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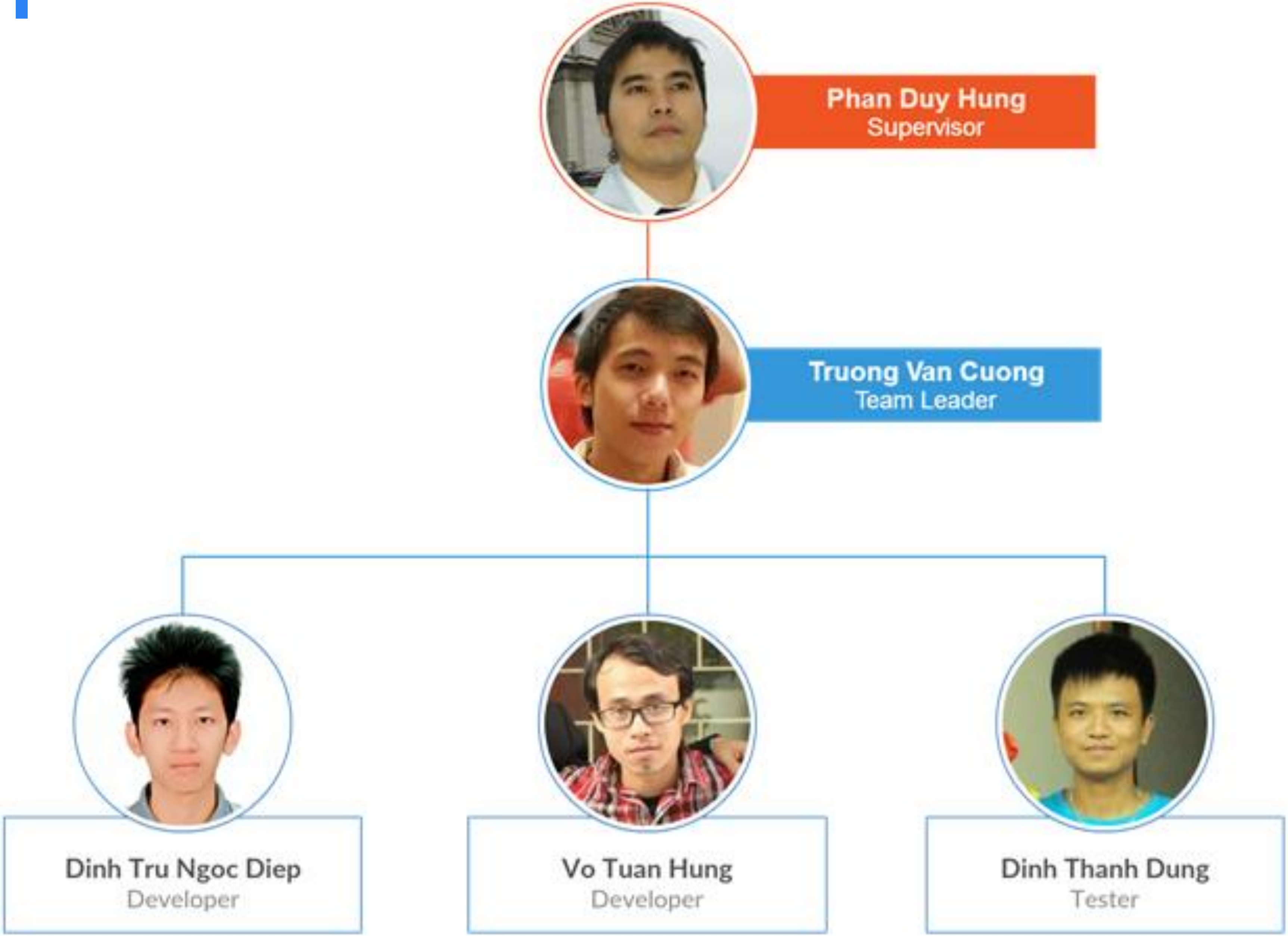
Home Security System

Capstone Project

THE PEOPLE



Phan Duy Hung
Supervisor

Truong Van Cuong
Team Leader

Dinh Tru Ngoc Diep
Developer

Vo Tuan Hung
Developer

Dinh Thanh Dung
Tester

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1 **Introduction**
Details about project Home Security System

2 **System Requirements**
Comprehensive description of requirements

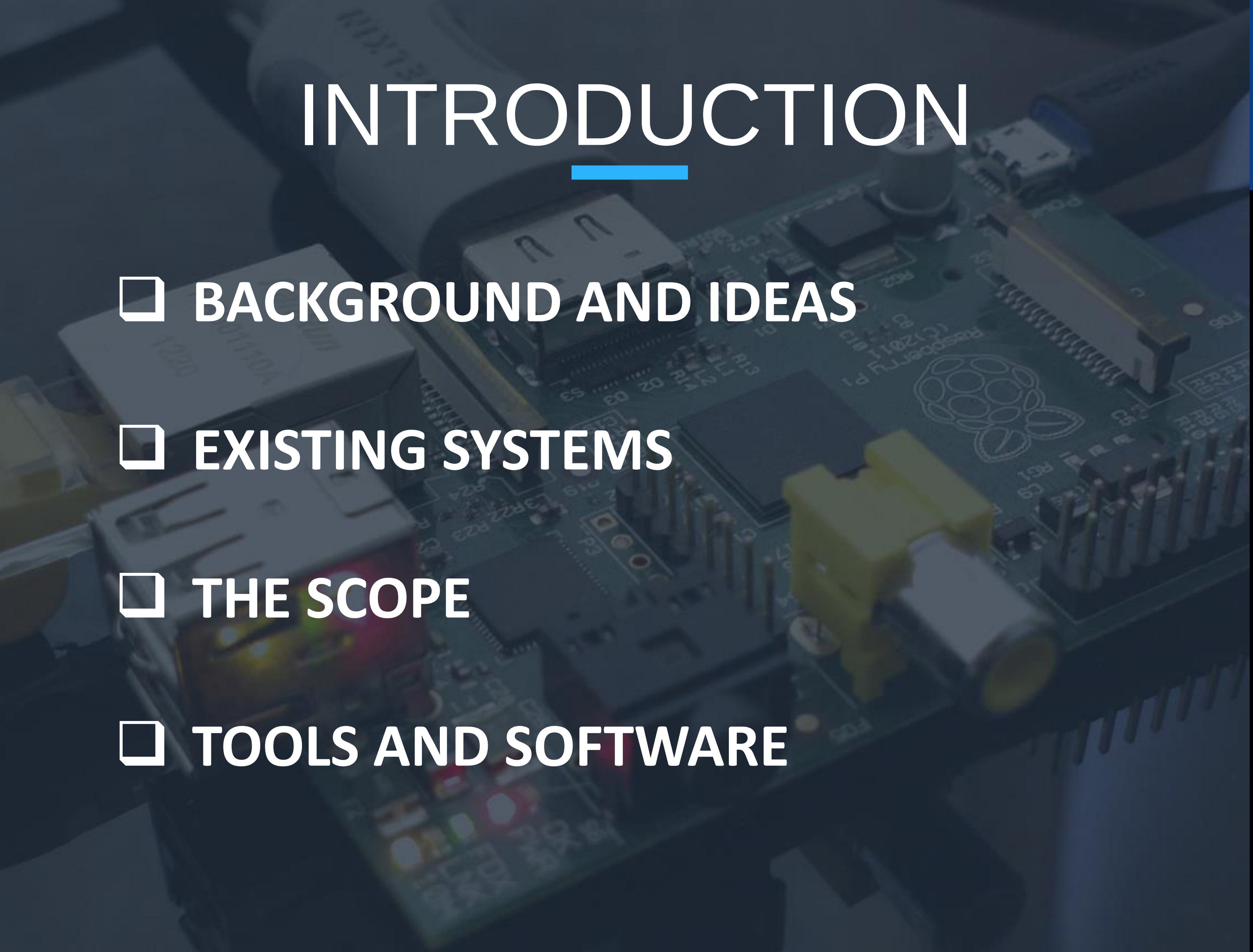
3 **System Design**
How to develop ideas

4 **Future Works**
Discussion about the future of HSS

5 **Demo**
Run demo prototype of Home Security System

6 **Question & Answer**
Q&A between team and committee

INTRODUCTION



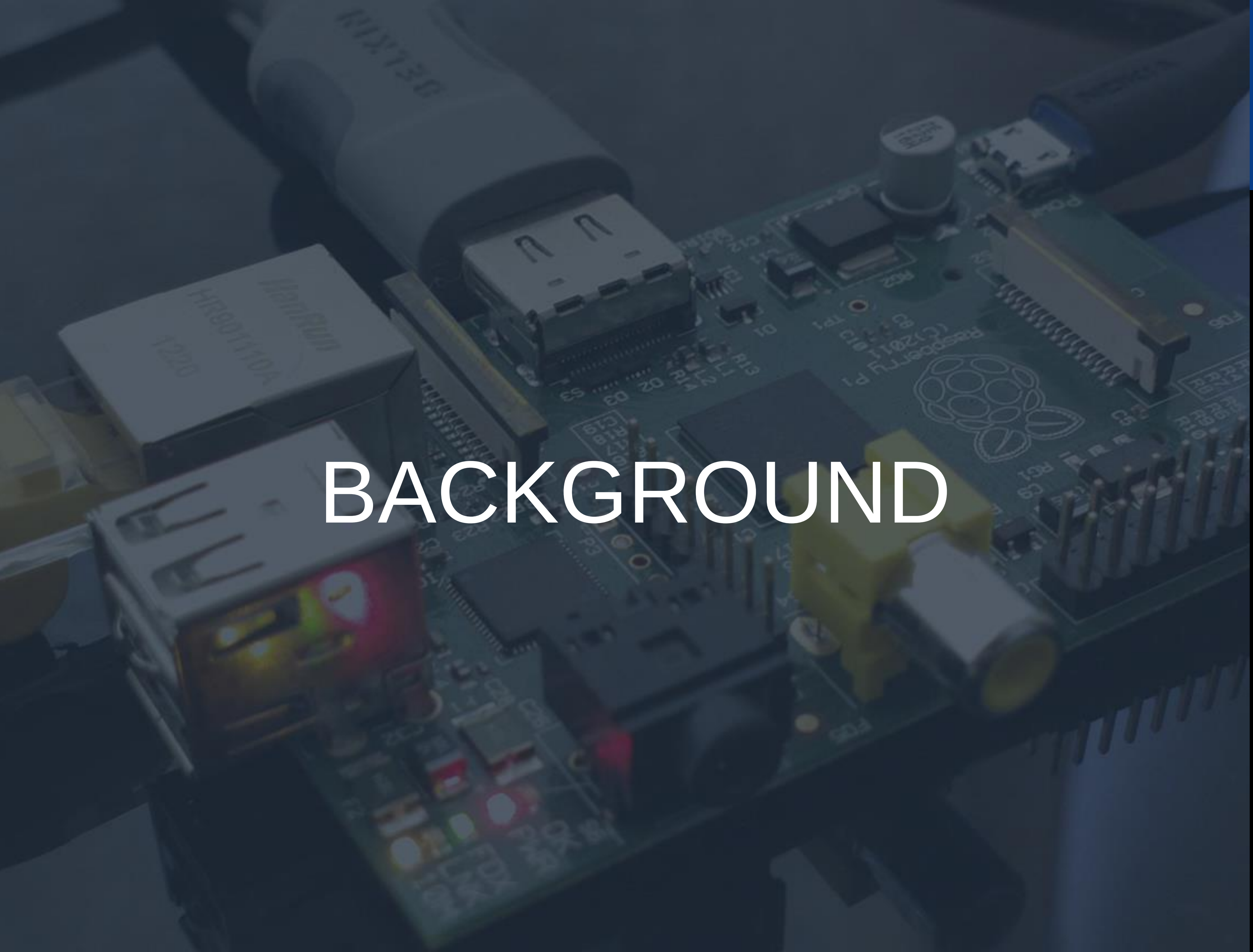
❑ BACKGROUND AND IDEAS

❑ EXISTING SYSTEMS

❑ THE SCOPE

❑ TOOLS AND SOFTWARE

BACKGROUND



BACKGROUND AND IDEAS

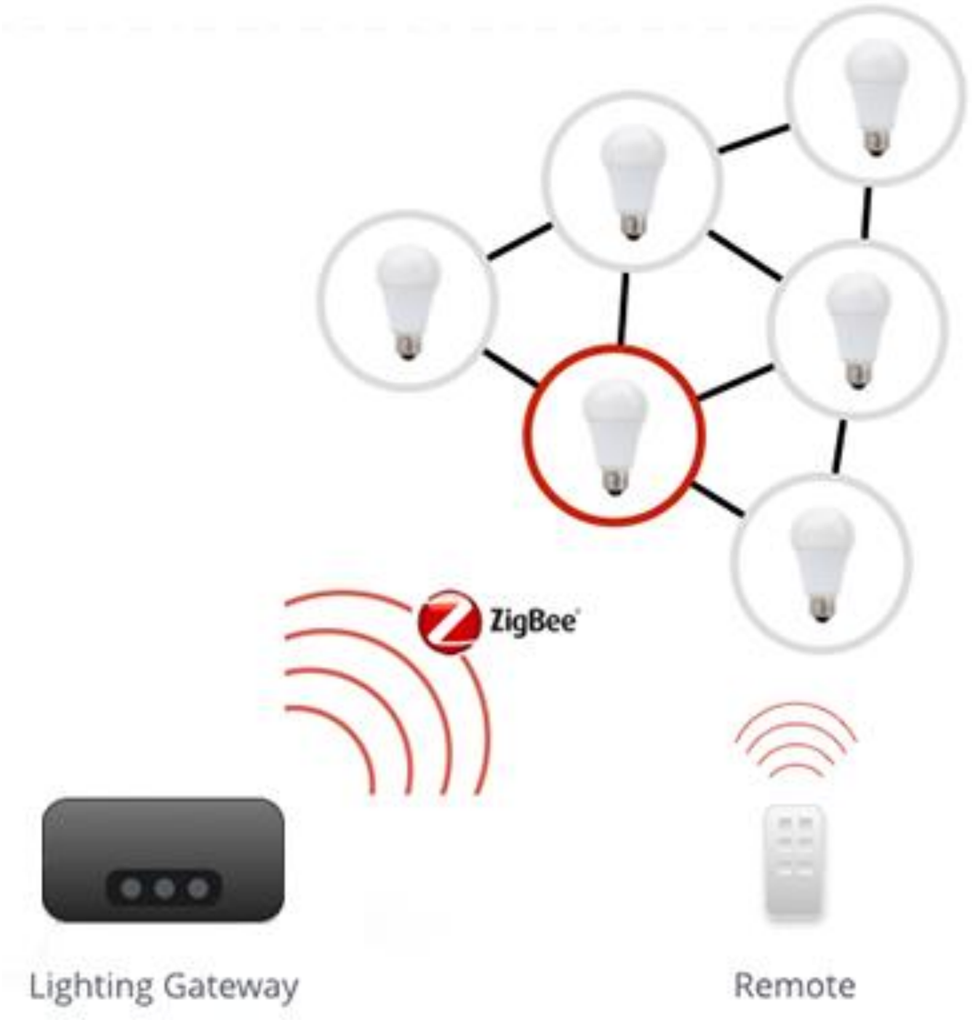
- **The term “Internet of Things” (IoT)**
  - System of interrelated computing devices, mechanical, digital machines and objects

- **IoT Requirement**
  - Transfer data over a network without human-to-human or human-to-computer interaction

- **Types of IoT communication**
  - Device-to-Device Communication
  - Device-to-Cloud Communication

