Intravenous Drip and Health Monitoring System

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Abstract— Saline, one of the most widely used intravenous (IV) medicines, is crucial in the treatment of critically ill patients. In order to prevent blood from flowing into the bottle while the saline bottle is emptied and the needle is still close to the vein, it is crucial to keep an eye on its level. The correct timing of extracting the needle from the patient's vein is typically disregarded due to negligence and any uncommon circumstance, which results in a large casualty and should also result in death. We have presented a cost-effective smart saline level monitoring device using Internet of things(IOT) that was created utilising a load sensor and an inexpensive, ultra-low power Arduino microcontroller. In addition, the patient's oxygen level, temperature, humidity, and pulse would all be tracked by the implanted health monitoring system. The GPS device would help locate the patient, and the buzzer used would function to sound an alarm when it was time to change the saline container.

***Keywords*—Internet of Things(IOT),Intravenous(IV) medicines, GPS, buzzer**

INTRODUCTION

The Internet of Things (IOT) is a network of physical objects made up of all the gadgets, cars, buildings, and other things that include electronics, software, and sensors that allow them to collect and share data with one another. Because to the convergence of several technologies, real-time analytics, machine learning, inexpensive sensors, and embedded systems, the Internet of things has advanced. Whenever time a patient is given saline, the patient must be closely watched by a nurse or any other family members.
Most frequently because of carelessness, lack of attention, a hectic schedule, and an increased number of patients, the nurse may forget to replace the saline bottle as soon as it has been completely eaten.

Due to the difference in pressure between the blood and the empty saline container, blood rushes back to the saline bottle right after the saline has finished.

This can cause their vein to reverse the flow of blood into the saline container. They cause patients' haemoglobin levels to drop, and they may also cause a scarcity of red blood cells (RBCs) in the patient's blood, which makes them feel exhausted. Hence, a saline level monitoring system must be created in order to somewhat lessen the patient's reliance on nurses or other carers. This system uses an automatic warning and signalling device based on Arduino.

When the intravenous fluid level falls below a predetermined level, the load cell's output voltage level changes. The nurse is informed by an alarm that the patient's supply of saline has run out as soon as the saline drops to a specific low level. The weight difference is used to determine how much saline is in the bottle and to send an SMS alert. If the nurse doesn't attend to the patient right away, a motor arrangement is made that flattens and suppresses the saline tube. This stops the salt from the veins from rising to the bottle.

In particular, there are fewer doctors in rural areas of a country territory than there are in urban areas for COVID-19 patients, high blood pressure patients, hypertension patients, diabetic patients, etc. Except for government medical facilities, medical equipment is scarce in rural areas. Hence, this device also detects the patient's medical issues. It can identify the patient's location as well as their pulse, SOP2, and humidity.

In order to reduce mishaps brought on by carer negligence and to enable remote monitoring in telehealth services, we have developed a low-cost smart saline level monitoring device that incorporates sensor and IOT technologies. This device was created using a load sensor, ultra-low power Arduino microcontroller. The load sensor converts the load of bottle into a certain voltage.

LITERATURE SURVEY

[1]. A remote drip infusion monitoring system using Bluetooth was developed by Hikaru Amano, Hidekuni Ogawa, Hiromichi Maki, Sosuke Tsukamoto, Yoshiharu Yonezawa, and W. Morton Caldwell. IEEE, EMBC. ISSN:1557-170X. Mistakes in intravenous fluid infusion rates in medical inpatients, Rooker JC, Gorard DA. 2019; 7(5): 482-5.

Created a system for remote drip infusion monitoring for use in medical facilities. A central monitor and many infusion monitoring devices make up the system. The central monitor at the nurses' station receives the data from the infusion monitoring device via a Bluetooth module when it detects the drip infusion rate and an empty infusion solution bag. A number of infusion monitoring devices send data to the central monitor, which then shows it graphically. As a result, the devised system can closely monitor numerous patients' drip infusion situations at the nurses' station.

[2]. "Smart drip infusion monitoring system for instant alert-through nRF24L01," International Conference on Nextgen Electronic Technologies: Silicon to Software (ICNETS2), 2018, by N. Shabana,

P. Tanmayee, S. Loganathan, and G. Velmathi Communication Engineering

The trickle implantation observing framework is used in smart drip infusion monitoring systems for usage in hospitals. The system consists of a drip infusion, devices for checking blood sugar levels, and a monitor. The empty imbuement arrangement sack can be detected by the mixture monitoring device using a pressure sensor (MPX10GP) technology module, and this information is then transmitted via radio frequency to the monitoring screen installed at the medical caretaker's station (nrf24L01). The monitoring screen receives the data from trickle-implantation monitoring devices and then displays it graphically. When the pressure sensor value reaches the threshold value, the control valve closes, stopping the flow of fluid in the patient's vein promptly and without any airflow. Because some medications might be injected into saline bottles, which could lead to variations in pressure, this system might not be precise.

