Integration Milestones:

1) Send stepper motor command from website
    a) Prototype main board
        i) Schematic including esp32, 2 stepper motor drivers, gpio break out
        ii) Layout
        iii) Home fabrication (toner transfer, etch, cut out, tin coating, populated)
    b) Esp32 and stepper drivers connected on prototype main board
        i) ESP model selected, ordered
        ii) Stepper drivers selected, ordered
    c) Esp32 running FreeRTOS
        i) FreeRTOS configured
        ii) Loaded onto esp32
        iii) Drivers loaded
    d) Esp32 running GRBL cnc firmware
        i) GRBL (esp32 ported) configured and loaded
    e) ESP32 running custom software stack
    f) ESP32 wifi connectivity
    g) Website backend sending and receiving http requests
2) CNC works
    a) Device frame built
        i) 80/20 chosen
        ii) Frame CAD model
        iii) Proper lengths ordered
    b) Y, Z axis rails built in
        i) Linear rails chosen
        ii) CAD included in frame
        iii) Rails/bearings ordered
    c) Stepper motors integrated into frame/rails
    d) ESP32 controlling motors
    e) Endstops integrated
        i) Endstops built into frame
        ii) Endstop IO integrated in main board
        iii) Endstop IO (polling/interrupt) integrated in embedded software
    f) Power supplied to motors
        i) Power supply selected, ordered
        ii) Main board power IO integrated
        iii) Relay board selected, ordered
3) Climate control
    a) Sensors integrated (humidity/temperature)
        i) Choose and order temperature/humidity sensor (combo/separate)
        ii) Connect/wire to main board IO
        iii) Design frame attachment for sensor, attach to device
        iv) Add sensor polling to software/esp32
        v) Add sensor data sending to website from esp32

vi) Add sensor UI/display to website

b) Lighting system integrated
   i) Lights chosen, ordered
   ii) Lighting frame attachment designed, manufactured
   iii) Lights attached to device
   iv) Lights connected to relay board, that to main board
   v) ESP32 control output of lights
   vi) Add website command control lights (handshake website, esp32)

c) “Squish sheet” integrated
   i) CAD
   ii) Manufactured (laser cut), sent to Lucas
   iii) Attached to frame, under lights

d) Integrate fans
   i) Fans chosen, ordered
   ii) Fans frame attachment designed, manufactured
   iii) Fans attached to frame
   iv) Fans wired to relay board/main board
   v) ESP32/main board pwm control output
   vi) Control fans from website

4) Irrigation system
   a) Fresh water reservoir built into frame
      i) Cad designed
      ii) Manufactured - vacuform, sent to Lucas
      iii) Attached to frame
   b) Waste water reservoir built into frame
      i) Cad designed
      ii) Manufactured - vacuform, sent to Lucas
      iii) Attached to frame
   c) Bed holder
      i) Outer water shell
         (1) CAD design
         (2) Manufactured - vacuform?, sent to Lucas
         (3) Solenoid chosen, ordered
         (4) Solenoid built into shell
      ii) Holding attachment for z axis cnc
      iii) Relay board and main board IO
      iv) Website control/monitoring
   d) Piping/plumbing
      i) PVC/rubber/plastic piping hardware chosen, ordered
      ii) Attachments (if any needed) designed, manufactured
      iii) Plumbing built into frame
   e) Water pumping
      i) Water pump chosen, ordered
      ii) Water pump frame attachment designed

iii) Water pump attached/built into frame
iv) Water pump IO connected/built into relay board and main board
v) Water pump IO running in software
vi) Water pumps controlled from website

5) Seeding system
   a) Storage hopper
      i) Storage hopper CAD
         (1) Body cad
         (2) Pawl cad
      ii) Body model 3D printed and vacu-formed, sent to Lucas
      iii) Body cut up/drilled/manufactured
      iv) Motor chosen, ordered
      v) Pawl printed, motor built in
      vi) Motor IO wired to relay board and main board
      vii) Hopper built into frame
   b) Distribution hopper
      i) Load cells chosen, ordered
      ii) CAD of hopper
      iii) CAD of pawl (if changed from storage hopper)
      iv) Hopper plug built
         (1) Plug CAD
         (2) Plug 3D printed/manufactured (rubber/silicone molds?)
         (3) Attached to frame
      v) Body model printed, vacu-formed, sent to Lucas
      vi) Body cut up/drilled/manufactured
      vii) Motor chosen, ordered
      viii) Pawl printed, motor built in
      ix) Motor IO wired to relay board and main board
      x) Load cells attached to hopper
      xi) Load cells wired to main board IO
      xii) ESP32 software updated to poll load cells
      xiii) Send load cell data to website, display on site
      xiv) Hopper built into y-axis cnc
   c) Add seed watering (rinse/soak)
      i) Edit plumbing to include line to distribution hopper
      ii) Water splitter/manifold chosen, ordered
      iii) Manifold added to plumbing (direct pumped water to irrigation/seed soak)
      iv) Manifold IO wired to relay board and main board
      v) ESP32 control of water direction (manifold)
      vi) Website control/monitoring of water direction (manifold)
   d) Y-axis control programmed to move through Zone A, Zone B, zone C
   e) Website CNC control updated to reflect Zone segregation
   f) Full seeding routine programed (single command to go through whole process)