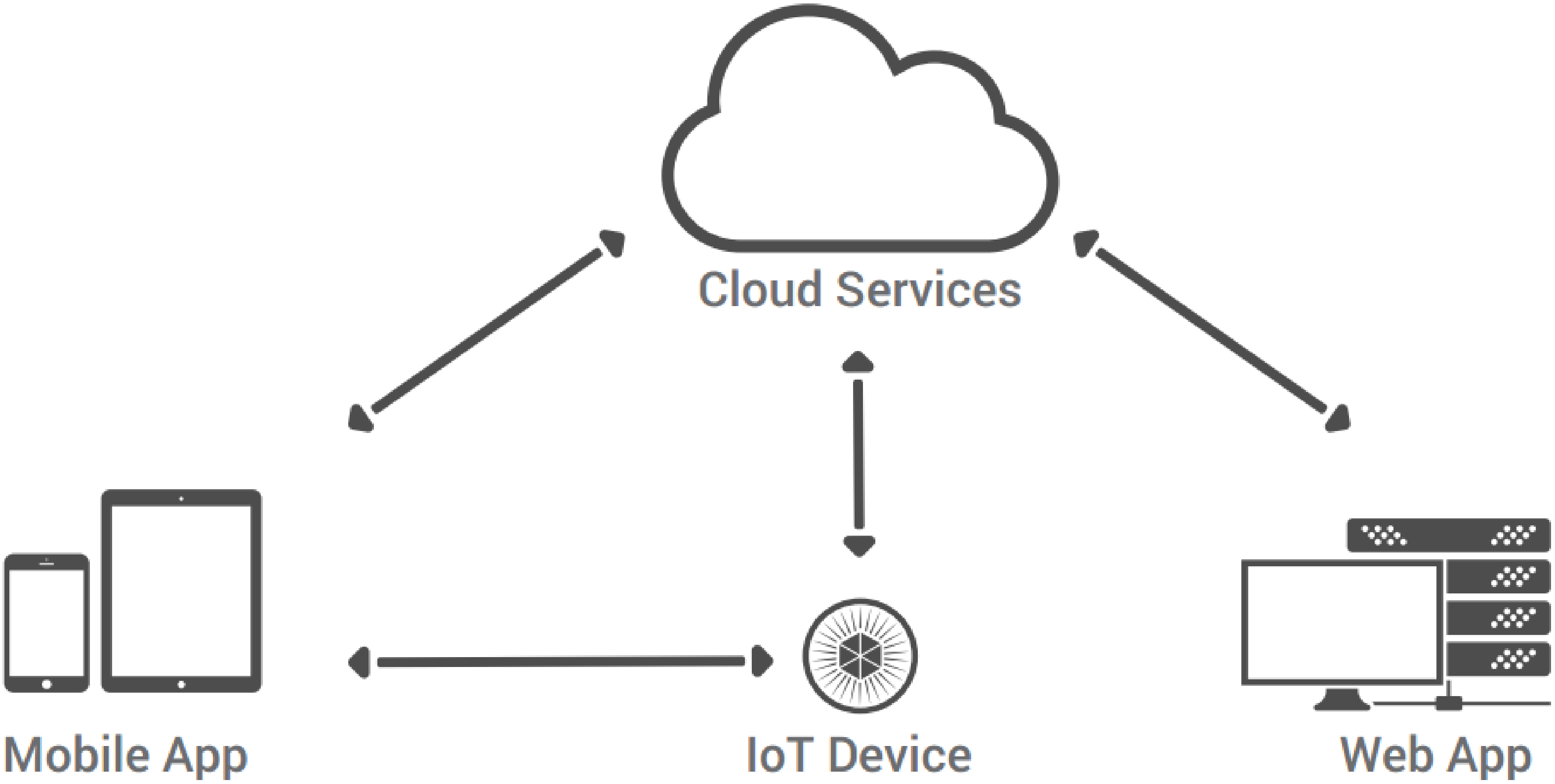
BACKGROUND AND IDEAS (CONT.)

- ❑ **Device-to-Device communication**

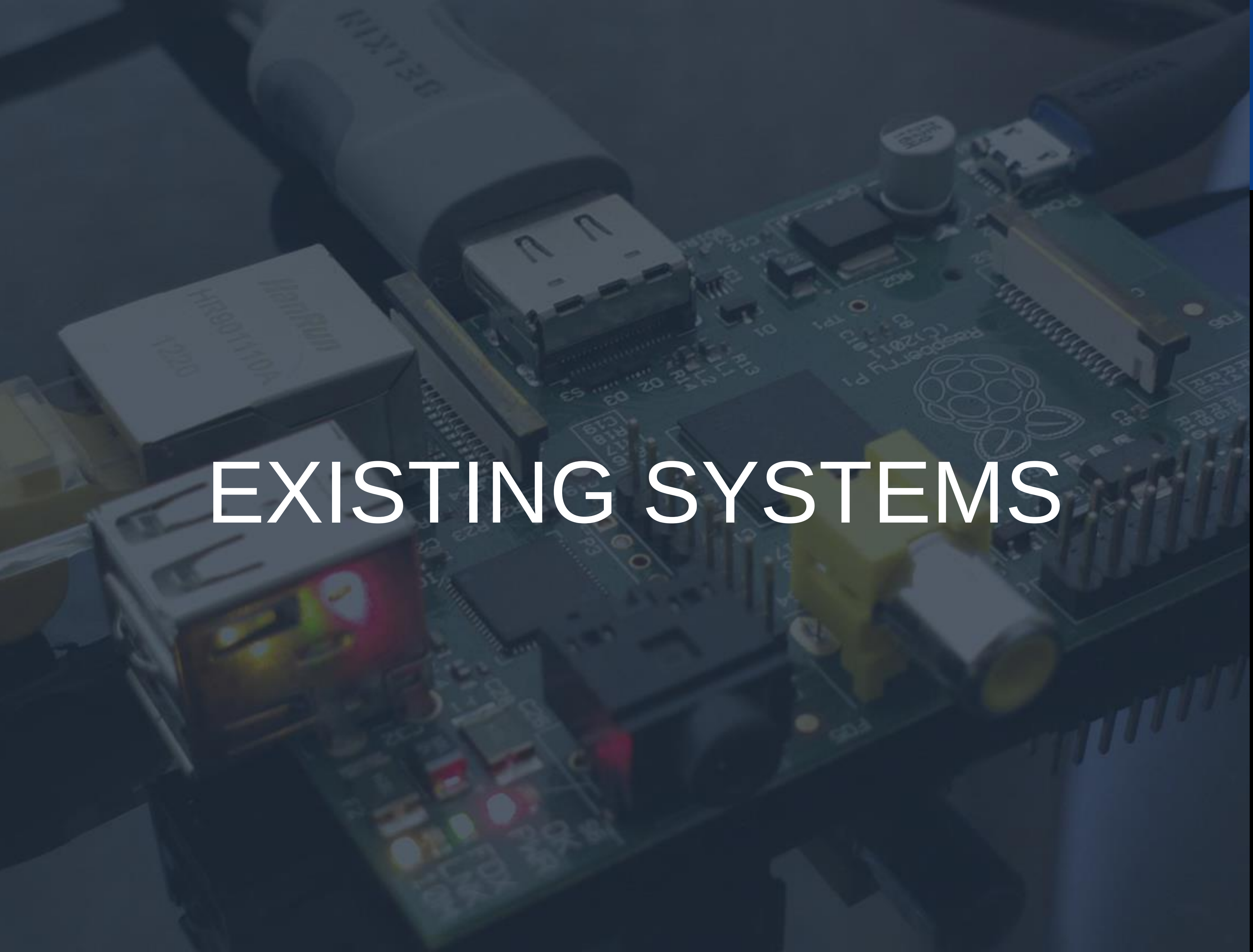


BACKGROUND AND IDEAS (CONT.)

- ❑ **Device-to-Cloud communication**



Communication Model of HSS Project



EXISTING SYSTEMS

EXISTING SYSTEMS

❑ IDEAL Security System

$250

Working

Connect to telephone landline

Alarm by calling directly to phone

Lose memory when power failure

2 door sensors, 1 motion sensor

remote control, telephone dialer

EXISTING SYSTEMS (CONT.)

❑ SimpliSafe House Security System

$260

$24.99/month for smartphone app

Working

Very simple to use

Plug and Play

Includes door sensors, motion detectors, CO detector, panic button for emergencies etc…

EXISTING SYSTEMS (CONT.)

❑ iSmartAlarm Premium Package

$199

$349 for including iCamera

Working

Smartphone application

2 door sensors, 1 motion sensor

2 remote tags

Very easy to integrate with addition sensors

RESEARCH

“91% of people keep their smartphone within 3 feet 24 hours a day”

