Home Secured

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***Abstract* – The objective of this project was to design, create and test a consumer alarm system with the addition of standard and nonstandard features. This item is expected to improve upon existing consumer products by adding convenient features such as an RFID system for ease of arming and disarming the system. The system also offers some features not found within a standard home alarm system such as an LCD screen. The group chose this as our senior design project because we felt it had a good mix of electrical and computer engineering concepts while remaining practical to create within the timeframe given to us.**

Index Terms* – *Power system, home security system, rectifier.

I. Introduction

Conceived and developed to take advantage of modern technologies to update a relatively unchanged product, the Home Secured, home security system is a fully functioning consumer level senior design project. The project is implemented across three dual layer copper planed perforated prototyping boards. The boards are divided into power system, sensors and base control board. Along with these two embedded systems exist which are implemented into a physical casing for our project. The microcontrollers contain a removable memory card that could be used in case of upgrades being needed and provide the project with a very good amount of digital I/O pins along with communicating between devices and providing the LCD screen for our use. Our power system operates using a commercial transformer to bring the system down to safe voltage levels, gets rectified and then passed into two D24V25F5 buck converters which power both microcontrollers for our project. Our sensor system consists of a single RFID receiver along with three RFID transmitters that match the commercial standard inclusion of motion, fire and the nonstandard tilt sensor.

II. System Profile

A. System Description

The system is laid out with three portions of casing in which it is protected from the environment and to protect users of the product. These are divided into the housing for the power system, base and sensors. The base is the largest followed by the power system followed by our sensors in terms of sizing.

III. SYSTEM COMPONENTS

A. Microcontroller

For our project we are using Raspberry Pi 3 which is the generation of the Raspberry Pi amily, Model B, 1 GB RAM. We decided to go with this one because it is one of the most popular one nowadays and it also fits our design consideration. According to Raspberrypi.org, it is the recommended one for school project use. It supports all the features that were available in the previous versions and also has backward compatibility. Also it fits well within our budget. It also comes with an HDMI cable, a microSD card with a card reader, the mother board with: a Broadcom CPU (BCM2837) 4x ARM Cortex VideoCore IV, a 40-Pin GPIO header (populated), a Wifi antenna, a DSI display connector, a MicroSD card slot, a 2.5/5V MicroUSB, a HDMI Port, a CSI Camera Connector, a 4-Pole 3.5 mm Audio & Composite Video, Ethernet Port, 2 USB Port, Bluetooth 4.1 Classic, and a 1 GB RAM LPDDR2 (900 MHz). It also comes with a cover case to protect the motherboard.

It features a wireless radio that is very small with a Broadcom BCM43438 chip that provides 2.4 GHz 802.11nn wireless LAN, Bluetooth Low Energy, and Bluetooth 4.1 Classic radio support. It is smartly built onto the board so it can be implemented at a lower cost. As opposed to the more used qualified module approach, the only feature that is not used is a disconnected FM radio receiver.

It also comes with a built antenna, so there's no need to connect an external one. The radios are connected to the antenna and built into the board so the device's size can be kept minimum. The antenna should be able to easily pick up wireless LAN and Bluetooth signals from our required distance.

The Broadcom BCM2837 SoC (system-on-chip) comes with four high-performance ARM Cortex-A53 processing cores running at 1.2GHz with 32kB Level 1 and 512kB level 2 cache memory, also it comes with a VideoCore IV graphics processor linking to a

1GB LPDDR2 memory module on the back of the board.

Like all the Pi series microcontrollers, the Raspberry Pi 3 features the 40-pin GPIO (general-purpose input-output) header. The only thing that's changed is that the UART is exposed to a switch on the GPIO's pin, which is handled internally by the operating system.

The same SMSC LAN9514 chip that were used in the Raspberry and Raspberry Pi 2 is the same chip that is featured in the Raspberry Pi 3, but this time with 10/100 Ethernet connectivity and four USB ports connected to the board. The chip is connected to the SoC via a single USB channel, it acts as a USB-to-Ethernet adaptor and USB hub.

