Home: IOT Based Home Automation Using NFC

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***Abstract*—One of the emerging technologies in today's World having spread its usefulness in a wide variety of domains is near-field communication. From automation of student's attendance monitoring to the ticketing system, it has been widely accepted across many countries. Its main feature lies in automation like automating car for locking/unlocking car doors, switching in GPS, turning on radio/speakers etc. The internet of things has given us opportunity to automate our home appliance and control it from a certain distance. A home automation system has become a trend, which gives a convenient way for users to personalize artifacts in home using sensors, Bluetooth and android system. This paper proposes the architecture for home automations using near field communication and general packet radio service along with a mobile application. The near-field communication is used as the central system in this paper to automate home environment for a user by locking and unlocking doors, lighting, air conditioning, switching on/off fans, personal computer, mobile, television as near field communication helps in providing energy efficiency and required security.**

Keywords—Home automation, NFC, IOT, Mobile Phone, GSM

I. INTRODUCTION

This paper demonstrates the system for home automation using NFC technology and monitoring via GPRS. Home automation is a utilization of Internet of Things (IoT). The apparatuses can be controlled remotely in adaptable ways. Further remote correspondence approaches give simple, adaptable and financially savvy answers for computerize home. The principle favourable circumstances of home computerization are:

1. Simple way of life and spares vitality,

2. Expanded wellbeing and enhanced security,

3. Adaptable and advantageous remote control,

The proposed architecture demonstrates features to control and automate home environment. This includes various features within home like turning on/off light, fan, air conditioner, Wireless Fidelity(Wi-Fi), Bluetooth. The system consists of an NFC(Near Field Communication) card, which is swiped across the reader on the entrance of the door for the door to be automatically locked or unlocked. Similarly, the NFC card is programmed to turn on or off the air conditioner depending on the room temperature. Once the NFC card detects that the temperature is high, it automatically turns on the air conditioner along with operating TV(Television), personal computer and turning on Wi-Fi.

Home automation is an emerging requirement by common man and commercial users for the reasons of ease of use and security. In countries like India, home automation is slowly paving its way. This paper demonstrates the architecture of home automation using a widely accepted technology – NFC. The main purpose of using NFC for home automation, here, lies in the many advantages that this technology has to offer. NFC is a type of remote innovation including an arrangement of conventions, which build up radio recurrence correspondence between the two gadgets inside a short closeness of 10 cm or less. It works at a frequency of 13.56 Mhz and exchanges information at a rate of 424 Kilobits for each second. Two NFC gadgets utilize electromagnetic radio fields for correspondence. NFC technology is easy to understand, secure and effortlessly reasonable. One single touch makes wonder with NFC without giving a large number of lines of code or data. NFC empowered cellular telephones can be utilized to share data, fast dial to a particular individual, communicate something specific consequently, bolt and open entryways, offer photographs, pay bills, as transport or prepare tickets and for interactive advertising. There are 3 modes in which, NFC operates – card emulation mode, reader/writer mode and peer-to-peer mode.

1. Card emulation mode – Here, NFC empowered gadgets act like a contactless savvy card. Advanced cells with NFC label work in this mode and can be utilized to make payments or ticketing.

2. Reader/Writer mode – NFC empowered gadget as a reader peruses data from electronic labels. It begins the correspondence by producing an attractive field and sends charges to the objective.

3. Distributed mode – Here, two NFC gadgets can trade information on the other hand. Each of these gadgets support both initiator and target mode. The information trade here happens gradually because of the administration of complex convention.

NFC framework contains a NFC reader and NFC tag. A NFC gadget can act both as a reader and a tag. NFC reader peruses the information present in NFC labels. NFC writer is utilized to compose client determined information on to the tag.

There are 4 types of NFC tags:- Type 1 & Type 2 can be read and written or read-only whereas Type 3 & Type 4 can be pre-configured at manufacture. The data that is stored on these tags comprises of text data like web address, SMS, telephone

number, email ID, vCard etc. The principle points of interest of NFC are:

1. Usability: NFC helps simple exchange of records like tunes, photographs and so on. It is not important to build up an association or make any design settings. It empowers simple association of gadgets just by a touch. NFC gives higher level of client accommodation.

2. Adaptable: NFC is being utilized as a part of an extensive variety of commercial ventures and administrations extending from managing an account to continuous overhauls, scholarly enclosure and person to person communication and different businesses.

3. Security and Safety: NFC gives a safe channel and backings encryption of information to be sent between two gadgets. This anticipates listening stealthily. Additionally, the nearby vicinity upheld by NFC counteracts obstructions empowering smooth information exchange.