- Morgan Stanley -

THE SCOPE

Internet
WLAN or Ethernet

Sensor
Motion and Door detection

Connection
HSS-Board and HSS-App
in a local network

Real-time Handling
Send and receive data
in real-time

Audio Quality
64kbps

Image Quality
JPEG 640x480 pixel

TOOLS AND SOFTWARES

□ Programming Language

□ Tools and Software

Qt

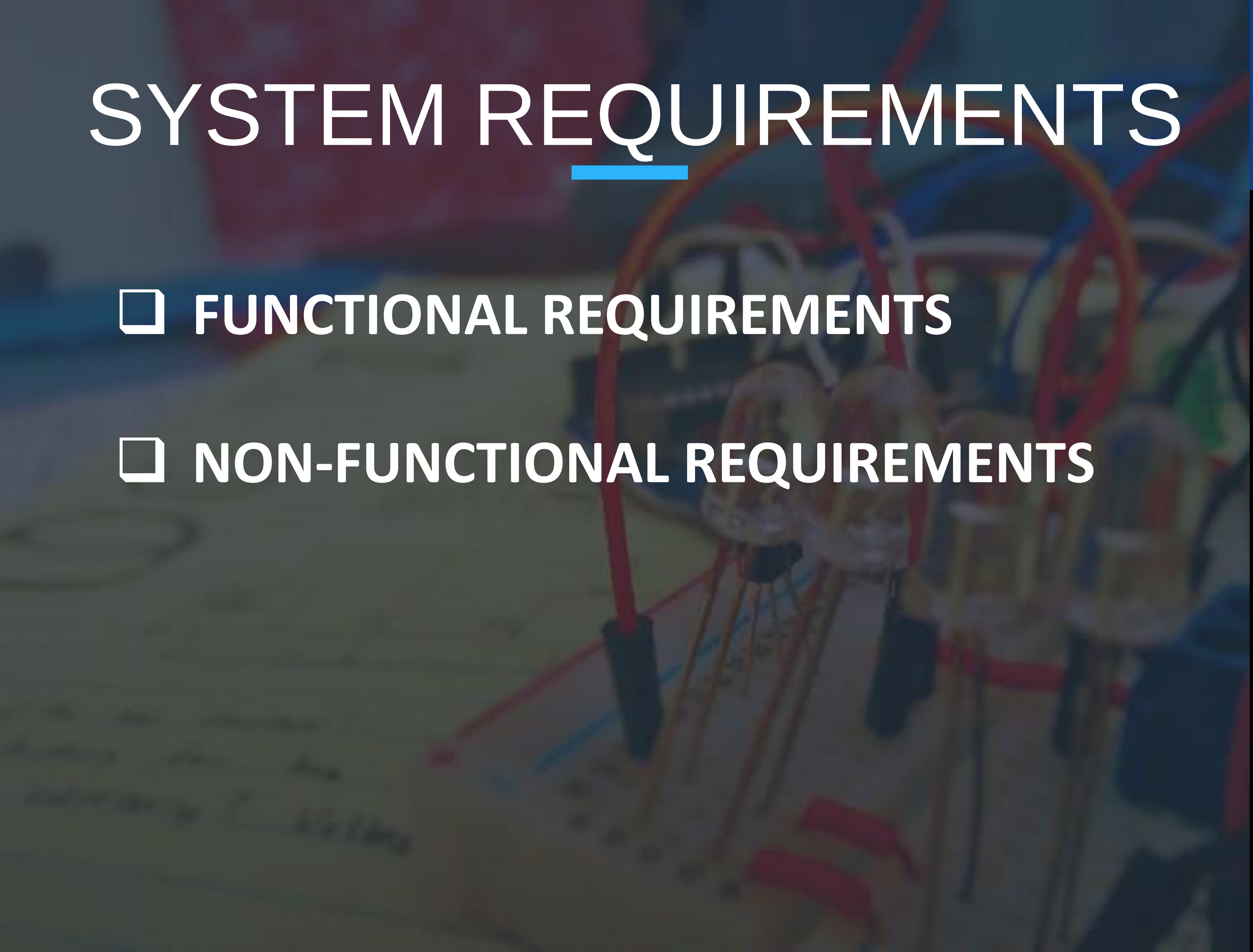
Github

Google Drive

Astah

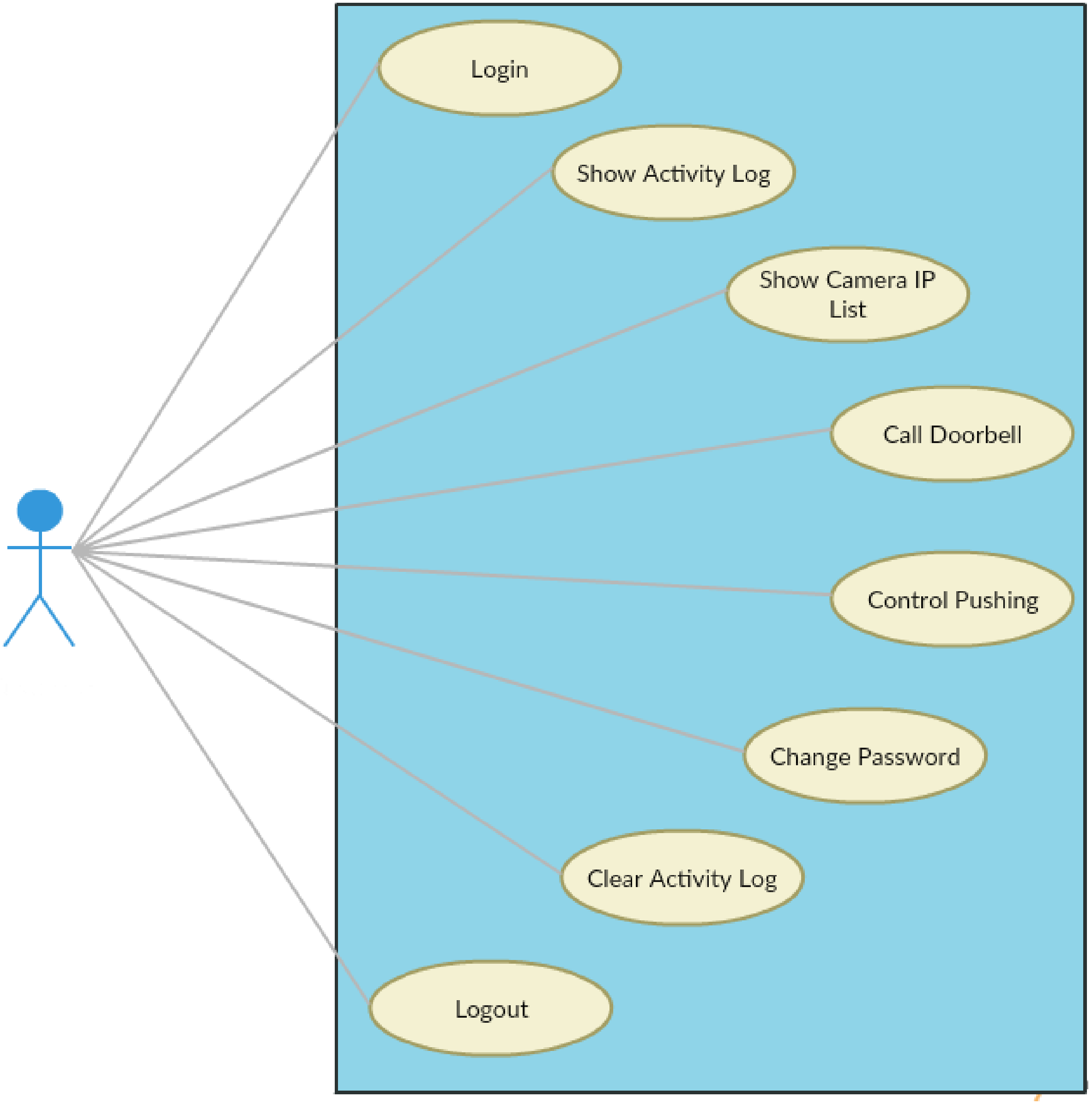
Arduino IDE

SYSTEM REQUIREMENTS



- □ **FUNCTIONAL REQUIREMENTS**
- □ **NON-FUNCTIONAL REQUIREMENTS**

FUNCTIONAL REQUIREMENTS



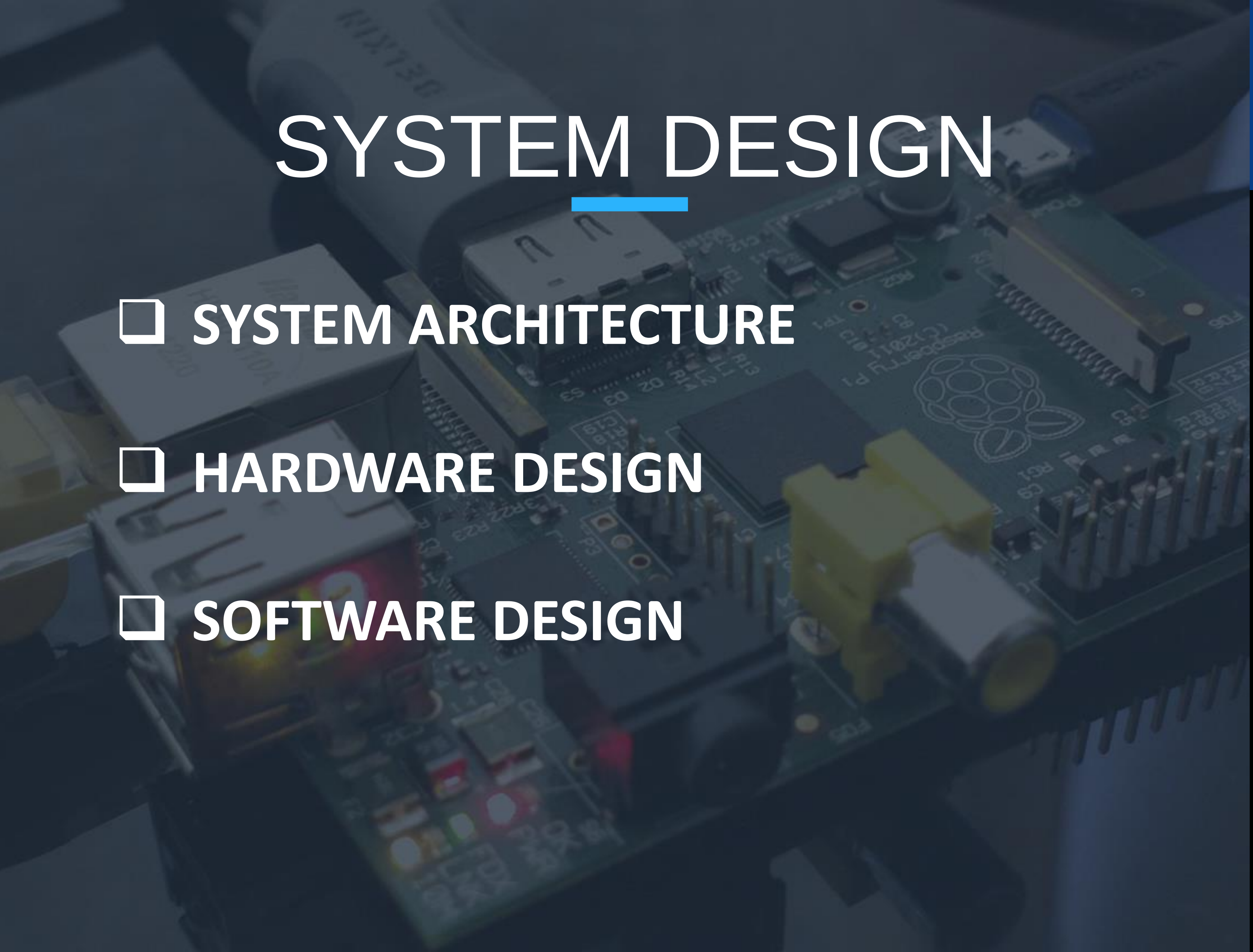
NON-FUNCTIONAL REQUIREMENTS

- **Safety**
  The supply voltage is totally safe with user (5V)

- **Reliability**
  Availability
  Low Failure Rate

- **Security**
  Always require authenticating process

- **Usability**
  Well-formed graphical UI
  Informative error messages

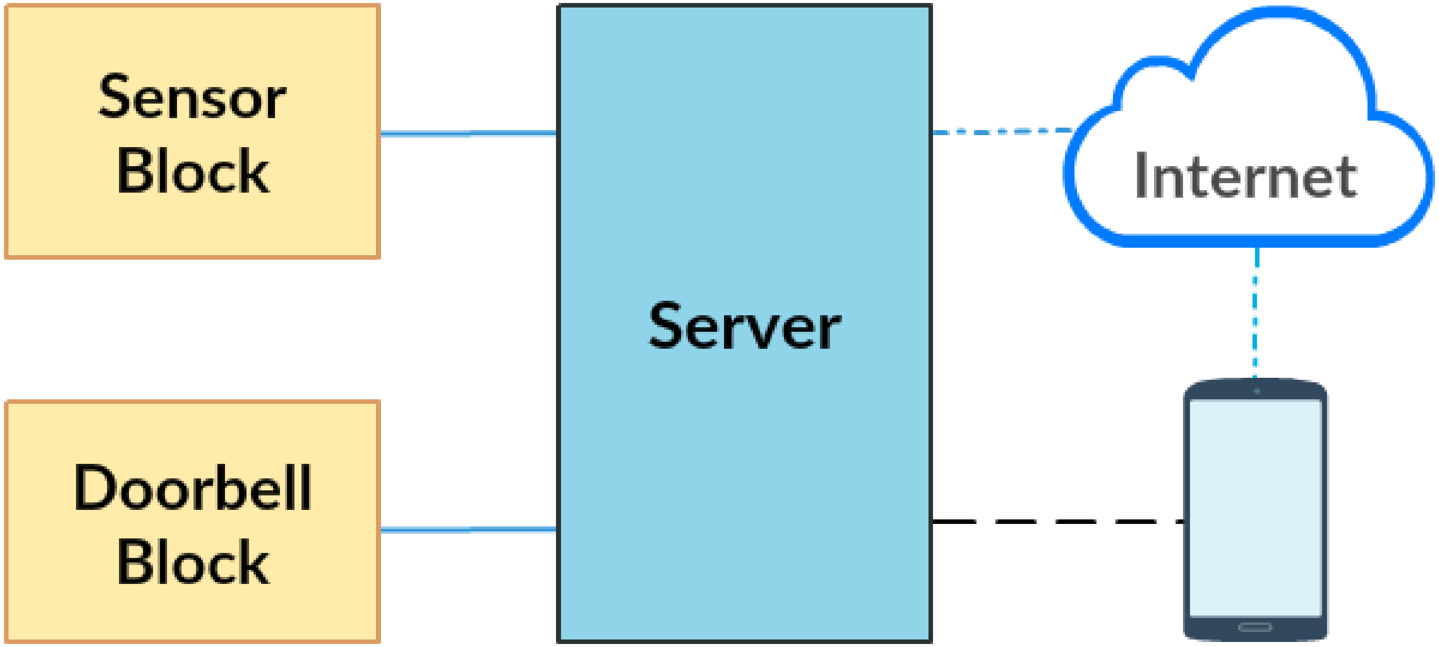


SYSTEM DESIGN

- □ **SYSTEM ARCHITECTURE**
- □ **HARDWARE DESIGN**
- □ **SOFTWARE DESIGN**

SYSTEM ARCHITECTURE

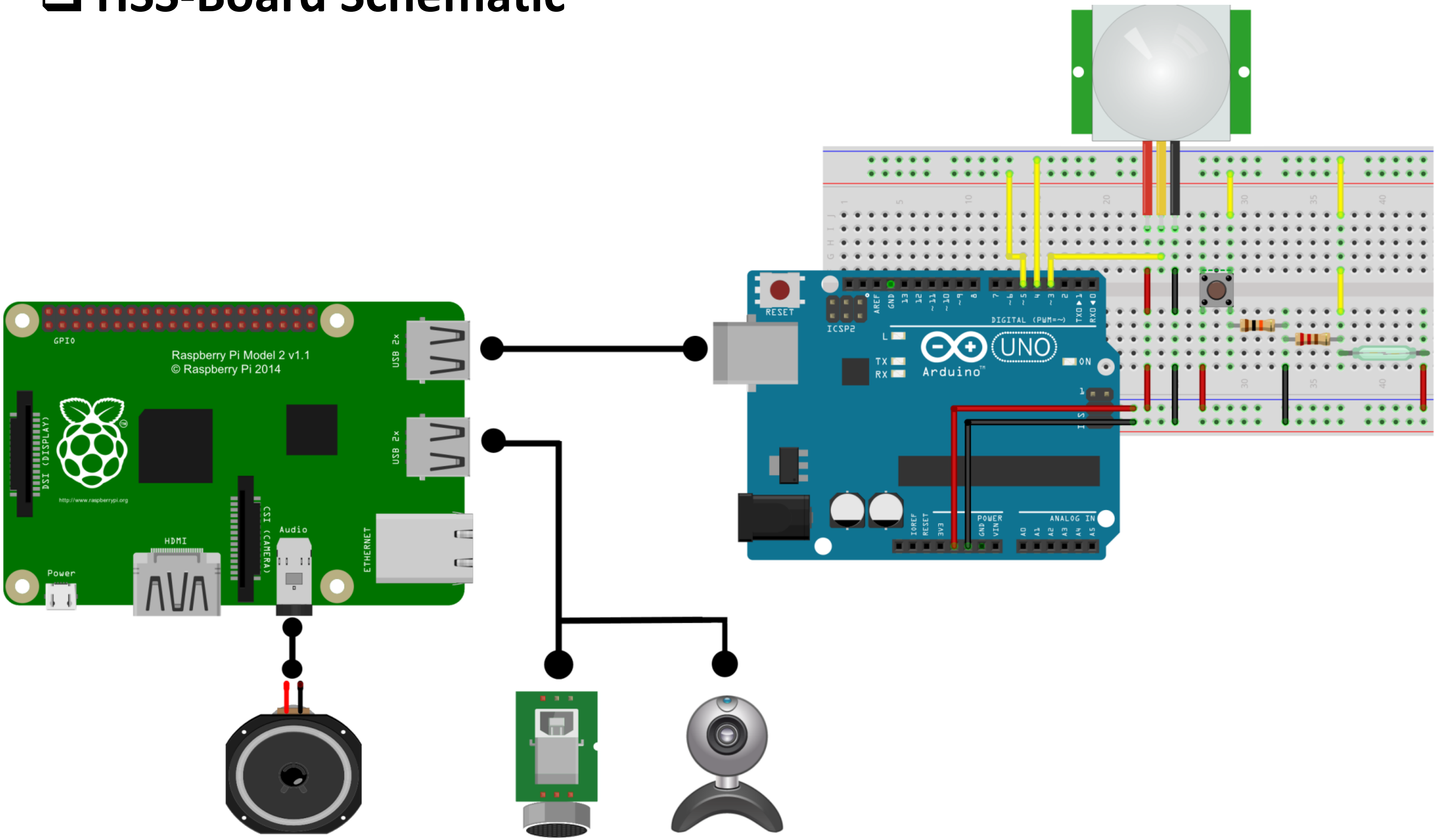
❑ **Overview**



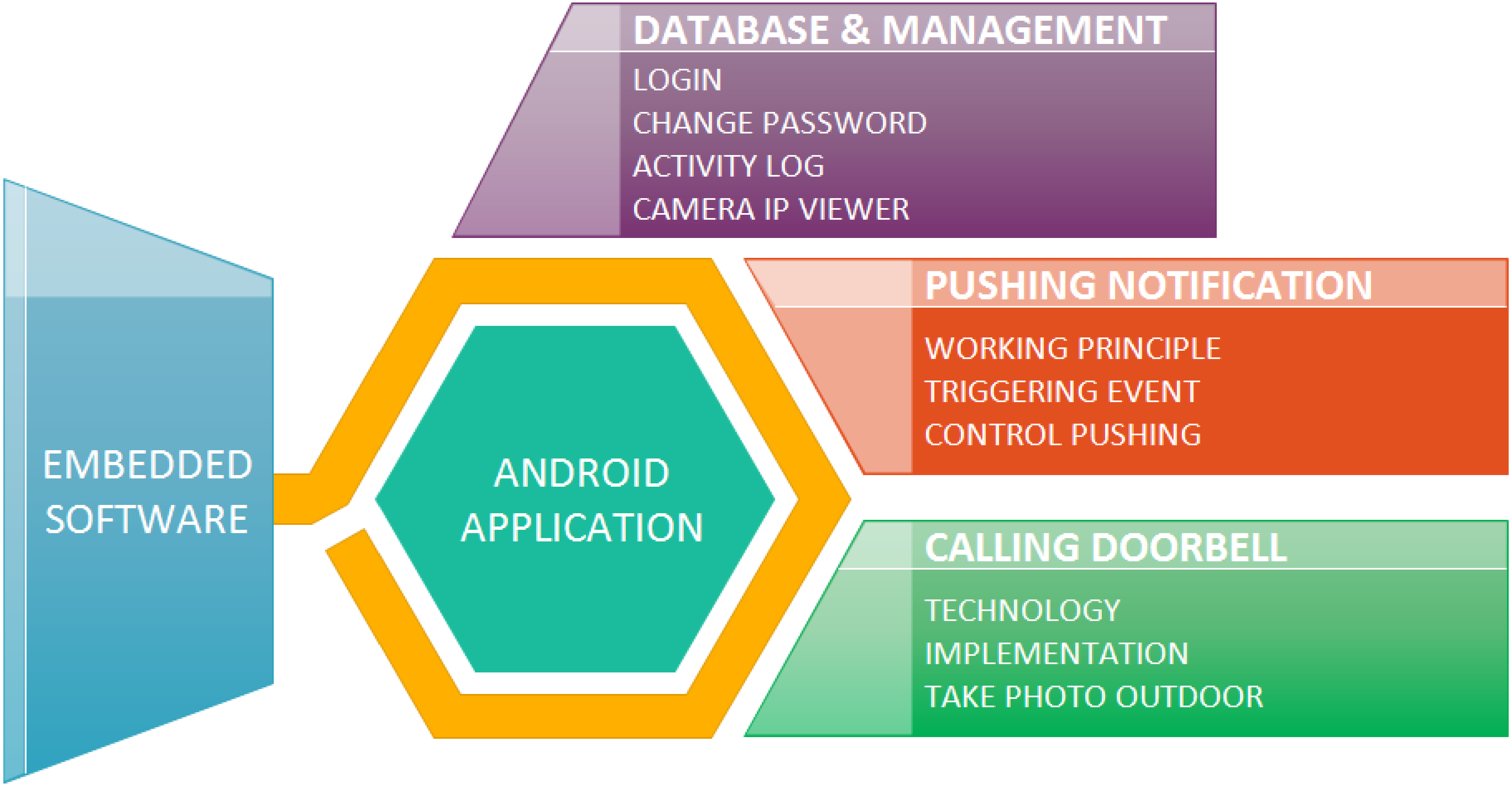
- **HSS-Board**: Devices in wired connection
- **HSS-App**: Android app and third-party services

