Undent Solutions
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PROGRESS REPORT

For the past couple months, Undent Solutions, consisting of Daphne Mui, Dona Patikiriarachchi, Elisa (Xuan) Lu and Marissa Hun, has been working towards completing a demonstration model of our Vehicle Lock-Out Prevention System. The system prevents vehicle owners from locking their keys in their car. It alerts the owner when the keys are found to be inside and unlocks a door to provide access to the vehicle.

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Requirements Analysis

Undent Solutions is planning to target the older car model market that still uses key entry to access their vehicle. We have already researched several other competing products existing in the market. The Vehicle Lock-Out Prevention System requires fast response time and reliability. Also, the user interface is designed to be user-friendly with LED indicators for user feedback and a single pushbutton for putting the system in standby mode.

System-level Analysis

The team at Undent Solutions has completed the overall system block diagram and decided upon the component architecture. We have completed the preliminary research for development of various modules of our system. We have already ordered and obtained most of our hardware components and started hardware and software integration.

Our research and analysis led us to buy mini momentary push buttons for the door sensors and a larger momentary push button for the manual override switch. A piezo buzzer will be used as the main user indicator when the keys are detected inside the car. We decided to use the eZ430-RF2500 by Texas Instruments for the RFID transceivers and tags as they are relatively cheaper than other similar products and the devices can be programmed as either an access point or end device. Much thought was given into choosing the ideal microcontroller for the integration of parts. Research and reviews led us to buy the Arduino Duemilanove microcontroller board based on the ATmega328 microcontroller by Atmel Corporation. We have determined that we need 12 digital I/O pins and 1 PWM pin for our system. The Arduino microcontroller board has 14 digital I/O pins, 6 of which are PWM configurable. It operates at a low 5V, has a clock speed of 16MHz and comes with ample API functions and reference material.

The Vehicle Lock-out Prevention System will be powered externally using AAA and 9V batteries. They will be placed into a common battery box for easy access by the user.

A stepper motor is being used to operate our unlocking mechanism. It is powered by a 9V battery and controlled with an H-bridge circuit connected to our microcontroller.

Door lock sensors are still under development.

Microcontroller programming and RFID transceiver programming was split between the members of Undent Solutions. The microcontroller will utilize 2 interrupts for door sensors and manual override. Software operations of the microcontroller that has already been programmed are:

- Interrupt handling for door sensors and manual override button
- Detecting input from all 4 door sensors
- Communicating with the RFID readers
- Buzzer operation.

Upon determining the ideal door lock sensors, the code to communicate with door lock sensors will be written. Furthermore, automation of the motor that unlocks the main door will be implemented shortly.

The RFID transceivers and tags have 18 development pins available, two of which will be used to communicate with the microcontroller. The transceiver (access point) and tag (end device) source code was written such that the tag can wirelessly transmit signal strength data back to the transceiver using the built in CC2500 radio chip. The transceiver receives the tag's data and

notifies the microcontroller. Software operations of the RFID transceivers and tags that have already been programmed are:

- Receiving signal strength data from the tags
- Detecting low battery power from both the transceivers and tags
- Communicating with the microcontroller

Technical Specifications

Our progress is following the technical specification document with some small variances, but the overall system still adheres to the functional specification document.

Budget

As of now, Undent Solutions is well under budget, spending approximately $165. With the bulk of our hardware components already bought, we believe we will not go over budget. The remainder of our parts that still need to be purchased are the door lock sensors and unlocking mechanism control circuitry. This leaves us with a reasonable amount of funds left over for unexpected and emergency purchases.

Human Resources

Our team has worked on projects and labs together in previous semesters, so we are familiar with everyone's individual style. We have been working very well together. Group meetings are relatively relaxed, but work is getting done to reach our target completion date.

Action Items

There is still some integration to be performed between parts of our system. The microcontroller still needs to be integrated with the unlocking mechanism motor, door open/closed sensors, and door lock sensors. Everything should be fully integrated by April 2, 2010. The demonstration model should be completed by April 9, 2010 and the project demonstration will take place on April 28, 2010.