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IoT Based Child and Woman Safety

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Abstract*— *The proposed system "IoT Based Child And Woman Safety" can be used to locating missing or lost children and also tracking the child movements outside from the home. The system can also be used to locate women who are in danger. We have combined GPS with one of the basic service of a smart phone which is GSM more specifically SMS in one system. Our proposed model contains various sensors which measure different parameters on a regular basis. In case of emergency a message will be sent to parents and/or police, by either pressing the panic button or pronouncing the keyword. The complete system is implemented using Raspberry Pi 3 Model B. Python programming is used interface all the sensors and other hardware. This device is wearable (like a wrist watch), and so it is easy to carry.

Keywords*— *Women safety, child safety, IoT, Raspberry Pi, Voice Recognition, GPS, GSM, MySql database

I. INTRODUCTION

With the rise of Internet of Things (IoT), standalone devices with web connectivity have become an important part of our lives. In internet of things objects are equipped with microcontroller/microprocessor and sensor devices and various software applications. They also have communication protocols which enable them to talk to other objects. Internet of things delivers on demand real-time services and helps in saving time, resources and even manpower.

In present scenario there is a drastic increase in the number of child kidnapping cases. Since crime against the children in the age of 14 years to 17 years is more popular, so parents are always worried about their children's safety. This paper proposes a voice enabled alerting system to aid to track children location in real time. Also at the present scenario women are competing with men in every field of life. Crimes against women are more common at present time. It is very important to ensure the safety of women. Hence our system provides a required safety to women so that they can do late night work.

II. RELATED WORKS

Real-time tracking has been a field of interest for many researchers and a lot of research work has been done for tracking system. In 2014, G.Bharathi and L. Ramurthy from Vemu Institute of Technology proposed "Children Tracking System Using Arm7 Microcontroller" in International Journal of Industrial Electronics and Electrical Engineering. It was very basic system which was able to provide only location of the user via GSM. In 2016, "A Review on IOT Based Smart GPS Device for Child and Women Safety Applications" was proposed in International Journal of Engineering Research and General Science. It proposed the concept of providing data over web server[2].

In 2017, "Smart Security Solution for Women and Children Safety Based on GPS Using IoT" was proposed. This system was a portable device which resembled a band on wrist. It consists of Pressure switch, when it is pressed, the device will get activated automatically within a fraction of milliseconds. Immediately the location of the victim will be tracked and messages will be sent to emergency contacts. The alarm unit will be activated and will produce siren sound to call out for help. Tear gas is also applied to harm the attacker which may help the victim to escape [7].

In our proposed system we have combined the ideas implemented on different controllers and developed a single system based Raspberry Pi3 in which for the first time voice command based processing is provided.

III. PROPOSED SYSTEM METHODOLOGY

We provide a reliable security system for the safety of children and women. In case of emergency and help the user can ask for help either by pressing the Panic button or by pronouncing a specific keyword that will be recognized by Raspberry Pi and will intimate the parents and/or police for help. The architecture of the proposed system is shown in the Figure 1. It consists of the Raspberry Pi 3, GSM SIM 300, GPRS, Temperature sensor, Heart beat sensor.

Hardware component used in this system are as follows:

A. Raspberry Pi

Raspberry Pi 3 Model B is single board computer. Its CPU speed ranges between 700MHZ and 1.2 GHZ. It also has on board memory between 256MB and 1GB Ram. This is used at transmitter or user end. It is the heart of the system. OS installed on it is Debian.

