cloud Storage
- Application Interface

From the user, perspective simplicity is the desired objective is to provide the simplest method to interact with the system. The following are the points that I need to consider:

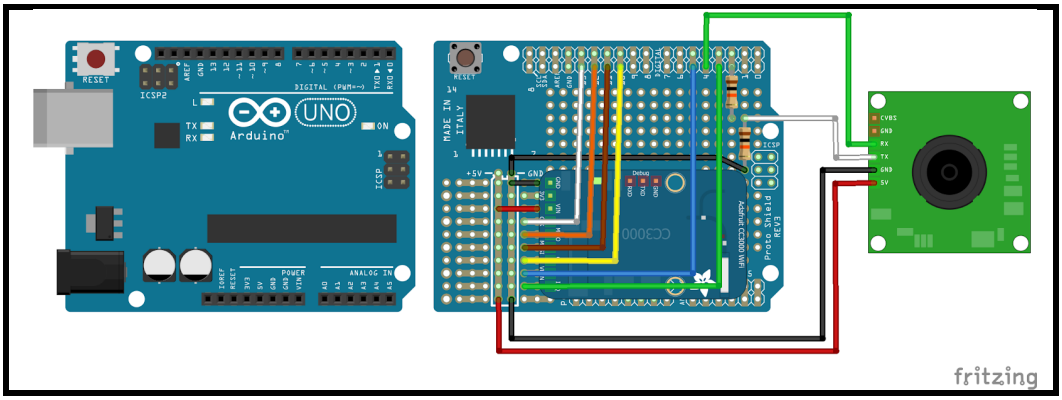
- Authenticated access to the system
- Remote access to the system
- Backup of data
- Some analysis
- smart decision-making capability

As a student, I can't afford overly expensive hardware to make my system 100% perfect in terms of performance. That being the biggest constraint the other one I face is the selection of the model to perform some analysis. The total cost predicted by me considering all of the components is under Rs 5000. The design/implementation time I require for building this project is about the time of the curse that is four weeks (one month). As for the performance I am to a level dependent on the model and hardware that I will be using. But even soo, for a student project I expect the system to perform at a level of 80% perfection with some minor errors that can be resolved later.

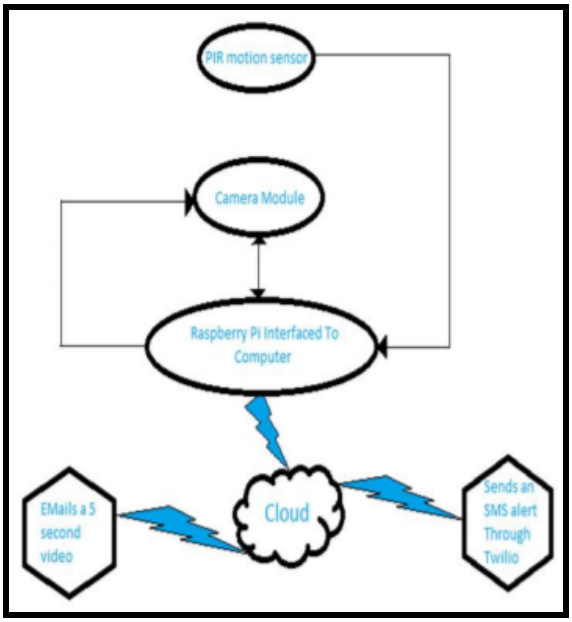
https://www.youtube.com/watch?v=Y2QFu-tTvTI

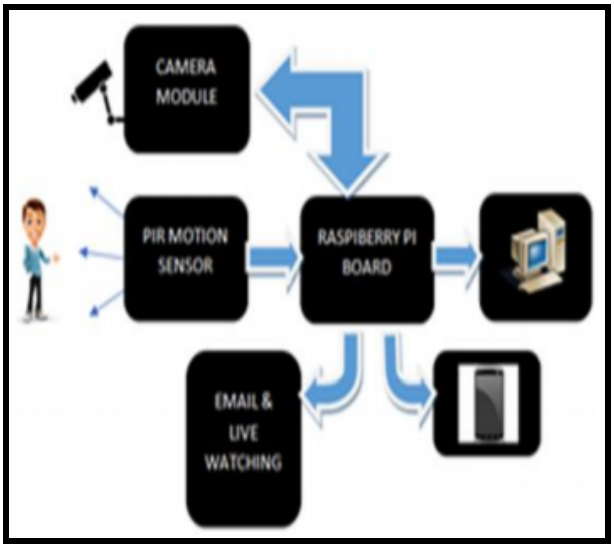
# Home Security With Arduino/Raspberry Design Document

