International Journal of Innovative Technology and Exploring Engineering (IJITEE)
ISSN: 2278-3075 (Online), Volume-9 Issue-1, November 2019

Automated Fluid Transfuser

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Abstract: ***In hospitals, Saline/Fluids is/are injected into the patient's body to treat dehydration/diseases in order to improve their health. Monitoring the fluid level and regulating its flow manually has always been a typical problem as it involves much attention by nurse constantly. Any kind of negligence or preoccupied states might invoke a possibility of backflow of blood (and swelling) from the concerned patient. Also blood transfusion using traditional method has a drawback regarding the accuracy in transfusing blood from one patient's body to another. Considering all these affordable health monitoring systems should be made available to every hospital in the days to come. AUTOMATED FLUID TRANSFUSER deals with these problems. This will accurately assimilate the advised portion of saline/fluid/blood into the patient's body. It alerts the nurse by sending notifications regarding the status of fluid level and in parallel regulates the flow, thereby averting the chance of backflow of blood and reducing the swelling. Automated fluid transfuser can be used in hospitals and homes for the bed ridden patients. It is not complex in operating to nurse or guardians.***

Keywords— Accurate, Backflow, Healthcare, Pressure, Cloud, Regulation, Transfusion, Patient, Supervision, IV Tube.

I. INTRODUCTION

A. Background Of The Invention

Saline bottles are primary requirements in hospitals. It is expected that every hospital should be provided with its basic requirements by the government without any failure, and the saline bottle/blood packet is one amongst them, as we consider that it is the primary health utility to maintain fluid balance in the patient's body. When the nurse sets up a saline bottle/blood packet to a particular patient, he/she should monitor the patient's health status, the pressure provision, and the fluid level. In the worst cases, when the fluid levels drop off completely due to uncertain negligence by the nurse, will lead to a possibility of backflow of blood from the patient's body due to the pressure applied.

Revised Manuscript Received on November 30, 2019.
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Additionally, there is no assurance of exact assimilation of the fluid into the patient's body as the existing procedure followed by the caretakers persist to the method of predicting the pressure to be applied to regulate the fluid assimilation. Hence, it is admissible that, this process requires periodical human supervision throughout, and conclude that the traditional process involves a few drawbacks.
Blood Transfusion is done from one patient's body to another in a manual way. Presence of air gaps during the transfusion due to the negligence can trigger a heart attack. Automation of this method is required to increase accuracy in transfusion and reduce the probability of failure in transfusing blood. Any fluid transmission like blood, saline and antibiotics must be regulated to maintain proper balance.

II. PRESENT STATUS

India doesn't have enough hospitals, doctors, nurses, as we consider health is a state primary subject. Disparities in the quality and delivery of care, health varies immensely between rural and urban areas. Global Healthcare Delivery is facing diversified challenges and issues related to health efficiency and utility. Health-related costs are being explored. Consequently, numerous healthcare consumers are facing healthcare ineffectiveness as well as poor access to healthcare services. However, these issues and challenges are severely facing certain patient's group such as the elderly and rural patients requiring palliative and pain care. A statistical survey conducted by Union Health Ministry provided an evident data regarding the day to day increase in the percentage of patients being admitted in hospitals every day irrespective of hospitals in rural and urban areas anticipating effective health care and facilities. But the dearth of medical qualifications was particularly high in rural areas. The Union Health Ministry report disclosed evident proof stating that comparatively 59% of the doctors in urban areas had a medical qualification, whereas 20% of those in rural areas had a medical qualification. Past researches conducted have documented disparities between urban and rural health care expressed in terms of healthcare access, utilization, and geographic distribution of providers and services. To enhance the health care delivery in hospitals an advancement is required in the traditional health care utilities.
It is observed that the Indian healthcare delivery system is expected to add 3.6 million beds, four million doctors and five million nurses in the next 15 years. A recent study says 100,000 hospital beds have been added annually over the last decade and if India continues to maintain a similar rate, it will fall short of the target by 1.6 million beds by 2035.
At present in India, there are 0.78 doctors, 2.2 nurses and 2.5 hospital beds per 1,000 people. The requirement by 2035 for every 1,000 people is 2.8 doctors, 2.5 nurses, and 3.5 beds. To achieve this, the study estimates, an investment of $245 billion would be required.

