Design of Tri-Level Secured Intelligent Wheelchair System

[1]Aishwarya Chavan,[2]Pranali Mali,[3]Aishwarya Patil,[4]Ajinkya Bapat

[1]UG Student,[2] UG Student,[3] UG Student, [4] Assistant Professor

[1,2,3,4] Department of Electronics and Tele communication,

NMCE,Peth naka,India.

Abstract—The physically challenged persons are one of the excluded section of the society and also they phase no. of problems in their daily life. In order to bring them in the main stream both the central as well as the state governments are introducing many well fair and schemes. According to the last survey, the total disabled population of India is 21 million which is 2.1 percent of the country's entire population. Interestingly the Indian census on the disabled population also details the type of their disability. For a cases of difficult or impossible walking, the use of the wheelchair is becoming essential. With the motivation of this to address this issue this system has been proposed the objective of this project is to facilitate the movement of disable people or handicapped and also the senior people who are not able to move well. Proposed wheelchair system is based on number of wireless standard like Bluetooth , GPS, GSM etc. and it is to be secured using XOR-PRNG, and Binary ECC protocol to deal with possible security threats during its operation on cloud via Air interface.

IndexTerms— XOR-PRNG,Bianry ECC Android, Bluetooth, GPS, GSM, Cloud.

I. INTRODUCTION

There are many ways for designing a smart wheelchair. Now a day's smart wheelchairs were mobile robots to which seats were added in the paper [2][3] Present days, most of evolved smart wheelchairs are built on by modifying commercially available powered wheelchairs[1]. All these designs are having same objectives like Easing the way the chairs are used, avoiding collisions as much as possible.

The physically challenged persons faces a lot of troubles like feeling of insecurity while travelling in the private buses, The disable person is largely dependent on a family because they get economical and emotional support from family, friends and relatives and also get encouragement, road constraints involve encroachment by bus stops, by venders, temporary structure and parked vehicles etc.

This paper proposes a design concept to build an innovative multilevel secured wheelchair system. The design methodology of this proposed system is divided into two parts , first booking of wheelchair before actually reaching at public places to ensure its availability, to reduce the inconvenience that could be possibly occurs. Second part of this design concept is actual operation of wheelchair using different wireless standard. This paper proposes an unique approach to facilitate this proposed system with three level of security provision which consist of high speed, collaborative Binary ECC-XOR-PRNG Protocol[11][12], OTP support and inbuilt security provisions. Implementation of such security protocol on wheelchair system is very first attempt and it is expected that it will stand against all kind of wireless security threats.

This paper describes design concept of proposed secured wheelchair system. The rest of this paper is organized as follow: Section 2 briefly summarize literature survey. Section 3 gives operational concept with discussion on Binary ECC-XOR-PRNG Protocol has been described. The conclusion and the future one of this paper is drawn in section 5.

II. LITERATURE SURVEY

According to the commentary paper published by Simpson in 2005[1], there are many forms for designing a smart wheelchair. By a referring to a study conducted by world health organization [4]. According to recent survey around every one person in fifty is suffering from paralysis. The purpose of paper [6] is to appraise them from the common point of view of physical therapists and biomedical engineering working on the development of wheelchair.

In paper [5] the experimental results and usability studies for wheelchair has done. It describes a shared controlled paradigm of man machine interrelative operation in which human operator selects the appropriate behavior while the software is responsible for executing behaviors and generating safe trajectories. Paper [7] proposed concept to drive a wheelchair using accelerations sensors and head movements with the possibilities of avoiding obstacle. There are few articles which Proposes new and more efficient man machine interface resulting from the fusion of two projects: The smart wheelchair project and Interacting Tele-thesis project. An EMG based hands-free control system for a wheelchair is proposed [15][16]. From the literature survey it has been seen that the existing smart wheelchair are based on Gesture control or speech or voice recognition mechanism without any security provision. But these system is having their own limitations as they are meant to be used by handicapped person. In an attempt to design a fully automatic and handy system this paper proposes a concept to operate a wheelchair using smart-phone.

This paper introduces a methodology to book a wheelchair before reaching at public places for their convenience. The design of the wheelchair is fully secured by applying three way security provisions which includes emergency buzzer, security offered by GSM system and introduction of collaborative XOR-PRNG protocol while online booking of wheelchair which offers six type of security provisions as described in [7]. The three way security provision as described in this paper is first attempt of its own kind in such system.

III. METHODOLOGY

The block diagram of proposed system is shown in Fig.1 and Fig.2. One of the important aspect of the system is to insure availability of wheelchair before reaching at the public places like railway station, bus stand etc.

