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IOT based Smart Home Security System using RFID and Bluetooth

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Abstract:

This IOT based smart security and smart home automation systems are trying to achieve comfort combined with simplicity. Bluetooth based Home security and Home automation are the twofold features of this system. The currently built prototype of the system sends alerts to the owner over message using the smart phone. This IoT project focuses on building a smart home security system which sends alerts to the owner and raises an alarm optionally. So, people want to use for security to become safety environment. There has been a focus on the deployment of home security alarm system. But if there is Automatic Home Security System, people can feel safety of their home and also be feeling smart and comfortable of their home. So Home Security System is necessary for every home. In this system, door lock that can be controlled by RFID card and automatic light system can be used. The alarm will sound if there is movement inside the house at night. This system can communicated with Short Message Service (SMS) on Android phone to control home appliances.

Keywords **—Smart home, home appliances, Arduino, Bluetooth, Android, RFID**

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I. INTRODUCTION

This system is presented Bluetooth based home automation systems using Android phones without the Internet controllability. The devices are physically connected to a Bluetooth sub-controller which is then accessed and controlled by the Smart phone using built-in Bluetooth connectivity. This system is also described RFID based home security system using Android phones with alarm message that use busser. Buzzer is an integrated structure of electronic transducers, DC power supply, widely used in computers, printers, copiers, alarms, electronic toys, automotive electronic equipment, telephones, timers and other electronic products for sound devices. The Home Automation can be implemented using different types of wireless communication techniques such as ZigBee, Wi-Fi, Bluetooth, GSM, etc. To effective of this system, we are going to implement this system IOT based Smart security and Smart Home Automation.

The system intended to control electrical appliances and devices in house with relatively low cost design, user-friendly interface and ease of installation. Home automation allows controlling house appliances like door, light, fan, air-condition… etc. It also provides emergency system and home security. Many manual actions are replaced by home automation which reduces human efforts and time saving.

This IoT project focuses on building a smart home security system which sends alerts to the owner.

This system is applied a servo-motor for door control. A servo-motor is an actuator with a built-in feedback mechanism that responds to a control signal by moving to and holding a position, or by moving at a continuous speed. With the program described running, and connections properly made, the Servo motor will continuously rotate 180º. The Servo motor can be coupled to a shaft which can be used for numerous applications.

II. OVERVIEW OF INTERNET OF THINGS

The internet of things (IoT) becoming a rapidly increasingly growth topic of conversation both in workplace and outside of it. It's a concept that not only has the potential to impact how we live but also how we work. This is the concept of basically connecting any device with an on and off switch to the Internet. This includes everything from cell phones, coffee makers, washing machines, headphones, lamps, wearable devices and sensors and actuators to the internet where the devices are intelligently linked together to enable new forms of communication amongst people and themselves almost anything else you.

The IoT is a giant network of connected of "things", which is related with people-people, people-things, and things-things. Significant advancement of IoT over the last couple of years

has created a new dimension to the world of information and Communication technologies.

The increasing technology is leading to anyone, anytime, anywhere connectivity of things with expectation which will extend and create an entirely advanced dynamic network of IoT. An easy way to comply with the conference paper formatting requirements is to use this document as a template and simply type your text into it[1].

III.   BRIEF INTRODUCTION OF ALL THE COMPONENTS

This section describes the architecture and design of flexible and low cost home secured system. The function of this architecture is divided into two parts: power control via smart phone and appliances control with bluetooth technology [8]. The following components are applied in this system:

1. Arduino UNO R3
2. LCD(16x2) Display (for temperature & password to enter the home)
3. RFID RC-522 and Master card
4. GSM SIM 900A
5. IR Receiver Diode (TSOP38238)
6. Bluetooth HC-05
7. Motion sensor (HC-SR501)
8. Buzzer
9. LDR Sensor (Light Depending Resistor)
10. Temperature Sensor(LM 35)
11. 2-Channel Relay (SRD-05 VDC-S L-C)
12. 4x4 Matrix Membrane Keypad 16-keys

Rotation 180 Degree Servo Motor
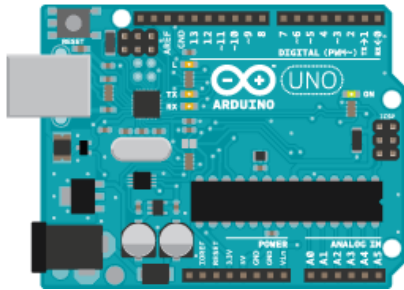
A. Arduino UNO R3

Fig. 1Arduino board

Arduino Uno is a microcontroller board based on the ATmega328 (datasheet).it has 14 digital input/output pins(of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button.it contains everything needed to support the microcontroller, simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. It's operating voltage is 5v and DC current per I/O pin is 40mA and DC current for 3.3v pin is

50mA and it is having 2kb of SRAM and !kb of EEPROM and it's clock speed is 16MHz[4, 7].