II. RELATED WORK

The paper [1] proposes a Smart board - an application used to control the home exercises. The application underpins different orders like Good bye home – shuts the windows and turns off the light, Welcome home-Night – closes windows shades and turns on the light, Welcome home-Day – opens windows screens and turns off the light, Good morning – opens the screens in kitchen, lavatory and lounge area. Notwithstanding this, the paper additionally tosses light on issues in the cooperation with application. Case in point if the tag is not read appropriately the application must give voice notices, if the tag is perused legitimately yet message is not agreeable and comprehended by application, it ought to raise a message, if a timeout happens it ought to convey back the client to introductory stride. The paper likewise showcases the label identification execution by deciding the most extreme and least separations permitted between the reader and tag. It likewise probes the force utilization that happens because of the collaborations between NFC labels and readers.

The paper [2] portrays checking of understudies' participation in Hungary utilizing NFC innovation. Every understudy gets a NFC empowered personality card. Mifare DesFire NFC cards are utilized. These cards are installed with one of a kind understudy identifiers. To give security the card likewise has two distinctive fingerprints of the particular understudy put away inside it. Utilizing an exceptional terminal the executive gives fundamental definitions to the cards. The personalization terminals are utilized by the understudies. Understudies give their fingerprints at these terminals and swipe their NFC cards. The back-office framework oversaw by head checks the legitimacy of the approval. Once the biometric approval passes, understudy's participation gets enlisted. These terminals are encouraged with time-tables and understudies' names for each address. The back office is fit for creating participation reports each day.

Hussein Ahmad et all [3] quickly clarifies the mix of NFC innovation in cell telephones all together facilitate the everyday exercises. The paper depicts four methods for coordinating NFC with telephones. The main way is Phone-to-Phone, where two NFC empowered telephones can speak with each other and exchange records, music, pictures just by touching each other. Second is Phone-to-Device, where NFC empowered telephone is brought close to NFC empowered gadget.

For instance telephone has brought close NFC prepared printer to get print outs, or close payment gadget for instalment exchange. Third is Phone-to-Tag, where the NFC labels have fundamental information, which might resemble a URL, or whatever other data. These labels are normally utilized as notices. Just by bringing NFC empowered telephones close to these notices vital information is got and the fourth is Phone-to-Reader, where NFC empowered telephones, when brought close to reader to do transaction and store electronic tickets. The paper likewise underscores on different uses of NFC in payments and ticketing, information exchange, recovery of data, mechanizing frameworks and so on. It additionally tosses light on security dangers on NFC. As the separation for correspondence is less, it gets to be troublesome for listening stealthily to accomplish.

The paper [4] depicts home robotization utilizing GSM (Global System for Mobile Communication) to control home from remote spot. Three sensors and three Light Discharging Diodes(LED) are utilized. The paper proposes and executes a framework constituting of ARM7(LPC2148), Power supply, Temperature sensors, GSM modem, Gas sensor, fire sensor, drove exhibit, max232, LCD, alert and load (light, fan). On identifying fire the red drove will gleam and shows the same by means of LCD. At the point when gas is recognized, yellow drove switches on and the same is appeared in LCD. So also when there is high variety in the temperature green drove shines as demonstrated in LCD.

In paper [13], creator clarifies a contextual investigation where NFC innovation is utilized to oversee immense socio-religious events, for example, Hajj, which happens each year in Makkah city, Saudi Arabia. Keeping in mind the end goal to deal with the spatial constraints and the quantity of individuals going to the occasion, the Ministry of Hajj has set up different checkpoints in the city. A profile including blood classification, therapeutic data, travel permit subtle elements and contact data is made for every traveller and is put away in a focal database oversaw by Microsoft SQL server. A duplicate of this profile can be replicated by particular pioneers on their NFC empowered telephones. A Microsoft ASP.NET web administration is utilized to get to the database. In this way, these NFC-empowered cell telephones can be utilized as a part of distinguishing proof, help lost individuals, medicinal crises and allow check.

Paper [11] delineates the benefits of utilizing wellbeing cards which are utilized to track the essential data of the patient wellbeing records. A cross breed cloud HealthSecure is characterized into which different doctor's facilities subscribe. This cloud characterizes a safe structure and capacity servers for reinforcement. 3 mobiles gadgets are utilized: one utilized by the medicinal administrator, one utilized by patient and has healthcard mounted in it and the other utilized by specialists which is NFC empowered. The exchanges made by these mobiles are secured by a SE (Secure Element).

