Purpose, Objective, Introduction:

The problem our team is trying to tackle is wandering in dementia patients. Alzheimer's disease or other dementia causes people to lose their ability to recognize familiar places and faces. It's common for grandparents living with dementia to wander or become lost or confused about their location, and it can happen at any stage of the disease. Although common, wandering can be dangerous and the stress of this risk weighs heavily on caregivers and family.
Solution:

The project is designed to give the patient around the clock care. It is a sensor system consisting of two boards. First, a weight sensor that is located under the patient mattress and motion sensor near the bed work together to collect and analyze data with an Arduino microcontroller. Second, an IR sensor that is able to tell if the patient is leaving the room. The code reads the input from the sensors on each of the two Arduinos (Client Arduino and Server Arduino) and notifies the server Arduino directly or over wifi from the client Arduino. Then the server Arduino changes the webpage to notify the user.

Scope:

Continuing from our first semester prototype, our team will focus on achieving the goals defined in the Tasks and Deliverables section. This document will keep track of the task needed to be done .

Tasks and Deliverables:

1. Project Planning Requirements:
    - Market feasibility: The team need to take a look at different aspect of the product when it comes to the market such as market pricing, competitor, market size and percent profit
    - Design Constraint: The team needs to review the constraints in the first semester (power usage, accuracy). As a team, all these constraints need to be discussed again in order to fix them or work around them.
    - Regulatory Compliance: The team needs to reevaluate the product's regulatory compliance, especially with RoHS Directive and ANSI battery.

2. Project Management Requirements: :
    - Weekly Minutes: Completing weekly reports will help the team keep track of the progress for the project and attendance of members. It will show what was done during the week and what needs to be done in the future. During these meeting, we can adjust the workload depending on if we are behind or ahead of the schedule
    - Mid-term and Final report: When the mid-semester mark hits, it will summarize the progress that the team has collected from the weekly report. This will summarize all our work individually as well as a team.
    - Presentation work: The team will work together to create appropriate presentations to show the work being done
3. Hardware Requirements: (Design):
    - Powering the system: To power the system, we need to get 5volts, the supply will come from the mains ac source, then using a switching mode

power supply we will convert the power from AC to 5v DC, the current should be minimum 2A to make sure that the system will operate in a good voltage level without flickering or dimming since we are using GSM modem and it requires 1A.

- Connecting the Arduino to weighing sensor (using data pin and clock pin): The load cell outputs cannot be connected directly to the Arduino, although Arduino board can detect small changes in voltage (4.9 mV) but this resolution still not enough for reading from the load cells, a dedicated amplifier board is being used to amplify the load cell voltage.To connect the sensor a synchronous serial protocol is used via two pins one for the data and the other for the clock signal.
- Connect the load cells to the Hx711 board: The board Hx711 can be used with two or four cells, in this system we will use four load cells to put them under the bed legs, the four load cells will read the weight of the bed added to the human weight, hence the controller can detect when the human leaves his bed.
- GSM modem (Serial): GSM modem communicates with the Arduino using two serial pins (Tx) which is the transmitter and this pin should be connected to a digital pin on the Arduino to work as receiver, the other pin is the (Rx) pin which is the receiver pin, this pin should be connected to digital pin on the Arduino board to act as serial transmitter
- IR sensors (Analog): A set of two IR sensors will be used in this system, the output of the IR sensor is an analog voltage that is reverse proportional to the distance, a threshold will be assigned and the sequence of the sensors triggering will specify the movement direction, this method will be used to detect whether the patient is entering or leaving the room.

4. Software Requirements:
    - Arduino IDE: The Arduino integrated development environment is the platform needed for writing the Arduino code, the Ide can be installed on windows or mac laptops, even there is a web-based version of this software. All manufacturers of the sensor and actuators build a library for their product to make it easier to use for Arduino developers, for this purpose the Arduino IDE can be loaded with tons of sensor libraries.
    - HX711 library: This board library helps to read the analog to digital conversion result, this board has 24bit ADC while the Arduino has 10bit ADC, this means high precision reading for small voltages coming from the load cells. The library has a read command which will do the required communication with the board and get the result of the weight stored on the Arduino ram.
    - GSM library: GMS modem and most modem types are communicating with controllers using Serial protocols which are called UART (universal synchronous asynchronous receiver transmitter. This protocol will be used to send ASCII commands called (AT: attention) commands. For each

GMS modem there is a pdf file that exactly specifies the required AT command for doing certain tasks like sending SMS or making a call or even reading the operator's name and time.
    - IR sensor analog read: Ir sensor gives analog output; there is a library on the Arduino to read the analog voltage from any analog pins from A0 to A5.
5. Implementation Requirements:
    - The Arduino microprocessor will be the main software for implementing, testing and communicating with the sensors such as strain gauges, motion sensors and also connecting to the Wifi to transfer and collect data for analysis.

6. Testing Requirements:
    - Strain gauges and motion sensors will need to pass initial testing; strain gauges will send data from pressure changes for Ardunio to process the data; also the motion sensors will read the data to the environment and send it to Arduino for processing. Preliminary testing needs to pass and final acceptance test will be carried out after all the hardware is put together as a system, the final test will make sure everything works correctly and provide output as desired for the project.

Work Performance:

Week 1 - Week 2: EE members will research board design and create a project plan for hardware components. We will also split the team to research software to be implemented into our design.

- Weekly meetings where all team members will be present.
- Review Meeting: Outline project requirements and plan. Outline research to be performed by each team member.
- Research: Each team member will conduct research on their assigned topic.
- Research Review Meeting: Each team member reports the finding from their research. Adjust development plan based on findings. Materials necessary for the project will be ordered.

Week 3 - Week 9: Each team member will present their status at weekly meetings.

- Weekly meetings where all team members will be present.
- Hardware requirements will be completed.
- Software requirements will be completed.

Week 10 - Week 11: The team will go through the implementation requirements and a test plan will be finalized.

- Implementation requirements will be completed.
- Test plan will be discussed and approved by all group members.

Week 12- Week 15: Testing will be done by all team members to ensure the functionality of the

device and that it meets all acceptance criteria. The team will prepare to present the prototype.

- Weekly meetings where all team members will be present.
- Testing requirements will be completed.
- Prepare the prototype for presentation at the open house.

Acceptance Criteria: (and regulation met)

Each task will be marked as complete after it has been accomplished and reviewed by another team member. To show the hardware has been completed it will need to be able to show that it is doing the task it was meant to do. To show that the software on the Arduino is completed, it will need to show that the detection system is working and can predict correctly 90-95% of the time.