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Water Saving Tweety

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Abstract: ***It is often seen that a lot of water is wasted from the water pipes, constructed by the municipality at the street corners. In some cases, this is due to the unawareness of people, not turning off the water tap, or an internal dis- turbance in the tap. The above factors motivate us to develop a solution so that water wastage can be reduced which helps to save the drinking water in this country. The main purpose of this project is to first find out if there is a container or bucket below the water tap for getting water. If there is no such thing and the water tap is open for no reason, then it will send a notification to the mobile number of the ward counselor or owner of the water tap so that she/he can take some immediate steps. Whenever that kind of situation occurs, the module will also broadcast an audio message., so that anyone who passes by in front of the water tap can also take some immediate actions. Also, if someone tries to steal it, the module will also warn the ward counselor by sending an Alert SMS.***

I. INTRODUCTION

It is certain that with the rise of global warming, there will be an acute shortage of drinking water in the world. As the days go by, people become more and more unaware of the shortage of drinking water. There is going to be a time on earth when we will all cry out for a drop of drinking water. And maybe that's when we'll realize the importance of a drop of water being wasted. If such kind of unaware people is constantly wasting water without any reason, then that day is yet to come.

A. Deal with Real World

It is often seen that a lot of water is being wasted without any reason from the water taps installed at the corners of the roads. There are some places in the world where people stand in long lines in front of a well for hours to get a drop of drinking water. If a little water is wasted in this way from every water tap every day, then the day will come when there will be a massive crisis of drinking water. For this reason, world greening will be disrupted and world warming will also increase. Through this project, we try to develop a water-saving module that will play a significant role in raising awareness among the people about water wastage.

B. Goal

For making a suitable solution for the problem of water wastage, we have to develop one module that will be placed under the water tap first. Now, if there is no container for taking water under the water tap, then the module will operate the servo motor. The water level sensor on the servo motor is to determine if any water is being wasted from that tap. If so, the message will be sent to the counselor's phone immediately and at the same time, the audio message will inform the people in the vicinity that water is being wasted through this tube.

C. Motivation

Nowadays, water is wasted everywhere such as various the road- side water taps or restaurants, or factories. It is not always possible that there will be a person who will monitor roadside water tap in any bad weather & take any action or report to the ward counselor if any water is being wasted from there.

The development of the autonomous module "Tweety" may be used to reduce these kinds of problems. If there is any wastage of water, it immediately sends an alert message to the ward counselor and informs the people around the water tap so that they too can take some immediate action.

D. Contribution

The project work will be helpful by determining the wastage of water from any water tap and informing its owner about it. The module can contribute an important role to minimize wa- ter wastage in different places. It can have different function- alities inside it to provide all necessary information and check that if someone tries to steal it, warn the owner by sending an alert.

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II. LITERATURE REVIEW

There exist very few works related to that topic which is the subject of the project. This section describes briefly the previous works likely similar to the project. The idea of the project is mainly based on the following models described in the following sections.

A. Smart Water Management System[1]

A smart water management system is an essential module that becomes very much useful in the current situation. Solar energy is the best green energy production in India. Solar powered agri- cultural pumps are available in the market today. The problemis the meaningful usage of solar energy, water, and storage. So batteries need to conserve solar energy and water quality and level indicator techniques are used to effectively manage the wa-ter system.

According to the quality of water, pure water is used for household purposes and unclean water for agricultural purposes.The level indicator warns the user about the water level in under-ground and overhead tanks. The solar-powered water pump acts like an autonomous system that automatically switches on/off according to the water level in the tank.

Dirty water is sprayed on the soil according to the level of water humidity and temperature. All of these techniques are controlled by using an Arduino board. It will send notificationsto the user using the controller. Users can save energy and waterby sensing and analyzing data through mobile applications.

Figure 1: Smart Water Management System[**1**]

B. Water Quality Monitoring System[2]

Water is an important element for the survival of mankind. Its various uses mean that it is always in a constant state of demand. The Water supply comes mainly from large reservoirs such as streams, lakes, and oceans. As such, it is a good practice to monitor its quality to make sure it is suitable for human use.

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Current water quality monitoring has often done in tradi-tional labs but it is a time-consuming and risky process. The main focus of the paper is to analyze the feasibility to implementan Arduino-based system for monitoring water quality levels.
A common prototype consisting of a microcontroller and mul-tiple connected sensors was employed to conduct weekly onsite experiments at multiple daily intervals. It has been found that the system works reliably but it is dependent on human assis-tance and has a tendency for data errors. However, the sys- tem provides a solid foundation for future expansion work of the same department to upgrade the system to be Internet of Things (IoT) friendly.

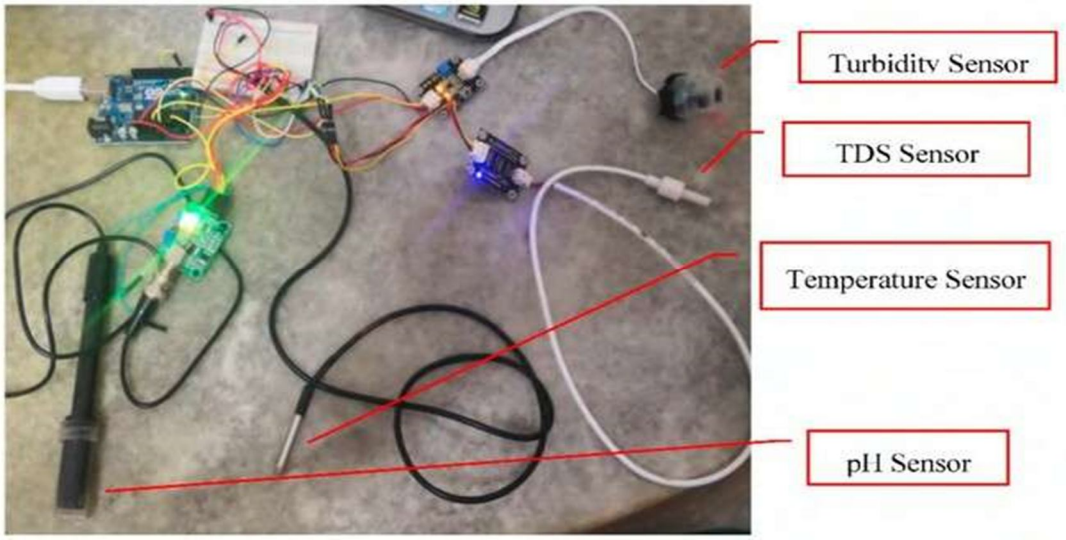

Figure 2: Water Quality Monitoring System[**2**]

III. ARDUINO UNO TECHNOLOGY

Arduino is an open-source electronics platform based on theHW & SW. Arduino boards can read inputs like a finger on a button, light on a sensor & turn it into an output like turning on an LED, activating a motor. By sending some instructions to the board, it can be possible to achieve a specific goal for which reasons the circuit is designed. The work has been done with thehelp of the Arduino programming language & the Arduino Software, based on a process.
Arduino acts like a CPU for mil- lions of projects, various complex scientific gadgets, and versatile IoT projects. A vast community of mak- ers has gathered around that plat-form. Their contributions include a vast amount of knowledge that canhelp novices and experts both.
The Arduino platform is very popular with people who have just started with an electronic device or project. No separate Arduino piece h/w is required to load a new code on board using a USB cable.[**3**] The Arduino IDE uses a very simple version of C++, which makes it easierto communicate with various sensors Arduino boards. It also helps to interact with the board by using our basic program-ming language.

