Ambubot for Emergency Medical Service in Smart Cities

Bhagyashree[1] Parinitha[2] Purvitha[3] Savita[4] Prof. Vanishree Abhay[5]
[1,2,3,4]Student [5]Assistant Professor
[1,2,3,4,5]Dr. Ambedkar Institute of Technology, Bangalore, India

Abstract— the paper that we are presenting provides smart solution for the emergency medical service by using an Ambubot. In this modern era people need their work done by monitoring in the remote location. Time plays a crucial role when dealing with people who face sudden health issue that unfortunately could suffer due to the inaccessibility of emergency treatment. In this paper, we have discussed the model where the temperature sensor and the heartbeat sensor are implemented in the robot.

Key words: Smart Cities, Emergency Medical Service, Ambubot

I. INTRODUCTION

The concept of high-tech machine being used today would relieve the effort of human beings which are done manually. The increasing population leads to the difficulty in manual operation, such as traffic congestion, health concern and air pollution. As we are dealing with the health concern, an emerging platform, Ambubot can be employed in order to facilitate the health care operation as a smart operating vehicle in smart cities. The Ambubot is an autonomous machine that is capable of moving around the environment and perform the various tasks which is controlled under human supervision. An Android application called 'Ambubot' is created and it should be installed in the smartphones of the patient or the users. Once the application is opened, the user needs to click the Ambubot icon in that, where an SMS is sent to the nearest Ambubot center along with the location of the patient. As soon as the Ambubot receives the message and the location of the patient, it starts towards the patient with the first aid kit, and some medical requirements in it. The Ambubot sends the message to the concerned doctor about the condition of the patient. Surrounding people can assist the patient with the first aid kit by communicating with doctor. The doctor number will be displayed on the robot. It can also be operated by using a solar panel (renewable energy).

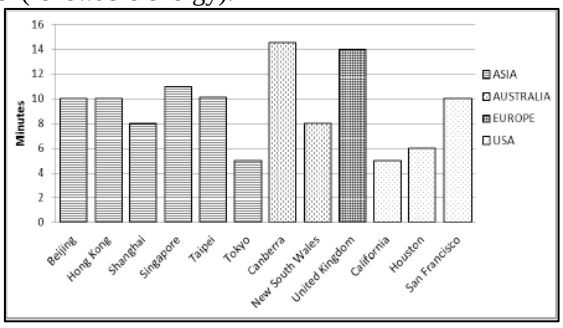

Fig. 1: Time taken for the ambulance to arrive

According to general survey, the time taken for the ambulance to arrive is shown in the graph given above. We usually call an ambulance by dialing a three-digit number, for any medical emergency. The ambulance takes an average of ten minutes or beyond that to reach the specified location of the patient. The reason maybe the problem in dispatching the ambulance or traffic congestion which delays the arrival time of the ambulance. In order to tackle these problems, we have illustrated the idea of Ambulance Robot.

II. BACKGROUND

The development of Ambubot is essential for rescuing people who suffer from natural and manmade disasters and these robots could be used in diverse situations. There are two types of Ambubot and they are Rescue Robot and Medical Robot. This paper is mainly based on Medical Robot.

Medical robots are produced for industrial sectors which have substituted human involvement in perilous and adverse tasks. From the past few decades the usage of robots in industries have grown strongly. But the enlargement of robot in the working sector is still restricted, which are called as the service robots that performs business for people. Service robots are capable of interacting with humans and work independently. Medical robots have a wide range of applications in the field of medicine for the researchers as well as for the public.

