Scientific Journal of Impact Factor (SJIF): 5.71

e-ISSN (O): 2348-4470
p-ISSN (P): 2348-6406

International Journal of Advance Engineering and Research Development

Volume 5, Issue 03, March -2018

ROBOTIC AUTOMATED SERVICE ASSISTANT FOR EMERGENCY MEDICAL SERVICE IN SMART HOSPITALS/CITIES.

Rishabh Chaturvedi[1], Ashish Mishra[2], K.Suganthi[3]

[1]*Department of Electronics and Communication Engineering, SRM Institute of Technology, Chennai, India.*
[2]*Department of Electronics and Communication Engineering, SRM Institute of Technology, Chennai, India.*
[3]*Department of Electronics and Communication Engineering, SRM Institute of Technology, Chennai, India.*

Abstract-*Humans normally have very short time to find the victims in case of an accident; otherwise the chances of finding the victims still alive are negligible. For handling this situation and providing the first primary medical help to the patients a robotic automated ambulance is developed.*
A mobile robot would be able to travel throughout the environment and can put their position wherever it's in condition. With the help of multiple sensors interfaced with a microcontroller and used for navigation, this robot will able to traverse from a point to a given destination in the correct path without hitting obstacles.
An android application is developed which will be used by the user to send the location of the accident to robot. The robot will reach the desired location. LM35 temperature sensors and LM358 pressure sensors will check for the patient pulse and heart beat and information will be send to the hospital registered with the robot via message through the GSM module.

Keywords-*Android application, GSM Module, Microcontroller, LM35 temperature sensor, LM358 Pressure sensor.*

I. INTRODUCTION

The idea of high-end technology that can serve the people well and relieve humans of tiresome work has been an object of human imagination. Increasing population density in smart cities demands adequate provision of medical services.In recent years, the patient's health is measured and monitored manually. As an emerging platform for that operation, an automated robot can be deployed in order to facilitate the health care services as a smart operating machine in urban cities. There are various sensor types used for autonomous navigation in mobile such as vision and range sensors. Mobile robots are mostly used to investigate hazardous and dangerous environments where the risks for human operation exist. This robot can also be used to interact with human such as take care the elderly and doing household chores. In future smart cities, mobile robots can take over some tedious and time-consumingtasks. Even after the measurement of all the information about the patient's health, sometimes people forget to submit the details to the doctor. Wireless sensor networks application for physiological signals communication transmission has many technologies, such as the Infrared, Bluetooth and ZigBee, etc. In this prototype the aim is to use the medical robot with all the sensors to measure the patient's parameters. The movement of the robot are controlled by using the android app with the help of mobile and Bluetooth technology. The robot moves to the patient and measure the patient's health parameters like blood pressure and temperature and the measured information is displayed by using the LCD displayand information will be send to the hospital registered with the robot via message through the GSM module.

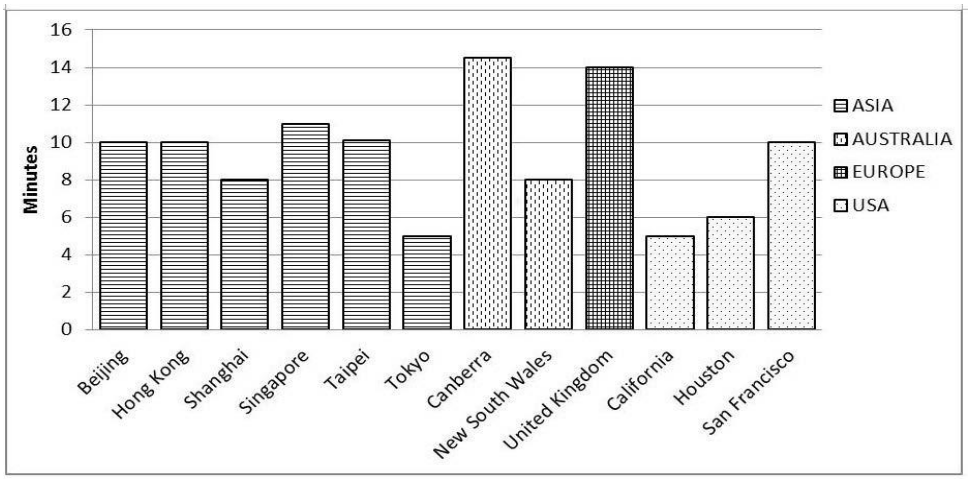

Figure 1. Response time of similar ambulance services in various countries.

