Interactive System Design 2
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Asthma Monitoring Device Project

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***Abstract*—The project was based on implementation of a new medical device using latest technologies that are available in the current situation.This document includes concept of the device and the requirement documents for this Device such as hardware, communication protocol and user interfaces.**

***Index Terms*—component, formatting, style, styling, insert**

I. Introduction

The project is based on asthma monitoring medical device. the device helps patient with asthma to ensure there health condition and to keep them safe in home as well as outside. patients with asthma can have a serious problem. The interior walls of the patients lungs' airways can become inflamed and swollen if he has asthma. Excess mucus may also be secreted by membranes in your airway linings. As a result, an asthma attack occurs. the device helps to detect the problems and the influence to have asthma attack. It save's the patients and make sure the patient is in proper condition. the device works as the person activates the device and blows air in the the device blow hole.

II. Asthma device monitoring factors

A.

The device is designed to monitors the main factors that cause asthma attack in patients body. the factors that device monitors are Tracking cough, Respiratory pattern, Presence of wheeze, Heart Rate and Activity Level.

III. Hardware Specification

The Asthma Monitoring Device is a Portable device with in build power supply and the patients can carry it with them where ever they wanted.

Fig. 1. Asthma Monitoring Device sample Prototype model [6].

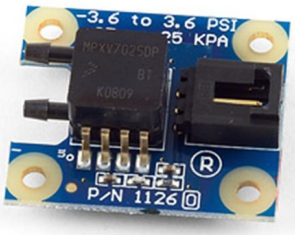

Fig. 2. Air pressure sensor [1].

A. Sensors

Direct TPMS measures the air pressure in the patient's lungs using a sensor installed in the device. The sensor communicates information to the microprocessor and sends data to the patient user interface when air pressure falls below the desired threshold.This helps the patient to know about his respiratory pattern.

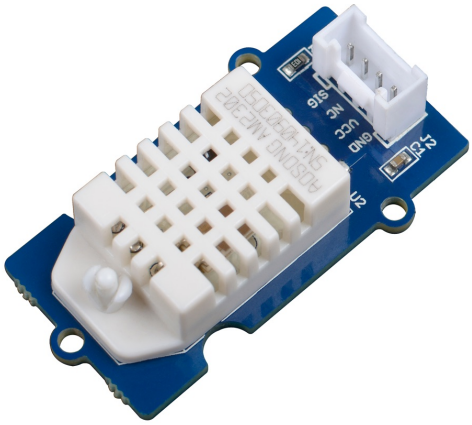

Fig. 3. temperature-humidity sensor [2].

These sensors were created to measure both the humidity and the temperature of the patient's body. They accomplish it by measuring temperature readings and measuring the amount of water vapor present in the air around the sensors using electrical impulses. By getting this data from sensors patient gets his body temperature and humidity.

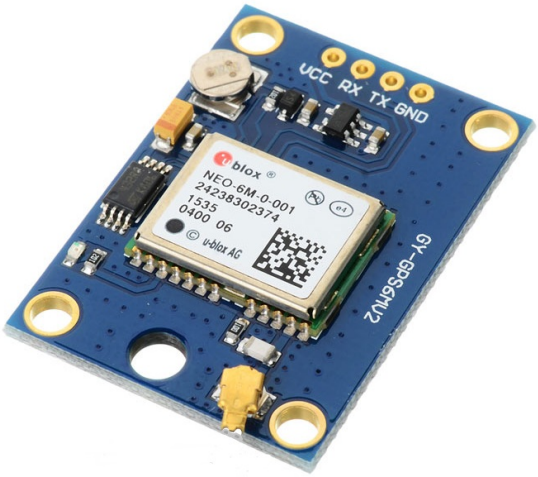

Fig. 4. Location sensor [3].

the location sensor is used to determine and located the patient. it helps the patient to find near by hospital. patient's doctor is also able detect the location of the patient in emergency situation. The Location Sensor is used to communicate with your phone's or tablet's global positioning satellite receiver (GPS). The GPS identifies the location of your device when the Location Sensor connects with the built-in GPS receiver.

