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Child Monitoring System.

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Acknowledgement

Thank God, as he should, for the majesty of his face and the greatness of his sultan, he is the patron of our grace, for those who have guided paradise, to the source of inexhaustible tenderness, to the candle that has caught and melted to enlighten us our way, to the most precious of our mothers. To the good heart and symbol of giving and love to our fathers, to all those who supported us, encouraged us and strengthened us with the fruit of this humble achievement. We thank our supervisor, Eng :Elayan Abu Gharbyeh, who has provided us with support and advice, and we thank all the teachers of our college and our dear university and all those who helped us, and thank God the Lord of the Worlds.

Abstract:

This project aims to build a system that monitors children from the age of 7-10 years. The main purpose is to help parents monitor and track children within the school by locating them and following the educational process within the school where teachers collect all the information for each child (classroom schedules, homework, exam schedules..... etc.), using devices such as smartphones where an application linked between school and mother has been created to send information about each child to his mother. It is designed with GPS, sound sensors and a device to learn how to navigate (walk or car). The government's efforts to improve the health of women and children are a reality.

Abbreviations

RFID	Radio-frequency identification
SoC	System On Chip
GPS	Global Positioning System
GPIO	General Purpose Input/output
VCC	Voltage, Common Collector
GND	Ground
PC	Personal Computer
USB	Universal Serial Bus
SS/SDA/Rx	Acts as Serial input
SCK	Serial Clock
MOSI	Master out slave in
MISO	Master in slave out
RST	Reset
RAM	Random-access memory
SIM	subscriber identity module
SPI	Serial Peripheral Intrface
RPI	Raspberry Pi
URI	Uniform Resource Identifier
URL	Uniform Resource Locator
GSM	Global System for Mobile

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Chapter 1:Introduction

1.1 Overview of the project:

Microcontrollers are used to develop intelligent systems that can be found in different applications in our daily lives. With the advent of a smartphone, it is possible to connect smartphones to wireless control systems. In this project, we aim to design a monitoring and tracking system for children by parents.

The system helps parents know a lot of details about their children such as (location and voice sensors) all connected to mobile apps (Android), as well as school admission dates and school departure dates for the child.

First, we will focus on the design of bracelets that are placed on the child's hand.

1.2 Motivation:

The main motivation for building this system is to monitor children within schools, to know their entry and exit records from school and to locate, especially children under the age of 15. There is a need to monitor children in public facilities such as shops, libraries, recreational cities, playgrounds, shopping centers and zoos. Some of these facilities have many disadvantages, such as tall and high counters with overlapping corridors, large screens, walls that separate rooms and many floors. A child can be easily lost in such an environment.

In this project, the monitoring and tracking system for children will be developed and, designing mobile applications.

1. 3 Goals and Objectives:

The goal of this project is to build a child monitoring systems that achieves the following objectives:

1: Design a system that helps parents monitor children remotely.

2: Help parents to locate the child and hear his voice.

3: Knowing when the child will enter and exit school.

4.The entire system can be controlled through the internet.

1.4 Short description of the project:

A system that works to monitor children through the design of bracelets that the child puts on his hand and provides the system (location, acoustic sensors) and all this information is stored and sent to the application on the mobile phone of parents, where the application is also designed to provide parents with a login system, and the application is the link between school and parent.

1.5 Problem Statement:

Most often, parents have anxiety problems for their children while they are in school as the time period at school is long. One of these problems is that parents do not know the whereabouts of their child (school or not), nor does she know what teachers' behavior is with the child.

The project was chosen to reduce the parents worry for her children while they are outside the home and to know her child's activity within the school .It creates a report and sends it to the cell phone.

The advantages of this project are:

1: No need to go to school constantly.

2: No need to worry about the child constantly.

3: No need to constantly contact to check on the child.

1.6 System Requirements:

The system must achieve the following functionality:

1. The system must be user-friendly to be used by a beginner and advanced users.
2. Design a suitable bracelet for the child where they do not get upset (shape, size, color…… etc.).
3. Create a phone application in a simple and easy where the parents can deal with.
4. When linking the school and the application on the parents mobile, the information must be received for each child by name and number.
5. High accuracy in location, sound sensors .

1.7 Expected Results:

We expect to accomplish the following at the end of the project:

1. A simple, low-cost system used to monitor children in schools.
2. The system sends the child's presence locations (in case of movement from one area to another).
3. The system creates detailed schedules for each child to know when to enter school.

1.8 Project Gantt chart:

Task	Duration (week)													
	First semester							Second semester						
	٢	٤	٦	٨	١٠	١٢	١٤	٢	٤	٦	٨	١٠	١٢	١٤
Planning														
Project requirements														
Analyzing and design														
Project development														
Project and testing and maintenance														
Documentation														

Table 1: *Project Gantt chart*

1.9 Report Outline:

The rest of this report is organized as follows: Chapter 2 introduces some literature review including available monitoring system and related project and talks briefly about the theoretical background of the project, hardware and software components. Chapter 3 discusses the conceptual design of the system, block diagrams, flowchart, and detailed hardware connection.

Chapter 2:Literature Review and Theoretical

2.1 Background:

This chapter provides a short review of some related systems and introduces a theoretical background of the project, including a description of the hardware and software components used in the system.

2.2 Literature Review:

Based on our research, we came across very limited products that are related to the current project. Following are two example projects:

2.2.1: A protection app:

The UAE has built a protection app that works to monitor children by locating them and knowing their movements and also knowing each child in any bus he went up and whether he went down at the appropriate station or not and the parents can know the owner of the bus and its number and the child can send a distress message in case of danger through the same Application, in this project does not care in case the child does not have a phone.

2.2.2: Child monitoring device in Swimming pools:

A system that monitors the high frequencies or wireless, consisting of a transmission unit carried by the child a reception unit carried by the child administrator to protect him in case he has moved a distance greater than his specified in the swimming pools where the official reaches warning signals for the child who has moved long distances to be rescued on the For four, this is one of the types of baby watching in swimming pools.

2.3 THEORETICAL BACKGROUND

2.3.1 General Description of the system:

Children are a gift from God, so children must be watched and protected well, there are many things to be observed:

1. The nature of the system: the good and appropriate design where the best materials are chosen to design the system to suit the age of the child and the focus is on the shape, color and nature of the material made from it to attract the attention of the child.
2. GPS: High accuracy in determining the location with changing environmental factors including (if the child is inside or outside the building vary the nature of the signal, weather changes affect the accuracy of the signal and others).
3. Sound: Choose the best types of sound sensors that are characterized by high quality and efficient performance.
4. WIFI: High speed in the transmission of information from the system to the application and maintain synchronization in the process of transferring information in the case that the mother wants to know the location of her child must be available High speed in determining the location and other information you request.
5. Mobile application: The appropriate design of the application the meet a number of tasks to be performed where the application is designed in an easy and simple way so that anyone can work.

2.4 Hardware System Components:

This section describes all hardware used in my project, it presents a figure for each one with short description about its work principle and why it is used in the system.

2.4.1:Microcontroller:

During my search, we`ve encountered microcontroller alternatives options.

•Raspberry Pi:

Raspberry Pi is the third best-selling computer brand in the world. The Raspberry Pi is a credit card sized computer that plugs into your TV or display, and a keyboard and mouse. It can be used to learn coding and to build electronics projects, and for many of the things that a desktop PC does, like spreadsheets, word processing, browsing the internet, and playing games. It also plays high-definition video. It runs the Linux operating system and the official programming language of Raspberry Pi is Python. Raspberry Pi has many modules out there, which are the Pi 3 Model B, the Pi 2 Model B, the Pi Zero, and the Pi 1 Model B+ and A+ and B. These models are different from each other as follows.

Item	RPi zero	RPi A+	RPi B	RPi B +	RPi 2 B	RPi 3 B
Issue time	2015/11/26	2014/11/11	2011/12	2014/7/14	2015/2/2	2016/2/29
Dimension	65x30x5mm	65x56mm	85.6x53.9mm	85x56x17mm	120x75x33mm	120x75x34mm
SOC	BCM2835	BCM2835	BCM2835	BCM2835	BCM2836	BCM2837
CPU	700 MHz Low Power ARM1176JZ-F Applications Processor				ARM Cortex-A7 900MHz Quad Core	ARM Cortex-A53 1.2GH Quad Core
GPU	Broadcom VideoCore IV, OpenGL ES 2.0, 1080p 30 h.264/MPEG-4 AVC					
RAM	512MB	256MB	512MB	512MB	1GB	1GB
Storage	MicroSD	MicroSD	SDCard	MicroSD	MicroSD	MicroSD
USB 2.0	1xMicro USB	1xUSB Port	2xUSB Ports	4xUSB Ports	4xUSB Ports	4xUSB Ports
Network Interface	No, via USB	No, via USB	10/100M Ethernet	10/100M Ethernet	10/100M Ethernet	10/100M Ethernet, Wi-Fi, Bluetooth
GPIO	40PIN	40PIN	26PIN	40PIN	40PIN	40PIN
Video Connections	HDMI, PAL and NTSC	HDMI, PAL and NTSC	HDMI, RCA, PAL and NTSC	HDMI, PAL and NTSC	HDMI, PAL and NTSC	HDMI, PAL and NTSC
Supported Resolutions	640×350 to 1920×1200, including 1080p, PAL & NTSC standards					
Audio	HDMI	Multi-Channel HD Audio over HDMI, Stereo from 3.5 mm jack				
Operating Systems	Debian GNU/Linux , Fedora, Arch Linux , RISC OS				ARM GNU/Linux,Windows 10, Snappy Ubuntu Core	
Power Draw/ Voltage	TBD but lower	TBD but lower	750mA up to 1.2A @5V	600mA up to 1.8A @5V	1000mA @5	TBD but Higher

Table 2 *: Raspberry Pi type*

Depending on each type characteristics, and considering my project needs, I figured out that Raspberry Pi 3 Model B as shown in figure 1, is the best choice among the others since it has the largest memory and is the fastest,

figure 1: *Raspberry Pi*

Moreover, it is easier to deal with the Internet, and because RFID pieces send values to the application that is designed.

