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# IOT-BASED HEALTH MONITORING SYSTEM USING MYSIGNALS AND LORA FOR REMOTE PATIENT CARE

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**Abstract**

*The Internet of Things (IoT) is revolutionizing healthcare by enabling real-time monitoring, diagnosis, and data collection from patients using intelligent sensors and devices. This paper presents an IoT-based health monitoring system utilizing My Signals hardware integrated with LoRa wireless communication to monitor vital signs such as ECG, body temperature, heart rate, and oxygen saturation. The proposed system is designed for remote and home-based care, addressing key challenges in rural healthcare accessibility, data accuracy, and real-time communication. The implementation results show the successful integration of sensors and LoRa communication, offering a cost-effective and scalable solution for improving patient outcomes.*

## INTRODUCTION

Internet is used now days in every field of life. Now the life is easier. Internet means that more than one device that can communicate with one another through internet like Wi-Fi, 3G, and 4G. A device can be a mobile or any type of machine or computers etc. These devices are connected and shared information to one another through internet. Ahmad, M., Jabeen. (2024) these devices can get information from environment according any situation. A device can also store data or information that get from environment. These information or data can also be used again and again according to the condition. In medical, IOT becoming part of health care. Different researches have been done on health care. Different health care system or devices are made. *Computational intelligence tools* are used for testing DNA data. CI is related to artificial intelligence. A *locate system* is designed that find the exact location of a person. An *architecture* is developed that take care of animals with *IOT and AI*. Now IOT and AI has been worked combine. Because data is stored on clouds, in medical field data is important for comparisons. For example, if DNA is test of a person, then previously data is required then any result can be generated on the basis of comparisons. *Remote pervasive patient health monitoring framework* is designed that monitors a patient at home carefully. An *m-healthcare system* built that recognizes the human activity Jabeen, M., Ibrar (2025). In such a way a person can be save. For *Mental health*, 14 research have been found.in this way an IOT care about a person. For all these applications and system

that discussed above, different algorithm and technologies has been used. A series of challenges including continuous attendance health professionals and staff and appropriate facilities in remote areas during an emergency situation need to be addressed to develop a flexible IoT-based health care system Ahmad, M., Jabeen, M. (2024. Other than that, human entered data is not as reliable as data that is generated automatically. IoT development Health-based monitoring systems allow personalized care in certain helpful circumstances to reduce health care costs and waste with increasing results. We present IoT based health monitoring system using MySignals development shield with (Low power long range) LoRa wireless network system. Electrocardiogram (ECG) sensor, body temperature sensor, heart rate and oxygen saturation sensor have been used with MySignals and LoRa. Assessment the characteristics and effectiveness of sensors and devices of the wireless platform are also analyzed in this article using the methodology of physiological data analysis and statistical analysis. MySignals allows the specified sensors to collect physical data. The goal is to transfer the collected data from MiSignals to a personal computer using a wireless system with LoRa. Arif, M., Jaffar, A.,(Eds.). (2025) the results show that MiSignals is successfully associated with ECG, temperature, oxygen saturation and pulse speed sensors. Communication with the hyper-terminal program was realized using LoRa and an IoT-based health care system is being developed in the MySignals platform as expected results obtained from the sensor. The Internet of Things may be used to collect infections and other data in these settings, and to collect data using the collection and then report to administrators and / or to perform some of this information (such as turning off damaged medical devices). It would be futile to try to define all these unique IoT applications in healthcare since every listing for new programs has been finalized. Instead, we describe three sets of IoTs treatment strategies: chasing people, chasing things, chasing people and things Jabeen, M., Hussain,(2024). At the moment, one of the biggest problems every country face is health. Developing no, what is possible to reduce the cost of disease and chronic disability is health care systems because health facilities are transforming themselves into others, summarized, in terms of visual acuity. To solve health problems, the internet of things (IoT) is a world of networking devices, cloud applications, and services, with variations a collaborative process based on the affirmation of fair values, air rules, good sensor, cheap and compact microprocessors, and air technology. Besides, LPWAN technology is taking the stage to improve new human health and air quality monitoring app. LoRa is one such type of LPWANprotocols, which focuses on deployment where the end device have low power (for example, there are batteries) and do not charge more than a few inches at a time the time and place of tra c data may be generated either by the endpoint or by an external requirement connecting the last device. Technology related to LoRa & LoRaWAN standards recorded in [98], by LoRa Alliance. This one subsection overviews the essence of the standard based on this source, and thus refers to an interested person for more information about LoRa & LoRaWAN. LoRa is a skin-tightening system that uses chirp spread the spectrum is more diverse than at least 125 kHz. This provides low power, long communication has high objective or environmental resistance. LoRaWAN is built on LoRa standards, in network layer. It uses a star topology, and nodes asynchronous; they only communicate when necessary, such as after an event or a scheduled measurement. Scheduled messages from nodes will suit long-term monitoring applications, whereas the event driven messages from the node would be appropriate emergency monitoring. LoRa applies MySignals, a wireless networking system biomedical sensor. There is also the performance and efficiency of the data collected analyzed that can be used for future purposes. LoRa communication with multiple protocols a radio shield was applied to the collected sensor data. This is noteworthy LoRa has a high contact range with a lower data rate, which is the best choice based on IoT Health system by specification that provides perfect interaction between IoT objects. In this article, we present an IoT-based health system based on the MySignals platform working with Arduino Uno can make e-health tracking a development platform Connect and measure fifteen sensors. The IoT-based health system performs all health activities, including diagnosis, and telemedicine by connecting to all the