[3]. International Journal of Engineering Research and General Science (IJERGS), Volume 3, Issue 3, May-June 2015, Pages 472-478, S. Tawade, M.S. Pendse, and H.P. Chaudhari, "Design and Development of Saline Flow Rate Monitoring System Using Flow Sensor, Microcontroller, and RF ZigBee Module."

The primary goal of the Automated Low Cost Saline Monitoring System is to provide an advanced saline level monitoring system.The objective is to offer a saline flow monitoring system that is affordable, dependable, and automatic and that can be simply installed in any hospital so that both doctors and nurses can easily monitor the saline flow from a distance.

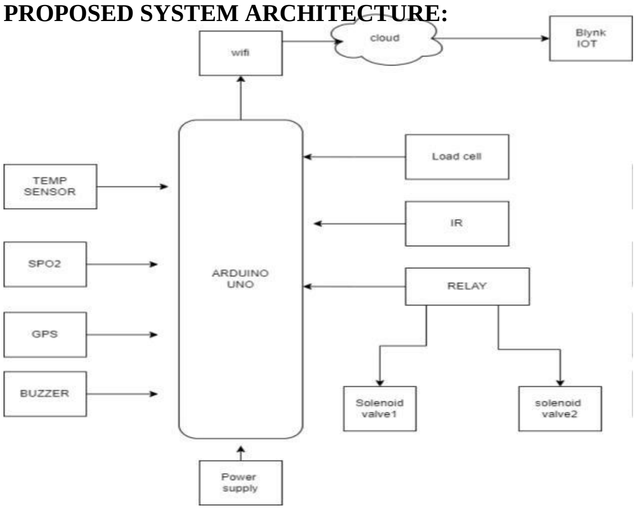
The suggested technique does away with nurses' or doctors' constant on-site patient observation. because it uses the ATMEGA 328 microcontroller, the CC2500 wireless module, the wifi module, and IR sensors. The disadvantage of this method is that Bluetooth module will have a short range connection and IR sensors are particularly sensitive to any impediments in their path. [4].HOSPITALS IOT

BASED DRIPS MONITORING Sanju Vikasini.R.M.2, Sanjay.B.1, The International Research Journal of Engineering and Technology (IRJET) has an e-ISSN of 2395-0056 and a p-ISSN of 2395-0072.

The monitoring of saline bottles in hospitals is a part of this project's activities. This system is made up of an Arduino AT Mega 328, a load cell, an amplifier called a HX711, LEDs, and a GSM module. This project will employ a load cell and an amplifier to convert weight to voltage in order to monitor how much of the saline bottle is left, taking into account the challenges that patients and nurses experience when trying to finish the drips bottle. LED lights in the patients' rooms, phone calls, and text messages will be used three times to alert and notify the nurses for the comfort of the patients. [5] Xinling Wen, "Design of Medical Infusion Monitor and Protection System Based on Wireless Communication Technology" IITA '08. ISBN: 978-0-7695-3497- 8 (2) Volume

Based on technologies such as photoelectric monitoring, modulation demodulation, single-chip microprocessors (SCM), wireless communication, etc., a medical infusion monitor and protection system is developed. By using an infrared photoelectric conversion characteristic, the infusion signal is captured. A wireless communication system is created by the SCM AT89C51, which also manages the wireless transceiver nRF905 and handles data monitoring, area infusion speed control, and wireless transceiver management. The higher PC can monitor and control each control node in real-time and update control schemes thanks to the serial interface MAX487 that connects the main controller to each controlnode.

PROPOSED SYSTEM ARCHITECTURE:



MODULES INVOLVED:
HARDWARE MODULES:

1. Arduino UNO
2. Temperature Sensor
3. Pulse sensor
4. Oxygen level sensor
5. Relay
6. Solenoid valves
7. Load cell
8. GPS
9. Buzzer

SOFTWARE MODULES:

1. Arduino IDE software
2. Embedded C/Arduino C programming
3. Android App(Blynk IOT)

SYSTEM DESIGN:

ARDUINO:

An open-source electronics platform called Arduino is built on simple hardware and software. A motor can be started, an LED can be turned on, and something may be published online by using an Arduino board to receive inputs like light on a sensor, a finger on a button, or a tweet. Sending a set of instructions to the board's microcontroller will instruct your board what to do. You achieve this by using the Arduino Software (IDE), which is based on Processing, and the Wiring-based Arduino Programming Language.