B. Capacitors

Due to the high-power application of our system it required specialized capacitors to be utilized by our system. We also looked for a specialized capacitor that fit as an off the shelf solution and came upon one utilized within television. The capacitors decision was strictly based on the ability to have a high capacitance and handle a high voltage. For our power system, we required ~9000uF of capacitance and a max voltage of around 50V or greater. The primary reason for the high capacitance is these act as smoothing capacitors which determine the amount of ripple that exists within the rectified voltage. The DV-50 capacitors were selected due to coming in a 4700uF size and a max voltage of 50V. The other consideration was the casing they came in.

C. Transformer

For our project, we utilized the MGT-1220 transformer which was an off the shelf solution when it came to safely handling the high AC voltage wall outlets output. We used a transformer common used for HVAC systems. This is an AC->AC filter which steps down the voltage to a much more manageable 20VA output for our use. This when rectified gets a slightly boost in the voltage which still put it in a safe spot where our buck converters could still easily handle. One of the main decision behind using this component was for safety of our PCB as a raw AC wall outlet output would require much thicker tracers.

D. Buck Converter

For our project, we utilized a buck converter known as the D24V25F5. This buck converter was selected for use in our project as it met a very exact specification primarily for us which was that it output a consistent 5V 2.5A for our use. The voltage had to maintain a voltage fluctuation of less than 5% error because anything outside this range is extremely likely to damage components for our project in general. One of the other main components to this selection as our buck converter was that it had a wide range of input voltages. It was originally selected to work with raw unchanged voltage from a wall outlet but was later changed to utilize a much lower and much safer voltage. The other main consideration for this component was that it had built in reverse protection and protects itself from overflow in the event of a short. This meant that if we made mistakes the chip would be undamaged in general and last for our entire use.

E. Radio Frequency Links

The device that we chose to enable our sensors to communicate wirelessly to the Raspberry Pi was the US-3x 433M made by Aukru. This device consists of two separate devices that are the transmitter and receiver. They both operate at 433MHz and they are used for one-way communication. This means that we will not be able to send any data to the sensors, instead we will only be receiving data from them. This product is perfect for our project because they are very cost efficient.

A. LCD Screen

Our LCD is a 3.5” touchscreen LCD for the Raspberry Pi with a 320 x 480 resolution and a 32 MHz speed. It also included a stylus which works with the touchscreen. This touchscreen LCD fits perfectly with the Raspberry Pi we are using. It supports all the Raspberry Pi versions currently on the market. The NeoSec 3.5″ TFT is a small touchscreen LCD display that pushes onto your Raspberry Pi (Model A/B) via the GPIO pins. The screen makes use of nearly all available space above the Pi, allowing a decent 320×480 resolution. It comes packaged in a small clip-top box with everything inside.

The screen features touch screen functionality alongside a little directional touch pad attached via a belt cable. I've not seen this kind of thing in the market yet so this was a fresh approach and comes in handy if you need precise mouse control (or you don't want finger marks on your screen!). The touchscreen itself does also come with a stylus, another nice little addition to the package.

The GPIO is accessible via the extra PCB tab below the screen, allowing you to connect any kind of header you want (or none at all). It looks as though this could be cut/snapped off if required, as there are a number of drill holes creating the break for you. It’s subtle and out of the way: A buzzer is mounted to the rear of the screen which makes a sound every time you touch. I found this quite annoying, however, NeoSec have told me that on the latest model this is optional, in case you don’t want the ‘beeps’.

The screen itself is nice and bright, with rich blacks. The 320×480 resolution allows the font to be a nice size allowing the user read on the screen without issue. I love the size of this screen, and the way it covers the Pi completely. There’s also very little blank space on the screen itself. It does feel a little more delicate than some other screens I have seen previously. This is probably down to the fact that there’s no PCB area around it. There’s also nowhere to fit nylon screws or similar to help keep things steady – but I did a DIY job on this which isn’t difficult.

I guess it’s hard to keep us happy – we all want the biggest screen on our Pi, but to achieve that you need to remove the PCB area. This is a tough balance to strike.

There’s an obvious competitor that you can’t help but compare to when you see other small Raspberry Pi screens…so this review will focus on the pros/cons of the NeoSec 3.5″ TFT compared to the 2.8″ PiTFT from Adafruit.

