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An Emergency Intelligent Rescue System for Public in Sustainable Cities

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Abstract. In this modern industrialized world, Sustainable Cities have developed several rescue systems with latest technological provinces like camera, IoT's etc. Though the systems are quite advanced, it becomes difficult to rescue the public during emergency situation, particularly cardiac patients who need immediate medical attention. Especially when the ambulance carrying the patient gets stuck in traffic congestion leading to delayed medical care, it results in instant fatality. To overcome this issue and save the critical patients, an Intelligent Rescue System(IRS) has been developed to assist the people during emergency situation. The system uses an Automatic External Defibrillator (AED) apparatus that uses an electric current to safeguard the person within the short time frame until the ambulance reaches to the destination. Moreover, this system observes the condition of the patient constantly with the help of embedded medical sensors and also works efficiently to track and locate the exact tragic accident sites through GSM.

Keywords. Intelligent Rescue System, external defibrillator, sensor, tracking, traffic congestion

1. Introduction

Generally, emergency situation to public on account of manmade problems and natural disasters [1] is on the higher side of rate. However, unexpected accident victims and patients requiring emergency care should be attended immediately to avoid serious threat to public life. In recent times, the loss of human life due to accidents and delayed medical attention of critical cardiac patients is on the higher side. The main reason for the increased death toll is due to the delay in the much required immediate medical attention as the ambulance carrying the critical patients is not able to reach the medical centers on time. Many researchers are working in this field to find a suitable and efficient system to overcome this critical problem.

During a critical situation, information will be communicated to the ambulance provider for emergency assistance [4]. Thus, the ambulance will be provided to the patient from the nearest service provider. Time is one of the important factors to save the critical patients. However, traffic congestion, wrong information about the location, distance to the patient location etc. will increase the travel time for the ambulance to reach the destination [2][3] especially in cities. To overcome this problem, an Intelligent Rescue System(IRS) has been developed where the pin point

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location of the patient is exactly tracked using GSM and with the help of AED, an emergency situation can be handled effectively and human loss can be avoided.

2. Related Work

The very fact that Robotic alternatives could achieve success in human failures entitles them to function in elevated roles in society beyond that of just service entities, but as allocators of resources of people [5].Learning the basicfunctionalities of the various components is very important to design a multidimensional system for testing the theoretical ideology of the existing environment. There are 3 distinct dimensions, namely, technology, people, and community. The differences in the methods leads to confusion and also becomes complicated during usage of alternate methods[6].

The development of new smart technologies which can provide advanced medical services to the community of smart cities is still incomplete and this paper is aimed at presenting a possible and feasible solution for one of the significant problems that is being arise in modern cities. Even though, AED supports many functionalities in a variety of public places, researchers are motivated to extend its purpose and usage in handling it with a help of designing an intelligent robotic system. This system can perform crucial tasks in case of emergency for rescuing the public in cities. The actual scenario in the sustainable cities indicate the difficulties in finding the nearby AED in a panic situation in as much as initiating the operations on the victim which is arduous task on its own. Also, to get familiarized with the AED, it is required to engage more people having the basic awareness to operate it.

3. Proposed Work

Intelligence Rescue System(IRS) will serve as an effective and successful platform to save human life during cardiac emergencies. The two techniques, which can be used to keep the critical cardiac patients alive are Body-attached sensor and mobile phone application.

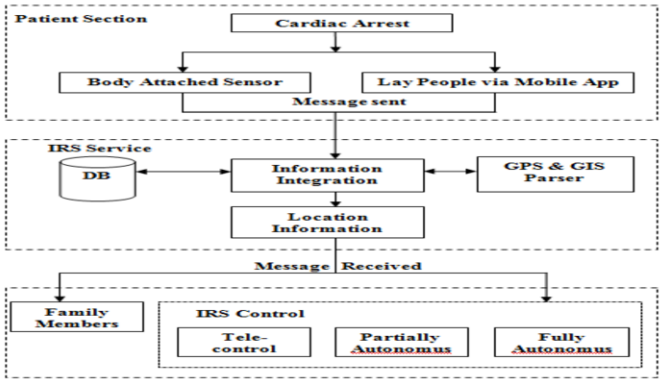

Figure 1. Operational Flowchart of Intelligence Rescue System

Figure 1 illustrates the operational flowchart of Intelligence Rescue System, which comprises 3 sections, namely, Patient Section, IRS Service Section and IRS

Control Section. The proposed system contains the patient section where GSM is incorporated inside utilizing RS232 port for the information transfer. This is an embedded platform connected with Global Positioning System(GPS) for tracking the exact location of the patient in short span of time using the global navigation satellite system. This unit are supported by a Micro-controller which is attached to a Heart beat sensor and the BP sensor.