2.4.2:Radio Frequency Identification (RFID):

The RC522 is a RF Module that consists of a RFID reader, RFID card and a key chain. The module operates 13.56MHz which is industrial (ISM) band and hence can be used without any license problem. The module operates at 3.3V typically and hence commonly used in 3.3V designs. It is normally used in application where certain person/object has to be identified with a unique ID.

Some of the applications used:

- Automatic billing systems
- Attendance systems
- Verification/Identification system
- Access control systems

RC522 Features

Operating voltage:	2.5V to 3.3V
Communication:	SPI, I2C protocol, UART
Maximum Data Rate:	10Mbps
Read Range:	5cm
Current Consumption:	13-26mA
Power down mode consumption:	10uA (min)
MHz RFID module:	13.56MHz

Table 3 RFID features

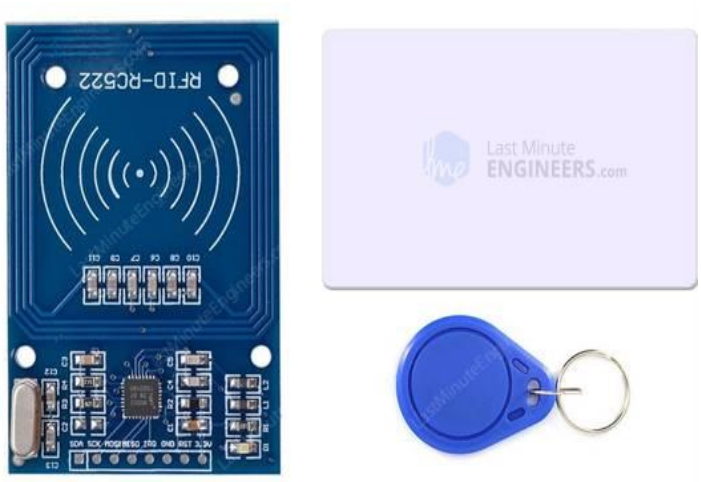

figure 2: RFID chip sensor

2.4.3: Mini A8:

This product applies the newest technology in Taiwan and has following advantages: small size, long stand-by life, simple operation, stable functions and convenient installation. It is widely used for household monitoring; children, the elder, and pets' care and the trace for lost cars or other possessions.

This is particularly useful if your vehicle, pets, child or your belongings have been stolen. Time to enjoy the benefits this GSM/GPRS/LBS tracker brings !How does it work Insert 1 SIM card, after the LED flashes 3 times, the device starts .Phone number bind setting: If you need to authorize several mobile numbers at the same time (should be less than four), you can use a star key to separate them, for example: "SQ79609500000*SQ79608800001". Once the authorization is successful, the authorize mobile number will receive "Authorization success, Device XXX, password XXX,. Voice monitoring: Use the emergency contact phone number to call the device, it will enter the

voice monitoring status. SOS Alarm: Press the SOS Button 3 seconds, it will call the emergency contact automatically .Call back function :Send SMS: 1111 to open the Auto-Call-Back function, Send SMS: 0000 to close the Auto-Call-Back function, When the sound around the device exceeds 60 decibels.

Basic Commands

Register:	**RG+ mobile number**
Check Location:	**DW**
Open Voice callback	**1111**
Close Voice callback:	**0000**
Emergency Alarm:	**SOS**
Authorization:	**SQ+ mobile number**
Cancel Authorization:	**SQ**

Table 4 *Basic command*

figure 3: Mini A8 chip

2.5 System Software Component:

This section will provide some information about the main programs and software technologies used in my project.

2.5 .1: Android Studio IDE:

Android Studio is the official integrated development environment (IDE) for Google's Android operating system, built on JetBrains' IntelliJ IDEA software and designed specifically for Android development. It is available for download on Windows, macOS and Linux based operating systems or as a subscription-based service in 2020. It is a replacement for the Eclipse Android Development Tools (E-ADT) as the primary IDE for native Android application development.

Android Studio was announced on May 16, 2013 at the Google I/O conference. It was in early access preview stage starting from version 0.1 in May 2013, then entered beta stage starting from version 0.8 which was released in June 2014. The first stable build was released in December 2014, starting from version 1.0

On May 7, 2019, Kotlin replaced Java as Google's preferred language for Android app development. Java is still supported, as is C.++

2.5. 2: Python script

Python is a well known high-level programming language. The Python script is basically a file containing code written in Python. The file containing python script has the extension '.py' or can also have the extension '.pyw' if it is being run on a windows machine. To run a python script, we need a python interpreter that needs to be downloaded and installed.

Python programming language codes were written for raspberry pi to execute the system requirements, python is used in project as a main part, which used to communicate to RFID .

2.5 .3: XAMMP

XAMPP is a free and open-source cross-platform web server solution stack package developed by Apache Friends, consisting mainly of the Apache HTTP Server, MariaDB database, and interpreters for scripts written in the PHP and Perl programming languages. Since most actual web server deployments use the same components as XAMPP, it makes transitioning from a local test server to a live server possible.

2.6 Constraints:

In this project, we are trying to apply full control to the monitoring system. **Because it is difficult to do this, for example:**

A. If the child removes the bracelet from his hands then we cannot know where the child is.
B. Additionally, we cannot guarantee a stable internet / network connection, which is necessary to connect to the mobile device.
C. If there is any defect in the mobile application, the mother cannot know the details of her child.

Mini A8 Kids GPS Tracker Locator Google map Real Time

figure 4: Mini A8 GPS Tracker Locator

Chapter 3 :System Design:

This chapter discusses the conceptual design of the system, it shows block diagram of system, flow chart, wiring diagram, design construes.

3.1 General Mechanism:

The system consists of the microcontroller and sensors that receive the configurations from the user through his mobile via the Internet, and according to these configurations the Raspberry Pi will trigger the sensors, and other elements to run the system as required.

The following steps demonstrate the mechanism of system work:

1) We will create a mobile app that displays all the options for the user, and there will be more than one setting for some manageable options (for example: location). When a user selects an option with a specific mode, the mobile app encodes and sends commands to a microcontroller over an Internet connection.
2) After the Microcontroller receives decryption commands, it edits its default settings according to the new commands.
3) The microcontroller reads data from RFID and makes decisions to control the system, based on the current settings chosen by the user.

3.2: Sub Circuits:

3.2.1: Block Diagram :

This block diagram Demonstrates the mechanism of the system in detail.

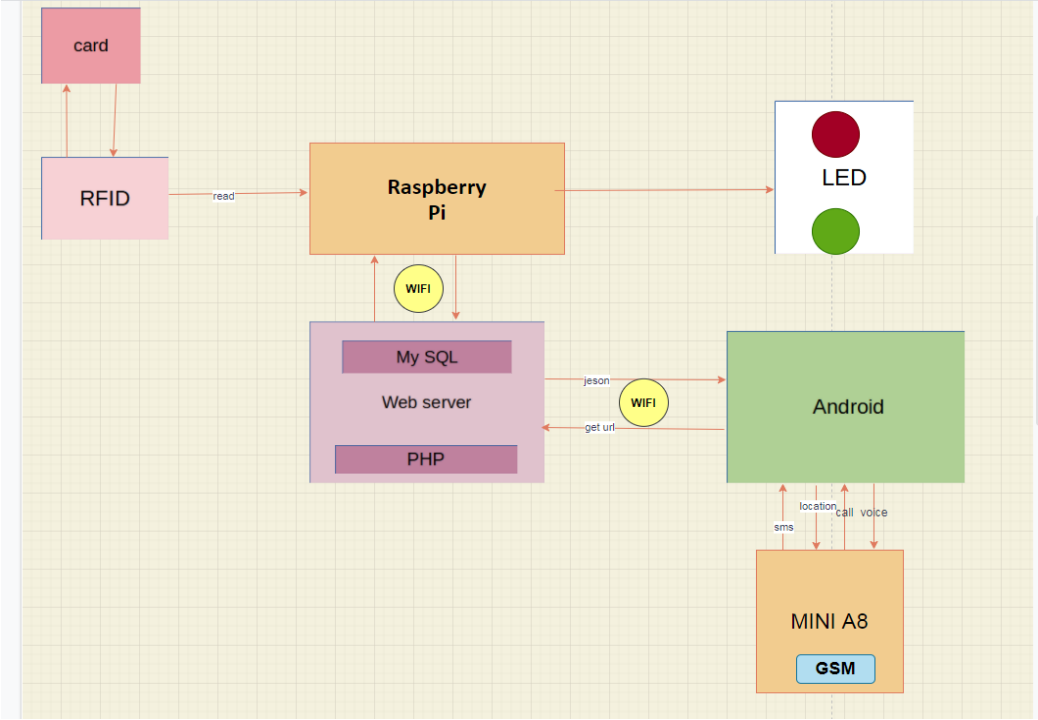

figure 5: Block Diagram

3.2.2: Flowcharts :

