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Real Time Implementation of Virtual Doctor using Robot

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Abstract: *The main objective of this project is to bring fully automated device to diagnose the patient for certain common diseases and dispense the medicines through Robotic arm automatically. A current scenario in self testing is like BP monitoring, and temperature monitoring. Moreover the medical facility is very less for those who live in remote areas and most of the experts and advanced facilities are available in urban areas. The scope of this project is to design and implement a reliable, cheap, low powered, non-intrusive, and accurate system that can reduce human effort in measuring vital signs and diagnose with required medications in case of abnormality. This project specifically deals with the signal conditioning and data acquisition of vital signs: heart rate, blood pressure, body temperature and also prescribe medicines including diarrhea and cough. Initially a microphone is placed on opposite of Automatic virtual robot(AVR)-Doctor and the patient to say their age and cause for the disease in code format i.e. eg. FEVER-01, BP-02 and dispense corresponding medicines automatically.*

Keywords: *Voice recognition, Heart Beat Sensor, temperature sensor, AVR Micro Controller, Robotic Arm, GSM.*

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I. Introduction

The growth of technology is witnessed everywhere and the use of technology in medical field is increased in recent times. The process is that, when the determined output value from the sensors is different from the predefined value, the computer acknowledges it as an abnormal value or a disease and offers treatment (i.e.) it prescribes medicines. Here the computer acts as the medical practitioner which is capable of finding out disease. The AVR controller is used to process the data, various bio medical sensors like Blood pressure sensor, and temperature sensor are used to gather the sample from the patients. A software program using visual basic and C program to print the medicines prescribed.

II. Methodology

The primary goal of this project is to offer medical services to poor in remote areas in the state in an effective manner. The main objective is to reduce the human effort in treating the patients. People in villages and remote areas do not stand a chance to get treated by a medical expert who lives in cities. A recorded voice and a display instructs the patient to be sit near to the AVR-Doctor and instructs to tell the type of disease in a coded form(e.g. Fever- 01, BP-02 etc) **.** The various sensor outputs are connected to the Microcontroller. If the output of the sensor is analog and the in-built ADC in AVR controller converts the signal to digital form. The sensed digital data is compared with the standard value , if does not matches then the patients are made aware of the disease using the monitor display connected to the PC. The Robotic arm gives the necessary medicines for the disease of the patient and also treats the patient in a hospitality manner. The Robotic Arm rotates in right and left and in 360' direction and picks the medicine as accordingly to the disease and give it to the patient.

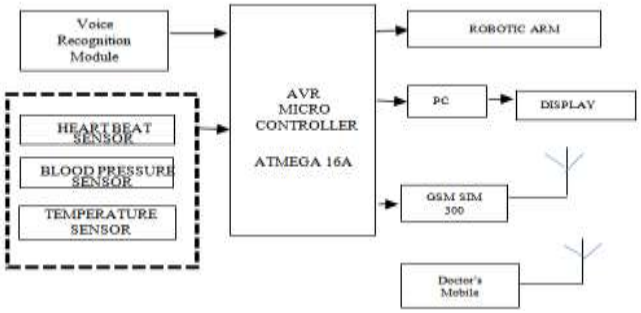


Fig2.1: Block diagram of AVR-Doctor

III. Hardware Description

- AVR Microcontroller
- LCD Display
- Blood pressure sensor
- Heart beat sensor
- Temperature
- Robotic arm
- GSM

3.1.1 Blood Pressure Meter

Blood pressure is a common disorder now a day. To measure the blood pressure a method called Pulse aximeter is used. The process is that it consists of a LED and a Photodiode, the LED is placed above the skin of the finger and the photo detector is placed below the finger. When the LED is on the light from the LED travels to the skin and is received by the photo detector, the changes in light absorption is measured by the photo diode. The light absorbed is directly proportional to the voltage. This voltage signal is conditioned and converted to digital and values are displayed.

