IEEE Mobile Chapter Design Challenge 2024

08:00 am – 05:00 pm CST, Saturday, November 23, 2024

Please register for the challenge at https://forms.gle/CYew7tTtw78aavKy9 by **October 23, 2024**.

General Information

IEEE Mobile Chapter is honored to host a Hardware – Software design challenge to be held at the University of South Alabama campus on November 23, 2024, from 8:00 am to 5:00 pm. Refreshments, lunch, and snacks will be provided on the challenge date. Teams will compete to design a system that will solve a problem given on the date of the challenge. In general, the system will require connecting a small hardware package to an Arduino Mega and creating a two-way communications link between the Mega and a smartphone app via Bluetooth. More information about the challenge is described below.

The top 3 teams from two categories, Middle & High School and General Public, will receive prizes. The 1st, 2nd, and 3rd place winners in each category will be announced at the end of the day of the challenge and will receive **cash awards of US $1,000, $750, and $500**, respectively, including a certificate. All participating teams will receive their own design as a souvenir.

Team Requirements and Eligibility

The design challenge is open to 2 separate groups: 1) middle and high school students (with at least one high school student required per team); 2) general public, including University students. Teams will consist of 2-4 members.

The challenge will be limited to the first 15 registered participating teams.

Registration Fees

Teams will be charged a **$50 registration fee for each Middle and High School Team, and $75 for each General Public category team**.

Design Challenge Information

This challenge incorporates ideas from digital logic, circuit analysis, and embedded development. Participants will be challenged by hardware and software topics. Therefore, a successful team will need to have both programming and circuit-building knowledge.

Exact details of the problem will be disclosed only on the challenge date. For now, all the disclosed information is below.

This challenge will consist of two primary pieces, using the following components:

1. Hardware development, supplied by the host, using:
   a. Arduino Mega (https://store-usa.arduino.cc/products/arduino-mega-2560-rev3?selectedStore=us)
   b. HC-05 Wireless Bluetooth (https://www.amazon.com/dp/B07VL725T8)
   c. LEDs and resistors
2. Software development in the form of an app from MIT App Inventor with instructions that will be given at the date of the challenge

Participants will develop an app with the MIT App inventor to perform actions that will be given on the date of the challenge. One of these actions will be to communicate (send commands and receive data) with the Arduino via Bluetooth using the card HC-05 Wireless Bluetooth RF Transceiver. Participants are encouraged to design the app with enough visual information to allow new users to quickly understand the device's functionality.

Participants will design the Arduino to receive information via Bluetooth and send commands to up to 30 LEDs according to specifications that will be given on the date of the challenge. Participants are encouraged to develop and connect the hardware neat and organized.

More information about how to operate those components can be found at:

- https://howtomechatronics.com/tutorials/arduino/arduino-and-hc-05-bluetooth-module-tutorial/
- https://howtomechatronics.com/tutorials/arduino/how-to-build-custom-android-app-for-your-arduino-project-using-mit-app-inventor/
- This is a link to a video explaining the Bluetooth permissions for the HC-05 to connect: https://www.youtube.com/watch?app=desktop&v=fDTJ8vlpJV4
- MIT App Inventor: https://appinventor.mit.edu/

Challenge Event Description

On the challenge date, refreshments will be served from 8:00 to 8:30 am. Lunch will be served from 12:00 to 1:00 pm. Snacks will be available throughout the day.

The problem will be disclosed in person on the morning of the day of the challenge. A description of the problem will be given, complete with Q&A, between 8:00 and 9:00 am. Participants will then be given 6 hours to design the app and Arduino to solve the problem, between 9:00 and 3:00 pm. Starting at 3:00 pm participants will demonstrate their solution to the challenge judges.

Each team will be given their own component kit to work with (excluding a cellphone, tablet and/or PC). At the end of the challenge, the teams will be able to take the component kits back with them as a souvenir.

The last 2 hours, 3:00 – 5:00 pm, will be reserved for final demonstrations and judging. The app created should be available for the judges to install onto their own devices for evaluation.

Materials

Provided Items

All materials and tools necessary to complete provided challenges will be provided by the host university.

Required Items (Brought By Each Team)

- Laptop PC(s) with all required software for application development: Arduino and MIT App inventor
- Smart phones and/or tablets for testing the app.
- Cables to connect from a Laptop to the cellphone and to an Arduino for application development and testing.

Recommended Items (Brought By Each Team)

It is recommended that participants bring the following items, which shall not be provided by the host university:

- Calculator.
- Pencils, paper, etc.
- Participants may bring their own Arduino Mega, Bluetooth card, LEDs, and boards on the challenge date. However, the evaluation will be done on the components provided by the host university.

Prohibited Items

Participants are prohibited from using the following items during the challenge:

- Documents not provided by the host university.
- Textbooks.

Scoring

Scoring Method

Teams will be awarded points for accurately completing the provided challenge. Each team will receive a maximum number of points, related to the difficulty of the challenge and to the team category (High School or General Public). Teams will be provided with the point values of each challenge differentiated by each team category. Teams may earn partial credit for partial completion of the challenge, as defined in the detailed rubric that will be provided on the challenge date. After the initial time limit passes, teams will lose a certain number of points every 10 minutes, until they submit their solution, or the challenge ends.

Participants will be judged based on their ability to successfully create an app that can interface with Arduino via Bluetooth.

Participants will be judged on the neatness of the hardware design.

Participants may earn more points based on added features to the app or to the hardware.

Primary points will be awarded based on the following:

- Basic functionality. Are the basic functions as specified on the date of the challenge demonstrated?
- Overall hardware mounting. Is it clean? Is it free of loose contacts? Are all cables color coded?
- Overall design of the app. Is it intuitive? User friendly? Are obvious symbology and graphics used to accurately represent the problem presented in the challenge?
- Innovation. Did the team add additional features outside of those mentioned? Did they create any useful and value-added functions other teams did not?

Ties

If a tie occurs between multiple teams, then placement will be determined by order of final submission. This means that whichever of the multiple tied teams submits their solution first will win.

Judge's Discretion

Judges and proctors may at any point determine that a participant's actions violate the rules in this document. Note will be made, and the judges will determine how it influences the participant's final score. Serious violations will result in disqualification and/or removal from the competition space.

Safety Notice

It is important to use best practices when interacting with lab equipment, and when utilizing circuit components. The safety of the participants, proctors, and equipment is our highest priority, and any unsafe practices will result in one warning, followed by immediate disqualification on a second infringement. Judges hold the right to immediately disqualify you if your action deems it necessary. If you are unsure whether something you plan to do is safe, please consult a proctor or judge.

Questions?

We encourage you to email any question regarding this challenge with the title "IEEE Mobile Chapter Design Challenge 2024" to IEEEMobileSection@gmail.com