In the figure 6, it shows the RFID action mechanism associated with RPI ,The shape shows the stages of the cutting in detail

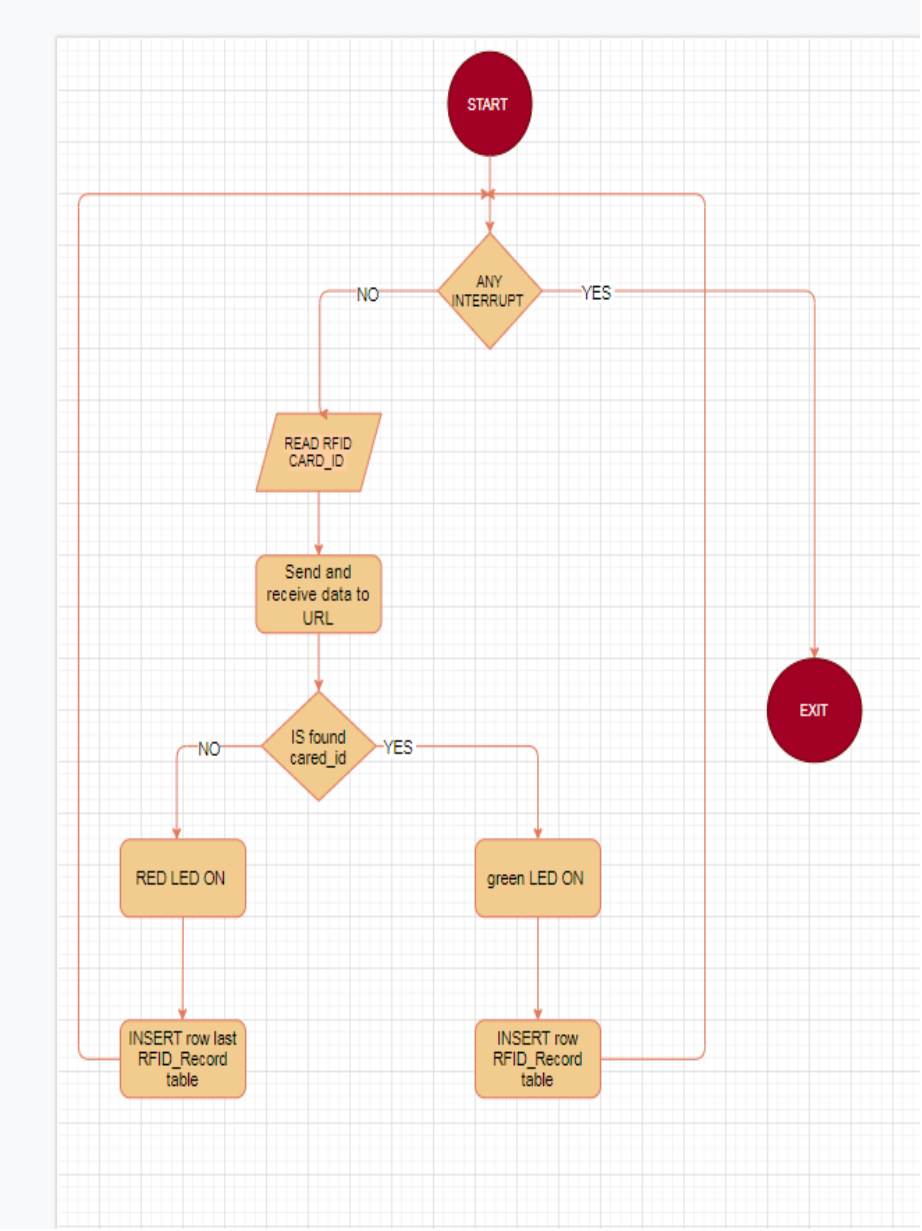

figure 6: Flowcharts

In the figure 7,shows the mechanism of the work of the application that was designed Where the figure shows the stages of the work of the application from the beginning of operation to the end of the execution of all orders .

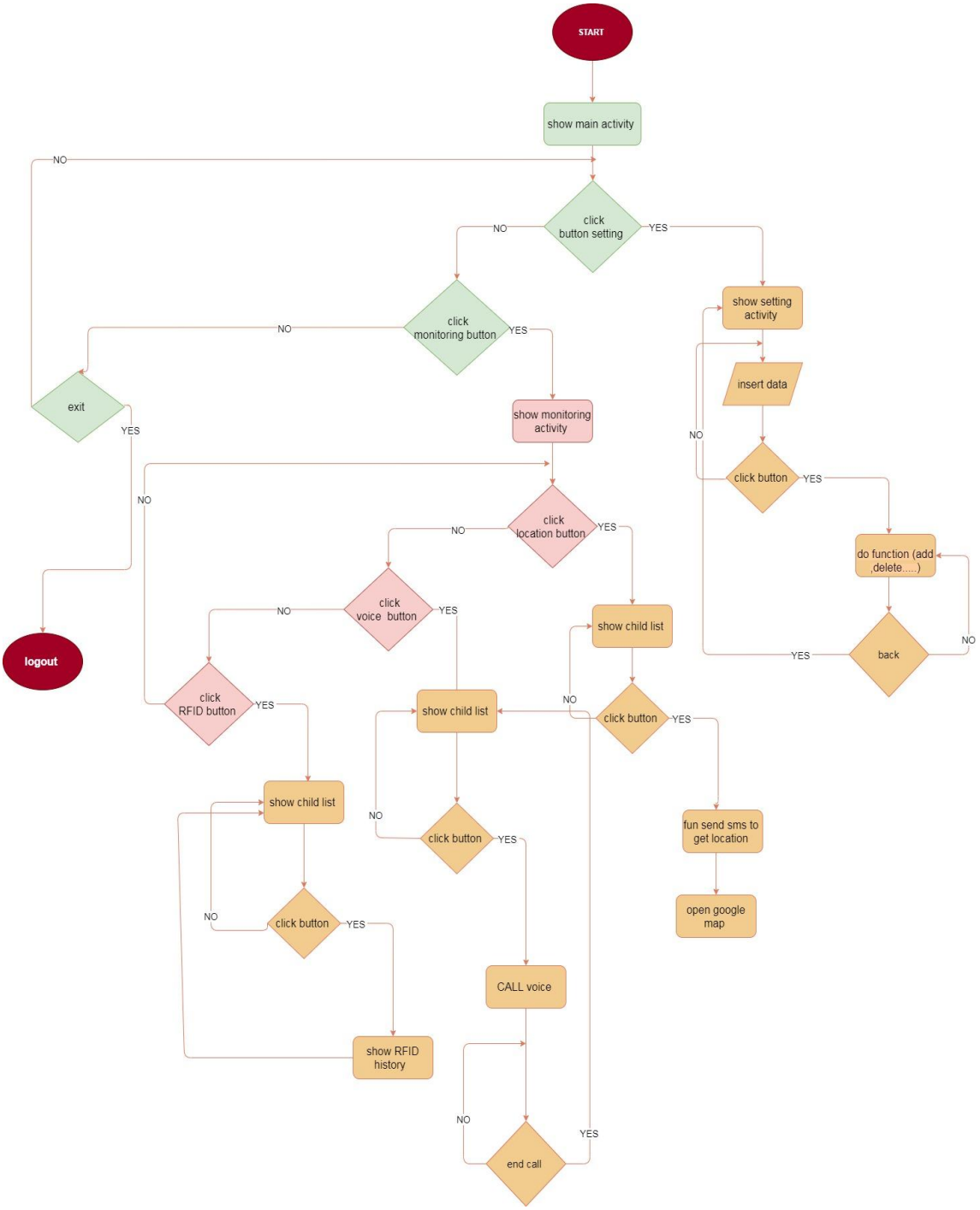

figure 7 Flowcharts

In the figure 8 ,shows the mechanism of the work of the web page from login, entering data, viewing tables and other things.

