Enhanced Driver Awareness Detection System

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***Abstract* — The Enhanced Driver Awareness Detection System assists the driver of a vehicle in navigating obstacles and is intended for off-road vehicle applications. The system provides multiple camera views to enable wheel position/ route selection for traversing difficult terrain without the use of a spotter or leaving the vehicle. The system also provides sensors for collecting data and relaying the information to the driver. This is accessible through an in cabin visual display as well as an on-windshield heads-up display. The vehicle power supply is used for the project and necessary steps were taken to prevent interference with the factory electrical, sensor, and safety systems.**

***Index Terms* — Automotive applications, cameras, infrared image sensors, microcontrollers, power system protection, sensor system, universal serial bus.**

I. Introduction

Off-road travel carries its share of risks. The highways one has access to within the United States today are a testament to civil engineering. They make it easy to forget how engaging a task driving can be. Off-road travel for the sake of this report is defined as travel on unimproved surfaces. They can span the range from mild dirt tracks and fire access roads to the extreme where there are no established roads. This type of travel brings with it hazards many are spared from in their day-to-day commutes, thanks to our transportation infrastructure.

Recreational pursuits and business operations alike have reason to leave established roads. Some destinations can only be reached through these means and some journeys would not be the same if taken any other way. Off-road driving has the potential to be challenging, mentally taxing, and dangerous. Modern vehicle development has worked to helped manage these risks. Ergonomic designs have increased driver comfort and thus helped reduce driver fatigue. Improved construction has led to safer vehicles in the event something goes wrong, as well as greater reliability. Technological advances have benefited off-road travel.

Though ill advised, many venture off-road alone. Whether it be a well logger for an oil company, or the recreational explorer, it happens often. In these situations, the vehicle driver must multitask and in technical or tight situations a spotter may not be available. The role of a spotter is to protect the vehicle by guiding and relaying information to the driver. Without someone to act as a second set of eyes technical situations are made more dangerous and cumbersome involving getting in and out of the vehicle to check clearance and examine terrain. Things can be overlooked or misjudged leading to vehicles becoming stuck or damaged.

The objective of this project is to provide a system to support the navigation of difficult terrain while providing pertinent real-time information to contribute to driver decision making. This is accomplished through the use of cameras and sensors that interface with the driver via an in-cabin tablet display alongside a windshield heads up display.

A real-time feedback of vehicle position in relation to the surrounding terrain is displayed on the in-cabin screen via external cameras. These cameras will show the area around the vehicle that would normally be obstructed from the driver's seat. The video cameras selected are covering forward for guiding tire placement and rearward to aid in reverse travel. Proximity sensors will enable the measuring of vehicles relation to rearward objects and relay to a heads-up display when problems are detected. This warning will be paired with the camera screens to highlight the issue for the driver to act. A temperature sensor is utilized to monitor engine compartment temperature to indicate abnormal conditions.

The vehicle chosen for the system prototype is a Jeep Wrangler JKU. See Fig. 1 below.

Fig. 1. Project protype vehicle manual tire alignment.

II. Functional Overview

The objective of this project is to provide a system to support the driver in navigating difficult terrain while providing pertinent real-time information. The primary problems being addressed are lack of awareness around the vehicle due to vehicle blind spots and prioritization of situational concerns. Providing driver visibility and alerts to various concerns were desired.

Various methods for achieving the desired functionality were examined for each section of design. The selection criteria and resulting choices are highlighted in the report that follows. Our chosen approach utilizes Raspberry Pi cameras that feed to individual Raspberry Pi modules around the vehicle then feed to a central Pi that interfaces with sensor inputs and the display. The video cameras selected are covering forward for guiding tire placement and rearward to aid in reverse travel. They are IR models with wide angle lenses. Sensors were selected primarily based upon budget and desired functionality. The sensors chosen are temperature and proximity sensors. The proximity sensors provide feedback on rearward obstacles, while the temperature sensor provides information regarding vehicle components with diagnostic and trouble shooting in mind. The information is relayed through the master Raspberry Pi to the visual display and the heads-up display depending upon the data. Video will be viewed on the main display with secondary data such as warning indicators visible on the heads-up display. The below list highlights the requirements for the project and the specifications that will enable these capabilities to be met.

