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Medicopter as a First Aid Tool

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ABSTRACT

The main focus of the paper is to help the patient who is under critical condition and gives real time medical assistant to the patient. The first few minutes of a medical emergency are critical. This is why proper care should be immediately provided to prevent any further complications; some examples include heart failure, drowning, traumas, and other respiratory issues. An air ambulance is a specially outfitted helicopter, or fixed wing aircraft, that transports injured or sick people in a medical emergency or over distances or terrain impractical for a conventional ground ambulance. Fixed wing aircraft most often used to move patients over long distances and for repatriation from foreign countries. These and related operations are termed as 'Aeromedical'. This type of aeromedical can be used only at the time of war for the soldiers. Aeromedical can be land in the place where there is huge space it can't be landed in the Center of the city or in congested place. To overcome, this problem drones are used in the medical field. These drones are helpful for transporting medicines, blood, donated organs from one place to another. The drawbacks of the medical drones are insufficient battery power, signal transmission to long range, cost, etc. As soon as the patient goes to the critical condition people surrounding to the patient doesn't know to give the first aid. To overcome, this drone with real time patient monitoring system is integrated to help the patient. The real time patient monitoring system interfaced with temperature sensor, ECG, Respiration sensor, heartbeat sensor and pressure sensor. The pic microcontroller (PIC 16F877A) used to interface all the sensors shows the real time patient monitoring system kit. In this system GSM modulesends the information of the patient through the message, GPS is used the track the location of the quadcopter to the operator of the ground station. This helps them to send the vehicle to exact accident location shows the quad copter. After fixing the sensors to the patient, the condition is continuously monitored and sends information to the nearby hospital and control center over a wireless.

KEYWORDS: *PIC microcontroller, Aeromedical, GSM module, Drone.*

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I. INTRODUCTION (MEDICOPTER)

Air medical services is a comprehensive term covering the use of air transportation, airplane or helicopter, to move patients to and from healthcare facilities and accident scenes. Personnel provides comprehensive prehospital and emergency and critical care to all types of patients during aeromedical evacuation or rescue operations aboard helicopter and propeller aircraft or jet aircraft. The use of air transport of patients dates to World War I, but its role was expanded dramatically during the Korean and Vietnam conflicts. Helicopters are used to transport patients between hospitals and from trauma scenes; fixed-wing aircraft are used for long-distance transports. Drones could soon be delivering everything from drugs to clothing, if companies such as Amazon and Google have their way. And now that vision has come a step closer to reality after DHL was granted permission to carry out the first ever authorised drone delivery in Europe. The logistics firm, owned by Germany's Deutsche Post, will send its 'parcelcopter' flying at up to 40mph (65km/h) to the car-free island of Juist, off Germany's northern coast. The drone is designed to deliver medication and other urgently needed goods to the island at times when other modes of transport are not operating. If the trial is successful, the craft could be used to deliver packages to other remote areas, or in emergencies.

II. Patient monitering system

It consist of five patient monitoring sensors, they are temperaturesensor,presuresensor,ECGsensor(electrocardiogram),respiration sensor, heart beat sensors interfaced with PIC microcontroller.

A. PIC microcontroller

The PIC microcontroller PIC16f877a is one of the most renowned microcontrollers in the industry. This controller is very convenient to use, the coding or programming of this controller is also easier. One of the main advantages is that it can be write-erase as many times as possible because it use FLASH memory technology. It has a total number of 40 pins and there are 33 pins for input and output.

