VEHICLE MONITORING SYSTEM (VeMS)

J Component Project Report for

CSE4035 – Mobile App Development for IoT (C2+TC2)

Bachelor of Technology

In

ECE with Specialization in Internet of Things and Sensors

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INTRODUCTION

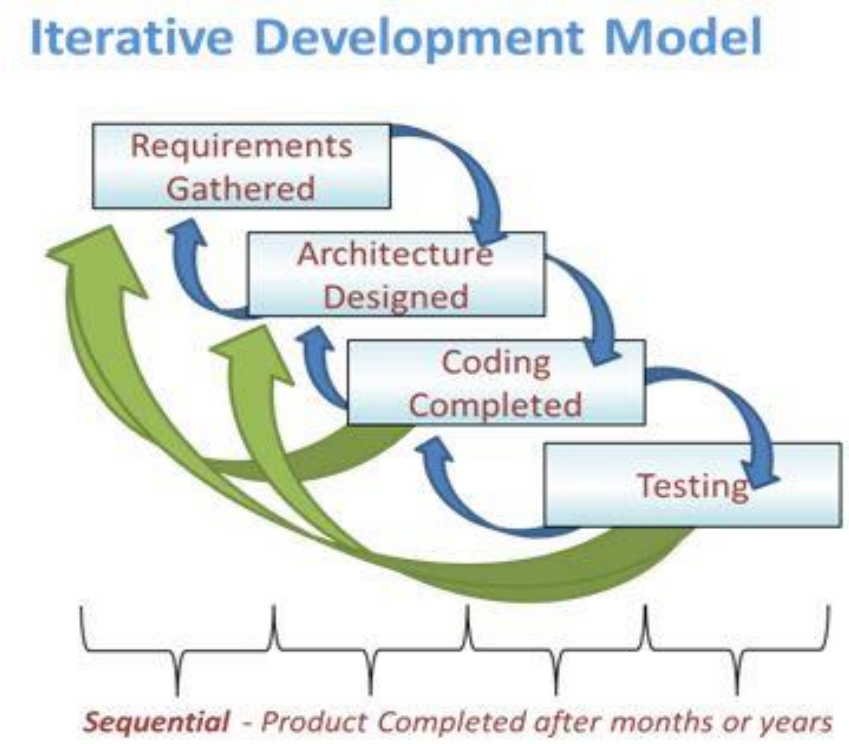
Motivation

VeMS is developed to automate/adapt/enhance vehicle systems for safety and better driving. Safety features are designed to avoid collisions and accidents by offering technologies that alert the driver to potential problems.

Background

It is very difficult for car owners who give their cars on rent to keep a track of all their cars. This is the case of cab service where we will connect the cab owners to their cars using IoT so that they can keep a track of their cars in real-time. This will make them secure about their cars and would stop the misuse of their cars.

We have followed the Waterfall reference model to proceed in our project.



Objective

The main idea behind VeMS is to track and monitor the vehicle parameters using IoT. The owner and driver will be able to view various parameter on one touch so as to make the vehicle management much more efficient. The parameter being object detection, weather forecast, engine performance and car location.

The alerts and app HMI will make the usage more secure than ever before. This is done by acquiring data from sensors, sending it to cloud, analyzing the received data and show it in the app interface and produce alert according to the defined conditions.

By applying this model in real car along with GPS sensor in it and analysing it for few months we can get the data about the roads and traffic conditions and then can further predict the routes which are more comfortable and time saving for the customer.

Organization of the report

The basic project description and goals are discussed to make a clear understanding of the project we have made. Which is followed by the description of all the components and software used in VeMS. Code are also defined for all the functionalities used in successful executing our project VeMS.

PROJECT DESCRIPTION AND GOALS

We successfully acquired the Humidity and Temperature values on Rpi using DHT 11 sensor. Temperature and Humidity were the engine parameters that we successfully sent to the cloud for the owner to monitor and predict the health of the engine.

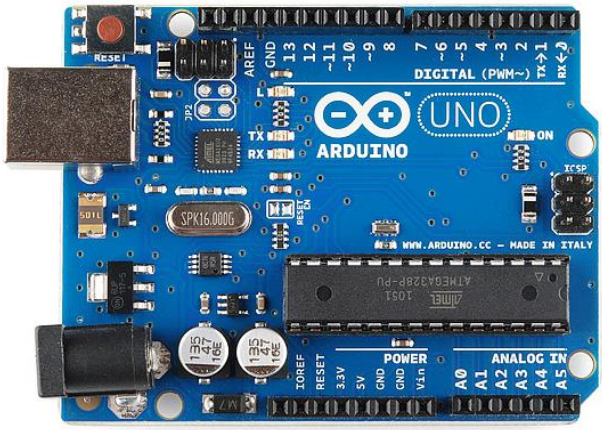
For the driver assistance, we have also added Weather API in the dashboard of the car itself. The driver can enter the name of the city he wishes to go and all the weather related information of the entered city will be displayed for his assistance.