B. Microprocessor

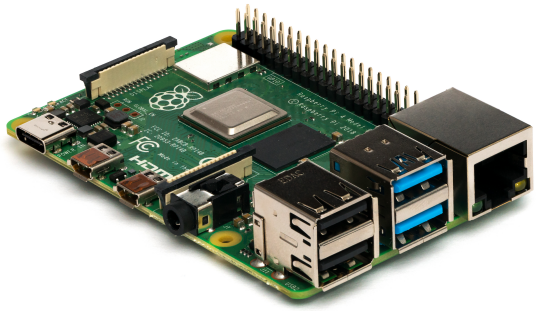

Fig. 5. Rasperri Pi Microprocessor [4].

Microprocessor used is Raspberri Pi. Huge processing power in a compact board. Many interfaces (HDMI, multiple USB, Ethernet, onboard Wi-Fi and Bluetooth, many GPIOs, USB powered, etc.). Supports Linux, Python (making it easy to build applications) Readily available examples with community support. Developing such an embedded board is going to cost a lot of money and effort. Raspberry Pi collects the data from sensors and sends the data to MQTT Broker. The mobile device and the patient doctor gets subscribed and receives alerts.

C. Power supply

Fig. 6. Power supply [5].

Identify applicable funding agency here. If none, delete this.

Rechargeable battery with 5v power supply.the power needed to run microprocessor and sensors are within 5v.

D. Communication Protocol

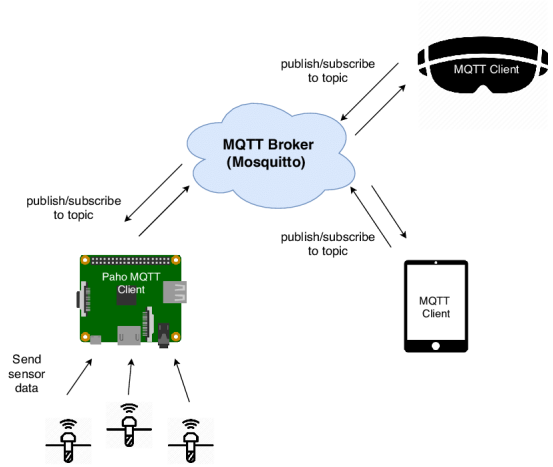

Fig. 7. Communication Protocol (MQTT) [6].

MQTT (When using the MQTT protocol, network traffic is consumed at a very low rate. Low latency is achieved by transferring less data from the publisher to the subscriber in less time. You can simply design IoT projects that offer real-time results because it allows asynchronous communication. MQTT Client gets data from processor and sends data to MQTT broker and the subscribers gets the data to there devices.

IV. Requirement Specification

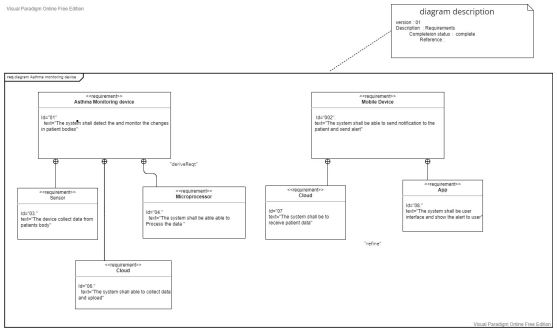

Fig. 8. Communication Protocol [6].

The Device is based on monitoring asthma in patients body and the device is portable. This device is going to measure the asthma rate of patients using sensors. Device collects from the sensor and sends it to the cloud. The patient's mobile phone will be connected and get data from the device and help the patient to check his asthma level in his body. It alerts the patient via mobile device in case of emergency and also sends information to the patient's doctor.

V. Usecase Specification

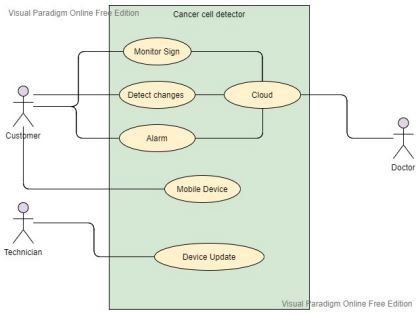

Fig. 9. usecase diagram [7].

The main use case of this device is to monitor the patients asthma rate in their body. the actors in this use case are patients doctors and network engineers. the device collects all the information and share the data to the user(patient) and also to the doctor who is treating the patient.

VI. Activity Specification

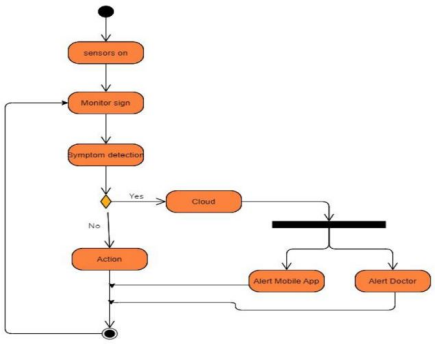

Fig. 10. activity diagram [**?**].