Figure 3: Arduino UNOBoard[**4**]

A. Board Components

Most of these ingredients are similar to Arduino. They are de- scribed as

1) *Power USB:* By using the USB cable from a computer or any power source, the Arduino board can be switched on. Setup USB connection by using a USB cable.
2) *Power (Barrel Jack):* The boards are powered directly from the AC power supply connected to the jack.
3) *Voltage Regulator:* The function of a voltage regulator is applied for controlling voltage and stabilizing the DC voltages by using the processor.
4) *Crystal Oscillator:* Crystal oscillator helps the Arduino boards for dealing with time issues that will be arisen.
5) *Arduino Reset:* It starts a program from the beginning. It can be possible to reset the board in two ways. One is to be, done by using the reset button on the board. Another one is to attach an external reset button to the Arduino pin labeled as RESET.
6) *Analog Pins:* The board is manufactured with 6(six) analog input pins A0 through A5. The pins can take its input by analyzing the signal from the analog sensor and convert it into a digital value.
7) *Main Microcontroller:* Each board has its microcontroller considered the brain of your board. The main IC on each is slightly different from other boards.
8) *ICSP Pin:* ICSP is an AVR tiny programming header for the board that consists of the parts such as MOSI, RESET, VCC, MISO, SCK, and GND. This is often specified as SPI which is considered as the output with an extension.
9) *Power LED:* This LED should be lighted up when one plugs the board into a power source for indicating power- ing up correctly. When the light does not switch on, it notifies that something is wrong at the time of setting up the connection.
10) *TX and RX LEDs:* There are two labels i.e. TX and RX on the board. Firstly, the digital pins ZERO(0) and ONE(1) mention the pins that are responsible for serial communication with the board and the uploader device. Secondly, the two LEDs i.e. TX and RX led responsible for indicating the uploading of the serial instructions.
11) *Digital I/O:* The board is manufactured with 14 digital I/O pins of which 6 pins provide PWM output. The men- tioned pins can be configured to work as input pins to read logic values or as digital output pins to control different modules like LEDs.[5]
12) *AREF:* AREF is termed as Analog Reference. It is gen- erally used to set external reference voltage as the upper limit for the analog input pins.

B. Sensors

Arduino UNO supports various sensors that are applicable in various robotic projects. The name of the sensors are as follow,

1) *Ultrasonic Sensor:* An ultrasonic sensor is a small mod- ule that is used to measure the distance to an object by using ultrasonic sound waves.
2) *IR Sensor:* An IR sensor is an electronic device that is especially responsible for measuring and detecting infrared radiation from the surrounding environment.
3) *Soil Moisture Sensor:* A soil moisture sensor measures the amount of water in the soil of a particular. The sensor can be stationary such as hand-held disadvantages.
4) *Temperature Sensor:* A temperature sensor is a device that is used to detect that measures hotness and coldness that can be converted into an electrical signal.
5) *Photoresistor Sensor:* A photoresistor is a passive component. This reduces the illumination resistance obtained on the sensitive surface of the material.
6) *Motion Sensor:* Motion detectors can be used to sense movement and take action like setting off an alarm, switch- ing a light off/on, etc.
7) *Shock Switch:* The shock sensor module can be wired to the Arduino board using a 10k resistor as a pull-up or pull-down resistor for the module.
8) *Passive Buzzer:* The passive buzzer is slightly smaller, with electronics underneath.
9) *Reed Switch Module:* The reed switch module for the Arduino board is a small electrical switch that can be op- erated by an applied magnetic field, usually used as a proximity sensor.

C. Applications in Water related Projects

It's already used in various autonomous water related projectsi.e.

1) Water Quality Monitoring System.
2) Mini Firefighter Robot
3) Solar Water Tank Regulator
4) Shower Regulator
5) River Water Monitoring System
6) Aquarium Auto Refill With Arduino
7) Rainometer
8) Automatic Pet Water Chiller
9) Water Quality Monitoring and Notification System
10) Unified Water Monitoring System
11) IOT Water Leak Detector

D. Limitation of Arduino Board

1) AVR microcontroller cannot be understood.
2) It is unable to run more than one program at a particular time.
3) It will be difficult to modify Shields & Sketches.
4) The board has limited memory to store some particular data during the process of running.
5) Lack of communications, peripherals & programming language which are the build-in functionality of the board.

IV. ESP32-CAM MODULE

The ESP32-CAM is a low-cost ESP32-based development boardthat has a camera attached to that board itself & small in size.It is the best solution for multiple Scientific Projects, various IoT applications, DIY projects, and Gadgets prototype building.

A. Board Components & Usages

The board combines WiFi, traditional Bluetooth and low power BLE, 2 high performance 32-bit LX6 CPUs. It is mainly based on a 7-stage pipeline architecture, on-chip sensor, hall sensor, temperature sensor, and much more and its main frequency adjustment ranges from 80MHz to 240MHz. Fully compatible with Bluetooth 4.2 & WiFi 802.11 standards, It can be applied as a master mode which helps to create an independent net- work controller or a slave to other hosts' MCUs that are attached to the existing devices.[**7**]

Figure4: ESP32-Cam Board[**6**]

ESP32-CAM can widely be used in various IoT applications.It is suitable for smart home devices, wireless monitoring sys- tems, industrial wireless control devices, QR wireless positioning system signals, wireless identification tools, and other IoT appli- cations. This is an ideal solution for all types of IoT application.

B. Applications in Robotics

It's already used in various robotic and autonomous moduledesign-related projects i.e.

1) Face Recognition Door Lock
2) Drone monitoring with ESP32-CAM
3) Plant-Growing Assistant
4) Computer Vision
5) Smart Doorbell
6) ESP32-CAM Remote Controlled Car Robot with Web Server
7) Displays images in Fire-base Web App with ESP32-CAM
8) Tilt & Pan Video Streaming Web Server with ESP32-CAM
9) Takes & send photos via Email with ESP32-CAM
10) ESP32-CAM QR Code Scanner
11) ESP32-CAM Gesture Controlled Virtual Mouse

C. Limitation of ESP32-CAM Board

1) It doesn't have any type of USB-to-UART interface.
2) It can use a little more battery power than usual when powering up a Wifi connection.
3) It is bigger than putting the AT chip of an Arduino on a PCB.
4) Here some circuits would need modification to work witharduino board, because the ESP32 uses 3.3.

V. WATER SAVING TWEETY: BASIC ARCHITECTURE

The main purpose is to design a module that will be able to reduce water wastage by sending an alert message to the registered mobile number. It also alerts the surrounding people that they can take some immediate action if such kind of wastage is noticed.

A. Existing Module

The project work is based on the normal Object Recognition Module with some extensions i.e. by adding some special features, with the help of esp32-cam, to make it usable for real-life application purposes.

1) *Object Recognition Module:* Object recognition is a part of machine learning where a c code is used to capture some images as the contents of its database. The machine is fed these data, which is then used to identify the same object properly.

On that model, add some extension such as -

a) Night Detection Module to capture images at night withthe help of led light.
b) Security Module to detect any kind of stealing.
c) Sound Module to broadcasting the alert message.

