DESIGN OF AN INTELLIGENCE SAFEGUARD FOR SENIOR CITIZEN USING IOT

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***Abstract*— This paper is about the design of an intelligence safeguard for senior citizen, who will be monitored and rescued by a smart system during aberrant conditions. So far in India, emergency medical response lags behind other countries. When a person is met with an accident or facing abnormal conditions (medical emergency) there is no immediate source to bail him out from that situation. Over the last few years there is a revolutionary development in the field Internet of Things. This is a platform where enormous data can be accessed seamlessly. Here the IoT is accessed by a protocol, Message Queuing Telemetry Transport (MQTT) which is a medium to communicate between the machines and also to control them. Each and every action and functionality is accessed by the server using Raspberry pi. Intelligence safeguard has an inbuilt Global Positioning System (GPS) which detects the patient location. Vibration sensor is the initiator of the entire process. This entire scenario is monitored by the defined server. Patient's health information is monitored periodically and stored which is prior sent to the hospital. Once patient reached the hospital, a notification will be sent to their welfare. IoT based smart medical emergency system is to support the smart city vision, which aims at saving the senior citizen.**

***Index Terms*—Medical emergency, Ambulance, Hospital, MQTT, Raspberry Pi, GPS, Vibration sensor, Stored health information.**

I. INTRODUCTION

In today's era, there are many cities which are working on transforming themselves into Smart Cities. If the city is going to be called as Smart City, then it should have all possible advancements in the sector of smart technology. Improving efficiency in healthcare sector is one of the difficult and most challenging jobs. That includes various aspects such as getting ambulance within minimum amount of time, providing proper treatment to the patient and providing treatment at the right time, so that the chances of surviving increases in critical condition. Moreover road accidents in the city have become a major issue of grabbing the youngster's life. Chest pain, choking, bleeding, fainting, seizures are some common medical emergencies [1]. If an emergency occurs, the person should be aided first and then they should be taken to the hospitals. We are in the 21st century but still we lag in medical emergency response. There are so many silly issues that devastated people life such as lack of humanity, delay in arrival of ambulance, traffic congestion, time to record the basic health information of the patient (blood pressure, sugar level, blood group etc,.) and no prior setup for treatment. So to overcome all these problems we are designing an intelligence safeguard which will immediately take action if the person or citizen falls ill (health issues such as heart attack, low BP, brain stroke and disease like narcolepsy) suddenly or if he met an accident. Here we are forming a circuit with the components- GPS, Raspberry Pi, Vibration Sensor, Temperature Sensor and push buttons. This intelligence safeguard is a wearable which will have a database of basic health information of the senior citizen which is going to help when it is needed. There are so many additional advantages which overcomes glitches until a person is admitted in the hospital. This smart system which clears all the obstacles by alerting the ambulance once the person becomes unconscious, guiding the vehicle to the nearest hospitals and sending information prior to the hospital before the arrival of patient or alerting the hospital. [2] Poonam Gupta, Dharmanath Rahatekar, Avanti Patil and Satyasheel Pol explains about the smart ambulance system where each and every action is taken and patient is given the at most treatment in the ambulance itself. Here we are sending the monitored health information to the hospital prior to the arrival of ambulance. All the process takes place by establishing a central server. This entire scenario is accessed by Internet of things. Internet of things is a medium between two physical devices which makes normal devices smarter.

Internet of Things is an ecosystem of connected physical objects that are accessible through the internet. The embedded technology in the objects helps them to interact with internal states or the external environment, which in turn affects the decision taken [3]. The IoT allows objects to be sensed or controlled remotely across existing network infrastructure, creating opportunities for more direct integration of the physical world into computer-based systems, and resulting in improved efficiency, accuracy and economic benefit in addition to reduced human intervention. It is the ability of sending and receiving data over the internet.

IOT is a technology which converts normal things to smart things. Internet of things is automatic and controllable.

When IoT is augmented with sensors and actuators, the technology becomes an instance of the more general class of cyber-physical systems, which also encompasses technologies such as smart grids, virtual power plants, smart homes, intelligent transportation and smart cities. Each thing is uniquely identifiable through its embedded computing system but is able to interoperate within the existing Internet infrastructure [4].

II. THEORITICAL FRAME WORK AND DESIGN CONSIDERATION:

Raspberry plays the vital role, which acts as a gateway. So we have three modules namely safeguard module, hospital module and vehicle module. Hospital module and vehicle module are connected wirelessly to RPi by Internet Protocol.

