Evariste Some

Final Project Proposal:
Quade, Temperature Sensor, Wi-Fi ESP8266, Buzzer, LCD
[Name of the project to be determined soon]

I. Project Overview

The Internet-of-Things (IoT) is the notion of all devices and products being connected to the Internet, rather than only computers and mobile devices, as has been the case until the recent past. The IoT is already booming, and its adoption will only accelerate in coming years. At the same time, the world continues to go wireless. Wired Internet and telephone connections are becoming rarer with each passing year, and consumers expect and demand wireless communications more and more. One critical enabling technology for the IoT is wireless communications: IP-cameras, printers, kitchen appliances, and more deliver greater flexibility in their design when they do not need a wired connection to access the Internet. In this project, we propose to build on top of the class project Quade (Quadruped) a highly integrated Wi-Fi SoC solution to meet continuous demands for efficient power usage, and reliable performance on the Internet of Things industry by using the Wi-Fi Development Tools (802.11) Wi-Fi Module ESP8266WRL-13678. A temperature sensor and low voltage buzzer is also deployed on the Quade, and with a remote interaction capability.

II. Project Scope

The MSP432P401R launchpad is an easy to use evaluation module board. It contains everything needed to start developing on the MSP432 including on-board emulation for programming, debugging, and energy measurements (TI slau597a, p.3). The MSP432P401x devices are part of the Simple Link microcontroller (MCU) platform simplified by access to the 40-pin headers and a wide variety of BoosterPack plugin modules that enable technologies such as wireless connectivity, which consists of Wi-Fi, Bluetooth low energy, Sub-1GHz and host MCUs (TI MSP432P401r, p. 2). The SimpleLink MSP432P401x MCU are optimized wireless host MCUs with an integrated 16-bit precision ADC, delivering ultra-low-power performance including 80µA/MHz in active power. As an optimized wireless host MCU, MSP432P401x will allow us to add high precision analog to applications based on SimpleLink wireless connectivity (TI MSP432P401r, p. 2). Using the Code Composer Studio environment, the in-class project Quade will be used. On top of Quade, a temperature sensor, a low voltage buzzer, and an LCD1602 will be deployed to respectively capture the temperature and plot in real time, to emit a noise when the

temperature goes below some threshold, and to display some information on the LCD. Finally, the complete and self-contained Wi-Fi networking capabilities, ESP8266 with a full TCP/IP stack, will be deployed on the Quad through the I2C interfaces. The ESP8266 will be wirelessly performed as the "slave" to a host computer. Lastly, a particular focus will be made on the 802.11 Wi-Fi Module ESP8266 to analyze its pros and cons, any imperfection of the radio such as carrier leakage, I/Q phase matching, or baseband nonlinearities. ESP8266 has a 32-bit processor with a single core processor that runs at 80MHz (Espressif ESP8266EX Datasheet, p.17).