B. Structure & Components

1) *Basic Components*

a) Thick Plastic Box
b) Arduino UNO Board (2 pcs)
c) ESP32-Cam Module
d) Water Level Depth Detection Sensor
e) Servo Motor
f) LDR Light Sensor Module
g) KY-036 Metal Touch Sensor
h) TTP223 Capacitive Touch Sensor
i) TIP 122 Transistor Speaker

j) Battery Snap with DC Jack
k) Jumper Wires

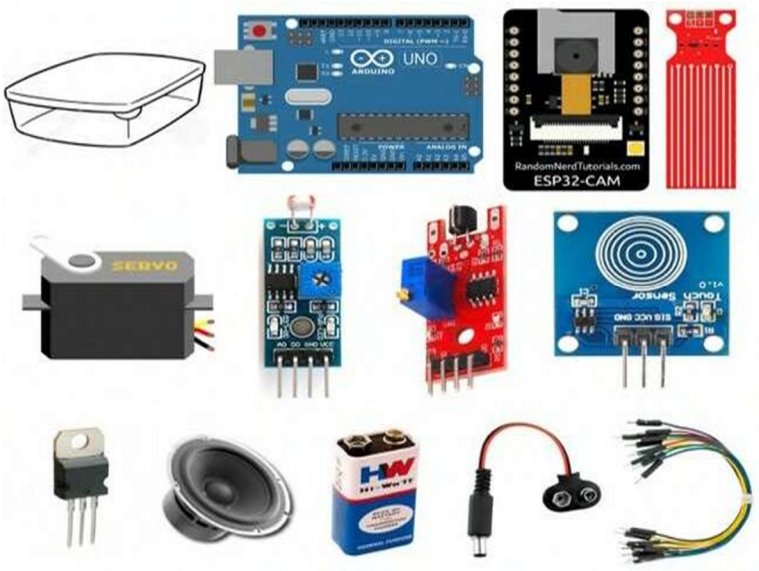

Figure 5: Required Components

2) Prototype Structure Design: The structure is the 1st initial model of the Water Saving Tweety, which is based on a normal human face detection module to unlock a door. The designing of the module is done by using one thickplastic box & cut it according to the required model. Nowplace one Arduino board as its CPU inside the box for taking all types of actions & functionality. The servo motor should be placed slightly below the body of the water tap, which will act as the main actuatorof the module. The water level sensor must be installedon this servo motor, which can determine the wastage of water.

Figure 6: Prototype Module

It is constructed with the help of one Arduino UNO & one ESP32-Cam module. The esp32-cam board helps to make the project flexible & extendable to include variousfunctionality.

3) *Final Structure:* The final structure is constructed based on the initial model of Water Saving Tweety. Now, it is used in the public areaespecially below the water tap to detect water wastage & provide the functionality, described earlier.

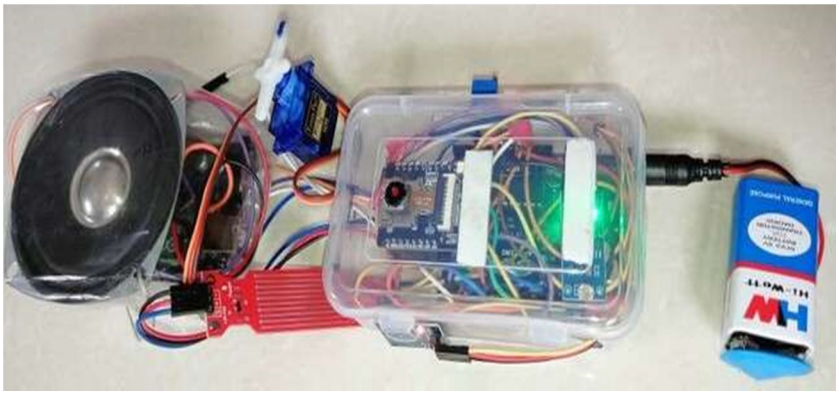

Figure 7: Final Structure

4) *Additional Functionality*

a) *Night Detection:* To create this extension, one need to use an LDR light sensor module inside theplastic box, where the LDR sensor will be facing towards the lighting surface at the top of the box.In order to work properly, need to design the circuitcorrectly and then connect the jumper wires.

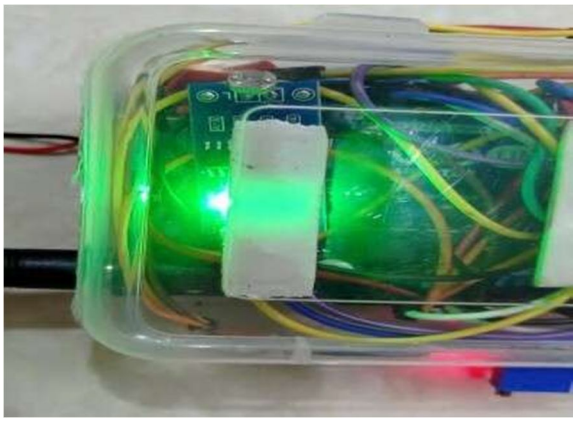

Figure 8: Night Detection Module

b) *Security Module:* To create this extension, need to use two different touch sensors, such as the KY-036 metal touch sensor and the TTP223 capacitivetouch sensor, to detect any human touch that is attached to either side of the plastic box. If such activity is detected, send a warning message to the registered mobile.

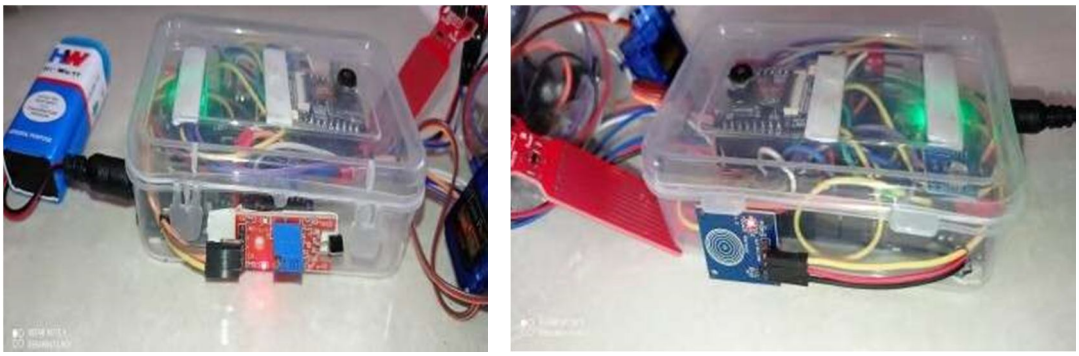

Figure 9: Security Module for Human Touch

c) Sound Module: To create this extension, need to use one TP122 transistor & speaker to broadcastthe alert message to take some favor from the sur- round people.