B. Android

Android operating system is primarily designed for smart phones and tablets. Android applications are written in Java programming language using the Android software development kit (SDK) and run in virtual machines. The ATMega328P Microcontroller is connected by HC-05 Bluetooth Module using wireless technique to the Bluetooth Controller Android application, and the Input/output ports of the embedded system board are connected to home appliances. Android is the base of the application software, which has the largest base of Smartphone [3, 10].

Fig. 2 GSM SIM 900A

C. RFID RC-522 and Master Card

MF RC522 is applied to the highly integrated read and write 13.56MHz contactless communication card chip, NXP launched by the company for the "table" application of a low voltage, low-cost, small size of non-contact card chip, smart meters and portable handheld devices developed better choice. The MF RC522 use of advanced modulation and demodulation concept completely integrated in all types of 13.56MHz passive contactless communication methods and protocols. [2, 9].

Fig. 3 RFID RC-522 and Master Card

D. LCD(16x2) Display and 2-Channel Relay (SRD-05 VDC-S L-C)

The liquid-crystal display has the distinct advantage of having low power consumption than the LED. It is typically of the order of microwatts for the display in comparison to the some order of milli watts for LEDs. Low power consumption requirement has made it compatible with MOS integrated logic circuit. The relay module is an electrically operated switch that allows you to turn on or off a circuit using voltage and/or current much higher than a microcontroller could

handle. There is no connection between the low voltage circuit operated by the microcontroller and the high power circuit. The relay protects each circuit from each other[2, 9].

Fig.4LCD display screen and 2 Channel Relay

E. *IR Receiver Diode (TSOP38238) and Bluetooth HC-05*

The TSOP48.. - series are miniaturized receivers for infrared remote control systems. PIN diode and preamplifier are assembled on lead frame, the epoxy package is designed as IR filter. The demodulated output signal can directly be decoded by a microprocessor. TSOP48.. is the standard IR remote control receiver series, supporting all major transmission codes. HC-05 Bluetooth Module is an easy to use Bluetooth SPP (Serial Port Protocol) module, designed for transparent wireless serial connection setup. Its communication is via serial communication which makes an easy way to interface with controller or PC. HC-05 Bluetooth module provides switching mode between master and slave mode which means it able to use neither receiving nor transmitting data[3, 5].

Fig.5.IR Receiver Diode and Bluetooth module HC05 Features

F. *Motion sensor (HC-SR501) and Buzzer*

HC-SR501 is based on infrared technology, automatic control module, using Germany imported LHI778 probe design, high sensitivity, high reliability, ultra-low voltage operating mode, widely used in various auto-sensing electrical equipment, especially for battery-powered automatic controlled products.

A buzzer or beeper is an audio signaling device, which may be mechanical, electromechanical, or piezoelectric. Typical uses of buzzers and beepers include alarm devices, timers and confirmation of user input such as a mouse click or key stroke[2, 9].


Fig. 6Motion sensor and Buzzer

G. *LDR sensor and Temperature sensor*

These devices depend on the light, when light falls on the LDR then the resistance decreases, and increases in the dark.When a LDR is kept in the dark place, its resistance is high and, when the LDR is kept in the light its resistance will decrease. A photoresistor (or light-dependent resistor, LDR, or photo-conductive cell) is a light-controlled variable resistor. The resistance of a photoresistor decreases with increasing incident light intensity; in other words, it exhibits photoconductivity. A photoresistor is made of a high resistance semiconductor[2, 9].

Fig. 7 LDR sensor and Temperature sensor
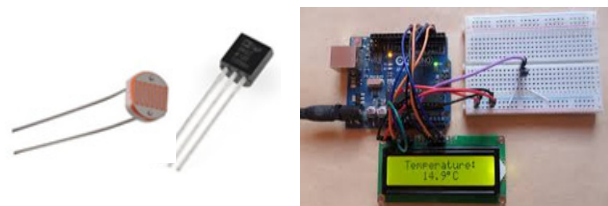
The LM35 series are precision integrated-circuit temperature sensors, whose output voltage is linearly proportional to the Celsius (Centigrade) temperature. The LM35 thus has an advantage over linear temperature sensors calibrated in Kelvin, as the user is not required to subtract a large constant voltage from its output to obtain convenient Centigrade scaling [2, 9].