Sometimes while driving in the night the driver may feel drowsy which increases the chances of accident so to avoid such incidents an additional feature Object Detection is also included which is a semi-automatic feature and can be turned on whenever the person driving the car requires it. Whenever any object comes very close to the car or crosses the minimum proximity distance then the driver will be alerted or the brakes will be applied automatically.

HARDWARE SPECIFICATIONS

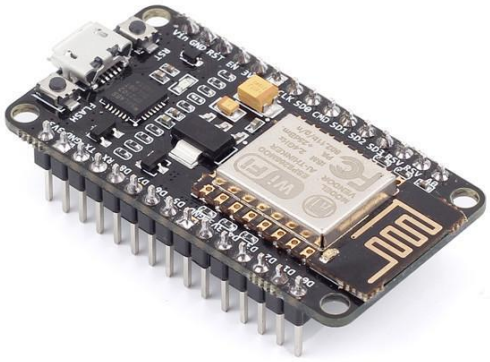
Arduino

Arduino Uno is a microcontroller board based on the ATmega328P (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button.



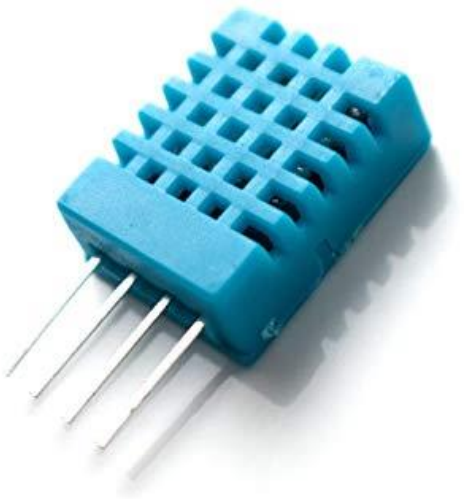
NodeMCU

NodeMCU is an open source IoT platform. It includes firmware which runs on the ESP8266 Wi-Fi SoC from Espressif Systems, and hardware which is based on the ESP-12 module. ESP8266 is a low-cost Wi-Fi microchip with full TCP/IP stack and microcontroller capability. It is a 32-bit microcontroller with 16 GPIO pins. It supports 802.11b/g/n standards. It has Low energy consumption, integrated support for WIFI network, reduced size of the board.



Temperature Sensor

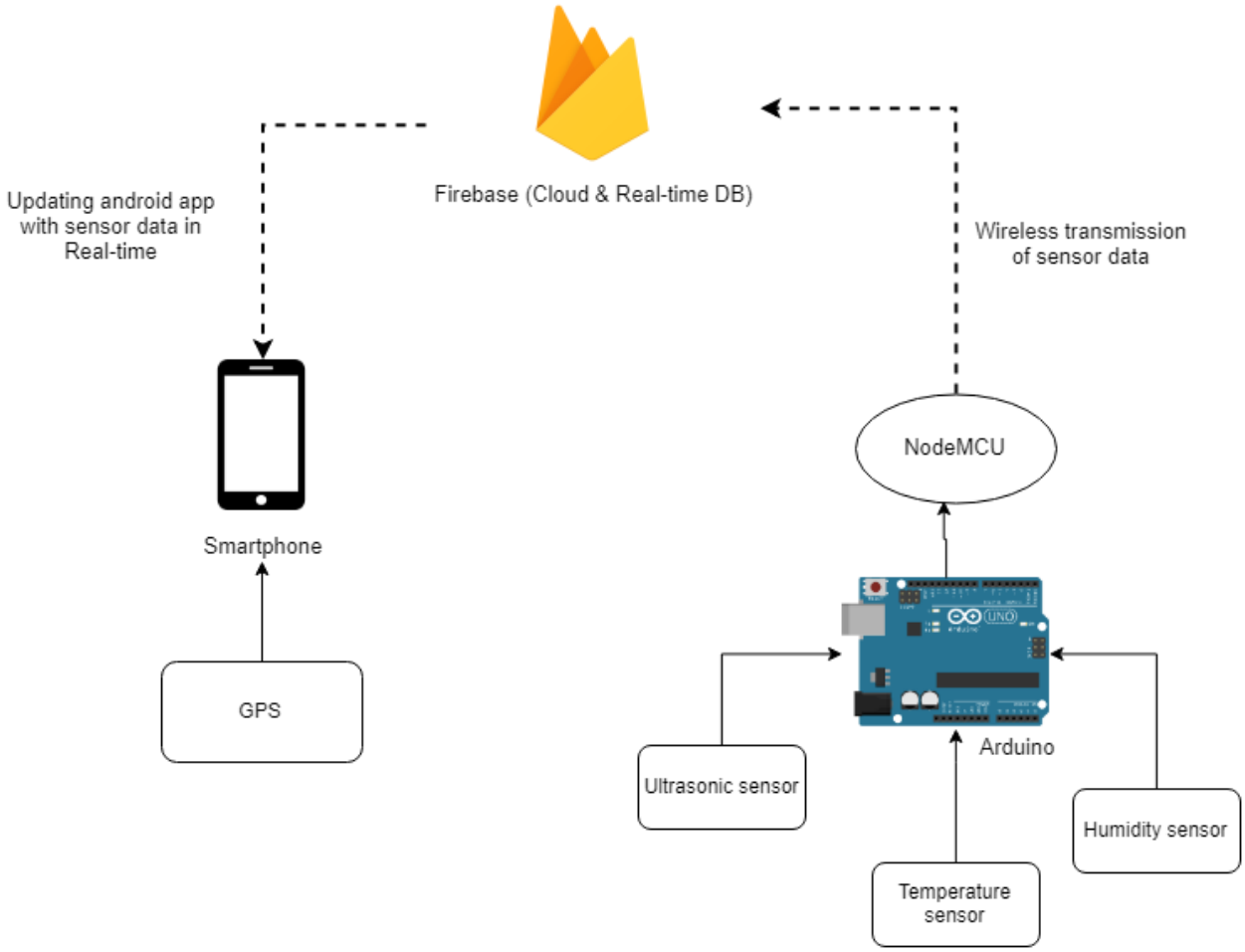
This DHT11 Temperature and Humidity Sensor features a calibrated digital signal output with the temperature and humidity sensor complex. Its technology ensures the high reliability and excellent long-term stability. This sensor includes a resistive element and a sense of wet NTC temperature measuring devices.