A. Requirements and Specifications

Our engineering requirements were determined primarily by the system constraints. The self-funded nature of the project, time, and limited access to tooling for manufacturing resulted in striking a balance between the competing demands.

A compact form factor, separation from factory systems, utility, and budget are the categories for our requirements.

1) System materials cost < $800, to be verified by tracking receipts.
2) Compact form factor, system weight < 10 kg, verified by weighing unit.
3) Separated from main electrical system, verified by performing low voltage disconnect procedure.
4) Proximity sensor alert, when objects are within 2' the HUD will inform the driver and the rear camera will be displayed full screen.
5) Camera field of view >= 180 degrees near view from driver's seat.
6) HUD will be able to magnify OLED image 2 times for warning icon windshield display.
7) Temperature sensor will provide a warning to be relayed through HUD to driver when user set value is reached.

B. Discussion Points

A system diagram is shown below in Fig. 2. The following discussion is separated into these sections:

1) HUD
2) Data Input- Camera and Sensors
3) PCB- Integration
4) Software Discussion
5) Power Distribution

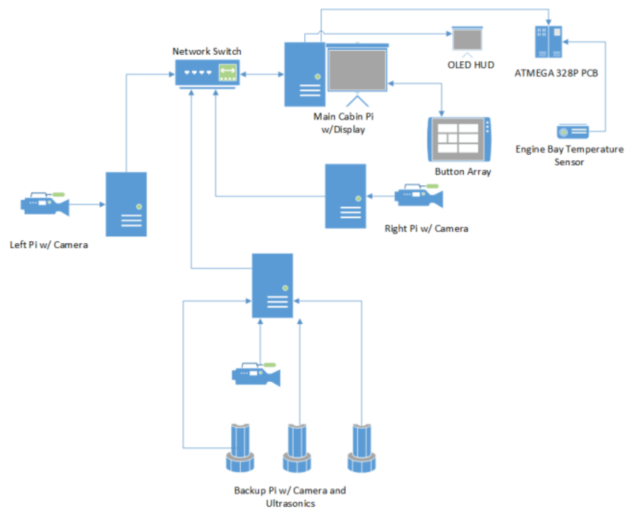

Fig. 2. Labeled diagram of system components.

III. Heads Up Display Optics

The motivation behind integrating a heads-up display (HUD) in the system was to be able to give the driver notifications as quickly as possible without them having to divert their attention away from the terrain ahead. Doing so through the HUD will allow the driver to keep their focus forward through the windshield and see any notifications projected onto the windshield from the HUD unit. The HUD will then communicate with the secondary display so once the driver sees the notification from the HUD, they can then see exactly what is going on by checking the secondary display.

The HUD will be utilized to display a variety of notifications and data for the driver. This includes emergency notifications in the case the vehicle gets too close to an object and there might be a collision. Arrow indicators will be used as well to notify the driver of where the impact may occur. The status of the system will also be shown through the heads-up display so any issues such as voltage irregularities will prompt a symbol on the HUD. Temperature data will also be shown through the HUD as well for driver convenience.

A. HUD Design

A basic HUD system can be broken up into two major components. The first being the imaging system and the second being the combiner. Before designing a system, we had to first establish what parameters and specifications we would need to follow. First, we set a budget of around $100 for the HUD unit itself. Then size was the second concern, we wanted to have a compact unit under 15 cm long. Finally, we wanted the HUD to magnify full color images by a factor of at least 2x from a small form factor display.

