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ENGINEERING
TEXAS A&M UNIVERSITY

Team 72: WIZARD (Weed Identification and Zapping via Autonomous Robot Device)

Bi-Weekly Update 3

Will Fenno
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Project Summary

- Organic farming does not allow the use of herbicides for weed control; an alternative method is required.
- WIZARD will use camera recognition through machine learning to accurately identify weeds and deliver a targeted electrical impulse.

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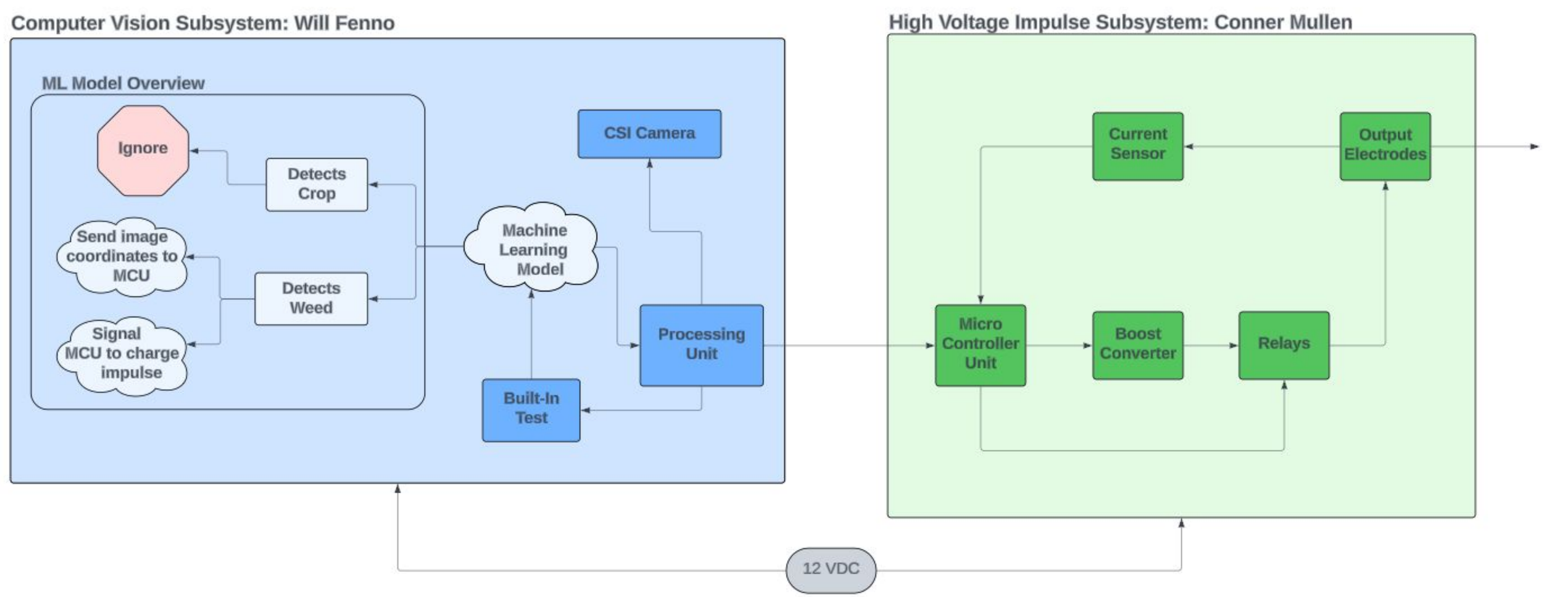
Project/Subsystem Overview