HARDWARE DESIGN

❑ HSS-Board Schematic



SOFTWARE DESIGN



EMBEDDED SOFTWARE

ANDROID APPLICATION

DATABASE & MANAGEMENT

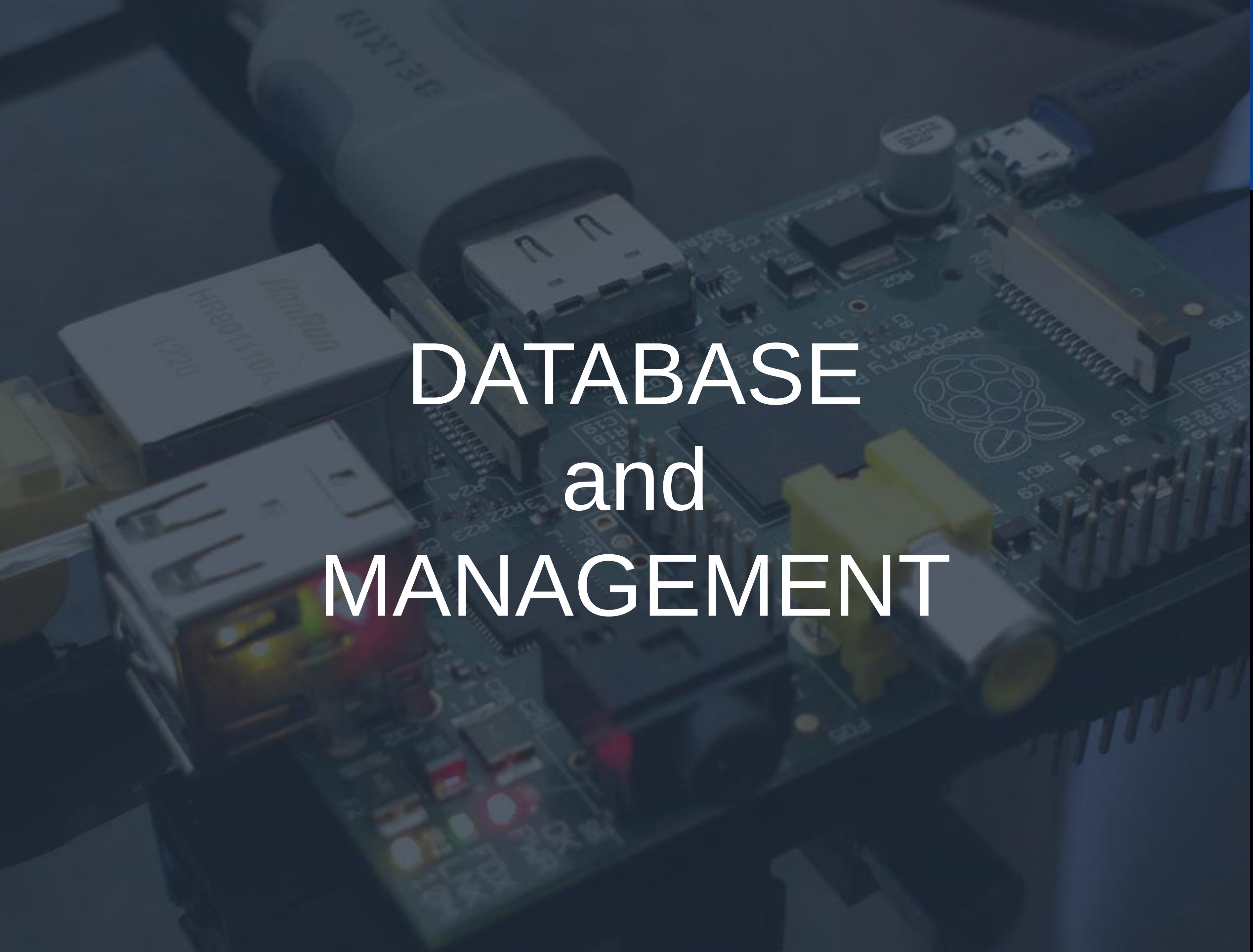
LOGIN
CHANGE PASSWORD
ACTIVITY LOG
CAMERA IP VIEWER

PUSHING NOTIFICATION

WORKING PRINCIPLE
TRIGGERING EVENT
CONTROL PUSHING

CALLING DOORBELL

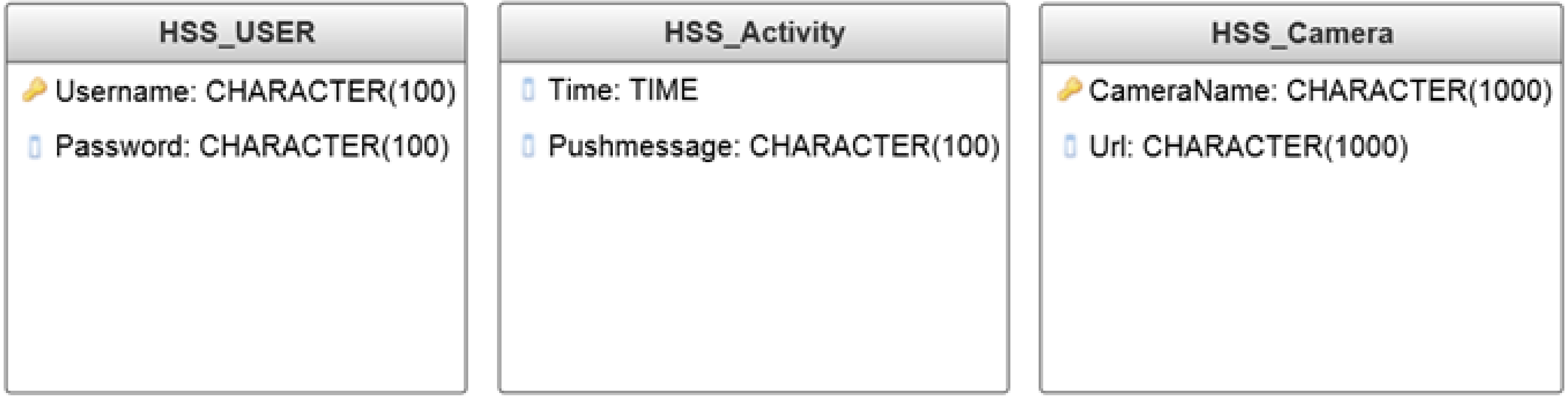
TECHNOLOGY
IMPLEMENTATION
TAKE PHOTO OUTDOOR



DATABASE and MANAGEMENT

SOFTWARE DESIGN

❑ Database



HSS_USER

🔑 Username: CHARACTER(100)

Password: CHARACTER(100)

HSS_Activity

Time: TIME

Pushmessage: CHARACTER(100)

HSS_Camera

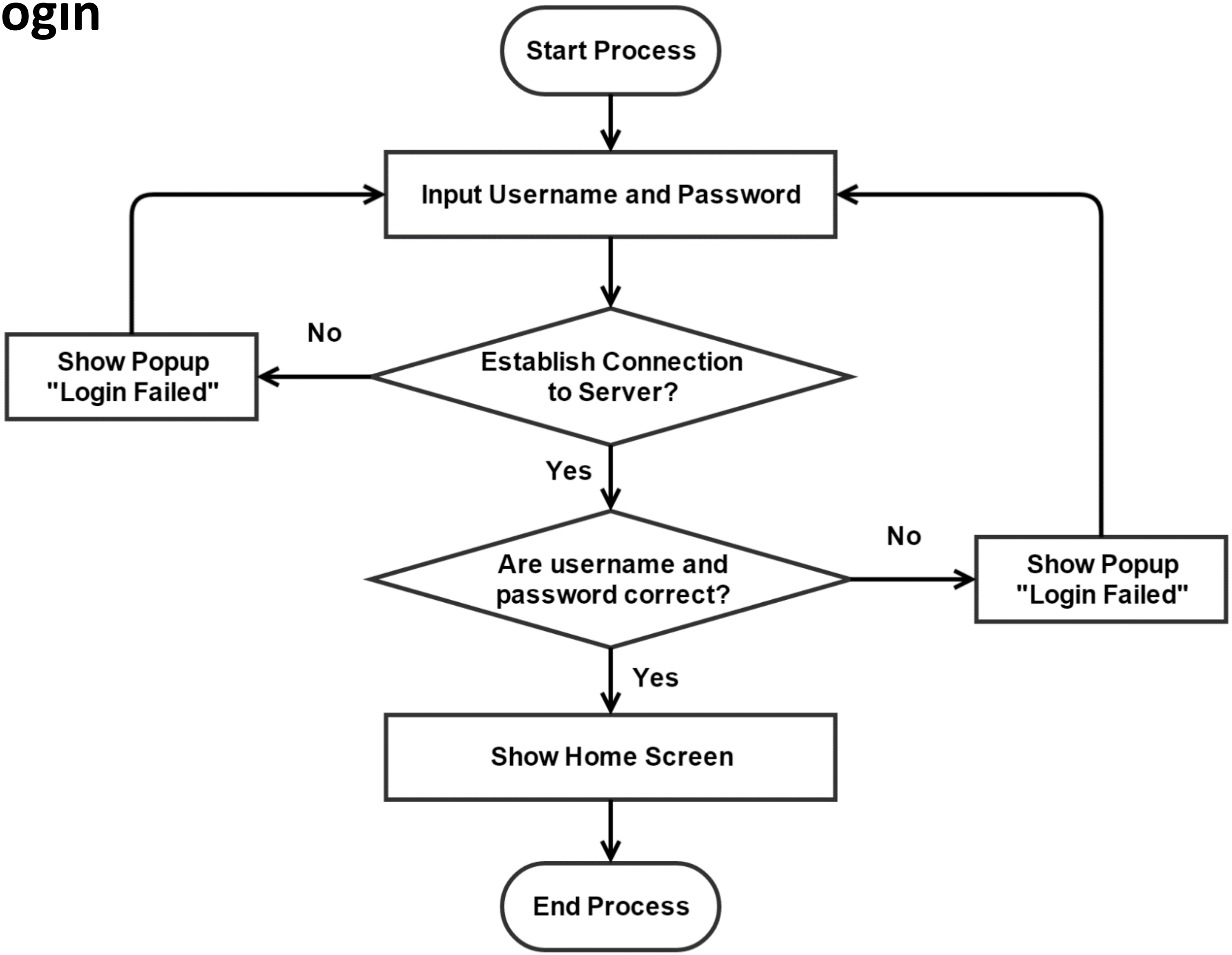
🔑 CameraName: CHARACTER(1000)

Url: CHARACTER(1000)

Name	Meaning
Username	Username for login
Password	Password for login
Time	Time of triggered event
Pushmessage	Message shown in Activity Log screen
CameraName	Name of Camera IP
Url	URL of Camera IP

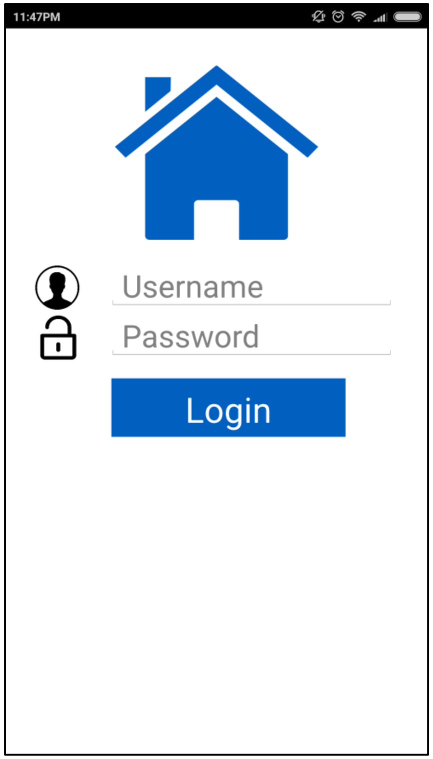
SOFTWARE DESIGN (CONT.)

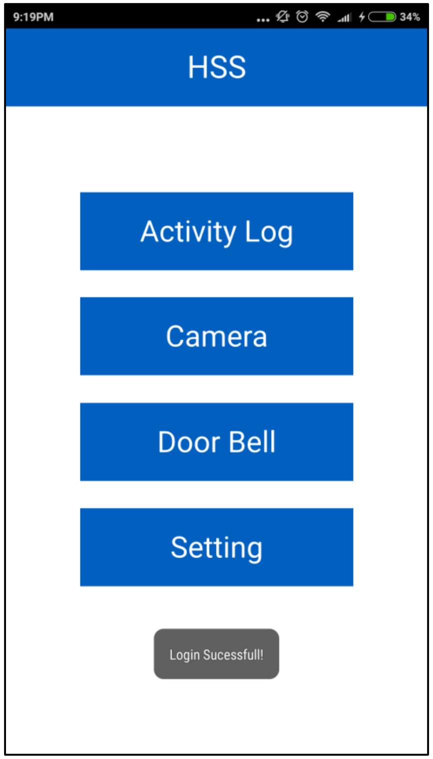
- ❑ **Login**


Start Process
Input Username and Password
Establish Connection to Server?
No
Show Popup "Login Failed"
Yes
Are username and password correct?
No
Show Popup "Login Failed"
Yes
Show Home Screen
End Process

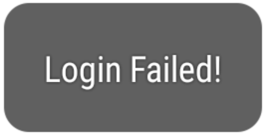
SOFTWARE DESIGN (CONT.)

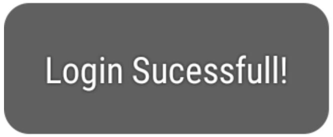
❑ Login





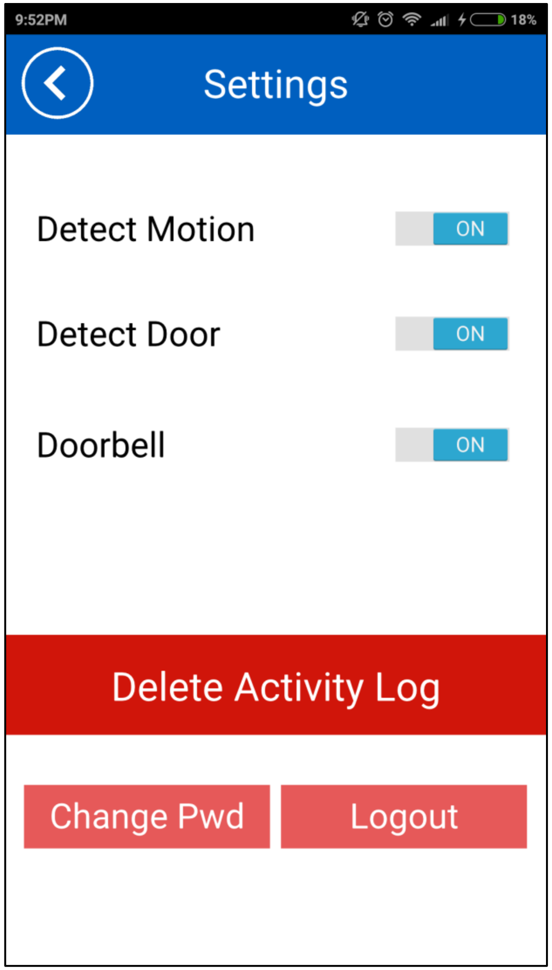
- **Popup on Screen**





SOFTWARE DESIGN (CONT.)