resources available on the Internet. IoT-based healthcare the system can be divided into three areas of intervention, such as clinical care, remote monitoring and context awareness where the clinical care of a hospital patient requires constant and close need attention, remote monitoring is for an elderly or pediatric patient who needs to arrive at a hospital, or clinics conduct regular health check-ups and context-awareness of patients general condition from anywhere in terms of clinical assistance, resp.The Internet of Things (IoT) can connect every even to one another like devices, human being, the world has been changed due to this technology especially in medical field. Jabeen, M., Ahmad, M.et al. (2024) presented everything in every field becoming very smart due to this IoT. Ahmed, Rana Hassam, et al.(2025). But the most important area in which IoT is becoming popular is Health care field. It provides many facilities to doctors and patients to full fill their needs on time and also it saves time and money. Now many applications have been made for this purpose. LoRa mesh network for a large area the monitoring application was developed by Lee et.al. They implemented 19 LoRa sensors in the network devices to identify the packet delivery report (PDR) by comparing it with a star topology network device. The result shows that mesh network devices reached 88.49%, where it is 58.7% for star topology network devices. Many implementations and proposals about the solution these problems have been made where it is shown that LoRa has the capacity to solve all these problems by integrating medical sensors, cloud and gateways. In addition, it should be understood that general work and the protocols required for IoT frameworks may be required small notes for proper functioning and health exception. These include notation cation services, resource sharing services, internet services, affiliate links a contract for a variety of purposes, and a link for main link. The easy, fast, low, and low-power research of devices and services can be added to this list. However, there is talk of such a universal IoT service outside the scope of this survey. Our contribution in this study includes the following:

- To design and implement a low-power IoT-based health monitoring system using MySignals and LoRa for real-time data acquisition.
- To collect, transmit, and store physiological data such as ECG, heart rate, temperature, and oxygen saturation through integrated biomedical sensors.
- To evaluate the system's effectiveness in enabling continuous remote health monitoring and improving healthcare accessibility, particularly in rural and underserved areas.

**Problem Statement**

Now a days, IoT devices has been used in every field of life. The most advancement of IoT devices are used in Health caring. Now devices are used to detect diseases. The main problem statement is that IoT devices now used for detect disease or for health caring while at homes.

**Research Question**

How can a low-power IoT-based health monitoring system be effectively designed and implemented using MySignals and LoRa for real-time physiological data acquisition?

What is the accuracy and reliability of biomedical sensors integrated into the system in collecting, transmitting, and storing physiological data such as ECG, heart rate, temperature, and oxygen saturation?

To what extent does the proposed IoT-based system improve continuous remote health monitoring and enhance healthcare accessibility in rural and underserved areas?

**Research Background:**

*Alansari Z. et al. (2019)* introduced a system that can calculated a DNA sequences. For calculated sequences, different computational intelligence tools have been used. Tools has been used for molecular biology and DNA sequence computations. Computation intelligence is the main part of Artificial intelligence. Many Algorithm used for this purpose like Fuzzy, Dempster-Shafer, Murphy or entropy Shannon, these algorithms used to evaluate DNA Sequence with IOT based computational intelligence tools. In CI, mostly math's related tools used so that DNA sequences can be calculated. Research process also defined, in first stage, all tools are defined that are used. In second stage, the

algorithm of entropy analysis is used. In the third stage, the CI tools for DNA sequences has been analyzed.

Tao H.et al. (2019) there is a real safety problem with patience Internet of Things (IoT) monitoring software. The cause of anxiety are recognized by the recent sophisticated security forces confidential attacks, including data breaches, data integrity, and data breaches nchikota. Treatment often provides patients with 'safety' health monitoring data during the interview. Anyway, they failing to cope with complex attacks during data collection conversion to cipher and after delivery. Khan, M. S. H., Ahmad (2023) In this case paper, we first learn about privacy and safety and health issues data access and transfer. Then we know database storage plans for IoT healthcare systems called Secure Data with the intent to solve a security problem similar to the above. Secure Data features four components layer: 1) IoT network sensors / devices; 2) Fog in the sky; 3) cloud Layer assembly; and 4) health insurance coverage. We mainly contribute to the first three stages. For two bags, Secure Data consists of two systems: 1) ground-carrying lights that can be applied gateway (FPGA) based on the hardware algorithm and 2) encryption sharing algorithm. We are studying the KATAN algorithm that we implement and upgrade to FPGA hardware platforms, when we use the concept of secret cipher sharing system protect the privacy of patients' data. In the cloud computing layer, we apply a distributed data distribution system that includes multiple cloud data servers to enhance patient data confidentiality in the cloud Assembly. The performance of SecureData it is supported by experiments with FPGAs in terms of infrastructure frequency rates, power charges, and total assembly time algorithms and its results indicate that SecureData may be efficient when applying for security risk protection on the basis of IoT health care

*Patil S. et al. (2019)* presented a system that is related to IoT health care advanced technology. This system is based on WBAN (wireless body area network) specially. In this paper, state-of art also discussed of network topology. Security and privacy also discussed and also its features like power, energy, quality of services etc. IoT health care real-time based system also discussed in this paper. Because real time-based system mostly problematic in some IoT applications. Furthermore, its policies and also strategies also discussed.

*Ugrenovic D. et al. (2019)* presented a system for patient's medical health care that used web browser for the purpose of sending information of a patient to a doctor. The technology that has been used also discussed. Contiki OS is used as simulator with protocol stacks 6LoWPAN. The IoT medical field now becoming very interesting research area.