Ultrasonic sensor

Ultrasonic sensors measure distance by using ultrasonic waves. The sensor head emits an ultrasonic wave and receives the wave reflected back from the target. Ultrasonic Sensors measure the distance to the target by measuring the time between the emission and reception.

DESIGN APPROACH AND DETAILS



All the sensor data is passed on to the Arduino microcontroller serially and later on pushed to NodeMCU for wireless contact with the Real-time DB (Firebase). Firebase is integrated with NodeMCU as well as the Mobile application to receive and display sensor data respectively. Once the app starts displaying the sensor data, in-built GPS module of the Smartphone calculates the current location and displays the same in the app.

1. Hardware code

```
#include  <ESP8266WiFi.h>
#include "DHT.h"
#include <FirebaseArduino.h>
#define FIREBASE_HOST "nodemcu1-2e0bf.firebaseio.com"
#define FIREBASE_AUTH "wIDy2qcTNfGbaGTSQ4Vnn58bd9ElseOdNjZlZman"
#define WIFI_SSID "ASUS" // Change the name of your WIFI
#define WIFI_PASSWORD "12345678" // Change the password of your WIFI
DHT dht;
const int trigPin = D6;  //D4
const int echoPin = D5;  //D3
// defines variables
long duration;
int distance;

void setup() {
  pinMode(trigPin, OUTPUT);
  pinMode(echoPin, INPUT);
  Serial.begin(115200);
   WiFi.begin (WIFI_SSID, WIFI_PASSWORD);
   while (WiFi.status() != WL_CONNECTED) {
    delay(500);
    Serial.print(".");
  }
  Serial.println ("");
  Serial.println ("WiFi Connected!");
  Firebase.begin(FIREBASE_HOST, FIREBASE_AUTH);
  Serial.println ("firebase ON");
  dht.setup(D1); //D1 for DHT11
  pinMode(D2, OUTPUT); //D0 for LED
  pinMode(D4, INPUT);
}
void loop() {
  //ultra
  digitalWrite(trigPin, LOW);
  delayMicroseconds(2);
  digitalWrite(trigPin, HIGH);
  delayMicroseconds(10);
  digitalWrite(trigPin, LOW);
  duration = pulseIn(echoPin, HIGH);
  distance= duration*0.034/2;
  Serial.print("Distance: ");
  Serial.println(distance);
  Firebase.setFloat("Distance", distance); //SEND distance
  delay(300);
  //ultra>
  String s = Firebase.getString("Switch"); //GET Led
  Serial.println(s);
  if(s=="ON"){
    digitalWrite(D2, HIGH);
  }
  else{
    digitalWrite(D2, LOW);
```

```
  }

  delay(dht.getMinimumSamplingPeriod());   ///* Delay of amount equal to
sampling period
  float humidity = dht.getHumidity();  ///* Get humidity value
  float temperature = dht.getTemperature(); // Get temperature value
  delay(200);
  Firebase.setFloat("Humidity", humidity); //SEND humidity
  delay(100);
  Firebase.setFloat("Temperature", temperature); //SEND temperature
  delay(100);


  if (Firebase.failed()) {
      Serial.print("setting /number failed:");
      Serial.println(Firebase.error());
      return;
  }
  delay(1000);
}
```