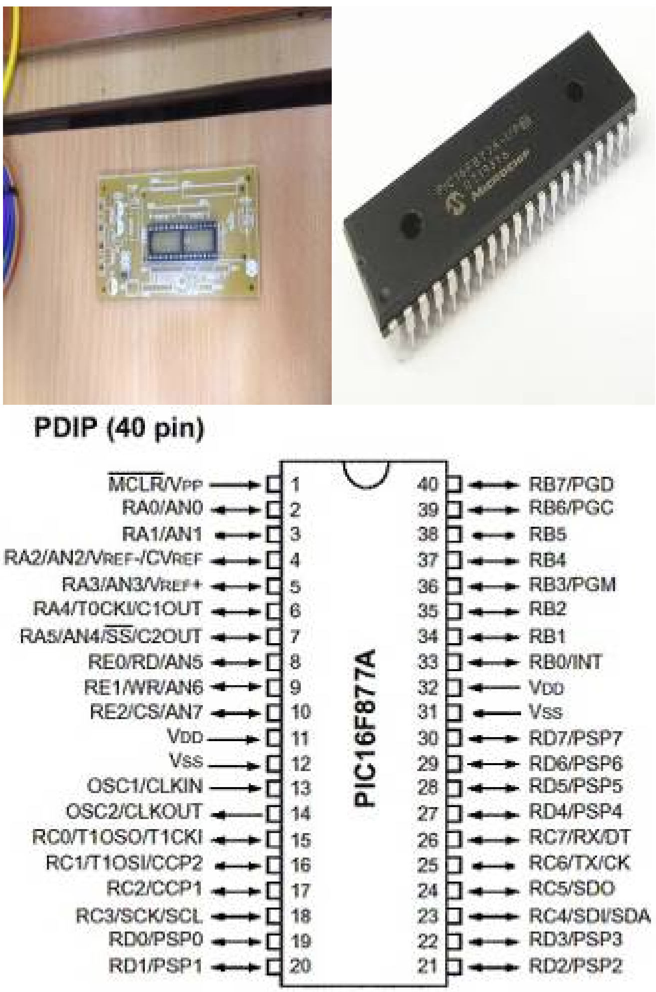


Fig 1.PIC microcontroller

B. Temperature sensor

The LM35 series are precision integrated-circuit temperature devices with an output voltage linearly-proportional to the Centigrade temperature. The LM35 device has an advantage over linear temperature sensors calibrated in Kelvin, as the user is not required to subtract a large constant voltage from the output to obtain the convenient Centigrade scaling. The LM35 device does not require any external calibration or trimming to provide typical accuracies of ±¼°C at room temperature and ±¾°C over a full −55°C to 150°C temperature range.

Fig 2.Temperature sensor

C. Heartbeat sensor

The basic heartbeat sensor consists of a light emitting diode and a detector like a light detecting resistor or a photodiode. The heartbeat pulse causes a variation in the flow of blood to different regions of the body. When a tissue is illuminated with the light source, i.e. light emitted by the led, it either reflects (a finger tissue) or transmits the light(earlobe). Some of the light is absorbed by the blood and the transmitted or the reflected light is received by the light detector. The amount of light absorbed depends on the blood volume in that tissue. The detector output is in from of electrical signal and is proportional to the heartbeat rate. This signal is actually a DC signal relating to the tissues and the blood volume and the AC component synchronous with the heart beat and caused by pulsatile changes in arterial blood volume is superimposed on the DC signal. Thus the major requirement is to isolate that AC component as it is of prime importance. To achieve the task of getting the AC signal, the output from the detector is first filtered using a 2 stage HP-LP circuit and is then converted to digital pulses using a comparator circuit or using simple ADC. The digital pulses are given to a microcontroller for calculating the heat beat rate, given by the formula

BPM(Beats per minute) = 60*f

Where f is the pulse frequency

Fig 3.Heartbeat sensor

D. Pressure sensor

Aneroid (or clock face) devices which also depend on auscultation are gaining popularity, as are devices which depend on oscillation. Oscillatory devices produce a digital readout and work on the principle that blood flowing through an artery between systolic and diastolic pressures causes vibrations in the arterial wall which can be detected and transduced into electrical signals. With an oscillatory device, a cuff is inflated over the upper arm or wrist. The new models use "fuzzy logic" to decide how much the cuff should be inflated to reach a pressure about 20 mm Hg above systolic pressure for any individual. When the cuff is fully inflated to this pressure, no blood flow occurs through the artery. As the cuff is deflated below the systolic pressure, the reducing pressure exerted on the artery allows blood to flow through it and sets up a detectable vibration in the arterial wall. When the cuff pressure falls below the patient's diastolic pressure, blood flows smoothly through the artery in the usual pulses, without any vibration being set up in the wall. The Vibrations occur at any point where the cuff pressure is sufficiently high that the blood has to push the arterial wall open in order to flow through the artery. The vibrations are transferred from the arterial wall, through the air inside the cuff, into a transducer in the monitor that converts the measurements into electrical signals. These digital devices deflate at about 4 mm Hg per second, making them sometimes seem slower to use than auscultatory aneroid devices, but they are more accurate.

