

ECE4011/ECE 4012 Project Summary

Project Title	Smart Parking Meter
Team Members (names and majors)	Shiv Chopra, CmpE Blake Heard, CmpE Madison Hester, CmpE Michael Knudson, CmpE Raj Patel, CmpE Andrew Trimper, CmpE
Advisor / Section	Dr. Xiaoli Ma
Semester	Fall 2019 Circle: Either Intermediate (ECE4011) or Final (ECE4012)
Project Abstract (250-300 words)	<p>This project revolves around creating a new, smart parking meter. Often, when people are trying to find parking in cities, they will end up driving for an extended period of time before they are able to find a parking spot near their destination. Our team would like to address this problem by creating a parking meter that can notify the user of an open parking space near their current location.</p> <p>The user will have an app that would navigate them to a parking spot near their desired destination. The parking spot directions would update in real time to account for parking spots that are taken while the user is commuting to their destination. The availability of parking spots would be found in an online database collecting readings from parking meters and their proximity sensors.</p> <p>When in the field, the design would incorporate cellular communication. Since there will not much data sent from the parking meter to the database, 2G communication will provide sufficient bandwidth for data transmission. For the purposes of prototyping, Wi-Fi will provide a more cost-effective solution.</p> <p>This parking meter would still perform all of the normal functions of a traditional parking meter such as notifying parking attendants of unpaid parking and accepting payment for parking. As an added benefit, this configuration would allow a parking attendant to remotely monitor parking infractions in real time. This advanced feature set should result in a challenging project that incorporates the distinct elements of electronics hardware and software while developing a product that could be put forward into the public sector.</p> <p>For reasonable completion of the project, the design will be iteratively prototyped where more critical-to-operation features will be implemented before moving on to other complicated features.</p>

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List codes and standards that significantly affect your project. Briefly describe how they influenced your design.	<ul style="list-style-type: none"> • Section 150-94: all-night parking. This code states that no person shall park between the hours of 1:00 AM and 6:00 AM in a particular area of Atlanta, so we would need to make sure that our parking meters do not accept payments in this area during the above timeframe. • C57.12.28-2014 - IEEE Standard for Pad-Mounted Equipment--Enclosure Integrity. This standard specifies enclosure specifications for high voltage electronics located outdoors. Although Meterrific's parking meter design is not high voltage, these environmental protection techniques still apply. • GPS Standard Positioning Service (SPS) Performance Standard-4th Edition. This standard specifies the accuracy that the team can expect from GPS when integrating location data to the team's mobile application. • IMT-2000. This group of standards sets the frequency and data transmission protocols used for 1G, 2G, and 3G communication. Meterrific's parking meters will need web connectivity over wireless networks, so it is essential to understand the nature of the transmission the meter must use to send and receive data.
List at least two significant realistic design constraints that applied to your project. Briefly describe how they affected your design.	<p>A realistic design constraint is the power the system will consume while being in a low-power environment. Since the average parking meter is being upgraded to an IoT device, new components for IoT functionality will draw more power in addition to the power already drawn from necessary components in the average parking meter. The problem arises when there are more components in our design than are able to be reasonably powered or when all of the components are drawing power 24/7.</p> <p>Other realistic design constraints are the size and cost of the smart parking meter compared to the average parking meter. If the smart parking meter is bulkier and can't fit within a shape or space similar to average parking meters, then it will be more difficult to transition between the two. If the smart parking meter is significantly more costly than average parking meters and revenue generated for example, then the public sector will have a harder time investing in this technology.</p>
Briefly explain two significant trade-offs considered in your design, including options considered and the solution chosen.	<p>One main trade-off is based on how to power the meter. Using solar power would make the meter more economical, but would supply less power to the meter making it hard to fit in all the features. A replaceable battery would have to be replaced, but would supply enough power for all the features.</p> <p>A second trade-off involves the proximity sensor. If we were to implement a proximity sensor within the meter, it would work with the bluetooth of the meter and be a drain on the battery. The other option is to use the GPS location from the phone to show when a car is close and rely on the user's phone and GPS technology.</p>
Briefly describe the computing aspects of your projects, specifically identifying hardware-software tradeoffs, interfaces, and/or interactions.	<p>The primary software aspect of the project will be the Meterrific app that will communicate with the hardware to determine the closest parking spot. The hardware includes a custom PCB board that includes a microcontroller, a WiFi compatible chip, an LCD screen, and a distance sensor.</p> <p>The major trade-off within this assignment will be between complexity and battery life. When we include more aspects, we will create more strain on the battery. The other large tradeoff will be between cost and complexity. The more aspects we include with hardware, the more limited our budget becomes.</p>

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<p>Leadership Roles (ECE4011 & Forecasted for ECE4012) (NOTE: ECE4012 requires definition of additional leadership roles including: 1. Webmaster 2. Expo coordinator 3. Documentation)</p>	<p>Shiv Chopra</p> <ul style="list-style-type: none"> Co-App Dev Lead, Expo Coordinator <p>Blake Heard</p> <ul style="list-style-type: none"> Co-App Dev Lead, Documentation Lead <p>Madison Hester</p> <ul style="list-style-type: none"> Co-Webmaster, App UI-UX Lead <p>Michael Knudson</p> <ul style="list-style-type: none"> Co-Webmaster, Fabrication Lead <p>Raj Patel</p> <ul style="list-style-type: none"> Co-Firmware Lead, Team Lead <p>Andrew Trimper</p> <ul style="list-style-type: none"> Co-Firmware Lead, Hardware Lead
<p>International Program: Global Issues (Less than one page) (Only teams with one or more International Program participants need to complete this section)</p>	N/A