2. Software code

AndroidManifest.xml

```
<?xml version="1.0" encoding="utf-8"?>
<manifest xmlns:android="http://schemas.android.com/apk/res/android"
    package="com.kkc.kishan.nodemcu1">

    <uses-permission
android:name="android.permission.ACCESS_COARSE_LOCATION" />
    <uses-permission android:name="android.permission.INTERNET" />
    <application
        android:allowBackup="true"
        android:icon="@mipmap/ic_launcher"
        android:label="@string/app_name"
        android:roundIcon="@mipmap/ic_launcher_round"
        android:supportsRtl="true"
        android:theme="@style/AppTheme">
        <activity android:name=".MainActivity">
            <intent-filter>
                <action android:name="android.intent.action.MAIN" />

                <category android:name="android.intent.category.LAUNCHER"
/>
            </intent-filter>
        </activity>

    </application>

</manifest>
```

activity_main.xml

```
<?xml version="1.0" encoding="utf-8"?>
<android.support.constraint.ConstraintLayout
xmlns:android="http://schemas.android.com/apk/res/android"
    xmlns:app="http://schemas.android.com/apk/res-auto"
    xmlns:tools="http://schemas.android.com/tools"
    android:layout_width="match_parent"
    android:layout_height="match_parent"
    tools:context=".MainActivity"
    android:background="#eeeeee"
    tools:layout_editor_absoluteY="81dp">

    <android.support.v7.widget.CardView
        android:layout_width="match_parent"
        android:layout_height="wrap_content"
        android:layout_marginStart="4dp"
        android:layout_marginTop="8dp"
        android:layout_marginEnd="4dp"
        android:layout_marginBottom="16dp"
        android:background="#dedede"
        app:cardCornerRadius="1dp"
        app:layout_constraintBottom_toTopOf="@+id/cardView2"
        app:layout_constraintEnd_toEndOf="parent"
        app:layout_constraintStart_toStartOf="parent"
        app:layout_constraintTop_toTopOf="parent">

        <TextView
            android:layout_width="match_parent"
            android:layout_height="wrap_content"
            android:text="VeMS"
            android:textAlignment="center"
            android:textColor="@android:color/holo_blue_dark"
            android:textSize="30sp"
            android:textStyle="bold" />

    </android.support.v7.widget.CardView>

    <android.support.v7.widget.CardView
        android:id="@+id/cardView2"
        android:layout_width="match_parent"
        android:layout_height="wrap_content"
        android:layout_marginStart="8dp"
        android:layout_marginTop="8dp"
        android:layout_marginEnd="8dp"
        android:layout_marginBottom="8dp"
        app:cardCornerRadius="8dp"
        app:layout_constraintBottom_toBottomOf="parent"
        app:layout_constraintEnd_toEndOf="parent"
        app:layout_constraintHorizontal_bias="0.0"
        app:layout_constraintStart_toStartOf="parent"
        app:layout_constraintTop_toTopOf="parent"
        app:layout_constraintVertical_bias="0.101">
```

```
<android.support.constraint.ConstraintLayout
    android:layout_width="match_parent"
    android:layout_height="match_parent">

    <ImageView
        android:id="@+id/imageView"
        android:layout_width="50dp"
        android:layout_height="50dp"
        android:layout_marginStart="8dp"
        android:layout_marginTop="8dp"
        android:layout_marginEnd="8dp"
        android:layout_marginBottom="8dp"
        android:src="@drawable/iconhum"
        app:layout_constraintBottom_toBottomOf="parent"
        app:layout_constraintEnd_toEndOf="parent"
        app:layout_constraintHorizontal_bias="0.06"
        app:layout_constraintStart_toStartOf="parent"
        app:layout_constraintTop_toTopOf="parent" />

    <TextView
        android:id="@+id/text1"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:layout_marginStart="8dp"
        android:layout_marginTop="8dp"
        android:layout_marginEnd="8dp"
        android:layout_marginBottom="5dp"
        android:text="00"
        android:textSize="64sp"
        app:layout_constraintBottom_toBottomOf="parent"
        app:layout_constraintEnd_toEndOf="parent"
        app:layout_constraintHorizontal_bias="0.17"
        app:layout_constraintStart_toEndOf="@+id/imageView"
        app:layout_constraintTop_toTopOf="parent" />

    <TextView
        android:id="@+id/textView2"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:layout_marginStart="8dp"
        android:layout_marginTop="8dp"
        android:layout_marginEnd="8dp"
        android:layout_marginBottom="8dp"
        android:text=" %"
        android:textSize="64sp"
        app:layout_constraintBottom_toBottomOf="parent"
        app:layout_constraintEnd_toEndOf="parent"
        app:layout_constraintHorizontal_bias="0.0"
        app:layout_constraintStart_toEndOf="@+id/text1"
        app:layout_constraintTop_toTopOf="parent" />

</android.support.constraint.ConstraintLayout>
```

```
</android.support.v7.widget.CardView>

<android.support.v7.widget.CardView
    android:id="@+id/cardView3"
    android:layout_width="match_parent"
    android:layout_height="wrap_content"
    android:layout_marginStart="8dp"
    android:layout_marginTop="8dp"
    android:layout_marginEnd="8dp"
    android:layout_marginBottom="8dp"
    app:cardCornerRadius="8dp"
    app:layout_constraintBottom_toBottomOf="parent"
    app:layout_constraintEnd_toEndOf="parent"
    app:layout_constraintStart_toStartOf="parent"
    app:layout_constraintTop_toBottomOf="@+id/cardView2"
    app:layout_constraintVertical_bias="0.0">

    <android.support.constraint.ConstraintLayout
        android:layout_width="match_parent"
        android:layout_height="match_parent">

        <ImageView
            android:id="@+id/imageView1"
            android:layout_width="70dp"
            android:layout_height="70dp"
            android:layout_marginStart="8dp"
            android:layout_marginTop="8dp"
            android:layout_marginEnd="8dp"
            android:layout_marginBottom="8dp"
            android:src="@drawable/icontemp"
            app:layout_constraintBottom_toBottomOf="parent"
            app:layout_constraintEnd_toEndOf="parent"
            app:layout_constraintHorizontal_bias="0.04"
            app:layout_constraintStart_toStartOf="parent"
            app:layout_constraintTop_toTopOf="parent" />

        <TextView
            android:id="@+id/text2"
            android:layout_width="wrap_content"
            android:layout_height="wrap_content"
            android:layout_marginStart="8dp"
            android:layout_marginTop="8dp"
            android:layout_marginEnd="8dp"
            android:layout_marginBottom="8dp"
            android:text="00"
            android:textSize="64sp"
            app:layout_constraintBottom_toBottomOf="parent"
            app:layout_constraintEnd_toEndOf="parent"
            app:layout_constraintHorizontal_bias="0.18"
            app:layout_constraintStart_toEndOf="@+id/imageView1"
            app:layout_constraintTop_toTopOf="parent"