H. *4x4 Matrix Membrane Keypad 16-keys*

This 16-button keypad provides a useful human interface component for microcontroller projects.Convenient adhesive backing provides a simple way to mount the keypad in a variety of applications. Matrix keypads use a combination of four rows and four columns to provide button states to the hostdevice, typically a microcontroller. Underneath each key is a pushbutton, with one end connected to onerow, and the other end connected to one column [2, 9].

Fig. 8 Keypad 16-keys

I. *Rotation 180 Degree Servo Motor*

Servo motors are small controllable motors that lend to implementation in many applications. There are Servos with many different speeds, sizes and torque capabilities, but all have 3 wires, power, ground and control. There are many ways to send this signal to the motor; this application covers how to send the desired PWM signal to the Servo motor using the Arduino UNO microcontroller.This application note is a tutorial of how to use an Arduino UNO microcontroller to control an analog Servo motor through signals sent to the Servo motor's control line. This document will provide directions for wiring the Servo motor, the Arduino UNO and cover microcontroller programming techniques to control movement of the motor [2, 9].

Fig. 9Servo Motor

IV. SYSTEM ARCHITECTURE AND CIRCUIT DIAGRAM

Hardware interface modules are directly interfaced with sensors and actuators through wires. It has the capabilities to control energy management systems like lightings and power plugs. For monitoring Home Environment the system supports sensors such as temperature, humidity and current. This system is implemented the following functions:

1. This system can be automatically open and closed by using LDR sensor and can also control by mobile phone at out of home light.IR sensor and Bluetooth device are used to Switch ON/OFF from smart phone and remote control.
2. This system can be check for inside home light by interfacing mobile message. When say to me light is on, you can send light off message to home and when say to me light is off, you can send light is on message to home.
3. This system can check motion by using motion sensor, this sensor senses motion and join buzzer alarm and send mobile message to me.
4. This system can close door by using RFID card. When you want to open, first you must RFID card is check and then type the correct password. You can these two factors are passed, the door is open.
5. This system can send mobile message for smart home security to two persons.
6. Bluetooth can reach a range of up to 9 meters(30 feet).

J. *Bluetooth based home automation system*

Home automation systems using smartphone, Arduino board and Bluetooth technology are secured and low cost. The Bluetooth system uses a PC or smartphone as receiver device. It has a high communication rate, great security and low cost, so it can be implemented as a real time system [5].

K. *Android Based Home Automation System*

Remote users represent authorized users who can access the system on their Smart phone applications using the Internet via Wi-Fi or 3G/4G network. Under the Home Automation we can control all electrical appliances from long distance through a mobile phone [6].

L. *Software Description*

Software of the proposed home automation system is divided into two parts: server application software and microcontroller firmware. The server application software is a library implementation of a micro Web-server running on Arduino Uno using the Ethernet shield. This Ethernet shield has the capability to be used both, as a client or a server. To successfully communicate between remote user and the Home Gateway, configuration stage and sensor/actuator control stage layers have been implemented on the Arduino Uno. The Arduino Uno and Ethernet shield were used to implement the micro Web-server for the Home gateway [7, 8, 10].

The software used here is Arduino IDE. The open-source Arduino Software (IDE) makes it easy to write code and upload it to the board. It runs on Windows, Mac OS X, and Linux. The environment is written in Java and based on Processing and other open source software. The Arduino Integrated Development Environment – or Arduino Software (IDE) - contains a text editor for writing code, a message area,

a text console, a toolbar with buttons for common functions and a series of menus. This software can be used with any Arduino board.
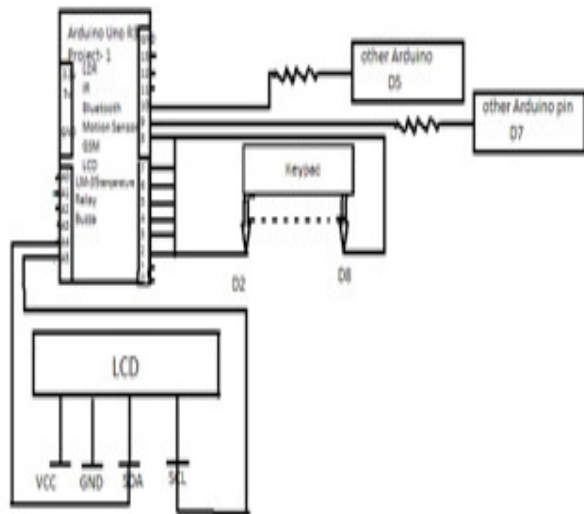