In order to achieve these specifications for our HUD we decided it would be best to go with a fairly simple lens system for our imaging system. This lens system is based on a Keplerian beam expander but modified to fit our application. Essentially, we would take two lenses and space them out by the length of their summed focal lengths. For our project we slightly reduced this distance in order to achieve a slightly uncollimated system so that magnification can be fined tuned by the mounting position and give the user some flexibility on how big the image will be on the windshield. However, the minimum magnification will be at least 2x the size of the original image coming from a small form factor display. So, our imaging system will be a small form factor OLED display, a 1 inch bi-convex lens, and a 2-inch plano-convex lens mounted in that order. A Zemax simulation is displayed below in Fig. 3 that shows we can achieve a 2x magnification at a distance of 5cm with the slightly uncollimated setup.

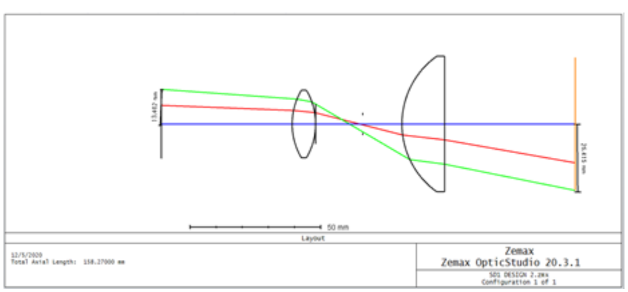

Fig. 3. Zemax simulation of Lens setup providing a 2x magnification at 5cm.

The secondary part of the HUD system is the combiner. This part of a HUD is meant to combine the images generated by the imaging system into the field of view of the user. In this case we will be utilizing a simple combiner that utilizes Fresnel reflections. This combiner is a thin film that will be placed onto the windshield in the path of the imaging system to allow the driver to see the imaged created by the imaging system. This option is the most cost effective and still provides great performance for our system specifications.

B. HUD Parts

The main driver of the HUD is the ER-OLEDM015 OLED display. The main reason for choosing this display was the OLED panel along with full color capabilities. OLED displays are naturally very bright and can emit a wide range of colors which was a very appealing option for this project as our display needs to be very bright and visible in an already very bright setting.

As far as our lens options we went with 2 lenses from Thorlabs. The first lens being bi-convex lens LB1761and the second lens being a Plano convex lens LA1401. These two lenses satisfy our Keplerian based expander for our images, and we are able to achieve at minimum a 2x magnification which meets our set specifications. These lenses provide good performance at a very affordable price.

Finally, for our combiner we are utilizing a generic reflective film that utilizes Fresnel reflections to allow the driver to see the images projected onto the windshield. Fig. 4 below shows a basic labeled diagram of all the HUD parts in the correct orientation along with an approximate ray trace to give an idea on how the image will be magnified in the complete set up.

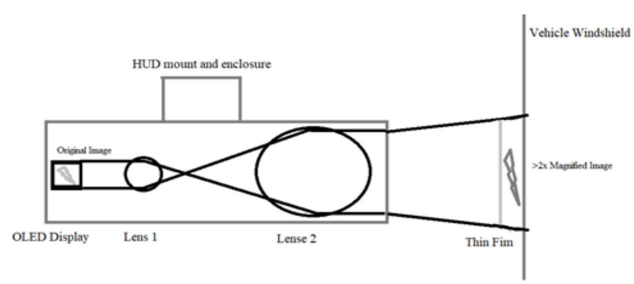

Fig. 4. Labeled diagram of all the complete HUD system in the correct orientation.

IV. System Inputs

The sensors and cameras provide real time feedback to the driver regarding their surroundings. They help enhance the driver's capabilities to detect objects/ features in the terrain, spatial relation of vehicle with the environment, and specific functions of the vehicle. Feedback to the diver is done via warning lights within the vehicles HUD system or video feeds within the display. Camera coverage is 180 degrees from the driver seat and 160 degrees to the rear center line of the vehicle.