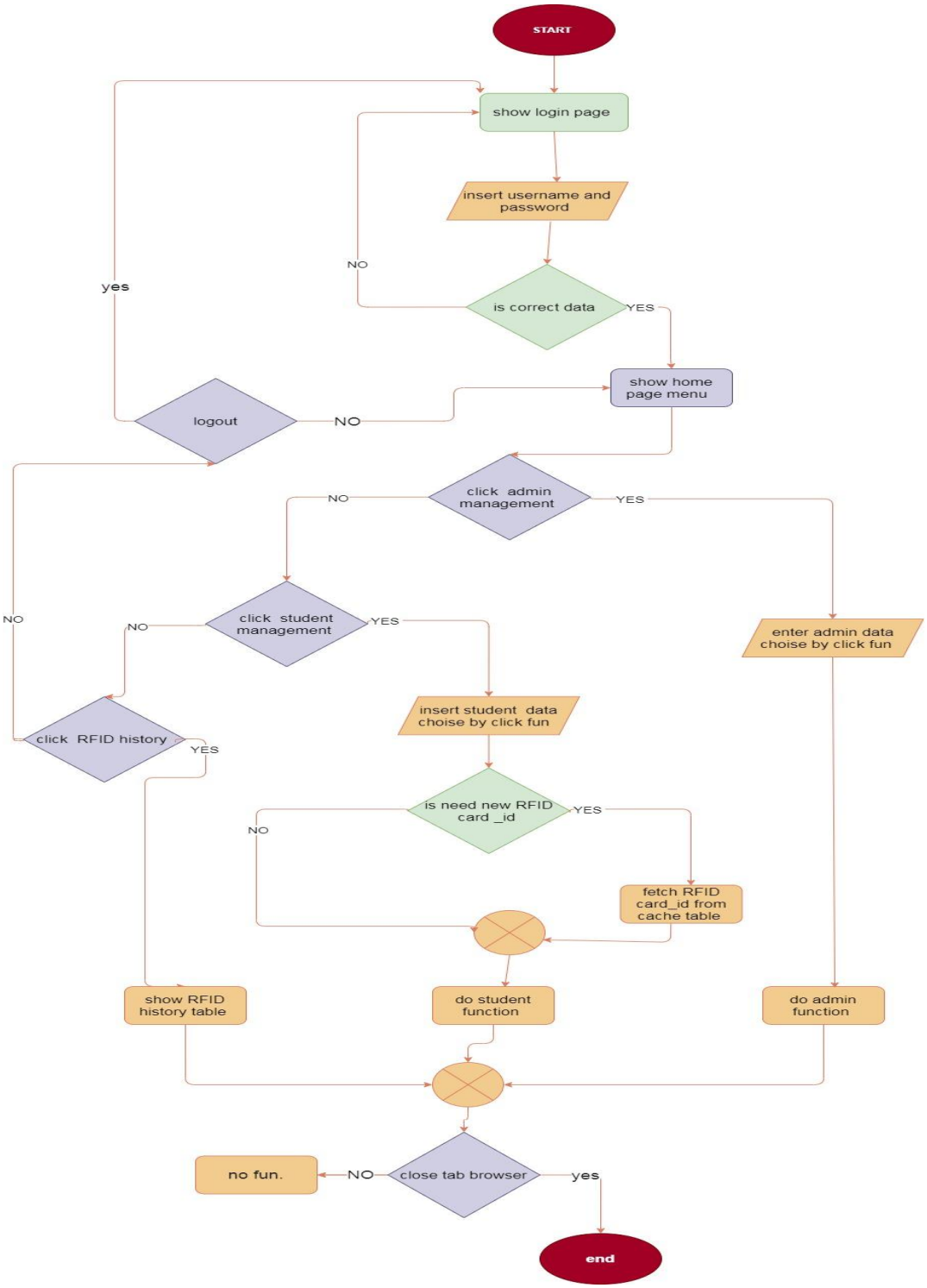

figure 8: Flowcharts

3.2.3 Wiring Diagrams:

In this section some component is shown with its connection the of the Raspberry pi the pins of each equipment will be connected physically as shown in the following figures.

- **RFID_RC522:**

  RFID RC522 you will notice that there are 8 possible connections on it, these being SDA (Serial Data Signal), SCK (Serial Clock), MOSI (Master Out Slave In), MISO (Master In Slave Out), IRQ (Interrupt Request), GND (Ground Power), RST (Reset-Circuit) and 3.3v (3.3v Power In). We will need to wire all of these but the IRQ to our Raspberry Pi's GPIO pins.

  You can either wire these directly to the GPIO Pins ,plug the RFID RC522 into our Breadboard then wire from there to our Raspberry Pi's GPIO Pins.

  Wiring your RFID RC522 to your Raspberry Pi is fairly simple, with it requiring you to connect just 7 of the GPIO Pins directly to the RFID reader. Follow the table below, and check out our GPIO guide to see the positions of the GPIO pins that you need to connect your RC522 to.

- **SDA** connects to **Pin 24**.
- **SCK** connects to **Pin 23**.
- **MOSI** connects to **Pin 19**.
- **MISO** connects to **Pin 21**.
- **GND** connects to **Pin 6**.
- **RST** connects to **Pin 22**.
- **3.3v** connects to **Pin 1**.

- **RFID_RC522 with Raspberry pi:**

  The figure 9 shown represents how an RFID is connected to a Raspberry Pi serially.

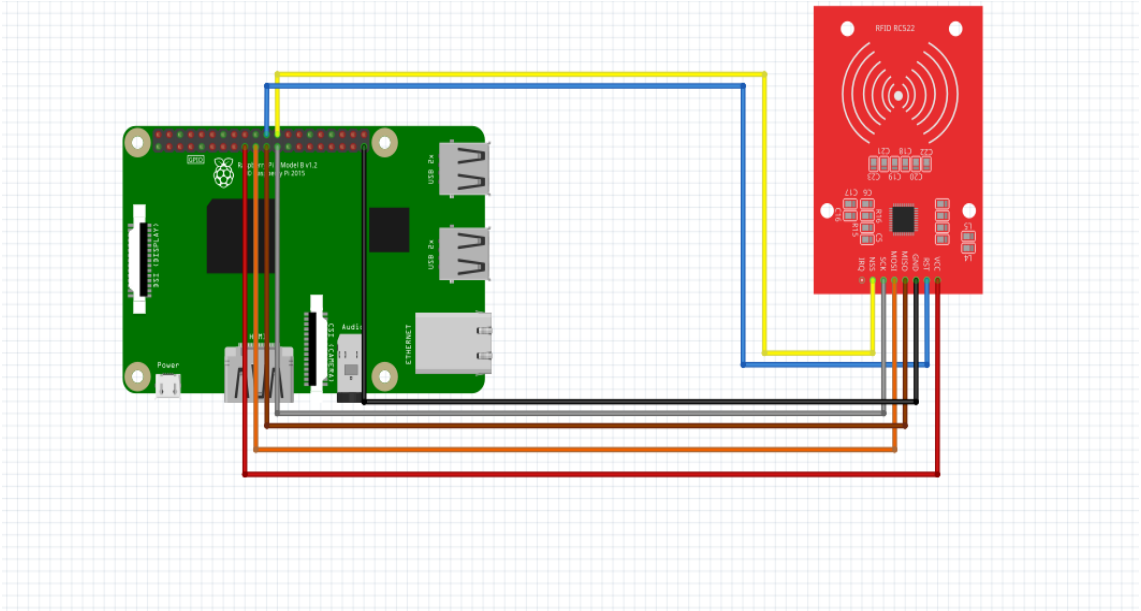

figure 9: RFID_RC522 with Raspberry pi

- **RFID_RC522 with Raspberry pi and LED:**

The figure 10,shown represents how an RFID and LED is connected to a Raspberry Pi serially.

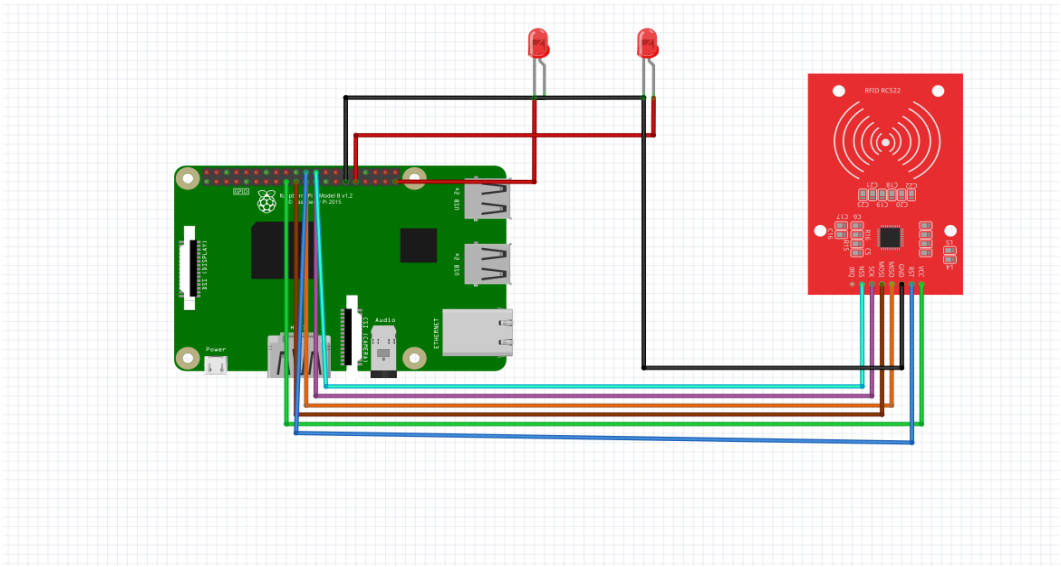

figure 10: RFID_RC522 with Raspberry pi and LED

3.2.4 : System Schematic diagram:

- **RFID_RC522 with Raspberry pi:**

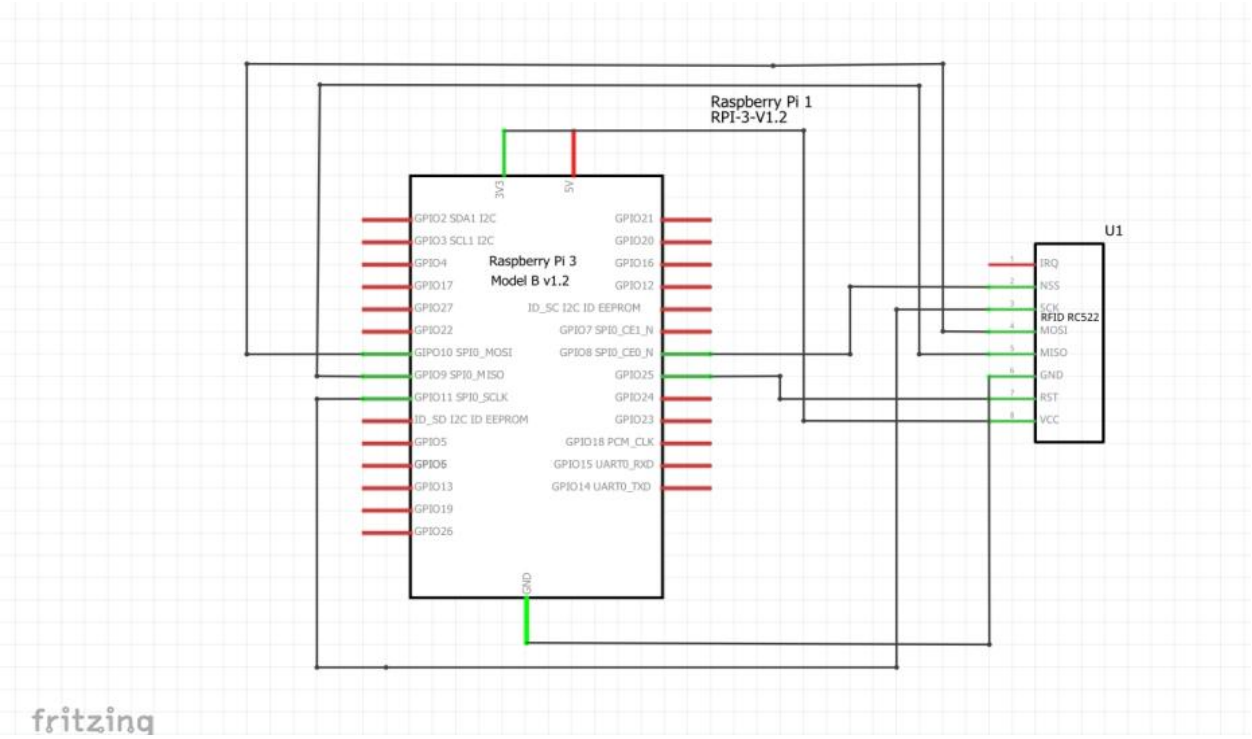

figure 11: Schematic diagram

- **RFID_RC522 with Raspberry pi and LED:**

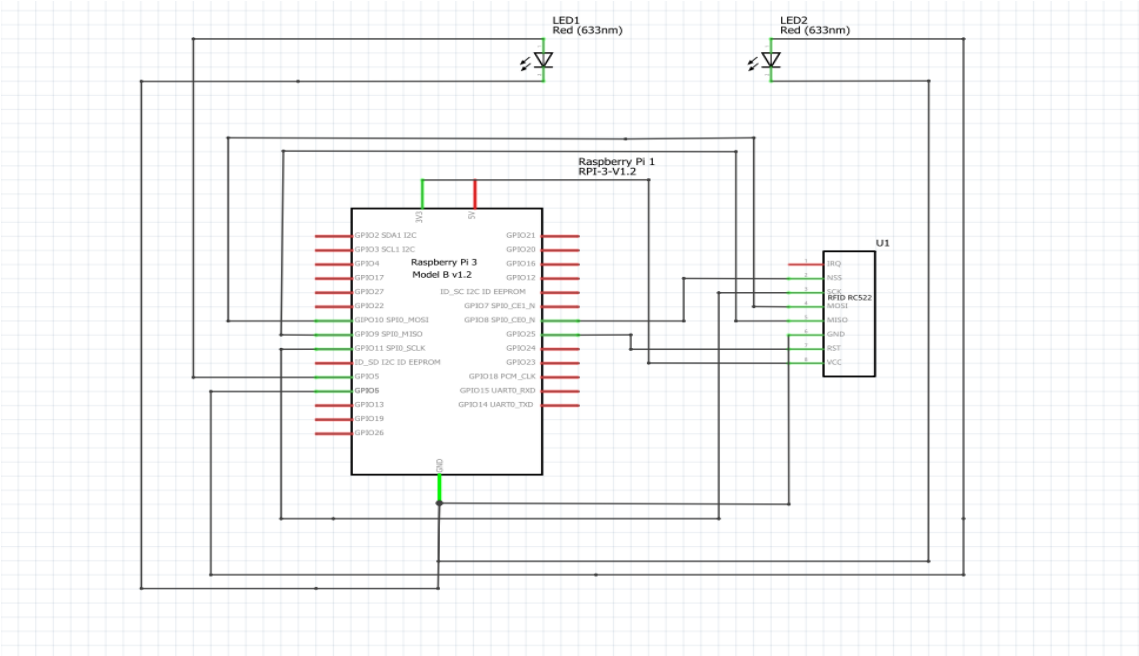

figure 12: Schematic diagram

Chapter 4:

Software & Hardware Implementation

4.1 Overview

This chapter describes the implementation of the software and the hardware of this project, including the circuit connection, and programming of the microcontrollers.

4.2 Operating System for mobile

There were many operating systems for mobile to be used to handle the software and hardware resources of my system such as Android and IOS. I have chosen android OS rather than IOS OS because it is the world's familiar mobile operating system. In addition, it is easy to be used and work with an Android device, it needs only to download Android studio program with unity android support. However, IOS device needs a complex procedure.

4.3 Software Implementation tools

This section will provide some information about the main programs and software Technologies used in my project.

4.3.1 Android studio IDE

Android Studio is the official Integrated Development Environment (IDE) for Android app development we have used this IDE to develop application.

application consists of 6 user interfaces, which are:

1. The Home Page interface, contains three buttons to move between the interfaces, The first button when pressed moves to an interface, the second button when pressed moves to an interface, the third button when pressed closes the application.
2. contain three button and any button opens the interface as in To choose which child you want to monitoring based on these buttons:
   - Location button, to determine the coordinates of the child's location.
   - Audio button, to determine the voice of the child's .
   - RFID button, to determine RFID Values.
3. Data entry interface for child information.
4. This app is linked with the internet to bring RFID values associated with raspberry pi.

The next figures show the system interfaces:

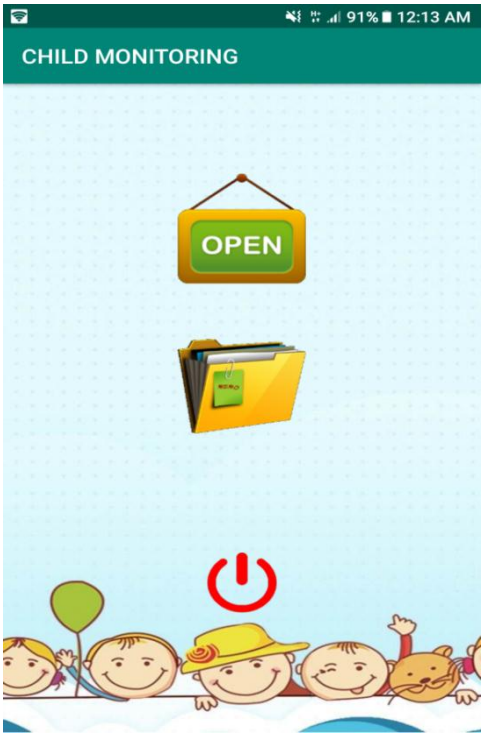

figure 13:home activity

figure 14:monitoring activity

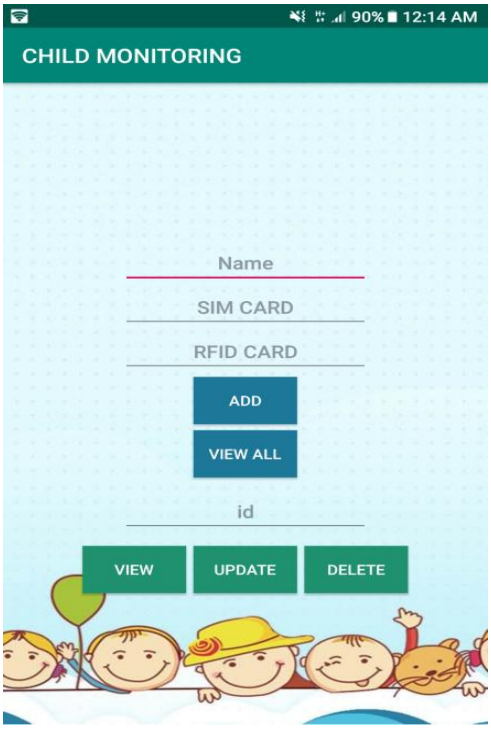

figure 15:setting child info

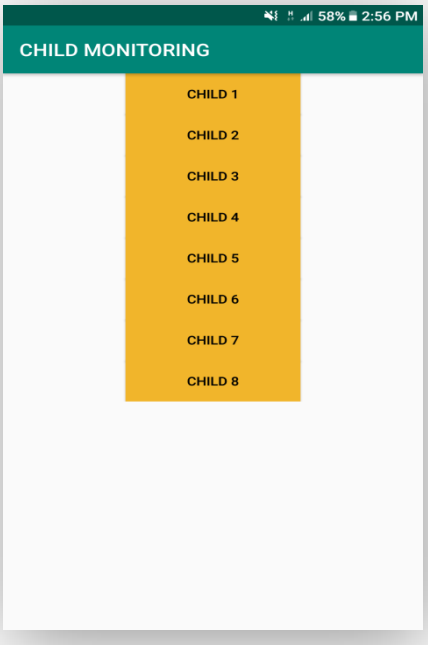

figure 16:show child

4.3.2 Python script

Python programming language codes were written for raspberry pi to execute the system requirements, python is used in project as a main part, which used to communicate to RFID .

4.3.3 XAMMP(web page)

XAMPP is a free and open-source cross-platform web server solution stack package developed by Apache Friends, consisting mainly of the Apache HTTP Server, MariaDB database, and interpreters for scripts written in the PHP and Perl programming languages. Since most actual web server deployments use the same components as XAMPP, it makes transitioning from a local test server to a live server possible.