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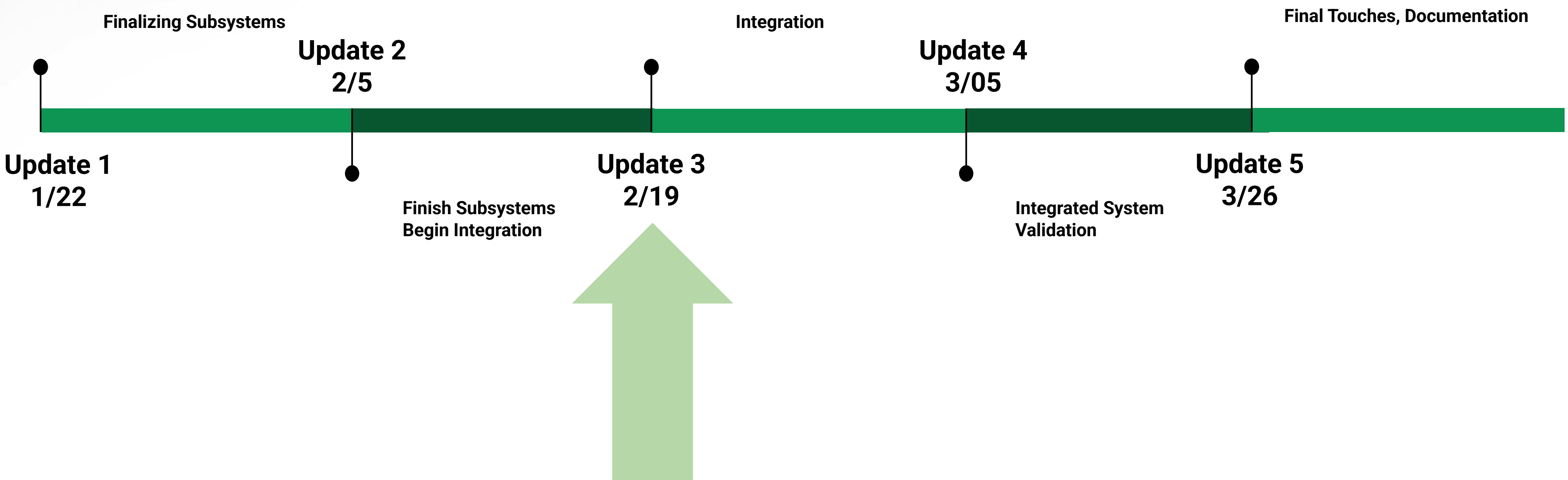
Project Timeline



Will Fenno

Accomplishments since last update 25 hrs of effort	Ongoing progress/problems and plans until the next presentation
Increased Jetson Nano performance using parallel threading. Completed Built-In Test (BIT) with main() system reset using Jetson GPIO pins and LED.	Integration: Write code that signals the High Voltage MCU upon confident weed detection.

Will Fenno

System BIT:
Pin 2: +5V Source
Pin 6: Ground (GND)
Pin 12: LED Control

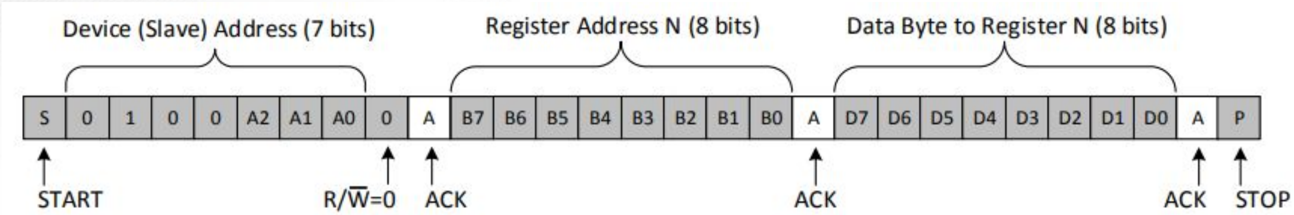
System Communication:
Pin 3: I2C (SDA)
Pin 5: I2C (SCL)
Pin 9: Ground (GND)

Alt Function	Linux(BCM)	Board Label			Board Label	Linux(BCM)	Alt Function
DAP4_DOUT	78(21)	D21	40	39	GND		
DAP4_DIN	77(20)	D20	38	37	D26	12(26)	SPI2_MOSI
UART2_CTS	51(16)	D16	36	35	D19	76(19)	DAP4_FS
		GND	34	33	D13	38(13)	GPIO_PE6
LCD_BL_PWM	168(12)	D12	32	31	D6	200(6)	GPIO_PZ0
		GND	30	29	D5	149(5)	CAM_AF_EN
		D1/ID_SC	28	27	D0/ID_SD		
SPI1_CS1	20(7)	D7	26	25	GND		
SPI1_CS0	19(8)	D8	24	23	D11	18(11)	SPI1_SCK
SPI2_MISO	13(25)	D25	22	21	D9	17(9)	SPI1_MISO
		GND	20	19	D10	16(10)	SPI1_MOSI
SPI2_CS0	15(24)	D24	18	17	3.3V		
SPI2_CS1	232(23)	D23	16	15	D22	194(22)	LCD_TE
		GND	14	13	D27	14(27)	SPI2_SCK
DAP4_SCLK	79(18)	D18	12	11	D17	50(17)	UART2_RTS
		RXD/D15	10	9	GND		
		TXD/D14	8	7	D4	216(4)	AUDIO_MCLK
		GND	6	5	SCL/D3		
		5V	4	3	SDA/D2		
		5V	2	1	3.3V		

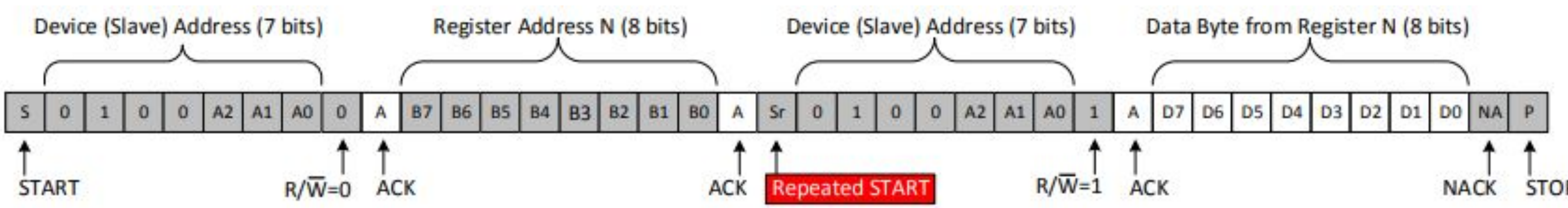
Conner Mullen

Accomplishments since last update 20 hrs of effort	Ongoing progress/problems and plans until the next presentation
PCB assembled and re-validated. Prepared I2C functions to send control signals from Jetson.	Integration: Validate I2C communication between Jetson and HV PCB.

Conner Mullen



Register	Address
Configuration	0x03
Input	0x00
Output	0x01



WIZARD Integration

Full Team

Accomplishments since last update	Ongoing progress/problems and plans until the next presentation
Jetson I2C and BIT. Confirm Jetson can send I2C and PCB can receive I2C.	Validate I2C Communication between Jetson and HV PCB. Confirm that Jetson is powered by buck converter.

Execution Plan

WIZARD Project Schedule

Deliverable/Task	JAN			FEB				MAR					APR			
	1/12	1/19	1/26	2/2	2/9	2/16	2/23	3/2	3/9	3/16	3/23	3/30	4/6	4/13	4/20	4/27
Complete Code Transfer to Jetson																
Set up Jetson & Install Software/Packages																
Integrate CSI Camera with Jetson																
Status Update Presentation #1 (01/22)																
Test ML Code on Jetson & Fix Potential Issues																
Update Schematics and PCB Layout																
Order PCB and Parts																
Adjust Power Supply Component Values																
Computer Vision Subsystem Ready for Integration																
Status Update Presentation #2 (02/05)																
Assemble Revised PCB, Quick Validation																
Begin Subsystem Integration																
High Voltage Subsystem Complete for Integration																
3D Model/Print Casing for Electronics																
Status Update Presentation #3 (02/19)																
Troubleshoot Any Integration Problems																
Status Update Presentation #4 (03/05)																
Meet with Sponsor and Team in Germany																
Make Small Changes from Sponsor Feedback																
Design Blitz																
Status Update Presentation #5 (03/26)																
Integrated System Validation																
Final Presentation 04/09																
Implement Necessary Project Adjustments																
Generate Detailed Documentation																
Send Final Report Draft to Sponsor, Make Revisions																
Final Demo 04/24																
Final Report 04/28																