II. ROBOTIC AUTOMATED MEDICAL VEHICLE

Working Principle, Model and Flowchart of the Robotic Automated Medical Vehicle are described as follows:

Working Principle:

The hardware design of the body-attached mainly consists of a gyro sensor, two Permanent magnet DC motor, a microcontroller (Arduino Uno), a GSM communication module, a twelve volts power supply, LM35 temperature sensor,LM358 pressure sensor, a 2x16 LCD Display Unit and a 2.47Ghz Bluetooth module. An android application is developed which communicates with the Bluetooth modules and send the data regarding the location of the patient as soon as he uses the android application. The robot is programmed to reach the already assigned location in its programmed database. After the Robot processes this data packet, it will generate two commands namely a command for dispatching the robot from the station to the scene as precaution to save patient life before ambulance arrives and other command for delivering an emergency message to family members via Global System for Mobile Communication (GSM) so they can obtain relevant information concerning the patient via mobile phone. Family members will be alerted through this. We also consider informing the nearest hospital after confirmation of the accident. The robot is capable of driving up to 15 km/hour.

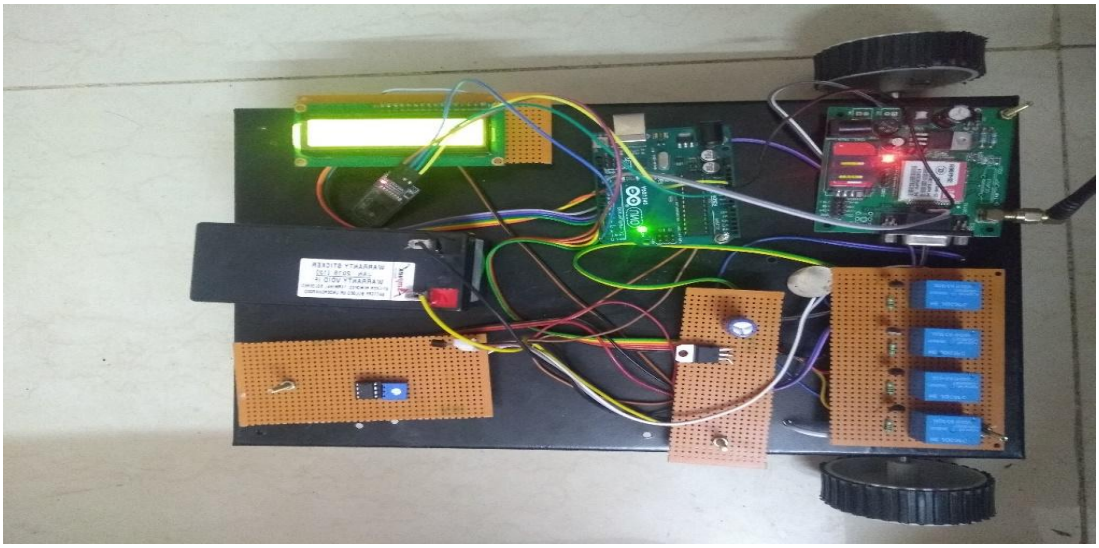

Fig 3. Cross sectional view of the robot.

PROTEAS SIMULATION: The Proteus Design Suite is a Windows application for schematic capture, simulation, and PCB layout design. The hardware simulation is carried out by placing various sensor modules and carrying out the simulation in various testing conditions to get the desired results. Testing the validation is an important part of the technology innovation process. The schematic is made and different sensor readings are extracted.