In this project, we will design a school web page to see the school entry and exit records for all students by using the RFID piece.

Login interface :

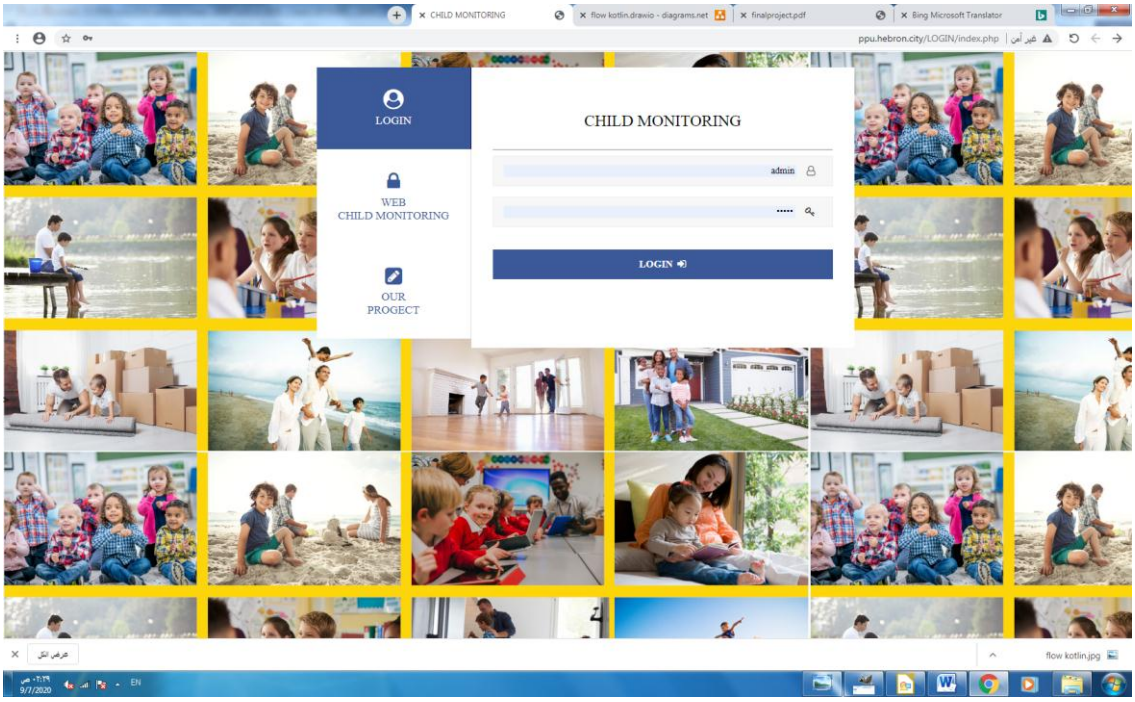

figure 17: login interface

Home interface :

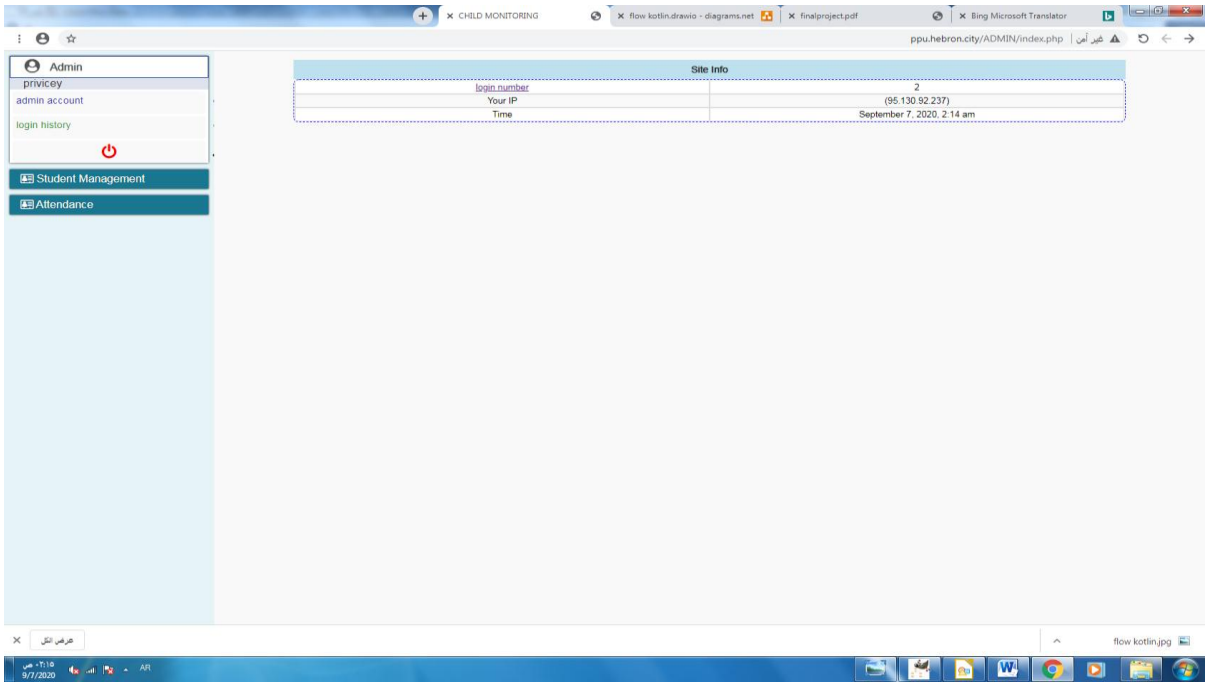

figure 18: home interface

Insert admin account:

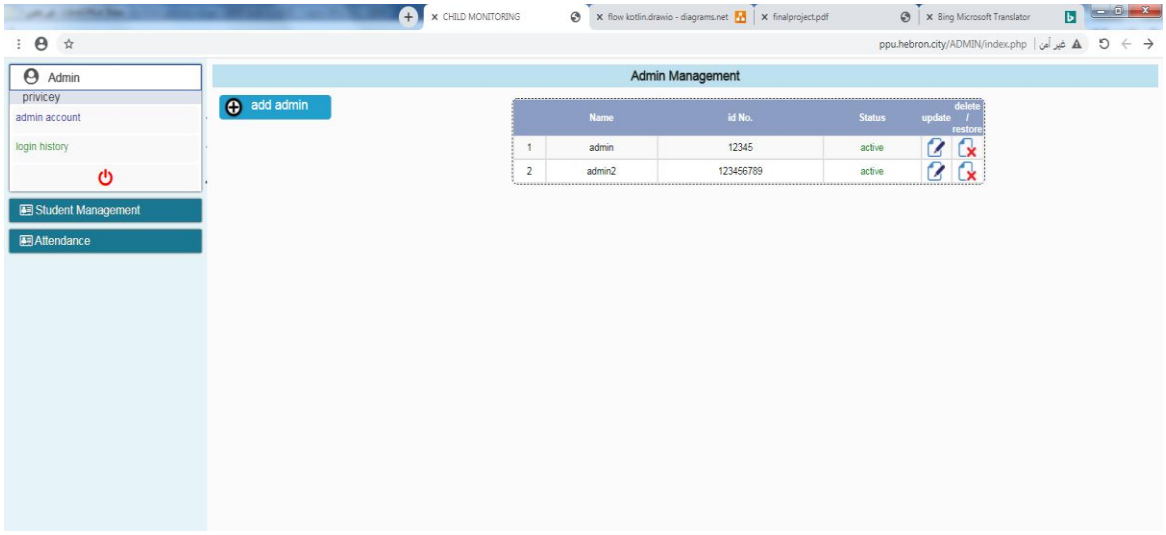

figure 19: admin account

Show login history:

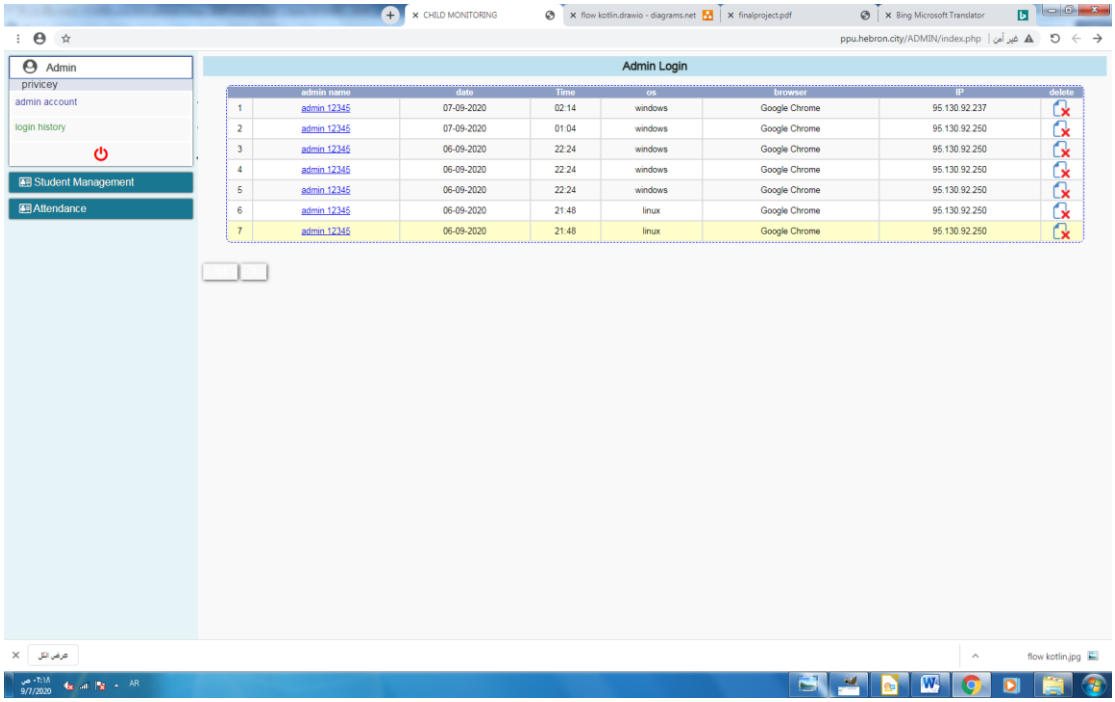

figure 20: login history

Add student :

