MEDSense: A Portable Pill Dispenser
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Week 2 Status Report:

According to Dr. Holger Shlutter, Vice President of Trumpf, the nation’s leading producers of solid state lasers, one of the best aspects of the American technology system is its liberal-minded acceptance of “failure.” Dr. Shlutter argues that while many countries such as Germany (his home country) have nothing but contempt for failure, the U.S. has an uncanny tendency to view failed attempts of R&D innovation as invaluable and necessary learning experiences. Rather than punishing failed attempts, American educational systems encourage students to attack their problems without the fear of failure. This attitude is compounded by an obsession with many of our country’s greatest technological failures such as those of Thomas Edison and The Wright Brothers. Because the failures of these idols inevitably resulted in revolutionary advances in technology, however, America uses them in order to emphasize the importance of persistence and perseverance over the possibility of failure.

Although there is certainly some validity to the previous argument, many research projects find themselves with very little time to learn from unexpected mistakes. Fortunately for engineering students today, however, the internet provides an unlimited source of information that presents detailed explanations of other people’s mistakes and research shortcomings. As a result, students and professionals can very quickly learn from these mistakes and, more importantly, plan on avoiding the same common mistakes. This has been my personal goal this past week of senior design.

Having obtained many articles and users manuals pertaining to the specific electronic devices that we are using in our pill dispenser, this past week has been spent studying the schematic layouts of different electrical connections, becoming familiar with different programming protocols and solidifying the design from last semester.

Any time multiple electrical circuits and modules are to be linked together to work synchronously, it is important that the user take care in programming the device. Just before the spring semester began, I came across Gumstix which, feature a number of

![Gumstix FCC Wifi Package](image)

Figure 1. Gumstix FCC Wifi Package
different technology modules that are all designed to work together. Specifically, one available package that includes an Intel microprocessor as well as a Wifi module and an RS232 module, seemed to be perfect for our particular application. More research revealed that Wifi is a better method of wireless communication for our particular application as opposed to Bluetooth. While Wifi is designed for long range connection of an external device to a main host such as a PC computer, Bluetooth is primarily designed to connect two external devices such as a cellular phone and a wireless head set. Additionally, because of the targeted uses of the technology, Bluetooth provides only a short range wireless connection. A portable device such as the MEDSense pill dispenser demands a considerable amount of freedom and,

![Figure 2. eb505 Bluetooth Module from A7 Engineering](image)

in this case, a large wireless connection range. Lastly, Wifi communication would allow for an easier connection with a PC, thus allowing for the seamless ability to send emails to an offsite source. For these reasons, Wifi appeared to be an ideal wireless solution for our medical device. With more research, however, the Gumstix became less appealing because of the gratuitous options available, resulting in unacceptable cost effectiveness. As an alternative solution, I decided to obtain an Embedded Blue eb505 Bluetooth module from A7 engineering, which should easily provide a general but short range connection to any other Bluetooth device within a 20m range. To solve the issue of maximizing the portability of the device, I have also purchased a Bluespoon USB Dongle from RadioShack ($39.00 US), which should provide Bluetooth wireless connection to any computer. Although most new computers are designed to be compatible with common wireless protocol, there is a possibility that a user of the MEDSense device will find themselves without a computer that supports Bluetooth technology. By providing the wireless dongle, any user will be able to plug the device into a female USB outlet and have flawless communication. The USB module will be conveniently stored in the external shell of the pill dispenser in a manner similar to that of the USB module for the
Microsoft Wireless Notebook Laser Mouse 6000 seen in figure 4. This will ensure that there is sufficient access to a Bluetooth connection no matter where the user may travel with the MEDSense bottle-cap pill dispenser.

Another modification to the original design is that I ordered a PIC16F684 rather than the intended microcontroller. Although all PIC microcontrollers have features that are useful for our application, the 16F684 is ideally suited for driving stepping motors, a major requirement for the MEDSense device. Fortunately, Microchip has provided users with a detailed explanation of how to drive a stepper motor using the 16F684 and has made available a sample electrical schematic. Using this schematic, we have ordered the necessary CMOS logic chips to drive our motor system. Because the ability to dispense and cut pills is most important to the success of the project, the design and construction of the necessary motor system has been listed as our number one priority.

The Second priority that has been established is programming the Real Time Clock that will ultimately determine when pills are dispensed. A potential problem that I have identified is that the PIC16F684 does not support UART or I2C communication protocols, which could interfere substantially with the integration of the PIC and the Real Time Clock. Once the motors are fully functional, the PIC and the RTC that drive the logic behind the motor functions will be programmed. In the meantime, however, more research is required to clarify the serial communication conflict. Solving this problem constructing the motor driving circuit is my goal for next week. Although there is a significant time restriction applied to this design project, I feel strongly that additional research will undoubtedly result in more rapid construction and integration of the many electrical components of the MEDSense bottle-cap pill dispensing device.