BOOKLET ARRANGEMENT SYSTEM

Smriti[1], Abhishek HP[2], Megna Gokul[3], Priyanka M[4], Manasa S[5]

[1] Student, Electronics and Communication Dept., AMC Engineering College, Karnataka, India
[2] Student, Electronics and Communication Dept., AMC Engineering College, Karnataka, India
[3] Student, Electronics and Communication Dept., AMC Engineering College, Karnataka, India
[4] Student, Electronics and Communication Dept., AMC Engineering College, Karnataka, India
[5] Asst. Professor, Electronics and Communication Dept., AMC Engineering College, Karnataka, India

ABSTRACT

We know that, for counting and arranging huge number of Examination booklets manually by humans consumes a lot of time. For saving time and energy, we take help of the systems. They not just save time and energy but also are used to minimize the human errors. When things come to examination, we all become serious and there is no chance of committing mistakes. Booklet counting machine proposes the idea of fast and efficient counting of booklets without human effort. Since humans can make error in counting the number of booklets it is very important to create a machine that counts the number of booklets fast and accurately and arrange it according to roll number wise. It finds a numerous application in many fields. This project is proposed as a remedial measure for the problem raised in the exam cell of the college. While arranging the books the chance to miss arrange the books which creates a new problem to the teachers also the students. During examinations, it is very important to send right number of booklets to the examination hall, if there is any counting error then some students might not get booklets and that can even waste time of the student. In order to overcome all these problems, we have created a robotic arm containing Gyroscopic sensor for counting booklets and stepper motors connected to stepper motor drivers for movement of robotic hand which is controlled by Raspberry Pi Board that can count and arrange the booklet without any human effort.

Keyword: - *Raspberry Pi, Python, OCR, Robotic arm, and Gyroscope Accelerometer sensor*

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1. INTRODUCTION

For saving time and energy, we take help of the systems. They not just save time and energy but also are used to minimize the human errors. When things come to examination, we all become serious and there is no chance of committing mistakes. Hence, we are focusing on booklet counting and arrangement system which will provide the service for teachers and students in college and schools. In most of the schools and colleges counting the books manually takes lot of time also there is a chance of missing the counts.

While arranging the books the chance to miss arrange the books which creates a new problem to the teachers also the students. We have introduced this system including the counting and rearrangement of exam booklets which helps to reduce the time consumed by human and also arranges the books accurately. This is a machine which uses OCR to detect the USN of the student and with the help of Robotic Arm and Gyroscope Accelerometer sensor, the booklet is picked. Here first all the USN is scanned and based on the scanned data the booklets are picked by the robotic arm. The picked booklet will be placed aside one by one and hence it will be in a sorted order. All these operations are controlled by Raspberry Pi 3 Model B+.

2. PROBLEM DEFINITION

We know that, for counting and arranging huge number of Examination booklets manually by humans consumes a lot of time. Booklet counting machine proposes the idea of fast and efficient counting of booklets without human effort. Since humans can make error in counting the number of booklets it is very important to create a machine that counts the number of booklets fast and accurately and arrange it according to roll number wise. This project is proposed as a remedial measure for the problem raised in the exam cell of the college. During examinations, it is very important to send right number of booklets to the examination hall, if there is any counting error then some students might not get booklets and that can even waste time of the student.

3. DESIGN/IMPLEMENTATION

3.1 Booklet Counting Using MPU6050

Booklet counting machine proposes the idea of fast and efficient counting of booklets without human effort. Since humans can make error in counting the number of booklets it is very important to create a machine that counts the number of booklets fast and accurately. It finds a numerous application in many fields. This project is proposed as a remedial measure for the problem raised in the exam cell of the college. During examinations, it is very important to send right number of booklets to the examination hall, if there is any counting error then some students might not get booklets and that can even waste time of the student. In order to overcome all these problems, we have created a machine that can count the books without any human effort. In this project we have used a Raspberry Pi and a MPU6050 accelerometer gyroscope sensor, where based on the reading of the gyroscope sensor the Raspberry Pi will count and will display the value in LCD display.

3.1.1 Block Diagram

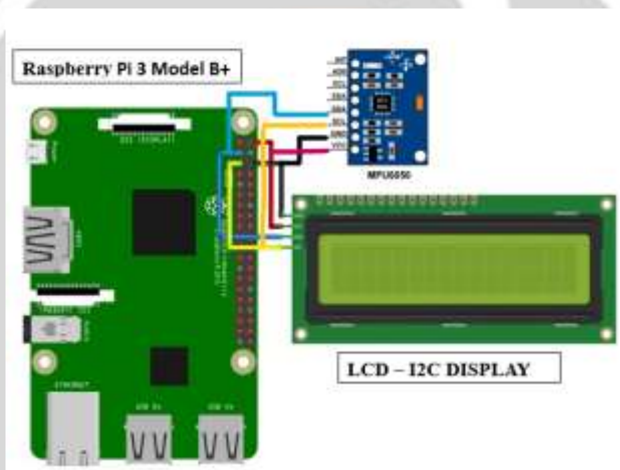


Fig -1: Block Diagram

3.1.2 Components Used

The components that are used for this project are as follows.

a) Raspberry Pi 3 Model B+:

Raspberry Pi is the name of a series of single-board computers. The Raspberry Pi is a very cheap computer that runs Linux, but it also provides a set of GPIO (general purpose input/output) pins, allowing you to control electronic components for physical computing and explore the Internet of Things (IoT). It runs Linux (a variety of distributions), and its main supported operating system, Pi OS, is open source and runs a suite of open-source software. Raspberry Pi is a programmable device. It comes with all the critical features of the motherboard in an average computer but without peripherals or internal storage. To set up the Raspberry computer, you will need an SD card inserted into the provided space. The SD card should have the operating system installed and is required for the computer to boot. Raspberry computers are compatible with Linux OS. This reduces the amount of memory needed. After setting up the OS, one can connect Raspberry Pi to output devices like computer monitors. Input units like keyboards should also be connected. The raspberry pi 4B Released in 2019, Raspberry 4B is a vast improvement from its predecessors, with a varying memory capacity from 2GB RAM to 8GB RAM. It also has a faster 1.5GHz processor and a good mix of 2.0 and 3.0 USB ports.

Fig -2: Raspberry Pi 3 Model B+

b) MPU6050 Gyroscope Accelerometer Sensor:

MPU6050 sensor module is complete 6-axis Motion Tracking Device. It combines 3- axis Gyroscope, 3-axis Accelerometer and Digital Motion Processor all in small package. Also, it has additional feature of on-chip Temperature sensor. It has I2C bus interface to communicate with the microcontrollers. It has Auxiliary I2C bus to communicate with other sensor devices like 3-axis Magnetometer, Pressure sensor etc. We have uploaded the code to read the gyroscope sensor values and for counting into the Arduino using Arduino IDE software. Based on the readings of gyroscope sensor counting is done and is displayed on the LCD display.

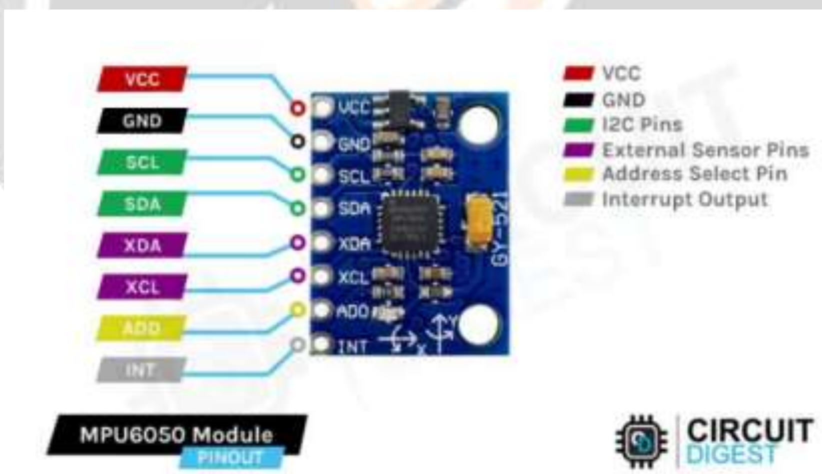


Fig -3: MPU6050 Gyroscope Accelerometer Sensor)

c) LCD-I2C Display:

The character LCD is ideal for displaying text and numbers and special characters. LCDs incorporate a small add-on circuit (backpack) mounted on the back of the LCD module. The module features a controller chip handling I2C communications and an adjustable potentiometer for changing the intensity of the LED backlight. An I2C LCD advantage is that wiring is straightforward, requiring only two data pins to control the LCD. A standard LCD requires over ten connections, which can be a problem if your Arduino does not have many GPIO pins available. If you happen to have an LCD without an I2C interface incorporated into the design, these can be easily acquired separately. The LCD displays each character through a matrix grid of 5×8 pixels. These pixels can display standard text, numbers, or special characters and can also be programmed to display custom characters easily. The I2C LCD interface is compatible across much of the Arduino family. The pin functions remain the same, but the labeling of those pins might be different. This chart will assist in identifying the pins on your Arduino model to the SDA and SCL functions. The Arduino R3 also extends the Data Line (SDA) and Clock Line (SCL) to the header pin beside the AREF header

Fig -4: LCD-I2C Display

3.2 Scanning the USN

Fig -5: Raspberry Pi with camera

For scanning the USN first we have to take the picture of the handwritten USN. Here we are using Raspberry Pi 3 Model B+ board with a Raspberry Pi 5MP Camera module for doing this process. The programming is done in such a way that the camera will automatically takes the picture of the USN and converts it into a grey-coloured image. The reason for converting into grey coloured image is for the OCR system to read the image clearly and predict the output accurately. This image will be stored in the same folder. For Handwriting OCR (Optical Character Recognition) we are the utilizing the service of MICROSOFT AZURE. This a cloud-based service providing platform which provides various services and one among those services is Handwriting OCR. The reason for using this service is for accuracy and to reduce the delay for providing the result of the OCR. Since the student subscription of this cloud is free, we can use this service without any payment. Once we have been subscribed to the service, we get an API KEY and an ENDPOINT. These two things will be used inside the code for sending the stored image to the cloud. The recognition is done with the help of computer vision and the result is sent back. The time taken for the result is of maximum 2 seconds.

3.2.1 Components Required

a) Raspberry Pi 3 Model B+:

The information related to Raspberry Pi 3 Model B+ is present in the 3.1.2(a) of A in Design/Implementation.

b) Raspberry Pi Camera:

The Raspberry Pi Camera Board is a custom designed add-on module for Raspberry Pi hardware. It attaches to Raspberry Pi hardware through a custom CSI interface. The sensor has 5-megapixel native resolution in still capture mode. In video mode it supports capture resolutions up to 1080p at 30 frames per second.

Fig -6: Raspberry Pi camera

3.3 Booklet Arrangement

3.3.1 Arrangement Using Robotic Hand

A robotic arm is a type of mechanical arm, usually programmable, with similar functions to a human arm; the arm may be the sum total of the mechanism or may be part of a more complex robot. The links of such a manipulator are connected by joints allowing either rotational motion (such as in an articulated robot) or translational (linear) displacement. The links of the manipulator can be considered to form a kinematic chain. The terminus of the kinematic chain of the manipulator is called the end effector and it is analogous to the human hand. However, the term "robotic hand" as a synonym of the robotic arm is often proscribed.

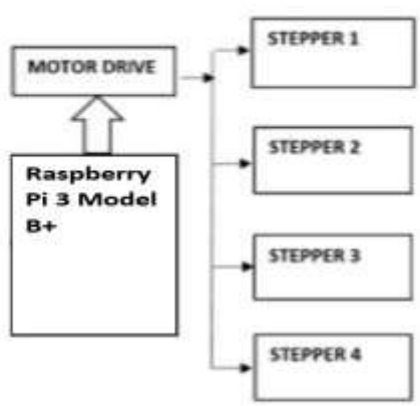


Fig -7: Robotic Hand Block Diagram

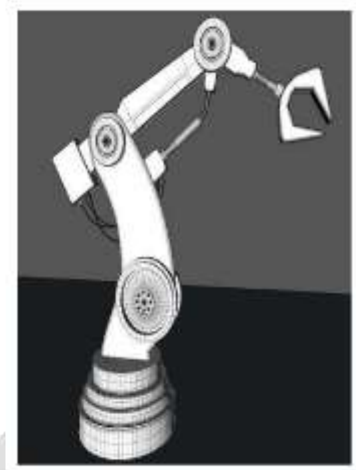


Fig -8: Robotic Arm

3.3.2 Components Required

a) Raspberry Pi 3 Model B+:

The information related to Raspberry Pi 3 Model B+ is present in the 3.1.2(a) of A in Design/Implementation.

b) Nema 17 Stepper Motor:

A Nema 17 stepper motor is a stepper motor with a 1.7 x 1.7 inch (42 x 42 mm) faceplate. Nema 17 high torque stepper motors provide great value with no quality sacrifice. The version with a step angle of 0.9° is more precise than the typical 1.8° version of the motor. These motors are engineered to provide the highest possible torque but minimize vibration and audible noise. A wide range of motor windings and stack lengths are readily available, or the motors can be customized to meet your machine requirements. We can also have the windings customized to perfectly match your voltage, current and maximum torque at operating speeds. NEMA stepper motor sizes depend on the frame size of the stepper motor. NEMA means the standards set by “National Electrical Manufacturers Association”, which is comprised of 560 major electrical manufacturers in the United States, primarily consisting of manufacturers of equipment and devices for power generation, transmission, distribution, and power applications. The purpose of standard setting is to eliminate misunderstandings between electrical product manufacturers and users and to specify the safety of these product applications.

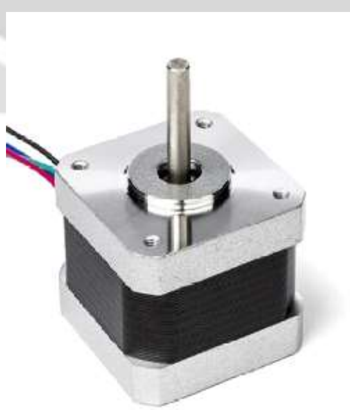


Fig -9: Nema 17 Stepper Motor

c) A4988 Stepper Motor Driver:

The A4988 stepper motor driver has an output drive capacity of up to 35V and ±2A. This allows you to control a bipolar stepper motor, such as the NEMA 17, at up to 2A output current per coil. Furthermore, the output current is regulated, allowing for noiseless operation of the stepper motor and the elimination of resonance or ringing that is common in unregulated stepper driver designs. The driver has a built-in translator for easy operation. This reduces the number of control pins to just two, one for controlling the steps and the other for controlling the spinning direction. The driver offers five different step resolutions: full-step, half-step, quarter-step, eighth-step, and sixteenth-step.

Fig -10: A4988 Stepper Motor Driver

4. RESULTS

4.1 Results of Booklet Counting

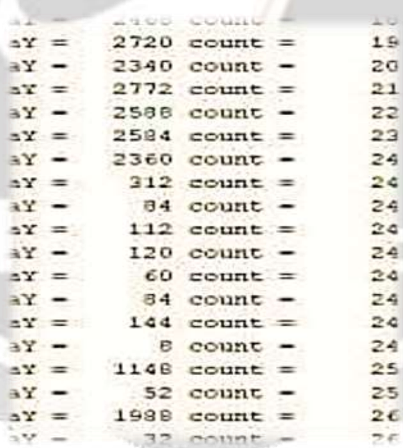
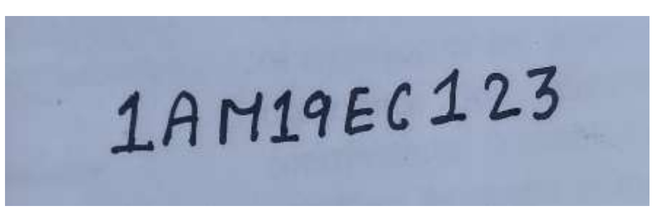


Fig -11: Results of Booklet Counting

Whenever the gyro sensor undergoes a deflection, the Arduino is successfully able to take the count as shown in the above figure.

4.2 Result of OCR



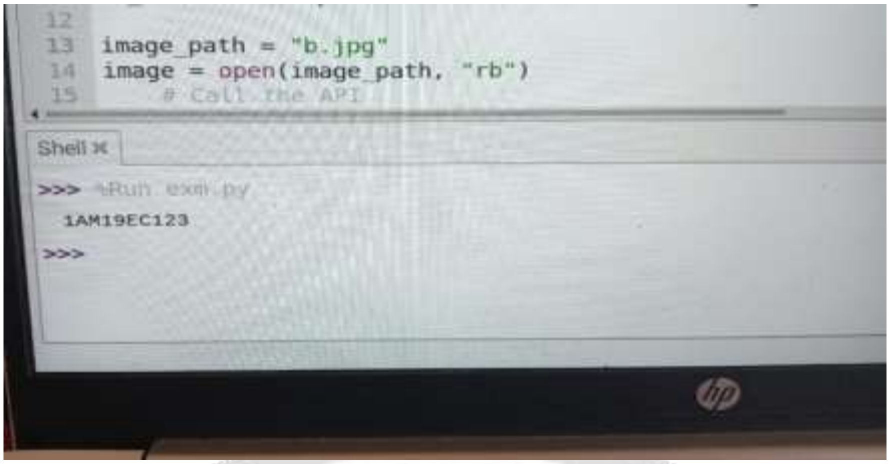


Fig -12: Result of OCR

The camera was successfully able to take the picture of the roll number. This image was processed by the OCR software and the software was successfully able to predict the roll number accurately as shown in the figure 19. As we see in the figure, the first picture is the image of the roll number and the second image is the result of the prediction done by the software.

5. CONCLUSION

Our machine is successfully able to count and arrange the booklet based on roll numbers by the help of a linear actuator, rack system, booklet roller which is controlled by Raspberry Pi. This system helps in a large way to reduce the time in a high scale compared to the work done for counting booklets manually. In additional to counting, rearranging is also done which saves a large time for the faculty in rearranging the books.

6. FUTURE SCOPE

This can be further developed in future to count and rearrange in large scale. It can further be used in industries, book publishing company, Xerox shops etc. It helps the schools, colleges and industries to run in a more productive way by improving the efficiency by reducing the time to do work. It can be used in companies for file counting and arrangement.

7. REFERENCES

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