III. SYSTEM DESCRIPTION

Ambubot is being proposed as a platform to save someone's life through any health issue. This robot is categorized into three different types based on degree of autonomy. It includes Tele-control Robots, Moderately Autonomous Robots, and Autonomous Robots. The patient's life can be saved using the robot which is controlled by the Mobile Phone Application. Through this application, the message regarding the patient's condition and the location of the patient is sent to Ambubot center. Using the GPS and GIS parser, Ambubot converts the longitude and latitude coordinates into a street map location. This data is processed by an Ambubot and it generates two commands. One command is for dispatching Ambubot from the Ambubot station to save the patient's life before the arrival of the ambulance and another command is used to send an immediate message about the patient condition to the family members through Global System for Mobile application. This message notifies the family members about the condition of the victim so that they can take some precautions till the ambulance arrives. Ambubot reaches the location of the victim with high speed. Advantage of this Ambubot is that it will not face the lateness problem due to traffic that is faced by an ambulance. The Ambubot is controlled by an Android Application specifically designed for Admin, who controls the Ambubot. Robots are not intelligent enough to execute the given task so pliability and human brilliance plays an important role in Partially Autonomous Ambubot. GPS information of the victim is sent to the Ambubot station. The main server located here computes the shortest path and sends it to the robot. According to the information given by the Ambubot center, the Ambubot reaches the destination of the victim. The cameras are mounted on the robot so that it records the present position of the robot and also the condition of the patient. Hence it gives the clear picture to the doctor about the

patient's condition. There is an human intervention in controlling the Ambubot through Mobile Phone application.

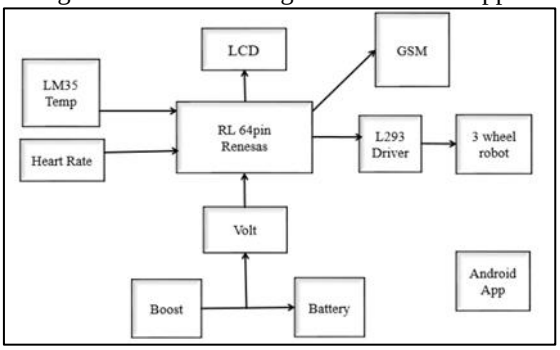

Fig. 2: Block diagram of Ambubot

IV. HARDWARE REQUIREMENTS

A. Renesas Microcontroller Unit

R5F100LEA microcontroller from Renesas RL78 series which is a 16bit microcontroller that has been used to design an Ambubot. Renesas Microcontroller has three units they are Power, Control and Communication units. The maximum power voltage is 12volt or less than that is constant. To make Microcontroller to process the data, we need to dump the code into Microcontroller using Renesas Flash Programmer. The RS232 cable or DB9 connector or USB-to-serial cable are used for communication.

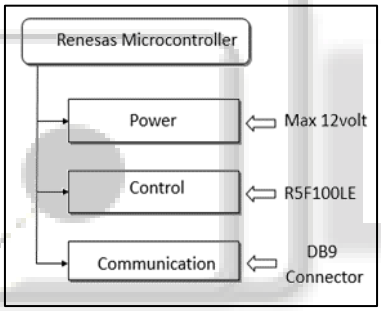

Fig. 3: Renesas Microcontroller

B. Liquid Crystal Display (LCD)

Liquid crystal layer is inserted between two electrodes. It is used as a user interface. It displays the messages sent from ambulance. It can take 16 characters which will be displayed in two lines and rest of them are truncated. LCD is used to display the latitude and longitude of the patient's location and even the directions of the robot in which it moves.

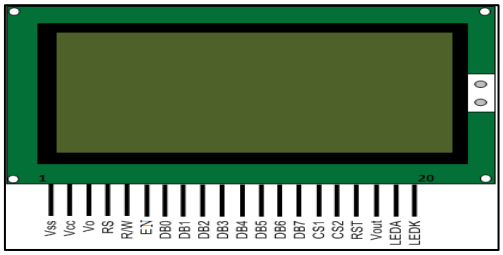

Fig. 4: Circuit Diagram of LCD

C. Global System for Mobile Communication (GSM)

GSM (Global System for Mobile Communication) is developed as a digital system using TDMA (Time Division Multiple Access) technology. GSM model can accept any GSM network operator SIM (Subscriber Identity Module). By this we receive the message from the patient through which the robot begins to move. It functions just like a mobile phone with its own distinct number.