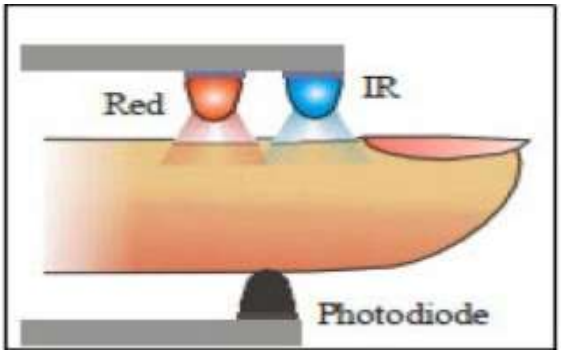


Fig 3.1: Pulse Oximetry

The range is of few Micro volts and the frequency is 0.1 Hz to 10Hz.
Then using PWTT (Pulse Width Transit Time) a regression equation is formed and the values are calibrated
Linear Regression = -0.6881 * PWTT +228.59

Block	Function
L-V Converter	Light to Voltage converter
Head stage amplifier (AD620)	To obtain the gain at 1000
1st order HPF	To filter DC components
2nd stage Amplifier	To maintain gain at 100
LPF	The lower frequencies are eliminated.

Table 3.1 Blocks Of Bp Monitor

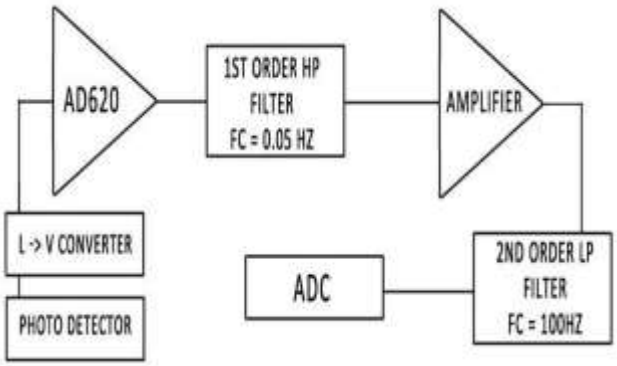


Fig 3.2: Block Diagram of BP meter

3.1.2 Heart Rate Meter

The electrical activity of the heart (i.e.), the blood flowing from articles to ventricles, from ventricles to aorta and from aorta to the all the other parts of the body, the cycle repeats itself until the whole blood is pumped out. When the cycle is occurring Trans membrane potential is produced, which is the internal and external spaces of cell membrane changes at each stage. Using surface electrodes the voltage can be measured and processed. Here gold cup electrodes in Lead 1, Lead 2 and Lead 3 configurations are placed in various parts of the body and voltages are captured. The output voltage ranges from 0.1mV to 0.5mV and frequency about 0.05Hz to 60Hz.

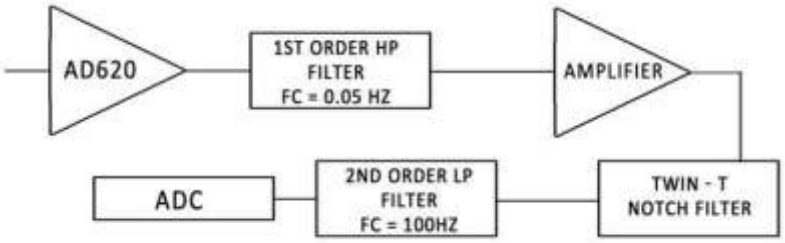


FIG 3.3: BLOCK DIAGRAM OF HEART RATE METER.

Block	Function
Head stage differential amplifier (AD620)	Pre amplification
1st order HPF	Filters DC components
2nd stage amplifier	Improve gain at 10
Twin T Notch filter	60 Hz noise elimination

TABLE II BLOCKS OF HEART RATE MONITOR

3.1.3 LCD Pin Configuration

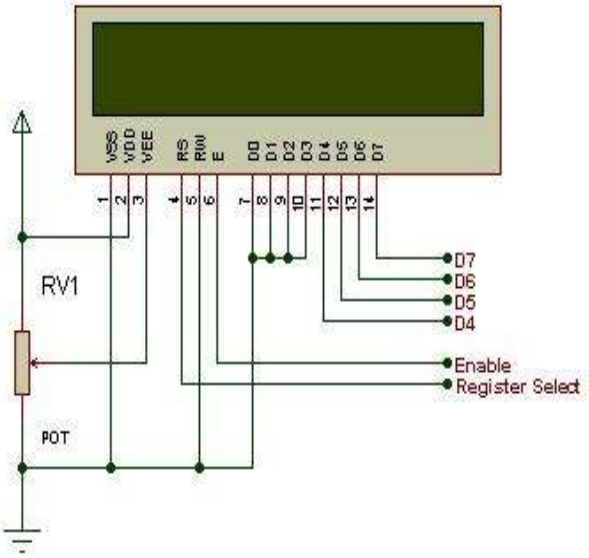


Fig 3.4: Pin Configuration of LCD

3.1.4 Digital Thermometer

In our day to day life the use of thermometer is increasing. Instead of going to a medical expert the digital thermometer serves as a self-testing device for measuring body temperature. The device consists of a thermistor which picks up the body temperature and converts in to equal voltage. The voltage being analog is sent to the ADC and corresponding digital voltage is seen.

