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An Innovative Approach to Control and Monitor I.V(Intravenous) Fluids

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ABSTRACT - Traditionally, doctors and nurses estimate the time which it takes for an IV bottle to empty based on their expertise, making I.V (Intravenous) therapy prone to missteps. The present analysis suggests a cyber space enabled I.V drip chamber monitoring platform. The technology permits medico and healthcare assistance to remotely auditor drip criterion, interim focusing on economical and great responsibility. In this work, a capacitive sensor is acclimated to determine the flow of liquefied in the bottle and the servo motor to give live update and management of the fluid flow through the device. Moreover, the papered system can have the scope of a programmer employing an input device and wi-fi permitting the para medical staff to provide new commands. Ultimately it facilitates the work of doctors, nurses, and alternative associated personnel or any para medical staff. The purpose of this work is to design an I.V (Intravenous) with the ability to immediately stop the flow of an I.V (Intravenous) and send a notification to the nurses and physicians, reducing the labor of nurses and doctors which also helps to prevent I.V related fatalities**.**

Keywords: *I.V (Intravenous) therapy, I.V Bottle, Capacitive sensor, Para medical staff.*

1. INTRODUCTION

I.V Drip Set is used to deliver nutrients and hydration directly into the bloodstream for immediate absorption and use by the body. Intravenous Therapy is the quickest way to get nutrients into the body because it bypasses the digestive system and goes straight to the organs, resulting in absorption rates of 90 to 100 percent. Administering I.V lines is a regular action for any health care assistant in almost every hospital (Nurse). The necessity for fluid and electrolyte assessment and management is the most basic requirement. In the hospital, the I.V-line monitoring is done entirely by nursing assistants. The I.V bottle level is monitored by the health care assistant. Unfortunately, the observer may forget to change the bottle at the appropriate time due to their busy schedule. Simple IV bottles with no further indication are used in the hospital. Any form of failure can cause different medical problems such as blood backflow in I.V setup.

Fig: Blood back flow

Fig: Air bubble

In certain situations, if the bottle gets empty and has not been checked for a certain duration, the air bubble may also be placed in the IV tube, which can be fatally monitored and thus vital. To prevent this, the current technique will facilitate the work of doctors, nurses, and alternative associated personnel or any para medical staff. The purpose of this work is to design an I.V with the ability to immediately stop the flow of an I.V and send a notification to the nurses and physicians, reducing the labour of

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nurses and doctors which also helps to prevent I.V-related fatalities. Main scope of work is to design an IV Stand which informs the health care assistant. Keep an eye on the IV line to signal the assistant that he has to come in right away.

2. LITERATURE SURVEY

In [2021] M. Safitri etal., "Short Text Message Based Infusion Fluid Level Monitoring System" The entity was depicted to control the fluid infusion points by absorbing a short text message system. Which will provide disclosure when the infusion point is at 50 ml, 20 ml, and 0 via SMS by using SIM Modem 900. Infra-red sensors and photodiodes are worn to encounter intravenous droplets of fluid, which calculates fluids' volume. Based on the analysis, infusion solution flow monitoring systems had the rate of program failure when detecting aqueous impart was just 1,21%.

In [2021] P. Sardana etal., "Design, fabrication, and testing of an internet connected intravenous drip monitoring device" The present study proposes a web connected exanimating for IV drip chambers. It has two major parts, specifically chamber part and pole part for level disclosure. The organized info was solidly and assuredly accrued to virtual service adopting HTTP API calls (Hyper Text Transfer Protocol). This input was mended and envisioned for ease of legibility for healthcare takers. There was a lag while transferring the message to concern paramedical staff due to traffic issue or noise distortion.

In [2020] Sanjay S etal., "Iot Based Saline Infusion Monitoring and Control System." They proposed a framework for IoT Based Saline Infusion Monitoring and Control System that makes use of Arduino and Node mcu. The theory is used to informant the saline elevation, such that, it automatically stops the saline flow to the patient when the saline level reaches 20% of its total volume. Was working only for saline solutions but not for other solutions.