Failures with highest risk priority numbers were identified, ranging from 5 to 100. The data analysis indicated that failures with the highest RPNs was (RPN: 100) transfusion of blood.

III. OBJECT OF INVENTION

It is an object to provide an efficient and quick method to avert the chance of backflow of blood from the patient's body. In addition to that, the promise of accurate assimilation of fluid as per the advised rate and transfusion of blood as per the requirement into the patient's body is another object of the invention. It is still further an object of the invention to send notifications through an app to regularly acknowledge the assigned nurse regarding the fluid levels. Furthermore, plummeted periodic human intervention is also an object of the invention.

IV. DESCRIPTION OF THE INVENTION

There are many formidable challenges faced by the health organization in the past few years. Many victims have been subjected to various health issues due to poor access to health utilities and their efficiency.

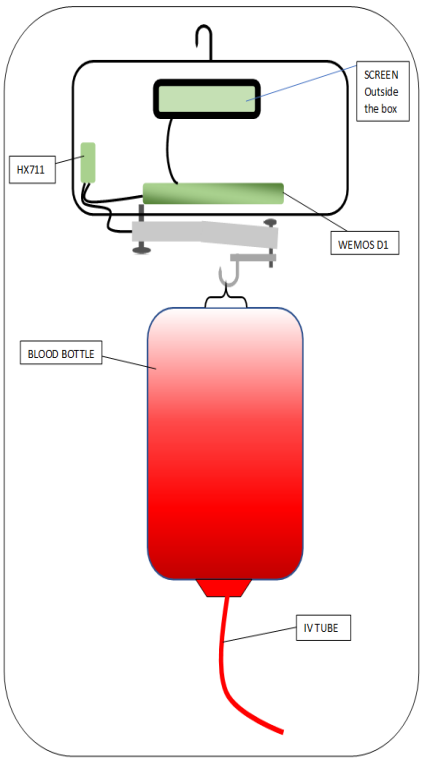
As described earlier there are certain problems being faced by the patients when the fluid levels in the bottle are not monitored properly. Hence there is an utmost need for advancement in the traditional methods followed while injecting fluid.

A. *COMPONENTS USED:*

1) Microcontroller(Wemos D1)
2) Servo Motor
3) Load Sensor
4) HX711
5) Display(Lcd Screen)

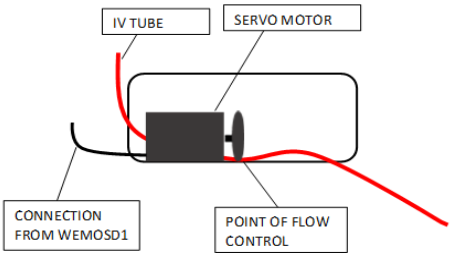
V. WORKING

In the Automated Fluid Transfuser, a shielded case is incorporated which contains a microcontroller, HX711, and WEMOS D1. A load sensor is placed at the bottom of the shielded case along with a hook to hold the bottle. The load sensor is calibrated to note the weight of the bottle undergoing periodic changes in the fluid levels. The IV tube is penetrated through another case which consists of a Servo motor to regulate the flow. Gradually when the fluid levels decline and the process is not under the notice of caretakers, due to the pressure applied the blood flows back into the IV tube from the patient's body. Sending notifications to the nurse regarding the status of fluid levels in the bottle can be a solution to get rid of the negligence of caretakers. Accordingly, the accepted minimum levels as recorded by the load sensor are noted by the microcontroller to update the cloud and it calculates the percentage change of the fluid level at this respective levels and these levels are considered as the threshold limits. When the bottle with fluid is set up, as the process of fluid injection continues the fluid level drops and the recorded weights weighed by the load sensor are updated to the cloud by the microcontroller constantly.