Output Voltage: -2.5 to +2.5V
Temperature Measured: 0 to 50 degree Celsius

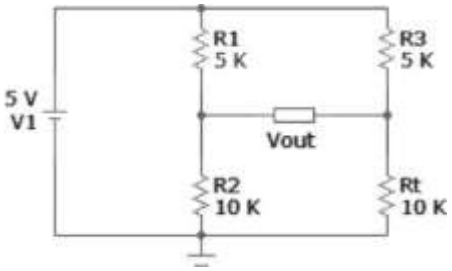


Fig 3.5 Circuit Diagram of Digital Thermometer

3.1.5 *Robotic Arm:*

The mobile pick and place robotic system can be represented by basic subsystems as;

1. Rotational manipulator

The rotational robotic arm consists of a stepper motor that moves in step angles to 360^0 by giving logic through controller. A stepper motor drive circuit drives the motor. The manipulator is one joint and has one degree of freedom.

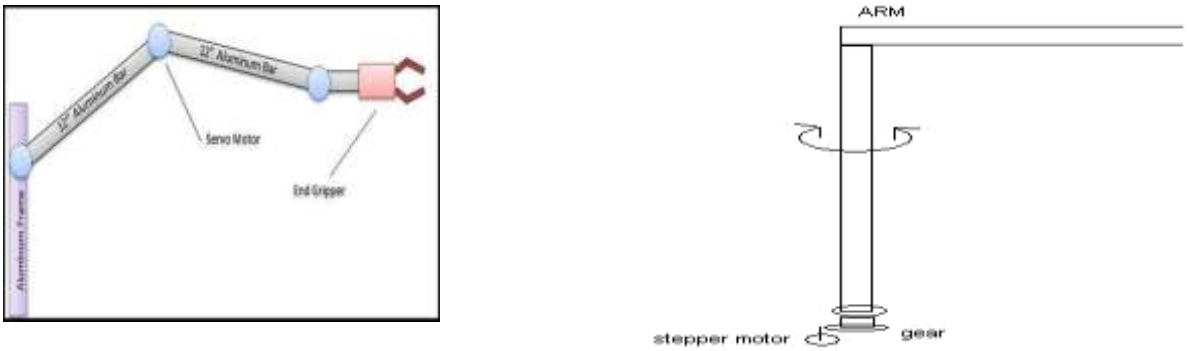


Fig 3.6: Body of Robotic Arm

3.1.6 DC Motor Circuit:

The H-bridge , is use to drive the DC-motor forward and backward.

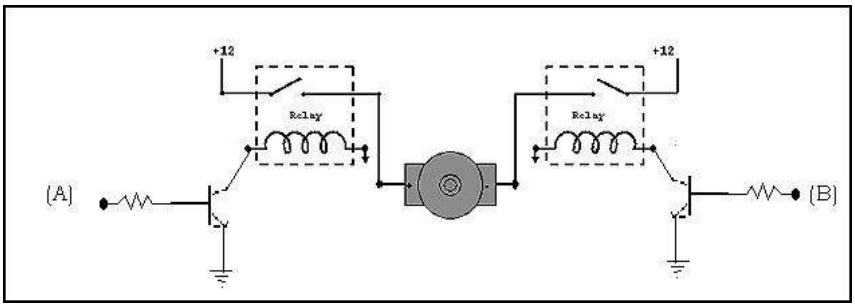
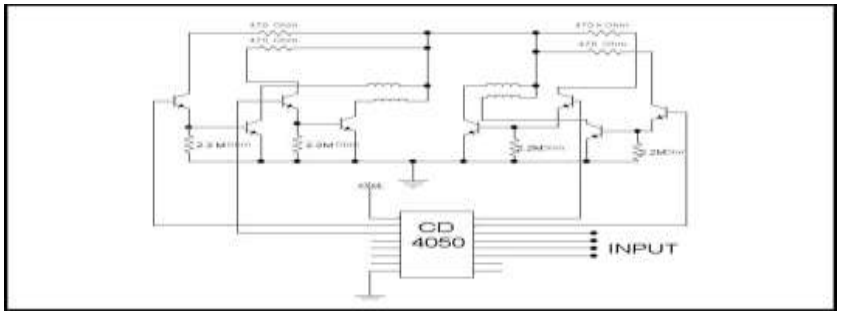


