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SMART I.V. SET

Tithi .V. Tiwari & Anurath .A. Gupta

Student, Biomedical & instrumentation, U.V. Patel College of Engineering, mehsana , India
Student, Biomedical & instrumentation, U.V. Patel College of Engineering, mehsana , India

Abstract: Modern IV therapy is less than a century old. Yet, it was known that medications could be injected into a vein as early as the 1600s. Because of a lack of scientific methods, original attempts to deliver IV fluids and drugs met with little success. Our SMART IV SET will overcome the complications like infiltration, hematoma, air embolism, blood backup in tubing, extra vascular Injection, Intra-arterial Injection etc. It will detect the emptying of IV bag with the help of level indicator. The indicator is based on color detecting principle. The alarm will ring at the pre set level and will alert the staff to replace of remove IV bag. The alarm signals will be transmitted to nurses' station or central monitoring system with the help of RF module which will prevent constant monitoring of IV.

I. INTRODUCTION

Intravenous therapy infuses liquid substances directly into a vein where Intravenous y means "within vein". It is commonly referred to as a drip because many systems of administration employ a drip chamber and it prevents air from entering the blood stream which may lead to blood embolism, and allows an estimation of flow rate.

Intravenous therapy may be used to correct electrolyte imbalances, to deliver medications, for blood transfusion or as fluid replacement to correct, for example, dehydration. It can also be used for chemotherapy.

Compared with other routes of administration, the intravenous route is the fastest way to deliver fluids and medications throughout the body.

Complications faced during IV therapy:-

- Infiltration
- Hematoma
- Air Embolism
- Phlebitis and Thrombophlebitis

Our **SMART IV SET** will overcome the complications like infiltration, hematoma, air embolism, blood backup in tubing, extra vascular Injection, Intra-arterial Injection etc.

It will detect the emptying of IV bag with the help of level indicator. The indicator is based on color detecting principle.

The alarm will ring at the pre set level and will alert the staff to replace of remove IV bag.

The alarm signals will be transmitted to nurses' station or central monitoring system with the help of Telemetry which will prevent constant monitoring of IV.

A color sensor is used which detects the distance, absence, or presence of an object by using a light transmitter.

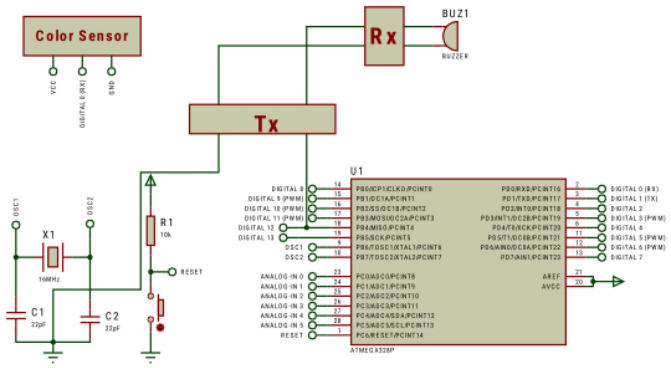
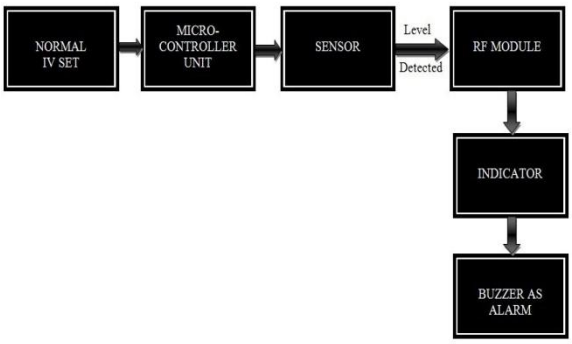