III. Functional Block Diagram

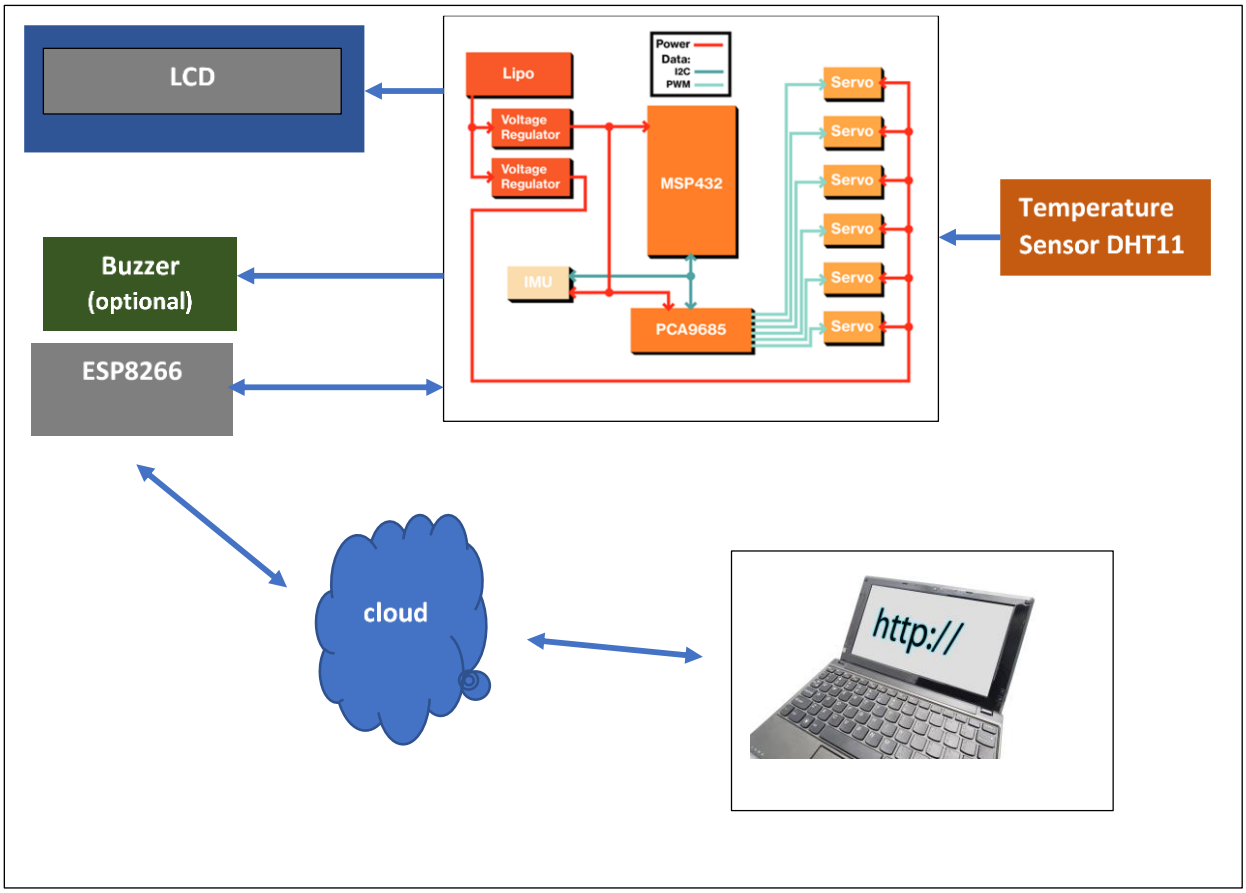
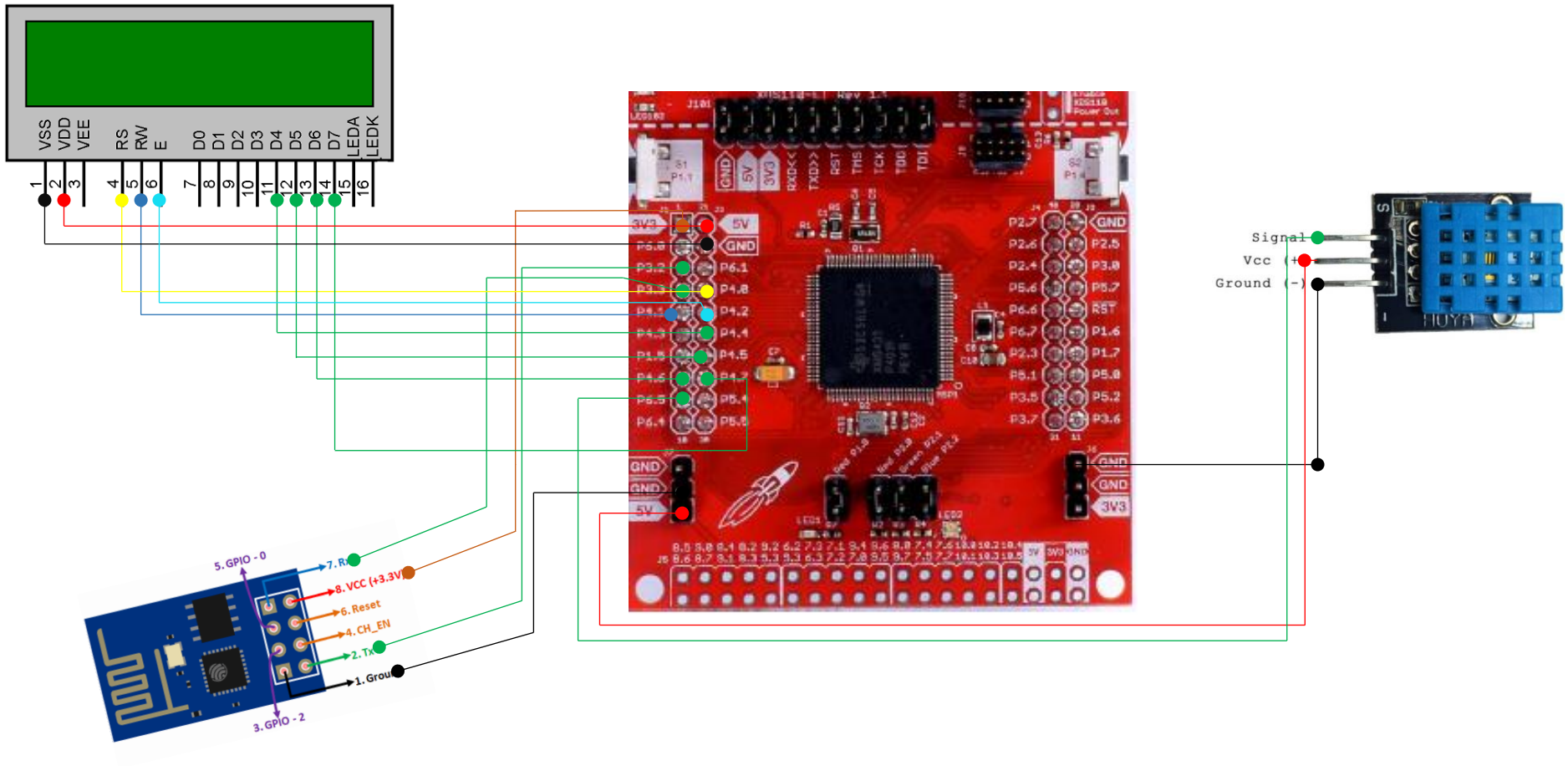