*Pitsios S. et al. (2019)* It is an indisputable fact that Internet technology (IoT) has become an important factor. advances in digital healthcare, as the number of IoT medical devices has grown launches, and now expects by 2020 there will be more than 161 million of them combined all over the world. Thus, as adolescence progresses, IoT healthcare faces a variety of challenges, e.g. such as summary, good planning, as well as definition and agreement of data is accessed from a wide variety of IoT devices. By the way various methods have been developed so far to solve any of them, none of them suggests a comprehensive way to achieve data interaction between advanced data which is available from different devices. For this reason, design this script for using words actively to address different aspects of these problems. Through this process, in the first place, a collection of device datasets made by erentets, following their deletion. In addition, creates a filtering effect used to capture the levels of the overall data quality of each dataset, as well as the size of each produced device each dataset, and its own trust. As a result, only high-quality data is stored and translated in the most common method, it can be used for other purposes. Procedure required analyzed by a single model, produces reliable results, obtain data interactions of 100% accurate, with data quality greater than 90% accurate.

*Sam D. et al. (2020)* discussed the IoT advancement in medical health care field. Also proposed a system that can check the health like pulse rate, breath rate, body temperature, body development etc. now, the IoT in medical health care ease the everything like a doctor can check their patients using wearable sensing device like at homes. Doctors can be in their clinics and patients can be in their homes. The email or SMS alert used to tell about health if any serious problem.

*Dutt V. et al. (2020)* Current device days' added technology plays a very important role. All employees are different information such as health information, bank accounts information, User Review etc., stores different items save. The head is also ours a book is a collection and evaluation of public health information and perform the treatment at a low-cost Time saving time in the prognosis of disease and medication trial and assistance of patients based on past data for differentiation time for various diseases. The biggest problem with this is the overwritten database different servers are the amount of data stored. Our data is stored more encrypted than the server etc., this type of question is available to employees as well as co-workers mind. Big data is the idea of removing many information from available data.

*Crbone F. et al (2010)* discussed problems, including advantages and disadvantages, as well as approaches to prevent it problems of using and connecting the Internet of Devices and health care systems. We present this discussion in the context of REMOA project, which focuses on solutions for buildings Care for patients with chronic illness. The Internet is now in use inadequacies that prevent them from being used effectively in the health system. Relationships and security affect such people far cry.

*George A. et al. (2020)* presented goalmouths of scientist's researchers are to further deliver a suggestion of the technology human life to make it easier. With this focus, this paper will describe using the phone as a sensor to drop medical system of patients. The Internet of Things has been featured in many areas' humanoid lifestyle, where health care is of utmost importance the area where the focus will be persuaded. Consider variety drawbacks of using cloud calculating, this paper will talk about using fog computing for faster data analysis. With this goal at hand, we tend to come and introduce the concept Fog Computing which is a better system compared to the Cloud Calculate. Fog Computing will highlight three types patients and those who are critical would be included Injured or just in the hospital in general or the people who may come in discharge requires periodic monitoring in the future depending on their existing health position.

*Islam M. et al. (2020)* IoT is a blessing in the field of information and technology. It develops and moving daily. It works for our good in the fields of housing, environment, shopping, security, manufacturing, industry, agriculture, education, health, health and more. In health care department, it has applications, technologies, benefits and challenges has four stage wise. As the world ages as a result of social unrest, there is not enough space for all for health. I think Health is the most expensive resource one can have. And so on without proper health care, the IoT can produce its best performance the ability to play an important role in creating a better world for all of us. This book represents the core the concept of IoT in the health care sector.

*Ugrenovic D. et al. (2020)* presented Internet of Things (IoT) for healthcare applications is a developing research area that has conventional consideration in the last rare years. The newsletter presents an isolated IoT healthcare system that delivers patient status through a web browser. For replication purposes, we use Contiki OS with a 6LoWPAN protocol, and Cooja, an adapter fixed inside Contiki. CoAP is particular as the application stage for data access and illustration.

**Methodology**

Body Sensor Technology is one of the technologies that has been used for human Health caring. BSN is an Health Monitoring System and body sensor network system through which a user can easily detect his/her temperature. LoRa is a frame work that is used for this purpose. It is a multi-sensor data. LoRa has a unique feature like it is a low power and low data rate device.

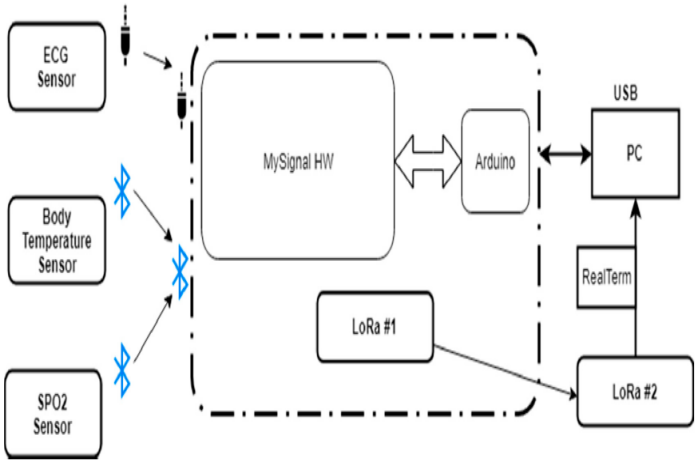


**Figure 3.1 System block diagram (Islam M. et al. 2019)**

In fig 3.1, the block diagram is given in which body sensor temperature is used in IoT Health care system. All medical sensors have been connected to the MySignal and Arduino has used to gathered data through Bluetooth or wired. Arduino and MySignal has been connected to the LoRa.