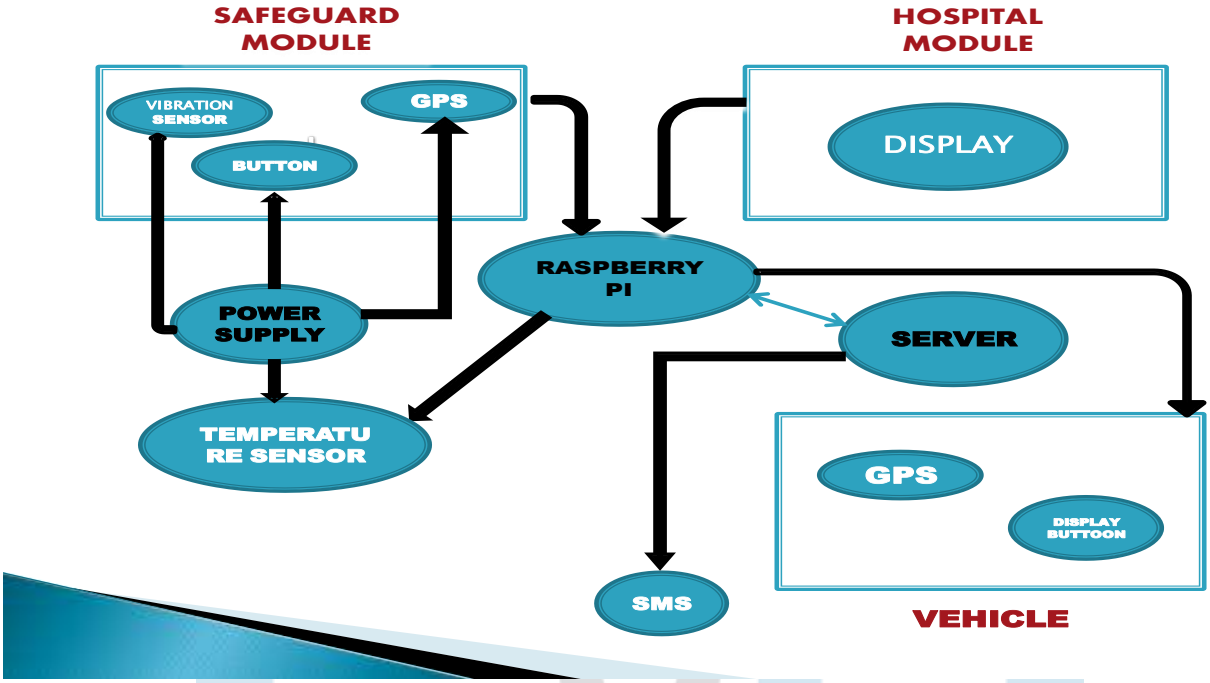

Figure 1 Block diagram of interfacing Raspberry pi 3

III. FUNCTIONAL DESCRIPTION

Vibration Sensor

- Vibration sensor works the principle of piezoelectric effect.
- Mechanical vibration to electrical pulse.
- It as data I/O pin, VCC and Ground pin.
- Vibration sensor activates the device
- Device is tapped by sensor, once the sensor is triggered
- Vibration is sensed by sensor and location of patient is sent to the ambulance.
- 5V supply is needed.

Raspberry Pi

- Platform to perform various operations.
- Special feature : Wi-Fi module
- It has 40 pins, USB port, Ethernet connection, Web cam and display.
- RPi pins can be accessed as GPIO, SPI, UART pins etc.,
- Two functionalities: CUI and GUI.
- CUI (Command User Interface) which controls by commands.
- Programming languages like Python, Java C etc, can be used.
- GUI- Graphic User Interface (E.g. : Node Red)
- Raspberry Pi 3 is an upgrade to a next generation main processor and improved connectivity with Bluetooth Low Energy (BLE) and BCM43143 Wi-Fi on board.
- Additionally, the Raspberry Pi 3 has improved power management, with an upgraded switched power source up to 2.5 Amps, to support more powerful external USB devices.
- The Raspberry Pi 3 four built-in USB ports provide enough connectivity for a mouse, keyboard, or anything else.

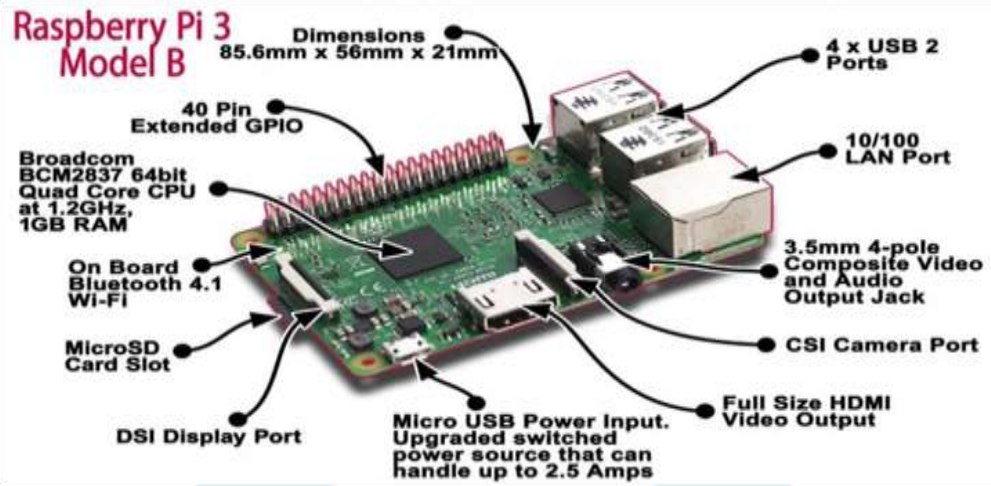

Figure 2 Components details for Raspberry Pi Model B

GPS Module

- The GPS receiver gets a signal from each GPS satellite.
- So given the travel time of the GPS signals from three satellites and their exact position in the sky, the GPS receiver can determine your position in three dimensions - east, north and altitude.
- When the GPS is enabled, the receiver in the phone receives input data from two or more satellites for determining accurate position.
- Antenna receives the information and sends to ambulance.