Fig 4.Pressure sensor

E. ECG sensor

This sensor is a cost-effective board used to measure the electrical activity of the heart. This electrical activity can be charted as an ECG or Electrocardiogram and output as an analog reading. ECGs can be extremely noisy, the AD8232 Single Lead Heart Rate Monitor acts as an op amp to help obtain a clear signal from the PR and QT Intervals easily. The AD8232 is an integrated signal conditioning block for ECG and other biopotential measurement applications. It is designed to extract, amplify, and filter small biopotential signals in the presence of noisy conditions, such as those created by motion or remote electrode placement. The AD8232 module breaks out nine connections from the IC that you can solder pins, wires, or other connectors to. SDN, LO+, LO-, OUTPUT, 3.3V, GND provide essential pins for operating this monitor with an Arduino or other development board. Also provided on this board are RA (Right Arm), LA (Left Arm), and RL (Right Leg) pins to attach and use your own custom sensors. Additionally, there is an LED indicator light that will pulsate to the rhythm of a heart beat.

Fig 5.ECG sensor

F. Respiration sensor

Thermistor based measuring system is used to measure the breathing rate of the patients. The thermistor is mounted inside a mask which is worn by the patient. The mask is a standard nebulizer mask that is used by asthma patients. The thermistor is mounted inside the mask so that it is directly in front of the patient's mouth. As the patient breaths the hot air from the patient's breath changes the resistance (Rth) of the thermistor. As a result, the voltage across the thermistor (Vth) will also change proportionally to how the patient breaths. We can therefore use Vth as an indirect measurement of how the patient is breathing.

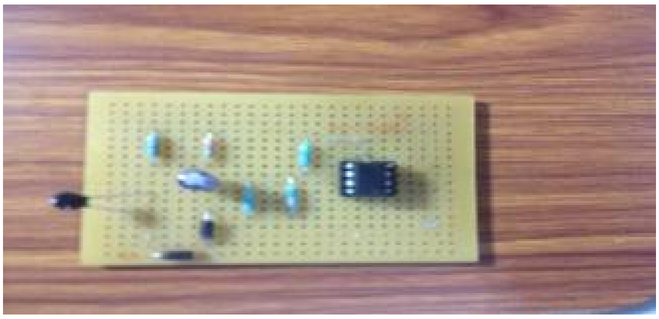


Fig 6.Respiration sensor

G. Global System for Mobile communication

GSM/GPRS Modem-RS232 is built with Dual Band GSM/GPRS engine- SIM900A, works on frequencies 900/ 1800 MHz. The Modem is coming with RS232 interface, which allows you connect PC as well as microcontroller with RS232 Chip(MAX232). The baud rate is configurable from 9600-115200 through AT command. The GSM/GPRS Modem is having internal TCP/IP stack to enable you to connect to the internet via GPRS. It is suitable for SMS, Voice as well as DATA transfer applications in M2M interface. The onboard Regulated Power supply allows you to connect a wide range unregulated power supply. Using this modem,you can make audio calls, SMS, Read SMS, attend the incoming calls and internet ect through simple AT commands.

Fig 7.Global System for Mobile communication

H. Zigbee

ZigBee is an open global standard for wireless technology designed to use low-power digital radio signals for personal area networks. ZigBee operates on the IEEE 802.15.4 specification and is used to create networks that require a low data transfer rate, energy efficiency and secure networking. It is employed in a number of applications such as building automation systems, heating and cooling control and in medical devices.

Fig 8. Zigbee

III. Cad Design.

Computer-aided design (CAD) is the use of computer systems (or workstations) to aid in the creation, modification, analysis, or optimization of a design. CAD software is used to increase the productivity of the designer, improve the quality of design, improve communications through documentation, and to create a database for manufacturing. CAD output is often in the form of electronic files for print, machining, or other manufacturing operations. The term CADD (for Computer Aided Design and Drafting) is also used.