**Table 3.1 LoRa Specifications (Islam M. et al 2019)**

| Characteristics | Specification |
|---|---|
| Module | SX1272 |
| Dual Frequency Band | 902–928 MHz (US) |
| Transmission Power | 25 mW |
| Sensitivity | −134 dBm |
| Channels | 13 (900 MHz) |
| Range | LOS = 21 km (13.4 m) |

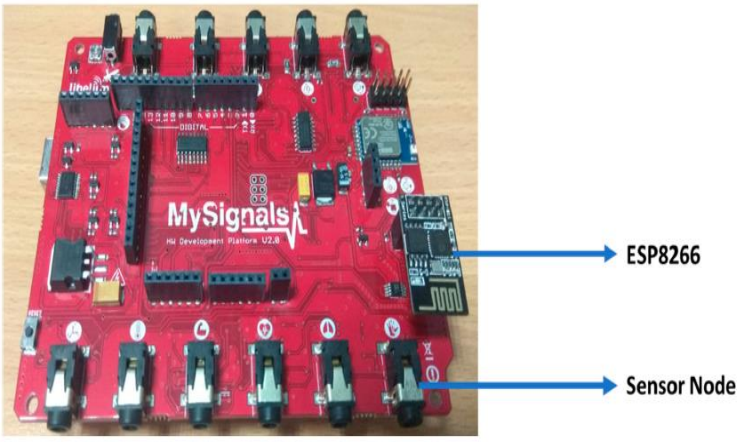


**Figure 3.2 MySignal board with 11 sensors (Kabir M. et al. 2015)**

**In fig 3.2, it is a diagram of MySignal with 11 sensors and Wi-Fi modules.**

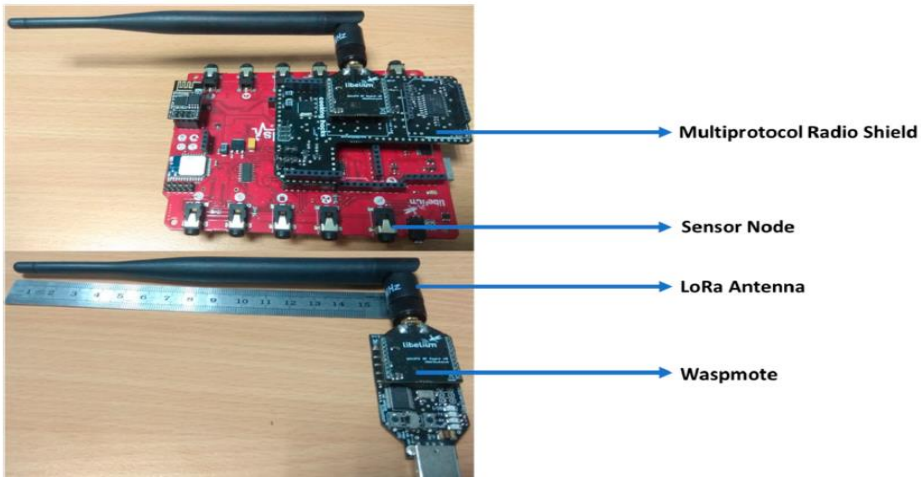


Figure 3.3 LoRa with multiprotocol (Kabir M. et al. 2015)

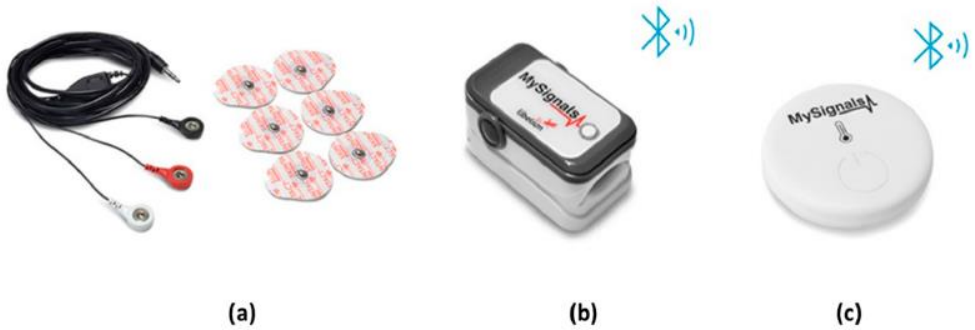


Figure 3.4 Sensors (Kabir M. et al. 2015)

Table 3.2 Psychological Information (Islam M. et al 2019)

## Result and Discussion

In Fig 4.1, the complete System is connected for the purpose of collecting human body data with all its elements.

