**Project Proposal**

**For Consideration Under**

**TIH – IoT and IoE**

Solution for Bringing Legacy Medical Equipment on IoT Platform

**Submitted by**

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**Contents**

[Revision History 2](#_heading=h.gjdgxs)

[Document Number 3](#_heading=h.30j0zll)

[Document Properties 3](#_heading=h.1fob9te)

[1](#_heading=h.2et92p0) Cover Sheet 3

[2](#_heading=h.tyjcwt) Executive Summary 5

[3](#_heading=h.1t3h5sf) Background 5

[3.1](#_heading=h.4d34og8) History 5

[3.2](#_heading=h.2s8eyo1) Statement of the problem 5

[3.3](#_heading=h.17dp8vu) Objectives 5

[3.4](#_heading=h.3rdcrjn) Deliverables 6

[3.5](#_heading=h.26in1rg) Project Plan with Major Milestones 6

[3.6](#_heading=h.lnxbz9) Resources and budget 7

[3.7](#_heading=h.35nkun2) Category of New Technology/Product 8

[4](#_heading=h.1ksv4uv) Appendix 8

[4.1](#_heading=h.44sinio) Supporting Documentation 8

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# Revision History

| Rev. | Name | Issue Date | Changes |
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# Cover Sheet

| Sr. No. | Name | Details |
| --- | --- | --- |
| 1 | Project Title | Solution for Bringing Legacy Medical Equipment on IoT Platform |
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# Executive Summary

We'll develop a Real-Time Patient Monitoring System to help clinicians keep track of the fundamentals. Signs of patients are available remotely via an application, helping individuals who need a hospital or somewhere to live. In remote locations, however, they are unable to access a doctor's office or a hospital, or even obtain a prescription. The patients with the right drugs. The patient may be monitored, so the doctor does not need to see them frequently. Vital signs are available online from any location. This technology can be used in hospitals. Doctors only need to sit in their office and watch the patient [1].

This method can potentially be sold as a product to people in remote regions to assist them in avoiding hospital fees. Patients in these regions may use the gadget to check their vital signs and can either go to a doctor or an AI-based system to get the right prescription [2].

The resources like Internet module ESP32 for establishing Wi-Fi connection to our microcontroller and AURDINO would be used as it is user friendly, more compact, simple and able to handle multiple tasks at once which will help us to provide desired result [3].

Through our Real-Time Monitoring System the doctor/family will be able to monitor the vital health metrics of the patient live. **Module 1** will collect the patient’s heart rate, SpO2 level, body temperature, blood pressure sensor and pulse rate using legacy medical equipment (sensors) connected to patient’s body or it can be wearable that will communicate the current status of patient. **Module 2** In the case of any emergency the threshold parameters will be set and it will be reported to doctor/family. Through **Module 3** with the help of edge computing a short and quick patient data summary will be created, it will be connected through microcontroller and then it will send the data on cloud/server to minimize the transfer time of information as this will provide us the real-time information with low latency so the doctor can take preferred action. With **Module 4** the analyzed data will be collected through cloud/server which was uploaded through edge computing. Now the doctor can observe the medical data and can interact with the patient directly with his/her state of health without going anywhere like patient’s location.

The success rate of this system is pretty high as if there is any change in the values of parameter form the threshold, the doctor/family would receive an emergency alert message or Email.

# Background

## History

IoT (Internet of Things) it can be defined as the latest technology where the several machines or devices communicate and interact with each other through a network over the internet [6].

In 1990, John Romkey designed the first internet device, a toaster that could be activated or deactivated with the help of internet. In 1994 Steve Mann developed a Wear cam. The term Internet of Things was first coined by Kevin Ashton in 1999, Managing Director of the Auto-Id center at MIT [7].

Till date we have developed so many smart gadgets and made everything smart like, smart wearable, smart home and smart car etc. But our main focus is on Smart HealthCare technology as till date this sector is not very much developed and need some improvements and re-creativity.

The problem that occurs due to lack of technology in Medical Health Care System is:

* No remote access to doctors to check the vital information of patient.
* There is some Health Monitoring available in the field but they are inefficient and cause errors in data sharing.
* Lack of early warning of patient vitals in healthcare devices if available (no threshold limits are set).

For the betterment of HealthCare in the field of IoT and using the improved technology Doctors can assist patients online because to IoT. The distance between the patient and the doctor can be greatly decreased by portable IoT-based health monitoring equipment, especially in rural and semi urban areas. IoT allows you to approach each patient individually, examine their health situation, and calculate their individual treatment plan. Doctors can remotely check patients' health using portable sensors and provide immediate care.

This is where our RTMS shines by providing real time information/data of patient’s health to doctor/family where they can check the live status of patient and can receive alert if the parameters of threshold cross the limit [5].

Now we’ll look upon Edge Computing, What is Edge Computing? “Edge computing” is a distributed computing framework that brings enterprise applications closer to data sources such as IoT devices or local edge servers.

Recently 5G is introduced in our countries which provide high speed data with low latency. For example driver less car and cloud gaming through any device, with 5G connection the real-time traffic and nearby data is sent to car system which can make decision on its own without driver instruction precisely and accurately. Similarly, it happens in cloud gaming that you don’t need any high end device to play graphics dense game, through high speed data and low latency we are able to play games on cloud server effortlessly and without any interruption [7].