Figure 10: Sound Module Structure

C. Circuit Design

1) Water Saving Module to detect Water Wastage

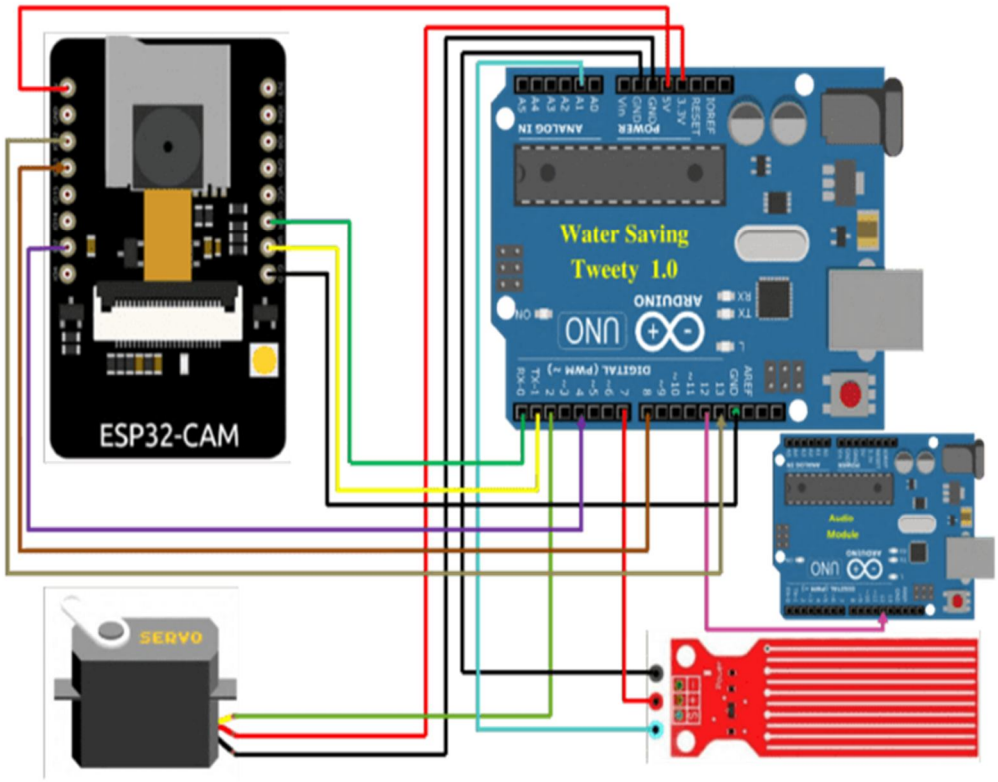

Figure 11: Water Saving Module Circuit Diagram

The Esp32 cam board achieves all the functionality ofthe project by exchanging the required information directly with the Arduino of the Water Saving Module. The servo motor simply allows the water level sensor, mounted on it tomove in front of or away from the water tap as directed by the Arduino board. A small signal from the main Arduino board is sent to the audio module's Arduino board, which then determines when to send the sound alert.

2) Night Detzction & Security Module

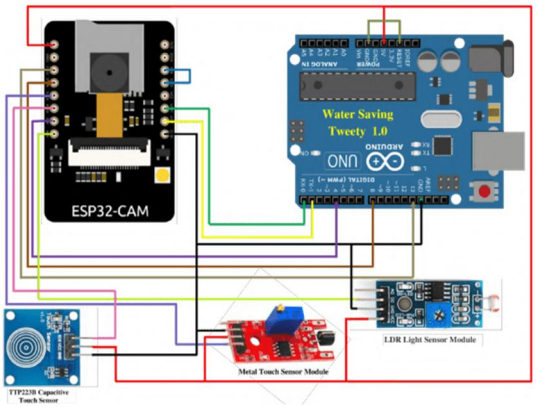

Figure 12: Night Detection & Security Circuit Diagram

3) Sound Module for Alert

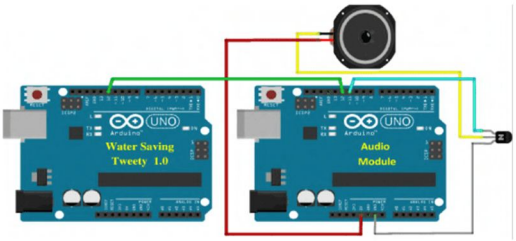

Figure 13: Sound Module Circuit Diagram

VI. BLYNK: MOBILE INTERFACE APP[8]

Blynk is a new platform that lets one quickly create interfaces for controlling and monitoring one's hardware projects from one's iOS and Android devices. After downloading the Blynk application to the smartphone, one can be able to create a project dashboard sliders, sort buttons, graphs, and other widgets on the screen. Using the widget, one can turn the PIN on and off or display data from the sensor.

A. Working Process

Blynk is ideal for monitoring one's fish tank temperature or remotely interfacing with common projects such as turn-ing the lights on and off. Blynk works mostly with the Raspberry Pi models, Arduino boards, ESP8266, particle cores & single-board computers & some common microcontrollers, and many more are being added over time.

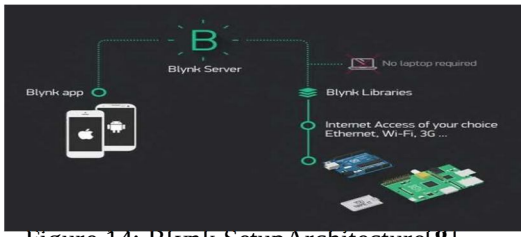

Figure 14: Blynk SetupArchitecture[**8**]

Blynk was designed for the various IoT applications. It can remotely control hardware, it can display sensor data, it can store data, it can visualize and many other great things.

B. Architectural Components

There are three major components in the platform:

1) *Blynk App:* allows one to create various interfaces, as re- quired for one's project using the various widgets provided.
2) *Blynk Server:* responsible for all types of communicationsbetween mobile and hardware. Blynk Cloud or Blynk server can be used in various projects. It is an open-source server, and can easily handle thousands of devices.
3) *Blynk Libraries:* It is used for all types of hardware com- munication with the server processes all the incoming and outgoing commands for execution purposes.

C. Connection type with Hardwares

Blynk is to be developed for supporting the following connectiontypes to establish a connection for interfacing hardware with theBlynk Cloud/Blynk's server:

1) Ethernet
2) Wi-Fi
3) Bluetooth
4) Cellular
5) Serial

D. Blynk interface for Water Saving Tweety

At the time of designing the Blynk interface in the mobile app for the project, receive an Authentication Token through the mail for establishing a connection with Blynk Server.

Interface Design Steps

1) Need to add a notification widget for appearing all kinds of alert messages.
2) Need to add one *image gallery widget* to collect theimages when water will be wasted from that water tap.

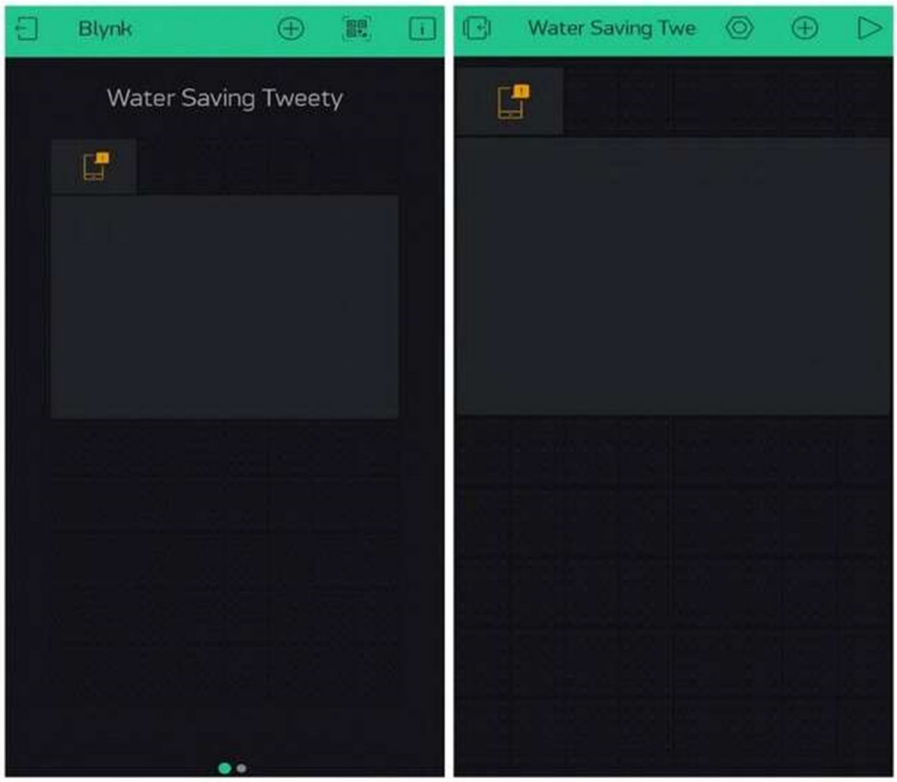

Figure 15: Blynk interface for Water Saving Module

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VII. ALGORITHM AND FLOW-CHART DESIGN

The algorithm and flowchart are two types of tools that areused to explain the basic purpose of the program by executing the process one by one. Here the discussion is about the differ- ences between an algorithm and a flowchart and how to create a flowchart to illustrate the algorithm visually i.e. graphical rep- resentation.