Figure 1 Basic circuit diagram

BLOCK DIAGRAM AND EXPLANATION

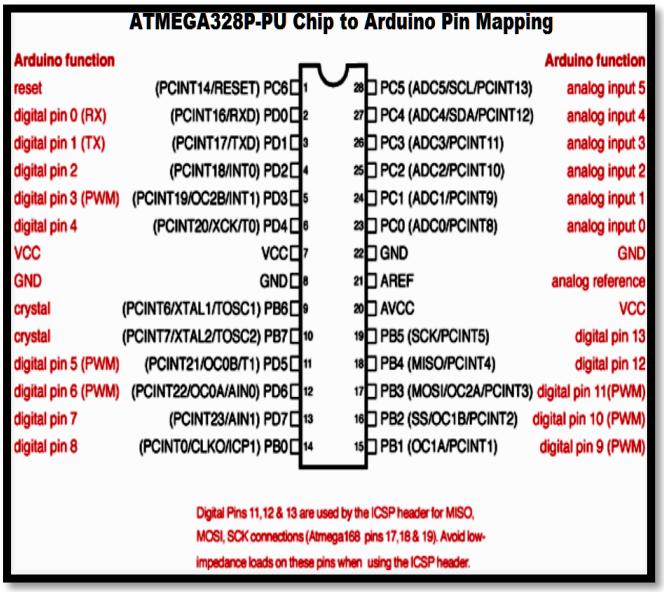


1. NORMAL IV SET:-

As mentioned earlier, normal IV set infuses liquid substances directly into vein. Substances that may be infused intravenously include volume expanders, blood-based products, blood substitutes, medications and nutrition.

2. MICRO CONTROLLER;-

We are using **ATMEGA328P controller** the AVR controller, which has some in built functions such as A to D converter.



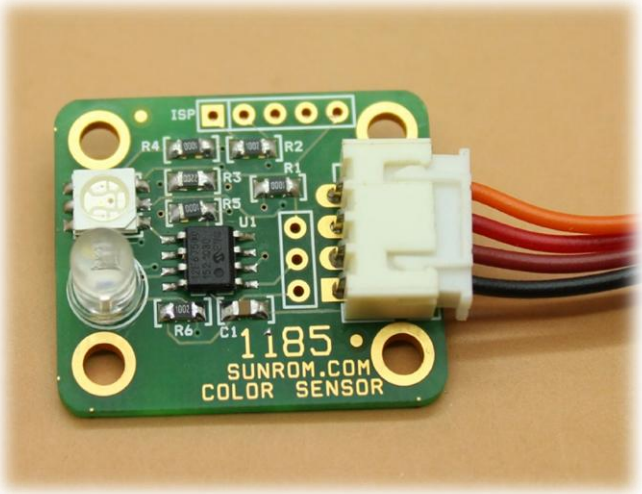
The figure shows the Pin diagram of the Controller.

- **CONTROLLER:-**

We are using **ATMEGA328P** controller. We set the various pattern into microcontroller. Before going to microcontroller first the entire analog signal digitizes and then it goes to the transmitter.

3. SENSOR:-

A color sensor is a device used to detect the colors of color spectrum. They are used extensively in industrial manufacturing.



This color sensor identifies color and gives serial output of RBG value. It can identify 16.7 million color shades giving RGB value for the detected color.

The detected color is identified as amount of three primary color values namely Red, Green & Blue with 8 bit accuracy for each primary color.

Any color can be separated or combined into three primary colors Red, Green and Blue using the RBG values.

4. RF MODULE (TRANSMITTER & RECEIVER):-

The RF module, as the name suggests, operates at Radio Frequency. TheRF signals travel longer distance and can also travel when theres an obstruction between the transmitter and receiver. This RF module comprises of an RF Transmitter and an RF Receiver. The transmitter/receiver pair operates at a frequency of 434 MHz.

An RF transmitter receives serial data and transmits it wirelessly through RF through its

antenna connected at pin4. The transmission occurs at the rate of 1Kbps - 10Kbps.The transmitted data is received by an RF receiver operating at the same frequency as that of the transmitter.

5. INDICATOR:-

A simple LED indicator will be used along with the buzzer. A LED will continuously glow until the IV set is replaced.

6. ALARM AT CENTRAL MONITORING SYSTEM:-

- With the help of RF Module, signal obtained at the receiver end will inaugurate the alarm.
- We programmed the alarm to buzz after a delay of 1 second which will alert the staff to take necessary actions.
- It will keep on buzzing until required action is taken into consideration.