There will be two types of sensors. resistances temperature detection (RTD) and ultrasonic sensors. The RTD sensor is used to measure the ambient engine bay temperature. The sensor can be used to measure specific components based upon user needs with warning thresholds being user configurable. The warning light will be displayed on the HUD at the set threshold. The ultrasonic sensors are used to detect objects behind the vehicle within a 2-foot range. The ultrasonic sensors will work similarly but when an object is detected within 2 feet of the vehicle a warning indicator will be displayed on the HUD system and the main display will jump to display the rearview camera feed only. for our system specifications.

A. Cameras

The motivation behind the camera system is to provide the driver a more accurate visual representation of the vehicle surroundings. Resolution, field of view, lens type, overall dimensions, and cost were the guiding criteria for component selection. The chosen camera set up was implemented using three micro RPi Cameras. These cameras boast a 160-degree field of view with an adjustable fisheye lens. The image quality along with the field of view and a resolution at 1080p produces a very impressive image that will allow the driver to see well beyond the specified 180-degree field of view. Furthermore, these cameras also have an infrared option that will be used for the rear-view camera. This camera option proved to be the best performing camera for the budget along with a small and easily mountable form factor.

B. Temperature Sensor

RTD sensors work based on the principle that the resistivity of the metal will change with temperature. This change in resistivity is what RTD sensors are based on. There are many different configurations of RTD, but they all involve a resistor. There are wire diagrams with 2-4 wire set ups that are hooked to a resistor. The additional wires aside from the two-path minimum is to enable temperature measurement that is less effected by the system itself due to resistance changes in the copper wires themselves. Our unit is shown in Fig. 5.

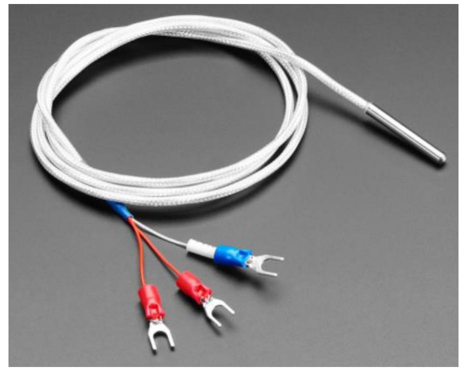

Fig. 5. Chosen sensor component PT1000.

One benefit of the RTD is that the output is a very linear voltage output thus making integration straight forward. Some of the down sides of RTD sensors are they do not change temperature quickly. This happens because of the thickness the materials used allows for a slower change in the overall temperature element. RTD sensors are used in most industrial applications. They work well in places that have a lot of radiated heat coming from components. Or also in places with extremely high vibration they can remain accurate. They are also good in places that are hard to mount sensors due to the fact they are generally small and compact sensors. Other example industries they are used in would be, HVAC, chemicals processing, and manufacturing. They are durable and good for being used in humid environments along with dry environments. They usually measure the temperature in rooms that are air conditioned as well. RTD sensors can also be designed with transmitters [1].