These are two different tools that are very useful for creating various new programs. An algorithm is a step-by-step analysis of one process, whereas a flowchart explains the steps of a programgraphically with proper direction flow of data from one blockto another.[**9**]

A. Algorithm Design

For designing the entire module, the following algorithms need to develop first which are as follows:

1) Water Saving Tweety Algorithm

a) Step1: Start

b) Step2: set all the pins as the input/output signals forthe sensors.

c) Step3: ESP32-Cam is fed a set of flat surface images and those images are then registered for any kind of flat surface identification.

d) Step4: if it detects any flat surface, then it sends a signal to Arduino board which moves the servo towardsthe opening of the water tap.

∗ **(I).** if the water level sensor detects any water wastagefrom the water tap, then it sends a signal to the ESP32 board.

- If that incoming signal is high, then it sendsa high signal to the Arduino board and also sends an alert notification to the registered mo- bile.
- At the same time, it also sends a high signal to the another Arduino board to spread the alertmessage

e) Step 5: End

2) Night Detection & Security Module Algorithm

a) Step 1: Start

b) Step 2: Set all the pins as the input/output signals for the sensors.

c) Step 3: If there is not enough light around or darkness falls at the end of the day, then the LDR sensor sendsa signal to the esp32 board.

If the signal, sent by the LDR sensor, is high, then led pin 4 of the esp32 board become brighter.

d) Step 4: If anyone try to steal the whole module for that purpose when he/she will touch it, then any of the two touch sensors which will detect it.

If the sensors detects the touch, it will send a signal to esp32 board which helps to send an alertmessage to the registered mobile.

e) Step 5: End

3) Sound Module Algorithm

a) Step 1: Start

b) Step 2: Set an audio for purposes of spreading alert message.

c) Step 3: Read the digital pin 12

d) Step 4: If pin 12 is high, then play the VOIALERT message.

e) Step 5: Otherwise, don't play anything.

f) Step 6: End

Out of these three algorithms, it is not possible to work with- out the algorithm of water-saving tweety. The other two are used for security purposes and the other for alert message broadcast- ing purposes.

a) The main function of the Water Saving Module is to sendan alert message to the mobile if it detects any flat surface, as well as any water, that is being wasted from the water tap

b) The Security Module will only be activated when someone tries to steal it. It also alerts by sending the theft warning message to the mobile.

c) The Sound Alert Module will broadcast the alert message only when the water is being wasted from the water tap.

B. Flow Chart Design

1) Flow Chart of Water Saving Tweety to detect any Water Wastage:

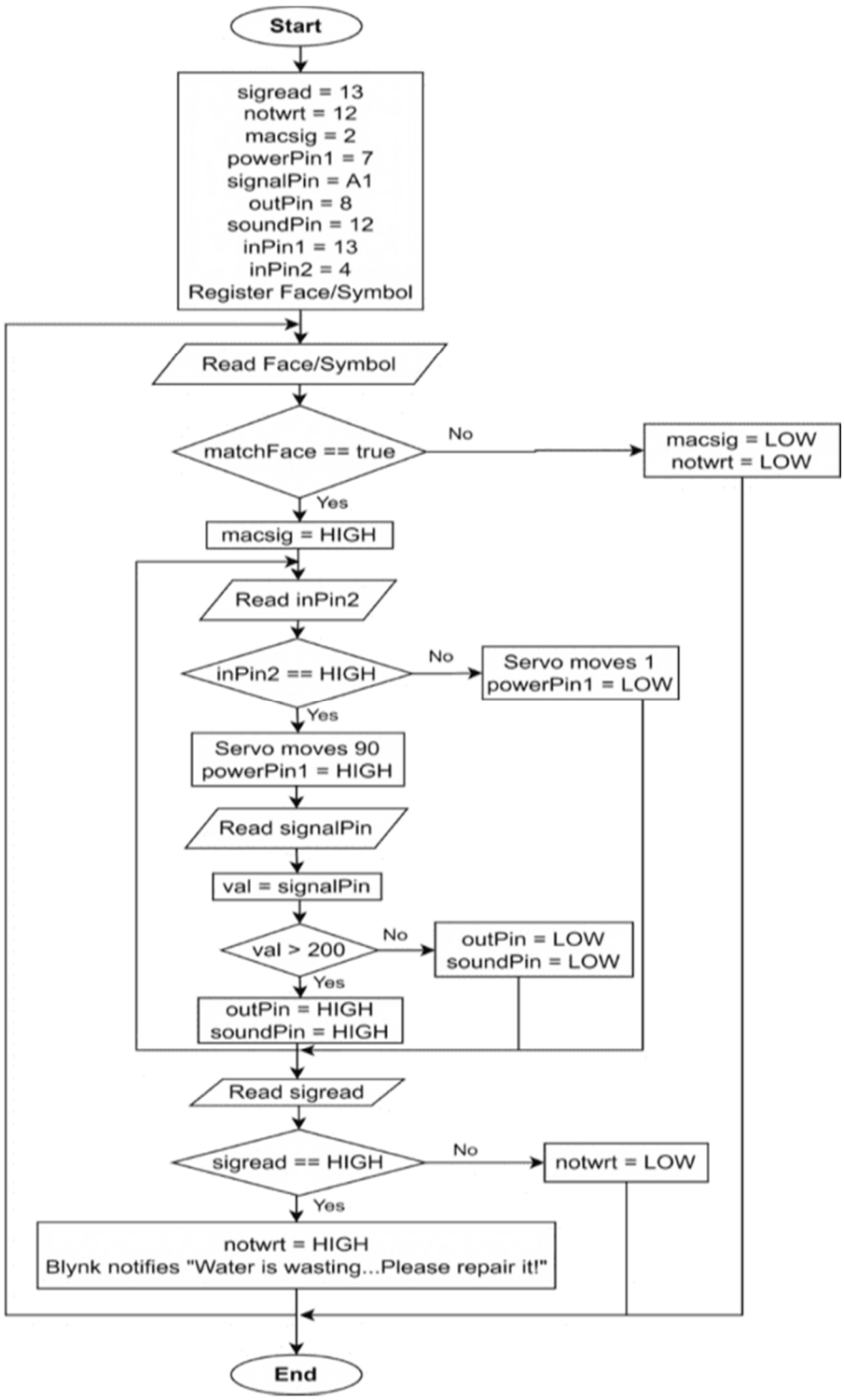

Figure 16: Water Saving Tweety Flow Chart

2) Flow Chart of Night Detection & Security Module

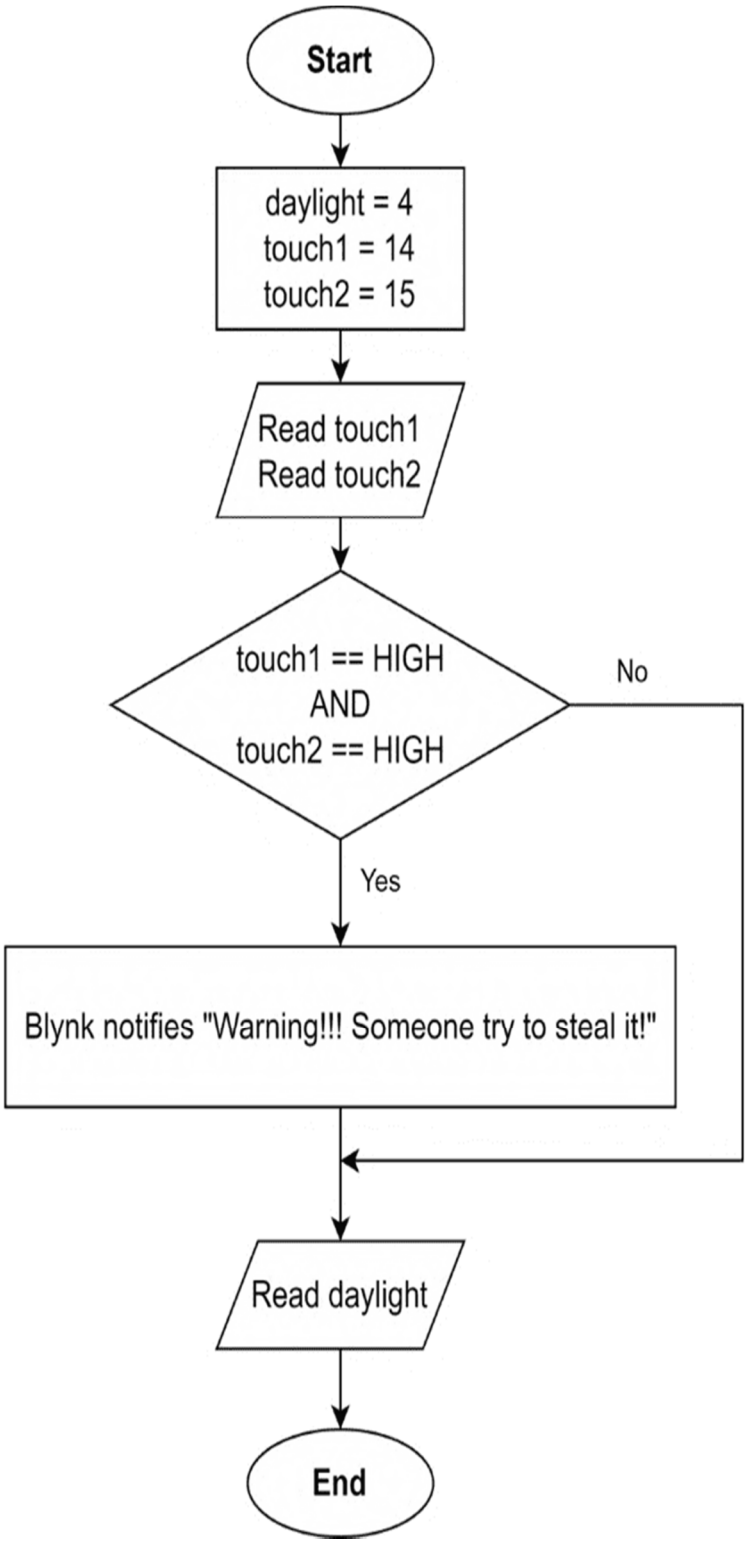

Figure 17: Night Detection & Security Module

3) Flow Chart of Sound Module for Alert

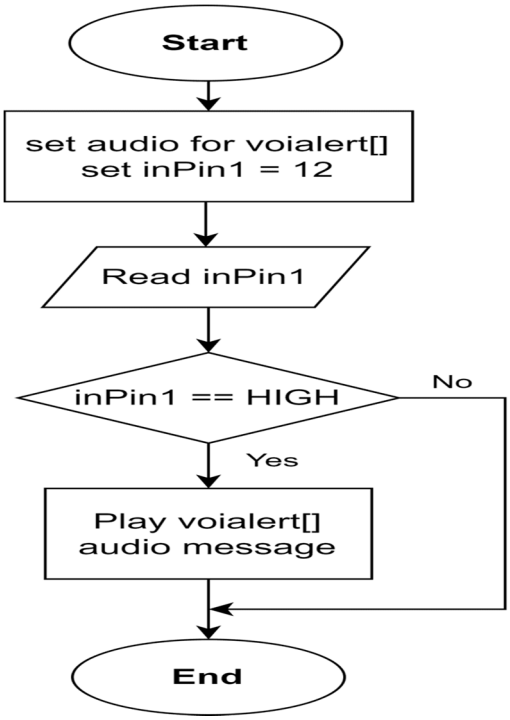

Figure 18: Sound Module for Alert

VIII. TESTING AND IMPLEMENTATION

The sub-modules and the entire model have been tested sev- eral times. Firstly, it gave some errors because of coding or sometimes for loose connection. Sometimes object detec- tion & recognition code could not work properly as expected.Now, all the codes are fixed & they are now bug-free to use any module like that. Now, it is working fine & all of its functionality doing well as the requirements.

The autonomous module can also get a good review from the locality, especially from those people who are used to collecting drinking water from the roadside water tap. It makes a deep realization to all of us, that says"*Save water, Save Life*"

Figure 19: Working Module at night

A. Arduino Code Implementation

By designing the circuit of the main water-saving module, when the code is written in Arduino and it is uploaded and runs, some functions were not working properly, such as capturing theobject and not being able to detect it, also moving the Servo at the right time, not being able to perceive leakage, etc.

1) *Camera & Notification Testing:* This code is especially used for the purpose of taking care ofall the sensors & the camera (object detection) from that the ESP32-Cam module will be able to notify the main person or owner about the alert of water wastage & stealing.

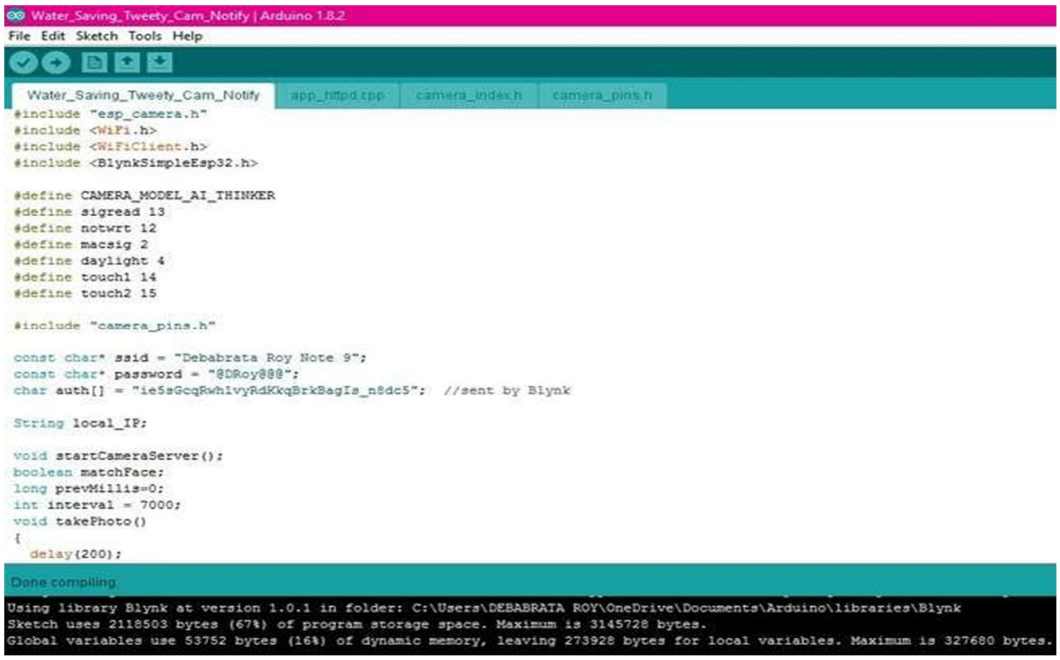

Figure 20: Camera & Notification Testing

2) *Signal Flow Testing:* This code is especially used for the purpose of taking care of those sensors, which are connected to the Arduino board di- rectly, to control the Servo & determine the water wastage. By sending the High signal to the ESP32-Cam board, it informs about the water wastage.