Although these screens are different in features and size, they’re suitable for comparison in terms of “Raspberry Pi supported touchscreen”.

I’m mentioning price up front as I think it’s important to consider this whilst reviewing each screen. There’s not a lot in it price-wise.

This NeoSec screen package comes in at $41 – that’s the screen, touchpad, pen and DVD. This is also pre-assembled. A basic package with just the screen is $25.

The AdaFruit screen rolls up at $34.95 – including the screen only (no buttons). You also have to assemble this screen, including soldering the main GPIO connector and taping down the screen element.

NeoSec wins this one. Considering the extras, you get with it, I personally think it’s a better deal for a ‘screen on Pi’ solution. (and the basic $25 package is clearly much cheaper)

The PiTFT requires assembly, including GPIO and button soldering, and taping the screen to the PCB. That tape isn’t very sticky at all so you’ll most likely need to get your own – I used No Nails tape. The NeoSec screen comes pre-assembled and ready to go. No assembly required.

The PiTFT rocks up at 2.8″ at 320×240 resolution – using the extra space around it for the PCB which provides holes for fitting support screws.

The NeoSec weighs in at a more comfortable 3.5″ and a clearer 320x480 resolution. The 3.5″ screen covers more of the Pi, which I think looks much smarter. That extra screen space does come at a price, which is that it has a slightly more delicate feel to it and has no mounting holes for support screws like the PiTFT. The font on the NeoSec screen seems smaller yet clearer, allowing more on screen, but there may be a way to match this on the PiTFT that I haven’t discovered yet.

The PiTFT has holes around it to use nylon screws as a screen support. It also has PCB area around the screen acting as a bit of protection. The PCB covers the entire underside of the screen, ensuring no light comes out of the back.

The NeoSec screen doesn't have any support holes, and has no PCB area around the screen (but it's a bigger screen, which is more important in my eyes). I can’t see the NeoSec doing well on a Model A without that Ethernet port holding it up. The NeoSec's PCB doesn’t cover the rear of the screen either, so light comes out on to your Pi.

The PiTFT has an optional upside-down connector to attach a belt to breakout to a breadboard. I don’t like the whole belt thing, it feels a bit too 90’s computing for me and the upside down back to front thing makes it hard to do something different, like add a regular GPIO header.

It’s hidden away though, which is nice and tidy if you’re not using it and I’m pretty sure I’m the only person who hasn’t purchased a Cobbler belt breakout so maybe don’t listen to me!

The NeoSec is a little more traditional with the GPIO, and simply gives you a mirror of the GPIO next to the screen. This is good if you want a simple prototyping access, but perhaps not as ideal if you just want a screen, as it does stick out. It looks as though it can be removed as drill holes indicate an easy option to cut or snap it off.

The PiTFT comes ready to fit 4 tactile buttons to, however these need to be purchased and fitted separately. The blue PCB of the Adafruit board is attractive when compared to traditional colours.

The NeoSec comes packed with a touchpad, touchscreen pen and DVD software. The PCB can’t really be seen, but it is the standard green colour.

The PiTFT benefits from the massive following and fan base that Adafruit command. Their forums are full of information, and generally a lot of people buy their products, so most people have had the issue and written about it on blogs and forums.

The down side of a large company like this is that getting 1:1 email support quickly is unlikely due to the sheer number of requests they must receive

(although I didn't try this option, purely on the assumption it would take too long).
The NeoSec screen doesn't have that massive following that AdaFruit does, so finding information already out there can be difficult. Fortunately, NeoSec counteract this by providing excellent personal support by email and also regularly on the Raspberry Pi forum

B. Radio Frequency Identification

The PN532 NFC/RFID controller breakout board is used as a complete set and required some pins to be soldered. The transmission module utilizes a modulation and demodulation concept that is integrated for different types of passive contactless communication methods and protocols at 13.56 MHz's. This is a relatively small and unobtrusive unit, requiring a connection from the 3.3V rail of the Raspberry Pi 3. The passive RFID tags contain unique strings of 16 bytes, which was easily to implement for defining the data formats.