Mobile phones

Mobile phones are used as ambulance and hospital display. The ambulance display gets the location of the patient. The hospital display gets the patients health information and tracks the ambulance.

IV. TECHNICAL DETAILS

1) IOT- Interconnection via the Internet of computing devices embedded in everyday objects, enabling them to send and receive data.
2) MQTT- MQTT stands for MQ Telemetry Transport. It is publish/subscribe, extremely simple and lightweight messaging protocol, designed for constrained devices and low-bandwidth, high-latency or unreliable networks.
3) RASPBERRY PI- It is platform to perform various operations under the Raspbian OS. Raspbian comes with over 35,000 packages; pre-compiled software bundled in a nice format for easy installation on your Raspberry Pi. Raspberry Pi acts as both server and gateway. Gateway acts as a pathway which connects external and internal environment. Server is a computer that manages and control network traffic.
4) PYTHON- Python is a widely used high-level programming language. Python features a dynamic type system and automatic memory management and supports multiple programming paradigms. It has a large and comprehensive standard library.

Steps for setup of a device

- Format Secure Digital (SD) card which will be inserted in RPi.
- Download Raspbian OS in the SD card.
- Insert the SD card to the RPi memory card holder
- Install OS to Raspberry Pi.
- By the feature CUI of RPi, program is compiled and published automatically in the cloud iot.eclipse.org
- The file name is scm.py

V. CONNECTIONS

Vibration sensor pins are connected to raspberry pi pins (Data I/O pin to (General Purpose Input Output) GPIO 17, Vcc to Vcc, Ground to Ground). GPS module (with antenna) is connected port of RPi. Power supply is given to RPi and GPS module. RPi has a special feature i.e., Wi-Fi module. This Wi-Fi module gets connected to the modem or hotspot. Server is used (free global server iot.eclipse.org). Mobile phone is used as ambulance display, hospital display. All the mobile phones are connected to RPi which acts as gateway to server.

VI. PROCEDURE

Our intelligence safeguard is a smart automatic device. Controlling the traffic, alerting the hospital and informing the welfare are the three modules performed by the Intelligence safeguard system. The speciality of our Intelligence Safeguard is to store the basic health information of the citizen, personal details and welfare contacts. The main component of this intelligence safeguard is vibration sensor. The vibration sensor is triggered when the person is abnormal (unconscious, heart attack, any emergency during pregnancy etc...) or when met with an accident. Vibration sensor works under the principle of piezoelectric effect which converts mechanical vibrations to electrical pulses (0 and 1). Once the patient falls down, the vibration sensor detects the vibrations and triggers the RPi by sending either 0 or 1. The input is given as serial port input. Here we have programmed the RPi such that only after receiving 1 from vibration sensor it should accept the input from GPS module. Input bit '1' from vibration sensor indicates true statement. GPS module sends the exact patient location to the RPi. The RPi publishes the location to the server (iot.eclipse.org) by the protocol MQTT. The mobile phone is used as ambulance display. My MQTT app is installed in the phone which is used as dashboard. The location of the patient can be accessed anywhere from the server by the protocol MQTT. The location and basic health information of the patient is sent to the nearby ambulance. The mobiles that are used has displays are connected to RPi via Wi-Fi.

The next step is to guide ambulance to the hospital. Since the hospital and ambulance are connected to a common server (RPi) via Wi-Fi by MQTT protocol, the hospital will get the patient's periodically monitored health information prior to the arrival of ambulance. The hospital tracks the ambulance. After reaching the hospital, information regarding where he is admitted will be sent to his welfare. This is done by adding certain welfare contacts to the server which will send a message indicating the patient's issue Information will be sent via SMS to the welfare.

VII. ACKNOWLEDGMENT

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VIII. CONCLUSION

A Smart Medical Emergency system can be brought up in India by implementing this Smart Intelligence safeguard to the citizens. This is wearable which will always be worn by the people. The sudden medical issue and medical emergency is noticed and immediately rescued by our intelligence safeguard. Sending patient's health information to the hospitals helps the hospital staffs to get the necessary pre-requisites regarding the patient's treatment. Thus so many lives can be saved and also it will make the city as Smart Medical country. Raspberry Pi being an intelligent platform using which multiple components can be connected to each other and can be controlled from a longer range of distance because the connection which is to be used would be through the internet. Raspberry pi based automation is a novel and advance technology. Raspberry Pi simplifies the process of automation. The nature of our proposed system is such that it provides a great scope for further development. For future work, proposed system will be extended for controlling the traffic signals and monitoring abnormal patients.

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