Consequently, the percentage change in fluid levels is calculated. Gradually, the fluid level drops and once when the calculated percentage change in fluid level is less than the first threshold limit, an alert(notification) is sent to the nurse regarding the status of the fluid levels and the emergency to change the bottle. In any uncertain case, where the nurse could not turn up then the fluid level further drops and reaches the second threshold limit. This encounter depicts the low level of fluid and the maximum probability of backflow of blood due to the upcoming completion of fluid in the bottle. To avert the chance of backflow of blood, the servo motor is put into the role.

Initially, the volume of the fluid and time required to inject should be updated in the application by the caretaker. The pressure required to inject the liquid in the advised time accurately will be determined in the cloud and resulting pressure will be applied by the servo motor over the IV tube accordingly. Considering the total volume as 100%, calculations are done accordingly to determine the time taken to assimilate x% of the fluid and thereby perceiving the time taken to assimilate the other (100-x)% of the fluid. If the determined time varies from the advised time, manipulations over the pressure are done with the help of the calibrated servo motor. This process results in the regulation of fluid.



Eventually when the second threshold limit has encountered then the servo motor applies complete pressure over the IV tube. It results in complete closure of the cross-section of the IV tube thereby averting the chance of backflow of blood. It can be concluded that there is no constant human supervision involved. An accurate portion of the advised fluid is assimilated into the patient's body through regulation. There would be no possibility of backflow of blood due to the pressure applied.

VI. DETECTION OF FAILURES IN HARDWARE

Detecting failures in hardware are possible through certain observations. Whenever inappropriate values are recorded by the microcontroller disparate from the predicted values through the load cell, then a notification is sent to the nurse regarding the immediate requirement in the replacement of the hardware which is causing the problem. Constant updates to the cloud regarding the changes are given by the microcontroller. Having the updates received late or completely not able to acknowledge, then it cites the problem with the microcontroller. A notification is sent when such a case arises.

Therefore, any kind of possible failures can be driven under the notice of the nurse through these procedures enabling the replacement of the hardware without any delay.

VII. APPLICATIONS

With the drastic growth in the rate of health issues, people are subjected to there is an expectancy of efficient legitimate health care delivery. Technical advancements in various fields in the past few years have enhanced the quality and fulfilled the needs of the needy. As per the evident information, there is an utmost requirement to enhance the traditional health care delivery with the technology has to be realized and necessary implementations should be done. The challenges faced by the hospitals due to their poor dedicated workers can be declined to an extent by relying on the enhanced health care delivery systems.

The ultimate bid of technological innovation continues to grow, enhancing all fields as it evolves. In the healthcare field, technology is playing a role in almost all platforms, from the patient registrations, data monitoring, lab tests to a self-care system. Technology made possible to treat patients in its style, enabling accuracy, quality in delivery and in reducing the constant human intervention. Therefore, the essence of technology has to be realized and adopted. Automated fluid transfuser is a health care delivery product constituting under this category, reaching the standards of quality and accuracy.

VIII. RESULTS & CONCLUSION

Saline systems with manual treatment are no longer a good practice as it involves utmost attention by the nurse or the guardian. Hospitals are in desperate need of advancement in their appliances. We cannot rely over the existing saline dispenser as it involves certain drawbacks like manual monitoring in regular intervals of time.

The entire proposed system is automated, it requires very less human intervention. It will be advantageous at night as there will be no such requirement for the nurses to visit patient's bed every time to check the level of saline in the bottle since an alert notification will be sent to the nurses when saline reaches the critical level. It will save the life of the patients. This will reduce the stress in continual monitoring by the doctor or nurse at an affordable cost.

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