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IOT Based Anesthesia Parameters Monitoring with Doctor Decision Assistance using Machine Learning

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Abstract - *Anesthesia plays a very important role in the surgery. In a long surgery anesthesia is given multiple times but not at a time to avoid the high dose which may affect the patient. If the dose is not given in time there is a chance where the patient will be conscious and the situation like these tends to panic. Even the anesthesia overdose may lead to deaths. There are some factors which should be noticed to the concerned anesthesia doctor before giving the anesthesia to the patient. The anesthesia doctor can get assistance with the help of advancements in Computer science by using IOT and ML. The raspberry pi used in this project will collect the data from the sensors and with the help of an in-built wi-fi module in the raspberry pi the data will be transmitted to the Thingspeak. Earlier this system was purely based on the Arduino for just collecting the data and automatic injector was used which is not safe for the patient as during surgery anesthesia is given at different parts of the body based on where the surgery is going to be done. So, It is not possible to use the automatic injectors for anesthesia. To overcome the dose fluctuations and to get assistance from the Machine learning algorithm to doctor which shows the risk prediction based on the parameters entered by the doctor. The Immediate message will be sent to the concerned staff if there is any fluctuation in the reading.*

Key Words: **IOT, ML, wi-fi, Thingspeak, Raspberry pi, Anaesthesia assistant, Arduino, Logistic Regression.**

1. INTRODUCTION

While performing long duration surgeries the anaesthesia is given to the patient several times but it is not delivered at a time as it may lead to overdose. Overdose may even end up in patient deaths. As, It is given multiple times to the patient during surgery the doctor needs to visualize the parameters every time he needs to inject the anaesthesia.

Not only overdose but low dose than required may make situations panic during the surgery. Here Computer Science fields like IOT and Machine learning logistic regression algorithm will help us to overcome the above with Indications when the parameter values go beyond or behind the par value and the machine learning algorithm predicts the risk based on the parameters. It is a hassle - free for the doctor as he gets assistance from the risk predictor. It is not possible to monitor every value every time for the doctor there are chances the parameter may get skipped.

The data from the sensors and the data is transmitted to the thingspeak cloud and from the cloud the data from sensors is retrieved to the website and different visualizations are shown based on the par values of the parameters. Even, If the values are fluctuating below or above the threshold immediate message will be sent to the concerned doctor.

1.1 Objective

The main objective of my project is to develop a IOT based anesthesia parameter monitoring machine and apply the algorithms for prediction and make it in Low cost and User Friendly. The device will also have safety features to ensure smooth operation at the patient's bedside and assist the doctor. This procedure is easy, riskless and time saving for doctors, patients and staff.

1.2 Challenges

The challenges faced while completing the project are discussed briefly here. First everything started from the decision of the domain. As, the project is in the health domain the main issue with these types of domains is that a lot of data is very restricted, closed and private. The case study to find the base paper took a lot of hours and even then, most of those are not open source and it struggled to get the required data from the limited sources.

Next, the main concern arises when we need to get the dataset for training the model. The anaesthesia parameter dataset in the internet is either limited or can state it is almost null available as open source. As Every hospital maintains the data of patients as private no where we can get the related data for the work. Anyway, after going through a lot of research papers there is an experiment performed by the University of Queensland on anaesthesia. They collected the data from 32 patients during the surgery. Finally, the dataset is taken from the experiment as the data is open sourced.

Next, the selection of the sensors based on the parameters needed for the doctor to get assistance. The parameters that should be taken into consideration took a lot of time to

eliminate the unnecessary variables and get the required ones. The step is sending the data from sensors to thingspeak cloud through raspberry pi using python code. There was an error while connecting the sensors and sending the date. The code is changed and adjusted such that the data successfully reaches the thingspeak cloud. Again, the main challenge is the project scope is not limited to one device but is to develop for multiple devices. To do that the website must be added with database connectivity and the login for different accounts should be provided to the user.

2. LITERATURE SURVEY

2.1 ANESTHESIA CONTROL SYSTEM WITH MULTI SENSOR USING ARDUINO IJIRAE: AM Publications, India, 2019

In the above paper, published 2019 by Thiyagarajan proposed the concept of control system with multi sensors using Arduino. The existing system is automated and is done without the use of the doctor but here comes the clash. The anaesthesia must be administered at different places on the patient body based on the surgery. The paper only states the offline use of the automated anaesthesia control but this is different when we come to real time application as stated above. Even the amount of anaesthesia should not be given as if. It should be crossed checked with parameters and the place where they have to be injected. So, This model fails automatically.

2.2 Microfluidic Syringe Pump Using Arduino Dr.Azha Periyasamy1, R. Jeya Kumar2, T. Karuppiah3 IJIRAE Vol. 8, Issue 4, April 2019

In the above paper, published 2019 by Azha & co proposed the concept of Microfluidic Syringe using Arduino. The existing system is automated and is done without the use of the doctor but here comes the clash. The anesthesia must be administered at different places on the patient body based on the surgery. The paper only states the offline use of the automated anesthesia control but this is different when we come to real time application as stated above. The Microfluidic syringe cannot be used to do the automated anesthesia machine control.

3. METHODOLOGY

3.1 BLOCK DIAGRAM

In the system, The Temperature sensor and humidity sensor which is DHT11 is used and spo2 and heart rate senor is MAX30102 is used and co2, wet sensors. All are taken as parameters. These sensors are connected to the raspberry pi. When the power supply is on the sensor send the data to the raspberry pi and the data from the raspberry is sent to the thinspeak cloud using inbuilt wi-fi module present in the raspberry pi using API keys of thingspeak. The trained model is deployed in the website for the prediction and the channel data in thingspeak is exported to the website using API keys.

