

# PERSONAL COMMUNICATION SYSTEM

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## ABSTRACT

*The project "Personal communication system" aims at developing a RF based device to establish encrypted and direct connection between two devices. This direct connection can be used to transmit data without using any third party networks or internet. Encryption techniques are used at multiple levels to maximize the security and reliability of the transmitted data. This system helps different part of an organization to communicate in a secure and reliable mode. This can be also used in emergency situations. Many organizations current need is a secure system with which they can communicate internally within the organization, which demands a highly secure and reliable system which works over a long distance. This system is developed to meet those demands and will be a standalone solution for their requirements.*

**Key words:** Personal Communication, Radio Frequency (RF), Receiver, Transmitter.

## 1. INTRODUCTION

As The project needs both specific hardware and software to be developed, It started with the development of the hardware. After a brief market analysis the right hardware components were chosen, after meeting with our strict requirements. The software is developed in Arduino platform using C/C++ programming language. The proposed system is a standalone hardware unit with our software running on it, which can connect to any device which may be a personal computer or a mobile device of the user through Bluetooth or USB interface. The sender can connect to the device using any one of the available connectivity option and can use the application which is developed for Android and windows to communicate and send data to their units. The sender uses the application to send data to the unit, the unit then encodes the message and adds CRC data to increase security and reliability all these data processing is done by the soc in our ESP-32 module, which then sends the data to the transceiver. The transceiver is programmed and fine tuned to support long range communication with low power consumption based on the data gathered from trials conducted by our team on [20-02-2020]. The transceiver receives the processed data from the main board and adds some fine tuning to the data further improving the efficiency of the transmission and uses an external IPEX antenna to transmit the data. Then the data sent on air is received by the receiver and processed at multiple levels then displayed as readable message.

## **2. SYSTEM STUDY**

### **2.1 Existing System**

Existing systems include enterprise solutions like BBM (BlackBerry Messenger), NetSfere etc and so on. These are not standalone systems and are implemented at the software level. These systems solely concentrate in encryption, they leave the physical layer with the ISP (Internet Service provider). As they use existing network of ISP's to transfer data between clients, these networks may be compromised or may fail as they are not engineered for providing these services.

#### **Draw Backs**

- Requires additional third party infrastructure
- This system adds an extra point of failure
- Not accessible to general public
- Very costly

### **2.2 Proposed System**

The proposed system is a complete solution including both hardware and software components, which does not use any third party networks, It uses 865MHz to 867MHz frequency band. LoRa protocol is used which can be tailored for our application. LoRa is a low power wide area network technology. It is based on spread spectrum technology. It is now acquired by semtech. RF module in this system is programmed to support hardware level encryption and also be energy efficient at the same time.

#### **2.2.1 Advantages of The Proposed System:**

##### **2.2.1.1 Advantages**

- It is scalable
- Does not require any third party services to function
- Does not require\*e any special licensing
- Works across multiple platforms
- Accessible to general public which aids in further development of this system.

## **3. SYSTEM DESIGN**

### **3.1 System Design**

Systems design is the process of defining the architecture, modules, interfaces, and data for a system to satisfy specified requirements. Systems design could be seen as the application of systems theory to product development. There is some overlap with the disciplines of systems analysis, systems architecture and systems engineering.

### **3.2 Fundamental Design Concepts**

The design process comprises a set of principles, concepts and practices, which allow a software engineer to model the system or product that is to be built. This model, known as design model, is assessed.

### **3.3 Modularity**

Modularity is achieved by dividing the software/hardware into uniquely named and addressable components, which are also known as modules. A complex system (large program) is partitioned into a set of discrete modules in such a way that each module can be developed

independent of 5 other modules. After developing the modules, they are integrated together to meet the software requirements. Note that larger the number of modules a system is divided into, greater will be the effort required to integrate the modules.

### 3.4 Abstraction

Abstraction refers to a powerful design tool, which allows software designers to consider components at an abstract level, while neglecting the implementation details of the components. IEEE defines abstraction as 'a view of a problem that extracts the essential information relevant to a particular purpose and ignores the remainder of the information.' The concept of abstraction can be used in two ways: as a process and as an entity. As a process, it refers to a mechanism of hiding irrelevant details and representing only the essential features of an item so that one can focus on important things at a time. As an entity, it refers to a model or view of an item.