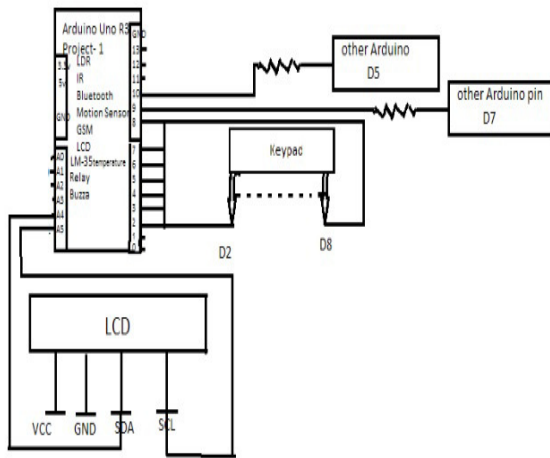**Fig. 10 Circuit Diagram for Door Lock System in Keypad**

Fig. 11 Circuit Diagram for Door Lock System (RFID)

V. RESULTS AND DISCUSSION

Intelligent home is also known as the smart residential home is moving towards the mobile remote control. In this system, door lock that can be controlled by RFID card and when RIFD card scan is passed, user must type password for open the home door. Using Rotation 180 Degree Servo Motor for open and lock the door. The alarm will sound by using motion sensor and buzzer if there is movement inside the

house at night and sending message to owner that the same time. This system can communicated with Short Message Service (SMS) on GSM to control home appliances that is light is on off by using mobile. IR sensor and Bluetooth device are used to Switch ON/OFF from smart phone and remote control. Automatic light system can also be including by using LDR sensor for power saving. This system can also read temperature by using temperature sensor and LCD display.

The system consists of a micro Web - server based on Arduino Ethernet, hardware interface modules and the Android compatible Smart phone app. This system allows authorized home owners to remotely control and monitor connected devices at home using any Wi-Fi or 3G/4G enabled Smart phone which supports Java. The smart phone app provides a graphical user interface (GUI) for accessing and controlling the devices at home.

The automatic switching on and off of the light is controlled by the Light Dependent Resistor (LDR).Implementation of wireless Bluetooth connection in control board allows the system install in more simple way. The control board is directly installed beside the electrical switches whereby the switching connection is controlled by relay.

Fig.12 Implementation of Home design and Circuit development in Home control

Fig.13Home Security using RFID

Fig.14Home Security using Keypad
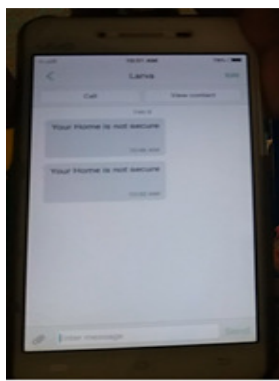
Fig.16 Security message for user' home condition

Fig.15 Security Alarm page using Motion Sensor and buzzer

VI.   CONCLUSIONS

The IoT technology can be used for new innovation concepts that can be wide used for development space for smart homes system in order to provide intelligence, comfort, safety and improved quality of life.Home control system is useful for everybody and necessary for every home. Since automatic light system can be used at day and night, this system can reduce the power consumption. This system can be provided for human being life.Remote users represent authorized users who can access the system on their Smart phone app using the Internet via Wi-Fi or 3G/4G network. Two authorized users can access in this system. Home Environment consists of Home Gateway and a hardware interface module.

M. Advantage and Further Extension

This low cost system with minimum requirements takes care of both home security as well as home automation. The advantages of the proposed system, the feasibility offered to the humans by reducing the human intervention. Another great advantage of the system is that it suggests a low cost option to the user for the repairing of the appliance.The building and home that apply this kind of system can improve daily life and reduce power consumption.

If RFID card and password are known by someone, we can change the password. Fire alarm system can be extended. We can extend the controlling the air conditioner automatically when room temperature is high by using temperature sensor. Future works will focus on creating a wireless network between the home server and the home devices using Zigbee and implementation of voice commands for controlling the application via voice.

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