C. Pushbutton

For our security system to be fully functional, we must design a physical system that can communicate with our microcontroller. This system must not only be user friendly but also use as little power as possible. Like with most security system panels, our design will be following suit.

Our main objective is to design an input device that will enable the user to navigate the menus on the graphical user interface of the LCD. The pushbuttons will let the user entered passcodes, arm or disarm the system, or silence the system for when a breach is detected. Without the keypad, then the design will lack. To complete this goal, we need to develop a 3x4 matrix that will let the user navigate to the different menus on the screen (settings, arm, disarm etc.…) and enter a passcode that the microcontroller can store. Another objective that we will be working towards is to design the input device to uses very little power. As a team, we feel that if we keep the total power consumption under 0.5 Watts then we will have completed our personal goal for this part of the project.

IV. SYSTEM CONCEPT

V. HARDWARE DETAIL

A. Radio Frequency Links

The transmitter has an operating voltage of anywhere between 3.5 to 12 volts. This is perfect for us since we will be implementing a 9-volt battery to power the wireless transmitter. Additionally, the receiver has an operating voltage of 3 volts to 5 volts. When testing these two RF links we discovered that there is a lot of noise coming from the receiver when we set the operating voltage to 5 volts. This problem was solved when we lowered the input voltage down to 3.3 volts. The two links operate using amplitude modulation and the total transmitting power of is around 10mW. The receiver uses around 4mA which is roughly one hundredth of a watt.

B. Power System

The project requires a very specific voltage input in order to operate without damaging components. The project utilizes USB Power Charging Standard 3.0 which requires a capable USB power provided of 5V 2.5A to be supplied through a single cable. We also met the normal power standard overall which is that a less than 5% fluctuation should be present when creating a power system for the clear majority of applications. We used the newest standard to be able to supply the biggest array of devices possible on the market. This allows portability between many modern devices of all types. One concern that was ignored with this decision is that most older devices which also require a very exact current output are no longer in existence. The other main feature of the power system is that it supplies up to two devices and has been tested with modern cell phones and microcontrollers. The power system was originally designed with cell phones in mind but later adapted for microcontrollers.

C. PCB Design

The specific details for our PCB is that we used .016 inch traces for the clear majority of our PCBs due to extremely low current and voltage requirements for most parts. The only part designed within the PCB that needed thicker tracers was our 5V pin outputs as they handle a slightly greater amount of current since they drive LED's for us. The copper weight chosen was 1oz due to this same reason. The PCB has a thickness of 1.6mm which was just thick enough to keep our wires insulated and free from capacitance in most of our circuit. The only other notable decision was our sizing was based on predefined allowanced by our manufacturing company. This means some of our PCBs were designed with a bit of extra room. All our PCBs were designed as a standard 2 layer PCBs for ease of design for our application.

D. Radio Frequency Identification

For the purposes of this design, there was only minimal knowledge required to implement and program the RFID:
(1) An RFID system is made up of two major components: which includes a reader and a transponder, the transponder emits the designated frequency when near the reader because it is a passive tag.
(2) The RFID reader is powered but an RFID transponder has no power and is dormant until acted upon.
(3) The RFID reader persistently send an analog signal in the area, which will turn on any compatible transponders in the region. The passive tag then emits the same frequency as the reader and the reader will be able to pull any existing data off it.
(4) The RFID Reader will receive any data the transponder emits and interprets digitally and restructures the data to the original data.
(5) The RFID transponder which is known as the tag has a small circuit implemented and can store about 2kB of digital data.

The image below shows how the RFID card and the PN532 must be near for it to work and it can only work with certain types of RFID cards.

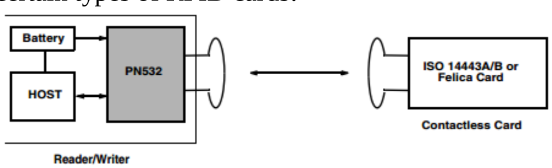


Figure 1 Communication between the RFID reader and an RFID card. Credit to Philips Semiconductors.