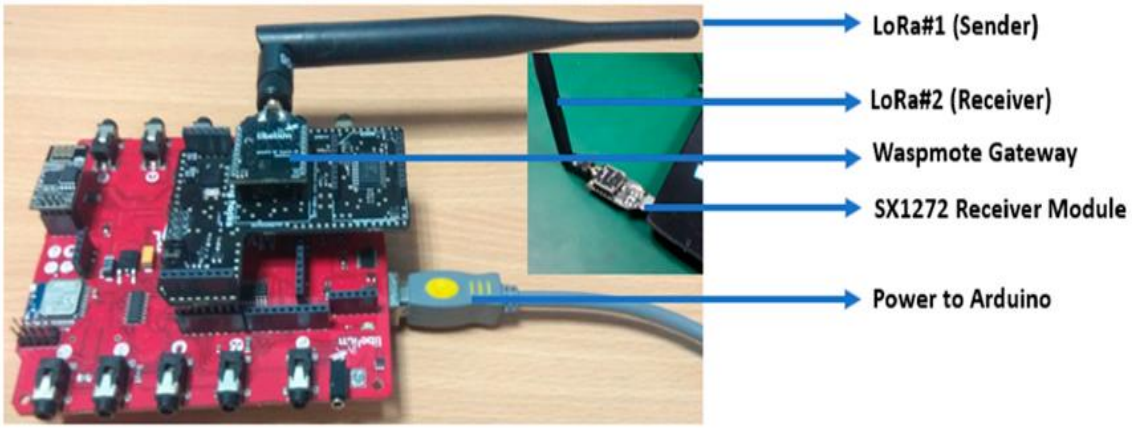


Figure 4.1 Complete System (Kabir M. et al. 2015)

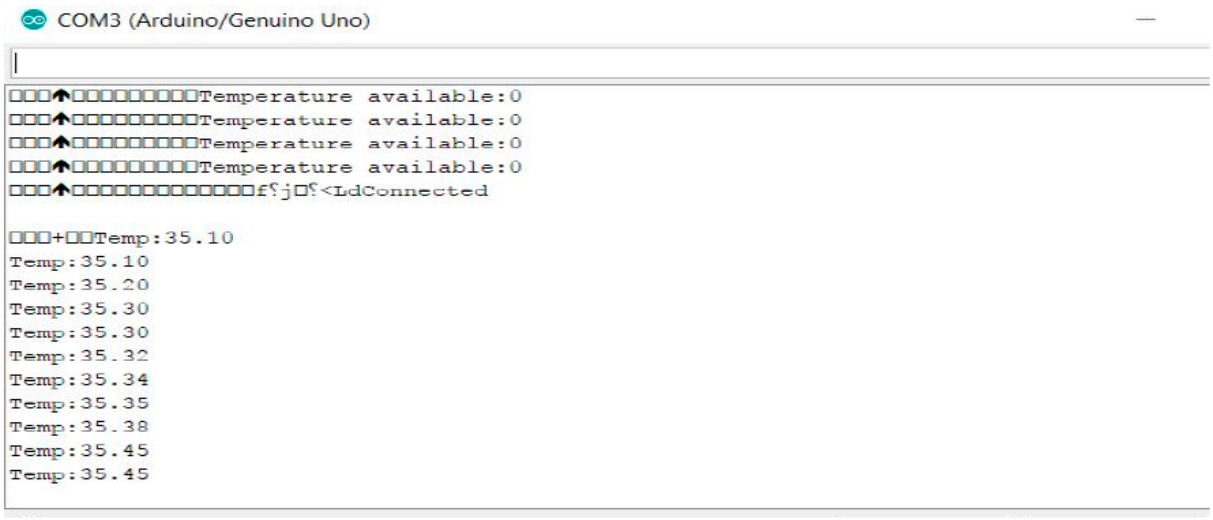


Figure 4.2 Temperature (Kabir M. et al. 2015)

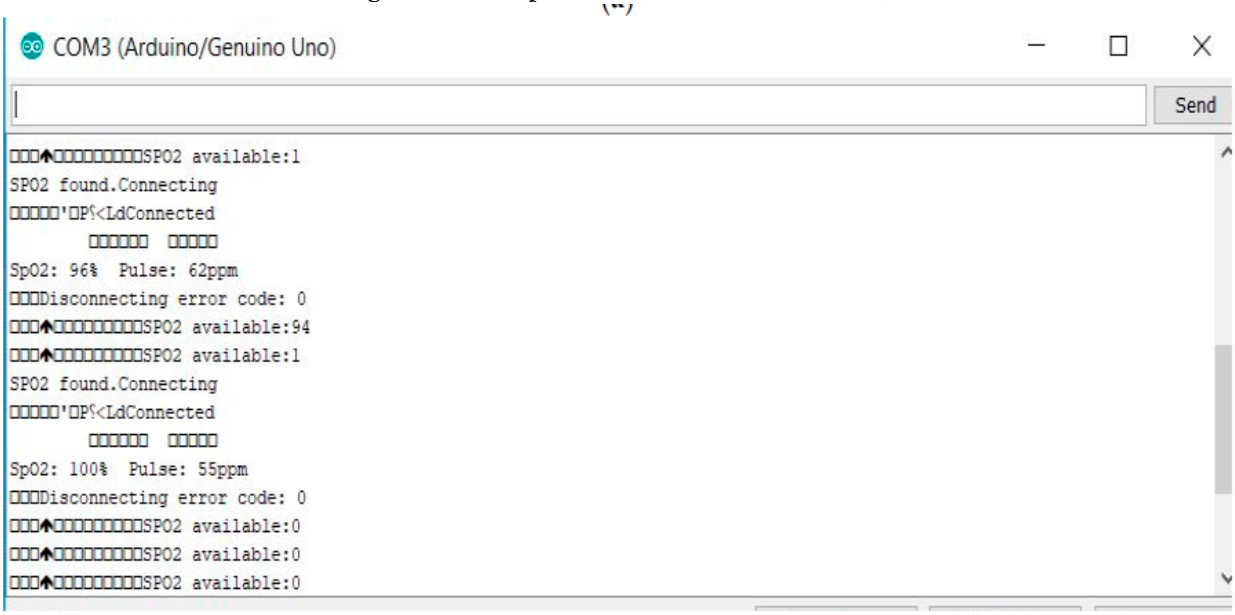


Figure 4.3 readings from monitor (Kabir M. et al. 2015)

