Multimode Operating Pacemaker using Accelerometer

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Abstract— Earlier pacemaker types had only one pacing mode i.e., it can only give pulse in a fixed rate with the certain interval based on the patient's requirement only in resting. So, it will suppress the patient's normal life and it also makes the situation worse if the patient faces any emergency. For satisfying all these conditions a pacemaker with different modes of operation for running, jogging, rest & sleeping we have the Multimode Manual Operating Pacemaker (MMOP) with different types of pacing modes which satisfy various demand functions. Here the various activities of patient are detected by an accelerometer sensor. For testing purpose, we use MEMS technology to determine the changes in the heartbeat due to various activities of human and with the help of a closed loop feedback system connected with MEMS. This pacemaker mimics like the SA node that act at the critical situation. With these types of pacemakers, the workload-dependent variation in heart rate is compromised. By adding GSM modem, we can know the current status (working mode, BPM) of the pacemaker.

Key words: Multimode Manual Operating Pacemaker (MMOP), Accelerometer

I. INTRODUCTION

In this corporate world, the human works are very busy scheduled. One have to do more works to survive in this world. The major problem arises over the world are the SA node simulation failure where this is compensated by the pacemakers. The requirements of the patients are made more complicated so that the design of the pacemakers is also made different based on their needs. Some of the patients required only support for the SA node to stimulate. Some of them requires the initialization. All the technologies have been worked and developed on this field, but there are some disadvantages that these persons should remain stable or at rest. When the necessity begins for the patient to run, jog, etc., then it is not possible to do with an artificial pacemaker. To overcome this, the different impulse is provided so that the controller provides adjacent values to compensate the necessity along with the motion sensor(MEMS). Along with that, there is a need for patient to know the working status and battery condition. For that we can have lot of choices such as Zigbee, GSM modem, IoT and much more.

Cardiothoracic Surgeon Leon Abrams, and Medical Engineer Ray Lightwood, developed and implanted the first patient controlled variable rate heart pacemaker in 1960 at Birmingham University.

Demerit in this version is that, it cannot supply in accordance with the demand function. "Current Status of Pacemaker Technology", M. Schaldach referred from url: www.springer.com

The rate responsive pacemaker has the drawback of lack of hardware for sensing motion as well as vibration, "Limitations of Rate responsive pacemaker", Volume 11, Issue 2, referred from url: www.onlinelibrary.wiley.com

Overcoming these drawbacks our project can compensate both of the requirements and it can work accurately and efficiently.

II. BLOCK DIAGRAM

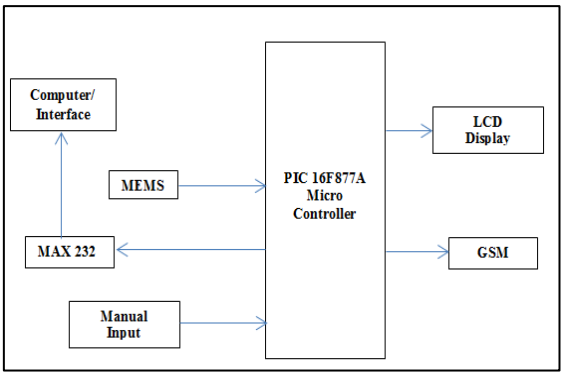

Fig. 1: Block Diagram of MOPA

III. TECHNIQUES FOLLOWED

The motion of the patient is sensed by the MEMS (Accelerometer) sensor. Here this sensor will calculate the motion and displays the activity of the patient. This work will have the separate speed where if he/she run, jog, etc. The data collected will be provided to the PIC microcontroller where this will calculate the threshold value for the work that the patient does. Also, the controller or the mode shifter will have the separate values that had been analyzed from that patient. Thus, the resultant values will be given by analyzing and comparing both the values. This value will be similar and equivalent to the person's required pulse. The microcontroller will do the function for this resultant value and will be provided to the patient. Here the parameter selected will have an effect on voltage, so that the resultant value will be in voltage. So, the LCD display is used to show up the voltage level that is provided to the patient. The MAX 232 is connected to the serial port for the computer interface. More parameters can be considered, analyzed and displayed on the interface than the LCD display.

The accelerometer sensor is programmed with the gestures of the patient to whom it is to be implanted. So, the normal activities to be monitored and it should be fed to the accelerometer. The MEMS are provided with the 5V supply to PIN 1 in the sensor. The output of the MEMS is taken from the PIN 2 and provided to the RA0 (PIN 2) in the PIC controller. The PIN 3 is grounded so that the circuit be closed for the MEMS. The oscillatory circuit is provided to the PIN 13 and PIN 14 which are capacitive grounded. In order to reset the system, the PIN 1 is connected with the power and ground. So, that the reset in done for the system. For the display purpose, the LCD display is connected with

the Pins DB4 (PIN 13), DB5 (PIN 14), DB6 (PIN 15), DB7 (PIN 16), RS (PIN 4) and E (PIN 5). The PIN 5 is connected with the push button. In order to view the status and for analysis and reference purpose, the interface is required. Thus, the max232 is used for the interface. The PIC itself will do the ADC conversion where this converted results were taken out from the PIN 25 and provided to the PIN 1 in MAX232. The serial ports of 1, 5, 6, 9 are connected with the interface of MAX232 and are connected to the computer.

IV. RESULT

By this project, we increased the abilities of a pacemaker. Patient can be taught to set the required input by setting the correct mode according to their working modalities. So, the normal life of patient can be restored and difference in lifestyle of pacemaker implanted patient and normal person would make no difference.

Fig. 2: Output of MOPA

Along with this we have a mode of communication between pacemaker and patient/guardian/doctor so, condition and working status of pacemaker are continuously monitored.

V. CONCLUSION

Thus, we can able to achieve the upgrade of a pacemaker by adding MEMS and GSM to the MMOP, so that we made a breakthrough in the area of pacemaker, and also there can be lot of advancements made in future. Due to the reason that the technical requirement is not satisfied, MEMS sensor doesn't have all the desired parameters and also GSM is not recommended to use due to occurrence of artifacts. If these drawbacks are satisfied, we can get then perfect outcome of this project.

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