Fig 3.7: H-Bridge Circuit

A	B	FUNCTION
1	**0**	**Forward**
0	**1**	**Reverse**
1	**1**	**Stop**
0	0	Stop

3.1.7 Stepper Motor Drive Circuit:

The circuit below, is useto drive stepper motor. The stepper motor has 6 wire in which two are use for VCC and GND



The remaining 4 wire is used to provide logic through the below shown circuit from the controller. The logic given to the drive circuit to move motor in step angles via controller is given in table.

X	X|	Y	Y|	Step Angle
0	1	0	1	0°
1	0	0	1	90°
1	0	1	0	180°
0	1	1	0	270°

Fig 3.8: Stepper motor drive circuit Boolean logic

3.1.8 Robotic Arm Features:

3.1.8.1 Degree of Freedom:

The point at which the robot manipulate rotates is called joint or axis. The number of joints in an industrial robot determines its Degree of freedom of motion. Our robot has one movement of axis so it posses *"one degree of movement"* , which means it has only one movement that is rotational.

3.1.8.2 Robot Motion*:* The robot has two basic movements;

i) The base travel movement. ii) The arm rotational movement.

3.1.8.3 End- Effector*:* The end-Effector is the hand connected to the robot arm. It is different from the human hand. The end- Effector gives the robotic system the flexibility necessary for the operation of the robot. The end-Effector of the project is a magnetic gripper and is driven by 12V DC source.

3.1.8.4 Pay Load: Payload is the load capacity of the robot. The project robot has a low payload of 200g.

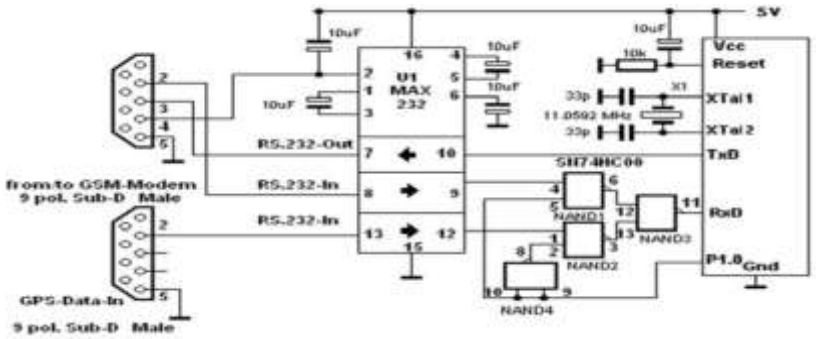
3.1.8.5 Accuracy*:* The accuracy of a robot describes how closely a robot can position its manipulator. The accuracy rate of the project is 70% due to mechanical gears .

3.1.8.6 Actuations: The method of driving the robot axes is called actuation. The actuation technique used in the robot is electrical.

3.1.8.7 Dimensions of Robot*:* Length of Robot is: 21 inches; Height of Robot is: 17 inches; Width of Robot is: 10 inches.

3.2 GSM Module:

GSM module used here is SIM900 Quad-band GSM.



IV. Results

The sensors interfaced with the microcontroller used to detect the diseases.The robotic arm rotates to the 360 degree and picks the medicines and dispense to the patient according to their diseases. Moreover the process continues in case of emergency the details of the patient are sent as a message to the nearby Govt. Hospital's Doctor through GSM module as

V. Conclusion

Our country has a great history in providing medical facility at low cost. This can be extended to remote areas also by our innovative technology AVR-DOCTOR and it creates a great impact on the society and the health industry will drastically depend on bio-medical electronics like the proposed one which shall be implemented in every remote village across the state and country. The lives of people is changing everyday and expecting a technological innovation to help them solving their issues. This project is unique and will surely help the poor people who are not aware of the current medical hazards. As per the words of Neil Armstrong "That's one small step for a man, one giant leap for mankind". This project will set in future as humanoid robots and assist the patient and treat the patients.

VI. Future Enhancement

In this project the language used here for displaying the disease and medications are English, using several translator programs various language scan be used for displaying. Here only 4 sensors are used; interfacing many numbers of sensors will help the people to get treated accordingly. Interfacing of one more robotic arm will makes the process more efficient and robotic arm to diagnose the patient and taking the blood samples from the patient automatically.

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