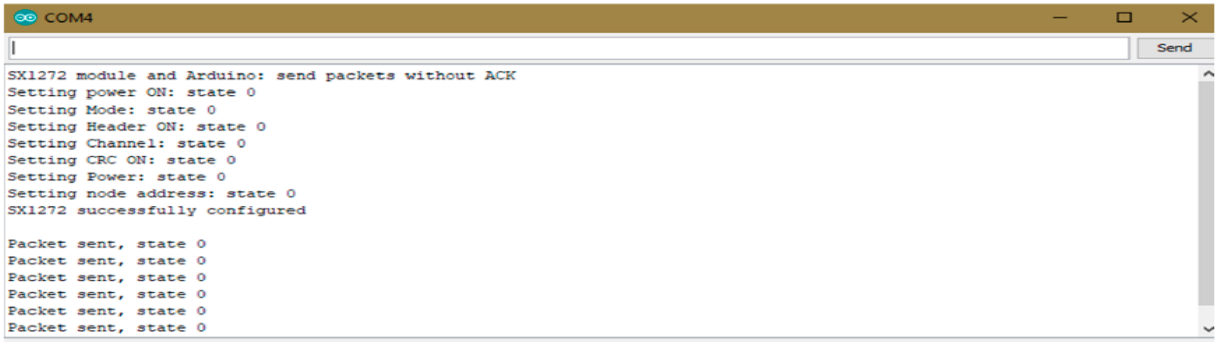


Figure 4.4 LoRa ready to transfer packets (Kabir M. et al. 2015)

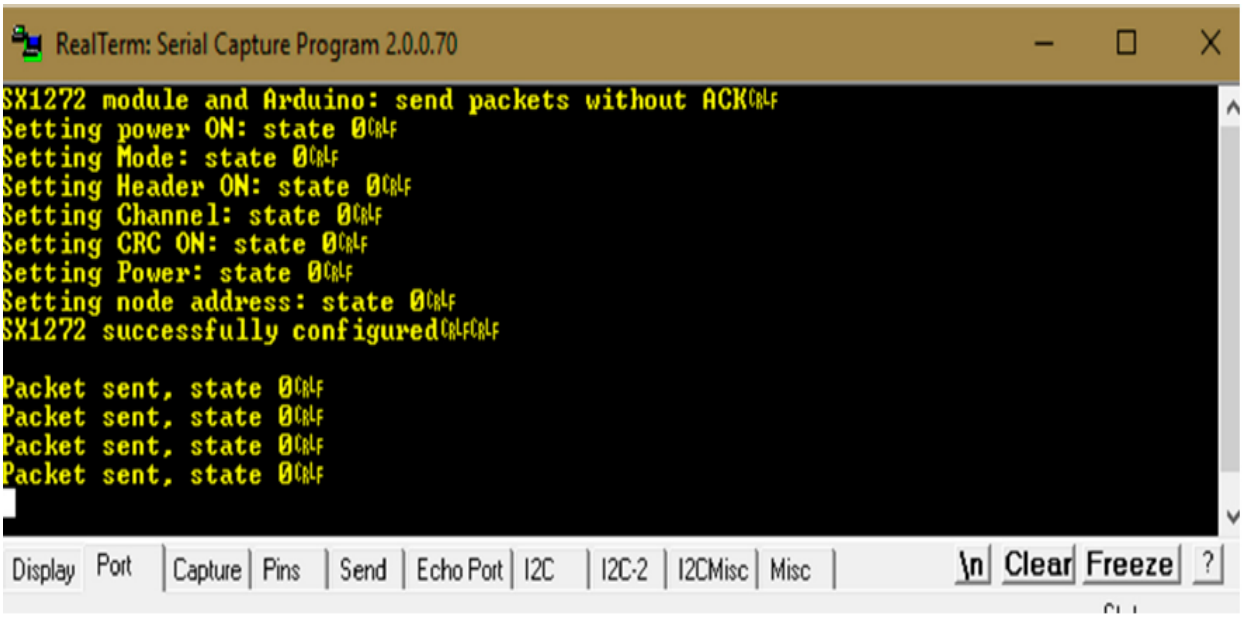


Figure 4.5 Test packets send (Kabir M. et al. 2015)