❑ Change Password



Detect Motion ON

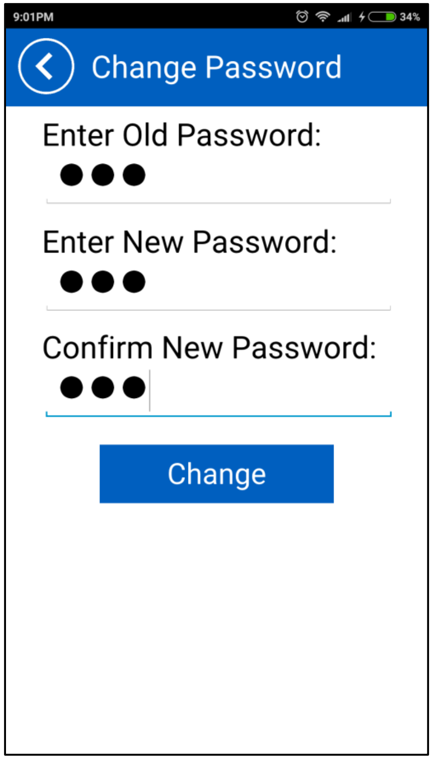
Detect Door ON

Doorbell ON

Change Password Screen

SOFTWARE DESIGN (CONT.)

❑ Change Password



9:01PM 34%

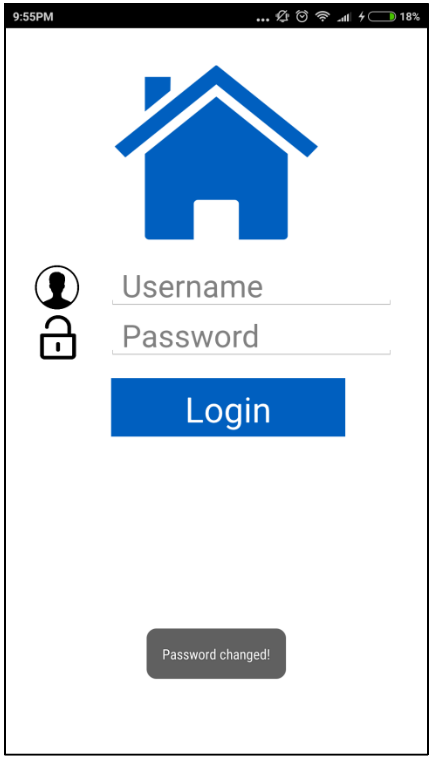
Change Password

Enter Old Password:
●●●

Enter New Password:
●●●

Confirm New Password:
●●●

Change



9:55PM 18%

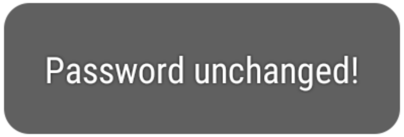
Username

Password

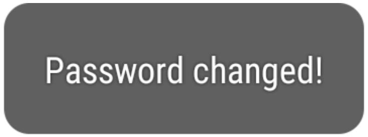
Login

Password changed!

- **Popup on Screen**



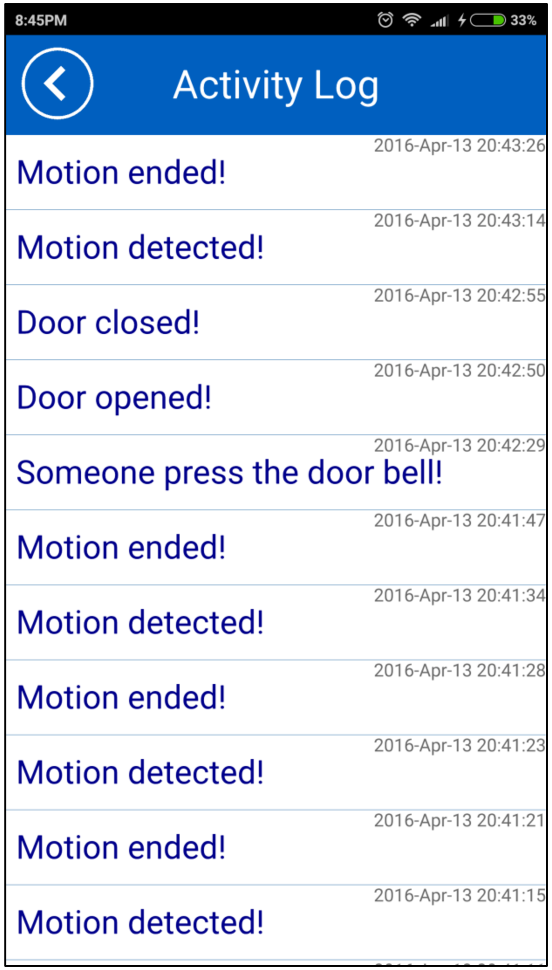
Password unchanged!



Password changed!

SOFTWARE DESIGN (CONT.)

❑ **Show Activity Log**



2016-Apr-13 20:43:26
Motion ended!

2016-Apr-13 20:43:14
Motion detected!

2016-Apr-13 20:42:55
Door closed!

2016-Apr-13 20:42:50
Door opened!

2016-Apr-13 20:42:29
Someone press the door bell!

2016-Apr-13 20:41:47
Motion ended!

2016-Apr-13 20:41:34
Motion detected!

2016-Apr-13 20:41:28
Motion ended!

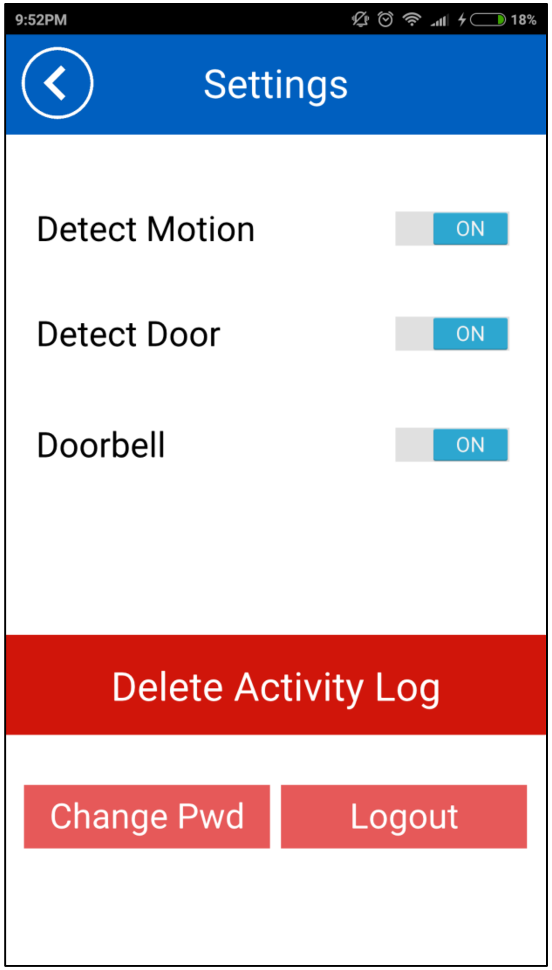
2016-Apr-13 20:41:23
Motion detected!

2016-Apr-13 20:41:21
Motion ended!

2016-Apr-13 20:41:15
Motion detected!

SOFTWARE DESIGN (CONT.)

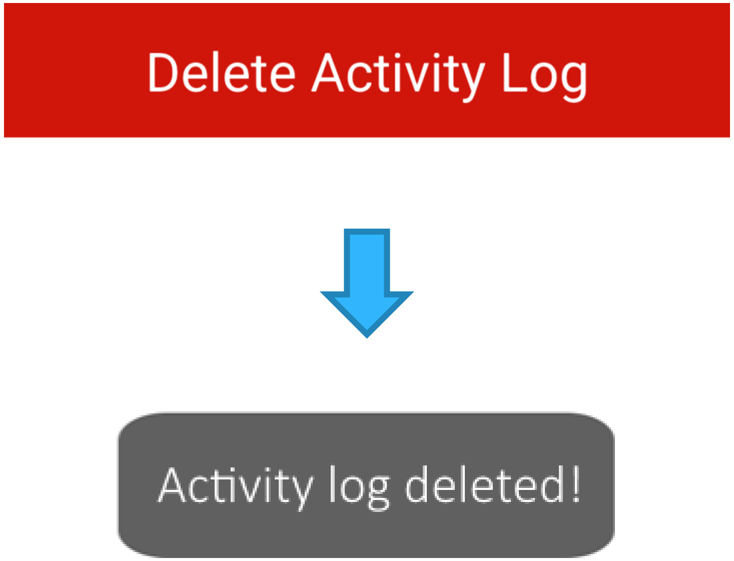
❑ Delete Activity Log



Detect Motion ON

Detect Door ON

Doorbell ON

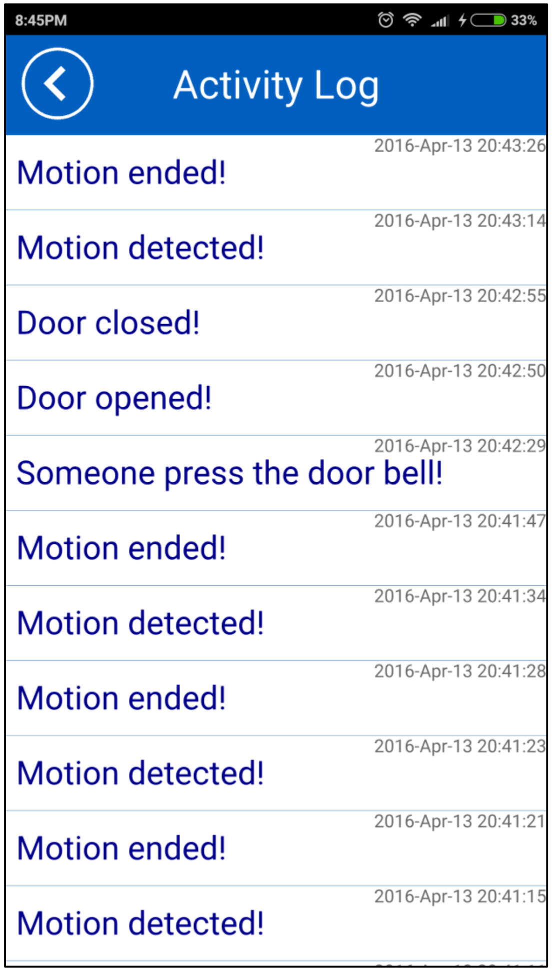


Delete Activity Log

Activity log deleted!

SOFTWARE DESIGN (CONT.)

❑ **Delete Activity Log**



Motion ended! 2016-Apr-13 20:43:26

Motion detected! 2016-Apr-13 20:43:14

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Motion ended! 2016-Apr-13 20:41:47

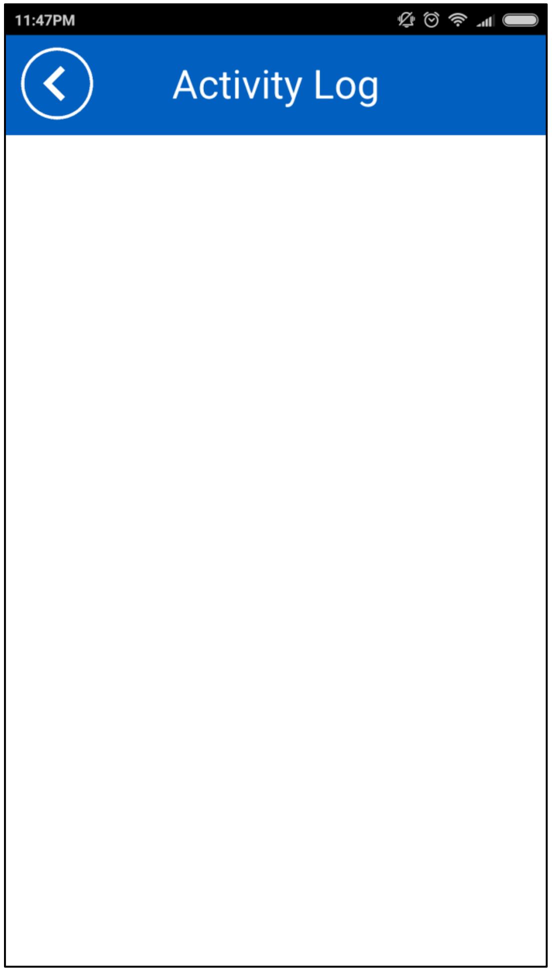
Motion detected! 2016-Apr-13 20:41:34

Motion ended! 2016-Apr-13 20:41:28

Motion detected! 2016-Apr-13 20:41:23

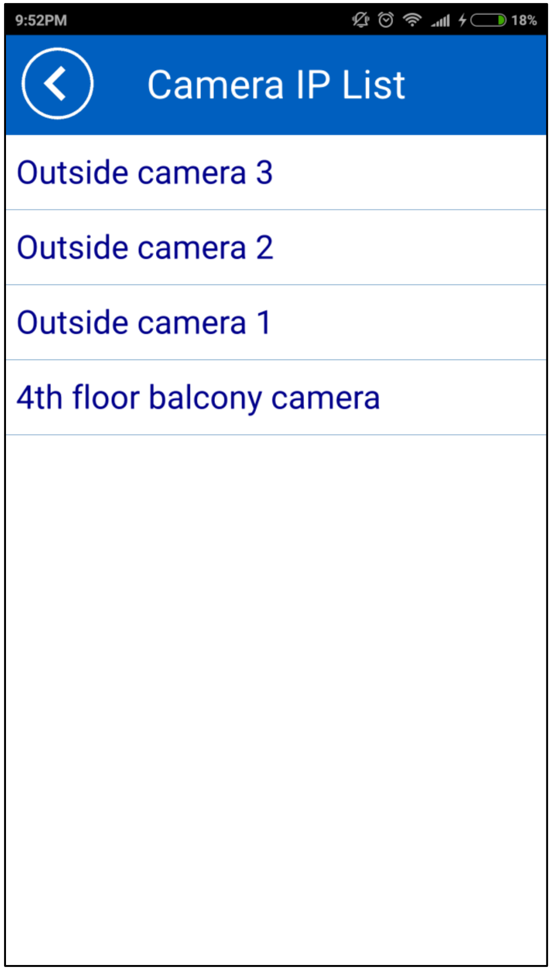
Motion ended! 2016-Apr-13 20:41:21

Motion detected! 2016-Apr-13 20:41:15



SOFTWARE DESIGN (CONT.)