Figure 1: Functional Diagram

In Fig. 1, the LCD, buzzer, ESP8266 and the temperature sensor will be mounted on the Quade.

IV. Wiring Diagram

(…**in progress**…)



MSP432 Microcontroller and LCD1602 pins connection description

MSP432 Microcontroller	LCD1602	Description
GND	GND	Ground (-)
VCC (+5)	VCC (+5)	Source (+)
P4.0	RS	Register Select
P4.1	R/W	Read/Write
P4.2	EN	Enable
P4.4	D4	Data 4
P4.5	D5	Data 5
P4.6	D6	Data 6
P4.7	D7	Data 7

MSP432 Microcontroller and ESP8266 pins connection description

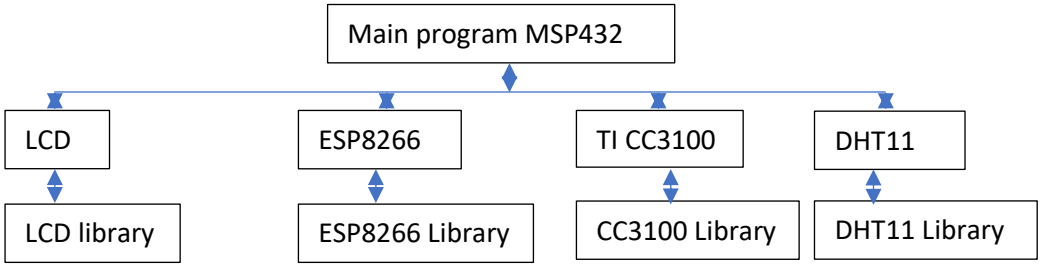
MSP432 Microcontroller	ESP8266	Description
GND	GND	Ground (-)
3V3	3V3	Source (+)
P3.2	TxD	Transmit Data
P3.3	RxD	Receive Data