In [2020] Mahak Goyal etal., "I.V (Intravenous)tube flow control device with IOT" They used Capacitive sensor to function whether there is solution useable in the packet or not, in case that detected air in the ampul, later the testimony is directed to NodeMCU. The indication of this task is to flourish an IV with potentiality so the discharge of an IV can spontaneously block and an alert will be emitted to paramedical workers which also help to reduce the casualties related to IV. No proper alarms were generated due to network connectivity.

In [2019] Sincy Joseph etal., proposed "Intravenous Drip Monitoring System for Smart Hospital Using IoT". They implemented an I.V drip surveillance entity to diminish the work of medical management. The main features of this system are installation of hardware as well as software sensors, fletching and storing details in an electronic information service. Rectification of gathered details to imbrute the drip review entity was tedious.

In [2017] Ramisha Rani K etal., proposed" Smart Drip Infusion Monitoring System for Instant Alert". They developed an effective system capable of monitoring the point of the IV drip administered to the patients in the clinic and evidence for the same. This recorded info can be analyzed in the medico station remotely for later reference. The recorded reports can be presented adequately with accurate info in a graphical way. Consumption of energy was more due to graphical representation, was expensive, not all hospitals could afford.

3. PROBLEM STATEMENT AND OBJECTIVES

3.1 PROBLEM STATEMENT

The fundamental issue with IVs is that a nurse would be Refilling or modifying the IV. Generally, this operation is extremely exhausting and time-consuming and requires the full participation of nurses during the day of the hospice where there are just one or two nurses for every ten to fifteen patients. Even if we are using a heavy machinery-built IV indicator, this is very expensive for starters and does not fix the problem of notifying the patient that he/she needs to change the IV on time.

3.2 OBJECTIVES

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To conquer this crucial condition, an IOT based automated modifying and determining tool is designed where sensors utilized. When the Fluid level is empty, it will alert the observer by sending a notification to mobile.

The work will be focused on achieving these objectives:

1. To develop a case to indicate the liquid surface level of IV fluid and alert the heath care assistant for timely intervention.
2. To send the alert message when the fluid rate is FULL, HALF, EMPTY, as the device count the flow of the solution and monitor infusion flow rate.
3. To design the device, compact with the existing IV stand by using IFTTT application, as the monitoring can be done by the medical staff staying away from the patient site where Wi-fi is enabled, as an application-based alert intimation for the health care assistant.
4. To add keypad buttons and Help button for manually controlling and monitoring infusion rate flow by any para medical staff.

a. PROPOSED SYSTEM

In this work a regulating and monitoring device that might be retrofitted to an existing I.V. infusion system. I.V. (Intravenous) therapy is prone to human error since doctors and nurses estimate the countdown which captures for an I.V packet to vacant depending on their expertise. A capacitive sensor is enforced in this work to determine flow of a fluid in a bottle, and a servo motor is used to provide real-time updates and management of the fluid flow through the device. Finally, it aids the work of doctors, nurses, and other ancillary professionals, as well as any paramedical personnel. The goal of this paper is to create an intravenous (I.V) with the ability to promptly stop the flow of an I.V and send a notification to nurses and doctors, decreasing nurse and doctor workload while also lowering IV-related mortality.

