SESSION 5: Electrical Engineering Individual Projects

Officer’s Club West
Session Chairman (1st Group): Bryan Scharman

Group 1
12:25 Skyler Lund
   “Software for the UHAND”

12:45 Haunani Hew-Len
   “Infrared System for the U-HAND”

1:05 Jesus Loya
   “Radio Frequency System for the UHAND”

1:25 Bryan Scharman
   “Measurements of Sea Ice”

Faculty Advisors: Cynthia Furse, Richard Grow
SOFTWARE FOR THE U-HAND

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Home automation products provide more independence to disabled individuals who cannot use their hands. While the home automation industry offers extensive products, most controllers to manage these products require touch input. Additionally, managing IR devices, RF devices, and PC applications requires three separate controllers. The Utah Home Automation Network Device (U-HAND) is a software-based, hands-free automation network controller which integrates IR, RF, and PC application control. This report details the design, coding, and testing of the software portion of the U-HAND project. The software was outlined, designed, and finally coded using ‘Processing’ language. The full H-HAND system was tested and shown to successfully control IR devices, RF devices, and PC applications.
INFRARED SYSTEM FOR THE U-HAND

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The objective for this portion of the project is to create an Infrared System which includes three main functionalities: 1) to receive and store incoming infrared signals, 2) to transmit stored infrared signals from the ASUS Tablet Computer to control various infrared devices, and 3) to establish communication between the Arduino Microcontroller and the ASUS Tablet Computer. A software program was written in order to implement each of these functionalities. The first part of the Infrared System design implements the IR receiver module TSOP 1138 to detect incoming infrared signals from various devices to be stored in the ASUS Tablet. A library of nine protocols, which includes the NEC, Sony, RC5, RC6, RECS80, Samsung, Daewoo, Denon, and JVC protocols, is used for storing the incoming data from the IR receiver. An additional library was created for storing “raw” incoming data, which is data that failed to fall under one of the specified protocols. The second part of the Infrared System design implements a simple infrared LED. When requested by the user, the Arduino Microcontroller will activate the IR LED in order to control the desired IR devices using the stored infrared signals on the tablet computer. The final part of the Infrared System design employs a handshake between the Arduino Microcontroller and the tablet computer in order to set up communication between both ends. The results of testing done on the various parts of this design will be included in this study.
Numerous RF technologies for home automation are available. Nonetheless, INSTEON provides a greater advantage since its dual band technology can be implemented to control devices via power line as well as RF communication. This part of the project evaluates the design of an RF system. The system includes the implementation of an Arduino microcontroller and a Two-Way Power Line Interface Module which are utilized to interface with common appliances via power line using X10 protocols. Similarly, a CM17A X10 serial module and a transceiver were employed to send and receive X10 commands via RF technology. Processing language was used to execute the data between the microcontroller and the PC-Tablet in order to perform the specific functions set by the end-user.
MEASUREMENTS OF SEA ICE

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To look at the effects of global warming on the ice pack in Antarctica, models have to be developed to understand what is actually taking place at the physical level. Sea ice is the combination of pure sea water and brine inclusions. This will allow us to develop electromagnetic means of monitoring key transport processes which are important to studies of climate change. To understand the full properties of the sea ice, the complex permittivity of the ice needed to be found with and without the brine inclusions and at different salinity values of the brine. A dielectric measurement probe was considered for frequencies from 200 MHz to 20 GHz, however we were unable to make the probe perform as prescribed because of the low temperatures. Instead, a bridge circuit was developed to measure the resistance and capacitance at low frequency. From these measured values, bulk permittivity and conductivity were computed. This data could then be used to validate and calibrate a numerical model of the effect of the brine inclusions on the overall permittivity of the system.