            app:layout_constraintVertical_bias="1.0" />

        <TextView
```

```
            android:id="@+id/textView3"
            android:layout_width="wrap_content"
            android:layout_height="wrap_content"
            android:layout_marginStart="8dp"
            android:layout_marginTop="8dp"
            android:layout_marginEnd="8dp"
            android:layout_marginBottom="8dp"
            android:text="°C"
            android:textSize="64sp"
            app:layout_constraintBottom_toBottomOf="parent"
            app:layout_constraintEnd_toEndOf="parent"
            app:layout_constraintHorizontal_bias="0.0"
            app:layout_constraintStart_toEndOf="@+id/text2"
            app:layout_constraintTop_toTopOf="parent"
            app:layout_constraintVertical_bias="1.0" />

    </android.support.constraint.ConstraintLayout>


</android.support.v7.widget.CardView>

<android.support.v7.widget.CardView
    android:id="@+id/cardView4"
    android:layout_width="match_parent"
    android:layout_height="wrap_content"
    android:layout_marginStart="8dp"
    android:layout_marginTop="8dp"
    android:layout_marginEnd="8dp"
    android:layout_marginBottom="8dp"
    app:cardCornerRadius="8dp"
    app:layout_constraintBottom_toBottomOf="parent"
    app:layout_constraintEnd_toEndOf="parent"
    app:layout_constraintStart_toStartOf="parent"
    app:layout_constraintTop_toBottomOf="@+id/cardView3"
    app:layout_constraintVertical_bias="0.0">

    <android.support.constraint.ConstraintLayout
        android:layout_width="match_parent"
        android:layout_height="wrap_content">

        <ImageView
            android:id="@+id/imageView2"
            android:layout_width="64dp"
            android:layout_height="64dp"
            android:layout_marginStart="8dp"
            android:layout_marginTop="8dp"
            android:layout_marginEnd="8dp"
            android:layout_marginBottom="8dp"
            android:src="@drawable/iconsloc"
            app:layout_constraintBottom_toBottomOf="parent"
            app:layout_constraintEnd_toEndOf="parent"
            app:layout_constraintHorizontal_bias="0.05"
            app:layout_constraintStart_toStartOf="parent"
            app:layout_constraintTop_toTopOf="parent" />
```

```
            <TextView
                android:id="@+id/text3"
                android:layout_width="wrap_content"
                android:layout_height="wrap_content"
                android:layout_marginStart="8dp"
                android:layout_marginTop="13dp"
                android:layout_marginEnd="8dp"
                android:layout_marginBottom="8dp"
                android:text="VIT Nescafe, VIT University Vellore"
                android:textSize="12sp"
                app:layout_constraintBottom_toBottomOf="parent"
                app:layout_constraintEnd_toEndOf="parent"
                app:layout_constraintHorizontal_bias="0.27"
                app:layout_constraintStart_toEndOf="@+id/imageView2"
                app:layout_constraintTop_toTopOf="parent" />
        </android.support.constraint.ConstraintLayout>


    </android.support.v7.widget.CardView>

    <android.support.v7.widget.CardView
        android:id="@+id/cardswitch"
        android:layout_width="150dp"
        android:layout_height="0dp"
        android:layout_marginStart="16dp"
        android:layout_marginTop="16dp"
        android:layout_marginEnd="8dp"
        android:layout_marginBottom="16dp"
        android:clickable="true"
        app:cardCornerRadius="65dp"
        app:layout_constraintBottom_toBottomOf="parent"
        app:layout_constraintEnd_toEndOf="parent"
        app:layout_constraintHorizontal_bias="0.0"
        app:layout_constraintStart_toStartOf="parent"
        app:layout_constraintTop_toBottomOf="@+id/cardView4">

        <android.support.constraint.ConstraintLayout
            android:layout_width="match_parent"
            android:layout_height="match_parent">

            <ImageView
                android:layout_width="100dp"
                android:layout_height="100dp"
                android:layout_marginStart="8dp"
                android:layout_marginTop="8dp"
                android:layout_marginEnd="8dp"
                android:layout_marginBottom="8dp"
                android:src="@drawable/iconsswitch"
                app:layout_constraintBottom_toBottomOf="parent"
                app:layout_constraintEnd_toEndOf="parent"
                app:layout_constraintStart_toStartOf="parent"
                app:layout_constraintTop_toTopOf="parent" />
```

```
        </android.support.constraint.ConstraintLayout>


    </android.support.v7.widget.CardView>

    <android.support.v7.widget.CardView
        android:layout_width="0dp"
        android:layout_height="0dp"
        android:layout_marginStart="16dp"
        android:layout_marginTop="8dp"
        android:layout_marginEnd="8dp"
        android:layout_marginBottom="8dp"
        app:cardCornerRadius="5dp"
        app:layout_constraintBottom_toBottomOf="parent"
        app:layout_constraintEnd_toEndOf="parent"
        app:layout_constraintStart_toEndOf="@+id/cardswitch"
        app:layout_constraintTop_toBottomOf="@+id/cardView4">

        <android.support.constraint.ConstraintLayout
            android:layout_width="match_parent"
            android:layout_height="match_parent">

            <TextView
                android:id="@+id/textView4"
                android:layout_width="wrap_content"
                android:layout_height="wrap_content"
                android:layout_marginStart="8dp"
                android:layout_marginTop="8dp"
                android:layout_marginEnd="8dp"
                android:layout_marginBottom="8dp"
                android:text="Distance:"

android:textColor="@color/common_google_signin_btn_text_dark_focused"
                android:textSize="34sp"
                app:layout_constraintBottom_toBottomOf="parent"
                app:layout_constraintEnd_toEndOf="parent"
                app:layout_constraintStart_toStartOf="parent"
                app:layout_constraintTop_toTopOf="parent"
                app:layout_constraintVertical_bias="0.060000002" />

            <TextView
                android:id="@+id/dist"
                android:layout_width="wrap_content"
                android:layout_height="wrap_content"
                android:layout_marginStart="8dp"
                android:layout_marginTop="8dp"
                android:layout_marginEnd="8dp"
                android:layout_marginBottom="8dp"
                android:text="00 cm"
                android:textSize="40sp"
                app:layout_constraintBottom_toBottomOf="parent"
                app:layout_constraintEnd_toEndOf="parent"
                app:layout_constraintStart_toStartOf="parent"
                app:layout_constraintTop_toBottomOf="@+id/textView4" />
```

```
        </android.support.constraint.ConstraintLayout>


    </android.support.v7.widget.CardView>


</android.support.constraint.ConstraintLayout>
```

