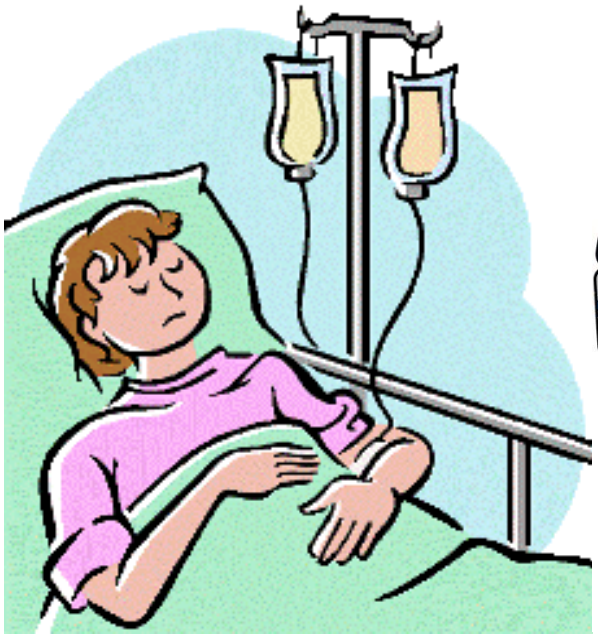
Vigilant IV STAND
IV Drip & Infusion Continuous Monitoring System

IV Drip & Infusion bottle Set is used to deliver nutrients and hydration directly into the bloodstream for immediate absorption and use by the body. Intravenous Therapy is the fastest way to have nutrients throughout the body because it bypasses the digestive system and goes directly into the organs, resulting in a 90-100% absorption rate (as opposed to only 20-50% possible orally).



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Need

Almost in every hospital, administrating IV Line is common activity for any Health care assistant (Nurse).

- The need for assessment and management of fluid and electrolytes is the most fundamental thing required. The IV line monitoring is completely performed by nursing assistant in the hospital. Health care assistant is responsible for monitoring the IV bottle level.

- Unfortunately, most of the time, the observer may forget to change the bottle at the correct time due to their busy schedule. Hospital uses simple IV bottles with no additional indication. It may create a problem for a patient because the reverse flow is possible.

    - **Blood Loss:** Blood starts to flow from the body towards the bottle because of pressure difference.

    - **Air Bubbles:** It can be of fatal risk of air bubbles entering the patient's bloodstream, which is a severe threat as air bubbles in the blood can be fatal.

- **Discharge quantity**: It is also a critical factor that depends on the medicine being administered. Typical infusion sets allow a user to manually adjust the fluid flow delivery rate by visually inspecting individual drops of the liquid falling within a drip chamber and adjusting a roller clamp accordingly.

- **Skilled Labour Requirement:** To successfully adjust the infusion rate, and monitoring & replacing fluid container at right time calls for well-trained health care assistant, as it is in Indian context, completely depends on the judgment and skills of the health care assistant.

- **Dedicated manpower:** To monitor the percentage of IV fluid in the bottle, calls for a dedicated man-power in the case of critical patients. Careless-ness of such assistant results in undesired effects on patients.

Problems with Prior Art

There are many solutions available to tackle this problem. The problem with available devices is that they need to be attached to the system, with drip set for flow rate monitoring and bottle for liquid surface level monitoring. Most of the devices exist as a solution for different problems in both cases. Because they need to be attached and the Drip & bottle set is a disposable system, users need to detach and reattach every time the bottle is being changed.

Objective

To overcome this critical situation, an IOT based automatic alerting and indicating the device is proposed where the sensor will be used. When Fluid level/weight is low, it will alert the observer by sending a mobile signal. The Project will be focused on achieving these objectives.

- To develop a case to indicate the liquid surface level of IV fluid and alert the heath care assistant for timely intervention.

- To develop the device to count the flow rate and monitor infusion rate.

- To design the device compact with the existing IV stand.

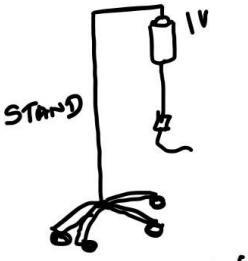
- Wifi enabled, mobile application based alert intimation for the health care assistant.