Throughout the years, countless of projects, ranging from simple household items to intricate scientific instruments, have used Arduino as their brain.

This open-source platform has attracted a global community of makers, including students, hobbyists, artists, programmers, and professionals. Their efforts have added up to an astounding quantity of accessible knowledge that may be very helpful to both beginners and specialists.

At the Ivrea Interaction Design Institute, Arduino was created as a simple tool for quick prototyping geared towards students with no prior experience in

electronics or programming. The Arduino board started evolving as soon as it gained a larger audience, diversifying its offering from basic 8-bit boards to items for Internet of Things (IoT) applications, wearable technology, 3D printing, and embedded environments. All Arduino boards are fully open-source, enabling users to construct them on their own and eventually customise them to suit their own needs. The programme is open-source as well, and users from all over the world are contributing to its growth.

Also, Arduino makes working with microcontrollers easier, but it has several advantages over alternative platforms for educators, students, and curious amateurs:

• **Affordable** – In comparison to other microcontroller platforms, Arduino boards are reasonably priced. Even the pre-assembled Arduino modules cost less than $50, and the cheapest Arduino module may be put together by hand.

• **Cross-platform** – The Arduino Software (IDE) is compatible with Linux, Macintosh OSX, and Windows. The majority of microcontroller systems are Windows-only.

• **Easy-to-use programming environment** - The Arduino Software (IDE) is flexible enough for sophisticated users to utilise while still being simple and straightforward for newcomers. Students learning to programme in that environment can use it because it is conveniently based on the Processing programming environment for teachers.

• **Open source and extensible software** - The Arduino software is available as open source tools for experienced programmers to extend. The language can be expanded with C++ libraries, and those interested in the technical details can switch from Arduino to the AVR C programming language on which it is based. Similarly, if you want, you can incorporate AVR-C code directly into your Arduino programmes.

• **Open source and extensible hardware** - The Arduino board plans are published under a Creative Commons licence, allowing experienced circuit designers to create their own version of the module, extending and improving it. Even inexperienced users can build the breadboard version of the module to learn how it works and save money.

Hardware

Arduino is a piece of open-source hardware. The hardware reference designs are available on the Arduino website under a Creative Commons Attribution Share-Alike 2.5 licence. Layout and production files for some hardware versions are also available. The IDE's source code is available under the GNU General Public License, version 2. Nonetheless, the Arduino staff has never released an official Bill of Materials for Arduino boards.

An Arduino board is made up of an 8-, 16-, or 32-bit AVR microcontroller from Atmel, as well as complementary components that allow for programming and integration into other circuits. The Arduino's standard connectors are an important feature because they allow users to connect the CPU board to a variety of interchangeable add-on modules known as shields.

The Arduino board makes available the majority of the microcontroller's I/O pins for use by other circuits. The Diecimila,[a] Duemilanove,[b], and current Uno[c] each have 14 digital I/O pins, six of which can generate pulse-width modulated signals, and six analogue inputs that can also be used as six digital I/O pins. These pins are accessible from the board's top via female 0.1-inch (2.54 mm) headers. There are also commercially available plug-in application shields. The Arduino Nano, as well as Arduino-compatible boards such as the Bare Bones Board[13] and Boarduino., may include male header pins on the underside of the board that can be plugged into solderless breadboards.

TEMPERATURE SENSOR

To determine temperature, these sensors employ a solid-state technique. That is, they do not use mercury, bimetallic strips, or thermistors. Instead, they make use of the fact that as temperature rises, the voltage across a diode rises at a predictable rate. (Technically, this is the voltage drop between a transistor's base and emitter - the Vbe. It is simple to create an analogue signal that is directly proportional to temperature by precisely amplifying the voltage change.

Technical specifications

Microcontroller	ATmega328P
Operating Voltage	5V
Input Voltage (recommended)	7-12V
Input Voltage (limit)	6-20V
Digital I/O Pins	14 (of which 6 provide PWM output)
PWM Digital I/O Pins	6
Analog Input Pins	6
DC Current per I/O Pin	20 mA
DC Current for 3.3V Pin	50 mA
Flash Memory	32 KB (ATmega328P) of which 0.5 KB used by bootloader
SRAM	2 KB

	(ATmega328P)
EEPROM	1 KB (ATmega328P)
Clock Speed	16 MHz
LED_BUILTIN	13
Length	68.6 mm
Width	53.4 mm
Weight	25 g

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ESP8266 (WIFI MODULE):

The ESP8266 WiFi Module is a self-contained SOC with an integrated TCP/IP protocol stack that can provide access to your WiFi network to any microcontroller. The ESP8266 can host applications or offload all Wi-Fi networking functions from another application processor. Each ESP8266 module comes pre-programmed with an AT command set firmware, so you can simply connect it to your Arduino device and get about as much WiFi functionality as a WiFi Shield (and that's just out of the box)! The ESP8266 module is a low-cost board with a large and rapidly growing community.

