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Smart Syringe Pump for Telemedicine and Health Care

Anushree.M 1, Arpitha.N 2, K.Shreya 3, Pallavi.S 4, Jayasudha.BSK 5

1Student, Dept. of ECE, KSIT, Karnataka, India
2Student, Dept. of ECE, KSIT, Karnataka, India
3Student, Dept. of ECE, KSIT, Karnataka, India
4Student, Dept. of ECE, KSIT, Karnataka, India
5Asst. Professor, Dept. of ECE, KSIT, Karnataka, India

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ABSTRACT: Injecting of fluids such as nutrients and medications into a patient's body in a controlled environment is one of the essential prerequisites of a treatment that requires precise flow control. Advancements in wireless technologies and internet of things (IoT) facilitates the use of medical devices wirelessly so that they can be accessed over a long distance for tele-monitoring and telemedicine. A frame work of a low-cost medical syringe pump is designed to provide better health care in the rural area. A DC motor driven syringe pump is designed using Arduino. GSM module is used to show the wireless operation of the device for alert. The objective of this research work is to design a low cost, portable, smart syringe infusion pump to improve quality of service in the healthcare sector of developing countries.

KEYWORDS: Arduino Uno; syringe pump; DC motor; LCD keypad shield;

I. INTRODUCTION

Syringe pump is a small infusion device that is used for controlled administration of small amounts of drugs or medications to a patient or for use in chemical and biomedical research. It can administer fluids precisely; especially for the child to administer liquid drug for long time. Medical infusion pump is a device used to deliver controlled quantities of fluids like nutrients, drugs, chemo and blood to patients. Syringe pump is a device used in research laboratories for applications that can distribute very small fractions of fluids or liquid medications. In the manual liquid drug delivery systems, fluctuations may occur while operating by a nurse or hospital staff. Syringe pumps are used to deliver precise amounts of fluid at specific time intervals. It delivers measured amounts of fluids or medications into the bloodstream. In this project syringe pump is controlled with Arduino. So we have flexible platform for one or more syringe pump controlled at the same time. Easily can operate, programmable and also add sensors reconfigurable device easily depend upon our needs. This project is to made "inexpensive and compact". Microfluidics is widely used in research ranging from bioengineering and biomedical disciplines to chemistry and nanotechnology. Infusion pumps delivering fluids in large or small amounts, and may be used to deliver nutrients or medications, such as insulin or other hormones, antibiotics, chemotherapy drugs, and pain relievers etc. Commercially available syringe pumps are probably high cost and have inherent limitations due to their flow profiles. so we develop low cost, flexible platform for add some future depend on our needs and no limitations. Here, we present a low-cost syringe pump that uses to regulate the pressure into microfluidic chips. Using an open source microcontroller board (Arduino), we demonstrate an easily operated and reconfigurable program syringe pump, DC motor control of the pressure at the inlets of microfluidic geometries.

II LITERATURE REVIEW

[1] Design and implementation of a telemedicine system using Bluetooth protocol and GSM/GPRS network, for real time remote patient monitoring.

This paper introduces the design and implementation of a generic wireless and Real-time Multipurpose HealthCare. Telemedicine system applying Bluetooth protocol, Global System for Mobile Communications (GSM) and General Packet Radio Service (GPRS). The paper explores the factors that should be considered when evaluating different technologies for application in

telemedicine system. The design and implementation of an embedded wireless communication platform utilising Bluetooth protocol is described, and the implementation problems and limitations are investigated. The system is tested and its telecommunication general aspects are verified. The results showed that the system has (97.9 +/- 1.3)% Up-time, 2.5 x 10(-5) Bit Error Rate, 1% Dropped Call Rate, 97.4% Call Success Rate, 5 second transmission delay in average, (3.42 +/- 0.11) kbps throughput, and the system may have application in electrocardiography.

[2]. Design and implementation of the telemedicine-enhanced antidepressant management study

Evidence-based practices designed for large urban clinics are not necessarily transportable into small rural practices. Implementing collaborative care for depression in small rural primary care clinics presents unique challenges because it is typically not feasible to employ on-site mental health specialists. The purpose of the Telemedicine-Enhanced Antidepressant Management (TEAM) study was to evaluate a collaborative care model adapted for small rural clinics using telemedicine technologies. The purpose of this paper is to describe the TEAM study design.

[3]. Design and Implementation of Wireless Sensors Network and Cloud Based Telemedicine System for Rural Clinics and Health Centers.

Tele medical centers use ICTs to overcome geographical barriers, and increase access to healthcare services. This is particularly beneficial for rural and underserved communities in developing countries groups that traditionally suffer from lack of access to healthcare. In addition to reviewing and discussing the current attempts in wireless body area network technology, a WBAN system that has been designed for healthcare applications will be presented. The wireless system in the WBAN uses medical bands to obtain physiological data from sensor nodes. The medical bands are selected to reduce the interference and thus increase the coexistence of sensor node devices with other network devices available at medical centers.