The PN532 Breakout Board transmits a full 16-byte RFID data word immediately upon receiving it from the RFID tag. It uses a serial interface peripheral interface which makes the transfer rate quick at a baud rate of 424 kbaud.

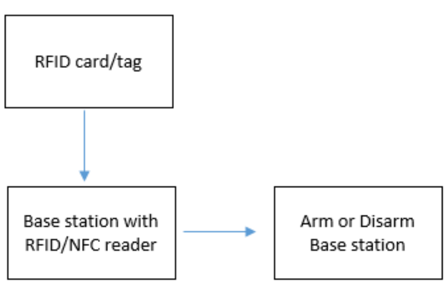


Figure 2 shows the data flow cycle. From the top left the RFID card or tag is near for the RFID/NFC reader to detect the card. Once scanned the microcontroller will decide whether the user wants to arm or disarm the system.

E. Sensors

i. Vibration/Tilt Sensor

We will be using the type of tilt sensor that operates off pure mechanics. These types of sensors are relatively cheap; therefore, it will keep the cost of our total project down. The way this sensor will work is that when the switch is turned on it will constantly read the voltage from the tilt sensor switch. As soon as an intrusion is detected, the coil in the sensor will contact the pin thus completing the circuit and sending a logical high value to the input pin of the transmitter. Since the sensor is connected directly to the transmitter, then we will not need to worry about the short contact time of the coil inside the sensor.

i. Motion Sensor

The part we will use for the motion sensor will be the HC-SR501. Its operating voltage is anywhere between 5 volts to 20 volts. This means we can use a simple 9-volt battery to supply voltage to it. The reason why this device is a great choice for our project is because the power consumption is extremely low. The device uses around 50 micro amps of static current while operating. If connected a 9-volt battery with around 100mAh of life, then the unit would last over 2000 hours before needing to be either recharged or replaced.

ii. Fire Sensor

The fire detector has four different connecting pins: ground, power, digital out, and analog out. Since we will be outputting a digital logic value, then we will not be using the analog output pin. The operating voltage of this module is anywhere between 5-3.3 volts. Because we want to use as little power as possible on the 3.3-volt rail, we will be supplying the module with 5 volts from the raspberry pi.

iii. Door Chimes

The main objective of our door chimes is to alert the user when a door has been opened when the system is not armed. When the system is armed and a door has been breached, then the security system will trigger an alarm to scare off any intruders. We feel that if we don’t include an added security feature to the entrances, then our design would not only be obsolete, but also easily bypassed. Reason being is because if an intruder were to breach an entrance, then their only concern would be avoiding our motion detectors.

The switch that we have chosen for our project is a normally closed reed switch. The two blades are initially making contact until a magnet is present which they would then separate. The pole convention of these two blades remains the same as the normally open reed switch. The difference is once a north pole of the magnet gets close enough to the south pole of the blade, then the south pole will attract to the magnet and the north pole blade will repel away from the magnet, thus opening the circuit. On one end of the Switches will be the pull-down resistor. The other end of the parallel configuration will be the 3.3-volt rail which is connected to a 1k ohm current limiting resistor. The complete system will operate by the GPIO pin reading low (door closed.) Once the door is opened and the magnet moves away from the reed switch, then switch will snap shut and current will be able to flow through the switch and into the GPIO pin, therefore either sounding the alarm or sounding the door chime.

VI. SOFTWARE DETAIL

A. System Software

Our firmware is designed using a mixture of Python, C++ and Qt creator. We use Qt creator as our main GUI. We use Python because it was easier to work around with the Raspberry Pi3 microcontroller and it came with great features for designing GUI. Qt creator came with Python, they work great together - even though there are many others we could have used such TkInter, wxPython, PyGUI etc - so we decided to work with it because of its simplicity. PyQt was very easy to work with. Also it features it lot of great tools to make the design more beautiful and presentable.