### 3.5 Input Design

The input message is given by a mobile application for android or via serial interface through usb port for computers. Which is received through SerialBT or Serial connection based on the device used

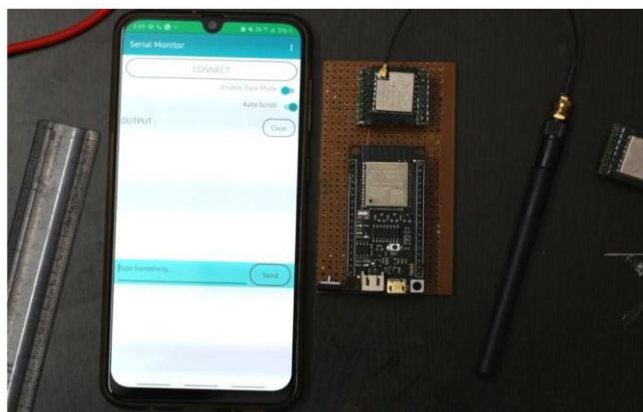


Figure 1: Input Design

### 3.6 Output Design

The output is transmitted via the SX1278 transmitter, the data to the transmitter passes through the SPI bus present in the ESP 32 module. SPI interface is used as it has highest reliability and virtually no data loss.

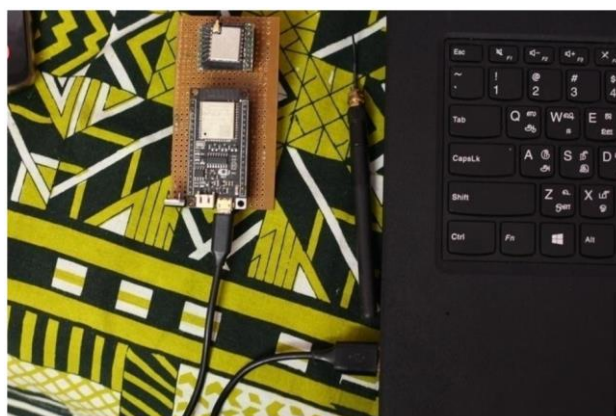


Figure 2: Output Design

## 4. FLOW DIAGRAM

### 4.1 Software Processing:

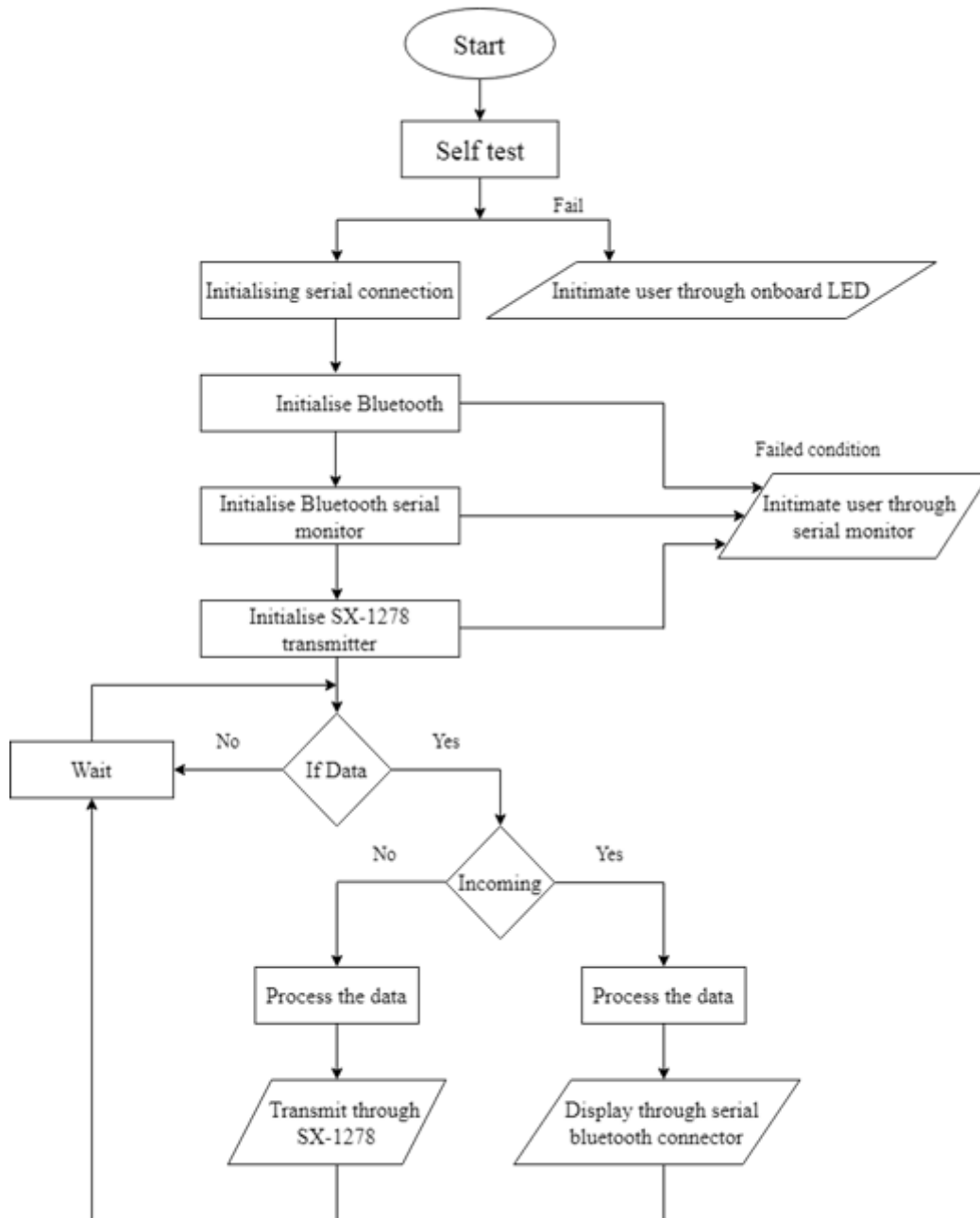
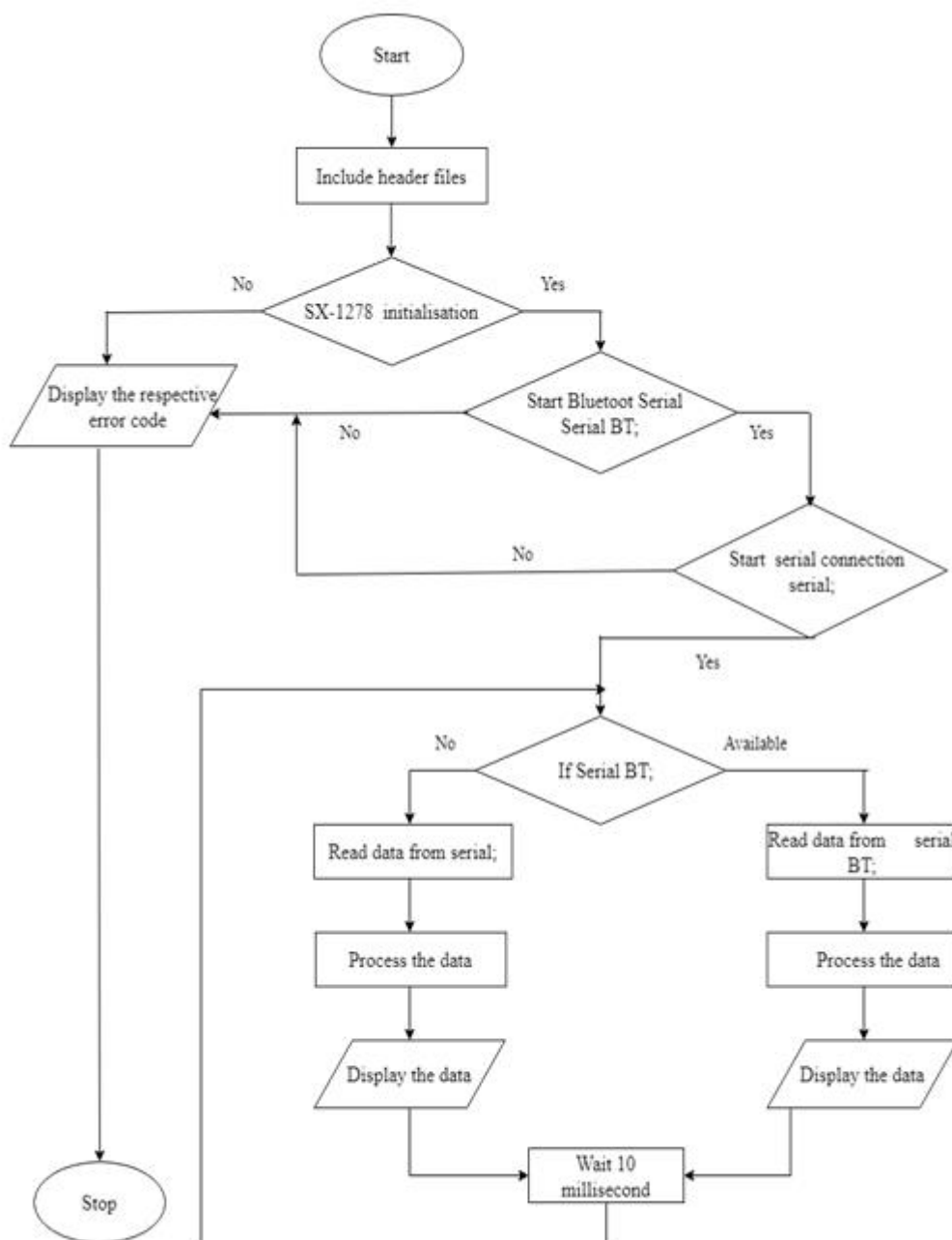