Features:

• 802.11 b/g/n • Wi-Fi Direct (P2P), soft-AP • TCP/IP protocol stack integrated • TR switch, balun, LNA, power amplifier, and matching network integrated • PLLs, regulators, DCXO, and power management units integrated

• +19.5dBm output power in 802.11b mode • 10uA power down leakage current • 1MB Flash Memory • Integrated low power 32-bit CPU could be used as application processor • SDIO 1.1 / 2.0, SPI, UART • STBC, 11 MIMO, 21 MIMO • A-MPDU & A-MSDU aggregation & 0.4ms guard interval • Wake up and transmit packets in 2ms (DTIM3)

Buzzer:

A beeper or buzzer is an audio signalling device that can be electromechanical, piezoelectric, or mechanical. The primary function of this is to convert the audio signal to sound. In general, it is powered by DC voltage and is used in timers, alarm devices, printers, alarms, computers, and so on. It can generate various sounds such as alarm, music, bell, and siren depending on the design. It has two pins, one positive and one negative. The '+' symbol or a longer terminal represents the positive terminal of this. The positive terminal is powered by 6 volts, while the negative terminal is represented by the '-'symbol or short terminal and is connected to the GND terminal.

The buzzer's specifications include the following.

• The colour is black; the frequency range is 3,300Hz; the operating temperature range is -20° C to +60° C; and the operating voltage range is 3V to 24V DC.

• The sound pressure level is 85dBA (10cm) and the supply current is less than 15mA.

RELAY:

A relay is a device that is used in conjunction with a microcontroller such as the Arduino to control either high-voltage or low-voltage devices. A relay is a switch that is activated electrically by an electromagnet. This electromagnet is simply triggered by a microcontroller's low voltage, such as 5V, and it pulls a relay contact to connect or disconnect a high voltage-based circuit.

This circuit demonstrates how to use an Arduino to control a relay. This circuit requires the Arduino Board, 1K and 10K resistors, a BC547 transistor, a 6V/12V relay, a 1N4007 diode, and a 12V fan. When the button is pressed, the fan turns on, and the fan remains in this state until the same button is pressed again.

The following are the Arduino relay specifications.

• It has a digital output and is compatible with any 5V microcontroller, such as the Arduino.
• The rated through-current for NO is 10A and 5A for NC.
• The control signal is TTL.
• The maximum switching voltage is 250 volts AC or 30 volts DC.
• The highest switching current is 10A.
• It measures 43mm x 17mm x 17mm.

PLUSE SENSOR:

• Header connectors are connected by a colour code cable. As a result, this sensor can be easily connected to an Arduino in the project without the need for soldering.

• An ear clip is the same size as a heart rate sensor and can be attached to the backside of the sensor with hot glue to wear on the earlobe.

• At the hook side, two Velcro dots are completely sized towards the sensor. These come in handy when making a Velcro strap to fit around a fingertip. This is used to wrap around the finger and cover the Sensor.

• Transparent strikers are protection layers that keep sweaty earlobes and fingers away from the sensor. This sensor has three holes near the outside edge that can be used to connect anything.

The following are the main specifications of this sensor.

• This is a hear beat detecting and biometric pulse rate sensor • Its diameter is 0.625 \s• Its thickness is 0.125 \s• The operating voltage is ranges +5V otherwise +3.3V \s• This is a plug and play type sensor \s• The current utilisation is 4mA \s• Includes the circuits like Amplification & Noise cancellation \s• This pulse sensor is not approved by the FDA or medical. As a result, it is used in student-level projects rather than for commercial purposes in health-related applications.

GPS

The following two values can be determined anywhere on Earth using the Global Positioning System (GPS, the entire process used to establish all positions at any point on the globe). GPS receivers are used for positioning, locating, navigating, surveying, and determining time and are used by both private individuals (for example, trekking, balloon flights, and cross-country skiing) and businesses (surveying, determining the time, navigation, vehicle monitoring etc).

CONCLUSION

As a result of the 1 kg load cell, an automatic drip monitoring system will be extremely accurate. Via various alerts, it will assist us in regularly monitoring patients. Additionally, clinicians will use IOT to continuously monitor each patient's health metrics using a variety of sensors. Also, it will prevent hurry and panic among the nurses. It offers numerous advantages and is economical. Also, since alerts are sent to numerous mobile phones via texts and alerts using an IoT application, this will never go undetected.

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