Conceptualization

The following concepts were developed to attend the scope.

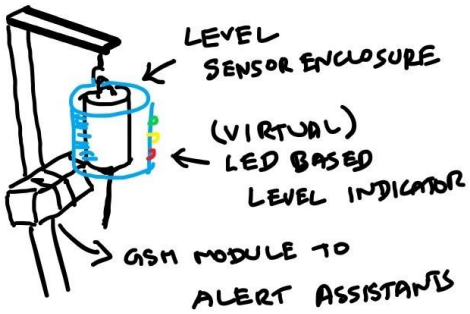
INTRAVENOUS STAND

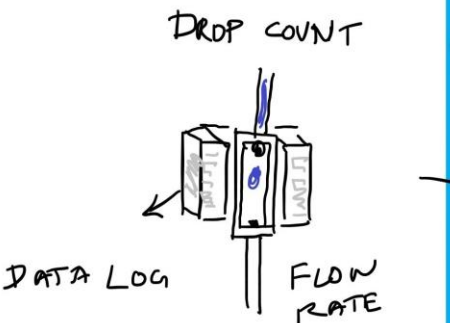
ACTUAL MODEL

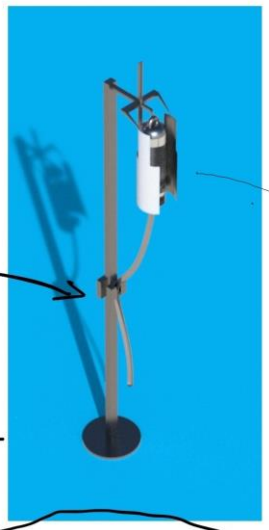


CONCEPT 1

CONCEPT 2



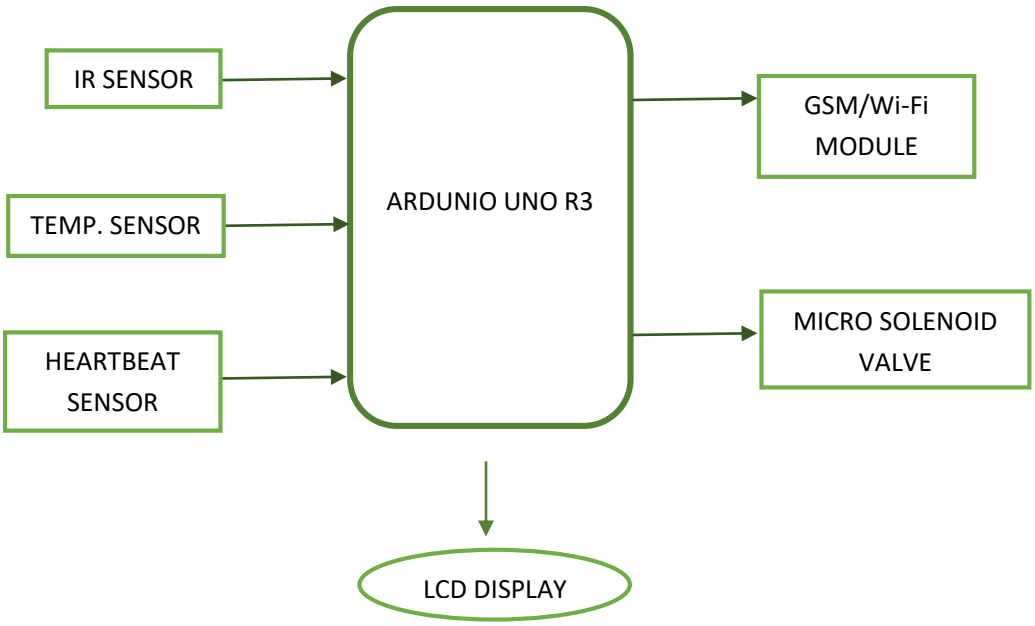




DRAFT CAD MODEL

CONCEPT 2 CAD

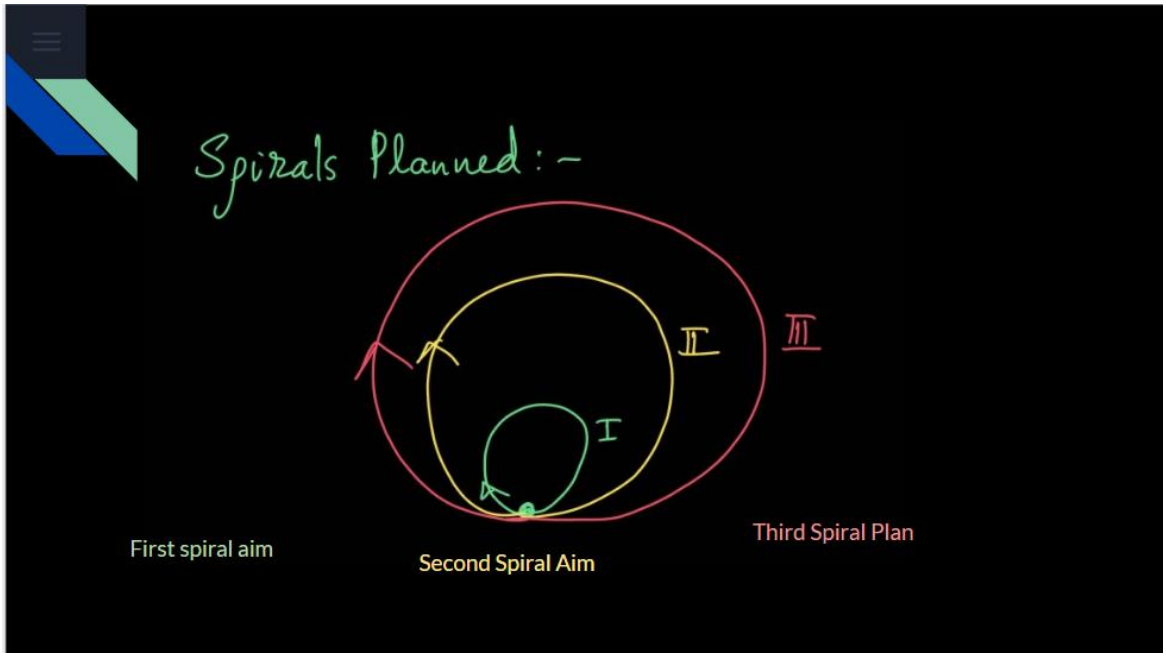
Components Required



Skills to be used

- CAD Modelling
- Fabrication
- Electronics
- Execution

Spiral Approach



First Spiral:

In the first spiral,

- Non- Contact Liquid level sensors (IR-Based) will be established.
- Indicators of Liquid Level for Auditory system – using different Beep Sounds for respective liquid level.
- LED based indicators for Visual Alert System – using different color based liquid level indication.

Second Spiral:

In the second spiral,

- Flow rate monitoring based on falling drop based counting sensors.
- Creating & storing Temporary data log for the amount of fluid infused for later usage.
- CAD modelling prototype for case enclosures

Third Spiral:

In the third spiral,

- Creating Wifi-Enabled – Android app based alerting system.
- Prototyping of CAD model for housing of micro-controllers designed.
- Testing of complete system in real time usage and rectifying functional errors.

References

[1] M. Safitri, H. Da Fonseca, and E. Loniza, "Short Text Message Based Infusion Fluid Level Monitoring System," *J. Robot. Control*, vol. 2, no. 2, pp. 60–64, 2021, doi: 10.18196/jrc.2253.

[2] P. Sardana, M. Kalra, and A. Sardana, "Design, fabrication, and testing of an internet connected intravenous drip monitoring device," *J. Sens. Actuator Networks*, vol. 8, no. 1, 2019, doi: 10.3390/jsan8010002.

[3] R. Anagha, S. Ashwini, G. Keerthana, and M. Monica, "IoT BASED INTRAVENOUS FLOW MONITORING SYSTEM The Glucose Monitoring System Consists of," no. May, pp. 7539–7543, 2020.

[4] N. Giaquinto, M. Scarpetta, M. A. Ragolia, and P. Pappalardi, "Real-time drip infusion monitoring through a computer vision system," *IEEE Med. Meas. Appl. MeMeA 2020 - Conf. Proc.*, 2020, doi: 10.1109/MeMeA49120.2020.9137359.