Figure 3: Software processing

## 4.2 Hardware Processing:



**Figure 4:** Hardware Processing

The entire system is developed in e four modules. They are

- Web interface
- Backend module
- RF module
- Microcontroller unit

The main objective of the system is to develop a RF based device to establish encrypted and direct connection between two devices. This direct connection can be used to transmit data without using any third party networks or internet. Encryption techniques are used at multiple levels to maximize the security and reliability of the transmitted data. This system helps different part of an organization to communicate in a secure and reliable mode. This can be also used in emergency situations.

**Web Interface:**

The messaging interface which the user interacts with the system.

**Backend Module:**

This module implements messaging system and software level encryption techniques.

**RF Module:**

This is a hardware component module. It handles all physical layer duties such as handshake between clients, hardware level encryption, modulation and keying techniques. LoRa protocol is implemented here.

**Microcontroller Unit:**

This is a separate microcontroller board consisting of its own memory. It integrates the RF module and acts as a server to serve clients. Web interface and backend code is stored here .

## 5. SYSTEM IMPLEMENTATION

Implementation is the stage of the project where the theoretical design is turned into a working system. At this stage the main work load, the greatest upheaval and the major impact on the existing system shifts to the user department. If the implementation is not carefully planned a controlled it can cause chaos and confusion.

Implementation includes all those activities that take place to convert from the old system to the new one. The new system may be totally new, replacing an existing manual or automated system or it may be a major modification to an existing system.

Proper implementation is essential to provide a reliable system to meet the organization requirements. Successful implementation may not guarantee improvement in the organization using the new system, but improper installation will prevent it.

The process of putting the developed system in actual use is called system implementation. This includes all those activities that take place to convert from the old system to the new system. The system can be implemented only after thorough testing is done and if it is found to be working according to the specifications. The system personnel check the feasibility of the system.

The most crucial stage is achieving a new successful system and giving confidence on the new system for the user that it will work efficiently and effectively. It involves careful planning, investigation of the current system and its constraints on implementation, design of methods to achieve the changeover. The more complex the system being implemented, the more involved will be the system analysis and the design effort required just for implementation.

The method of implementation and the time scale to be adopted are found out initially. Next the system is tested properly and the same time users are trained in the new procedures. The system implementation has three main aspects. They are education and training, system testing and changeover.

The implementation stage involves following task

- Careful planning.
- Investigation of system and constraints.
- Design of methods to achieve the changeover.
- Training of the staff in the changeover phase.
- Evaluation of the changeover method.

The method of implementation and the time scale to be adopted are found out initially. Next the system is tested properly and the same time users are trained in the new procedures.

## **6. CONCLUSION**

This is a simple and efficient solution for enterprise communication needs which does not require any third party networks. It adds an extra level of security and it is a complete redesign of the preexisting systems. The software can further upgraded in future to send documents and voice. The transmitter and receiver can be upgraded to cover long distances. Encryption can be upgraded for future needs.

## **7. FUTURE ENHANCEMENT**

The software can further upgraded in future to send documents and voice. The transmitter and receiver can be upgraded to cover long distances. Encryption can be upgraded to further enhance security for future needs.

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