- **View Camera IP**



9:52PM 18%

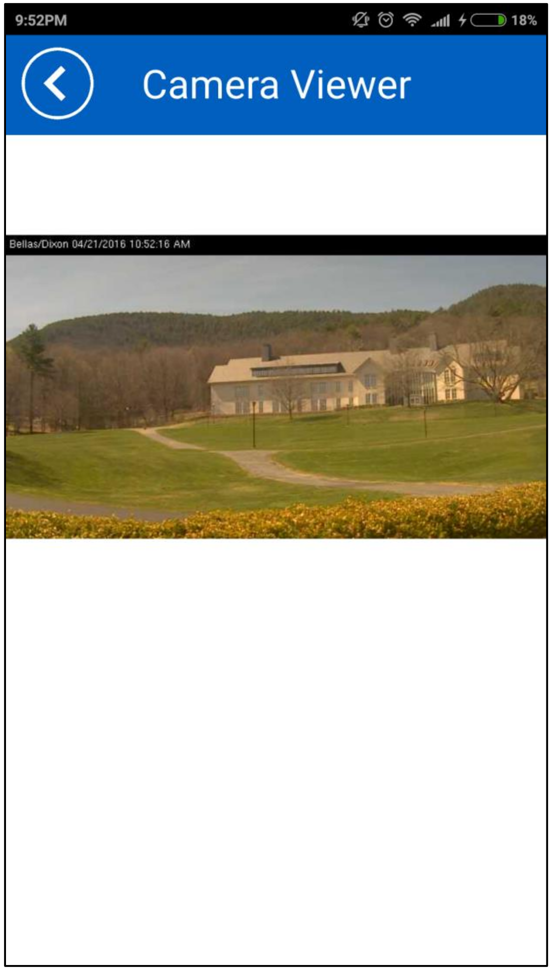
Camera IP List

Outside camera 3

Outside camera 2

Outside camera 1

4th floor balcony camera

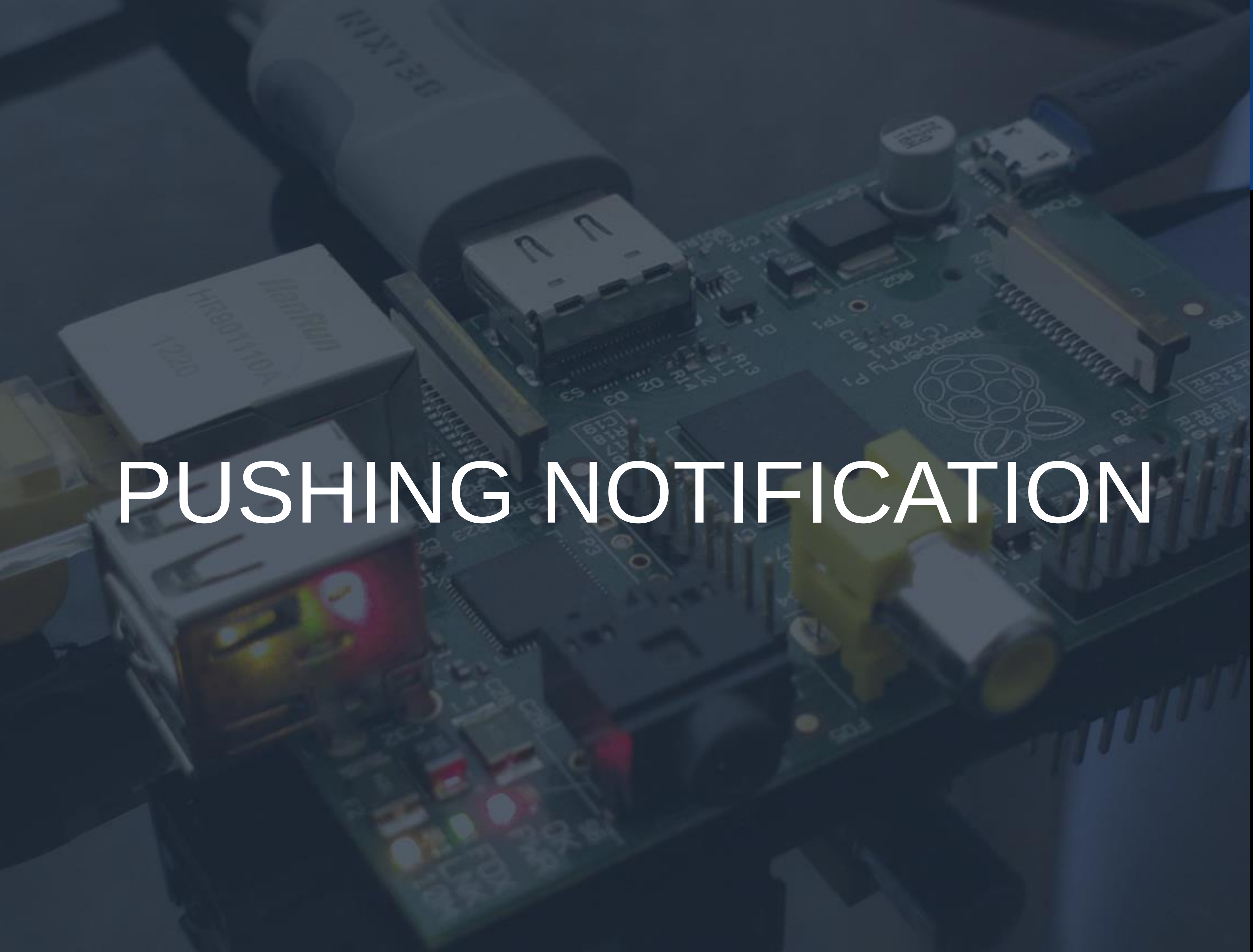


9:52PM 18%

Camera Viewer

Bellas/Dixon 04/21/2016 10:52:16 AM

PUSHING NOTIFICATION



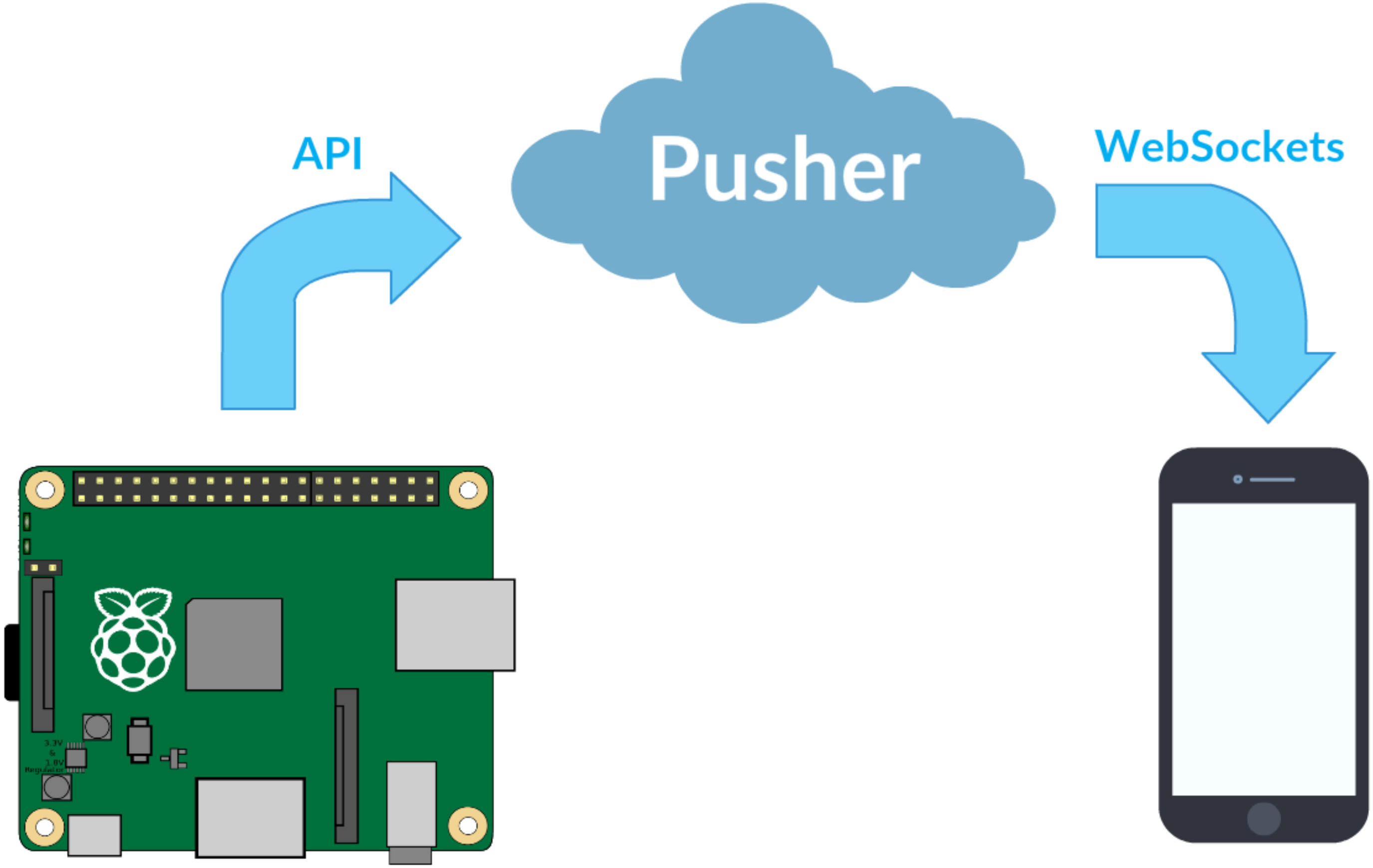
SOFTWARE DESIGN (CONT.)

❑ **Pushing Notification**

- **Pusher**
  - A service for message communication between web and mobile applications
  - Deliver over 160 billion messages to more than 5.4 billion devices

SOFTWARE DESIGN (CONT.)

❑ **Pushing Notification**



SOFTWARE DESIGN (CONT.)

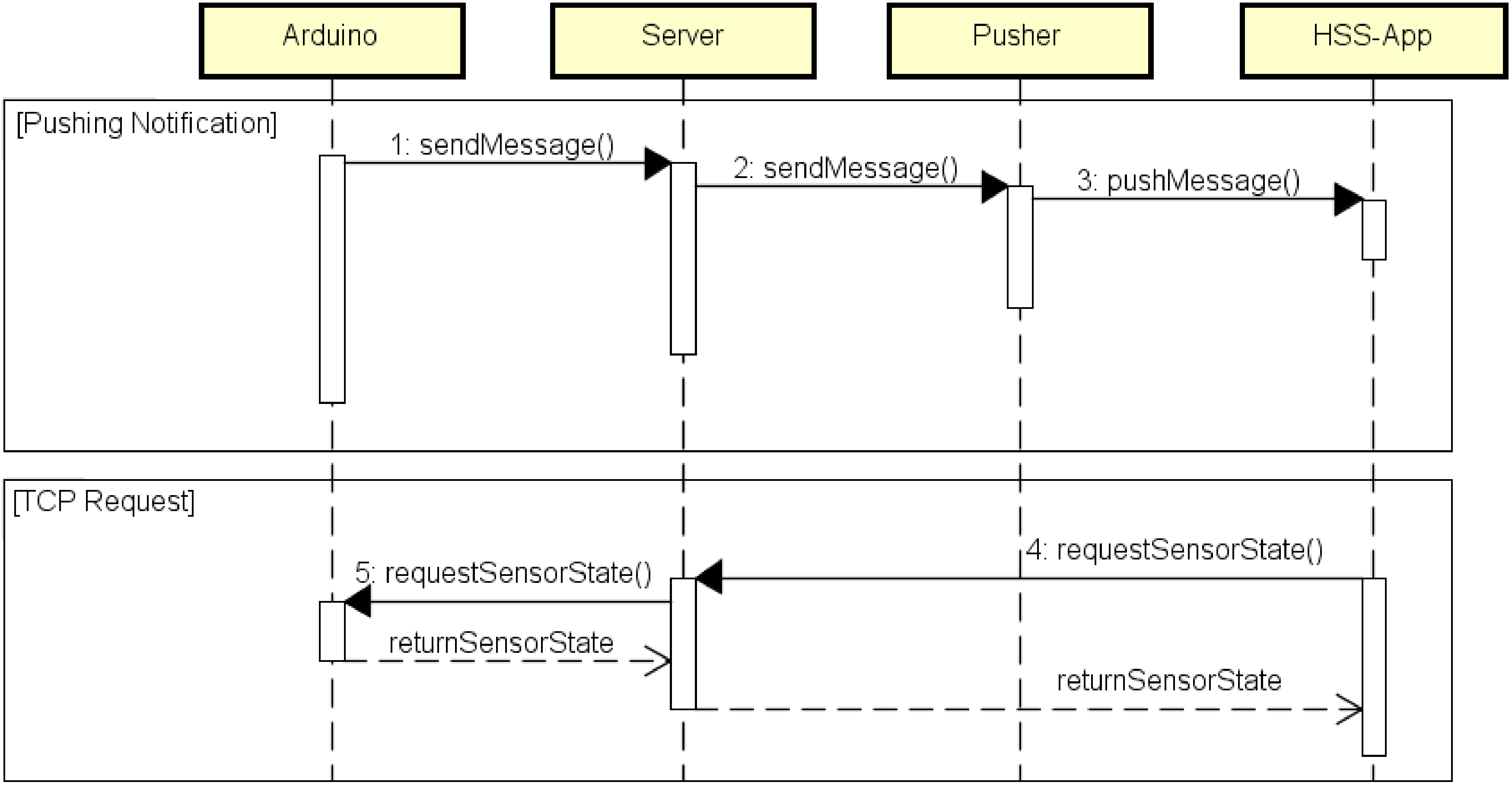
❑ **Pushing Notification**

- **On Raspberry Pi**
  - Connect to Pusher server
  - Send message to a channel

- **On HSS-App**
  - Connect to Pusher server
  - Subscribe to Raspberry Pi channel
  - Listen for message
  - Show notification when message arrived

SOFTWARE DESIGN (CONT.)

❑ **Client – Server Communication**



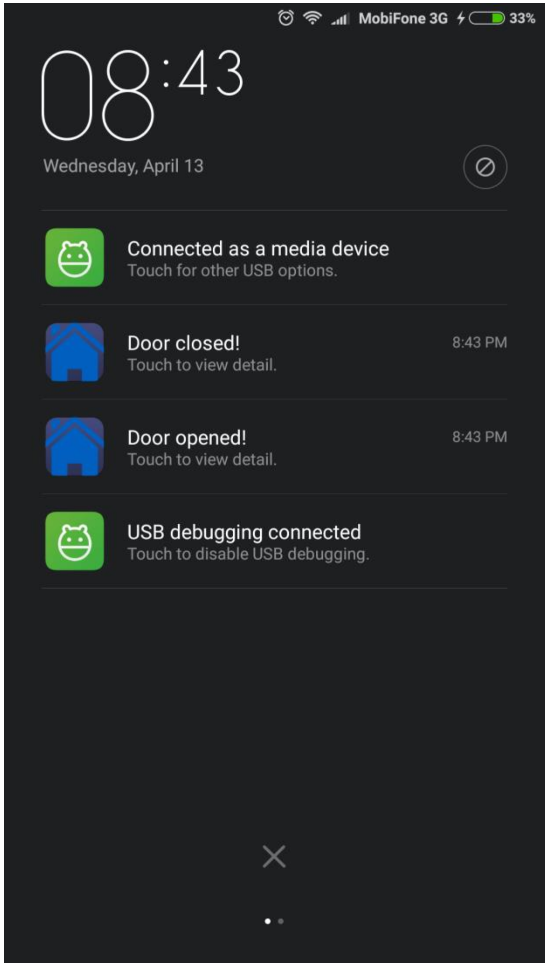
SOFTWARE DESIGN (CONT.)

❑ Pushing Notification: Triggering Event

Sensor	Trigger	Action	Message
Button	Press or hold once	Push to HSS-App	**Someone press the doorbell**
Door	Change state from closing to open	Push to HSS-App	**Door has been opened**
	Change state from open to close	Push to HSS-App	**Door has been closed**
PIR	Detecting motion	Push to HSS-App once every 5s	**Motion detected**
	Motion ends	Push to HSS-App after 5s without any motion detected	**Motion ended**

SOFTWARE DESIGN (CONT.)

❑ Pushing Notification: Sample Screen



MobiFone 3G 33%

08:43

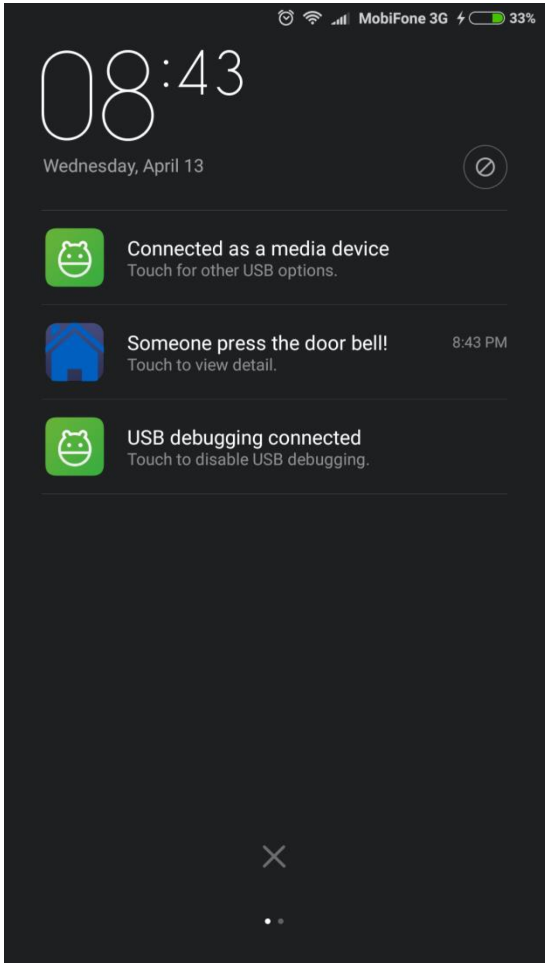
Wednesday, April 13

Connected as a media device
Touch for other USB options.