The activity of the device is to monitor the asthma. When the person activates the device he blows out air in the device. the sensors in the device device collects the data such as temperature respiratory pattern and his location. once the device collects the data from sensors it sends the data to microprocessor. the microprocessor then sends the data to the patients phone and to the doctor via MQTT communication protocol. When the patients condition is critical the smartphone app shows the alert on the app and also allows the patient to call the doctor in case of emergency.

VII. Constraints

the device is portable and it needs to have a portable power supply. the user must be always able to find a charging port when the device battery level is low. the device is portable and he need to carry with him extra instead of having sensors attached to his body or in his phone.

VIII. User Interface

Fig. 11. user interface Login [**?**].

The Patients user interface is on Mobile phone app. the patient can see his asthma monitoring factors data in his smartphone via Asthma Heath Care App. the user Logs in using his Personal ID and password provided by the Device. Figure [11] shows the welcome screen page of the smartphone app. Once the patient

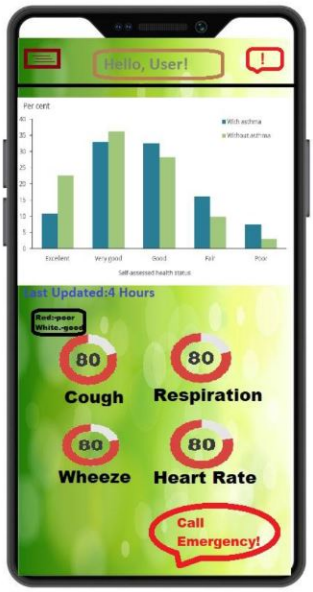

Fig. 12. user interface of the smart app [**?**].

enters his User ID and Password the app opens up another screen which shows the data of the Patients. the Patient is able to see his Asthma Rate in a graph that shows in the time period. the patient can change the Visibility of the graph according to different time intervals. the patient is able to choose the time intervals hourly. daily or in weekly format. the User interface also shows the cough rate, Heart beat rate, wheeze and respiratory pattern in icons where the patient is able see the percentage of the factors. the Smart app is able to detect the factor and also shows the Level of percentage and helps to identify whether the patient body conditions are OK.

IX. Discussion

A. concept

the project overall covers about the asthma medical device. the task of this project was given by the Profssor to come up with the idea of medical device using latest hardware and technology. the main concept of this idea was build on the task and came with the solution of Asthma monitoring device. the device Hardawre specifications were choosed and built for the proper functionining of thr device and to save the purpose its build for. The initial problem

was divided into different task. task one was to make a small presentation on our idea and the task 2 was based on the hardware specification. during the lecture time of the presentation . the second presentation brought up many ideas about the hardware component's to choose for the device. As it was presented during class the discussion with other people about the presentation helped to get more ideas and specially it helped to choose the best microprocessor for the asthma monitoring device. with the help of group discuission the problem with the communication protocal was solved. the ideas that were shared by the other presentation were able to figure that problem

.

X. Conclusion

Medical technology has the potential to save lives, improve health, and aid in the development of long-term healthcare solutions. Patients, healthcare professionals, healthcare systems, and society all benefit from the technology, which includes novel gadgets and diagnostics. The above-mentioned medical device, as well as its possible hardware, electronic components, sensors, and actuators, are the first solution for how this particular demand might be produced as an early prototype, and do not reflect or indicate the final product, which is ready for production. Much more research is needed on this topic, which will necessitate the contributions of professionals from several sectors like as electronics, mechatronics, mechanical, electrical, software, network engineers, medical personnel such as doctors, and many more. This basic concept might be expanded upon and brought to fruition through further investigation.

XI. Future Direction

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XII. Authors and Affiliations

The class file is designed for the project of interactive system design Forth semester. and documet was made by single author.

Acknowledgment

I'd want to express my heartfelt gratitude to Professor, who provided me with the fantastic opportunity to work on this wonderful project on the topic of Medical Devices, which also allowed me to perform a lot of research and learn a lot of new things. I owe them a debt of gratitude.

References

The Project document was written on the templet based provided by the proffessor. 7-page DIN A4 PDF report. (IEEE template - https://www.ieee.org/conferences/publishing/templates.html)

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