[4]. Low-cost feedback controlled syringe pressure pumps for microfluidics applications.

Microfluidics are widely used in research ranging from bioengineering and biomedical disciplines to chemistry and nanotechnology. As such, there are a large number of options for the devices used to drive and control flow through microfluidic channels. Commercially available syringe pumps are probably the most commonly used instruments for this purpose, but are relatively high-cost and have inherent limitations due to their flow profiles when they are run open-loop. Here, we present a low cost syringe pressure pump that uses feedback control to regulate the pressure into microfluidic chips. Using an open source microcontroller board (Arduino), we demonstrate an easily operated and programmable syringe pump that can be run using either a PID or bangbang control method. Through feedback control of the pressure at the inlets of two microfluidic geometries, we have shown stability of our device to within ±1% of the set point using a PID control method and within ±5% of the set point using a bang-bang control method with response times of less than 1 second. This device offers a low-cost option to drive and control well-regulated pressure-driven flow through microfluidic chips.

[5]. Microfluidic Syringe Pump Using Arduino Syringe pumps are used to deliver precise amounts of fluid at specific time intervals

It delivers measured amounts of fluids or medications into the bloodstream. In this project syringe pump control with Arduino microcontroller. So we have flexible platform for one or more syringe pump control with same time. Easily operate, programmable and also add sensors reconfigurable device easily depend upon our needs. This project is to made “inexpensive and compact”.

[6]. Developing the control system of a syringe infusion pump. Infusion pumps have multiple uses according to their location.

According to its use, there is a need to control specific parameters. The objective of this work is to implement and to assembly all the modules of an infusion pump, controlling all the functions. The control was implemented with the microcontroller board based Arduino and a webpage was developed to assist the user to record, retrieve and access information about the operating conditions.

[7]. Syringe Pump Based on Arduino for Electro spinner Application.

In this research, a control system in the form of a syringe pump has been developed for controlling volume and flow rate of a liquid or a solution. Syringe pumps are fabricated by controlling the speed and pulse width modulation (PWM) of stepper motors based on Arduino Uno. The tools used are a stepper motor as a syringe driver, Arduino Uno as a controller, four digits

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seven segment as a displayer, and a keypad matrix as an inputinterface. Theprinciple of the syringe pump is to push the injection pump whose speed has been adjusted to the flow rate. The speed of the flow rate and volume is obtained by setting the delay time of the stepper motor using PWM pins from Arduino Uno. Syringe pump that is developed is able to work in the flow rate range of 0.10-12.00 ml/h. It's can be applied to medical as a control of volume and flow rate of drug fluids as well as nanofiber using electrospinning technique.

[8]. Design and Implementation of Low Cost Smart Syringe Pump for Telemedicine and Healthcare.

Delivery of fluids such as nutrients and medications into a patient's body in a controlled environment is one of the essential prerequisites of a treatment that requires precise flow control. Advancements in wireless technologies and internet of things (IoT) facilitates the use of medical devices wirelessly so that they can be accessed over a long distance for telemonitoring and telemedicine. In this work, a frame work of a low-cost medical syringe pump is designed to provide better health care in the rural area. A dc motor driven syringe pump is designed using microcontroller board with necessary driver circuitry. Armature voltage of the DC motor is varied to generate different flow rates. To convert rotary motion of the motor into linear motion, lead screw mechanism is employed. Almost all parts of this device are easily available to local market. There is provision for multiple flow rate control, safety features and wireless control of the device. GSM module is used to show the wireless operation of the device. Experimental findings show that the error of flow rate is within ± 5% of the desired flow rate. The objective of this research work is to design a low cost, portable, smart syringe infusion pump to improve quality of service in the healthcare sector of developing countries.

[9]. Designing of microcontroller based Syringe

Delivering medications and fluids intravenously is a common practice in modern medical procedures. Administering medications or fluids directly into a patient's blood circulation results in a predictable and immediate absorption of the drug or fluid administered, this may play a vital role in the treatment of certain acute conditions which require immediate action by drugs or fluids.

Syringe Pumps are highly useful in delivering a precise quantity of the substance at specific periods of time as required. This research presents a proposal to create a cost effective working prototype of syringe pump for variable and low delivery rates for the administration of small volumes. The presented Syringe Pump utilizes a lead **screw mechanism that is driven by a stepper motor which itself is controlled by an electronic circuit based on an 89S52 microcontroller that works as the brain of the system export this cheaper product abroad. and controls all other peripherals like LCD, Keypad and other components.**

Due to the possibility of the complete prototyping of the syringe pump locally from the electronic hardware designing to the code writing and to the mechanical assembly designing and fabrication it allows us in future to modify this design in accordance to the need of any related industry at home letting off the dependency on manufacturers from other parts of the world .