PRACTICAL APPLICATION

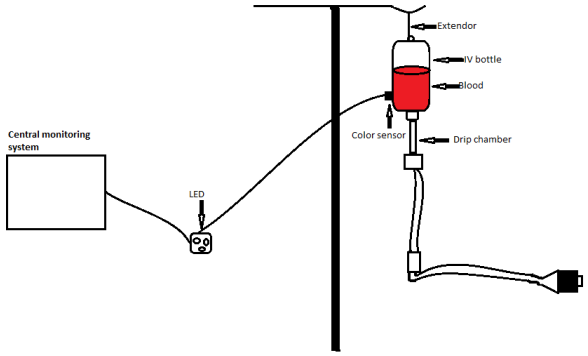


Figure 2

Fig. 3 shows the Smart IV set where the sensor is arranged on the IV bottle at a prefixed level which detects the wavelength of the reflected light. The controller is programmed in such a way that if the wavelength of the reflected light matches that of the red color than no output will be given but if the reflected light goes out of the decided range than it will give signal and the LED will glow also signal will be transmitted to the central monitoring system where alarm will start ringing.

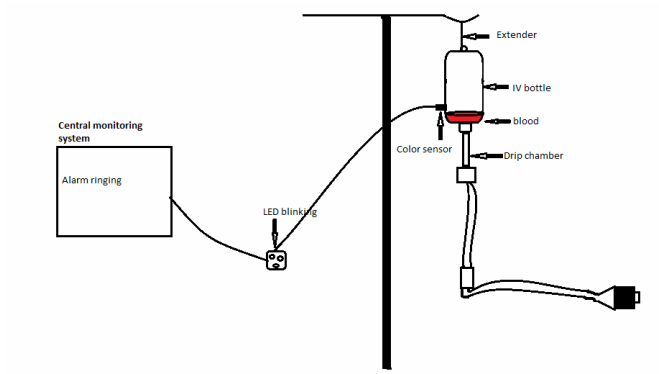


Figure 3

As shown in fig4 the level of blood falls below the sensor and hence the sensor sets the LED to blink and the alarm at central monitoring system to ring.

The central monitoring system should be in the range of 50meter as the signal is transmitted through the RF module which works under this range.

Here the color sensor used detects the 3 primary colors red, blue and green so we use this sensor to detect the blood. For other IV fluids a high precision color sensor can be used.

LIMITATIONS

There are few limitations like:-

1. It can be a little expensive
2. The installation can be time consuming

ADVANTAGES

l. Eliminating the necessity of a nurse leaving her station to make numerous checks on the level of intravenous fluids. This conserves time and energy of the nursing staff.

2. The elimination of the necessity of entering patient's room during the night to make checks on the fluid level.

3. Eliminating the possibility of the emptying of a bottle when a second bottle is to follow. Where a second bottle of fluid is needed and a first bottle has been entirely emptied, it becomes

necessary to again stick the patient with a needle as well as using a second intravenous set-up, i.e., tubing, needle etc.

4. In large wards where one or more patients are receiving intravenous fluids, a nurse is able to check at a glance throughout the entire ward, whether any intravenous feeding is about to be completed. This can be done without leaving her station in the ward.

5. Provide an automatic signal of the above character, which can effectively be interposed between the bottle containing the fluid for an intravenous feeding or the like and the supporting stand for the bottle.

AREA OF APPLICATION

These quintessential IV sets can be used majorly in hospitals in patient's wards and operation theaters. This can replace the normal IV sets available now days.

It can make good business and can provide employment to many.

FUTURE EXPANSIONS

- About the future, we will try to make it as economical as possible.
- Idea of controlling all IV sets centrally.
- Awareness about this innovation.
- Making it more unembellished.

CONCLUSION

From the work done till now, we can conclude that this idea and improvement of IV set will be a boon to the healthcare industry. This will prove to be the ultimate one of its types!

REFERENCE

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- Atmel-8159-8-bit –avr-microcontroller.pdf
- www.**sunrom**.com/p/**color-sensor**