MainActivity.java

```
package com.kkc.kishan.nodemcu1;

import android.Manifest;
import android.annotation.SuppressLint;
import android.content.pm.PackageManager;
import android.content.res.ColorStateList;
import android.graphics.Color;
import android.location.Address;
import android.location.Criteria;
import android.location.Geocoder;
import android.location.Location;
import android.location.LocationManager;
import android.support.annotation.NonNull;
import android.support.v4.app.ActivityCompat;
import android.support.v7.app.AppCompatActivity;
import android.os.Bundle;
import android.support.v7.widget.CardView;
import android.view.View;
import android.widget.TextView;

import com.google.android.gms.location.FusedLocationProviderClient;
import com.google.android.gms.location.LocationServices;
import com.google.android.gms.tasks.OnSuccessListener;
import com.google.firebase.database.DataSnapshot;
import com.google.firebase.database.DatabaseError;
import com.google.firebase.database.DatabaseReference;
import com.google.firebase.database.FirebaseDatabase;
import com.google.firebase.database.ValueEventListener;

import java.io.IOException;
import java.util.List;
import java.util.Locale;

public class MainActivity extends AppCompatActivity {

    private FusedLocationProviderClient fusedLocationClient;
    FirebaseDatabase database;
    DatabaseReference myRef;
    TextView textView1;
    TextView textView2;
    //<
```

```
    TextView textView3;
    String cityname;
    //
    CardView cardView;
    TextView distance;

    @SuppressLint("MissingPermission")
    @Override
    protected void onCreate(Bundle savedInstanceState) {
        super.onCreate(savedInstanceState);
        setContentView(R.layout.activity_main);

        fusedLocationClient =
LocationServices.getFusedLocationProviderClient(this);

        database = FirebaseDatabase.getInstance();
        myRef = database.getReference();
        textView1 = findViewById(R.id.text1);
        textView2 = findViewById(R.id.text2);
        //<
        textView3 = findViewById(R.id.text3);
        //
        distance = findViewById(R.id.dist);
        cardView = findViewById(R.id.cardswitch);

        fusedLocationClient.getLastLocation()
                .addOnSuccessListener(this, new
OnSuccessListener<Location>() {
                    @Override
                    public void onSuccess(Location location) {
                        // Got last known location. In some rare
situations this can be null.
                        if (location != null) {
                            // Logic to handle location object

                            try {
                                Geocoder geocoder = new
Geocoder(MainActivity.this, Locale.getDefault());
                                List<Address> addresses;
                                double myLat = location.getLatitude();
                                double myLong = location.getLongitude();
                                addresses =
geocoder.getFromLocation(myLat, myLong, 1);
                                String cityName =
addresses.get(0).getAddressLine(0);
                                textView3.setText(cityName);
                            } catch (IOException e) {
                                String cityName =  "VIT Nescafe, VIT
University, Vellore";
                                textView3.setText(cityName);
                                e.printStackTrace();
                            }

                        }
```

```
                    }
                });

        cardView.setOnClickListener(new View.OnClickListener() {
            boolean switch1 = false;

            @Override
            public void onClick(View v) {
                if(switch1){
                    switch1 = false;
                    cardView.setCardBackgroundColor(Color.LTGRAY);
                    myRef.child("Switch").setValue("OFF");
                }
                else{
                    switch1 = true;
                    cardView.setCardBackgroundColor(Color.WHITE);
                    myRef.child("Switch").setValue("ON");
                }
            }
        });
        myRef.addValueEventListener(new ValueEventListener() {
            int thum = 0;
            int ttemp = 0;

            @Override
            public void onDataChange(@NonNull DataSnapshot dataSnapshot) {
                long count = dataSnapshot.getChildrenCount();
                String hum =
dataSnapshot.child("Humidity").getValue().toString();
                String temp =
dataSnapshot.child("Temperature").getValue().toString();
                String distance_value =
dataSnapshot.child("Distance").getValue().toString();

                distance.setText(distance_value);
                if(Integer.parseInt(distance_value) <= 5){
                    distance.setTextColor(Color.RED);
                }
                else{
                    distance.setTextColor(Color.LTGRAY);
                }
                textView1.setText(hum);
                int ihum = Integer.parseInt(hum);
                textView1.setTextColor(Color.argb(100, 100-ihum, 100-ihum,
ihum*2));
                textView2.setText(temp);
                if(ttemp > Integer.parseInt(temp)){
                    textView2.setTextColor(Color.RED);
                }
                else if(ttemp < Integer.parseInt(temp)){
                    textView2.setTextColor(Color.GREEN);
                }
                else{
                    textView2.setTextColor(Color.GRAY);
```

```
                }

                ttemp = Integer.parseInt(temp);
                thum = Integer.parseInt(hum);
            }

            @Override
            public void onCancelled(@NonNull DatabaseError databaseError)
{

            }
        });
    }

}
```