MSP432 Microcontroller and DHT11 pins connection description

MSP432 Microcontroller	DHT11	Description
GND	GND	Ground (-)
VCC(+5)	VCC (+5)	Source (+)
P6.5	DOUT	Transmit Data

V. Software Diagram

(…**in progress**…Update is made as the implementation goes. A final diagram will be provided as soon as the implementation is finalized)



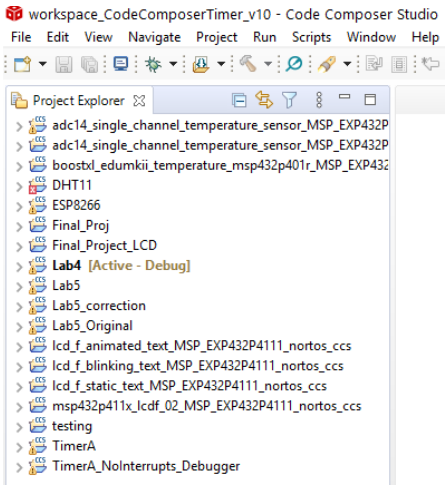


Figure 2: Compilation of different modules

VI. Project Requirement

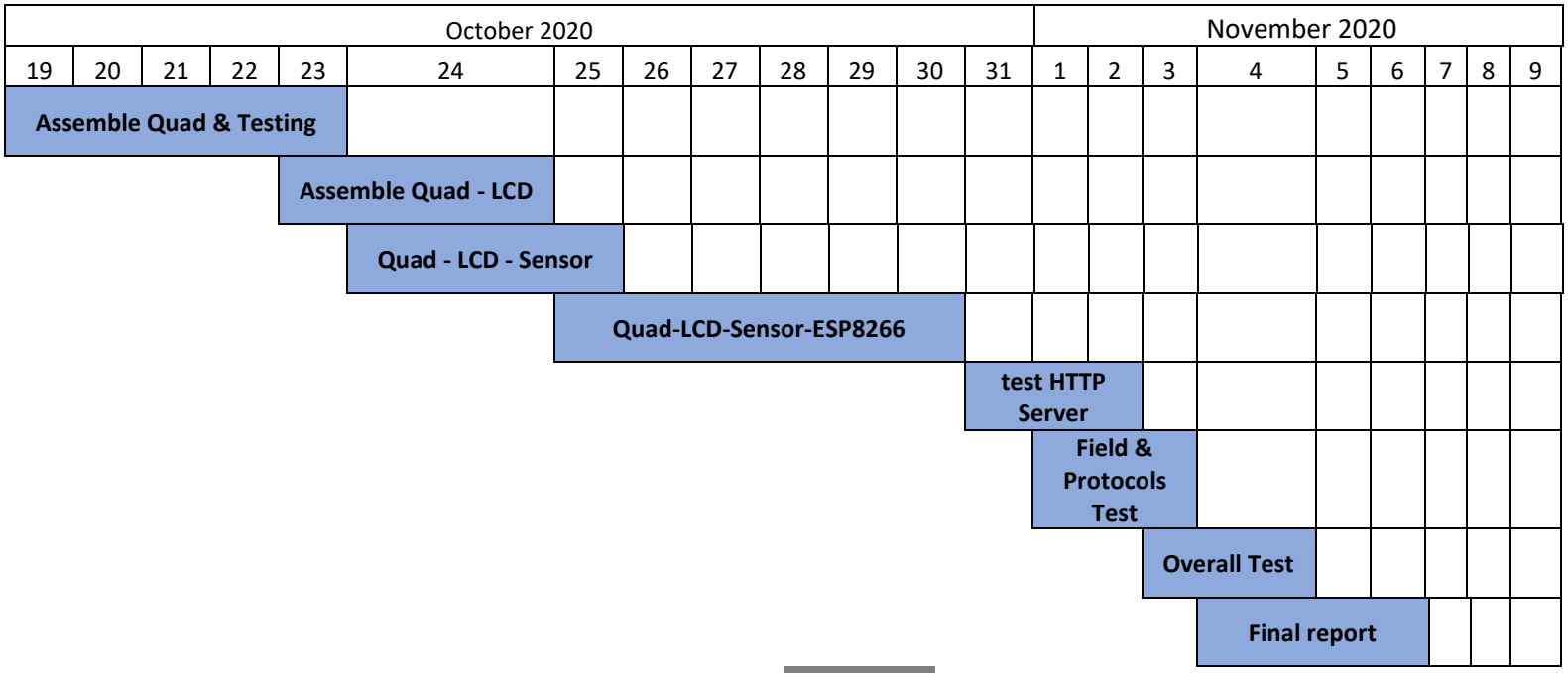
(…**in progress**… Update is made as the implementation goes)