The temperature sensor we chose was the PT 1000. There are many good options as far as RTD sensors. Another option that was being looked at was the PT 100.The PT 100 is about the same sensors as the PT1000. But there is variation between them. Some of the variations are the resistance sizes. The PT 1000 boasts a 1000ohm resistance at 0 degree Celsius over the 100ohm at 0 degree C in the PT 100. This difference is a lot when considering the accuracy of the two sensors. The PT 100 could have a range of +/- 1 degree C vs the Pt 1000 that can have an accuracy of around +/- .1-degree C. Now the accuracy when compared to the cost is not too bad to have the more accurate one. The PT 100 comes in at a cost of $11.95 vs the PT 1000 at $14.95. This ends up not being a bad tradeoff for accuracy vs cost. Another thing is they are both PT meaning they are coated in platinum. But the Pt 1000 is equipped with a 316L stainless steel shield. This 316L stainless steel means that it is highly corrosion resistant. The metal contains nickel and molybdenum making it also resistant to chemical contaminants and acidic solutions like bromides. This will help keep the durability of the sensors and provide it to last longer. This will help since the location in the engine bay will have very harsh conditions. Both the PT100 and the PT 1000 have a max operating temp of 550 C and a range of -200C to 550C. This will ensure safe operation of the sensor. Seeing how most jeep temperatures under the hood get up to around 180 - 200 C. Both models have a resistance variation of around 3.85 ohm/C nominal. This means for every degree the resistance goes up around 3.85 ohm. This means as the temperature gets hotter the resistances will start to increase. Making it harder for the current to pass with all the atoms bouncing around. Both sensors have roughly the same dimensions. They both have a 4mm diameter and roughly a 30mm long tip size for the sensing end. The PT 1000 is a three-cable model. This allows for a much more accurate reading. By allowing the two wires connected to the drive the resistor and record the voltage. These two wires will be used to subtract their two voltages and then record the difference. This will allow for detection of voltage drop within the wires. This then allows for the third wire to be connected to one end of the PT1000. Also, both the PT 100 and PT 1000 make integration with our Raspberry PI easy. That is a bonus for the team. Both sensors will also need to be used with an amplifier [2].

C. Ultrasonic Sensor

This is the sensor option we chose to go with. It has one of the best wide-angle beams in the line of HRLV MaxSonar. This is good for our application due to the fact it will provide good coverage along the rear of the vehicle. This will help with the overlapping of the sensor field of views. Below in the figure are the ranges of the sensor at different ranges. There are different ranges provided at different supply voltage levels used. The voltage we will be supplying our sensor with. The current draw with the sensor will be in the 3.1- 3.5mA range. The current draw will very briefly spike due to the sending of the ultrasonic sound wave. This could in turn cause the Raspberry pi to go into a shut off mode. In order to correct this issue a capacitor will need to be utilized. This will help to prevent a large current draw. Some other nice features of the sensor are the high read rate at 10Hz. This will allow for better reliability in reading as the car is moving. The sensor also incorporates many ways to read the sensor. PIN 1 on the sensor is for temperature sensing. PIN 2 is used for a Pulse Width Output. PIN 3 is used for the analog output voltage. The relation of the analog output is for the 1023 for the 10-bit resolution. So forever 5 on the ADC corresponds to range in mm. as an example for let’s say 60 bits you multiply that number by 5 so 5*60=300mm.The analog option also works with 5V. PIN 4 is the ranging Start/Stop. This setting uses a pull up high on the pin if this pin is left unconnected it will allow the sensor to freely keep reading. If held low the sensor will stop ranging. The high mode only lasts for 20uS.PIn 5 is the Serial Output this is the PIN we will be using. Start/Stop. This setting uses a pull up high on the pin if this pin is left unconnected it will allow the sensor to freely keep reading. If held low the sensor will stop ranging. The high mode only lasts for 20uS. Pin 5 is the Serial Output this is the PIN we will be using. This pin will allow for an easy connect ability to our Raspberry pi 4. Sensor unit is visible in Fig. 6 below.

Fig. 6. Chosen sensor MB1003 HRLV.

Using this pin allows for less complications as far as the coding and the set up with the sensor. We will be supplying the sensor with 5V to get the best detection field. Some of the other features with the sensor is it has a good operating temperature in between 32F to 149F allowing for a good operating range of the sensor. The sensor is also good with weather as far as rain it can handle a good amount. It will not perform at all if completely submerged in water. The sensor's max range is 195 inches with a larger field of view the further the detection range. One downside is very large objects at 11inch will just continue to be reported as 11 inches. But this will work well the driver will have time to check the cameras within the vehicle to see the object. The dimensions of the sensor are compact so that is also a bonus for our application. Having just one transducer over the other version also will allow for better reliability. Also, the cost was another reason for selecting this sensor at only $37.95 it came within our budget. [3]