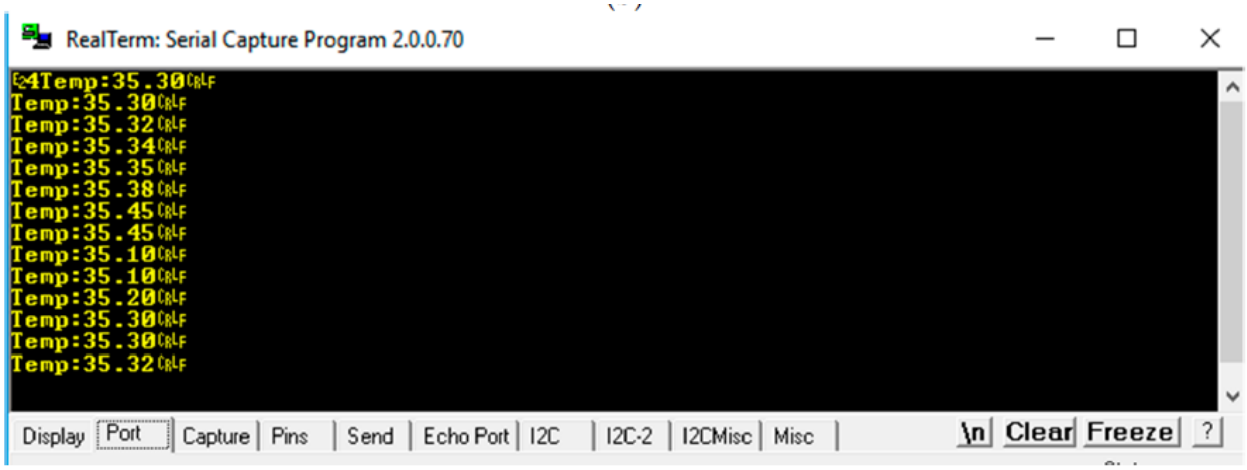


Figure 4.6 Data receiving (Kabir M. et al. 2015)

Table 4.1 Comparisons between human body and sensor data (Islam M. et al 2019)

| Human Body Characteristics | Normal Data | Sensor Data (Proposed System) | Issues |
|---|---|---|---|
| Body Temperature | 36.5–37.5 °C | 35.10–35.40 °C | Air condition environment |
| Pulse Rate | 60–100 bpm | 55–62 bpm | No |
| Oxygen Saturation (%) | 96–99 | 96–100 | No |
| ECG Values (Heart Rate) | 60–100 bpm | 60–100 bpm | No |
| ECG Values (Time Interval (s)) | 0.1–0.2 | 0.1 | No |

Table 4.2 Comparison between different network technologies (Islam M. et al 2019)

| Network Technology | Data Rate | Transmission Range | Power Consumption | Battery Life |
|---|---|---|---|---|
| BLE | 1–2 Mb/s | 10 m | 40 mA TX, Standby 0.2 mA | 1 Year |
| ZigBee | 0.02–0.25 Mb/s | 100 m | 30 mA TX, Standby 1 µA | Week |
| Wi-Fi | 11 Mb/s–10 Gb/s | <1 km | 400 mA TX, Standby 20 mA | Hours |
| LoRa | 290 bps–50 Kbps | 15 km | 28–44 mA TX, Standby 1.4 mA | 10 Years |

Table 4.3 Statistical sample data analysis of sensor (Islam M. et al 2019)

| Wearable Sensors | Sample Mean (Sensor Data) | Population Standard Deviation | Sample Standard Deviation | Confidence Interval Approximations Range |
|---|---|---|---|---|
| Body Temperature | 35.26 | 0.084 | 0.092 | 35.18–35.33 (95%) |
| Pulse rate | 58.33 | 2.624 | 2.875 | 53.30–61.35 (99%) |
| Oxygen saturation | 98.33 | 1.247 | 1.366 | 96.89–99.77 (99%) |

Table 4.4 Hypothesis testing (Islam M. et al 2019)

| Hypothesis Testing (Left Tail) | Null Hypothesis Mean ($H_0$) | Sample Mean (Normal Human Body) | Sample Size | Significance Value | Result |
|---|---|---|---|---|---|
| Body Temperature Sensor | 35.26 | 37 | 6 | 5% | The null hypothesis cannot be rejected. The z score of 46.33 is within the nonrejection area |
| Pulse Rate Sensor | 58.33 | 80 | 6 | 5% | The null hypothesis cannot be rejected. The z score of 18.46 is within the nonrejection area |
| Oxygen Saturation Sensor | 98.33 | 97.5 | 6 | 5% | The null hypothesis is rejected and accepts the alternative hypothesis. The z score of –1.49 is in the rejection area |

In fig 4.7, the system collecting a ECG sensor data from a human body.

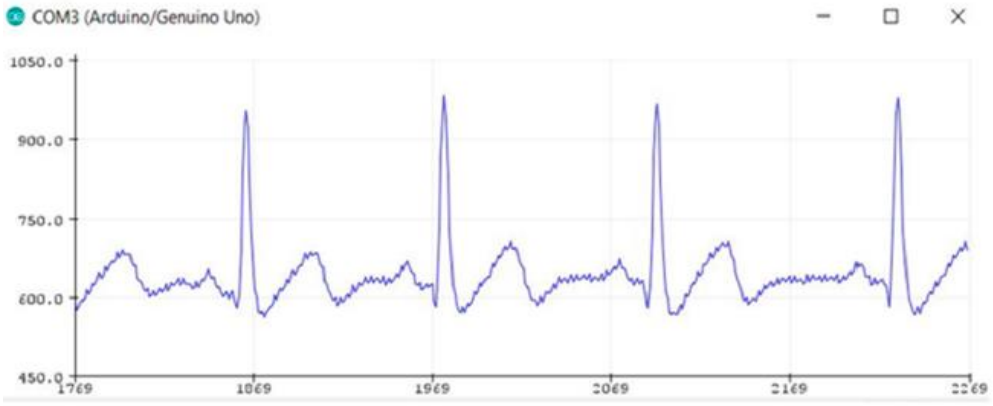


**Figure 4.7 ECG sensing data (Kabir M. et al. 2015)**

In fig 4.8, Arduino collect pulse rat, body temperature and oxygen rate. The average oxygen saturation rate is a 96 to 100 percent and In fig 4.9, average rate of body temperature that is collected through sensors is 35.40 C and In fig 4.10, average rate of pulse rate is 55 to 62 bpm.