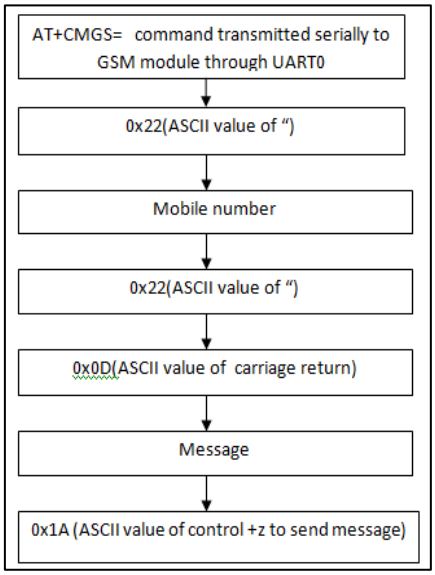

Fig. 5: Flow chart of GSM

D. Heart Rate Sensor

The heart rate sensor is normally used to give the digital output in the form of number of heart beats per minute. It is measured by placing any of the fingers of the patient or the user on the sensor. The sensor gives accurate output. The heart rate is measured based on the basis of the blood flow in the fingers. This principle is known as light modulation through blood flow.

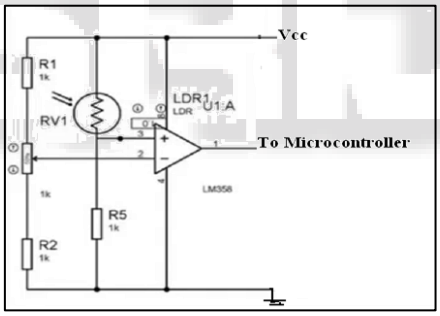

Fig. 6: Circuit Diagram of Heart rate sensor

E. Temperature Sensor

The temperature sensor is used to measure the body temperature. It can be divided into two types, one which produces the voltage naturally and the other produce some other physical response that must be converted to a voltage for measurement.

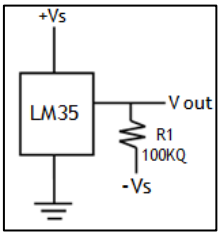

Fig. 7: Circuit Diagram of LM35

F. L293 Motor Driver

The L293 motor driver consists of two DC motors, one on either side. The current flows in clockwise as well as anti-clockwise directions. When the current starts flowing in anti-

clockwise direction there is a fluctuation in voltage, so to regulate the voltage we use L293 motor driver.

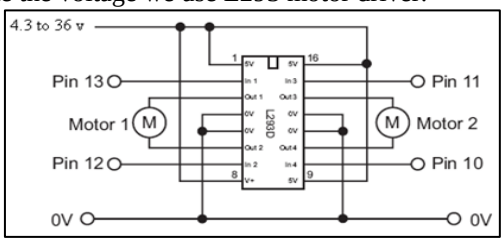

Fig. 8: Circuit Diagram of L293 Driver

V. TECHNOLOGY USED

A. *Eclipse V10*

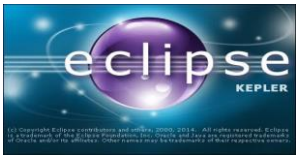

Fig. 9: Eclipse Kepler

Eclipse Kepler is an open-source, cross-platform software program that can run on any of the operating systems. Instructions for each platform are distinct. Before installing a new version of Kepler we need to uninstall any prior versions.

B. *MySQL*

Fig. 10: MySQL

SQL is a language to talk to the database or to access the database such as MySQL. MySQL is a freely available open source relational database Management system which make use of a SQL for processing the database with an ease and with a more reliability so that a user can access the database easily.

C. *Java*

Fig. 11: Java

Java is a programming language, a development environment, a deployment environment. Java is used for developing both applets and applications. Java actually refers to more than just a particular language like c or pascal. It is divided into three parts such as high-level language, java bytecode, java virtual machine.

D. *Cube Suite+*

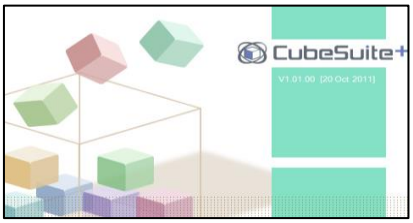

Fig. 12: Cube Suite+

Cube Suite+ is an IDE which is used for writing code in the phases of a project development. It provides all the basic software which is necessary for Renesas microcontroller in one package.

Cube Suite+ is used for writing code to display message in LCD and to track the location of a patient in GSM. It provides security in editing.

E. *Renesas Flash Programmer*

Fig. 13: Renesas Flash Programmer

Renesas Flash Programmer is software that erases, writes, and verifies program on the target system or program adapter on which a Renesas Electronics single-chip microcontroller with on-chip flash memory is mounted. Writing is controlled by the host machine and Graphical User Interface (GUI) specific to writing.