V. PCB

The PCB will be used to integrate the PT1000 temperature sensor. The boards will incorporate the ATMEGA 328PU. This chip comes standard on most Arduino UNO R3 boards. The PCB will also incorporate a voltage regulator to take vehicle voltage down to 5V to allow for operation of the ATMEGA chip. Then the PCB will communicate via the serial TX and RX pins incorporated on to the PCB. To the raspberry pi via its TX/RX pin outs. But in between the Raspberry PI and the PCB a level shifter will be needed to step up the voltage from 3.3V on the PI to 5V for the PCB. Then going the other way from the PCB to the PI it will step down from 5V to 3.3V. See Fig. 7 below and Fig. 8.

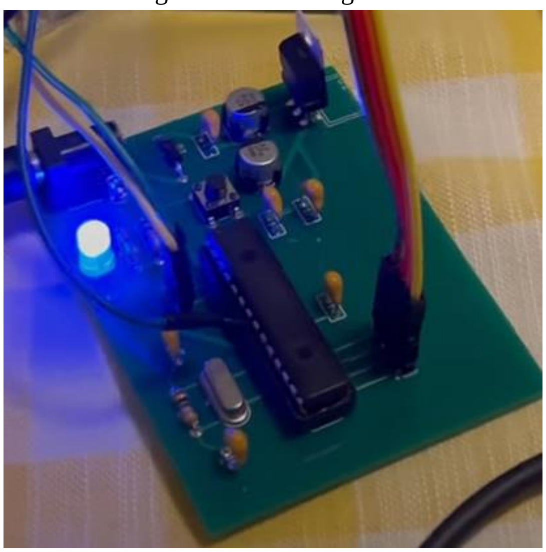

Fig. 7. PCB unit for sensor integration.

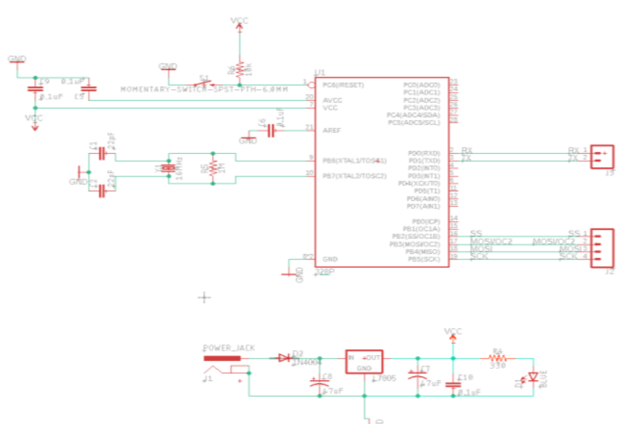

Fig. 8. PCB schematic

VI. SOFTWARE DETAIL

Our multiple Raspberry Pi's required a more complex approach to software design in order to incorporate and have each individual piece communicate accordingly. The bulk of our software was done in Python3 for its expansive libraries, most of which is run on our main cabin display Pi that controls logic as well as listens via TCP socket protocol waiting for packets to be received from our other Pi units. Our ATMEGA 328P MCU was coded in C for its ease and simplicity to send the data to our main cabin Raspberry Pi. The rear mounted Raspberry Pi will be connected to 3 of our ultrasonic sensors, which if tripped below our threshold value of 2 feet will send a packet of data to our main display Pi which will launch a full screen view of the rear camera as well as launch our OLED program to inform the user of danger. This OLED program is also launched in the event the temperature sensor value gets too high to inform the user of dangerous high temperatures under the hood of the vehicle.