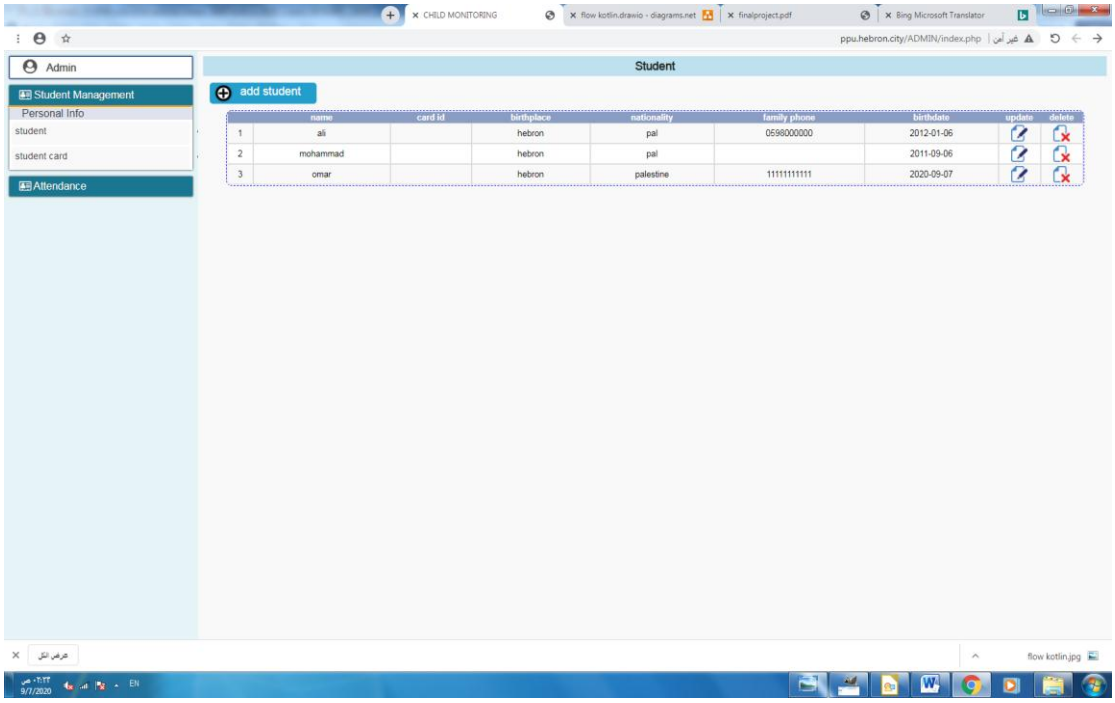

figure 21: student

Student cared :

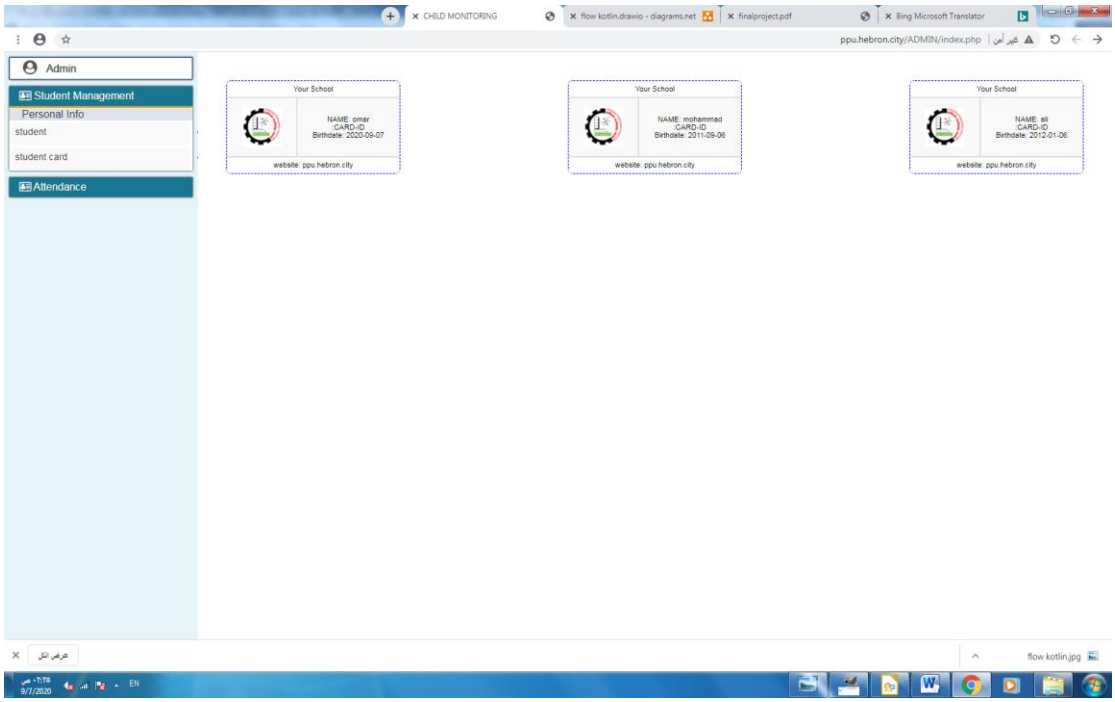

figure 22: student cared

RFID record :

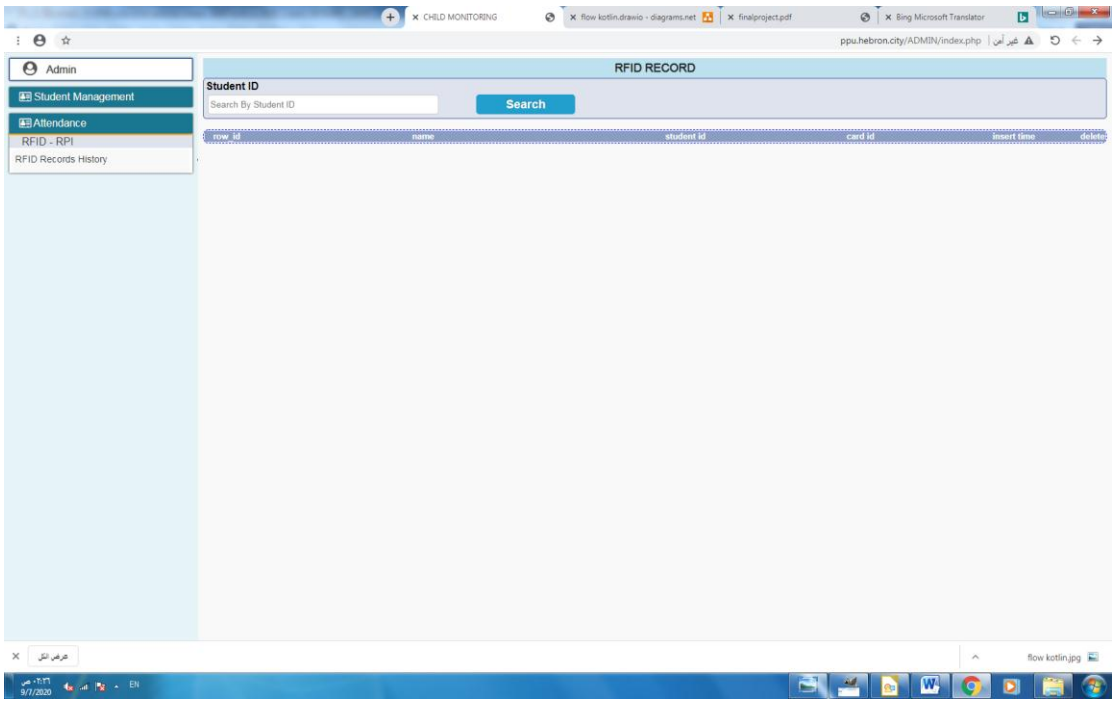

figure 23: **RFID record**

4.4 Hardware Implementation

This section will provide some information about the hardware implementations of project.