RESULTS

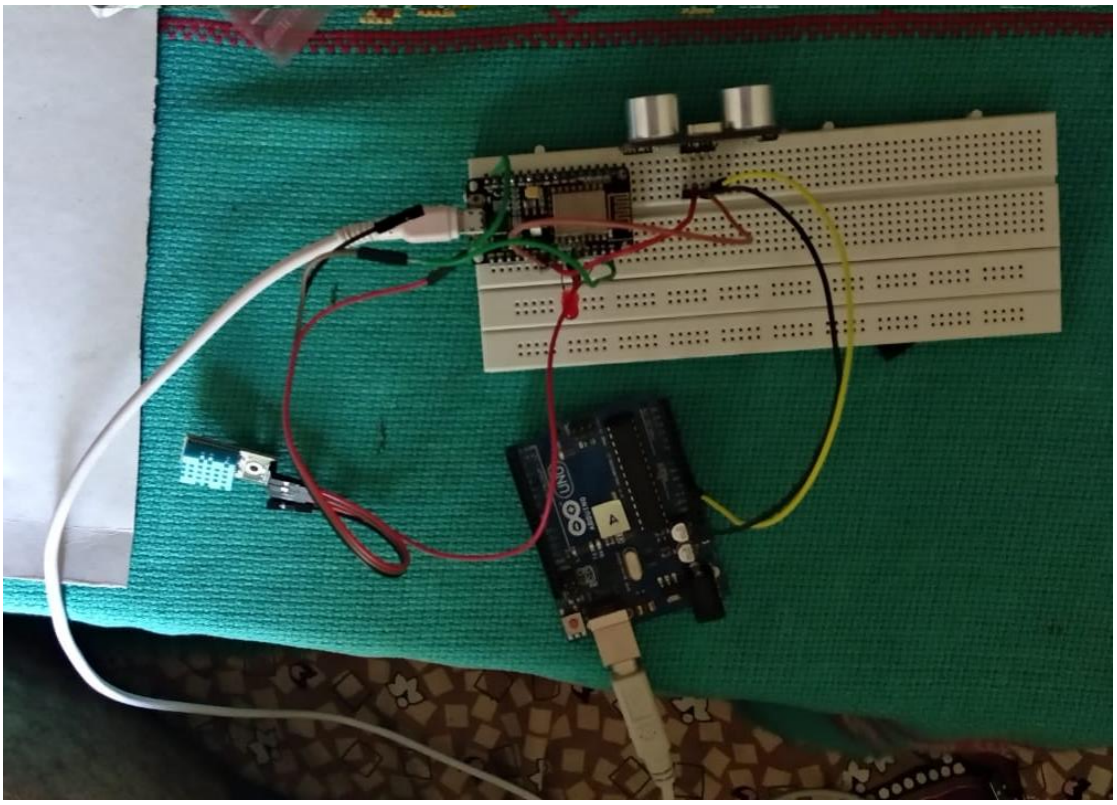


Fig. 1 Hardware setup (Arduino + NodeMCU + Sensors)