To create a system that would be responsive enough we needed the following multiple python3 scripts/programs to run given an event that would trigger them, note all the programs displaying camera feeds needed to be optimized for multithreaded use as running on a single thread showed too much lag:

1)FirstFullRun() – this is for our first run of our program from boot featuring all of our cameras in the 3 display array, we needed to create a separate version of this to incorporate our 15 second delay upon boot to allow neighbor Pi's to boot and start their camera feeds, camera feeds are acquired over the network via IP address of associating views

2) FullRun() – this is our program that displays all the cameras in our grid, this is the default screen our system will always revert to after the completion of an event, camera feeds are acquired over the network via IP address of associating views

3) BackupCam() – launches a full screen view of our backup cam for 15 seconds, camera feed is acquired via IP address of Pi attached to rear mounted camera

4) LCam() – launches a full screen view of our left mounted camera for 15 seconds, camera feed is acquired via IP address of Pi attached to left mounted camera

5) RCam() – launches a full screen view of our right mounted camera for 15 seconds, camera feed is acquired via IP of Pi attached to right mounted camera

6) ButtonLaunch() – Runs in the background upon boot and waits for a button to be pushed via GPIO, depending on button this will either stop/start the UltrasonicMonitor(), start RCam(), start LCam(), start BackupCam(), in the event the BackupCam() is launched

via TCP packet transfer, ButtonLaunch() commands will take priority.

7) ServerLaunch() – Runs on the main cabin Pi, opens port 5555 on its IP allowing for it to listen to any TCP socket packet transfers to occur, if a packet is accepted it will launch BackupCam() and Oled_backup().

8) ClientLaunch() – Runs on the Raspberry Pi attached to the rear mounted camera, this program simply sends a packet of data via TCP to the IP address and port of our main cabin Pi

9) UltrasonicMonitor() – Runs upon boot on the rear Raspberry Pi, this monitors the values of our ultrasonic sensors, where if the distance value drops below 2 ft it will then trigger to launch our ClientLaunch() program

10) Oled_Temp() – C written program which launces the oled to display a red warning indicator for our HUD system

11) Oled_backup() – C written program which launches the oled to display a warning indicator for the rear when something is too close

12) SerialRead() – C written program that monitors the serial communication between our ATMEGA328P and Pi for our temperature sensor readout, if it goes beyond the threshold it will then launch Oled_Temp()

VII. Power Distribution

The vehicle battery was chosen to power this project due to the ability to meet design requirements without needing an additional battery and related components. The project is intended to be a more robust hard mounted unit and thus the additional wiring needed to use the stock vehicle battery as opposed to a separate 5V battery for our system was not against design parameters. This kept the design less maintenance intensive without having the need to charge an additional battery. The additional electronics demand is calculated to be at most 15 amps at 12 volts DC. This results in 180 watts of power. The stock battery supplies 600 cold cranking amps with a reserve capacity of 120 minutes and a 70 Amp hour (Ah) rating. 12-volt amp hours are used to describe electrical charge capacity. 70-amp hours of capacity theoretically means that that battery can supply one amp of current for 70 hours or any combination thereof. This equates to a ballpark number for our system without other vehicle electrical demands at 70 / 15 = 4 hours and 20 minutes of use before the battery would be killed. In order to prevent this and other potential problems circuit protection is needed. The location within the vehicle engine bay is shown below. Power from the battery will flow along this path to the in-cabin unit. The wire will need to be able to handle 15 amps over an estimated ten-foot run. Based upon wiring ampacity vs wire gage charts the wire gauge for using stranded copper wire is 12 gauge if a less than 3% voltage drop is desired.

Circuit protection is defined as keeping the parameters within their designed operating range. The prevention of over/ under current and voltage is desired. Other addressed concerns are prevention of brown outs for microcontroller operation, reverse biasing of the system due to improper battery installation, and application of a low voltage cutoff. A manual resettable fuse is in place to prevent dangerous over current conditions. The 15-amp rating was calculated at four raspberry pi units drawing at a max of 3 amps each when running full capacity with reserve for the network splitter and PCB at 0.6 amps each. Fuses typically come in 10- or 15-amp values and the need for a specialty one in between is not needed. A manual reset model was selected due to the desire to know when an error occurs so that a resettable unit does not continuously flip on and off if unable to be checked immediately. Resettable was chosen for the ability to reuse and not replace when diagnosing problems in the field. The Raspberry Pi4 contains internal low/under voltage protection to prevent brown out conditions.