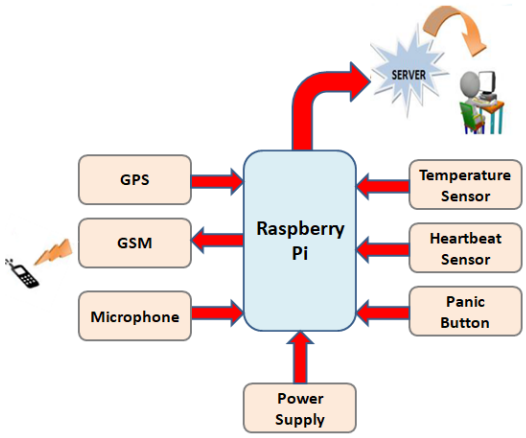

Fig. 1: Block Diagram

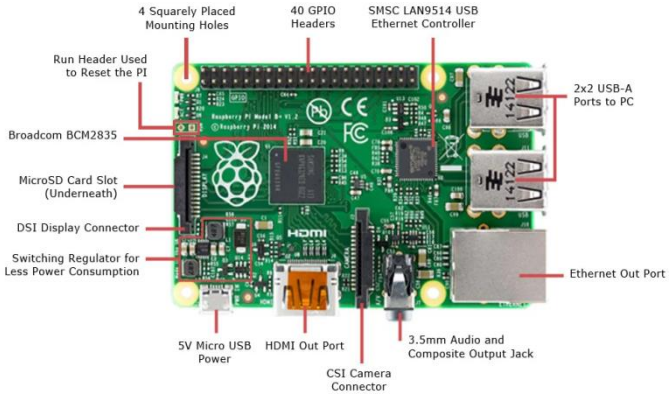

Fig 2: Raspberry Pi 3 Model B

B. GPS

GPS (Global positioning system) is used to get the position of the gadget in terms of latitude and longitude. GPS receiver used in our project is SKG13C from SKYLAB, it operates at 1575.42MHz frequency and 3.3V or 12V DC supply. It is interfaced via USB port to Raspberry Pi, has low power consumption typically 45mA at 3.3V and NMEA-0183 compliant protocol. This module operates at temperature range of -40^{o}C to 85^{o}C. Latitude and longitude values are extracted from NMEA sentence. Fig 2 shows the sample output.

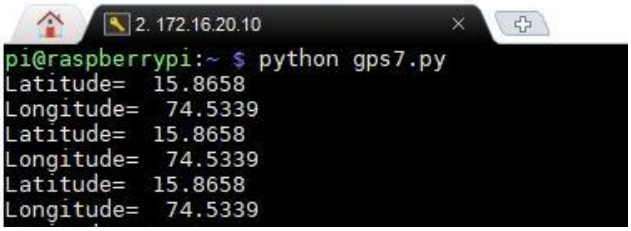

Fig 3: GPS receiver's Output

C. GSM

GSM SIM300 modem can be used to send SMS, receive SMS and make the calls. The basic GSM operations are done with the help of AT commands. It has standard RS232 interface as well as serial UART interface along with SIM holder and external antennas. Operates at 3.4V to 4.5V DC supply and normal operating temperature is -20^{o} C to +55^{o} C.

Following are the AT commands used in our system:

AT: It is used to test the condition of the modem. The modem responds with an OK if everything is fine or an ERROR in case of error.
AT+CMGF=1: Command to set the communication to Text Mode.

AT+CMGS=[Mobile Number]: Command to send SMS from the GSM Modem to particular number as mentioned in command.

D. DHT11 digital temperature sensor

DHT11 digital temperature and humidity contains a calibrated digital signal output of the temperature and humidity. DHT11 is used for temperature measurement in the range: 0 – 60^{o}C with accuracy of ±2^{o}C operating at 3.3V – 5.5V DC suply.

E. Heart beat sensor

Heart beat sensor (TCRT1000) finds the pulse rate. It has infrared light emitter diode and detector arranged side by side in a leaded package which blocks the surrounding ambient light which may affect the sensor performance.

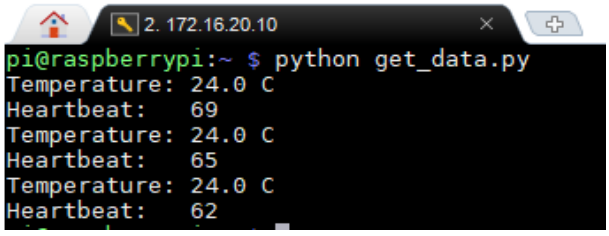

Fig 4: Temperature and heartbeat sensor outputs

F. Panic Button

It is another option for triggering Raspberry Pi in case of emergency to take appropriate actions.

G. Microphone

Microphone is used for giving the audio input i.e. the keyword. We have used USB webcam with built-in mic. The audio is recorded and processed to convert it to text using Pocketsphinx and SphinxBase packages, the text is then compared against the keyword. This voice keyword recognition is performed offline.
The bulk of the process we followed was generic to Linux; so much of the information here should be applicable to other embedded Linux systems. The procedure is briefly explained here:

Step 1: We tested the mic using arecord at the command line to create a 5 second (-d 5) file named test.wav using command,
"$arecord -D plughw:0,0 -d 5 -f cd ./test.wav"

And play this audio file using,
"$aplay test.wav"

Step 2: Install the required tools and dependencies.
"$sudo apt-get install bison libasound2-dev"

Step 3: To use PocketSphinx, you need to install both PocketSphinx and the support library Sphinxbase.

Step 4: We now create a language model. For initial testing we created a text file with the "Help" phrase written, saved it and uploaded it to the online tool.

Step 5: Now run the following command to start recognizing speech.
"$pocketsphinx_continuous -hmm /usr/local/share/pocketsphinx/model/en-us/en-us -lm 2193.lm -dict 2193.dic -adcdev sysdefault -inmic yes"

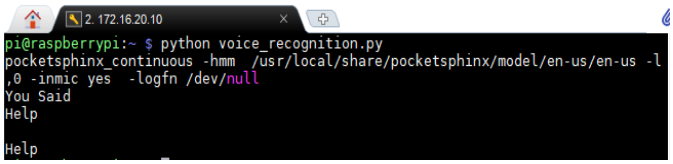

Fig 5: Voice recognition using Pocketsphinx

The software part used in our project is as follows:

A. Python

Programming language used in this system is Python. Python is an interpreted high-level programming language for general-purpose programming. Created by Guido van Rossum and first released in 1991, Python has a design philosophy that emphasizes code readability, notably using significant whitespace.