The proposed framework [14] incorporates advances like NFC, Wireless Sensor Networks (WSN), distributed computing and interpersonal organization in building a keen home. The framework has a few detecting and control circuit sheets (SCB) each mounted with various sensors, for example, temperature sensor, moistness sensor, light sensor and so on.,. These SCBs can thusly impart utilizing Zigbee or Bluetooth module mounted on them in this way shaping a WSN. The cloud stage fabricated records every data recorded at a shrewd home. This data can likewise be shared by means of long range interpersonal communication for reviewable purposes with companions and different clients. NFC labels are utilized for distinguishing proof and mode exchanging inside the home (on/off light, AC, TV and Wi-Fi and so forth.).

The paper [12] briefs how an open transport association introduces a NFC tag at transport stop. This tag gives data like street works, continuous information on transport, street preoccupations, transport stations, delays, separation, venture time, legitimacy and cost of ticket, guide, and climate of the destination area[13-15]. The paper additionally depicts the innovative, operational, authoritative, social, monetary and social hindrances with the proposed base and the NFC empowered cell telephones out in the open transport[16].

III. PROPOSED SYSTEM

The circuit board will be put close to the principle entryway at passage as shown in figure 1. The circuit board will have a NFC reader implanted on it. The board additionally includes a microcontroller, light sensor, temperature sensor, LCD, transfers and GSM modem. All together for a man to computerize home utilizing NFC, he/she ought to have a NFC card. This NFC card comprises of a tag which is predefined with a one of a kind pin number or a key. In the event that whatever other NFC card is utilized, the exercises won't be performed.

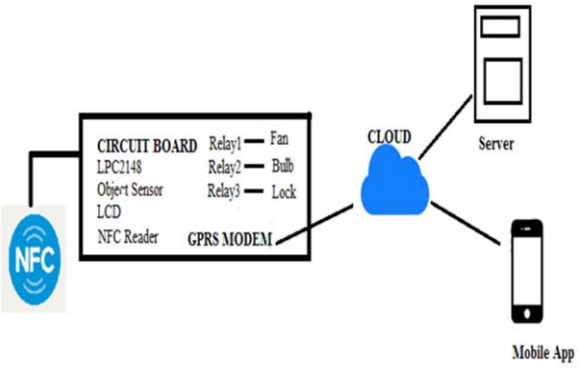

Fig. 1. Block diagram of control unit.

At the point when the individual swipes NFC card against the reader mounted on the circuit board which thus is altered close to the passageway entryway of a home ought to validate if the auto dis legitimate or not. In the event that the NFC card is genuine, a message of verification will be displayed else a non-credible message will be shown. On the off chance that the card is substantial, the entryway opens. Further contingent upon the light intensity the light sensor checks if the home has adequate light. In the event that the light force is low, the lights are on else the knob won't sparkle. Thus, the temperature sensor will be set to some temperature say 30 degree Celsius, so when temperature comes to above 33 degrees Celsius the fans/AC switch on. Once the individual leaves home, the entryway ought to get bolted and lights, fan or AC ought to switch off naturally. Further the electronic gadgets can be remotely controlled utilizing an application that can be gotten to through a mobile application as appeared in block diagram in figure 2.

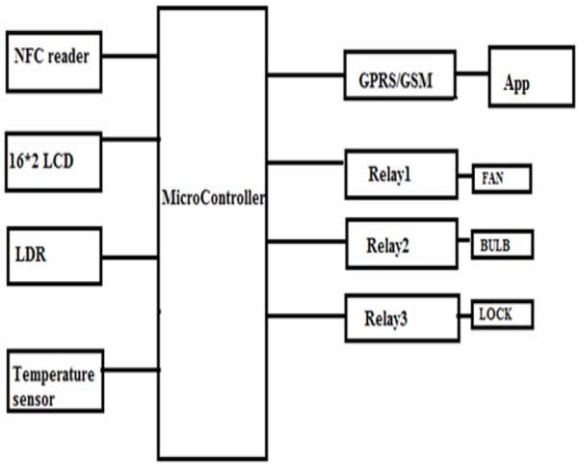

Fig. 2. Block diagram of the proposed system.