Door closed! 8:43 PM
Touch to view detail.

Door opened! 8:43 PM
Touch to view detail.

USB debugging connected
Touch to disable USB debugging.



MobiFone 3G 33%

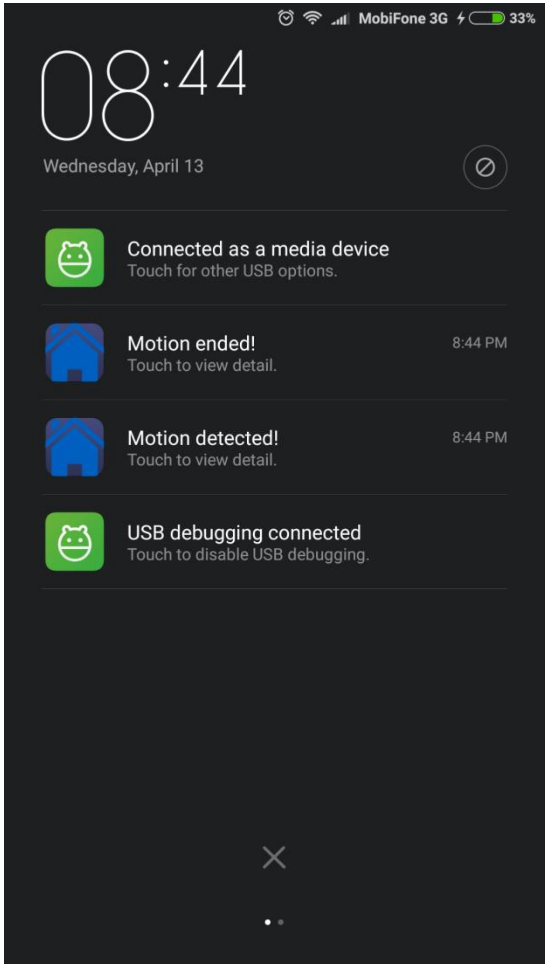
08:43

Wednesday, April 13

Connected as a media device
Touch for other USB options.

Someone press the door bell! 8:43 PM
Touch to view detail.

USB debugging connected
Touch to disable USB debugging.



MobiFone 3G 33%

08:44

Wednesday, April 13

Connected as a media device
Touch for other USB options.

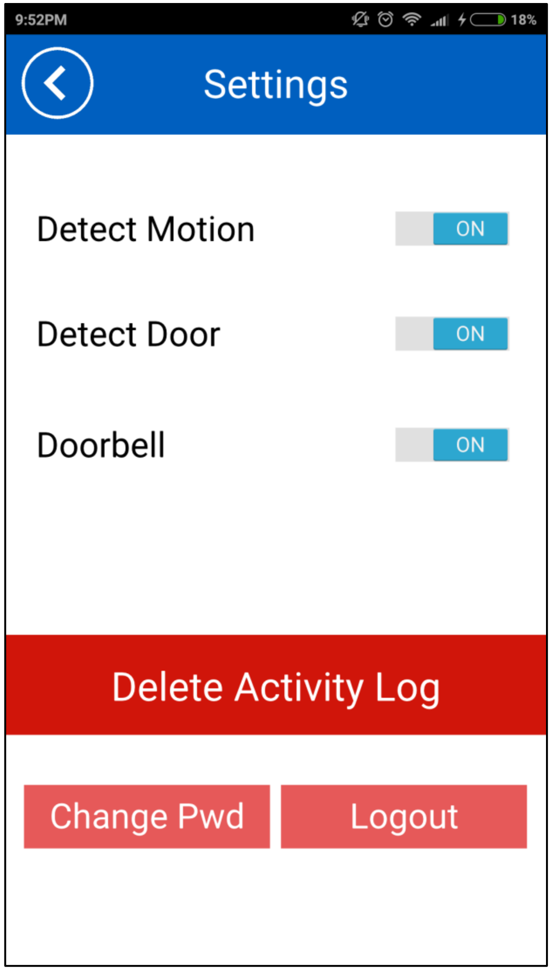
Motion ended! 8:44 PM
Touch to view detail.

Motion detected! 8:44 PM
Touch to view detail.

USB debugging connected
Touch to disable USB debugging.

SOFTWARE DESIGN (CONT.)

❑ **Control Pushing Notification**



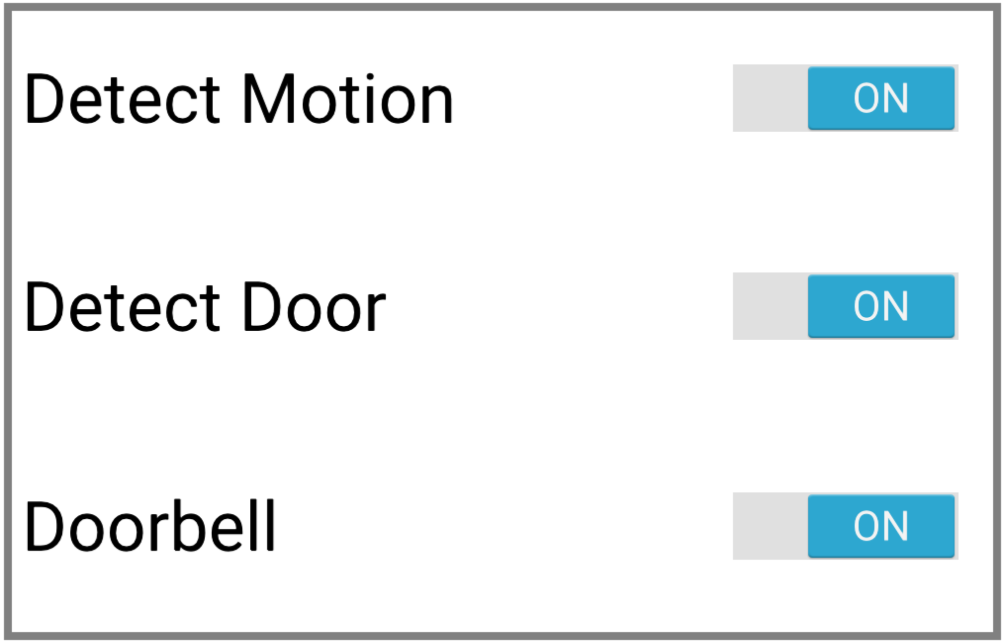
9:52PM 18%

Settings

Detect Motion ON

Detect Door ON

Doorbell ON



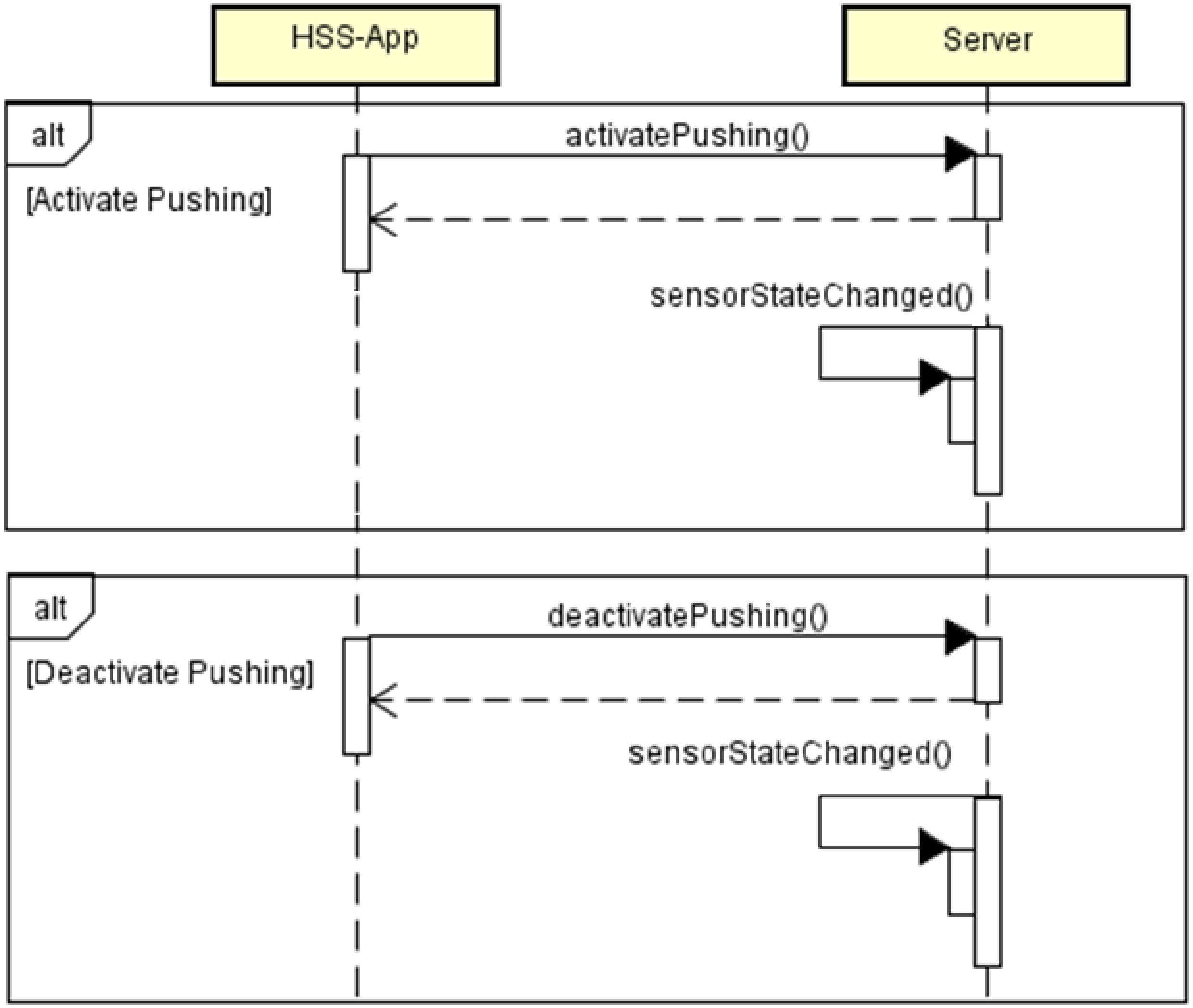
Detect Motion ON

Detect Door ON

Doorbell ON

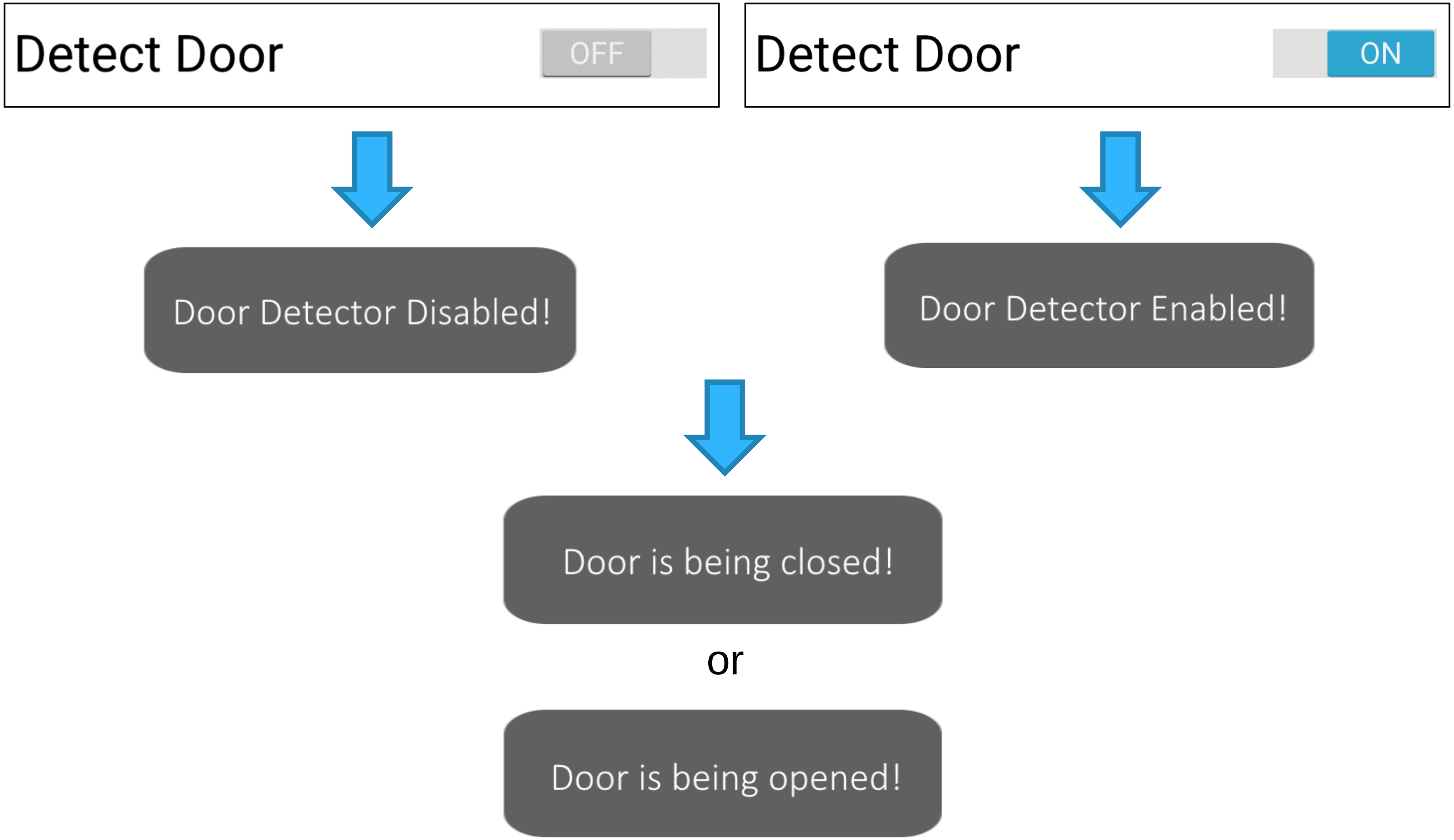
SOFTWARE DESIGN (CONT.)

❑ Control Pushing Notification



SOFTWARE DESIGN (CONT.)

❑ **Check current door stte**



Detect Door

Detect Door

Door Detector Disabled!

Door Detector Enabled!

Door is being closed!

or

Door is being opened!

CALLING DOORBELL

SOFTWARE DESIGN (CONT.)