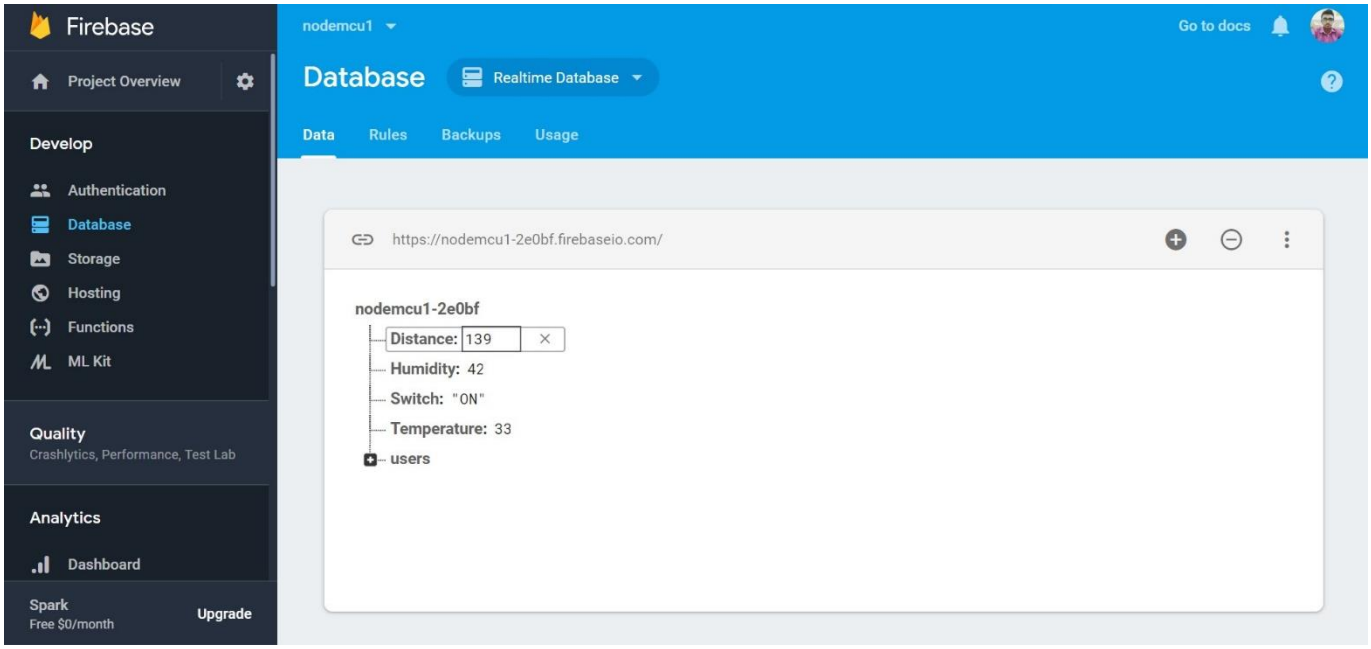


Fig. 2 Firebase web interface for NodeMCU and mobile app integration

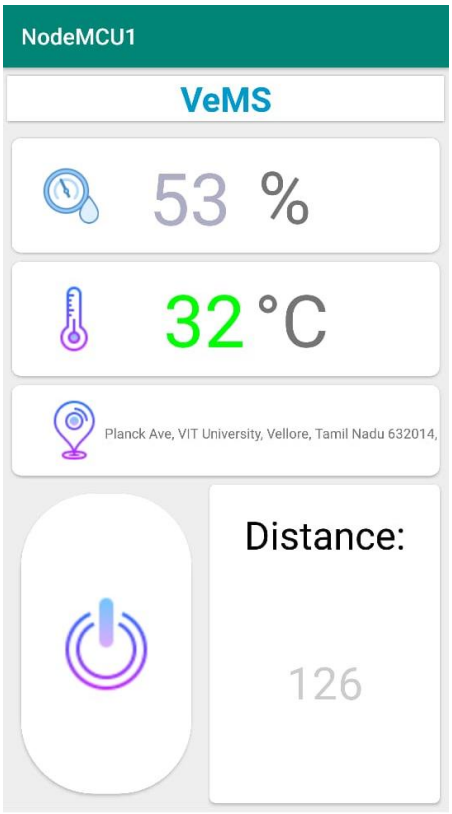


Fig. 2 Android app (Integrated with Firebase cloud service)

REFERENCES

[1] Personal Driver Assistance System (PDAS) based on Raspberry Pi International Journal of Engineering and Technical Research (IJETR) ISSN: 2321-0869, Volume-3, Issue-4, April 2015

[2] http://www.electronicwings.com