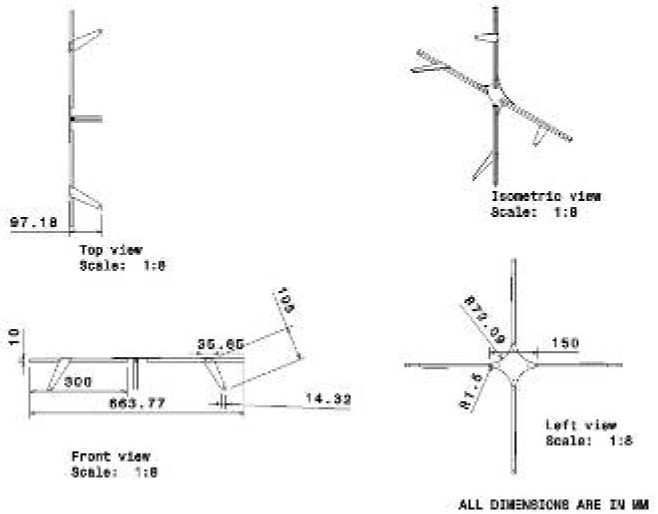


Fig 9.Cad Design.

IV. Quadcopter calculation

This equation is used to find the thrust, velocity, mass of the vechile.

Power= Prop Const* rpm$^{\text{Power factor}}$ (1)

$T=\frac{\pi}{4}D^2\rho v\Delta v$ (2)

T=thrust[N]

D=propeller diameter[m]

v=velocity of air at the propeller [m/s]

Δv=velocity of air accelerated by propeller [m/s]

ρ=density of air [1.225 kg/m^3]

$$T=\frac{\pi}{8}D^2\rho v(\Delta v)^2 \quad (3)$$

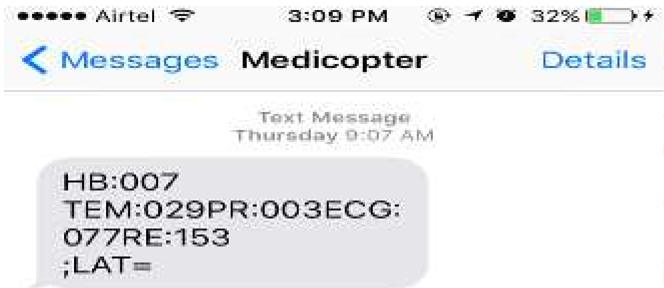
$$P=\frac{T\Delta v}{2} \square \Delta v = \frac{2P}{T} \quad (4)$$

$$T=\left[\frac{\pi}{2}D^2\rho P\right]^{1/3} \quad (5)$$

$$m=\frac{\left[\frac{\pi}{2}D2\rho P\right]^{1/3}}{g} \quad (6)$$

Where $g=9.81\ m/s^2$

After monitoring patient heart beat,ECG and temperature, the readings are transmitted to the ground station mobile as shown in the below fig 9.Using Medicopter the immediate condition of the patient through SMS and Lab view.



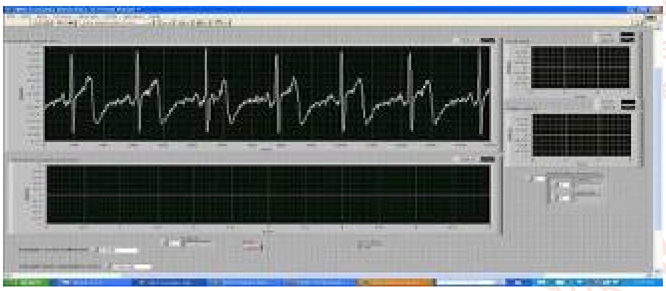


Fig 9.Lab view output Heartbeat of the patient

V. Conclusion

Thus the sensors programmed using the MPLAB software and made simulation using Proteus software and compiled the program into the EEPROM. The sensors on the body of the patient, compared the readings with the instruments in the hospital and confirmed the readings are correct. Using Medicopter the immediate condition of the patient through SMS and Lab view. The maximum speed of the quadcopter is 100kmph which will reach the destination very fast before the ambulance. In the future we will create an android app to locate the destination of the accident zone. By changing the Lipo battery to hydrogen fuel cell that will increase the endurance of the quadcopter from min to hours.

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