There were two design options that I could consider for this project first being using the Arduino kit alongside a camera. Given the limited capability of Arduino UNO in terms of storage we require a Wifi Shield in order to send the stream of video over the Internet and store it on the cloud. I visualized the block diagram to the one as seen below. However, I prefer to design using a Raspberry for this project as it already has the wifi module along with its ease while using a camera and the GUI allows better accessibility while developing.

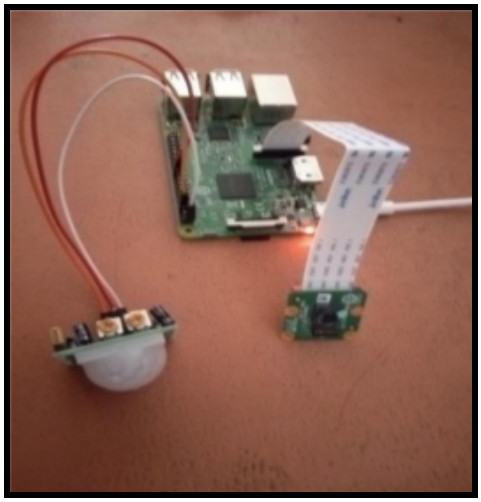



The following are the flow and block diagrams that are essential representations of the development process I will be going through in this project.

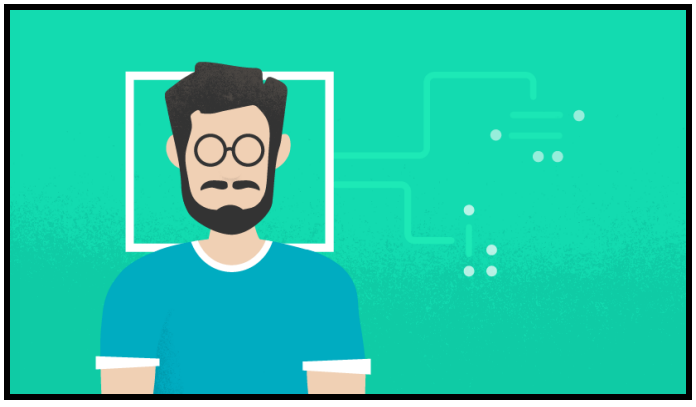


The PIR (Passive Infra-Red) Sensor is a Pyroelectric device that detects human body motion by measuring changes in the infrared levels emitted by surrounding objects. The Raspberry Pi Camera Module is a custom designed add-on for Raspberry Pi. It attaches to Raspberry Pi by way of one of the two small sockets on the board upper surface. This hardware will play an important role in designing the system. Such as the camera being triggered to capture picture or video once the motion sensor is triggered.



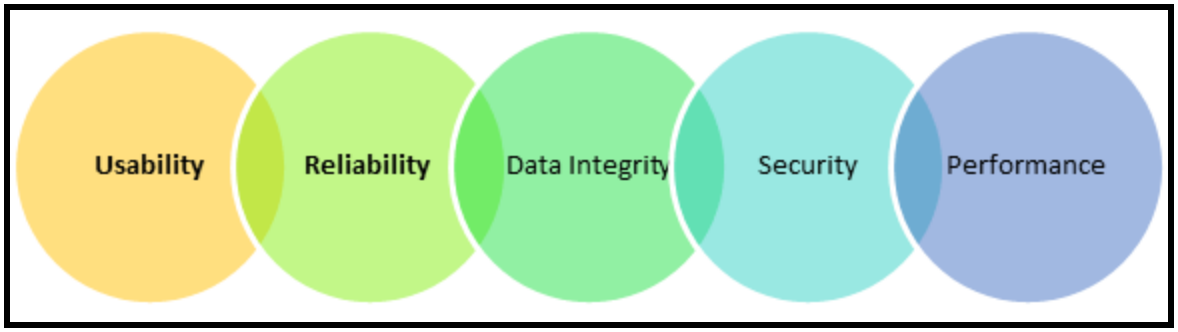
Hardware alone is not enough for building a system, software plays an important role too. Python is an interpreted high-level programming language for general-purpose programming. I will be using it for this project. Twilio is a cloud-based service that enables powerful communication between mobile devices, applications, services, and systems throughout the business in order to bridge the gap between conventional communications. It can prove useful in transmitting notifications on the camera being triggered.