4.4.1 RFID_RC522 configuration

RFID or Radio Frequency Identification system consists of two main components, a transponder/tag attached to an object to be identified, and a Transceiver also known as interrogator/Reader.

figure 24: RFID connect

4.4.2 MINI A8 configuration

Used for determine location and sound hearing.

figure 25: SIM into mini a8

4.5 Implementation Results

By the end of the implementation process, a child remote monitoring system was built by designing a watch-shaped bracelet placed by the child and also worked on RFID programming to find out records of entry and exit from school and this data is sent to the application and web page that is designed, show in the figure**:**

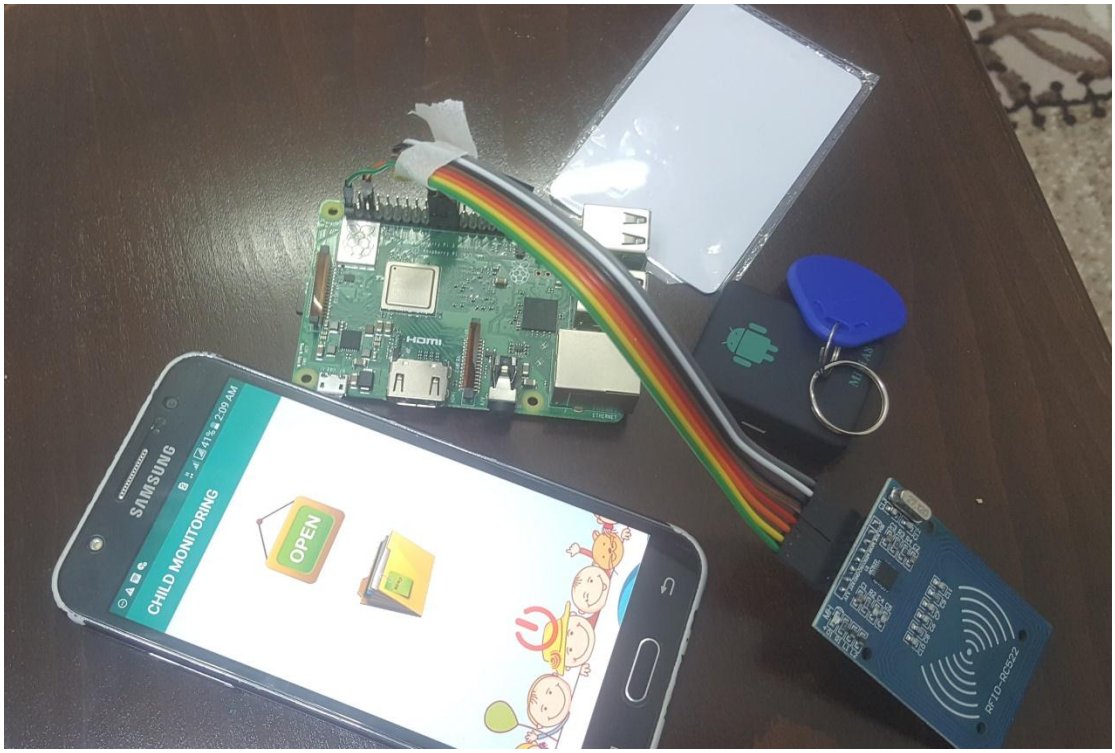

figure 26:final test

4.6 Implementation Issues

During the implementation of the project, we faced many obstacles and we had to take Several issues to achieve the most appropriate design for the system and access to the best features Related to the objectives of the project. These issues and results are summarized as follows:

1. GSM :
   We had trouble locating very high accuracy.
2. Connection between android and hardware device:
   We had a problem in the process of linking both the application and RPI in order to get the correct and accurate values where RPI was programmed to send data over the Internet and the application was programmed to receive this data.

Chapter 5

Validation & Testing

5.1 Overview

In this chapter we will discuss the testing of all component of the system and the results obtained. We test all the parts to ensure that all of the functions work perfectly and without errors.

5.2 Software Testing

5.2.1 Testing Android Application

We used Android Studio to design an android application to receive data. we designed the application's interfaces (many Button to move the interfaces, log in &Location, Audio & Web interface) then loaded the application on the Android mobile to check and test the functionality of the validity of:

1) Received data.
2) determine location .
3) determine Audio.
4) determine RFID value .

5.3 Hardware Testing

In this section we will discuss the testing of components.

1. Testing RFID _RC522 in the app :

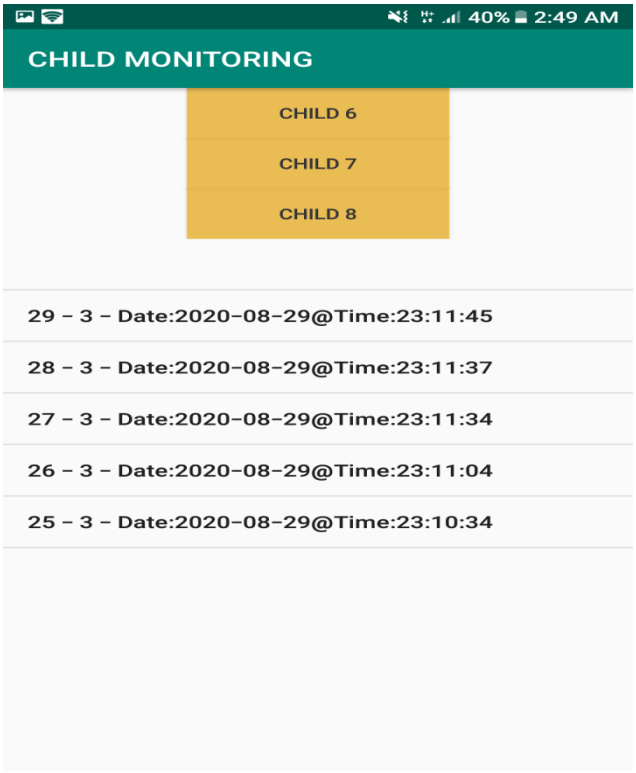

figure 27: Testing RFID

2. Testing MINI A8 location in the app:

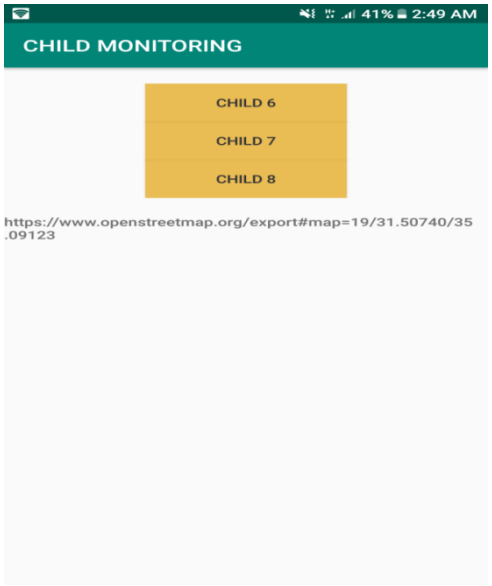

figure 28: Testing MINI A8

3. Testing insert data :

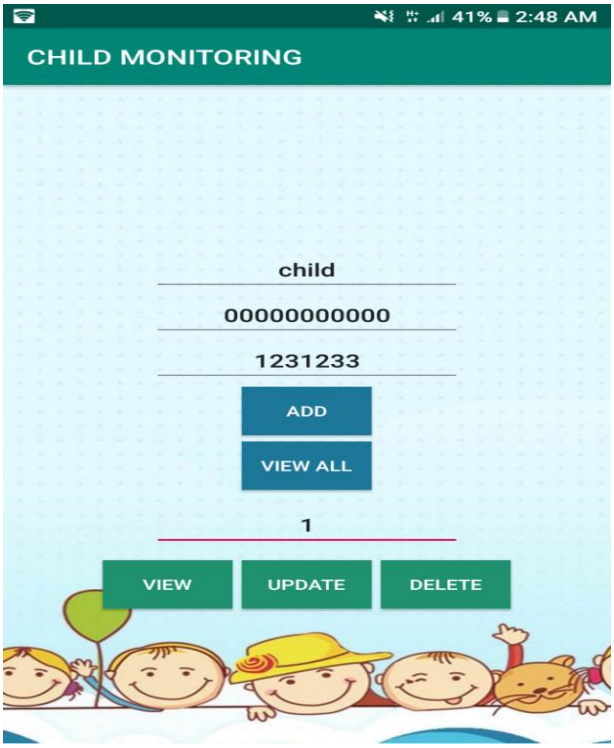

figure 29: Testing insert data

4. Testing MINI A8:

figure 30: Testing MINI A8

5.4 System Test

After ensuring that all the parts are working properly, we started assembling and integrating the parts with each other to make the system ready to operate.

5.4.1 Raspberry pi sensors - Web Server to http integration test

After testing sensor as a separate unit, we integrate sensors and start sending data to web server , we tested that the web server recorded values are the same as the raspberry measured values.

5.4.2 Android – Web server integration test

After server receiving data from raspberry pi through PHP page and insert it to MySql , we can show the history of rows by android activities that call URL and receive JSON data then parse it to show it as list view .

- Get data(RFID sensors) from web server.
- Determine location by SMS.
- Listening voice by call.
- Test received details is the same as the data in each interface.

system was completed and tested successfully and it works as required without any major problems.

Chapter 6

Conclusion & Future work

6.1 Overview

In this chapter, we will conclude the challenges, final result and future work of my project.

6.2 Final Result

The system was able to measure many values through sensors then transmit these values to Raspberry pi to process them to do different functions. On the other hand, the android application was able to send commands and receive information through internet without any problem.

The main system's components, which are: Raspberry pi, sensors and android application were all combined together, and formed an integrated system that reads the values of the sensors and processes them to do the required functions.

6.3 Futures Works

The system designed and developed with in this project can be extended as on IOT devise. Moreover, the functionalities of the system are open for further extent.

6.4 Conclusion

The main objective of this system is to help parents monitor their children in an easy and simple way and does not require much effort. The objectives of this system are to monitor children remotely by locating the child, hearing his or her voice, knowing when he or she is going to school, and when to get out of school, this system can be used by anyone who is not technically.

The project can be developed so that new technologies are added to it and widely disseminated by countries and used by all pepole.

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