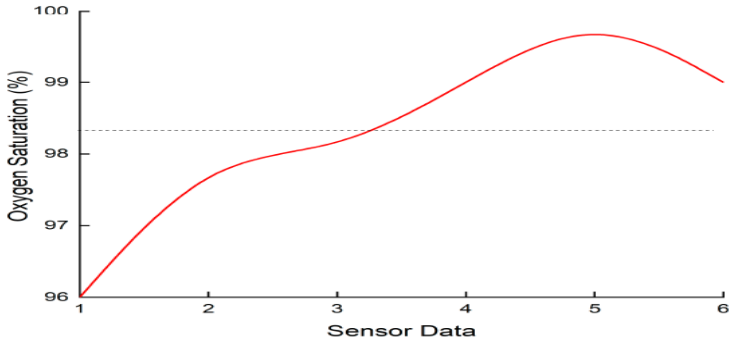


**Figure 4.8 oxygen saturation (Kabir M. et al. 2015)**

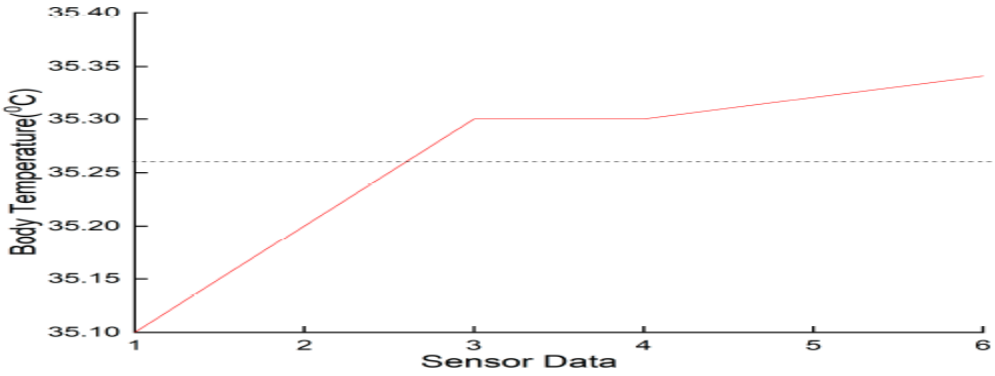


**Figure 4.9 Body temperature (Kabir M. et al. 2015)**

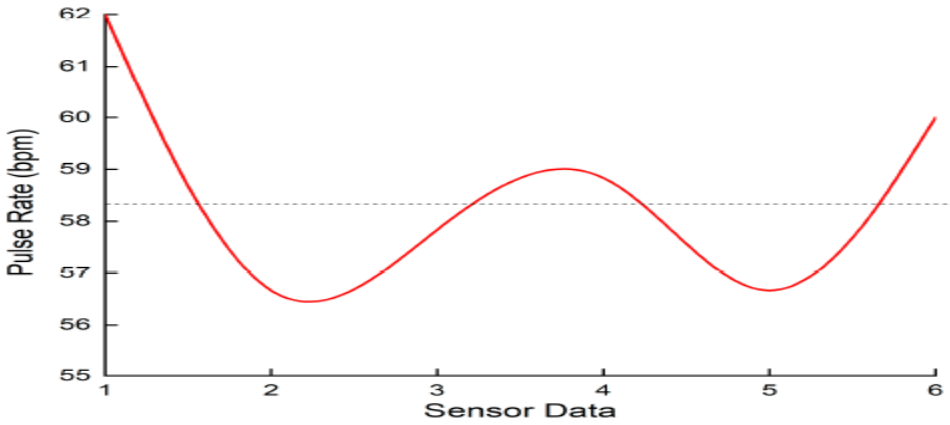


Figure 4.10 pulse rate (Kabir M. et al. 2015)

Table 4.5 Comparisons between health-related system with sensors (Islam M. et al 2019)

| System | Sensor Node | Applied Network Technology | Micro-Controller | Power Consumption |
|---|---|---|---|---|
| Blood Pressure Monitoring System | Blood Pressure | BLE | AT89c2051 | Low Power |
| ECG Telemetry System | ECG | BLE | Arduino | Low Power |
| Remotely Patient Monitoring System | Motion, ECG | BLE | MSP430 | Low Power |
| Health Telemonitoring System | ECG, Blood Pressure | BLE, ZigBee | N/A | Low Power, Potential Battery-less |
| ECG Monitoring System | ECG | ZigBee | ARM7 | Potential Battery-less |
| Healthcare System of Doppler Shifts | ECG, Photo-plethysmogram (PPG) | Wi-Fi | N/A | High |
| Patients' Daily Activity Monitoring System | Inertial | Wi-Fi | N/A | High |
| Safety and Health Monitoring Applications | PPG, Body Temperature | LoRa | ARM Cortex M0 | Low Power |
| Sustainable Health Monitoring System with Smart Clothing | ECG, Oxygen Saturation, Pulse Rate | Bluetooth | Arduino | Low Power |
| Human Body Signal Monitoring System | ECG, Body Temperature, Pulse Rate, Oxygen Saturation | LoRa | Arduino Uno | Low Power |

**Summary**
The system is designed with three technologies that are MySignal, LoRa and biomedical sensors. These network technologies work together and collecting data through sensors from human body. The MySignal is successfully collecting the boy temperature, oxygen saturation and pulse rate. The LoRa module has been installed and it can connect to system and working properly. To check the data accuracy that is collected from human body, statistical analysis and hypothesis testing has been performed.

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