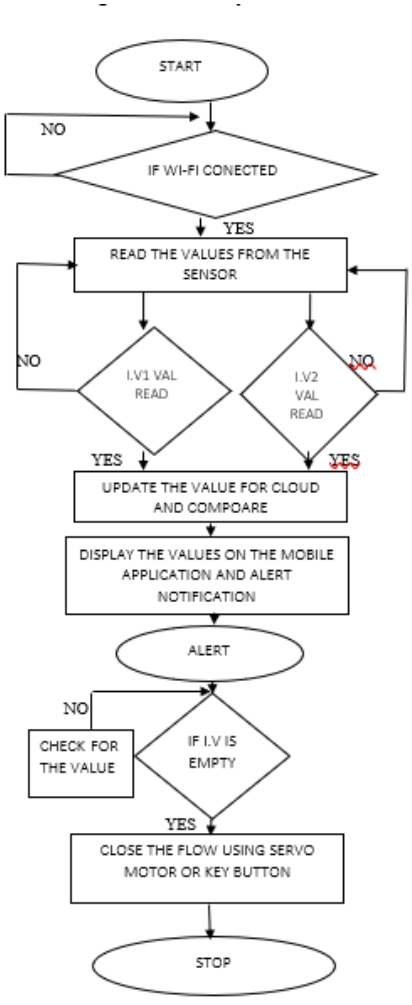

Fig: Proposed flow chart of I.V(Intravenous) fluid set

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b. METHODOLOGY

- Major things in the paper are Esp32- Microcontroller, 2 conductive electrode strip, servo motor. we have Esp-32 Microcontroller, which has been used and it is programmed according to the requirement.
- To carry out this demonstration, we will initiate this apparatus as follows: First and foremost -, our driver circuit with conductive electrode strip, is primarily acts as a parallel plate capacitor which changes its output voltage with the change of its dielectric medium in between its plates, which senses the amount of saline solution in the I.V packet.
- The corelate plate has been associated on the I.V packet which tell us if the solution is empty or not. As it gets vacant, the capacitive parallel level sensor is linked to the Esp-32 microcontroller which controls the position of liquid. Once the liquid flow has been stopped, the condition of the saline fluid will be emitted to a server. Esp-32 microcontroller has WI-FI potential used to circulate this notification on stream.
- Blynk application can be penetrated by esteemed medical staffs which tends to be great help to nurses as they have the understanding of the saline level.
- As the fluid level decreases nurse will get an intimation i.e., notification indicating as empty.
- To control the infusion flow they will be having two options: Firstly, voice command can be given from elsewhere using IFTTT by following commands,
- TURN OFF - Where turn off condition is used for turning off the infusion flow.
- TURN MIDDLE - Where turn middle condition is used for turning middle the infusion flow.
- TURN FULL - Where turn middle condition is used for turning fully with respect to infusion flow.
- By using above conditions over a voice, we will be able to control the infusion flow. To function above conditions wirelessly, I have used new technology for voice over controlling the functions i.e., IFTTT (if then than that). where the voice is controlled by google assistant and based on voice command the servo motor functions whenever any paramedical staff is away from the patient site.
- We are using Servo motor, has integrated gears and a shaft that can be specifically composed. It let on the shaft to be positioned at discreate angles, by taking these angles we have 3 conditions:
- Full – is used for raising the infusion flow when angle is at 180 degrees.
- Half – is used for quite slowing down infusion flow when angle is at 90 degrees.
- Close – completely closing the infusion flow when angle is at 0 degree.
- The above conditions work wirelessly by using IFTTT and based on voice command, the servo motor allows the rotation of the shaft. Which further helps in monitoring the infusion flow when nurse or any paramedical is away from the patient site.
- By this work, will be an enhancement in the extant I.V infusion packet as this will have network connectivity and control aspects.
- This way the whole mechanism will be embraced for the apt functioning of the I.V system.

4. CONCLUSION AND FUTURE WORK

In our proposed system, we will be designing and implementing an automatic intravenous fluid control device. This device will advance the patient care and make it trouble-free. Our proposed system will be a perfect helping hand in case of controlling intravenous fluid for the clinical aspects as it has ability to immediately stop the flow of an I.V (Intravenous) and send a notification to the nurses and physicians, reducing the labour of nurses and doctors which alsohelps to prevent IV-related fatalities.

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6.1 FUTURE WORK

- We need to design and manufacture the dedicated flow control knob for the infusion of I.V.
- We can further add a patient monitoring system to the same which monitors the parameters such as heartbeat, SPO2 value, Temperature etc.
- We can develop our customized Android Application for the same.

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