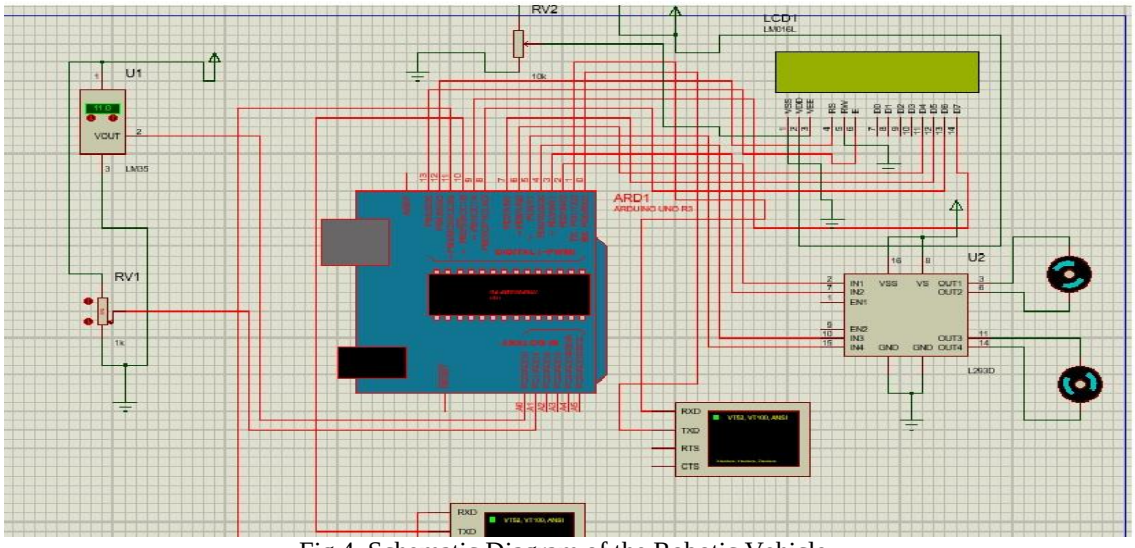

Fig 4. Schematic Diagram of the Robotic Vehicle.

When the patient presses the "Location 1" button on the dedicated app, the robot receives the signal from the Bluetooth module and the required digital signals are passed on to the relays connected to the two PMDC motors which initiate their movements with proper delay so that the movement of the robot is uninterrupted. The same movement of the motors has been shown in the given Schematic for "Location 1"and simulation has been carried out.

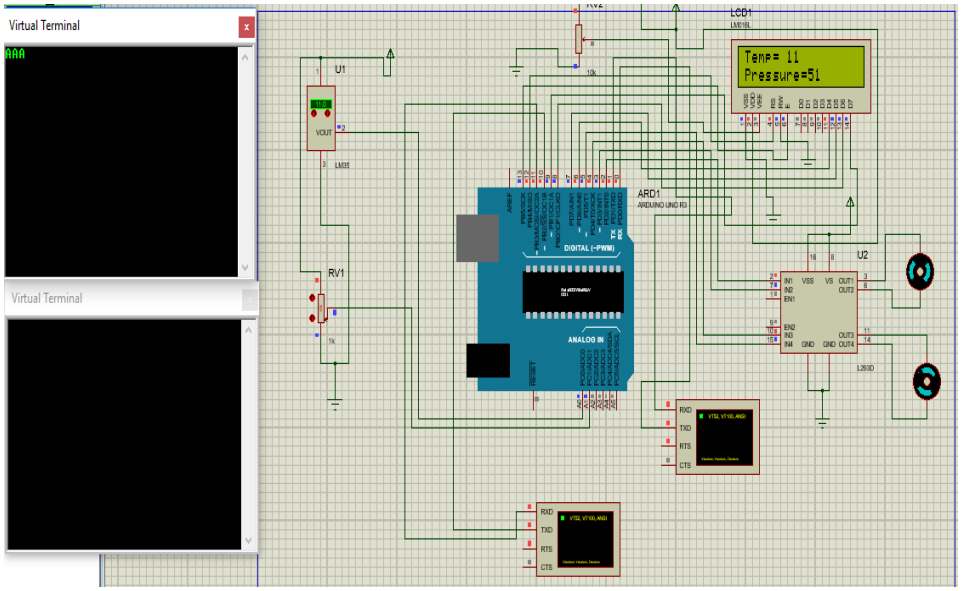

Fig 5. Schematic for "Location 1" motor movement.