❑ **Calling Doorbell**

- **Voice over IP Technology (VoIP)**
  - Delivery of voice communications and multimedia sessions over IP network
  - Providers usually offer lower rates than traditional phone
- **SIP (Session Initiation Protocol)**

  Signaling and controlling communication sessions
- **STUN (Session Traversal Utilities for NAT)**

  Assisting devices behind NAT with their packet routing
- **Linphone SIP Server**

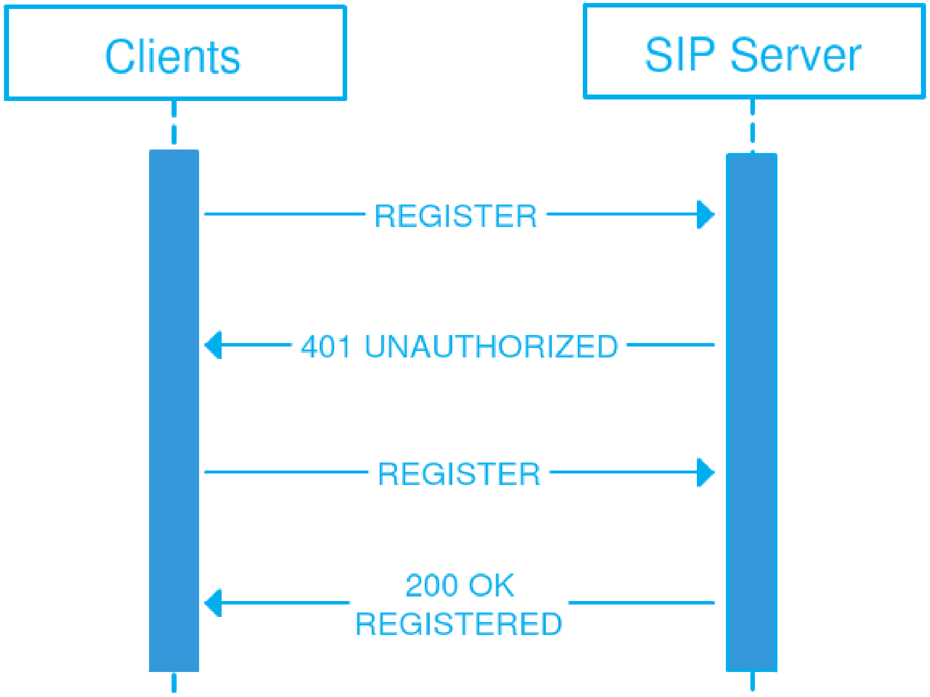
  Free SIP service based on Flexisip proxy server

SOFTWARE DESIGN (CONT.)

❑ **Calling Doorbell**

- **SIP Server in HSS**

  Responsible for keep registering with clients in both 2 sides: Raspberry Pi and HSS-App; then routing the connection when initiating a VoIP call (Calling to Doorbell)



SOFTWARE DESIGN (CONT.)

❑ **Calling Doorbell**

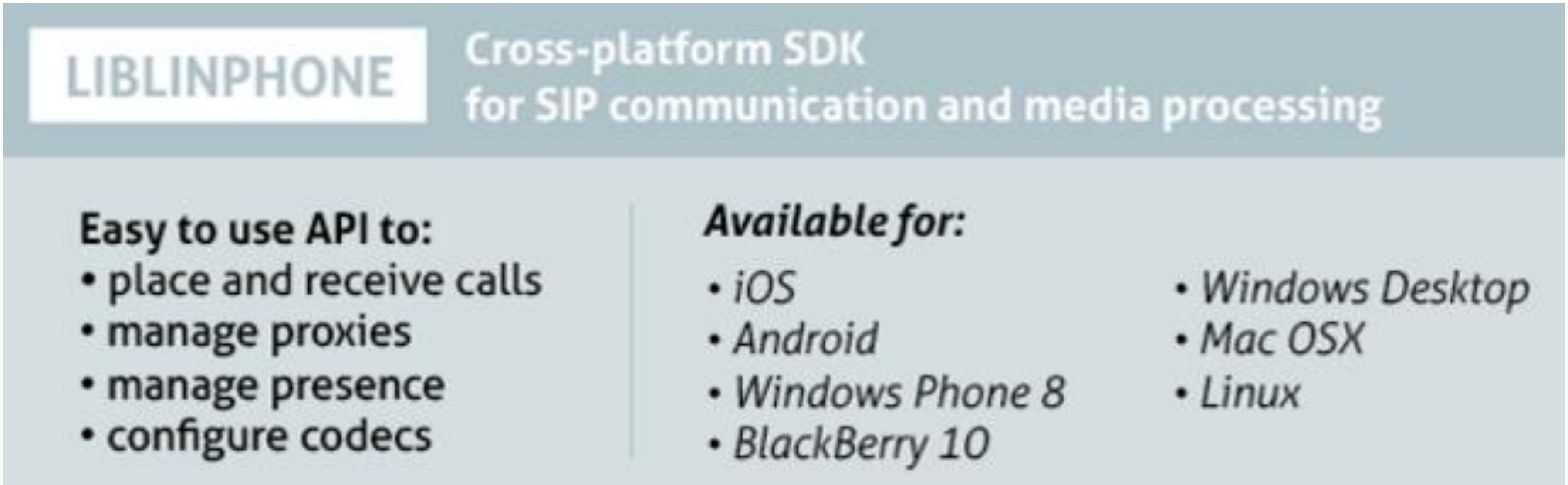
- **On Raspberry Pi**
  - **Install Linphone module package for Python**
  - **Setting in code:**

Parameter	Value
SIP Server	sip.linphone.org
STUN Server	stun.linphone.org
Auto Answer Call	Yes
Sound Input	ALSA: USB PnP Sound Device
Sound Output	Default

SOFTWARE DESIGN (CONT.)

❑ **Calling Doorbell**

- **On HSS-App, Linphone Library and API were used for developing VoIP feature**



LIBLINPHONE

Cross-platform SDK
for SIP communication and media processing

Easy to use API to:

- place and receive calls
- manage proxies
- manage presence
- configure codecs

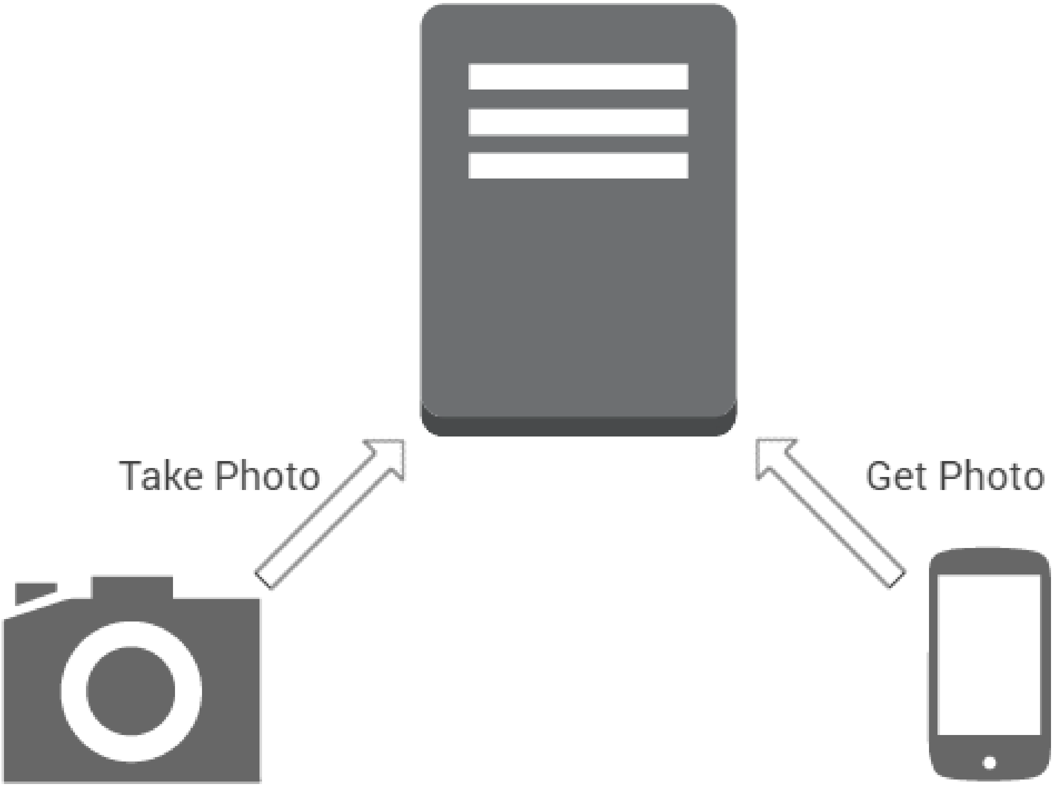
Available for:

- *iOS*
- *Android*
- *Windows Phone 8*
- *BlackBerry 10*
- *Windows Desktop*
- *Mac OSX*
- *Linux*

SOFTWARE DESIGN (CONT.)

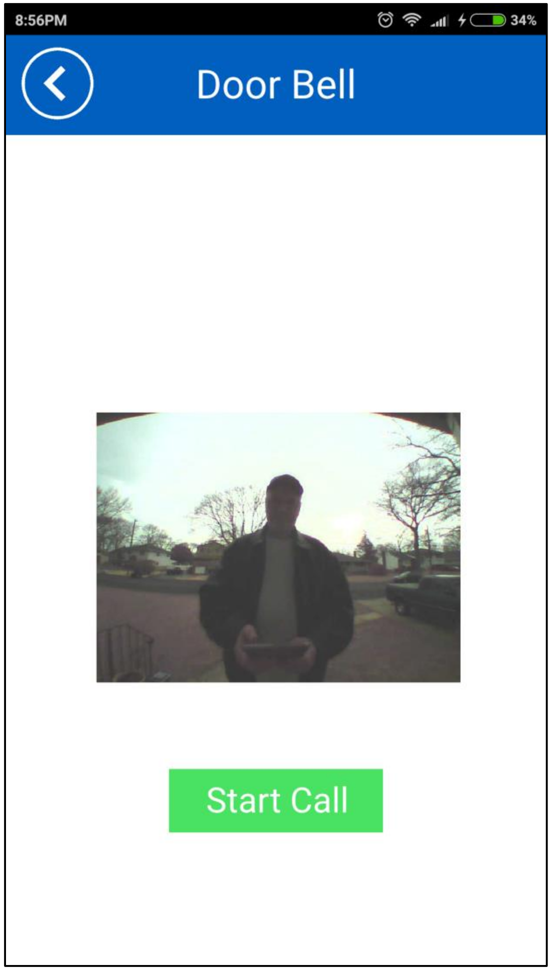
❑ **Calling Doorbell**

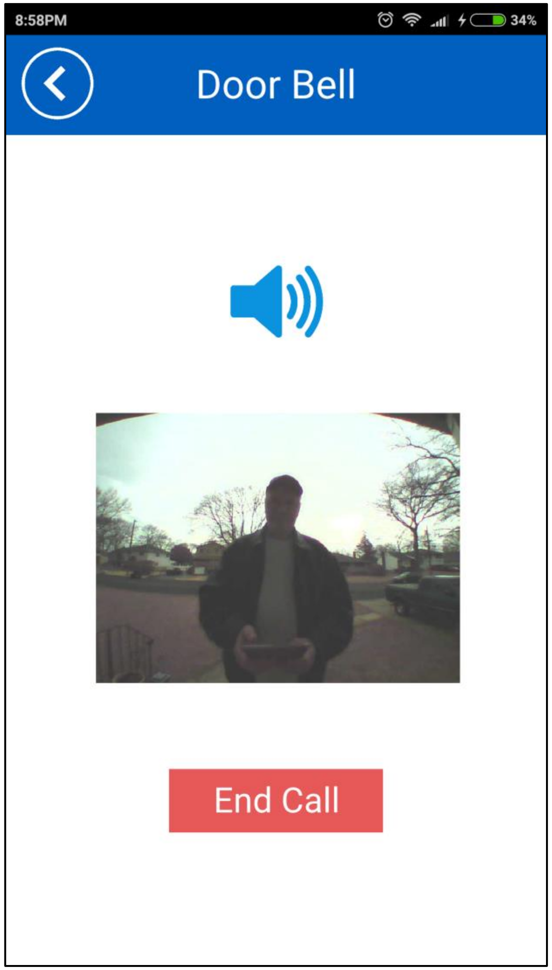
- **Take photo when someone press the doorbell**
  - **fswebcam**
  - **Apache HTTP Server**

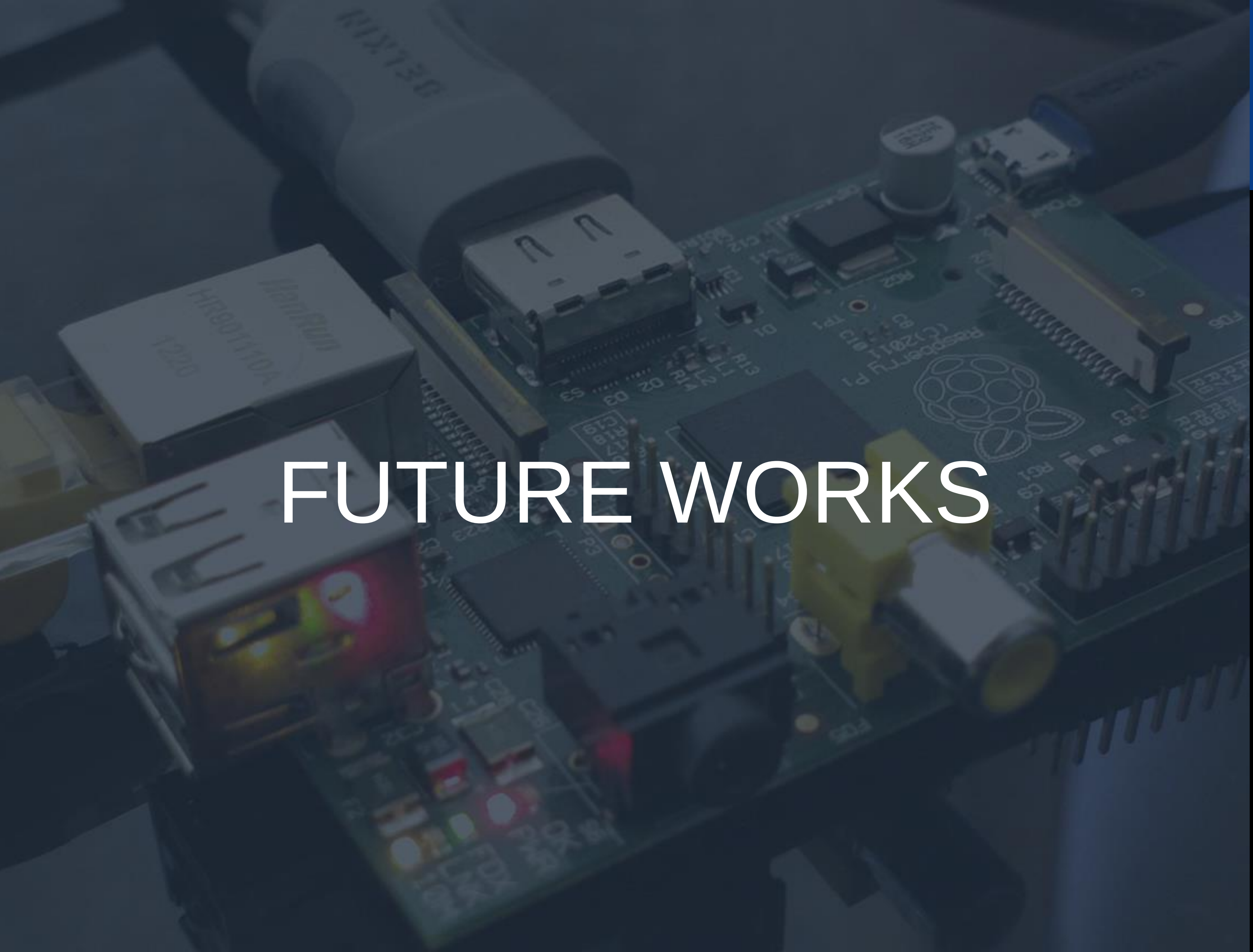


SOFTWARE DESIGN (CONT.)

❑ **Calling Doorbell**







FUTURE WORKS

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- **Add more sensors**
  CO detector, glass break sensor, etc…
- **Support video for calling doorbell**
  Track your visitor in real-time, not only static image
- **Self-setup at first**
  Fully automatic synchronization at first setup
- **Self-manage existing Camera IP**
  Full of features to manage viewing every camera IP

DEMO

QUESTION & ANSWER

THANK YOU