Annotations

- Not Started
- In Progress
- Completed
- Behind Schedule

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Validation Plan

Paragraph #	Test Name	Success Criteria	Methodology	Status	Owner
3.2.1.1.	Capacitor Charge and Discharge Time	Time between start of charge up and end of discharge is less than 8 seconds	Measure voltage across output electrodes throughout a charge and discharge cycle, calculate time delta	TO BE TESTED	Conner Mullen
~~3.2.1.2.~~	~~Electrode Discharge Mode~~	~~Electrodes are only connected to high voltage output after contact is detected~~	~~With no contact: confirm that the voltage across electrodes is low~~ ~~With contact: confirm that indicator LED is on, and that the voltage across electrodes is high~~	~~TO BE TESTED~~	~~Conner Mullen~~
3.2.1.3.	False Positive Rate	FPR of less than 5% to prevent unintended crop damage	Conduct image classification test using a validation set with known crop and weed labels. Track the number of images where crops are incorrectly identified and calculate results	COMPLETED	Will Fenno
3.2.1.4.	False Negative Rate	FNR of less than 5% to prevent missed weeds	Conduct image classification test using a validation set with known crop and weed labels. Track the number of images where weeds are incorrectly identified and calculate results	COMPLETED	Will Fenno
3.2.1.5.	Camera Field of View	System detects objects at a range of 62.2 degrees horizontally and 48.8 degrees vertically	Measure the system's response to objects placed inside and outside the specified field of view	COMPLETED	Will Fenno
3.2.2.1.	Electrode Placement	Arcing does not occur across electrodes	Charge system to maximum voltage, visually confirm that no arc forms	TO BE TESTED	German Students
3.2.2.2.	Mounting	All components are secured properly	Visually inspect all connections to the robot or other platform, then attempt to move mounted components around to test strength of mounts	TO BE TESTED	Full Team
3.2.4.1.	Power Source	12V DC is converted to 5V, capable of 2A	Before powering on: Perform continuity test for all 12V points Power on board with 12V DC source and test voltage at output of power converters	COMPLETED	Conner Mullen
3.2.4.2.	Inputs	All control signals work as expected, as indicated by LEDs and relay clicking	Power system on, set to each combination and confirm that the proper LED indicators are on and listen for relay clicking	COMPLETED	Conner Mullen
3.2.4.3.	Outputs	LEDs all light up under correct circumstances Energy discharges through electrodes	Verify that proper LEDs light up under proper circumstances Voltage at electrodes reaches 80V	COMPLETED	Conner Mullen
3.2.4.4.	Interface Between Processor and Electronics	I2C signal sent from processor is received by MCU, correct output is observed (specific output and input signals will be updated as we finalize designs)	Send I2C commands from processor to microcontrollers, verifying that every necessary function is initiated properly	COMPLETED	Full Team
3.2.5.1.	Temperature (Thermal Resistance)	System functions in complete range of temperatures (10C to 45C)	Low end of temperature range exists outside in Texas, high end will be created with temperature chamber	TO BE TESTED	Full Team
3.2.5.2.	External Contamination	Large particles are kept out of the electronics casing	Bombard empty casing with dirt, grass, and other particles; open casing and visually inspect inside	TO BE TESTED	Full Team
3.2.6.1.	Built-In Test (BIT)	The system will activate a red LED in the case of camera failure during the startup process	Intentionally simulate camera failure via disconnection to verify LED activation response	COMPLETED	Will Fenno
3.2.6.2.	Isolation and Recovery	In the case of a BIT fault, the system will be reset and restore normal operations	Conduct a reset test in response to a camera detection failure	COMPLETED	Will Fenno
Note	Specific values and signals will be included as we continue to develop and finalize our designs				

Thank You!