Fig 1: Block diagram of online booking of wheelchair.
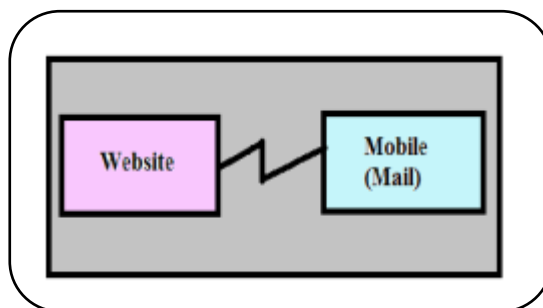
For this purpose the proposed system allows to book a wheelchair. The same thing is shown in fig.1. To book a wheelchair a user has to register with wheelchair provider using an unique Login ID and Password. This unique ID will authenticate wheelchair user and ensure security. After successful booking of a wheelchair that person will received a confirmation message. The system will facilitated with two more level of security provision of OTP support and use of collaborative Binary ECC-XOR-PRNG protocol which is better choice for long distance communication and when system is dealing with number of wireless protocol[11][12,] in addition with unique Login ID system.

Fig 2: Block diagram of wheelchair
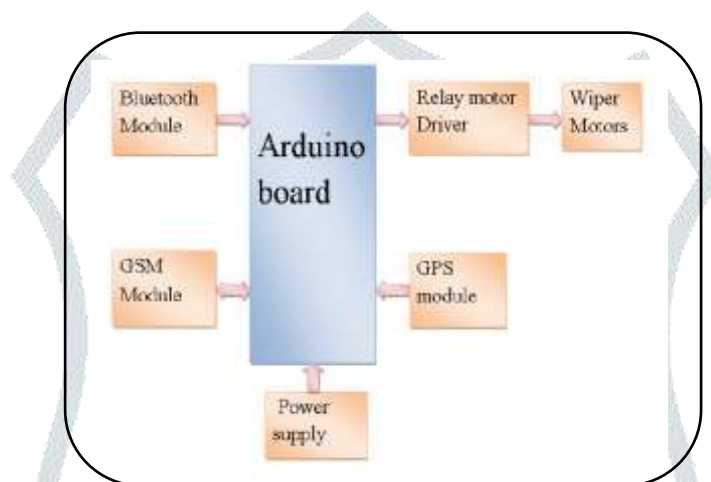
After successful booking of wheelchair the second part of the proposed system is actual operation of wheelchair. The design of wheelchair system consist of number of wireless standards like GSM System ,Bluetooth and GPS. The GPS will traced out the location of wheelchair and it will send to control office by that way It is possible to get the location of the wheelchair. In case of emergency situation the proposed system provide emergency alert to the control office using GSM System. The handicapped person will operate the proposed wheelchair using Bluetooth enabled smart phone without taking help from any other person. This is the highlighting concept of this paper. Since the system includes number of wireless module also implementation of Binary ECC-XOR-PRNG Protocol. It requires a high speed micro controller. According to literature survey ATmega256 will be better choice over 8051 or PIC controller.

This system consist of GSM Module which has its inbuilt security provision viz A3, A8, A5 Algorithm. Where A3 is Authentication algorithm, A5 is encryption algorithm and A8 is cipher key generation algorithm [12] having said that GSM has no of security issues as described in [10][11]. To overcome this issues the proposed system has provision of that Binary ECC-XOR-PRNG Protocol.GSM System suffers from many security related problems. Many Techniques in GSM like IMSI Number ,IMEI number provide advantages like authentication and authorization of user , Information about used device for communication and its secrecy ; despite of this GSM system has many security related issues due to presence of Air Interface and use of Wireless Protocol in its operation[12]. New up-coming Wireless Technology has many characteristics similar to wired technology. After tracking object by RFID System, result of its location which is traced by GPS will be send to Authorized user or server using GSM system, required a considerable powerful security protocol[13][14].

Table no.1: Comparison between 8051 and ATmega256

Parameter	Micro controller 8051	Arduino Mega
Operating voltage	5V	5V
Clock frequency	12 MHz	16 MHz
Flash memory	8 KB	558KB
SRAM	256 Bytes	8 KB
EEPROM	NO	4 KB
Inbuilt ADC and DAC.	Not present	Present
Pins	40	54

Motor is connected to the Atmega 256 through Relay Motor driver. Relays are like Remote control switches and are used in many applications because of their relatively simplicity, long life, and proven high reliability. Relays contain a sensing unit, the electric coil, which is powered by Alternating current or Direct current.

IV. CONCLUSION AND FUTURE WORK

This paper concludes the design concept of an innovative wheel chair system which could give an ease to a disabled person. The highlighting point of this paper is to build wheel chair system using an efficient wireless standard. This paper suggest implementation of Binary ECC-XOR-PRNG Protocol in this system. According to literature[10][11] it is expected that , this system will deal with all kinds of possible security threats during its actual operation. Implementation of such a security protocol on such a system is one of its first attempt of its own kind .The future work of this paper will be to design a fully automatic wheel chair system and to apply mention security protocol on hardware platform to secure the system during its operation. As mentioned in earlier section this paper believes that such a multilevel security provision will address all kind of possible security threads and insure safety of that disabled person and avoid misuse of this proposed system.

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