ECEN 5783 Embedded Interface Design (Fall-2019)

Project-5 Submission:

Submission Date: **November 20ᵗʰ 2019**
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Super-Project Title: Industrial Plant Monitoring and Control System

Please Note: *For a clear view of the attached images inside this PDF file, please kindly refer to our **GitHub Repository** that contains all the individual file copies and PDFs that contain the individual elements as required in for the project. Thanks.*

Component List:

The specific list of **hardware components** that we are using for our Super-project deliverables (in addition to a pair of Raspberry Pi's), specifically for ECEN 5783 are as below:

	Product	Quantity	Amazon Link	Example Link	Tentative Price/Unit (USD)	Tentative Total Cost
1.	RFID Module	1	Link	Link	7	7
2.	NFC Module	1	Link	Link	10	10
3.	GSM Module	2	Link	Link	25	50
4.	Fingerprint Module	1	Link	Link	18	18
5.	Buzzer Module	1	Link	Link	6	6
	Total (*tentative*) cost:					91

Please Note: The above list of components is an exhaustive list of the items that we were loaned out by the department and the components list is directly borrowed from the one unofficially presented for Project Proposal.

To provide further details on the accurate list of components and how they are being used or are planned to be used in the super-project, please see the below project sub-sections that are dependent on our Block Diagram:

*Please Note: There have been some very minor modifications made to the implementation details mentioned in our Block Diagram.

Remote Operator Side:

This is the sub-section of the project that is intended to be connected with the rest (i.e. the Industry plant side and the AWS cloud interface). The remote operator side is built on two pillars: *a custom Linux kernel node* and *a Raspberry Pi node*. These two pillars are interfaced with a few of the components mentioned in the above list. The specific details of the connections on the remote operator side are as below:

	Connections	Communication Protocol Used	Implementation Status	Implementation Details	Scope of task
1.	Fingerprint Module to BBB	UART	In-progress	The fingerprint module user-space open-source projects have been referenced in the ECEN 5013 class where the work is being done. The kernel module creation is in-progress as currently the focus is on	Falls under ECEN 5013 tasks

				BBB setup for that course and then, interfacing objectives with BBB.	
2.	RFID Module to BBB	SPI	In-progress	The RFID module user-space open-source projects have been referenced in the ECEN 5013 class where the work is being done. The kernel module creation is in-progress as currently the focus is on BBB setup for that course and then, interfacing objectives with BBB.	Falls under ECEN 5013 tasks
3.	NFC Module to BBB	I2C	Not Started	The implementation for this section will involve adding open-source user-space programs (and/or scripts) that will allow the NFC module to be interfaced with the BBB as a separate process with the appropriate module being added to the BBB kernel.	Falls under ECEN 5013 tasks
4.	GSM Module to BBB	UART	Not Started	The implementation for this section will involve adding open-source user-space programs (and/or scripts) that will allow the GSM module to be interfaced with the BBB as a separate process which will receive messages from the Industry Plant Side while the appropriate module is to be added to the BBB kernel.	Falls under ECEN 5013 tasks
5.	BBB to Buzzer	UART	In-progress	The implementation for this section will be a simple device file that other processes (as above) will write to on the BBB and a script will read the device file for alerts and will turn on/off the buzzer as per the data stored in the device file on the BBB.	Falls under ECEN 5013 tasks
6.	BBB to RPi	UART / BLE	Not Started	This implementation has to be yet decided if it will be based on UART or BLE connection protocols. As a safety measure, this week this task will be taken in hand and work will be started on the UART interface.	Falls under ECEN 5013 tasks
7.	RPi with MySQL DB	Software Implementation	To be borrowed from previous project implementations	The MySQL DB implementation is planned to be utilized and borrowed from the previous project implementations of EID for uniformity and effective use of time.	EID Task
8.	RPi with UI web client	Node.js	Partially completed	The RPi – UI web client interface has been designed in general using two approaches in the past: Tornado webserver and Node.js webserver. For this section of the project, Node.js webserver will be implemented based on the implementations in the previous class projects. In general, the UI web client (HTML page) has been partially created.	EID Task

9.	RPi to AWS IoT Core	AWS Cloud	Not Started To be borrowed from previous project implementations	The RPi – AWS IoT Core implementation is planned to be utilized and borrowed from the previous project implementations of EID for uniformity and effective use of time.	EID Task

BBB   – Beaglebone Black (Custom Linux Kernel) Node
RPi   – Raspberry Pi Node

Industry Plant Side:

This is the main-side sub-section of the project that is intended to be connected with the AWS cloud interface and immediately act a server to the remote operator side client. The industry plant side is built on three pillars: *a custom low power node, a SiLabs friend node* and *a Raspberry Pi node*. These three pillars are again interfaced with a few of the components mentioned in the above list. The specific details of the connections on the industry plant side are as below:

	Connections	Communication Protocol Used	Implementation Status	Implementation Details
1.	Grid Eye Sensor to LPN	I2C	Completed	I2C based grid eye sensor connection is established with LPN.
2.	LPN to FN	BT Mesh	Completed	LPN – FN BT Mesh connection is implemented.
3.	Fingerprint Sensor to FN	UART	Completed	Fingerprint sensor is implemented with FN.
4.	FN to Buzzer	GPIO	Completed	Buzzer implemented.
5.	FN to RPi	UART	In-progress	Communication development is in progress.
6.	RFID to RPi	SPI	Not started	Python development for connecting RFID module with RPi.
7.	BLE Auth (BT) with RPi	BT	Completed	Bluetooth based local security management that can be extended to a smartphone application.
8.	RPi to Local Config UI on Webclient (Tornado)	Tornado	In-progress	To be borrowed from previous project web client interfaces.
9.	RPi to AWS IoT Core	AWS	In-progress	To be borrowed from previous AWS cloud implementation.

LPN   – Custom low power node
FN   – SiLabs friend node
RPi   – Raspberry Pi Node

AWS Cloud Interface:

This is the bridge between the remote operator side client and the industry plant side server. The AWS cloud interface encompasses the following basic elements that are basically software blocks that reside in the cloud. The implementation details are allocated here as well. The specific details of the connections for AWS cloud interface are as below:

	AWS Connections	Implementation Status	Implementation Details
1.	IoT Core with RPi(s)	Not started	Implementation concepts to be borrowed from previous project implementations.
2.	IoT Core to Lambda	Not started	
3.	Lambda to SQS	Not started	

4.	SQS to UI web client UI	Not started
5.	Lambda to Dynamo DB	Not started
6.	Lambda to SNS	Not started

Updated WBS:

The updated WBS can be found below: