

# Student Teacher Integrated Network Ground – “S.T.I.N.G”

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**Abstract** - The name itself suggests, an integration between students and teachers with the magic of IoT, without affecting the educational system by providing means to make important stuff like attendance system, presentation system, doubt solving, providing notes completely automatic so that teachers and students can focus truly on what's important-Knowledge. The project helps the student to have quick and easy method for registering themselves for the attendance by the Facial Attendance. Student utility box will help the students to acquire the study material for completing their assignments, works related to the academics. All these will make classroom smarter and will bring the best results from the students in their academics. Augmented reality will help understand the concepts better as visual representation of important components of different parts will make students understand the working of different things more precisely and with accuracy. The digital notes will be provided to the students in no time, this will not only save time but also help in saving paper and space. The project will be of great use and has tremendous potential to help the developing minds of students.

**Keywords:-Python, Sql, Arduino, Raspberry Pi.**

## I. INTRODUCTION

Student Teacher Integrated Network Ground is a bunch of benefits from the various point of views. Attendance system is the biggest distraction for students and even for teachers, in some cases. What if it was fully automatic? What if the presence itself of the student in the classroom made him 'present' in the attendance register? Well, F.A.S.T can help in actually achieving that! It provides a system where in the 'face' of a person is used to identify a student. So when a student enters the classroom, the camera would scan the face of the student and a computer vision algorithm with machine learning would identify the student in 10 milliseconds and mark them present on the SQLite database simultaneously! The attendance system will have three stages to establish- Data Creation, Training and Detection. Data Creation and Training will be performed while registering a student itself but the Detection part will be performed everyday- to actually mark students present on the database!

The system will first need to create a dataset for the student's face. This process will try to spot a face on screen and create 50 images of the face of the student. The

student will be more detectable if he/she gives multiple expressions during the data creation process. The PILLOW library for python will then zoom on the important features of the face- eyes, nose and mouth and create a new dataset and delete the older one, this process takes maximum 4 seconds. These help in the making the work of taking of attendance more easy and reliable. Many components are included in the attendance. This represents the set of users, which are the Students

Who will be using this application? The teachers and students

It will act as bridge between the teachers and students for the interaction.

Following are the description of entities involved in Student Teacher Integrated Network Ground.

## II. RASPBERRY PI

The **Raspberry Pi** is a series of small single-board computers developed in the United Kingdom by the Raspberry Pi Foundation to promote teaching of basic computer science in schools and in developing countries. The original model became far more popular than anticipated, selling outside its target market for uses such as robotics. It does not include peripherals (such as keyboards and mice) and cases. However, some accessories have been included in several official and unofficial bundles. This module provides the functionality for customers to place. The raspberry pi is slower than a modern computer or laptop but still is a complete Linux computer and can provide all the expected abilities that implies, at low power consumption level. The entire project around the raspberry pi and Arduino. The Raspberry Pi is the hardware used for making it more portable and on go usage.

The Functions to be provided by the Raspberry Pi are:

- Provide appropriate hardware for computing task
- Increased portability
- Working as normal computer in much lesser space
- Efficient and less power consumption

### III. FACIAL ATTENDANCE SYSTEM

Facial Attendance System aka (F.A.S.T) short for Facial Attendance System Technology is a system integrated onto S.T.I.N.G to improve the quality of education for the students and improve the attendance system at whole. Students don't need to touch any kind of sensor or use any RFID card to identify themselves or mark themselves present on the attendance database. Their face is their identity and their face is the only thing required to mark themselves present. The whole face attendance thing has three main stages-Data Creation, Data Training and the Attendance Phase.

### IV. ARDUINO

Arduino is an open-source hardware and software company, project and user community that designs and manufactures single-board microcontrollers and microcontroller kits for building digital devices and interactive objects that can sense and control objects in the physical and digital world. Its products are licensed under the GNU Lesser General Public License (LGPL) or the GNU General Public License (GPL), permitting the manufacture of Arduino boards and software distribution by anyone. Arduino boards are available commercially in preassembled form or as do-it-yourself (DIY) kits

Arduino is an open-source platform used for building electronics projects. Arduino consists of both a physical programmable circuit board (often referred to as a microcontroller) and a piece of software, or IDE (Integrated Development Environment) that runs on your computer, used to write and upload computer code to the physical board.

The Arduino platform has become quite popular with people just starting out with electronics, and for good reason. Unlike most previous programmable circuit boards, the Arduino does not need a separate piece of hardware (called a programmer) in order to load new code onto the board - you can simply use a USB cable. Additionally, the Arduino IDE uses a simplified version of C++, making it easier to learn to program. Finally, Arduino provides a standard form factor that breaks out the functions of the micro-controller into a more accessible package

Functionality of the Arduino are as follows:-

- Onboard LED for pin 13.
- Support for various modules.
- Support for analog IN.
- Support for analog OUT.
- Support for digital IN.
- Support for digital OUT.

### V. ULTRASONIC SENSOR

The ultrasonic sensor or the HC-SR04 sensor is an important aspect of the project. It is used to alert a student if they are too close to the camera. The HC-SR04 sensor has namely four pins-Trig, Echo, VCC and GND. The sensor has an accurate range of 100cm and can read upto 400cm, but the reading won't be accurate then. So the sensor has two openings, one opening emits ultrasonic sound, and the other one receives ultrasonic sound. Just like a bat. The bat emits ultrasonic sound and calculates the time in which the sound comes back, to calculate the distance of the obstacle in front of it, or to know if there is any obstacle in front of it. So there's an LED connected to pin 13 of the Arduino, and once something comes too close to the sensor, the LED lights up. The LED is there to indicate the student that they are too close to the Face Attendance Camera.

### VI. SKYE EDU AR

Everyone's striving for immersive learning, and we strive for the same too. Through this project, we want students to enjoy learning and immerse into the learning process. Therefore we have embedded Augmented Reality onto S.T.I.N.G. The augmented reality part's been built on the Unity Engine along with the Vuforia SDK. Vuforia SDK provides a framework to develop augmented reality applications. They have paid plans as well as free to try plans. Their paid plans even include an online database where the 3d models and image targets can be stored.

### VII. OVERHEAD PROJECTOR 2.0

An overhead projector uses various principles of light to project a sheet of paper onto a wall. The paper has to be mounted onto the projector and the projector uses mirrors and a huge bulb to project the sheet onto the wall. Nowadays, overhead projectors have vanished from universities. Everyone wants a new, modern alternative to the overhead projector. The overhead projector is an important thing to show something on paper to students. And hence we have created a solution to this problem. The solution is -OVERHEAD PROJECTOR 2.0, S.T.I.N.G's onboard camera can be tilted and used to show a sheet of paper to the whole class. S.T.I.N.G will already be connected to the projector, so the same can be used to project notes for the students.

### VIII. IMPLEMENTATION

Hardware/Software Interface: This section lists the minimum hardware and software requirements needed to run the system efficiently.

Hardware requirements- Raspberry Pi, Camera, Arduino Uno, Arduino Nano, Jumper cables, HC-SR04.

Software Requirements- Python 3, Python 2, Arduino IDE, Java, Raspbian OS.

The Raspberry Pi acts as the brain of the whole thing, The Arduino communicates serially with Raspberry Pi and does what the Raspberry Pi tells it to. The HC-SR04 is connected to the Arduino Uno. The camera is connected to the Raspberry Pi and the Raspberry Pi is connected to the power source. The whole circuit is mounted onto an acrylic board which in turn can be mounted on a wall next to the blackboard. The acrylic panel will have another acrylic panel below it and perpendicular to it where the notes can be mounted easily. F.A.S.T runs on Python 2.7 along with openCV.

## IX. WORKING

### A. Data Creation

In the data creation phase, a student stands in front of the camera where 21 images are taken of the student's face, automatically in a loop. The faces are then identified in the image using openCV, short for 'Open Source Computer Vision'. We used a basic HaarCascade template to identify a person's face when it comes in front of the camera. We then used the 'PILLOW' image processing library in python to zoom onto the student's. The image is then converted from regular BGR or RGB to GRAYSCALE. GRAYSCALE was chosen because the person's face's cascade areas-eyes, nose, mouth, etc. are identified by size and shape, and NOT the COLOR of the skin of the student. The skin color can cause ambiguity problems at whole. And we definitely don't want that. Therefore the GRAYSCALE Filter.

### B. Training

The images are then cycled through quickly by an openCV trainer in the TRAINING phase. The images are cycled through quickly and trained by the neural network that openCV has and stores the trained data in a '.yml' file. The yml file has the trained data stored along with an id number attached to each face. A student is recognized not by their name, but by their ID number on the system.

### C. Attendance Phase

In the attendance phase, a database connection is required where the student will be marked present. To mark the student present, the student needs to come in front of the camera. Once the student comes in front of the camera, the recognizer refers to the YML file and if a known person pops up, it identifies the person. So, once a person gets identified, an SQL query is passed to the database to mark

the student present. That's all for the Face Attendance System.

### D. Augmented Reality

The augmented reality system works using image targets. These image targets are trigger points for a 3d Model to pop up. The image targets are provided to the Vuforia SDK. Then we have to program in C# to play a sound providing explanation for the 3d model. The image target can be any image. Once the image target is provided, the SDK converts it into a tunnel like image so that the image can be identified in the real world from any angle.

### E. Ultrasonic Sensor

The ultrasonic sensor is provided a threshold. The Arduino is coded to light the LED up once the user gets closer than 20cm to the camera. Therefore the threshold is 20. Once the threshold is surpassed, the LED lights up.

## X. CONCLUSION

So, education is necessary, and we are not manipulating the student-teacher relationship or the learning process altogether. We are just manipulating the means of teaching and the means of marking students present on the database. Attendance is a difficult task, and most colleges usually pass 'attendance registrars' to every class on which students sign. The registrar is passed to each student one by one and the teacher and the students both, get disturbed because of this. So, we have just modified the means of education, not the relationship between the teacher and the student. Augmented reality acts as a catalyst in the learning process for students. We hence believe that through this project, we have enhanced the quality of education, the attendance system through the wonders of technology.

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