The low voltage cutoff was included for conditions where the unit is being operated with the engine off and battery not being charged and for parasitic draw if the vehicle is not driven for extended periods of time. The value of 12.2 V was chosen to leave the battery at 50 percent charge and thus able to start the vehicle again in most circumstances. This was accomplished with a monitor circuit and relay placed in the power distribution center. Reverse bias protection has been included to protect in the event the vehicle main battery is installed incorrectly with the terminals reversed. This was done via a physical connection set-up that cannot be connected incorrectly alongside color coded labels. the microcontrollers

The vehicle operates between 12 and 15 V DC depending on if the vehicle is in operation or not with the alternator charging the battery. The microcontrollers and other electronic components are designed to work off 5 V DC. A DC-to-DC step down converter is required to provide power to the main assemblies downstream from the battery and circuit protection block. In researching the design of these converters, it was decided that purchasing a commercial off the shelf unit would be the most efficient in use of time, money, and power delivery.

VII. Conclusion

Overall, the focus of this project was to provide a cost-effective product that would greatly enhance the awareness of drivers around their vehicle. This awareness of surroundings will help with the overall safety of the vehicle along with ease of driving in off road situations by eliminating the need for a spotter outside the vehicle. As a team we learned more about engineering practice and ourselves over the course of this project. The challenge of designing components that must interface with others that are yet to be finalized is difficult. Multiple people working on separate tasks that must come together at the end requires organization and communication.

The system was designed with cost, capability, and manufacturability in mind. The desires for this system were in constant conflict with the project budget. This in conjunction with the time and manufacturing resources available led to the decision to develop a proof-of-concept prototype. The funding and resources needed to deliver a system capable of meeting the true needs of a comprehensive off-road spotting aid was not possible while staying within our constraints.

Acknowledgement

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[4] J. Gums, "Types of Temperature Sensors," digi key, 26 1 2018.[Online] .Available: https://www.digikey.com [Accessed 17 9 2020].

VII. Biographies

Joshua Weed is on track to graduate from the University of Central Florida in May of 2021 with a bachelor's degree in Electrical Engineering. A long time 4x4 enthusiast, his exposure to vehicles began when working general automotive repair. Josh was a member of the Society of Automotive engineers Baja team. Working at Oshkosh Defense from January to August 2018 Josh was rotated amongst various stages of testing, development, and production for the Joint Light Tactical Vehicle (JLTV) that is replacing the Humvee for the US and Coalition armed forces. The desire for working with ground vehicles has remained and is the primary search sector for post graduate employment.

Paul Ramos is on track to graduate from the University of Central Florida with a B.S in Photonic engineering from CREOL in 2021. Having lived his whole life in Orlando and graduated high school with an IB (International Baccalaureate) diploma he was highly motivated to choose a major that would satisfy his ambitions to work in a field that has the potential to change millions of lives. The motivation behind this project started when his passion for cars was introduced when he was 15 years old.

Gage Libby is pursuing a bachelor's degree in Electrical Engineering on the Power and Renewable Energy Track at the University of Central Florida. He is due to graduate in the Spring of 2021. With the desire to work in the power industry working as a field engineer.

Scott Jokela attends the University of Central Florida and is on track to graduate in the Spring of 2021 with a BS in Computer Engineering following UCF's comprehensive track. He currently pursues and actively engages in topics of computer architecture and computer vision focusing on hardware-based acceleration from GPU's and other accelerators, with a focus on Nvidia's offerings. Scott throughout all of college has worked a full-time job. This project attracted him due to the fact it incorporated some key fundamentals of high-end self-driving cars, some of which are used by large tech giants like Nvidia and Tesla, the leaders in the field of self-driving hardware and software.