III PROBLEM IDENTIFICATION

Pump with variable and low delivery rates for the administration of small Volume.

- The main purpose of our system Architectureis to make it compatible and a patient friendlydevice.
- The alarm system that are present In the hospital cause disturbance to the patients. At this situation it is very important to notify the hospital staff without causing any noise due to the buzzer or alarms

IV. OBECTIVE

The main objective of our project
Is to develop a low cost smart syringe
Pump that can deliver fluids into a
Patients body under controlled
Environment.

V. EXPERIMENTATION

Internet of Things (IoT) involves a large number of embedded devices and exchange large amounts of data all around the world. Integration with IoT makes a device smart as it saves time and reduce risk. Depending upon the health condition the servo motormoves to the particular angle to give syringe. The proposed system architecture where it is depicted that the syringe pump and all of its status such as flow rate, position, direction, patient bed number etc.

can be sent via wireless network, cloud server and finally can be put into general structure of IoT. The main purpose of our system architecture is to make compatibility with the patient. The alarm system is something that creates noise pollution inside the hospital. It may cause disturbance for the other

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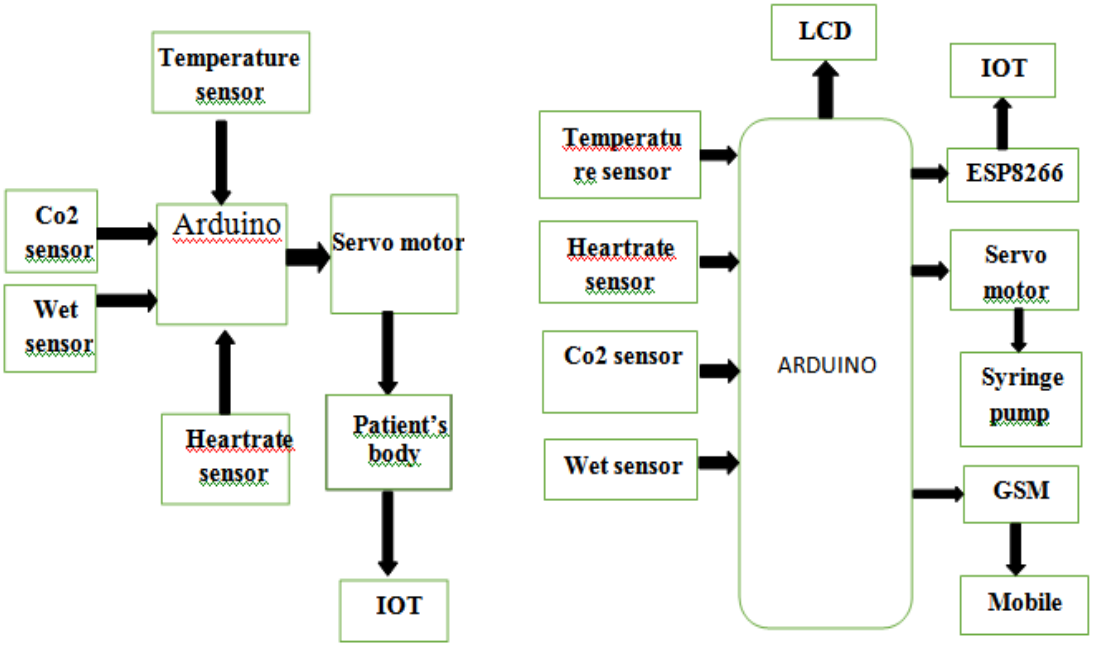
patients besides them. In this position it it is very sensitive to notify that the hospital staff should make sure that there is no noise by any buzzer or alarms. This could be possible via the communication using GSM module to give a status SMS to the hospital staffs. a smart syringe pump with reduced cost, smart syringe pump that can deliver fluids into a patient's body under controlled environment. and better efficiency for the application of telemedicine in the rural areas of developing The main objective of our project is to develop countries .

PROPOSED METHODOLOGY

BLOCK DIAGRAM



VI CONCLUSION

Delivery of fluids such as nutrients and medications into a patients Body in a controlled environment is one of the essential prerequisites of a treatment that requires precise flow control. Advancements in wireless technologies and IOT facilitates these use of medical devices wirelessly s that they can be accessed over a long distance through tele-monitoring and telemedicine. A framework of low cost medical syringe pump is designed using Aurdino. GSM module is used to show the wireless operation of the device for alert. The objective of research work is to design a low cost portable , smart syringe infusion pump to improve the quality of service in the healthcare sector of developing countries.

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