III. SYSTEM MODEL/MEDHODOLOGY

The block diagram of our proposed model is given below:

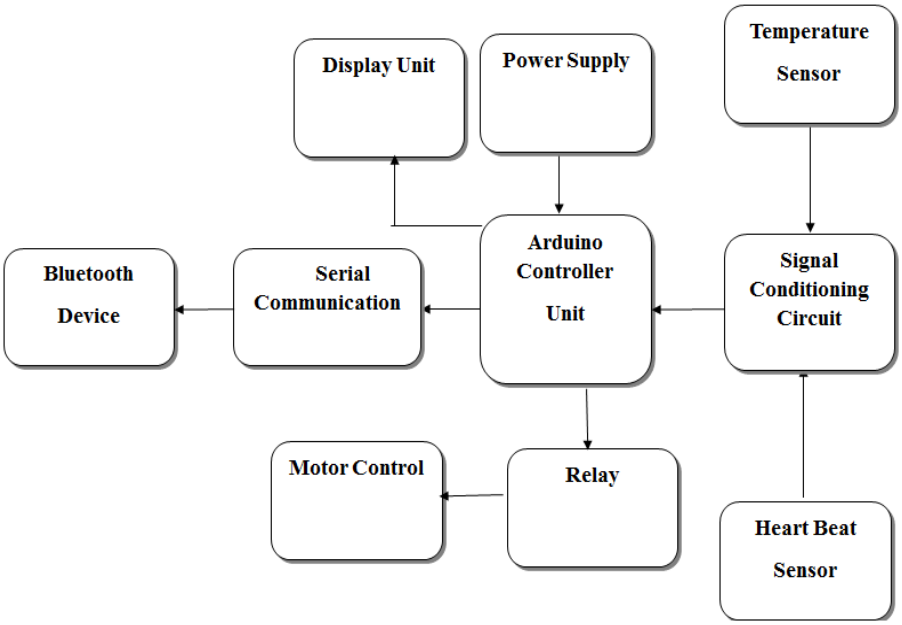

Fig 6: Block Diagram of Robot

A metal chassis is used as the robotic base for the robot. The robot base has 4 wheels, 2 of them are driven using DC motor driver and 2 are self-rotatory wheels based on the movement of two rear wheels. Arduino Uno is used as the controller used that will interface various other components and sensors. A USB 2.0 connector will power up the Arduino when connected to a PC or laptop. A 12V battery will be used to power the robot as the motor driver cannot be powered using 5V output from Arduino. A capacitor is used for filtering the excess current and a voltage regulator converts 12V from power supply to 5V that will power up other modules like Bluetooth module, LCD, relays. A Bluetooth module is required to establish

connection of robot with the an- droid app that will be developed which will be responsible for location tracking.4 relays of 5V each are required for back and forth movement of 2 rear wheels. For switching purpose of relays, 4 transistors and 4 resistors each reused.

III.1 OPERATION /WORKING

The movement of robot is incorporated using two 12V DC motor, one for each of the rear wheel. To display the variables that will be measured, will be displayed in 16x2 LCD. The variables measured will be temperature and pressure. A 1k potentiometer(pot) is used to maintain contrast of LCD.Temperature sensor will measure the patient's body temperature and the same will be displayed in the LCD.An operational amplifier is connected to the pressure sensor to increase its thresh- old value for measure. The sensitivity of the sensor can be varied using a 1k pot. Finally, if the measured value exceeds the threshold value set, the message will be sent to the mobile number entered in the Arduino code. Further, a GSM module, powered 12V from battery will relocate the message on the recipient mobile if the threshold value is exceeded.
An android application is to be developed which will be used by the user to send the location of the accident to robot. The robot will reach the desired location. Sensors will check for the patient pulse and measure temperature. Information will be send to the hospital registered with the robot via message through the GSM module. To ensure proper and faster service in case of an accident in a smart city. In the project, we will be developing an android application. This application developed will be synced with the robot for its operations.
The overall plan for working of this model is:

1. Assembling of robot.
2. App development.
3. Synchronizing and testing of whole robot.

The flow chart governing the overall working of the robot is given below:

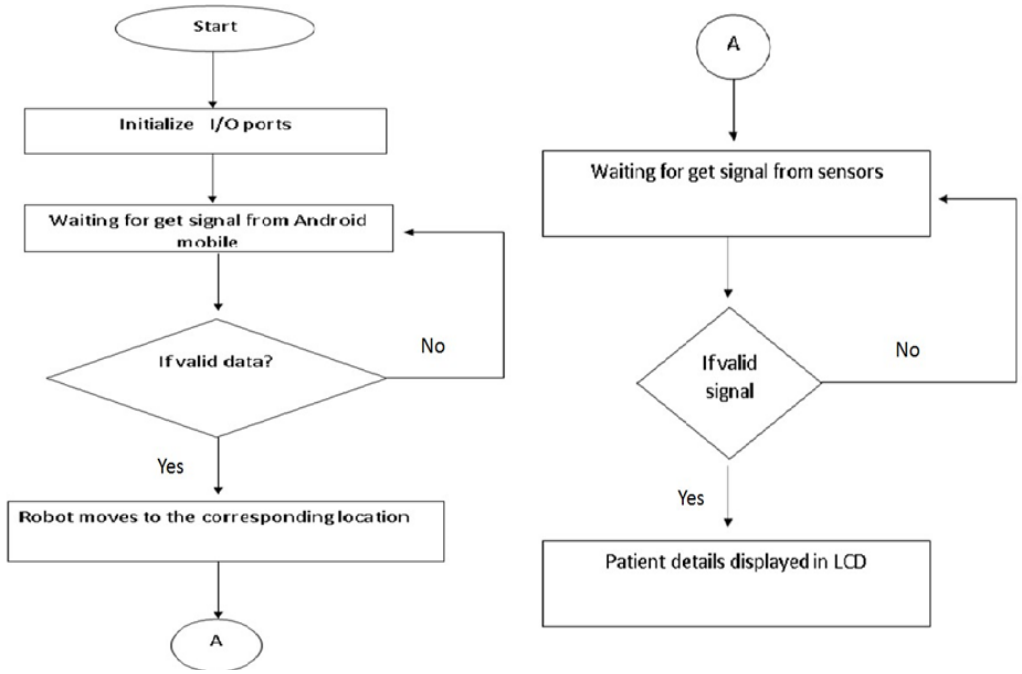

Fig 7: Flowchart

The Arduino Uno is interfaced with the laptop and using Embedded C coding in the Arduino software, other components are made to work accordingly. The 12V battery has two connections, one is Vcc i.e.12V supply and the other one is ground. These connections can be established sing two wires connecting other Vcc and ground connections respectively. The 1 mF Electrolytic capacitor is used for filtering purpose or removing un- wanted current signal and ensuring smooth power supplies 7805 voltage regulator regulates 12V power supply down to 5V.HC-05 Bluetooth module is connected to Arduino. The robot will be operated using this module only. This can be powered up through Arduino and we can see the availability of this module when we check for nearby available Bluetooth devices by the name of HC-05. The android app going to be developed will be interfaced using this module only. Electromagnetic relay that acts as a driver is used. These are used to switch the supply between 12V to 5V. The internal of a relay consists of an inductively coupled coil. Since, we are using 5V relays which consist of 5 pins each. 2 pins are connected through the coil. 3rd pin is used as a center-tapped transformer and using BC547 NPN transistor as a switch and 1k resistor for each relay, the relay is switched from 5V to 12V that is then fed

to the L293 DC motor driver that powers up the rear wheels and in turn, the robotic model moves. The temperature and pressure values will be shown in the alphanumeric LCD and if any of these values exceeds the threshold set by the user, the subsequent warning will be displayed. A piezo electric sensor is used as the pressure sensor. LM358 dual operational amplifier is used to increase the sensitivity value.

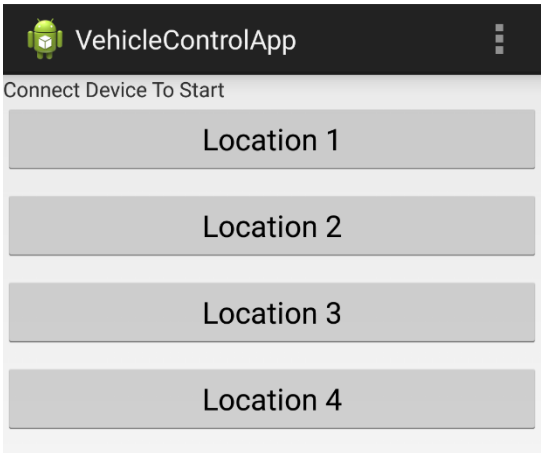

Fig 8: User Interface of the Android App used.