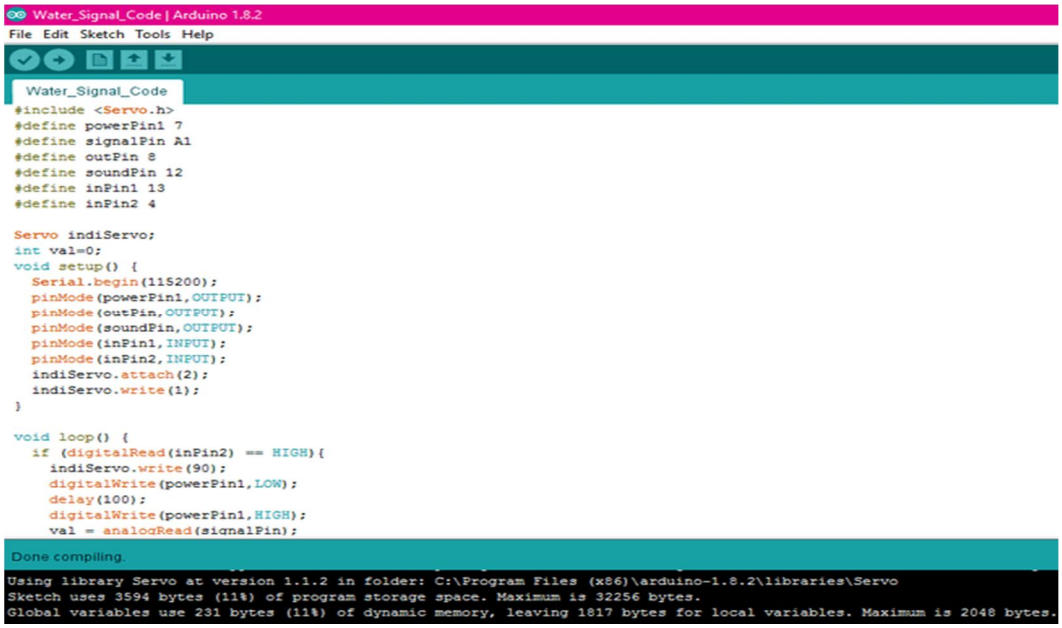

Figure 21: Signal Flow Testing

3) *Sound System Testing:* This code is especially used for the purpose of broadcasting alertmessages about water wastage. It depends upon the signal,which is coming from the Arduino board after detecting theproblem of water wastage.

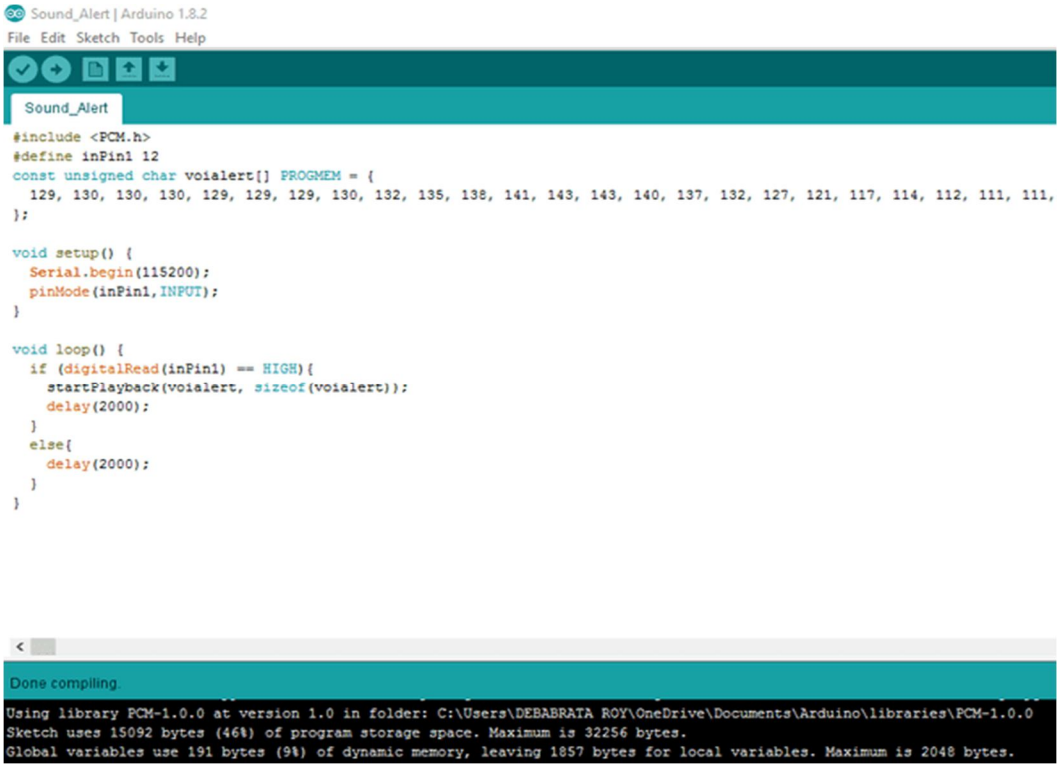

Figure 22: Sound System Testing

IX. MODEL ANALYSIS

The entire model can be used in various real-world areas such asany water pipe's joint leakage, any water wastage from roadside, household & factory water tap. The autonomous module can detect any water wastage by capturing the cur- rent phenomena & then sens- ing any water leaking from thewater tap. If so, then it re- ports or sends the alert noti- fication. It also takes care of its security from any kind ofstealing.

The water-saving module can be upgraded, by using one solar panel that is facing to- ward the sun-ray, as its main power source, instead of usingsome battery cells. The module can include one LED mon-itor to display the last timing of water wastage & its frequency and the total number of buck-ets by its observation throughout the day.


Figure 23: Work on Real Environment

A. Detecting Water Wastage

When the module identifies the flat surface & there is no pot or bucket to collect the water, then it moves the servo towards the water tap opening to detect the water by a water level sensor which is attached to that servo.

Figure 24: Image of Water Wastage

When the module detects any water wastage, then it notifies the owner or the ward counselor with the image of that time, taken by the ESP32-Cam. The image can help the owner toidentify the current condition of that water tap.

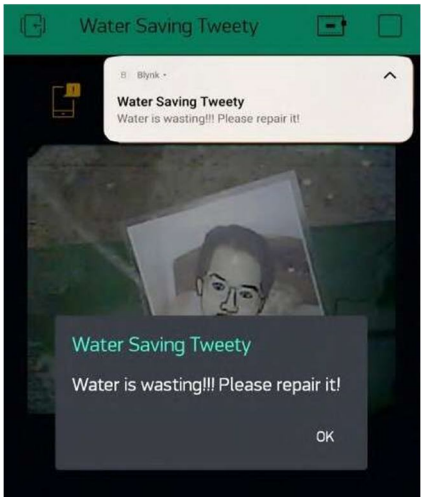

Figure 25: Notification of Water Wastage

B. Detecting Water Bucket

When the module can detect any water bucket or pot to store the water coming out from the water tap, then the Servo does not move its hand which is attached to the water level sensor to detect any water wastage.