This Edge Computing will bring great success in HealthCare system as well. As the Data is created or gathered across a number of places, transported to the cloud, where computing is consolidated, and then processed there at scale and at a lower cost. Edge computing controls sensitive data and lowers the cost of data transmission to the cloud while enabling real-time responsiveness to build new experiences. By performing the work close to the source rather than transmitting it to a more distant cloud and then waiting for a response, Edge reduces latency, which lowers reaction time [7].

## Statement of the problem

## The requirement for a doctor to operate medical scanning equipment including CT scans MRIs, X-ray machines, and ultrasounds in semi-urban and rural settings.

## Traveling takes a lot of time and money, for the patient as well as the physician.

## When compared to real-time monitoring, IoT-based telemedicine is less accurate.

## Currently there no such device available in the market that can monitor the overall health of patient and send the data to doctor/family from a distance.

## A lack of deep neural networks, machine learning, and artificial intelligence. For instance, in an emergency, if a doctor is unavailable and the patient's condition is rather critical, we can impose a device that can inject a dose of medication into the patient's body in accordance with his or her RTMS readings.

## Objectives

The objective is to develop a real-time patient monitoring system that will enable physicians and patients' family to monitor a patient's health outside of the hospital by using sensors, cloud storage, data transmission, and mobile IoT apps. The primary goal of the suggested research project is to create a remote health surveillance system using nearby sensors. When there is an emergency, the suggested system also sends email to the doctor and offers GSM messages and live location.

Heart Rate monitoring, SpO2 level detection, body temperature measurement, blood pressure sensor and pulse rate monitoring are the only important metrics pertinent to our study. In the event of a rapid change in the parameters, some parameters will be remotely displayed to the doctor via the application. The IoT technology with help of edge computing it will convey the location and patient’s live vital information within a short period of time with accuracy to the emergency team and family members if the doctor is not readily available.

## Deliverables

This real-Time monitoring system will form by three modules. Each module performs particular tasks and depends on other's data [4].

**Module 1 –**

Patient will be connected with our RTMS, this will contain:

* Heart Rate Sensor
* SpO2 Sensor
* Temperature Sensor
* Pulse Rate Sensor
* Stress and Discomfort Sensor
* Blood Pressure Sensor
* GSM

**Module 2 –**

Module 1 will be connected to the Microcontroller/microprocessor which will collect the data and proceed to the application. (To be imposed) Through Microcontroller information will be shared to designated place [2].

**Module 3 –**

Collected data will be analyzed by edge computing on the server/cloud it will collect a short summary of patient’s information through microcontroller and resulted data will be sent to the doctor/family member.

**Module 4:** Analyzed result will be received by doctor/family member within the short period of time through edge computing on IoT platform. On the basis of information doctor will take action.

## Project Plan with Major Milestones

| Sr. No. | Milestone | Target Date | Remarks |
| --- | --- | --- | --- |
| 1 | Module 1 | 3 month from beginning |  |
| 2 | Module 2 | 3rd month to 9th month |  |
| 3 | Module 3 | 6th month to 18th month |  |
| 4 | Module 4 | 18th month to 24th month |  |

## Resources and budget

| Sr. No. | Item | 1st Year (Rs) | 2nd Year (Rs.) | 3rd Year (Rs.) | Total (Rs.) |
| --- | --- | --- | --- | --- | --- |
| 1 | Manpower | 8 .0 | 8.0 | 0 | 16.0 |
| 2 | Equipment (Exclusive of GST) | 7.0 | 3.5 | 0 | 10.5 |
| 3 | Consumables | 1.25 | 0.75 | 0 | 2.00 |
| 4 | Travel | 1.50 | 0.75 | 0 | 2.25 |
| 5 | Miscellaneous expenses | 0.75 | 0.50 | 0 | 1.25 |
| 6 | Contingency (max @5% of 10) | 1.25 | 0.50 | 0 | 1.75 |
| 7 | Sub total | 19.75 | 14.00 | 0 | 33.75 |
| 8 | Overhead (max @20% of 7) | 1.50 | 1.25 |  | 2.75 |
| 9 | Faculty Fee (inclusive of all overheads/ institute share etc) @maximum of 20%of total project value | 1.75 | 1.25 |  | 3.0 |
| 10 | Total (7+8 +9) | 23.00 | 16.50 |  | 39.50 |
| 11 | GST (@18% of 10) | 4.14 | 2.97 |  | 7.11 |
| 12 | Grant Total (10+11) | 27.14 | 19.47 |  | 46.61 |

Milestone wise Fund Requirement

| Sr. No. | Milestone/Deliverable | Amount needed for Milestone Completion (INR) | Amount needed for Milestone Completion (INR) |
| --- | --- | --- | --- |
| 1 | Project Beginning ( Description ) | Project Start Date(T0) | /- ( Initial Fund required) |
| 2 | Module1 | T0+ Months | /- |
| 3 | Module2 | T0+ Months | /- |
| 4 | Module3 |  |  |
|  | Module4 |  |  |
| 5 | Total Duration | 0 Months |  |

## Category of New Technology/Product

| Sr. No. | Category | Details |
| --- | --- | --- |
| 2 | New-to-the-firm Products/Technology (new Product Lines) | Products that take a firm into a category new to it. The products are not new to the world, but are new to the firm |

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