The ATmega328 is a single-chip microcontroller which can perform efficient controlling instructions in a single clock cycle, thus allowing the designed system to reduce or control the power consumption according to the processing speed. The AD8232 Single Lead Heart Rate monitor is used to compute the electrical movement of the heart. The digital pulsation are recorded by a microcontroller for calculating the heart beat rate and calculated by

BPM (Beats per minute) = 60*f**(1)**

Where f is the pulse frequency. The LCD display is used to provide the output in a digitalized and viewable manner.

The IRS service section has a Micro-controller which is attached to the Motor relay and wheels of the robotic vehicle. The Arduino Uno is an open-source microcontroller board with the arduino IDE for communicating with a computer, another arduino board or other microcontrollers. The IR sensors[10] along with the DC Battery are also observed in this section which measures the heat of an object and also detects the motion by emitting infrared light emitting diode. A photo diode gives response in term of change in the resistance when light falls on it. The motor relay is an electromagnetic switch whose basic function is to allow a low power control voltage to operate a high power switch. The control and the switch are electrically isolated from each other having their own voltage and current ratings/requirements. The Zigbee RSSI is used for communication between the various sections in this project. Finally the control section has an operationalPC in which the Zigbee acts as a Transceiver.

4. Result and Discussion

In this proposed system, Code Composer Studio has been used to program the PIC microcontroller where arduino IDE is used to create a platform for displaying values on the PC. Whenever the pulse of the patient raises than a normal pulse, a signal called emergency is sent to the Intelligence Rescue System where it computes the distance with the help of GSM to reach the patient. Apart from this, an emergency alert is sent to the concern mobile number and to the University web page as well.

S.No	Date	ambubot Value
1	2019-03-11 08:41:22	1
2	2019-03-12 11:41:12	ALERT
3	2019-03-12 04:19:48	ALERT
4	2019-03-12 04:19:57	ALERT
5	2019-03-12 04:30:26	ALERT
	2019-	

Figure 2. ObservedValues

Figure 3. Input pulse exceeds normal pulse

Figures 2 and 3 depict the signals through Zigbee and PIC control from the transmitter when the heart beat senses the patient's pulse. The patient location is found out with the help of the signal obtained by the receiver. Once the emergency signal is received, automatically the IRS reaches the patient location from its source station and also the message is passed to the patient family members.

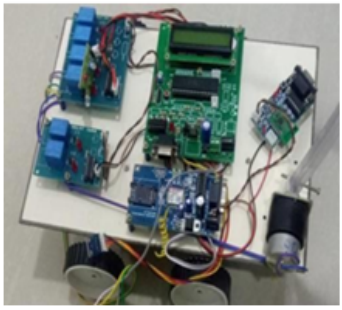

Figure 4. Intelligence Rescue System in Operation Figure 5. Emergency Messages

Figure - 4 indicates the prototype of the operation and Figure-5 shows the alert messages to the family members, thereby making the automatic Intelligence Rescue System to serve as a platform for saving someone's life during cardiac attack /arrest. During the first review, the heart beat sensor and infrared sensor have been interfaced in the arduino which enables the IR sensor to detect the entry of the patient into the ambulance immediately. The heart beat sensor automatically starts sensing pulses and displays the pulse value in the LCD. If the IR sensor detects no obstacle then no pulse value will be displayed.

5. Conclusion

The proposed Intelligence Rescue System is used to provide the service of an ambulance fitted with AED, which can assist anyone developing a sudden cardiac arrest. When there is a sudden variation in electrical impulses of the heart, the normal functioning of the heart is disturbed and leads to a cardiac arrest. This may occur either

instantaneously or within a short period after developing symptoms. Early access to AED can be a life saving measure in the event of someone suffering a sudden cardiac arrest.

This paper deals with a special intent to improve the Intelligence Rescue System which can immediately search the AED to treat the patients having cardiac attack / arrest. The dispatch process of the Intelligence Rescue System from its docking station to the patient location can be executed by three different modes viz., tele-control, partially autonomous and fully autonomous.

Future research of this project can focus primarily on upgrading of the autonomous functionalities of the Intelligence Rescue System while parallely working on other extra aspects such as the ability to attach the sensor onto the patient's body which can continuously monitor the condition of the patient and transmit the information to concerned specialists who can evaluate the patient's health condition. This future research will provide better results and can save the precious life of a person during cardiac arrest. The findings will also lessen the burden of the rescuers to find an AED near the premises. By this purposeful and fruitful research, more practical and commercial values to the society can be implemented in addition to improving the life expectancy and value of other people's life.

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