This project embedded many subsystems that interact with each other. The following will be required to make the project successful:

- Buzzer: an alarm is triggered when a defined particular action is true [defined actions are still in progress]. The buzzer is physically connected to the Quad to some pins illustrated on the wiring diagram. A program module is required to act upon a given action from the Quad.
- LCD1602: it will display a set of state that we are still defining
- ESP8266: this radio connection is shown on the wiring diagram and operates on the 2.4GHz transceiver band with high speed clock generators and crystal oscillator. The ESP8266 supports the frequency channels 2447MHz, 2452MHz, 2457MHz, and 2462MHz (Espressif ESP8266EX Datasheet, p.17). A program module is required to allow an interaction between Quad – ESP8266 – Remote user actions.
- Temperature Sensor (undecided, but DHT11 is likely to be used): the sensor is connected to some pins illustrated on the wiring diagram. It measures the temperature and humidity of the field. Data can be displayed on the LCD or transmitted to the remote user via ESP8266 for further processing.
- Quad system: [description in progress]
- CC3100: The CC3100 device is the industry's first Wi-Fi CERTIFIED chip used in the wireless networking solution. The CC3100 device is part of the new SimpleLink Wi-Fi family that dramatically simplifies the implementation of Internet connectivity. The

CC3100 device integrates all protocols for Wi-Fi and Internet, which greatly minimizes host MCU software requirements. With built-in security protocols, the CC3100 solution provides a robust and simple security experience (TI CC3100, p. 2).

VII. Proposed Timeline



(…Grant chart in progress…)

Note on 10-20-2020: regardless of quade program, the MSP432 will be used to program the LCD, DHT11, and ESP8266 to gain time.

Note on 10-20-2020: beginning implementation MSP – LCD – DHT11 on 10-21-2020. Goal: get it done by 10-22-2020.

Note on 10-26-2020: implementation of MSP432-LCD-ESP8266-DHT11 in progress. CC3100 may be added and to remove ESP8266.

VIII. Bill of Materials

(…**in progress**…giving the orientation, we might add or remove some components)

Device	Description	Cost	Observation	URL
ESP8266	Wi-Fi Module		In class Kit project	https://www.mouser.com/ProductDetail/SparkFun/WRL-13678?qs=WyAARYrbSnZdmwzlRTs1Tw%3D%3D&gclid=EAIaIQobChMI9ITJqdTA6gIVE9bACh38gwhOEAQYAiABEgKgZvD_BwE
LCD1602	To display customized information	$9.90	The connection to MSP432 and ESP8266 requires some resistors	https://www.mouser.com/Search/Refine?Ntk=P_MarCom&Ntt=139536055
DHT11	Temperature and humidity sensor	$5.00	The connection to MSP432, ESP8266, and LCD requires some resistors.	https://www.adafruit.com/product/386
Quad	Quadruped robot using MSP432 and additional supports	$95.00	In-class Kit project	
Miscellaneous	Additional cost	$10.00		
TOTAL COST		$129.9		

IX. Trade Study

(…**in progress**…)

X. Theoretical Analysis

(…**in progress**…)

XI. Version Control Repository Set Up

A new repository has been created on the trunk evso9816.
The address is: https://github.com/evso9816/Embeddedd-App-ECE2440

All update can be found at this repository.

References

(…**in progress**…)