B. Web Server

Apache server with MySql database is employed in this project. The user's parameters acquired by Raspberry Pi are stored on a server continuously every 5 min and the same are uploaded to the web-page which is created using PHP which makes it globally accessible. And security is provided by providing the login id and password only authorized person can login to the page and access user's parameters from anywhere.

IV. DESIGN FLOW

When the Raspberry Pi is powered on it first initializes the GSM SIM300 with AT commands. Once the GSM is initialized the controller checks for GPS and it then initializes all sensors.

Heartbeat rate varies from one person to other but generally we take 60-80Bpm as the normal heartbeat rate. Heartbeat less than 50Bpm and above 100Bpm is considered as abnormal condition. The normal body temperature of a human varies between 35°C to 40°C. If the body temperature is less than 35°C then it's considered as hypothermia and if it's greater than 40°C then it's considered as hyperthermia.

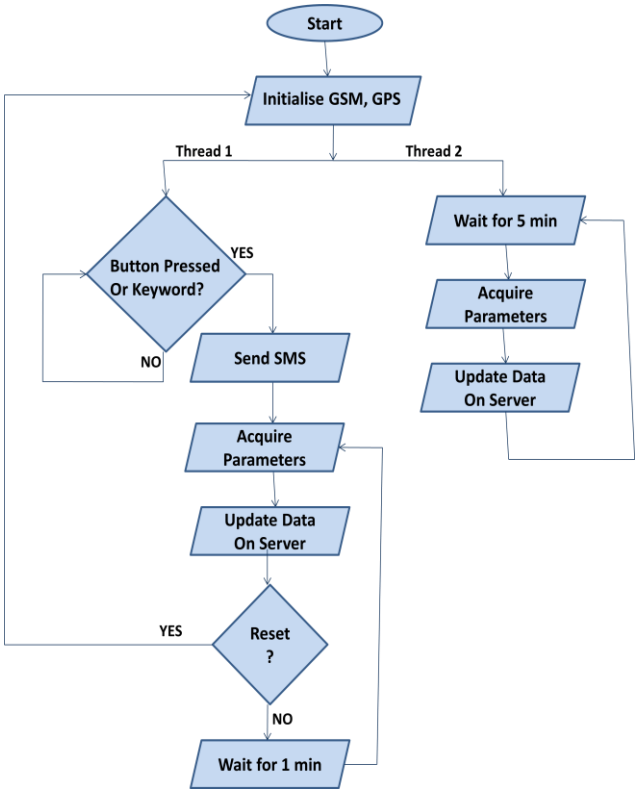

Fig. 6: Design Flow

After recognizing the speech if keyword matches then message is sent to care taker of child/woman and/or police indicating emergency help.

V. RESULTS

Using putty software we can access Raspberry Pi over PC or laptop. To do to so we have set static IP of Raspberry Pi. In our case we have set it as 172.16.20.10. All the interface hardware working is verified using putty software, which shows the outputs of the sensors before uploading to the web page. Temperature sensor shows the body temperature as 24^{o}C, and heartbeat sensor shows the heartbeat rate as 62.

A. Web Page

The web page is created and it can be accessed from any remote place using mobile, laptop or a desktop. We are using the PHP and HTML language to develop a web page. MySQL database is used to store parameters dynamically on Apache server.

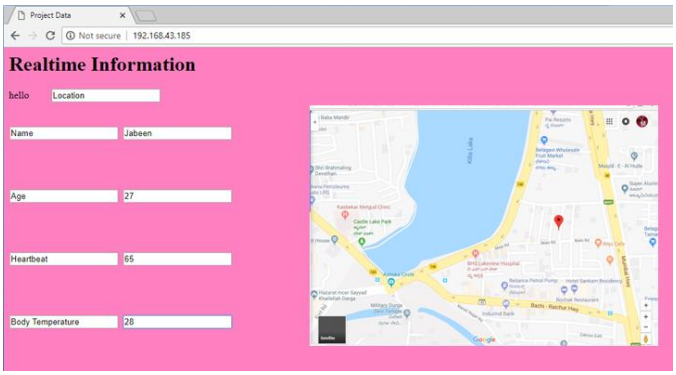

Fig 7: PHP web page showing realtime information about the user

B. GSM Output

When panic button is pressed or keyword is matched, a message will be send from GSM modem to registered number(s).

Fig 8: Message sent by GSM

VI. CONCLUSION

The IOT based "Child and Woman Safety System" is successfully designed to measure and monitor child/woman parameters such as temperature, pulse rate, location by the use of low power, light weight sensors. The measured parameters are successfully recorded using Raspberry Pi and stored in MySql database and the same are uploaded to the web page using PHP. In case of emergency user need to press panic button or speak up the keyword, then a message is sent to concerned care takers/parents and/or police using GSM.

ACKNOWLEDGEMENT

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