SODIUM HYPOCHLORITE IRRIGATION AUTOMATION IN MEDICAL TREATMENT

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Abstract: Sodium hypochlorite (NaOCl) is the most commonly used solution in root canal treatments, as well as surgeries of bones it is used as irrigating solution. It is widely used in dental practice during root canal treatment. Application of solution is bit simple but insecurities can cause severe complications can occur when it comes into contact with soft tissues especially due to crytotoxic features. When this solution is injected into the adjacent areas like tissues, the patient experiences intense pain, and an urgent treatment should be implemented in order to prevent a long-term sequelae. This severe pain can cause oral mucosa, infection in tissues, built of bad bacteria, long term headache, and loss of taste ability due to direct contact with tongue & built of cancer cells. Our introduced design is one step towards avoiding all the complications by use of electronics.

Key Words: NaOCl, Root Canal Treatment, Motor, PIC, Temperature Monitoring, RTD, Automation in Medical Treatment.

1. INTRODUCTION

Sodium hypochlorite (NaOCl) is the most used medical solution in dental treatments, as it exhibits a very effective antimicrobial activity for macrobiotic of affected root canals[1]. However, this solution can cause complications in particular due to its cytotoxic features. When NaOCL is injected into the tissues, the patient usually experiences strong pain, and an urgent management should be implemented in order to prevent a longstanding sequelae[4]. Furthermore, the long-term neurologic injuries that this type of accidents may cause. In endodontic, we need to have Sodium hypochlorite (NaOCl) rinsing with NaOCL in order to do so the canals must rinse for sufficient amount of time. Furthermore the solution should have a perfect concentration[2]. If using 3% Sodium hypochlorite (NaOCl) solution germs are killed after sufficiently long exposure time using about 3 min amount of accidents during endodontic therapy require accurate and prompt action. Considering the physical properties of bone and calculating the subsequent cell damage from NaOCl contact could develop management of

these coincidences. In order to avoid these complications we need to have a proper control over the flow of solution. Through this project we are going to have to control over the irrigating of sodium hypochlorite. We are going to help medical field with proper control system and to avoid complications also the severe damages

2. OBJECTIVES

- Automatic liquid NaOCL control
- Continuous Temperature monitoring

3. BLOCK DIAGRAM
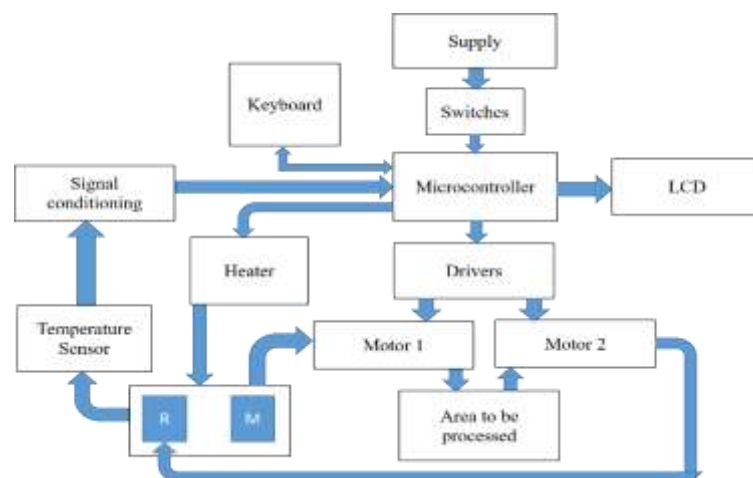
Proposed system design:

A.NaOCL temperature control:

NaOCL is used in this application is having most important temperature factor. It works on 50℃. Thus we need to monitor and control the temperature of it continuously. For that purpose we are using the heater controlled by PIC microcontroller. The heater is set to the particular required temperature. This temperature is displayed on the LCD by microcontroller.

We are using heater to maintain the solution temperature. Two separate beakers are used to hold used also pure solution. Temperature monitoring is very important

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because NaOCl required to be maintained at proper temperature. LCD is to display the operation.