When the values cross the threshold immediate message will be sent to the concerned person.

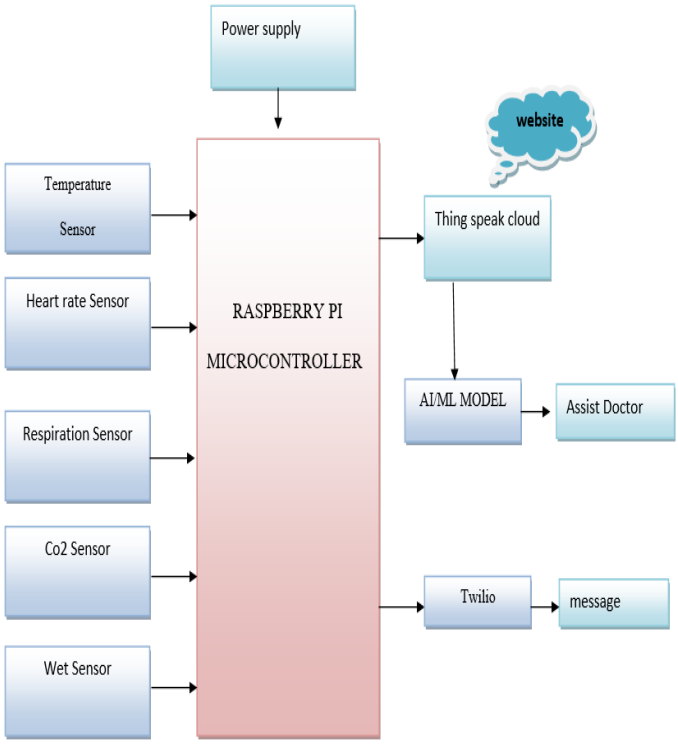

Figure 1: Block Diagram

3.2 REQUIREMENTS

3.2.1 HARDWARE:

1. RASPBERRY PI
2. DHT11 TEMPERATURE SENSOR
3. HEART RATE SENSOR
4. SPO2 SENSOR
5. CO2 SENSOR
6. WET SENSOR

3.2.2 SOFTWARE:

1. THINGSPEAK
2. TWILIO
3. WEBSITE, GOOGLE COLLAB

4. OUTPUTS AND DISCUSSION

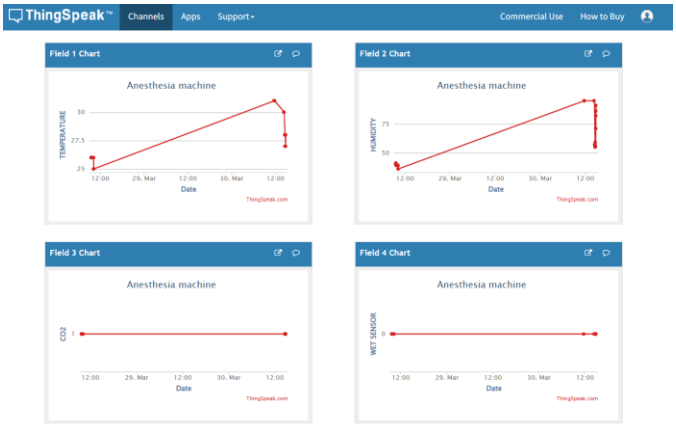

Figure 2: ThingSpeak Channel

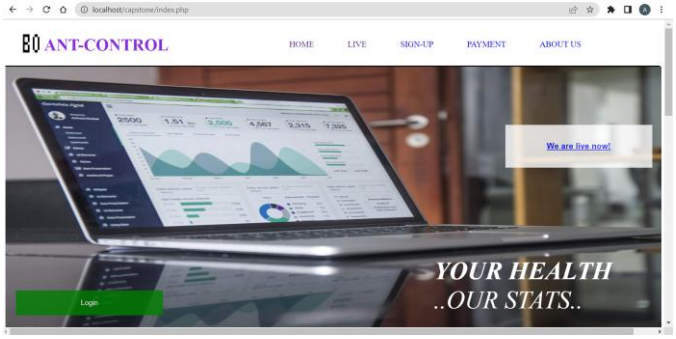

Figure 3: Website for results

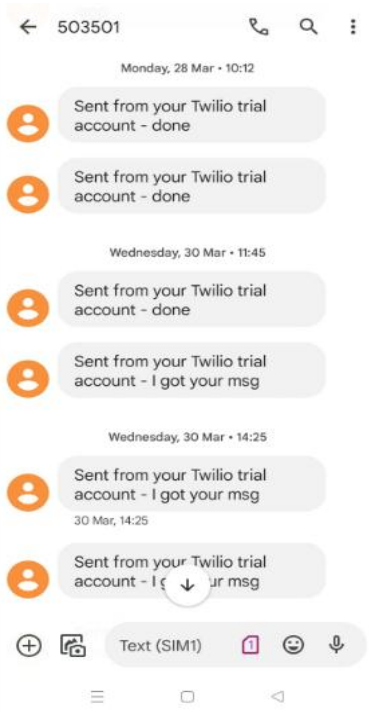

Figure 4: Messages received to phone

5. CONCLUSION

This project attains high logistic accuracy and the as you see the immediate message will be sent to the concerned staff when the sensor crosses the threshold and even assist the doctor with decision and the website stores the data as it got fetched from the ThingSpeak cloud and further this project is not just limited to one device, the website supports for multiple devices.

6. ACKNOWLEDGEMENT

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