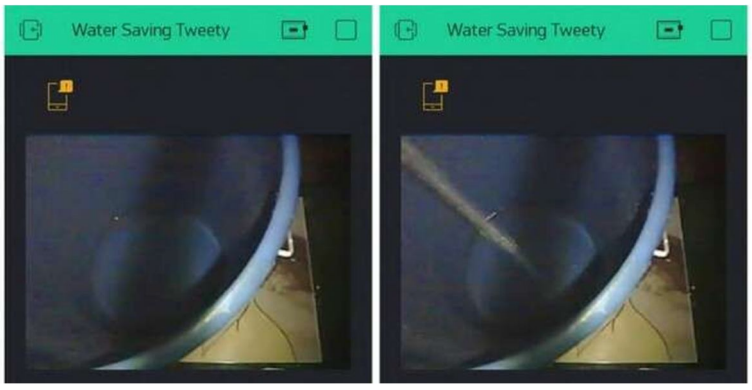

Figure 26: Image of Water Storing

C. Detecting Module Stealing

When the human touch detection sensors identify any kind of human touch for the purpose of stealing the entire module, then it sends the alert notification to the owner's phone.

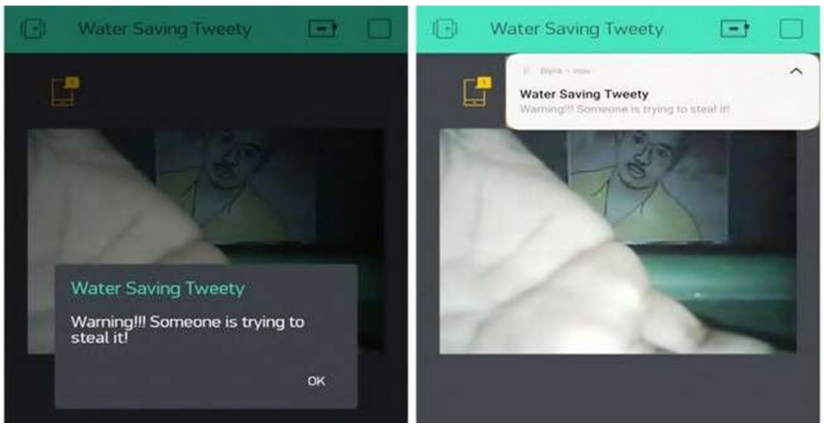

Figure 27: Alert Message about Stealing

X. CONCLUSION

The module can be used in various types of projects to reduceor minimize water wastage in different places. It can also detect the human touch for the safety measures of the device. It is designed as a simple, small & sample copy of a futuristic desired model and this concept can be used in the future. It can also be useful at the Educational Institutes' drinking water taps, Banks' drinking water opening, Roadside water taps, etc.

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Appendix A
Link & Resources

1) Arduino UNO https://www.arduino.cc/en/guide/introduction https://www.tutorialspoint.com/arduino/arduino board descr-iption.htm
2) ESP32-CAM Module https://media.digikey.com/pdf/Data/Sheets/ DFRobot/PDF-s/DFR0602 Web.pdf
3) Blynk Interfacing App https://blynk.io/
4) Algorithm and Flowchart https://www.edrawsoft.com/explain-algorithm-flowchart.html
5) Smart Water Management System https://www.scribd.com/document/504402835/environments-08-00006-2
6) Water Quality Monitoring https://www.grdjournals.com/uploads/conference/GRDCF /007/024/GRDCF007024.pdf
7) Flowchart Maker Online Diagram Software https://app.diagrams.net/
8) Circuit Design App for Makers https://www.circuito.io/

Appendix B
Biographical Sketch

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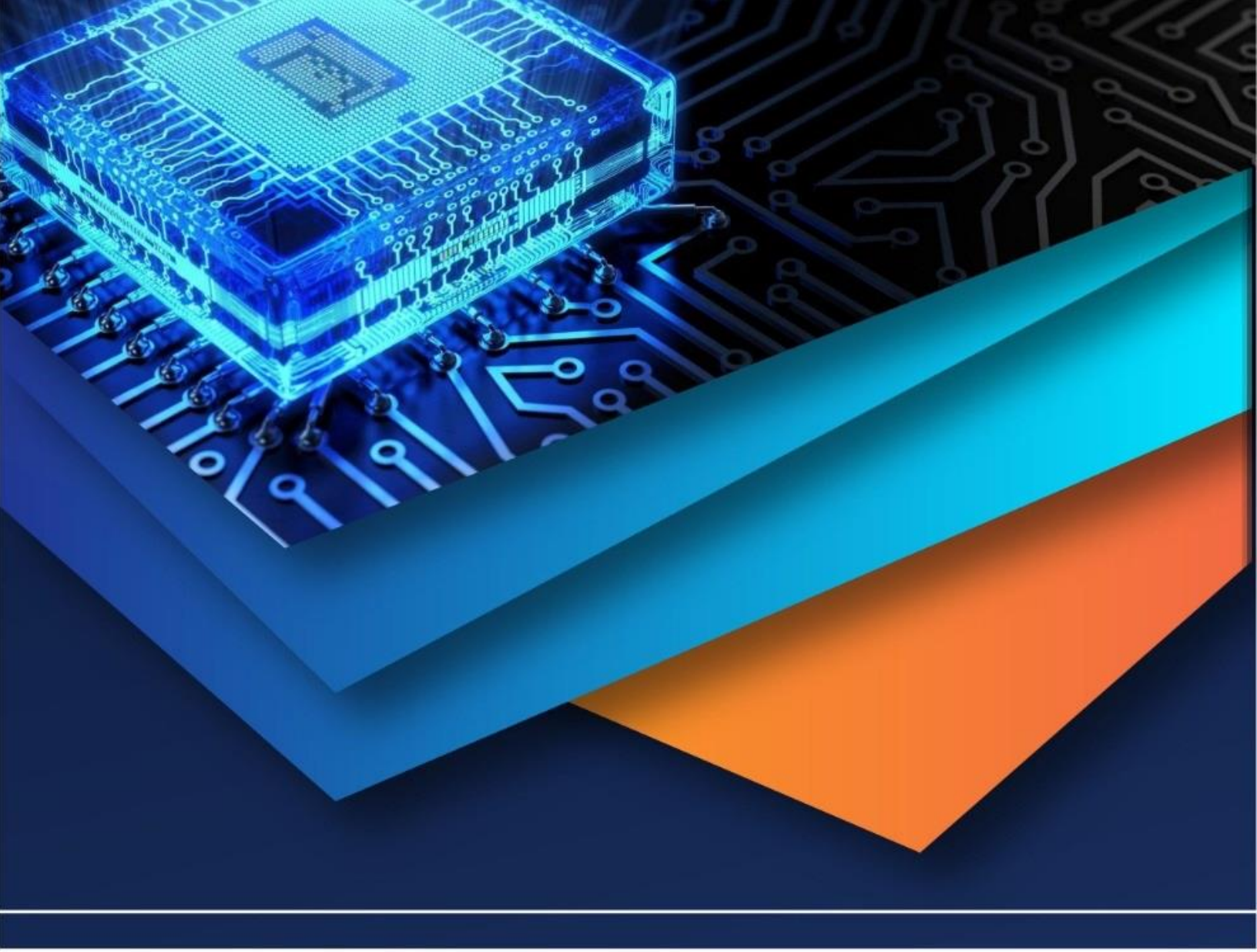
Education

a) MCA from National Institute of Technology, Agartala with CGPA of 9.50
b) B.Sc (Computer Science) Gold Medalist from University of North Bengal with 79%
c) (10+2) from Siliguri Boys High School with 81.8%
d) Madhyamik from Siliguri Boys High School with 90%



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