The interface will be simple for ease of use. It will consist of basically two main icons at the front screen like: Menu and Setup etc. The setup option is for the user setup the different mode they can change the system into. Inside setup, the user will be able to create pins, update pins or remove pins. The system will allow up to three pins or accounts for administration purposes; only people with the administrator accounts/pins will be able to configure or make changes to the system's display. At startup the user will be prompted a message to register or create at least one account to administrate the system, but later on they can add more account up to three. Also in the setup the user will be able to able to select the screen color for the display. Inside the menu will be different options to set the sensors and alarm sounds. When going into the menu, the user will have choices to disarm or arm a particular or all the sensors. If the user chooses to disarm a sensor a warning message will appear with description explaining the risks of doing so and asking to confirm the disarming. The user will be able to manually test the sensor to make sure they are always functional by clicking the On/Off button. The menu will give the user options to lower or higher the alarm sounds. Inside the menu there will also be options like reset, mode etc. The reset button will be used to reset some features in the system in case the user cannot undo a feature manually or if the system is freezes. The mode option will be used to set the sensors to a specific mode. For some sensors it may be temperature, distance, level of noise, level of smoke etc. There will be four arrow navigation panel to allow the user to navigate with the menu. Once inside the menu there will be a title (the name) of the selected option on top, on the bottom left there will be a back button to go back to the previous step once you go back there will be a forward to go forward; on the right side there will be an exit button if the user decides to go the main menu; also there will be an Ok/accept button to confirm the user's choice

B. Wireless Communication

Wireless communication is the basis of how the sensors will communicate with the Raspberry Pi. This is a very important aspect of the project because this will warn the user if there is an intruder in their home or business. We decided to go with a regular transmitter and receiver. We must figure out what frequency to set each device so they can transmit and receive properly. These devices are less susceptible to an intruder gaining access to the system.

The receiver will be implemented within the Raspberry Pi and will scan the surrounding area looking for any signals given off by the TX433 transmitter that will be implemented in the sensors. Once the receiver picks up any of the surrounding signals from the transmitters that are implemented it will decode the necessary information and will tell the Raspberry Pi if there is an alert that is needed. If there is an alert needed due to one of the sensors detecting some type of fault, then there will be an alert signal to let the user know that there is an intrusion in their environment.

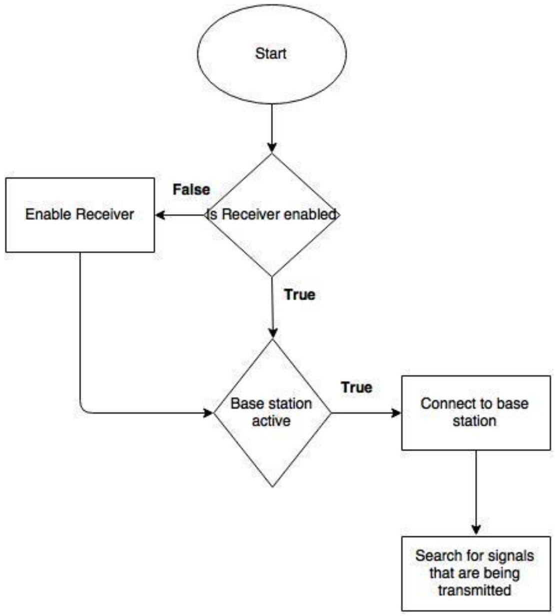


Figure 3 This diagram shows the software design of the receiver. The software will determine if the receiver is enabled. It will obtain the signal from the sensors implemented and decode it and then the base station will determine the status that the system should be set to.

The transmitter will be implemented in the sensors we have designed. The transmitters main purpose is to communicate with the receiver implemented with the Raspberry Pi. The transmitter will be transmitting in at a set radio frequency in the surrounding area and will send a signal depending on whether there is an intrusion or if the system is stable and there is no alert to report.

