CARDIFF SCHOOL OF COMPUTER SCIENCE & INFORMATICS

IoT Device for Home Monitoring

Initial Plan

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Project Description

The Internet of Things (IoT) is transforming the way in which business, governments and consumers interact with the world. According to recent findings about 1.4 trillion dollars are going to be spent on IoT devices by 2021. Even looking trough historical data proves the uprise of Internet of Things. For example the number of devices connected to the Internet of Things in 2012 was 8.7 billion, which in 2017 has risen to the staggering 20.3 billion. With such and increase of IoT devices and cheaper components, it makes sense to make them more affordable and that is going to be the direction in which this project is going to head out.

The aim of this project is to create an affordable and robust IoT device for home monitoring. This project will also differentiate from existing solutions by adding biometric authentication and video streaming functions. Pairing that with a smartphone application means that the use of a smartphone biometric scanners (e.g fingerprint scanner) and NFC technology will be used for unlocking and locking the house doors. A camera will also be used for monitoring the home environment, which will be activated either when the user desires or when a motion sensor detects movement. With the expansion of the Internet of Things, focus on modular sensor design will also be kept in mind. This means that the user will have the ability to add more sensors to his/her's sensor network in the future.

The project will also include the use of the following hardware:

- raspberry pi 3 - this will be used as a server, which will process sensor data and forward it to the android application

- NodeMCU ESP8266 ESP-12E board - will communicate and send sensor data to the server

- pn532 NFC RFID anthena - will be coupled with the NodeMCU board

- motion detectors - detect movement when user is not at home

- raspberry pi camera - will be used in the camera streaming function

Project Aims and Objectives

These are the project aims and objectives that outline what I intent to accomplish throughout the time frame of the project.

1. **Gain an understanding of how devices connected to the Internet of Things operate**

   - Understand the underlying network involved with devices connected to the Internet of Things
   - Understand the security and privacy risks of devices connected to the Internet of Things
   - Understand the advantages and shortcomings of existing solutions, similar to this project

2. **Develop IoT device for home monitoring, with an accompanying android application for further control**

   - Identifying the hardware parts needed for the project (e.g. micro-controllers, sensors, etc.)

   - Research the software frameworks required to develop such a device

   - Gain an understanding of the software and hardware that is going to be used troughout the development process

3. **Evaluate and produce an analysis of the developed IoT device's dependability**

   - Perform tests to establish the dependability of the system (e.g. removal of one sensor, should not break the sensor network)

   - Produce an analysis from the evaluation results and establish what are the device capabilities and potential shortcomings

   - Introduce a perspective on possible future improvements regarding dependability

4. **Produce and Deliver final report, which includes all background research on the project matter, as well as the inclusion of self-reflection**

   - Produce a final report, including all the background research done for the project, descriptions of the methods used and justifications as to why were they used, description of the problems encountered during the project development and the steps taken to solve those problems. In addition, the report will also include self-reflection, outlining what improvements can be made.

Work Plan

The following plan is developed with consideration to any other school commitments and will include 4 milestones. Also regular meeting with the supervisor will be carried out.

week 1:

- Background research on how devices connected to the Internet of Things operate and communicate

- Researching the methods and software used by other similar IoT device projects

- Research on client-server models and sockets

- Meeting with supervisor, for further discussion and clarification of the project objectives and aims

week 2-4:

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- Start the development of the client- server model, used for communication between the raspberry pi and the android application

- Background research on encryption standards of IoT devices

- Choosing a suitable encryption algorithm for the communication between the client and the server

week 5-7:

- Add a fingerprint reader function to the android application

- Connect the NFC reader to the NodeMCU board and program it to recognise only authorised personnel

- Research on how NFC technology works

  Milestone 1: Finish the fingerprint door unlock/lock system

week 8-11:

- Add a camera viewer function to the android application

- Develop the camera streaming service

- Program the motion detector sensor to activate the camera upon detecting movement

  Milestone 2: Finish the camera stream function

week 12-13:

- Finish any work left from previous weeks

- Perform tests, to analyse the security and durability of the system

- Test system in the labs to make sure that it is ready for the demonstration and everything operates as intended

- Fix any bugs found

- Start writing the final report

week 14-15:

- Finalise the writing of the final report

  Milestone 3: Submit Final report(11/05/2018)

VIVA week:

- Prepare for the VIVA demonstration

  Milestone 4: Project completion

References

[1] Internet of Things - number of connected devices worldwide 2015-2025. [Online] Available at: https://www.statista.com/statistics/471264/iot-number-of-connected-devices-worldwide/ [Accessed: 5-Feb 2018]

[2] Freddie Roberts. IoT spending to reach $1.4 trillion by 2021, says IDC. [Online] Available at: https://internetofbusiness.com/iot-spending-1-4-trillion-2021-idc/ [Accessed: 5-Feb 2018]