First the pure solution is carried through tube, which is taken out by motor 1. Motor 1 is driven by driven by the motor drivers. The drivers are controlled by microcontroller. This flow of liquid NaOCl is by amount of 2ml/minute. Then after certain amount of time the liquid is taken out by the motor 2. This happens due scientific phenomenon called as negative pressure. This process happens very fast. We can able to see the input and output given to microcontroller to control. The microcontroller is used to monitor the temperature of the solution. To start and stop motion of the motor as well as to get required instruction from keyboard. Here we are using keyboard to get appropriate input which is the amount of irrigation to be taken place.

B. PIC:

Peripheral interface controller with 40 DIP is used in automatic luggage follower for controlling operations. It operates in 5.5V supply voltage with internal oscillator frequency 16MHz. PIC operates with 75 instructions and having USART pin for serial communication. We are using the simple digital IO ports for purpose of control of LCD, keyboard, Relay, motor, & heater

LCD:

LCD (Liquid Crystal Display) is an electronic screen display. A 16x2 LCD display basic & is very widely used in many circuits. These are preferred over seven segments and other multi segment LEDs. The reasons being: LCDs are economical; easily programmable; have no limitation of displaying special & even custom characters (unlike in seven segments), animations and so on. A 16x2 LCD means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. This LCD has two registers, namely, Command and Data.

RTD Temperature Sensor, PT100:

Sensor Scientific, Inc. Platinum Thin Film RTD Elements are fabricated using state-of-the-art thin film processing techniques, resulting in an element of exceptional quality and stability. The wide choice of resistance, tolerance, and size options allows for complete design flexibility.

RTD elements are available with extension leads, and incorporated in complete temperature probe assemblies.

DC motor:

A DC motor is any of a class of rotating electrical machines that converts direct current electrical energy into mechanical energy. The most common types rely on the forces produced by magnetic fields. The speed DC motor can be 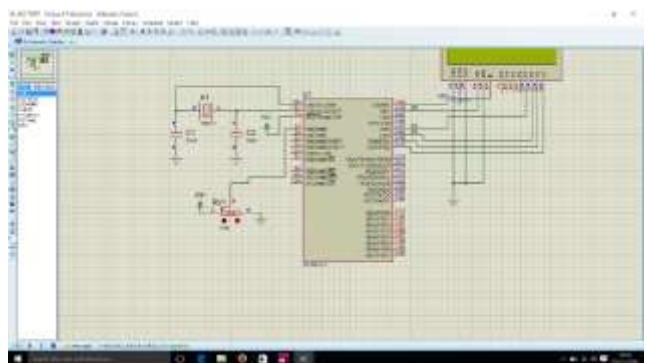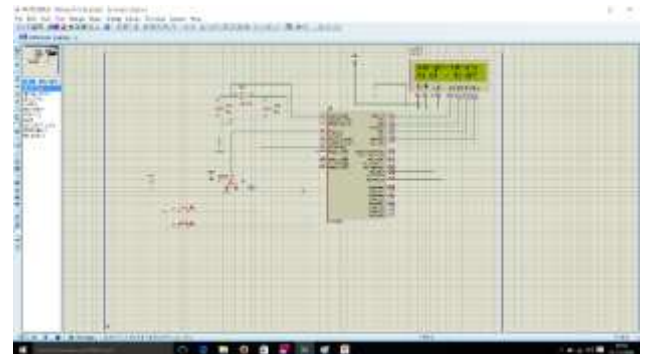controlled by varying the supply voltage or by changing the current in its field winding. The circuit use a 100 RPM 12 V DC motors with gearbox, 6mm shaft diameter with internal hole, 125 gm. weight, Stall torque = 1.5 Kg/cm torque, No load current = 60 mA (max), and Load current = 300 mA(max).
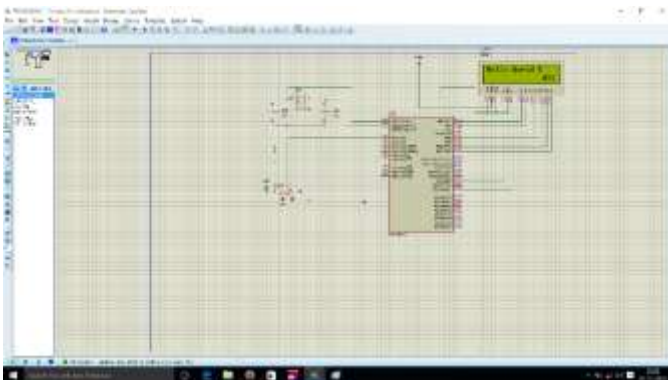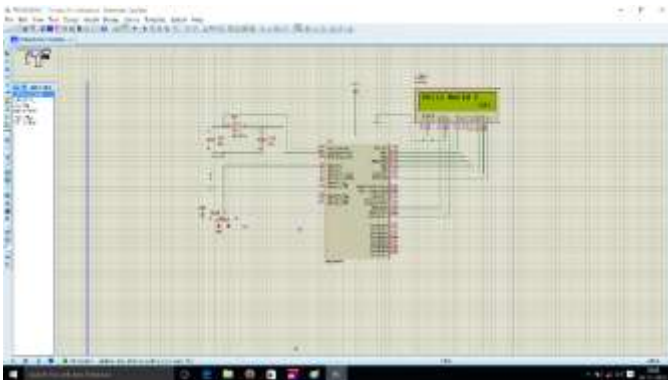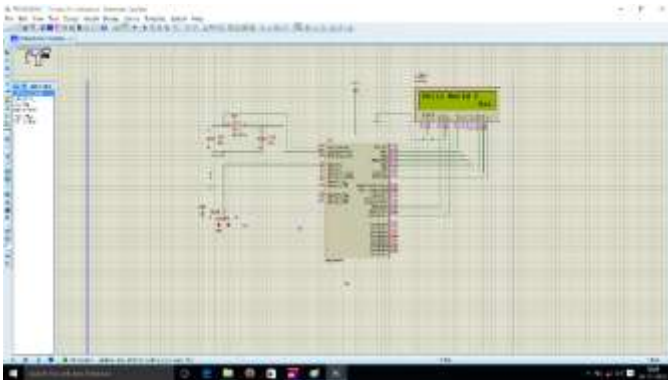
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5. RESULTS

5. CONCLUSION

By completing this project we can ensure the accuracy, precision & effectiveness in the treatments with use of Sodium Hypochlorite. This includes further possibilities of improving our design to an extent where we could use full automation with robotic hands and intelligent Artificial Intelligence and machine learning.

5. REFERENCES

[1] "OxyChem Sodium Hypochlorite Handbook", survey published by OxyChem on December 2014 provided information concerning sodium hypochlorite or bleach, solutions. Furthermore it also outlines recommended methods for handling, storing, and using sodium hypochlorite.

[2]In the Journal of IMAB - Annual Proceeding (Scientific Papers) 2016, vol. 22, issue; Elitsa Deliverska, Department of Oral and Maxillofacial surgery, Faculty of Dental medicine, Medical University - Sofia, Bulgaria in their study paper "Oral mucosa damage because of hypochlorite accident – a case report and literature reviewed", we seen some severe damages caused by Sodium Hypochlorite accidents.

[3]In the Journal of Oral Hygiene & Health, a paper published by Shibu Thomas Mathew named "Risks and Management of Sodium Hypochlorite in Endodontics" we discovered more on the risks and management about the subjected area of contact with Sodium hypochlorite. Published May 26, 2015.

[4]In the paper "Efficacy of several concentrations of sodium hypochlorite for root canal irrigation" by Baumgartner JC1 & Cuenin PR, we more on studied the use and importance of Sodium hypochlorite solution in root canal.

[5] "Review: the use of sodium hypochlorite in endodontics — potential complications and their management" by H. R. Spencer, V. Ike & P. A. Brennan in this paper we properly studied some severe damages caused by Sodium Hypochlorite accidents.