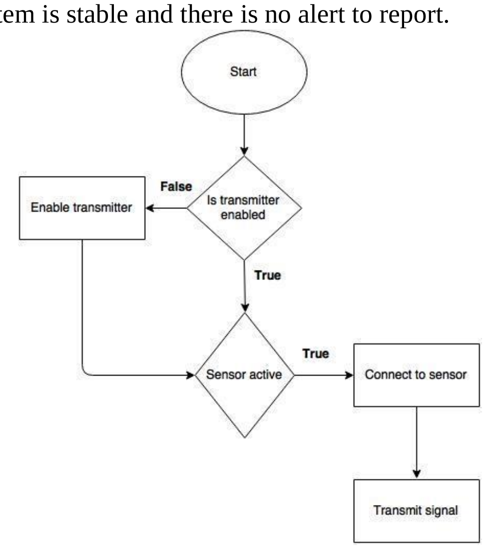


Figure 4 This diagram shows the software design of the transmitter. The software will determine if the transmitter is enabled and if it is it will transmit a signal in the environment to the base station to determine the status of the environment.

VII. BOARD DESIGN

A. Wireless Sensor PCB

The wireless transmitter and parts are all implemented with a battery onto a dual-planed perforated prototyping board. The sensors are fully interchangeable between each PCB for ease of swapping them out for our use. The wireless sensors were the easiest to implement in general due to being a simple header pin connection between the parts. This also allows for the sizing to be extremely small by comparison to some of the larger sensors found in non-subscription home security products. No ground plane and spare wiring were implemented within these designs to reduce possible noise and capacitance. The biggest challenge for these PCB's were in the ordering process as they had a minimum required board size.

B. Power System PCB

The power system PCB was our first created and was the highest risk one to work with. The biggest design consideration for this PCB was that our traces could deal with extremely high amounts of current to pass through them in general. This also meant we had to secure a way to allow for the connection of the wall outlet to the board directly. This was accomplished using bore holes in our PCB design which would then allow manual soldering of parts to the PCB. The PCB also was designed with a lot of empty space for the traces. This was because due to dealing with not only high voltages it dealt with AC voltages which could cross traces easily due to the inherit capacitance between the traces that exist. The sparse design of this board also negates the noise generated through the traces to each other which can be a problem for signal applications in which noise affects the application greatly. However, mid-way through the board the input gets rectified into a DC signal. This portion of the board has a much denser layout for the power system as the DC currents won't receive interference from other traces. It also doesn't allow for current to pass through due to trace capacitance that could short the system.

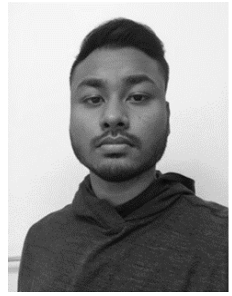
C. Mainboard PCB

The mainboard PCB is the heart of our project and connects to our microcontroller directly. This was our last created PCB and caused the most issues with designing it in general. This PCB is extremely wire dense and needed to support over 40 input/outputs. The major issues run into with this PCB was the spacing and routing through both layers. The PCB contains about 30 components along with supporting the many I/O's. This meant that on top of wire routing the space available on the board was a huge consideration. In terms of trace considerations for the PCB the only traces that required a thicker trace was the 5V connection as it handled a higher output current than all the other ones on the board. The other biggest consideration for this design was it contained a sizeable pre-allocated schematic that was needed to work with our T-Connector from our microcontroller. This meant that instead of our original planned layout for our pushbuttons they needed to be moved along with the components we had decided on. This means our base board changes the layout of our casing also required for our project. One big consideration with the pre-allocated schematic is the fact that it needed to be reshaped. The schematic originally used a bigger ground copper pour which had to be changed to work with our design in general. The reason being is due to the high amount of VIAS the ground copper would interfere with the lower surface connections of our project. Other issues were with milling as we learned PCB manufacturers start to require a proper milling outline to be drawn for circuits into their own file. This was because of the inability to view the exact outline when combined with the top copper. The last consideration was using proper case sizes to fit on this board as many of the components were nonstandard components not available to use within the Eagle PCB library.

THE ENGINEERS

Phillip Dannelly is a 27-year old graduating Electrical Engineering student who is looking for employment outside of Florida.

Josh Fry is a 26-year old graduating Electrical Engineering student who is taking up employment within the state of Florida.



Tony Baran is a 23-year old graduating Computer Engineering student who is taking up employment within the state of Florida and are interested in companies such as Lockheed, Siemens, Disney.

James Tavil is a 25-year old graduating Computer Engineering student who is taking up employment within the state of Florida.

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