A. System Requirement

In this segment there is an overview of the necessities of home automation framework. The framework ought to likewise give a productive approach to actualize additional administrations later on. The programming prerequisites include Philips Flash utility – A programming utility to peruse, compose, identify, eradicate and check BIOS chips, Keil ARM programming – A programming device to fabricate implanted C program and DocLight – A re-enacting, breaking down and testing apparatus for serial correspondence. The equipment necessities include MIfare Classic NFC card , CR0381 NFC reader, ARM LPC2142 microcontroller, Light Dependable Resistor(LDR), LM35 Precision centigrade temperature sensor, LCD, Hand-off, GPRS modem, Home machines like fan, globule, attractive lock and so on.,

B. Detailed Design and Implementation

Mifare NFC 1k Classic card is composed with a key "BMSCE" utilizing Docklight application. "BMSCE" is utilized to approve the card and individual to obtain entrance. The reader, reads the key from tag. It checks if the secret key in NFC tag matches. If the key is detected as 'BMSCE', 'CARD IS VERIFIED' is printed on LCD else, 'UNAUTHORISED' is printed on LCD. On authorised entry as shown in Figure 4, the magnetic door gets unlocked, the LM35 temperature sensor sends information to microcontroller. Here, the limit temperature is set to 33 degrees Celsius. Likewise, the temperature prints on the LCD. If the temperature exceeds 33 degrees the fan gets on. LDR checks light intensity and if it is dark the bulb glows else the bulbs remain off. Subsequent to

settings, General Packet Radio Service(GPRS) association and Hyper-Text Transfer Protocol(HTTP) ask for, a versatile application created is utilized to control the exercises like exchanging on/off the fan, lights remotely.

Fig. 3. A simple web application.

Figure 3 demonstrates the web application created. The ON and OFF catches have a php script that sends orders to GPRS modem which thus associates with the microcontroller. SWITCH1 alludes to the transfer associated with knob, SWITCH2 alludes to the hand-off associated with fan and SWITCH3 speaks to the attractive entryways.

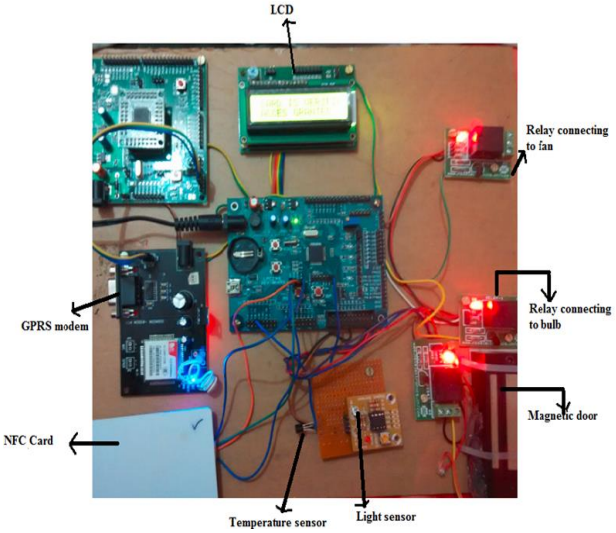

Fig. 4. Circuit board with authorised NFC card.

Figure 5 demonstrates that, when an unapproved NFC card is utilized, none of the exercises associated with home mechanization succeed. The lights stay off, fan stays off and the entryway remains bolted. Likewise, if the individual needs to leave the home, on tapping his/her NFC card on the circuit load up put close entryway, the fan, globule switches off, the entryway gets opened and once the individual moves out of home gets bolted.

IV. CONCLUSION AND FUTURE SCOPE.

NFC based shrewd home is a vigorous and intense framework. In this paper, we have demonstrated how NFC can be utilized as a part of computerizing home environment. This anticipate is simply not restricted to home but rather can be further taken forward by extending the NFC innovation in different fields and grow more secured frameworks. There are numerous easy methods to use portable applications and NFC-empowered advanced mobile phones effectively accessible in the business sector which can facilitate the everyday exercises of a worker, a kid, a debilitated, a patient or a seniority.

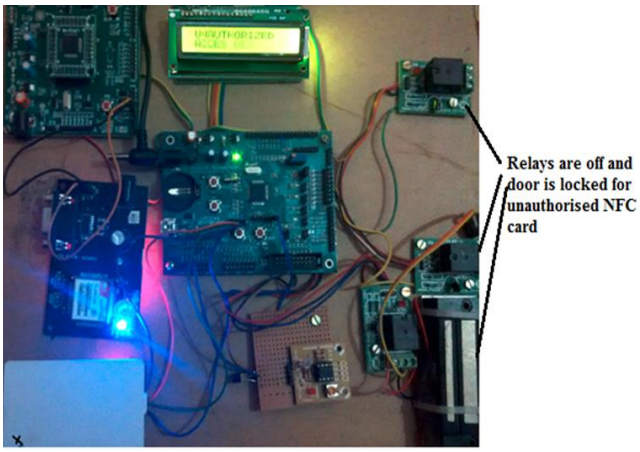

Fig. 5. Unauthorized NFC card.

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