IV. CONCLUSION

In this paper, we explained the use of smart vehicle for smart city which can be implemented to intelligent vehicles based on their architecture. Many among these technology isreadily available in the market today and the rest of them are still on the development stage to guarantee safe and reliable operation. For this purpose, several sensors such as camera, ultrasonic sensor, and laser scanner are common modules for a mobile robot, which can be employed to any mobile robot.
New technologies for planning in mobile robots can also be implemented in order to organize and plan more intelligent behaviors.
In addition, following trends in mobile robots can change regarding action, behavior, and structure of the intelligent vehicles. For instance the common four-wheel cars can be modified into different actuation mechanisms in order to perform the vehicle with different degrees of freedom and flexibility. These trends in actuation can be adapted to vehicles to achieve novel architecture in future cars. Furthermore from the power point of view, current oil based power systems can be changed to electrical or solar energy, which is not practical yet.
This medical mobile robot was developed to implement emergency dispatching of robot with medical treatment. With using this system the patients do not have to spend precious time and pay inconvenient visits to have health checking at either hospitals or clinics because they can know about their health status directly at home. Patients can check their health by themselves easily and advices about their health status are displayed to them immediately. According to the type of biomedical signals that needs to be obtained from the patients, different types of pluggable transducers will be connected to the embedded system for signal acquisition. In future we aim to improve the hardware of the robot to more flexible structure such as omnidirectional.
We also consider improving the system from robot to multiple robots for collaborative performance and user will be able to monitor the patient wherever they are.

REFERENCES

[1]http://www.electronics-lab.com/articles/LM317/
[2] H. Ning et al., “From Internet to smart world”, IEEE Access, vol. 3,
pp. 1994_1999, Oct. 2015.
[3] R. Jalali, K. El-khatib, and C. McGregor, “Smart city architecture for community level services through the Internet of Things”, in Proc. IEEE 18th Int. Conf. Intell. Next Generat. Netw. (ICIN), Feb. 2015, pp. 108_113.
[4] M. Arif, H. Samani, C.-Y. Yang, and Y.-Y. Chen, “Adaptation of mobile robots to intelligent vehicles”, in Proc. 4th IEEE Int. Conf. Softw. Eng. Service Sci. (ICSESS), May 2013, pp. 550_553.
[5] Y.-C. Lin, S.-T. Wei, S.-A. Yang, and L.-C. Fu, “Planning on searching occluded target object with a mobile robot manipulator”, in Proc. IEEE Int. Conf. Robot. Autom. (ICRA), May 2015, pp. 3110_3115.
[6]C.-P. Lam, C.-T. Chou, K.-H. Chiang, and L.-C. Fu, “Human-centered robot navigation_Towards a harmoniously human_robot coexisting environment”, IEEE Trans. Robot., vol. 27, no. 1, pp. 99_112, Feb. 2011.

[7]T. Yonezawa, I. Matranga, J. A. Galache, H. Maeomichi, L. Gurgen, and T. Shibuya, "A citizen-centric approach towards global-scale smart city platform", in Proc. Int. Conf. Recent Adv. Internet Things (RIoT), 2015, pp. 1_6.
[8] K. Nagatani et al., "Redesign of rescue mobile robot Quince", in Proc. IEEE Int. Symp. Safety, Secur., Rescue Robot. (SSRR), Nov. 2011, pp. 13_18.
[9] E. Liu and E. Wong, "Emergency ambulance services", Central Government Of_ces, Hong Kong, Tech. Rep. RP15/95-96, 1996.
[10] H. A. Samani, J. T. K. V. Koh, E. Saadatian, and D. Polydorou, "Towards robotics leadership: An analysis of leadership characteristics and the roles robots will inherit in future human society", in Intelligent Information and Database Systems. Berlin, Germany: Springer, 2012, pp. 158_165.
[11] T. Nam and T. A. Pardo, "Conceptualizing smart city with dimensions of technology, people, and institutions", in Proc. 12th Annu. Int. Digital Government Res. Conf., Digit. Government Innov. Challenging Times, 2011, pp. 282_291.