VI. IMPLEMENTATION

Implementation include registration page, user or patient login page and emergency detail page. During emergency, user or patient will send a message to Ambubot. Once after receiving the message, it tracks the location of the patient and moves towards the location. It sends the basic information to the doctor and in turn doctor reply.

A. *User Registration and Login*

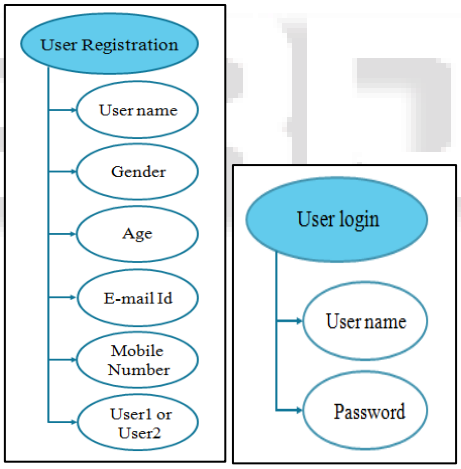

Fig. 14: User Registration and Login

The Android application needs to be advertised to the people, so that they can install in the mobiles easily and make use of the application. The user needs to get register and an One Time Password will be generated to interact with the Ambubot after logging into the application. Once user get registered they will be credited with the 200 points.

B. *Emergency Details*

In the Emergency service, we have included the options such as medical, accident, fire and theft. The user or patient can select the problem and can capture the present situation, it will be sent to the doctor. Based on the problem being selected by the user, the message will be sent to the Ambubot and it compute the GPS location through the given latitude and longitude. Then Ambubot reaches to the location and the particular assistance will be given to the selected problem. The doctor's number will be displayed on the LCD of the Ambubot. The user can call the doctor and the doctor will

notify the user with any first aid or treatment that is required to the patient.

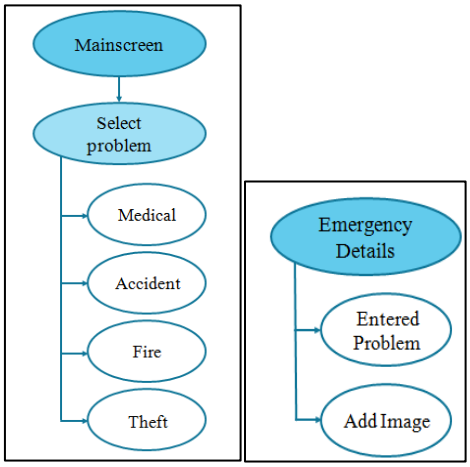

Fig. 15: Emergency Details

As and when person sends the information about the patient, he will be credited with the 200 more points, the credit points can be used as a concession when he is facing any problem with regard to medical, fire, theft or accident. The credit points keep on increasing 200 more points for each and every time he make use of the application by getting logging in.

VII. SNAPSHOTS

Fig. 16: User Registration

Fig. 17: User Login

Fig. 18: Main Screen Page

Fig. 19: Emergency Details

Fig. 20: Capturing Image

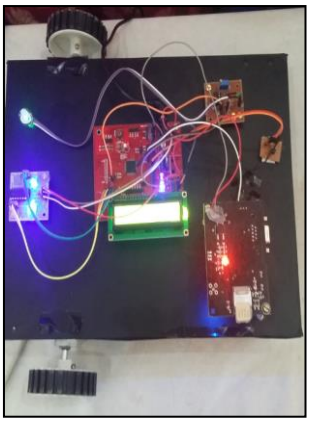

Fig. 21: Ambubot

VIII. CONCLUSION AND FUTURE ENHANCEMENT

Today we find robots working for people in industries, factories, warehouses, and laboratories. In this paper, we have described the usage of a robot in emergency medical service in short time when the person undergoes sudden variation in health. The dispatching of Ambubot is Autonomous. In the future scope, we are adding the camera to know the motion of the robot and the condition of the patient so that the doctor will be able to assist the patient with the proper guidance. We are also adding the Electrocardiogram (ECG) which checks the problem in heart like heart attacks, abnormal heart rhythms and we also add a sensor for identifying obstacles.

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