The implementation of a model for face detection through the camera can be really useful and add extra functionality to the system. Facial data of owners could be stored and allowed access without triggering any alarms. At the same time, the facial data of suspicious individuals could be referenced with criminal databases and officials alerted.

# Home Security With Arduino/Raspberry Testing Document

The 4 common components of an IoT system are Sensor, Application, Network and Backend. For the purpose of performance and reliability of this new system that I am developing, I will need to check each of the above-mentioned components. IoT testing is a type of testing to check IoT devices and systems. Today there is an increasing need to deliver better and faster services. There is a huge demand to access, create, use and share data from any device. The thrust is to provide greater insight and control, over various interconnected IoT devices. Hence, the IoT testing framework is important.




Testing for IoT devices broadly revolves around Security, Analytics, Device, Networks, Processors, Operating Systems, Platforms and Standards.

Usability Testing: There are so many devices of different shape and form factors are used by the users. Moreover, the perception also varies from one user to others. That's why checking the usability of the system is very important in IoT testing. I will need to check each and every device that I will be connecting including the sensors, the cameras and all.

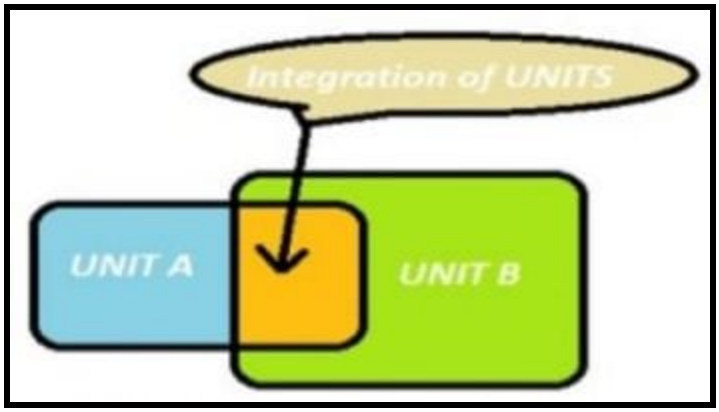
Compatibility Testing: There are lots of devices which can be connected through the IoT system. These devices have varied software and hardware configuration. Therefore, the possible combinations are huge. As a result, checking the compatibility in the IoT system is important. I need to check for the compatibility between devices in my system such as the raspberry and the camera.

Reliability and Scalability Testing: Reliability and Scalability is important for building an IoT test environment which involves the simulation of sensors by utilizing virtualization tools and technologies. I need to test out the sensor and that it works in a number of conditions. I need to test out the software seeing to it that it works well in all situations. Resolving errors rather than throwing exceptions.

Data Integrity Testing: It's important to check the Data integrity in IoT testing as it involves a large amount of data and its application. I need to check that the data is not lost or stolen from the system.

Security testing: In the IoT environment, there are many users are accessing a massive amount of data. Thus, it is important to validate user via authentication, have data privacy controls as part of security testing. The system needs to be protected from outside intrusions. The system should be safe from outside intrusions.

Performance Testing: Performance testing is important to create a strategic approach for developing and implementing an IoT testing plan. A certain level of sophistication is expected from such systems. I need to optimize the software by reducing the response times of the systems. The system needs to accurately notify any intrusions and allow a smooth experience to the owners.




One more major player in IoT testing is Integration testing. IoT is successful if the Integration test plan is accurate and robust enough to catch flaws in the system. Integration testing is testing the integration of different part of the system together. Two different parts or modules of the system are first integrated and then integration testing is performed.

The aim of integration testing is to check the functionality, reliability, and performance of the system when integrated. Integration testing is performed on the modules that are unit tested first and then integration testing defines whether the combination of the modules give the desired output or not. Integration testing can either be done by independent testers or by developers too.

Given the processing needed by the system, it is necessary to perform in-depth testing of it. I could use a professional testing framework such as Shodan or Thingful. Using such a third party software testing framework greatly reduces the burden of manually testing IoT systems because in such systems it is really hard to pinpoint errors and at the same time find ways to solve them.