**ENGR 498**

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Group Progress Report due 26th June 2019

**Project Overview**

Our target is to build an IoT-based user programmable home automation system.

One model will have temperature, motion, sound and a smoke sensor/detector controlled with multiple ESP8266-NodeMCU units. The other model will have a camera and it will be controlled through a Raspberry Pi 3B+. The data collected by the sensors is to be encrypted and sent to a server (or Cloud) where it will become accessible for the user from anywhere in the world through a website. The camera will also be accessible anytime from anywhere live.

The users are given the control to turn on/off their home-devices based on the readings from the sensors. The user will decide how the devices will operate based on their preferences(if-then-that.) For example, if the temperature in the room where the device is operating is more than 21 (degrees Celsius) turn on the AC. Or, if the user wishes to turn on the vacation mode, he/she will get instantly notified if movement is detected in his/her house and he/she would have live access to the camera as far as there is motion and up to 5 minutes after the motion ends.

**Goals from last week**

* Circuit Integration with all the sensors to the ESP-8266-NodeMCU and the ADS1115
* Camera Integration with the Raspberry-pi
* Local Host setup
* Database management
* Website Design

**Accomplishments/Discoveries from last week**

* Live Video could be easily viewed on the localhost at any point in the network using python and flask.
* The sensors were successfully integrated with the ESP8266-Node MCU and the ADS1115 ADC.
* The camera works perfectly fine on the raspberry pi, the program saves a video whenever there’s motion, and it sends an alert to the user’s email with pictures captured live from their house.
* The user interface for the website was made using HTML5 and CSS3 along with Bootstrap.
* The SHA algorithm was successfully implemented and allows data integrity during data transfers.

**Current project state**

The circuit is built with all the sensors (motion, sound, smoke and temperature), the microcontroller (ESP8266-NodeMCU) the relay and the ADS1115 ADC. All sensors are working successfully together, however the sound sensor needs further testing. The sensor readings have been successfully sent using a local host from the microcontroller to a phone using the ESP8266 Web Server. The data has also successfully been sent to the Google Firebase (Cloud.) All data from the sensors is successfully displayed and gets updated live. For example, when heat is encountered on the temperature sensor, an increase in temperature can be noticed in the received data at both cloud and localhost platforms.

Also, OpenCV is used to program the web camera to detect motion in the house for security purposes; the camera starts recording a video whenever motion is detected and it saves it. It also takes a picture every 30 seconds in case of motion. Then, the pictures are emailed to the user as an alert. The program restarts itself every 5 hours not to overwrite the video. All videos are saved on the Raspberry pi. Regarding cryptography, the code for SHA256, AES, Triple DES works perfectly on ESP8266 which guarantees integrity, but some modifications are still needed to get the confidentiality (encryption) part of the system to work. We have a problem with that part as the decryption on the cloud end needs to be done in JavaScript. We are working on HTML5, CSS3 and JavaScript simultaneously for the front-end website development of the website for the user interface. This is a long process and hence it goes parallelly with the rest of the work.

**Goals for this week**

1. Website Front End Completion:  
   The basic structure of the website is made using HTML5, CSS3 and bootstrap. Now JavaScript will enable us to implement logic to our system. The JavaScript will allow us to link different webpages. Using Nodejs and DOM manipulation, this will allow us to make the interface easier to use and work with. This will then complete the user front end that would involve the Home Page, the control panel, etc.
2. Google Firebase API Commands:  
   We are using the real time database of the google firebase that allows us to update the data instantaneously. So, the Cloud comes with an API, hence it must be understood throughout and practice its implementation. There are many API commands that allow us to access the changed data or to output a .jason file. These make interacting with the sensor data and the output command easy. Cloud computation can be easily achieved using this method.
3. Hardware Software Integration:

Once the Website is built and communication is achieved from the Google Firebase, the cloud computation is achieved using JavaScript. Then the website is made to interact with the sensor data from the Firebase Real Time Database and also with the live video from the Raspberry Pi feed. These are put together with the user commands in order to either switch the device ON/OFF depending on what parameters are chosen by the user.

1. Data Security:  
   What we want to achieve in the project in terms of cryptography are the CIA principles. Confidentiality, Integrity and Availability. Confidentiality is to be achieved by the encryption protocols which we will be looking at again this week including RSA and triple DES. Integrity is already achieved using the SHA256 protocol, but we are looking forward to integrating it with the main code. Availability is to be achieved by making the hardware of the system safe and allow further modifications, and by making the system available everywhere which is already done by sharing the data by email and firebase.